



LEGAL METROLOGY INFRASTRUCTURES

Harmonization of the legislative acts and normative documents on metrology in Ukraine

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This article describes the modern metrological legislative and normative bases in Ukraine, as well as the primary tasks to be undertaken for their harmonization. Ukraine has been an OIML Corresponding Member since January 1997.

Modern metrology is distinguished by close worldwide collaboration and cooperation, since no individual country can resolve the whole set of metrological issues alone. This is why cooperation is increasing between the various national metrological services both multilaterally and bilaterally, accompanied by key mutual exchanges of experience and information.

Internationalization is an obligatory feature of measurement: world trade determines the global economy while scientific, technological and medical studies depend on international cooperation. Developing the coordination of legal metrology concepts, requirements and procedures is a long-term process, but accelerating this coordination is necessary especially taking into consideration the main goal of the WTO *Agreement on Technical Barriers to Trade* and reinforced by other related international agreements on the elimination of such barriers.

International organizations such as the OIML, ISO, the IEC and others define and implement the main concepts of metrological harmonization policy; in particular the OIML is concerned with harmonizing normative legal metrology documents, which are made effective through or on behalf of national legal metrology departments. Requirements can be laid down both by normative documents (ND) and by national standards developed by the various national bodies.

Taking into consideration the international acceptance and worldwide application of OIML publications, a priority task for the development of a national normative metrology base is the harmonization of national documents with OIML publications, which should be carried out taking into account the priorities given below.

The State Metrology System of Ukraine [1, 2] is based on the provisions of the new Law of Ukraine

Metrology and Metrological Activity No. 113/98 of 11.02.98 (hereafter called "the Law"). The main provisions of the Law are harmonized with norms and rules on metrology and with OIML publications (OIML D 1 in particular [3]) which are generally accepted throughout the world.

The SI units, adopted by the CGPM, coordinated by ISO and recommended by the OIML, are used in Ukraine. One of the most important challenges is the unification of units of measurement; if the results of measurements are to be comparable worldwide they are to be based on the SI units, though some other units that are not covered by the SI (but widely used in practical metrology) may be permitted for implementation by decision of the unified national metrological body of Ukraine, the Derzhstandart.

For the first time the Law regulates the acceptance procedures of the results of metrological work conducted abroad. In accordance with international agreements signed by Ukraine, test results, type approvals, verifications and calibration of measuring instruments conducted in foreign countries can be accepted. As of today the Derzhstandart has signed two bilateral agreements on recognition of type approval (with Lithuania and Bulgaria), as well as multilateral agreements with 11 CIS countries (Russia, Belarus, Moldova, Kazakhstan and others).

To implement the provisions of the Law and to ensure the efficient functioning of the State Metrology System, in 1998–1999 the Cabinet of Ministries of Ukraine adopted the following Decrees:

- On approval of the Regulations on the State Service of Unified Time and Reference Frequencies (No. 1121 of 18.07.98);
- On approval of the Regulations on the State Service of Certified Reference Materials for the Composition and Properties of Substances and Materials (No. 1120 of 18.07.98);
- On approval of the Regulations on the State Service of Standard Reference Data on Physical Constants and

- Properties of Substances and Materials (No. 1117 of 18.07.98);
- On approval of Regulations on the Procedures for Importing Measuring Instruments into the Territory of Ukraine (No. 1300 of 17.08.98);
- On approval of the Regulations of Establishing Payment for all Kinds of State Metrological Inspection (No. 770 of 02.06.98);
- On approval of the Regulations on Metrological Activities in the Field of Defense in Ukraine (No. 1306 of 17.08.98); and
- On approval of the Regulations on Metrological Activities in the Sphere of Scientific Research and Development in Ukraine (No. 528 of 01.04.99).

According to article 15 of the Law measuring instruments, measurement methods and prepacked products are liable to state metrological inspection and supervision. According to article 16 the state metrological supervision covers measurements used in:

- diagnosis and curing of human illness;
- quality inspection of drugs;
- quality and safety inspection of foods;
- environmental inspection;
- job safety;

- geodesic and hydro-meteorological work;
- trade-commercial operations and settlements between buyer (consumer) and seller (supplier, manufacturer, executor);
- fiscal, banking and customs operations;

Table 1 Obligatory conditions for type approval and verification in Ukraine and inter-verification intervals for the most widespread measuring instruments

