

Metrology, certification and standardization

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Annotation: The article discusses the issues of studying the basic concepts of metrology: measurement, verification and methods of ensuring the uniformity of measurement. In addition, the article explores all aspects of certification and standardization in metrology.

Key words: Quality management system, standardization, metrology, economic conditions, certification.

Nowadays, the importance of metrology and technical regulation under any economic conditions can hardly be overestimated. The materials acquired by scientists can also provide an understanding of the tasks of metrology: the study of basic concepts in the field of metrology, such as measurement, verification, the study of ways to ensure the uniformity of measurements and methods for assessing their accuracy, the role and importance of metrology in international economic and scientific relations; study of the legal foundations of metrological activity; instilling skills in the use of technical regulations and standards of various types in the development of innovations and the development of economic activities of organizations.

Metrology (from the Greek word metron — measure, logos — study) is the extraction of quantitative information using measuring instruments about the properties of objects and processes, measuring the

properties of objects and processes with a given accuracy and reliability. In other words, metrology is the science of measurements, methods and means of ensuring their unity and ways to achieve a given level of accuracy. Modern metrology includes three components: [1]

1. Legal metrology.
2. Fundamental metrology.
3. Practical metrology.

The measurement results are expressed in legalized values. One of the main tasks of metrology is to ensure the uniformity of measurements. It can be solved subject to two fundamental conditions:

1. Expression of measurement results in uniform legalized units.
2. Establishing the permissible errors of measurement results - the limits beyond which they should not go beyond a given probability.

The main task of metrology is to ensure the uniformity of measurements by establishing units of physical quantities, state standards and reference (exemplary) measuring instruments, ensuring the uniformity of measurements and uniformity of measuring instruments, developing methods for assessing the error of measuring instruments, control and testing, as well as a system for transferring unit sizes from standards , reference (exemplary) measuring instruments to working measuring instruments. The solution of this problem is impossible without the establishment of uniform rules, requirements and norms applied at all stages of metrological support. In metrology, the most accurate measuring instruments are called reference or exemplary. [2]

Standards that store and reproduce units of measurement with the highest accuracy are called state primary and are officially approved as a reference for the country.

The uniformity of measurements is maintained by transferring the unit of quantity from the initial standard to the working measuring

instruments, carried out step by step using working standards and reference (exemplary) measuring instruments. The accuracy of these measures decreases from step to step, as a rule, by 2–4 times. Metrology of measuring instruments (MI) in accordance with the verification scheme is periodically subject to verification, which consists in determining by the metrological body the error of measuring instruments and establishing its suitability for use, provided that this error does not exceed the permissible value.

Work on ensuring the uniformity of measurements is carried out by specialized organizations, special services of organizations and even individuals. The network of metrological bodies is called a metrological service. The activities of these bodies are aimed at ensuring the uniformity of measurements and the uniformity of measuring instruments through verification, revision and examination of measuring instruments.

All measurements carried out in the country must be carried out on measuring instruments that have passed special tests, called type conformity tests, and entered into a special State Register of Measuring Instruments. Measuring instruments used in the field of state metrological control and supervision are subject to verification. At the request of the owner, measuring instruments used outside the specified area can be either verified or calibrated.

Verification of measuring instruments - a set of operations performed by the bodies of the state metrological service in order to determine and confirm the compliance of the measuring instrument with the established technical requirements. As follows from the above definition, verification is an operation of experimental verification of the compliance of the metrological characteristics of measuring instruments with established values, i.e., in fact, an operation of tolerance control. If the characteristics of the measuring instrument are within the established

range of possible values, then the measuring instrument is recognized as suitable; if they do not enter (exit), then according to the results of verification, it is recognized as unsuitable for further use (rejected).

Calibration of measuring instruments is a set of operations performed to determine and confirm the actual values of metrological characteristics and suitability for use of measuring instruments that are not subject to state metrological control and supervision. The first difference between calibration and verification, as it follows from their definitions, is the uncertainty of its performer. The second difference is that verification must give an unambiguous answer about the conformity or non-conformity of the measuring instrument with the established requirements, and the calibration provides for the determination of the actual values of the metrological characteristics and its suitability for use. Based on the results of the calibration, a measuring instrument can be recognized as suitable for use in a given specific technological process, even if its real metrological characteristics went beyond the tolerance values established during testing and type approval, but satisfy the requirements for a specific measuring process. In addition to these differences, verification and calibration are in many ways similar, since they are based on transferring the size of a unit of a measured quantity from the same standards using the same methods. Therefore, the tasks of the GSI include legal, organizational and technical support for the calibration of measuring instruments, carried out by a special body. [3] Some examples of the definition of the formation rules for the names and designations of decimal multiples and sub-multiples of the International System of Units are formed using multipliers and prefixes.

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