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## METROLOGY IN UKRAINE

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**Abstract.** *The structure of Ukrainian metrology service, tasks of everyone its unit, basic stages of development and transformation of national legislation are considered on metrology tasks and harmonization of basic concepts and organizational structure of nowadays national metrology service in Ukraine.*

**Keywords:** metrology service, legislation, structure, transformation, harmonization, nanometrology, standard, measure

### METROLOGIA W UKRAINIE

**Streszczenie.** *W artykule są rozpatrywane pod względem zadań metrologicznych oraz harmonizacji podstawowych pojęć i struktur organizacyjnych w nowoczesnych dziejach państwowej służby metrologicznej w Ukrainie: struktura ukraińskiej służby metrologicznej, zadania jej każdej odrębnej jednostki, podstawowe etapy rozwoju i transformacji ustawodawstwa krajowego.*

**Słowa kluczowe:** służba metrologiczna, prawnictwo metrologiczne, struktura, harmonizacja, nanometrologia, wzorzec, miara

### Introduction

The development of trade, industry and eventually caused the need to ensure traceability. At first, the Chamber of Weights and Measures of Venice Republic representation appears in the medieval city Lviv. She later it was formalized at the state level during the Austro-Hungarian and interwar Poland – in the West part of Ukraine, but from the early twentieth century in Kyiv and Kharkiv – in the under Russian ruled the Eastern part of Ukraine. New statement feature of metrological service was get already after the restoration of Ukrainian independence after the 1991 referendum.

Very important is the training of qualified personnel for metrology service. This contributed to the emergence of the first in Eastern Europe Lviv Polytechnic National University (1844), in epy central Ukraine – Kyiv Polytechnic Institute (1898) and at the East Ukraine – Kharkiv Polytechnic (1885). The scientists of these institutions designed measuring equipment, worked out methods of measurement and testing and so on. The development of electrical metrology in Ukraine is closely linked with the works of Lviv Polytechnic scientists. In particular, in the interwar period in the department of electrical measurements was remained the state reference of electromotive force and the standard resistance. Subsequently, thanks to the academician Ivan Fedyk assistance Lviv was actively involved in the temperature measurement. So, design and scientific office "Thermodevice" was founded in 1956 and became the lead organization on this issue in Eastern Europe. It carries out research and design work in a variety of contact and non-contact primary temperature transducers and secondary facilities. Being established close scientific cooperation with the employees of the Lviv Polytechnic and Ivan Franko Universities, where successfully was prepared highly qualified personal.

Modern metrology is characterized by close collaboration and cooperation among all the countries in the world, since a single country cannot accomplish all the necessary metrological tasks alone. Metrology is a discipline in which the key element is a high degree of international, regional and national coordination [1 – 3]. Transforming national metrological legislation with the aim of effectively adapting the activity of the National Metrology Service to bring it into line with modern requirements in the framework of the Global Metrology System is an important and difficult task.

### 1. National legal metrology

The legislative basis of the *State Metrology System and the State Committee of Ukraine for Standardization, Metrology and Certification* was established in 1992. This was done via a decree of the Cabinet of Ministers of Ukraine entitled *On traceability assurance* (no. 40-93 dated 1993-04-26) with traceability assurance as one of its responsibilities [2, 3].

In 1996 a draft law entitled *On metrology and metrological activities* was developed which highlighted all the major aspects

of the organization and management of metrological activities. It was accepted by the Ukrainian Parliament (the Verkhovna Rada) and adopted as Ukrainian Law in 1998. The modern legislative basis of the National (State) Metrology Service of Ukraine includes the Law of Ukraine *On metrology and metrological activities* (no 113/98 of 1998-02-11), updated in 2004 (no 1765-IV of 2004-06-15). Present day activities of the State Metrology Service are based on this law on units of measurement, standards and measuring instruments. The main provisions of this law are harmonized with standards, rules on metrology as well as with the International Organization of Legal Metrology (OIML) publications, which are generally accepted throughout the world [2, 4].

The office was transformed into the State Committee of Ukraine for Technical Regulation and Consumers' Police in 2000. From 2011 its functions in the field of metrology were transferred to the Department of Technical Regulation of the Ministry of Economic Development and Trade of Ukraine.

Developing of a new Law *On metrology and metrological activities* draft has been ongoing since 2011. European experts are also involved in the drafting process.