Measuring instrument	Mandatory type approval and verification	Inter-verification interval
Trade scales	+	1 year
Gas meters	+	5 years
Water meters	+	2 years
Heat meters	+	2 years
Electricity meters	+	8-16 years
Taximeters	+	1 year
Noise-meters	+	1 year
Gas analyzers	+	1 year
Glass medical thermometers	+	∞
Tonometers	+	1 year
Fuel dispensers	+	1 year
Manometers	+	1 year
Dosimeters	+	1 year
Alcoholometers at exhalation	+	1 year
Instruments for checking velocity	+	1 year

Table 2 Structure of the normative basis of metrology in Ukraine

ND Name	Total ND	Basic ND	Verification schemes	Methods of verification	MM	Other ND
State standard (DSTU)	43	11	30	2	-	-
Managing ND and Recommendations (MND, R)	11	5	-	5	-	1
Interstate standard (GOST)	347	18	114	192	23	-
Interstate managing ND (RD)	269	8	-	126	11	124
Methods of the metrological institute (MR)	1 872	53	35	1 625	111	48
Total:	2 542	95	179	1 950	145	173

Table 3 Structure of the normative basis in fields of measurement

Area of measurement	Number of ND's				
	OIML (R, D, P)	Total ND in Ukraine	DSTU, MND, R	GOST, RD	MR
1. Geometric value measurement	8	326	3	77	246
2. Mechanical value measurement	26	228	4	43	181
3. Measurement of parameters of flow, consumption, level, volume of materials	27	181	5	34	142
4. Pressure measurement, vacuum measurements	4	117	2	24	91
5. Measurement of a physical and technical composition and characteristics of materials	28	447	1	47	399
6. Pharma-physical and temperature measurements	6	111	2	29	80
7. Time and frequency measurements	-	48	2	10	36
8. Measurement of electrical and magnetic values, radiotechnical measurements	4	408	12	100	296
9. Acoustic measurement	5	38	-	8	30
10. Optical and optometrist-physical measurements	2	149	6	27	116
11. Measurement of ionizing radiating and nucleus constants	-	77	3	33	41

- recording of energy and material resources (electrical and thermal power, gas, water, oil products, etc.);
- work carried out on the instruction of the courts, arbitrators and other public bodies;
- mandatory product certification; and
- registration of national and international sporting records.

In Fig. 1 the fields of applications of legal metrology are shown, and Fig. 2 depicts the scope of activities for which type approval and measuring instrument verification

are necessary. Table 1 gives information on mandatory type approval and verification as well as inter-laboratory verification intervals for commonly used measuring instruments.

According to the positive results of the state calibration and checking tests conducted by the Derzhstandart, more than 1 000 types of measuring instrument were entered in the State Register in 1992–1998. At present over 230 domestic and joint ventures manufacture such instruments in Ukraine.

