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25 years of accreditation of the Testing Laboratory at KOMAG Institute of Mining Technology

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Abstract:

The article presents the 25-year history of accreditation of the Testing Laboratory of the KOMAG Institute of Mining Technology in Gliwice. It describes the process of implementing and applying the management system in accordance with the standards being in force within the years 1995-2020. The article shows the process of changing the standards requirements for the accreditation for testing laboratories. The most important changes in the approach to laboratory activities, which are currently focused on activities that determine their quality, are highlighted. Minimization of documentation is the result of the change in approach to testing activities and competence of the personnel is of key importance. At the same time, the changing requirements for the testing process itself are presented on the example of testing the powered roof supports.
The article describes changes in the testing infrastructure of the Testing Laboratory, both before obtaining accreditation, as well as its development over 25 years of accreditation.

Streszczenie:

Publikacja poświęcona jest 25-letniej historii akredytacji Laboratorium Badań Instytutu Techniki Górniczej KOMAG w Gliwicach. Przedstawiono w niej proces wdrażania i stosowania systemu zarządzania zgodnie z normami obowiązującymi na przestrzeni lat 1995-2020. W artykule pokazano proces zmian norm dotyczących wymagań akredytacyjnych laboratoriów badawczych. Zasygnalizowano najważniejsze zmiany dotyczące podejścia do działań laboratorium, które obecnie są ukierunkowane na działania procesowe decydujące o ich jakości. Wynikiem zmiany podejścia jest minimalizacja dokumentacji, zaś za kluczowe uznaje się kompetencje personelu. Równolegle przedstawiono zmieniające się wymagania dotyczące samego procesu badawczego, na przykładzie badań górniczych obudów zmechanizowanych.
W artykule opisano zmiany dotyczące bazy badawczej Laboratorium Badań, zarówno przed uzyskaniem akredytacji, jak również jej rozwój na przestrzeni 25 lat akredytacji.

1. Introduction

Accreditation - a term that was only used several decades ago to refer to journalists or diplomats, today is also associated with laboratories. However, in this context, it has a different meaning.

According to the PN-EN ISO/IEC 17000:2020-12 [1] standard, accreditation is "attestation" by a third party, relating to a conformity assessment body, to formally demonstrate its competence in performing the specific tasks associated with conformity assessment.

Accreditation is than a formal recognition, by an authorized organizational unit, of the competence of a certain organization or person operating in the field of conformity assessment.

It is, in a way, a credit of trust granted to an organization, or a testimonial confirming the reliability of an organization offering a given type of service.

In the case of testing laboratories, the term "accreditation" means the procedure in which, on the basis of an assessment made by an authorized body (in Poland - the Polish Centre for Accreditation), a statement (accreditation certificate) that a given entity is competent to perform specific tasks, is issued.

In the case of laboratories, it involves carrying out tests to show that the tested object meets the requirements for its intended use.

The benefits of accreditation in the case of testing laboratories are presented in the table 1.

Table 1. The benefits of accreditation [2]

Addressee	Benefits
Accredited organization	Confirmation of competences Recognition of results Competitive advantage
Users	Trust in the quality and safety of products and services Reliable and precise results of measurements and tests Reliable information
State administration	Trust in legislation and decisions of state bodies Technical support in notification processes Assurance of public safety
Industry and business	Access to European and world markets Better product quality Lower control and manufacture costs Chance for innovation Effective risk management

Authorizations granted initially by the Central Office of Product Quality, and then by the Polish Centre for Testing and Certification were the basis for granting accreditation to testing laboratories.

Being aware of the benefits of accreditation, the Division for Attestation Tests, as an organizational unit operating within the structures of the Mining Mechanization Centre in Gliwice, submitted in June 1992 an application to the Central Office for Product Quality for the assessment procedure and for granting accreditation for testing the powered roof supports.

In that time the Division for Attestation Tests had the following departments:

- Department for Testing the Powered Roof Supports in the scope of testing the kinematics and functionality as well as fatigue strength of powered roof supports,
- Department for Testing the Hydraulic and Mechanical Systems in the scope of testing the hydraulic cylinders of powered roof supports, hydraulic control and protecting components as well as hydraulic pipes and hoses,
- Department for Physical and Chemical Tests in the scope of testing the material properties and chemical composition of powered roof support components.

