

IN THE METROLOGICAL INSTITUTES (BRIEF INFORMATION
ON CERTAIN COMPLETED WORK)

UDC 389.0.001.5(048)

The Tbilisi Branch of the D. I. Mendeleev VNIIM (All-Union
Scientific-Research Institute of Metrology)

Development of Methods and Agents for Measuring the Fatigue Characteristics of High-Elasticity Polymer Materials in Natural and Artificial Climatic Conditions. A method is proposed for studying resins for fatigue resistance in natural and artificial conditions, and also an accelerated method for determining the characteristics of resins. In order to confirm the method, the special machines UR-250, UV-3000, and UIR have been developed and manufactured; these are designed for tests on plane and dumbbell-shaped resins under these conditions.

Development of a Method for Calculating Errors in Determining a Physical Parameter in Some Region from its Measured Values Outside that Region. The extrapolation method has to be applied in many problems in measuring technology when it is required to determine the space configuration of some physical parameter from its measured values at a set of points G . The sets G can have different forms of structure, containing either a denumerable number of internal points of the region V or an infinite number (by means of the continuum) of points lying on the boundary S .

Various methods are considered for solving extrapolation problems; these methods correspond to different structures of G and are effective in the sense of having practical application. Also considered are questions concerning the random errors which accumulate at individual points of the region in solving these problems.

The results obtained can be applied in determining the boundaries of a confidence interval and the value of the corresponding confidence coefficient in various regions of measurement.

Research and Testing on Sound Receivers and a UIP-1M Installation. A review is given of methods for testing piezoelectric sound transformers at an excess static pressure of up to 10 MN/m^2 .

The absolute method—the method of the electroosmotic exciter—was used to test the sound transformers. The method of the invariant sound field was chosen in the mass graduation of the transformers. The tests were carried out in the frequency range 5-15 kHz in white noise.

The results of the investigation show that when the static pressure is increased, a decrease is observed in the sensitivity of the piezoelectric sound transformers, the explanation being the change in the polarization of the piezomodule and the piezomodule and the dielectric pressure.

The UIP-1 installation has been modernized on the basis of the data from the tests.

Development of a Mock-Up for a Model Accelerometric Transformer. A design for a piezoelectric accelerometric transformer (PAT) was chosen and its dynamic and design parameters were calculated. On the basis of the

Translated from *Izmeritel'naya Tekhnika*, No. 6, pp. 85-87, June, 1970.

©1970 Consultants Bureau, a division of Plenum Publishing Corporation, 227 West 17th Street, New York, N. Y. 10011. All rights reserved. This article cannot be reproduced for any purpose whatsoever without permission of the publisher. A copy of this article is available from the publisher for \$15.00.

calculations, wide-band accelerometric transformers were manufactured. The theoretical studies showed that the most advantageous design for the PAT is a design of the soldered type.

As a result of the experimental studies of the dynamic characteristics of the model PAT its graduation characteristic was obtained and the truth of the calculated resonance frequency and PAT transmission coefficient schemes which had been chosen was confirmed to a known degree of accuracy.

Calculation of Errors in Graduating Impact Accelerometers. Information has been gathered and experiments carried out on graduating impact accelerometers and determining the error of graduation. In particular, a method was chosen for graduating impact accelerometers and an apparatus developed in accordance with the principle under consideration. Basic tests were carried out on the model accelerometer. Questions were considered relating to the effect of various factors which influence the apparatus; consideration was also given to the summation of partial components of errors.

Working-Out of Methods for Manufacturing Checking Agents for 0.2 pH-Unit Industrial pH-Meters. In accordance with the checking scheme for pH-measuring agents, in addition to the standard and reference solutions, working buffer solutions with $\delta_{\text{ind}} = \pm (0.02-0.03)$ pH units are needed. In order to prepare these solutions it is advisable to use buffer mixtures in the form of tablets for the purpose of adjusting and checking very widely distributed industrial and laboratory pH-meters with an error of not less than ± 0.05 pH. However, at the present time we have not started producing these tablets, and working buffer solutions are not being produced either.

On the basis of the studies carried out, dry buffer mixtures were selected in order to prepare the working buffer solutions. These mixtures reproduce the normal pH series from 2.00 to 10.00 by 0.2 pH-units (with $\delta_{\text{ind}} = 0.02$ to 0.03 pH-units) at 20°C, and a method has been worked out for mixing them reliably.