Fig. 1 Fields of application of legal metrology

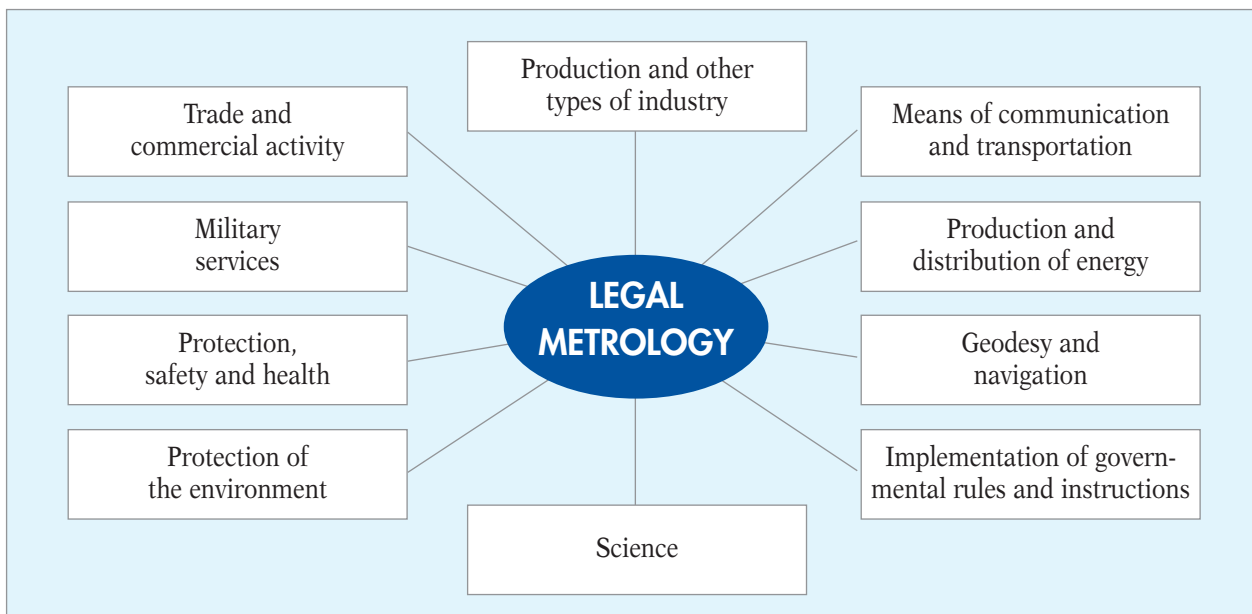
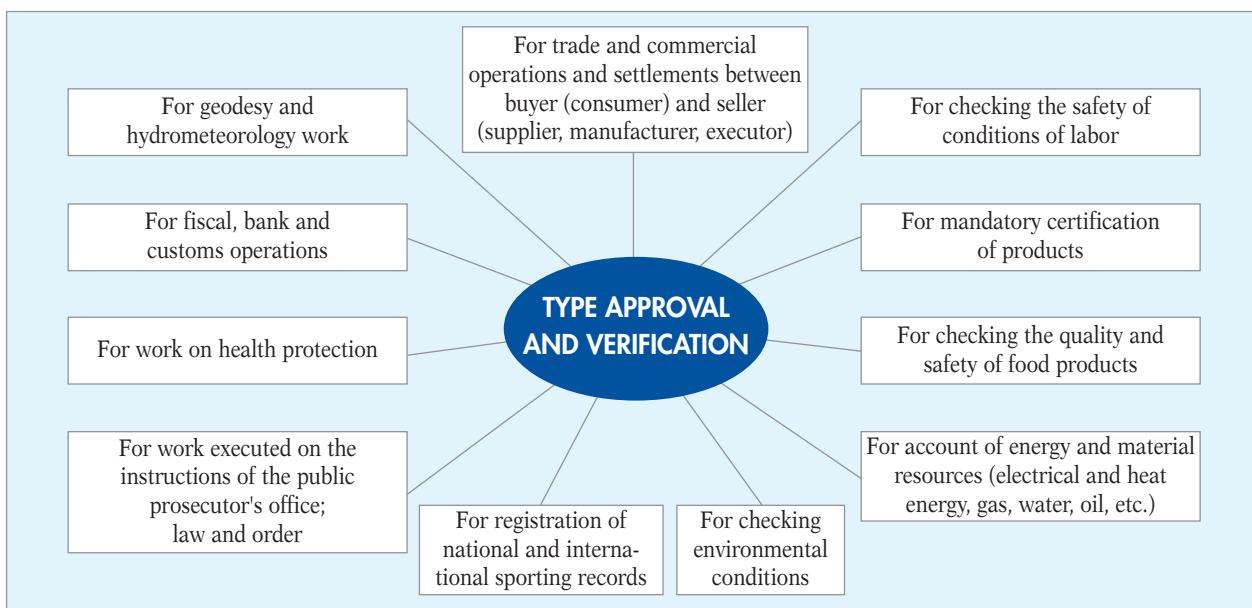


Fig. 2 Scope of metrology activities in Ukraine for which type approval and verification of measuring instruments are necessary



The Normative State Metrological System basis includes state standards (DSTU), managing normative documents and Recommendations on metrology (ND, R), interstate standards of CIS countries (GOST), interstate managing documents on metrology of CIS countries (RD, PMG), and methods (recommendations) of the metrological institutes (MR), which were drawn up before January 1, 1992. The System consists of over 2 500 normative documents, (mainly MR's) and includes 59 national ND's and over 350 GOST. Table 2 shows ND distribution by type; the number of fundamental ND's will increase in the future with the reduction of the relative amount of interstate ND's. Table 3 shows ND distribution by measurement area, which determines the necessary number of ND's by area.

