

**METHOD OF DETERMINATION OF STANDARD UNCERTAINTY OF
MEASUREMENT MEASURING**

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ABSTRACT

Extensive work in the field of measurement shows that its role in science and technology and in the life of human society is extremely high. And, of course, the development of society is determined by the status and capabilities of measurements and its metrological support. Ensuring the uniformity of measurements is one of the most pressing issues in metrology. Therefore, any measurement information obtained as a result of measurements (regardless of the conditions, time and place of the measurements) is important and useful in ensuring the unity of measurement in the required accuracy.

Keywords: *Uzstandart, metrologica, label, export, standard, Oz DSt, modification.*

АННОТАЦИЯ

Ўлчаш соҳасида кенг кўламда олиб борилаётган ишлар унинг фан-техникадаги ва кишилик жамиятининг ҳаётдаги роли ниҳоятда юқори эканлигидан далолат беради. Ва, албатта жамиятнинг тараққиёти ўлчашларнинг ҳолати ва имкониятлари ва унинг метрологик таъминоти билан белигиланади. Ўлчашлар бирлигини таъминлаш метрологиянинг энг долзарб (устивор) масалаларидан бири ҳисобланади. Шунинг учун ҳам ўлчашлар натижасида олинган ҳар қандай ўлчаш информацияси (ўлчашлар қандай шароитда, қандай вақтда, қаерда ўтказилишидан қатъий назар) талаб этиладиган аниқликда ўлчаш бирлигини таъминлашда унинг аҳамияти ва фойдаси.

Аннотации

Обширная работа в области измерения показывает, что его роль в науке и технике и в жизни человеческого общества чрезвычайно высока. И, конечно же, развитие общества определяется состоянием и возможностями измерений и их метрологическим обеспечением. Обеспечение единства измерений - одна из самых актуальных проблем метрологии. Следовательно, любая информация об измерениях, полученная в результате измерений (независимо от условий, времени и места проведения измерений), важна и полезна для обеспечения единства измерения с требуемой точностью.

Таянч иборалар: Ўзстандарт, метрологи, Синаш, калибрлаш, ёрлиг, экспорт, Ўз ДСт, модификация.

Опорные слова: Узстандарт, измерений, этикетка, экспорт, Oz DSt, модификация, метрологии.

Ensuring the uniformity of measurements is one of the most pressing issues in metrology. Therefore, any measurement information obtained as a result of measurements (regardless of the conditions, time, and place of the measurements) will be more important (and higher) only if it meets the requirement of providing a unit of measurement with the required accuracy. Many scientists have praised the importance of measurements. For example, the great Russian scientist D.M. Mendeleev said this about it; "Any science begins with measurement, and exact science cannot be imagined without measurement."

U. Kelvin, on the other hand, said the same about measurement; "Everything is determined by the degree to which it is measured."

According to philosophers, the most basic way (method) in the study of physical properties, the study of processes, is measurement.

From a technical point of view, the importance of measurements is determined by the generation of information on the management of technological processes, ensuring high product quality, facility management, control.

Now we come to the part where we talk about the middle ground. Uncertainty is a parameter that is related to the description of the measurement results and the distribution of values, i.e., the measured size can be written with sufficient justification. From the definition of the term "uncertainty" it refers to the degree of reliability in which the quantitative accuracy of the measurement and the value of the measured quantity can be allowed to remain within the value range determined by the measurement conditions according to the measurement result.

Uncertainty of measurements RMG 43-2001 - "Guide to the expression of uncertainty of measurements" and UzT 51-147: 2006 - Recommendations. The state system of providing measurements of the Republic of Uzbekistan. In testing and calibration laboratories, uncertainty is assessed in accordance with uncertainty application standards.

Uncertainty of measurements is a parameter or indicator that describes the dispersion (scattering) of values associated with the measurement results and which can be added to the measured quantity on a reasonable basis. The parameter can be, for example, the standard deviation (or a multiple of it) or the width of the confidence interval (range). The term uncertainty means "Neopredelennost" (Uncertainty) in Russian. Measurement uncertainty typically involves many constituents. Some of these constituents can be evaluated from the statistical distribution of the results of a series of measurements and can be characterized by experimental standard deviations. Other organizers, which can be characterized by standard deviations, are also evaluated from the estimated distribution of probabilities based on experience or other information.