### 2. National metrological organizational structures and the scope of its activities

The State (National) Metrology Service of Ukraine comprises [3, 5]:

- the Department of Technical Regulation of the Ministry of Economic Development and Trade of Ukraine,
- State Scientific Metrological Centers,
- the Service of Uniform Time and Etalon Frequencies,
- the Service of Reference Materials for the Composition and Properties of Substances and Materials,
- the Service of Standard Reference Data on Physical Constants and Properties of Substances and Materials,
- metrological centers,
- regional bodies.

The main objectives of the Department of Technical Regulation focus on implementing common scientific and technical policy in the field of metrology, including:

- organizing and carrying out fundamental research in the field of metrology and developing national measurement standards,
- determining procedures for the development, approval, registration and maintenance of measurement standards, as well as their comparisons with national and international measurement standards,
- determining general requirements for the verification, calibration and metrological evaluation of measuring instruments;
- participating in cooperative projects with international organizations etc.

The main Metrological Centers in Ukraine are the National Scientific Centre "Institute of Metrology" (Kharkiv), State Enterprises "All-Ukrainian State Scientific and Research Centre of Standardization, Metrology, Certification and Consumer Protection" (Kyiv) and Scientific and Research Institute "System" (Lviv).

The Kharkiv Institute of Metrology [6] is a leading center for assuring the uniformity of measurements in Ukraine. Its role is to

- carry out fundamental and applied research in the field of metrology,
- organize the development, maintenance and improvement of national and secondary measurement standards used in traceability schemes,
- carry out state testing of measuring instruments in designated fields of measurements,
- carry out verification and metrological certification of measuring instruments in designated fields of measurements,
- develop normative documents in the metrology field.

It should be noted that the leading world countries occupying key positions in microelectronics and implementation issues in the practice of metrology of linear measurements in micro- and nanometer ranges give paramount importance. The development of microelectronics, micromechanics, nanotechnology requires improved methods for measuring linear dimensions of the elements of the topology of the chip, analysis of surface structures, as well as measuring instruments confirming the validity of the measurements of the dimensions of real objects and their elements.

Measurements on linear dimensions in the micron and submicron range by scanning electron microscopy using today is considered as one of the most accurate and it is used in Kharkiv Institute.

Kyiv "Ukrmetrteststandard" [7] is designated as a leading center of the National Metrology Service of Ukraine. It performs the following functions:

- development, maintenance and improvement of measurement standards;
- maintenance of the national (state) register of approved types of measuring instruments;
- state testing verification and metrological certification of measuring instruments in designated fields of measurements;
- realization of state metrological supervision in designated regions;
- development of normative documents in the field of legal metrology (testing for type approval and verification of measuring instruments, etc.).

Lviv State Scientific and Research Institute "Systema" [8] has substantial achievements:

- in metrology supporting the measurement information and automatic control systems for industrial processes;
- in developing standards on measurement and reference measuring instruments, mobile laboratories;
- in creating information management systems for the purpose of quality assurance;
- in establishing systems of basic standards, technical and economic information classifications and appropriate manuals;
- in preparing organizational and methodological documents for the Ukr CEPRO system.

The important place in thermometry takes Lviv Scientific and Production Association "Thermopyrlad" named after V. Lakh as an enterprise specialized in the development and serial production of devices for monitoring temperature from minus 260°C to 4000°C, which are used practically in all branches of industry, agriculture, nuclear power plants, scientific research and medicine.

The high qualification, extensive experience of our specialists, advanced technology and complete sets allows us to develop modern temperature control devices, which are successfully used in nuclear power plants, steel mills and many other facilities. All products are certified by SERTATOM of Ukraine and are accep-

ted by representative of SERTATOM [9].

Precise instrumentation for verification needs is developed by the Institute of Electrodynamics of the National Academy of Sciences of Ukraine [10] that is used both by Ukrainian Metrology Service and by NIST, PTB, GUM etc.

The main objective of the metrological centres and the regional bodies are initial verification, reverification and metrological certification of measuring instruments, and the realization of state metrological supervision in designated regions [2–5, 11].

### 3. Summary

The new national law on metrology will allow national metrological legislation to be adapted to the requirements of the most recent standards and recommendations of the various international metrology organizations, and will allow the activity of the national metrology service in Ukraine to be effectively promoted.

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