Below are the main metrological standardization activity categories:

- terms and definitions in the field of metrology (DSTU 2681-94);
- units of measurement and units systems (DSTU 3651-97);
- state standards and verification schemes (DSTU 3231-95);
- organization and procedures for conducting state tests of measuring instruments (DSTU 3400-96);
- organization and procedures for conducting verification of measuring instruments (DSTU 2708-94);
- organization and procedures for conducting metrological certification of measuring instruments (DSTU 3215-95);
- methods of measuring instrument verification and for conducting measurements (MM);
- nomenclature of normalized metrological characteristics of measuring instruments;
- presentation of measurement results and rates of measurement accuracy;
- requirements for reference materials composition and characteristics of materials and substances; and
- methods of evaluation of probability and forms of data presentation for the characteristics of properties and materials, and others.

The Ukrainian Technical Committee for standardization TC-63 *General norms and rules for state traceability* was established on the basis of the Metrology Institute, which developed about 40 national ND (DSTU, MND, R) from 1992 to 1998. 107 intergovernmental ND's (including 32 GOST, 14 RD and 57 MR) were canceled and revised during this period.

Taking into consideration that in Ukraine intergovernmental ND's are as effective as national ones, a problem exists in defining the metrological issues to be regulated at national and international levels, as well as questions of harmonizing both national and intergovernmental ND's with international documents, standards and regulations. It is advantageous to develop and adopt fundamental ND's at national level which

regulate the metrology service's organizational and methodical functioning, and at intergovernmental level to regulate those ND's which promote the mutual recognition of the results of measurements, testing of measuring instruments, type approval and verification (methods and means of verification, MM, and others).

In 1997 the Derzhstandart approved state standard DSTU 3651.0...2-97 which regulates both the specific units of the SI system and off-system units, based on ISO 31: 1992 *Values and units* and ISO 1000: 1992, which was used as the state standard in CIS countries for the first time. It comprises three interconnected parts: (1) regulation of the main units of the SI system, (2) derivatives of SI units and off-system units, and (3) physical constants and characteristic numbers that are regulated (also for the first time) in CIS countries.

In accordance with Resolution 8 of the 20th CGPM (1995) a class of additional SI units (radian and steradian) was excluded; these are referred to in the new standard as derived units and are determined as non-dimensional units. For the first time in CIS countries the updated provisions of CGPM documents were implemented in a state standard.

The national normative base is harmonized in detail with OIML International Documents and Recommendations; broader technical harmonization principles for measurement reliability are specified by the EU to ensure free trade flow. As an essential element in ensuring quality, the international and European standards in the area of systems quality assurance contain requirements for measuring instrument calibration and for referencing all the results of measurements to units, which are reproduced by national measurement standards.

As shown in Table 4 the system of international standards, Documents and Recommendations, interstate and national ND includes the following main categories of ND:

- terminology;
- traceability;
- units of measurement;
- measurement standards of units;
- state and local verification schemes;
- general requirements for measuring instruments;
- measuring instrument metrological characteristics;
- measuring instrument tests;
- measuring instrument verification and calibration;
- metrological inspection and supervision;
- metrological supervision for prepackaged goods; and
- accreditation of measurement and calibration laboratories.

The OIML Certificate System is used for types of measuring instruments that are covered by OIML Recommendations for metrological requirements, testing procedures and test report formats. Up to date

Table 4 System of international standards, Recommendations, Documents and national ND