Standard uncertainty is the uncertainty of a measurement result expressed as a standard deviation. Uncertainty assessment for type A is a method of estimating uncertainty through statistical analysis of a series of observations.

Type B uncertainty assessment is a method of estimating uncertainty with methods that differ from statistical analysis of a number of observations.

Sum uncertainty is a quantity that defines the interval around a measurement result in which a large part of the distribution of values that can be written on a reasonable basis can be added to the measured quantity.

Theoretical part. The uncertainty assessment of the results consists of the following steps:

1. Assess the uncertainty of the results (measurements). Gather initial data for calculations, including the measuring devices used, test conditions, and other factors affecting the process.
2. Describe the measured value and model it. Describe the measurement. The specification or determination of the measured value depends on the measurement accuracy required. The measured value must be determined with sufficient accuracy relative to the accuracy required for the value to be uniform for the practical purposes of the measurement.
3. Sources of uncertainty. When assessing uncertainty, a list of possible sources of uncertainty should be compiled. There is no need to consider quantitative aspects at this stage; the goal is simply to clarify what exactly needs to be considered.

The assessment of standard uncertainties depends on the nature of the measured value, knowledge of the measurement method used. The standard uncertainty of the input values is evaluated for type A or type B based on the available data on the possible variability of the value and the value. Uncertainties can often be derived from experimental studies of individual factors and are appropriate. That is, the assessment on type A.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad (1)$$

$$u(\bar{x}) = S_{\bar{x}} = \sqrt{\frac{1}{n(n-1)} \cdot \sum_{i=1}^n (x_i - \bar{x})^2} \quad (2)$$

determined on the basis of formulas. Estimation of standard uncertainty by type B.

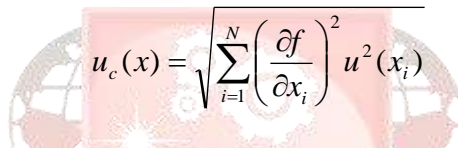
$$u = a/\sqrt{3}, \quad u = a/\sqrt{6} \quad (3)$$

determined on the basis of formulas) is built on the basis of scientific reasoning.

4. Correlation analysis. The two unwanted values must be independent or related to each other, i.e. correlated. The extent to which the correlation effect is taken into account depends on the appropriate measurement, knowledge of the measurement method, and estimates of the input values performed.

The degree of correlation is determined using the correlation coefficient.

5. Calculate the sum (standard) uncertainty. The sum is the standard uncertainty



$$u_c(x) = \sqrt{\sum_{i=1}^N \left(\frac{\partial f}{\partial x_i} \right)^2 u^2(x_i)}$$

rasschityvaetsya according to the formula Oz T 51-147: 2006.

6. Extended uncertainty. The output of the extended uncertainty is calculated by multiplying the standard uncertainty by the coverage factor (Table 1):

$$U(X) = \pm k \cdot u_c(X) \quad (5)$$

Table 1

Determining the uncertainty coverage ratio

Reliability level, %							
	50 %	68,27 %	90 %	95 %	95,45 %	99 %	99,73 %
k	0,674	1	1,64	1,96	2	2,58	3
In the correct distribution $k = \sqrt{3}$, and in a triangular distribution $k = \sqrt{6}$							

The sum of the standard uncertainties is determined by the largest of the added fractions not exceeding six degrees of freedom, in practice the probability of reliability is assumed to be 2 at 0.95.

7. Uncertainty Report. The data and their analysis should be presented in such a way that, if necessary, they can be easily observed and the final result recalculated. In cases where intermediate results are required and the full result is required, the report should include:

- the value of each input size, its standard uncertainty and a description of how it was obtained;

- ratio between result and input results, covariance or correlation coefficients;

the number of degrees of freedom of the standard uncertainty for each input value.

Research part. Determination of moisture uncertainty of medical hygroscopic non-sterile surgical medical cotton packed in 40 and 50 kg.