From the recommended mixtures, tablets have been obtained with the required mechanical characteristics and a satisfactory external appearance. The working buffer solutions obtained from the selected buffer systems are characterized by a high buffer capacity, low dilution effect and low temperature coefficient. Thus the results obtained can form the basis for producing tablets in order to prepare working buffer solutions.

On the basis of this work a draft GOST (Unified State Standard) "Tablets for the preparation of working buffer solutions" has been worked out.

Development of the Active Network of the GSSD on the Electrical Properties of Conductors and Dielectrics. The primary organizational structure is given for an active network of the GSSSD, in seven already established and fourteen developing directions, which has come together as a result of attracting organizations and scientists into voluntary co-operation with GSSSD.

The progress in recruiting people for the State Information Fund is described and a summary given for 1970. About 6,000 characteristics have been accumulated from the material obtained from outside processing organizations.

The resources of a department of GSSSD have been used to compile data from sources in the literature for the period 1960-1969 to the amount of 15,000 pieces of information about the characteristics of more than two thousand materials and substances.

The All-Union Scientific-Research Institute of the Committee of Standards, Measures, and Measuring Devices

Development of a Long-Term Plan for Solving Problems Connected with the Creation of Leading Technical Materials in Accordance with the Certification of Measuring Processes. Studies carried out in VNIK (the All-Union Scientific-Research Institute of the Committee of Standards) in 1969 relate to the number of searches directed to solving part of this problem—the guaranteeing of accuracy in measuring information. The volume of work is restricted to a consideration of questions relating to the principle of certification of measuring processes.

The introduction of this progressive principle enables us to obtain reliable results from measurements without making metrological investigations at every application of the measuring process.

Some theoretical questions are considered, related to the guaranteeing of reliability in mass measurements. In particular consideration is given to the concepts of "measuring process" and "metrological characteristics of the measuring process." Conditions are formulated which, when observed, exclude the possibility of ascribing false accuracy to results of measurements, methods are considered for fulfilling these conditions in practice, and general requirements are formulated for the certification of measuring processes.

It is shown that the certification of measuring processes must be based on metrological experiment, a brief characterization is given of the contemporary state of the mathematical theory of experiment, and a network diagram is given of the training of the country's metrological service for the certification of measuring processes.

The lower branch of the network diagram was considered—the development of leading technical materials in relation to the certification of measuring processes. Recommendations are given on the sequence and organization of the development of RTM (leading technical materials).

N. I. Kosorukov

Development of the Legal Foundations for Responsibility for Breaches of the Rules for the Metrological Provision of Measurements in the National Economy of the USSR. The work carried out at VNIK in 1969 is the first study of questions related to the legal regulation of the metrological service, the effectiveness of which depends to a considerable degree on the legal forms in which it is clothed. The legal nature of state supervision of the condition of measuring equipment is considered; state supervision is one of the methods known to Soviet law of ensuring socialist legality. An analysis is made of the legislation on responsibility for breaches of the rules for the metrological guaranteeing of measurement in the USSR. The practical activity of local organs of the Committee of Standards is generalized—activity in the struggle with metrological breaches permitted by institutes, enterprises, and organizations of various ministries and departments. A comparative characterization is given of the legislation on responsibility for violation of metrological rules which exists in foreign countries. On the basis of the study which has been made, conclusions are formulated on the need to extend legal responsibility for violating the rules for the metrological provision of measurements in the USSR; these conclusions are confirmed by the new problems confronting the metrological service in contemporary conditions, and also by all the practice of realizing it. Proposals have been worked out for introducing into the existing legislation additions and amendments having as their aim the differentiated application of legal sanctions in accordance with the seriousness of the violations permitted and the dimensions of the damage caused.

Kh. O. Malikova

The Revision of GOST (State Standard) 8291-57 "Load-Piston Manometers." The draft of the standard "Load-piston excess pressure manometers" was worked out by VNIK in 1969 on the basis of GOST 8291-57, previously in force, which was compiled in 1957.

Unlike GOST 8291-57, the newly compiled draft does not contain manometers of the 0.2 accuracy class (3rd class), which it is not practical to manufacture, but is supplemented with manometers of the 0.02 class, which are manufactured to the technical specifications of the producer plants. The draft standard includes MP-250 manometers with measuring limits of 5-250 kg/cm². The draft envisages adjustment of loads (according to the customer's requirements) to the local value of the free-fall acceleration, and also a number of measures to cut out deformation errors in measuring high pressures. There is a reconsideration of complementing manometers with loads, which has been convenient in use.