<i>Object of standardization</i>	<i>International standard, Recommendation, Document</i>	<i>National standard Ukraine, interstate standard or other ND</i>
Terminology	VIML (V 1: 1978) VIM (V 2: 1993)	DSTU 2681-94. Metrology. Terms and definitions (draft DSTU 2681-99)
Traceability	OIML D 1: 1975 OIML D 13: 1986	Law of Ukraine "On metrology and metrological activity", 1998
Units of measurement	ISO 31/0-13: 1992 ISO 1000: 1992 OIML D 2: 1998	DSTU 3651-97. Metrology. Units of measurement (three parts) Draft DSTU 3651-3-99 (OIML D2:1998)
Measurement standards	OIML D 6: 1983 OIML D 8: 1984	DSTU 3231-95. Metrology. Measurement standards. Main positions, order of development, statement, registrations, keeping and using (draft additions DSTU 3231-95) GOST 8.381-80. SSM. Measurement standards. Ways of expressing inaccuracy
Verification hierarchy schemes for measuring instruments	OIML D 5: 1982 OIML P 4: 1986	Requires development of national ND. GOST 8.061-80. SSM. Verification schemes. Contents and building
General requirements for measuring instruments	OIML D 3: 1979 OIML D 11: 1994 OIML R 34: 1979	Requires development of national ND. GOST 8.401-80. SSM. Accuracy classes of measuring instruments. General requirements
Metrological requirements for measuring instruments	OIML D 15: 1986 OIML P 17: 1995	Requires development of related national ND. GOST 8.009-84. SSM. Standardized metrological characteristics of measuring instruments
Testing of measuring instruments and metrological control	OIML D 16: 1986 OIML D 19: 1988 OIML P 1: 1991	DSTU 3400-96. Metrology. State testing of measuring instruments. Main positions, organization, order of undertaking and consideration of results (draft DSTU 3400-99)
Verification and calibration of measuring instruments	OIML D 10: 1984 OIML D 12: 1986 OIML D 20: 1988 OIML D 23: 1993 OIML R 42: 1981 OIML P 15: 1989	DSTU 2708-94. Metrology. Verification of measuring instruments. Organization and order of undertaking DSTU 3215-95. Metrology. Metrological qualification of measuring instruments. Organization and order of undertaking MND 50-032-94. Metrology. Fabrication rules, using and keeping state verification stamp of Ukraine
Certified reference materials	OIML D 18: 1987	GOST 8.315-96. Certified reference materials. Basic principles
Metrological supervision	OIML D 9: 1984	NDU-96. State metrological supervision
Metrological supervision for prepackaged products	OIML R 79: 1989 OIML R 87: 1989	MND 50-048-95. State metrological supervision. Order of checking the amount of prepackaged products during packing and sale
Accreditation of measurement and calibration laboratories	OIML P 7: 1989 ISO/IEC 25: 1990 EN 45001: 1989	NDU-98. Accreditation of measuring laboratories

figures and full details can be found on the OIML web site: www.oiml.org.

The program of harmonization of national ND's with the related OIML Recommendations is currently being undertaken. For instance, work on developing DSTU projects harmonized with OIML R 31 and R 32 are coming to an end. The analysis of the existing system of national measuring instrument standards, covered by OIML Certificate System, has been fulfilled. Table 5 presents information as at 01.01.99 on the number of measuring instruments that have been approved in Ukraine against national ND's, similar to OIML Recommendations. The Recommendations shown in Table 5 are planned for urgent harmonization in Ukraine.

Therefore in Ukraine 12 national ND's and 10 ND projects are harmonized to some extent with 27 OIML Vocabularies, Documents or Recommendations. The main method of harmonizing national ND's is to directly introduce the OIML Documents or Recommendations (with translation into Ukrainian with some national revisions or additions, if required). It is planned to harmonize six other ND's with OIML Recommendations in the near future.

The general analysis of the metrological normative base shows that in Ukraine, despite the availability of a wide range of basic national ND's, both the development of new ND's and the revision of some existing ND's are required.

Table 5 Information on type approval of measuring instruments in Ukraine

<i>OIML Recommendation</i>	<i>Recommendation title</i>	<i>OIML certificates</i>	<i>No. of measuring instrument types approved in Ukraine</i>
OIML R 31: 1995	Diaphragm gas meters (DSTU)	1	25
OIML R 32: 1989	Rotary piston gas meters and turbine gas meters (DSTU)	-	16
OIML R 50-1: 1997 OIML R 50-2: 1997	Continuous totalizing automatic weighing instruments (belt weighers) - Parts 1 and 2	20	-
OIML R 51-1: 1996 OIML R 51-2: 1996	Automatic catchweighing instruments - Parts 1 and 2	-	2
OIML R 60: 1991	Metrological regulation for load cells (<i>currently being revised</i>)	143	10
OIML R 61-1: 1996 OIML R 61-2: 1996	Automatic gravimetric filling instruments - Parts 1 and 2	1	23
OIML R 76-1: 1992 OIML R 76-2: 1993	Nonautomatic weighing instruments - Parts 1 and 2	165	77
OIML R 117: 1995 OIML R 118: 1995	Measuring systems for liquids other than water Fuel dispensers for motor vehicles (Test procedures/report)	} 10	32
	Total:	340	185

Taking into consideration international metrological practice in metrology would better align the Ukrainian metrological system with requirements generally accepted throughout the world and would ensure both the acceptance of measurement results carried out in Ukraine, and the results of industrial product testing all over the world. This would contribute to increasing the competitiveness of Ukrainian enterprises on markets worldwide. ■

References

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- [3] OIML D 1 *Law on Metrology*. OIML, 1975

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