In 1994 a proposal was submitted for the pre-audit which included the following stages:

- assessment of advancement in using the quality system in the laboratory in accordance with the requirements of EN 45001:1993 Standard [3] and ISO/IEC No. 25:1990 Guide [4],
- assessment of the quality system documents,
- acquainting with the scope of tests submitted for accreditation.

As a result of the pre-assessment, it was recommended to introduce some changes, especially in the organizational area, consisting in the separation of two areas of the Division's activity, so on January 1, 1995, the following two separate units were established:

a. Testing Laboratory, which conducted research activities and applied for accreditation according to the requirements of the EN 45001:1993 Standard and ISO/IEC No. 25:1990 Guide,
b. Department of Attestation Tests, who conducted the attestation activities and made efforts for accreditation of the certifying body according to the requirements of the EN 45011:1993 Standard [5].

After the organizational changes and the introduction of corrective measures, an accreditation audit was carried out in the Testing Laboratory on June 27-28, 1995, which resulted in the granting the first accreditation certificate for the testing laboratory No. L 39/1/95 for 3 years on October 31, 1995.

The certificate number (39) indicated that the Laboratory was one of the first to be accredited in Poland. Accreditation documents are as follows:

1. Accreditation certificate for the testing laboratory No. 39/1/95 with validity up to 30.10.1998.
2. Contract No. AB/L 39/95
3. Accreditation mark PCBC
4. Rules for using the accreditation mark by the accredited testing laboratory.
5. Scope of accreditation.

Historical certificate and accreditation mark are shown below.

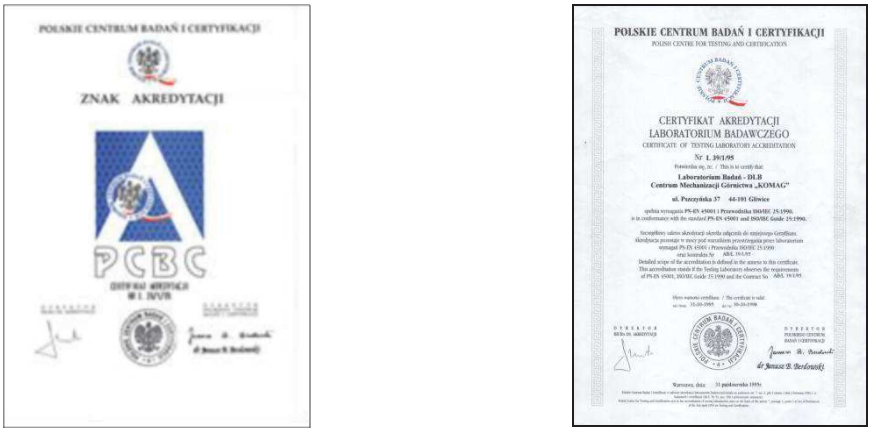

Fig. 1. Certificate and accreditation mark of the Testing Laboratory [1995]

2. Accreditation scope and testing infrastructure

Scope of accreditation granted in 1995 for testing powered roof supports especially:

1. testing the powered roof support's structure,
2. testing the hydraulic components of the powered roof support,
3. physical and chemical tests of the powered roof support components,

which were based on own procedures and testing instructions developed on the basis of the following documents:

1. "Temporary requirements, guidelines for designing and testing in laboratory as well as for in-situ tests of powered supports for issuing the approval of the type for production and use" [6] issued in December 1984 by the Ministry of Mining Industry and Energy, which was in force until November 1998,
2. "Design and strength requirements for powered supports" [7] developed by specialists from KOMAG Gliwice, GIG Katowice and the Silesian University of Technology in Gliwice, which were in force since November 1998,
3. Polish standard PN-G-50041:1994 "Protection of work – Powered roof supports – Requirements for safety and ergonomics" [8].

In the years 1998-2005, the tests of new powered roof supports included the scope presented in the Table 2.

Table 2. Type of powered roof support tests

Item	Type of test
1	Checking the main dimensions of roof supports
2	Assessment of the assembly and disassembly convenience
3	Checking the functionality and kinematics
4	Stability tests
5	Fatigue tests
6	Testing the static strength

7	Testing the dynamic strength
8	Testing the materials

For the new power hydraulic components the scope of testing is given in Table 3.

