The 55th International October Conference on Mining and Metallurgy
15 - 17 October 2024, Kladovo, Serbia
https://ioc.irmbor.co.rs

DOI: 10.5937/IOC24409P Original Scientific Paper-Management

VERIFYING THE LABORATORY QUALITY SERVICE BY AN INTERLABORATORY COMPARISON

Emina Požega[1a], Dragana Božić[1b], Vera Požega[2a], Srđana Magdalinović[1c], Sanja Petrović[1d], Miloš Đukić[1e], Milenko Jovanović[1f]

[1]Mining and Metallurgy Institute Bor, Alberta Ajnštajna 1, 19210 Bor, Serbia
[2]Faculty of Economics, University of Niš, Trg kralja Aleksandra Ujedinitelja 11, Niš, Serbia
[1a] emina.pozega@irmbor.co.rs, https://orcid.org/0000-0001-6797-2435;
[1b] dragana.bozic@irmbor.co.rs, https://orcid.org/0000-0003-1055-8449;
[1c] srdjana.magdalinovic@irmbor.co.rs, https://orcid.org/0000-0002-2916-2850;
[1d] sanja.bugarinovic@irmbor.co.rs, https://orcid.org/0000-0001-5197-1614;
[1e] milos.djukic@irmbor.co.rs, https://orcid.org/0000-0002-3307-4669;
[1f] milenko.jovanovic@irmbor.co.rs, https://orcid.org/0000-0002-6757-4143;
[2a] pozegav1864@gmail.com

Abstract

The Accreditation Body of Serbia (ATS) requires the accredited laboratories to participate in an interlaboratory comparison.

The MECA laboratory of the Mining and Metallurgy Institute Bor, a laboratory for non-destructive testing (steel ropes, metal materials and welded joints), accredited by the Accreditation Body of Serbia, has participated in an external control, participating in an interlaboratory comparison.

Keywords: *laboratory, quality assurance, interlaboratory comparison*

1. INTRODUCTION

From very beginning of the Institute in 1962 under the name the Copper Institute Bor, today the Mining and Metallurgy Institute (MMI) Bor (hereinafter referred to as the Institute), the Institute includes the testing laboratories within its structure. Improvements, related to the test results of the testing laboratories within the Institute, are defined in the Rulebook of the Testing Laboratories Quality. The Rulebook primarily refers to the accredited activities of the Institute [1]. The content and structure of the Rulebook are aligned with the international standard, SRPS ISO/IEC 17025:2017 [1,2].

Tests in the laboratories of the Institute are carried out on the basis of defined methods from the Accreditation Scope and according to the national regulations. The Accreditation Scope is defined by the material type, technique, method and scope of testing. According to the prescribed rules of the Accreditation Body of Serbia, the valid scope of the Institute accreditation is renewed, reduced or increased in cycles and duration of the accreditation scope. The laboratory methods for the tests in the Institute can be standard (there are the valid standards) and non-standard house methods, so-called the Validated House Methods (VMK). The non-standard house methods used in the Institute laboratories are given in the Laboratories Code [1]. The testing laboratories have competent internal and external staff. The staff is trained to act impartially, professionally handle the equipment, evaluate the test results, sign the test reports and work in accordance with the quality management system (QMS) [3] of the laboratory. The workspace of the laboratories is distributed in different locations. A part of the working space of the laboratories is located within the building

complex of the Institute, within the central laboratory (CL), then within the premises of the Zijin Bor company. There are also laboratories of the Institute that work in the field.

2. EXPERIMENTAL

Considering the tests types and measurements, carried out in the MECA Laboratory, the laboratory for the non-destructive testing of steel ropes, metal materials and welded joints, the tests and measurements are carried out in the field, at the location of the users of the testing services.

Testing of the ropes is performed according to the VMK, while the tests of metal materials and welded joints are performed according to the standards from the accreditation scope.

2.1 Standard Requirements from the Accreditation Scope

When working on objects, the environmental conditions under which they are tested, if they are not specified by the special requirements, should be such that they enable the normal work of the work executors.

The MECA Laboratory staff is obliged to maintain the orderliness in the premises they use during work. At the end of the work, all used devices, equipment and other means must be disposed of in the places provided for it, in an orderly condition.

2.2 Requirements of the House Validated Method VMK J.m.1:2019 [4]

The magnetic-flux testing of steel ropes procedure (number of broken wires, determination of the metal mass relative loss in the cross-section of the rope and determination of the rope diameter) is carried out in the field and laboratory.

The field is understood to mean the test site, which can be the underground or above ground. Testing of export steel ropes in mining can be both, underground and above ground, while testing of cable cars and ski lifts in ski centres is only above ground and is usually performed at a height of 4-5 meters.

The site of the field test can be an underground pit room, a pit facility on the earth surface, or an open space on the surface.

If the weather conditions threaten the safety and health of the employee, the temporary work at height is prohibited. The underground works are performed only with the presence and instructions of a superior person of the organization. Movement during the examination is allowed only on the prescribed and marked routes.

In order to protect the researchers from exposure to the landslides or collapse of earth, rock or other material in the tunnel there must be supports, and there must also be sufficient ventilation and safe places for them to take refuge in the event of fire, intrusion of water or material.

In the underground rooms of the mine, where methane and other flammable gases or dangerous coal dust appear and in the danger zones of explosions, on the objects located in the oil and gas fields, it is forbidden to bring easily flammable substances, smoking accessories or other means that can cause fire, ignition or explosion.