GOST 3274.4-98 "Cotton fiber. Moisture content determination methods "determines the actual moisture content of the test sample. Based on this, a mathematical model of measurement. The mathematical model of the test to assess the uncertainty of the moisture content of cotton is determined by drying the sample under the influence of a constant temperature. The moisture content (W) of cotton fiber is calculated as a percentage by the following formula

$$W = \frac{m_h - m_c}{m_c} \times 100 \quad (6)$$

Using measuring devices (USX, VXS, VXS-M1) as follows:

$$W = \frac{m_h - m_c}{m_c} \times 100 - 0,4$$

where is the mass of the sample before drying the cotton fiber, g;

- mass of the sample after drying of cotton fiber, g;

In cases where there are different results in the assessment of moisture content of cotton fiber, we determine it by the following formula:

$$W = \frac{W_1 \times 30 + W_2 \times 70}{100}$$

where - the mass of the moisture fraction of the combined sample (average moisture content of the layer is 30%), taken at a depth of 3-5 cm,%;

- obtained at a depth of 20 cm (moisture content mass of the combined sample (average moisture content of the layer 70%),%.

Water puffiness is given by formula (1) (1): $v_1=1558$ %; $v_2=1555$ %; $v_3=1557$

% the values of uncertainty are as follows $m_1=1558$; $m_2=1555$; $m_3=1557$

Computation of type A uncertainty. Number of measurement results: $i=(1, 2, 3)$ $n=3$;

$$\bar{m} = \frac{1}{n} \sum_{i=1}^n m_i = \frac{1}{3} \cdot 4670 = 1556,66 \approx 1557. \quad u(\bar{m}) = S_{\bar{m}} = \sqrt{\frac{1}{n(n-1)} \cdot \sum_{i=1}^n (m_i - \bar{m})^2} =$$

$$= \sqrt{\frac{1}{3(3-1)} \cdot \sum_{i=1}^3 (1^2 + (-2)^2 + 0^2)} \approx \sqrt{\frac{1}{6} \cdot 5} \approx \sqrt{0,8333} \approx 0,912.$$

Calculation of uncertainty of type B. For VLR-200 laboratory scales (measuring range from 1 g to 200 g) the error is 1 mg. Equivalent to the probability distribution and a right-angled distribution a, the standard uncertainty is: $u(m_b) = a / \sqrt{3} = 1 / \sqrt{3} \approx 0,577$; sample from the combined sample, 1 % $u(m_o) = a / \sqrt{3} = 1 / \sqrt{3} \approx 0,577$; volume of distilled water, ± 10 ml, 0,01 l; $u(V) = a / \sqrt{3} = 0,01 / \sqrt{3} \approx 0,005$; $\pm a_3$ – the value of the comparison interval of the psychrometer is $a_3=1$ and the stability of the climate ± 2 °C; $u(T) = a_3 / \sqrt{3} = 1 / \sqrt{3} = 1/1,732=0,577$, 95 %; duration of water, when detected using a stopwatch, its error: 0.2 sec.

$u(H) = a / \sqrt{3} = 0,2 / \sqrt{3} = 0,115$. Calculation of standard uncertainty of type V.

$$u_c(m)_B = \sqrt{(c_1 \cdot u(m_b))^2 + (c_2 \cdot u(m_o))^2 + (c_3 \cdot u(V))^2 + (c_4 \cdot u(T))^2 + (c_5 \cdot u(H))^2} = 1,006$$

The total standard uncertainty is determined as follows: $u_c(m) = \sqrt{u(m)_B^2 + (c \cdot u(m))_B^2} = 1,356$

The reliable uncertainty value of the $U(X)$ water absorption of the buffer in the probability of P is given by:

$U(X) = \pm k \cdot u_c = 2 \cdot 1,356 = 2,711$ The result of evaluating the water absorption value of the tampon $X \pm U(k, P) = (1557 \pm 2,711)$ the actual humidity value is determined. The degree of accuracy required in evaluating and compiling a measurement uncertainty report depends on factors such as the requirements of the measurement method and the customer's requirement. Extensive work in the field of measurement shows that its role in science and technology and in the life of human society is extremely high. And, of course, the development of society is determined by the status and capabilities of measurements and its metrological support.

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