Table 3. Scope of testing the power hydraulic components

Item	Type of test
1	Leak tightness test
2	Fatigue test
3	Static strength test
4	Dynamic strength test
5	Testing the materials
6	Testing the anti-corrosion protection

The subsequent accreditation periods, covering the years 1998-2001 and 2001-2005, did not introduce significant changes to the scope of the Testing Laboratory activity.

Comprehensive tests of powered supports was possible due to the construction of a state-of-the-art technical infrastructure for testing, which included the following test stands presented in Fig. 2:

1. Stand for testing the strength of powered roof support,
2. Stand for testing the functionality of powered roof supports
3. Stand for testing the hydraulic legs and the components of high-pressure hydraulics,
4. Stand for testing the components of mining machines and equipment,
5. Stand for testing the valves.

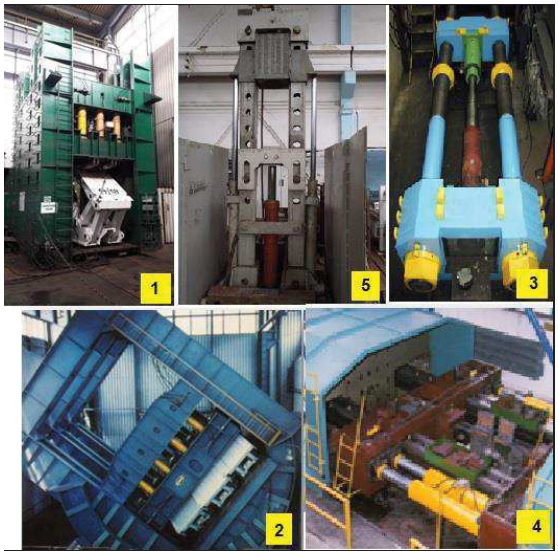

Fig 2. Test stands of the Testing Laboratory [1995]

3. Accreditation after accession to the European Union

The association, and then Poland's accession to the European Union, brought a number of changes both in the accreditation process of testing laboratories as well as in testing methodologies.

Thinking about laboratories developing their quality systems, the Polish Committee for Standardization issued in 2001, the European standard PN-EN ISO / IEC 17025: 2001 [9].

This standard replaced the PN-EN 45001: 1993 document used by the laboratory.

The next edition of the standard containing the requirements for the testing laboratory was the standard issued by ISO/IEC in 2005, which was prepared as the international standard and was issued in Poland as the Polish Standard: PN-EN ISO/IEC 17025:2005.

In June 1998, the European Parliament issued the Directive 98/37/EC, which contained the basic requirements for the safety of machinery and equipment.

Detailed requirements referred to the so-called harmonized standards, drawn up under a mandate from the Commission by CEN and CENELEC, and then incorporated unchanged into national standards.

In the annex to the directive, powered roof supports are listed in the context of type examination for the needs of the notified body.

Regarding the safety requirements for powered roof support, the following two standards were issued:

1. EN 1804-1:2004 – including the requirements for powered roof support design [10],
2. EN 1804-2:2004 – including the requirements for hydraulic components of powered roof support [11].

It should be emphasized that in the case of powered roof supports, the Testing Laboratory was one of two testing laboratories in Europe that performed accredited tests in this scope for the needs of notified bodies.

The previously mentioned harmonized standards fundamentally changed the way of testing the powered roof supports structure and hydraulic components.

In the case of testing the powered roof supports structure, scope of testing was specified in Annex A to EN 1804-1:2004 Standard, which included the following types of tests:

a. testing at static load equal to 1.2 of the nominal force,
b. testing the components hydraulic legs and cylinders at compressing and tensile load equal to 1.5 nominal compressing and tensile force,
c. testing the load-bearing capacity (yield of the powered roof support),
d. cycles of the fatigue test with the amplitude from 1.05 to 0.25 nominal force (26000 load cycles for two-leg roof support and 30000 load cycles for four-leg roof support) for different combined loads,
e. testing the powered roof support at horizontal load,
f. testing the transportation catches for lifting and moving.

The harmonized standards alleviate the requirements for test results acceptance criteria to the criterion that after the tests completion none of the roof support's base material should contain cracks and no cracks in the joints or permanent deformations that would lower the technical parameters of the roof support are allowed.