V. N. Gramenitskii

Development, Manufacture, Study, and Attestation of the Unified Manometric Part of Experimental Models of a Load-Piston Balance with Upper Measuring Limits of 20, 200, 100, and 2000 kg by Means of an Automated Counting Device. As we know, in weighing a body on an OGV load-piston balance, one has to put specimen loads and weights on the pan in the quantity required to achieve equilibrium. This takes up a great amount of time and reduces the labor productivity of the servicing personnel. Experience in using the experimental model manufactured and applied earlier at VNIK has shown that applying the manometric part of a balance with an automated reference device makes it possible to cut down the weighting time to a period several times shorter.

As a result of the work carried out at VNIK in 1969 a unified manometric part has been developed, manufactured, and attested with the automated reference device for the OGV-2000, OGV-1000, OGV-200, and OGV-20 developed earlier at VNIK and now in use.

Working diagrams have been compiled, eight sets have been manufactured and tested, and the scales have been experimentally graduated.

V. N. Gramenitskii

Development of Methods of Processing Statistical Data in Studying Installations on Dynamometric Wrenches Designed for Measuring Torques. A method is proposed for statistically processing data obtained in graduating and checking dynamometric wrenches designed for mechanical mounting work. A result is given from the calculated stress distribution formulas in bolts when the flanges are tightened in dependence on the rotation angles of the nuts. Correct attestation of wrenches and choice of a rational system of tightening the bolts ensure uniformity in compaction and correctness in further work on the joints of flanges.

Processing statistical data consists in processing a variational series, checking the hypotheses of independence of the selection and of the distribution of the operation error being normal, and in excluding misses (gross errors on the part of the observer).

Because of the nonlinearity of the spring, the wrench, and other factors, one may expect a certain nonlinearity in the scale of the wrench. So the choice of the number of points for graduation becomes important. Increasing the number of points naturally complicates the graduation, and decreasing it increases the operation error at the ungraduated points. A graduation interval is chosen such that this additional error is small, the test consisting in checking at a deliberately large number of points and in establishing by statistical methods the feasibility of reducing the number of points.

A. S. Nemirovskii

The Study of the Surfaces of Facets of Monocrystalline Prisms in Order to Establish Effective Parameters Characterizing the Operating Properties of Prisms. Monocrystalline acoustic lines have of late been acquiring wide applications in radio technology in ultrasonic radio signal delay lines.

The object of the present study, carried out at VNIIC in 1969, was to investigate the microgeometry of monocrystalline prisms in order to find the parameters which have an effect on the operational and metrological characteristics and which depend on technological factors, and also to make recommendations about the requirements for the geometry of the surface which will ensure accurate angle measurements.

The microgeometry of the surface has been studied on the basis of the theory of random processes. The correlation functions for different types of processing and different types of processes have made it possible to reach conclusions about the structure of the surface.

As a result of analyzing the macrogeometry of facets of monocrystalline prisms, it has been established that surface roughness does not depend on the depth of cutting and depends essentially on the feed.

The determination of the form of the mathematical expectation of the main surface roughness parameter has enabled the periodic component of the profile to be found to a first approximation.

An analysis of the accuracy of the collimation method for measuring angles of acoustic lines showed that the microgeometry of the facets has an important effect on the measuring error.

The article gives recommendations on parameters for the geometric shape of facets of acoustic lines providing for measurement of angles from 2.5" to 7.5", and a comparative method is worked out for measuring angles.

Studies are first made of the surface microgeometry of finished monocrystalline prisms. These studies are directed towards improving processing technology, the designation of reasonable requirements for a surface in order to ensure that linear-angular measurements have the necessary accuracy, and towards developing measuring apparatus in order to control the geometric parameters of monocrystalline prisms, that is, to improving the quality of acoustic lines.

L. N. Logacheva

Development of an Automated Installation for Checking Low-Capacity Measures. The equipment developed for automated checking of low-capacity measures is of a universal character. It can be used in order to check other instruments by the volume method. The apparatus totally lacks mercury as a checking fluid. This makes it possible to achieve unambiguous measuring results and remove the effect of error from wettability and meniscus.

S. I. Fedotov