The use of protective equipment is mandatory according to the regulations that apply to a certain type of work and were adopted and applied by the service provider (examiner) on the spot (protective suit, appropriate footwear, gloves, helmet with lamp holder, lamp, etc.).

Due to work at the open space or in underground spaces, examiners are exposed to harmful microclimatic influences, namely: high or low temperatures, air flow, air humidity, snow, rain.

For work, the optimal temperature should be between 17°C and 19°C because at that temperature the influence of air humidity is insignificant on maintaining a constant body temperature.

Exposure to high temperatures leads to an increase in the intensity of the body vital activities, in contrast to the exposure to low temperatures where there is a decrease (it leads to the cessation of the system vital activities) more in QI-CL.29 [5].

The daily cleaning of the MEGA Laboratory premises is the domain of the Institute's Center for Electronic Business Informatics (electronic video informatics), within which the rules for maintaining orderliness and hygiene are regulated.

One of the ways to MEGA laboratory services quality check is an inter-laboratory comparison, which is the organization, performance and evaluation of measurements or tests of the same or similar items carried out by two or more laboratories, in accordance with predetermined conditions.

As part of the inter-laboratory tests of the participating laboratories, the MECA Laboratory of the Mining and Metallurgy Institute Bor and the laboratories of the Welding Institute d.o.o. Belgrade, the tests were performed on a sample of the welded joint, in accordance with the plan of inter-laboratory tests and valid standard for the test method: non-destructive testing - visual testing – general principles [6].

The goal of the interlaboratory comparisons was to verify the personnel performance, test equipment reliability and to verify the reliability of the test results.

3. RESULTS AND DISCUSSION

The subject of the test was a butt-welded (BW) joint marked as the VT3. The test side was the face of the seam.

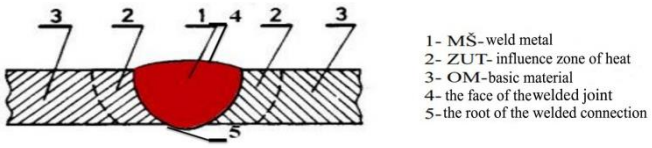

Figure 1. *Parts of the welded joint*

Two researchers from the Institute participated. The third researcher did not participate in the interlaboratory testing but only followed the process for training. One researcher from the laboratory of the Welding Institute d.o.o. Belgrade participated. During testing, the lighting was 500 lux, used equipment was a magnifying glass and meter. Preparation of the sample surface for testing was done with a steel brush and cloth.

Based on the interlaboratory tests requirements, a visual inspection was performed in the scope of 100% of the VT3 sample, for the quality level according to the SRPS EN ISO 5817 "B" [7] standard, and on that occasion the following was confirmed:

The first researcher from the Institute

- on l=30 mm - 2018 (surface pore) - Not satisfactory
- on l= 95mm - 502 (excessive overhang) - Not satisfactory

The second researcher from the Institute

- on l=30 mm - 2018 (surface pore) - Not satisfactory
- on l= 95mm - 502 (excessive overhang) - Not satisfactory

The researcher from the laboratory of the Welding Institute d.o.o. Belgrade

- on l=30 mm - 2018 (surface pore) - Not satisfactory

- on l= 95mm - 502 (excessive overhang) - Not satisfactory

Figure 2. *Surface pore*

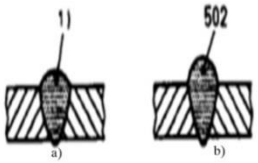

Figure 3. *Appearance of normal a) and excessive weld metal*

A surface pore is a pore that projects onto the seam surface.

According to the irregularity classification, an excessive overhang belongs to the shape and size irregularities, Figure 3. It can occur due to too short transverse oscillation of the electrode, too large diameter, high current, low speed.

A welded joint without irregularities does not exist. There are evaluation criteria, that is, the acceptance of welded joints. These acceptance criteria are embodied in standards. The standards specify exactly which errors are acceptable and to what extent. Acceptance criteria for welding steel structures are given in the standard SRPS EN ISO 5817 [7].

4. CONCLUSION

On the basis of inter-laboratory comparative tests, performed using the mentioned method, it can be stated that the results obtained in the laboratories of the Mining and Metallurgy Institute Bor, MECA laboratory and Welding Institute d.o.o. Belgrade - Laboratory were IN AGREEMENT.

ACKNOWLEDGEMENTS

This work was financially supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, Contract on realization and financing of the scientific research work of the Mining and Metallurgy Institute Bor in 2024, Contract No.: 451-03-66/2024-03/ 200052.

REFERENCES

[1] QM-CL.91 Rulebook of the Testing Laboratories Quality, Internal Documentation of the Mining and Metallurgy Institute (IRM) Bor, 2022, p. 1-52. (In Serbian)
[2] Standard SRPS ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories, p. 1-30. (In Serbian)
[3] QMS ISO 9001 Quality Management System. Requests
[4] House validated method, VMKJ.m.1:2019, Internal Documentation of the Mining and Metallurgy Institute (IRM) Bor, 2023, p. 1-5. (In Serbian)
[5] QI-CL.29, Instructions for Work in the Field, Internal Documentation of the Mining and Metallurgy Institute (IRM) Bor, 2023, p. 1-12. (In Serbian)
[6] SRPS EN 13018:2017 Non-Destructive Testing - Visual Testing – General Principles
[7] SRPS EN ISO 5817:2023 Welding - Fusion-Welded Joints in Steel, Nickel, Titanium and their Alloys (Beam Welding Excluded) - Quality Levels for Imperfections