In testing the actuating components (hydraulic legs, canopy cylinders and auxiliary cylinders), Annex B to the EN 1804-2:2004 standard specifies the scope of tests including the following tests:

a. tests with symmetrical axial load (stroke limiter test, compliance test, overload tests),
b. tests under asymmetric load (bending test and compliance test),
c. durability tests (asymmetric load - 6,000 cycles, axial load - 15,000 cycles, load to the leg in the most extended position - 100 cycles).

Therefore, in 2005, the Laboratory of Tests introduced both standards to its scope of accreditation.

Moreover, the scope of accreditation was extended by including the following groups of tested objects:

- hydraulic transmission pipelines, their components and fittings,
- frictional legs,
- shackles,
- steel sprags,
- lining meshes.

In 2008, the third standard of the EN 1804-3:2008 series [12] was published, containing the requirements for hydraulic control components, which was also included to the scope of accreditation.

4. Development of the testing infrastructure

Growing requirements for accredited laboratories both regarding the quality management system, as well as testing according to specific standards and intensive use of test stands forced modernisation of the Testing Laboratory infrastructure.

In the years 2004-2007, a lot of work was undertaken to modernise the laboratory's testing infrastructure.

The most important projects included the following:

- designing and manufacture of a state-of-the-art oil-water emulsion cooling system supplying the test stands,
- change of the hydraulic system to the electrohydraulic control of the stand for powered roof supports functionality tests and the stand for strength tests,
- manufacture of an automatic monitoring system for fatigue tests on the test stand for testing the strength of powered roof supports,
- modernisation of the valves test stand, extending the possibilities of its use for testing the dynamic loads and tensile static loads,
- modernisation of the stand for testing the strength of powered supports loaded with additional horizontal force,
- modernisation of the system for recording the parameters measured on a testing facility.

At the same time, along with extending the scope of accreditation, actions were taken to build new test stands.

In the years 2008-2011, the technical documentation of the following test stands was prepared at the KOMAG Institute of Mining Technology which then were used in testing:

- a stand for testing hydraulic legs,
- a stand for testing steel sprags,
- a stand for testing lining meshes.

A view of the test stand lining mesh is shown in Fig. 3.

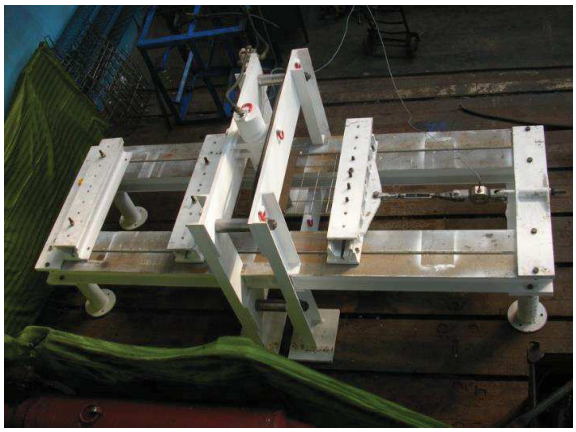

Fig. 3. Test stand lining mesh [2011]

The next stage of extension and modernisation of the testing infrastructure was realized in 2012-2013.

Funds from the European Regional Development Fund allowed for the following:

- modernisation of the stand for testing the functionality of powered roof supports, consisting in the extension of the mechanical equipment of the test stand roof components and replacement of the hydraulic system by this manufactured according the developed technical documentation,
- modernisation of control systems for test stand by changing the control panels and using fatigue test recording systems,
- development a programming environment enabling the collection, analysis and visualization of measurement data and their transfer to customers,
- implementation of an electronic monitoring system for supervising the measuring and testing equipment.

5. Improvement of the management system

The development and modernization of the testing infrastructure ensured meeting the requirements for technical competences in subsequent accreditation cycles covering the years 2005-2009, 2009-2013, 2014-2016 and 2016-2020.

In 2009, integration of management systems, which were in force at the Institute, was completed.

The integration process covered the following three basic levels of management:

- the level of the integrated management policy, which took into account the management of quality, the accreditation system of testing laboratories and the accreditation system of the product certifying body,
- level that takes into account all functions regarding the processes and improvement activities of a different nature (organizational, technical, methodological, IT, etc.) focused on finding the best solutions at various organizational levels in each sphere of the institute activity,
- level of integration of the management system documents.

The quality management system in the scope of R&D projects, designing and author's supervision over the machines and devices as well as expert opinions was the basis of the integrated management system.

This system combined the following management systems resulting from the accreditations granted by the Polish Centre for Accreditation:

- quality management system according to PN-EN ISO 9009:2009 Standard being in force in all Institute's divisions,
- management system according to PN-EN ISO/IEC 17025:2005 Standard valid for accredited tests,
- management system according to PN-EN 45011:2000 Standard valid for products certification processes.

There were the following advantages of the integrated system:

- uniform Quality Policy taking into account the requirements of all standards,
- uniform organization of documentation and no duplication of documents and forms,
- easy supervision of the management system and its improvement through the introduction of common internal audits and management reviews, and the implementation of joint corrective and preventive measures [13].

A positive assessment in 2017 of the competence to manage a flexible scope of accreditation proved the improvement of the management system.

Flexible scope of accreditation by the Laboratory allowed for:

- implementation of own modified testing methods,
- use of updated standard testing methods.

The laboratories with flexible scope of accreditation are obliged to update so-called *List of tests conducted within the flexible scope of accreditation.* The list is an extension of the testing laboratory fixed scope of accreditation [14].

In 2018, the next edition of the PN-EN ISO/IEC 17025:2018-02 standard [15], containing the requirements for a testing laboratory management system, was published.

This standard introduced a number of significant changes compared to the previous edition (including requirements for impartiality, confidentiality and risk).

In accordance with the adopted philosophy of the process management, the new PN-EN ISO/IEC 17025:2018-02 standard identifies the basic processes related to testing, in particular:

- review of inquiries, quotations and contracts,
- method selection, verification and validation,
- sampling,
- handling with the testing objects,
- technical records,
- calculation of measurement uncertainty,
- confirmation of the results usability,
- presentation of test results,

- complaints,
- if the work is inconsistent with the requirements,
- data supervision [16].

The assessment of the Testing Laboratory in 2019 confirmed that the requirements of the new standard were met and allowed for the extension of the scope of accreditation to include test for the construction industry in testing the mechanical properties of steel bars, wires, wire rods and meshes for concrete reinforcement.

The current certificate of the Testing Laboratory is presented below (Fig. 4), and full scope of accreditation can be found at the link http://komag.eu/badania/laboratorium-badan.


POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATION
PCA
CERTYFIKAT AKREDYTACJI
LABORATORIUM BADAWCZEGO
ACCREDITATION CERTIFICATE OF TESTING LABORATORY
Nr AB 039
INSTYTUT TECHNIKI GÓRNICZEJ KOMAG
ul. Pszczyńska 37, 44-101 Gliwice
LABORATORIUM BADAŃ
ul. Pszczyńska 37, 44-101 Gliwice
DYREKTOR
POLSKIEGO CENTRUM AKREDYTACJI
LUCYNA OLBORSKA

Fig. 4. Current accreditation certificate of the testing laboratory [2019]

This year, another accreditation cycle ended in May, and therefore in February this year the Polish Centre for Accreditation re-assessed the competences of the Testing Laboratory.

6. Conclusions

Over 25 years of accreditation; The Research Laboratory has performed approximately 3,500 accredited tests of all types of construction products, contributing to the improvement of work safety both in the underground of mines as well as in other industries.

Initially, mainly powered supports and their components were tested, while in recent years the scope of testing is not limited to tests for the mining industry, but also covers other areas, e.g. construction industry.

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[3] EN 45001:1993 General criteria for the operation of testing laboratories

[4] ISO/IEC GUIDE 25:1990 General requirements for the competence of calibration and testing laboratories

[5] EN 45011:1993 General requirements for bodies operating product certification systems

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[9] PN-EN ISO/IEC 17025:2001 Ogólne wymagania dotyczące kompetencji laboratoriów badawczych i wzorcujących (General requirements for the competence of testing and calibration laboratories)

[10] EN 1804-1:2004 Machines for underground mines - Safety requirements for hydraulic powered roof supports - Part 1: Support units and general requirements

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