QUALITY CONTROL

SPECIALIZATION OF MEASUREMENT TECHNIQUES IS ONE OF THE MEANS FOR RAISING PRODUCTION QUALITY

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Metrology and measurement techniques play an important part in implementing the resolution of the Communist Party of the Soviet Union Central Committee (CPSU CC) and the USSR Council of Ministers No. 937 on "Raising the role of standards in improving production quality."

Under conditions of industrial production, measurements are an organic part not only of the technological process, but also of the entire production process, at all its stages, starting from the development of conditions for production in general and for its component parts, and ending with the testing stage, even more than that, with the utilization of the products. A reasonable consideration of measurement problems, selection and application of corresponding measurement means at all the stages of manufacture and utilization of products can provide substantial advantages, raise the technical and economic effectiveness, and ensure the required production quality.

The particular features of modern production measurements consist of a considerable rise in the number of measured quantities which characterize the properties of products and processes, of extended measurement ranges, higher precision requirements, the necessity of measuring simultaneously several different quantities and preserving their mutual relationships in order to find their interdependence (combined measurements), more complex measurement conditions, etc.

The number of specific measurement problems which have to be solved at present in production is extremely large. These problems are being solved not only by engineers and technicians at the enterprises, but also by production workers who participate in raising and substantiating measurement problems, selecting, producing, improving, and applying the required measurement equipment and means for its metrological servicing.

In principle it is possible to carry out, with equipment suitable for measuring directly a limited number of quantities, both indirect and combined measurements of an unlimited number of derived quantities, to determine their mutual relationships, and extend measurement ranges into the sphere of both large and small values.

However, in selecting the required measurement methods and equipment under specific production conditions, it is impossible to be limited only by considerations of principle. It is necessary to consider the importance of each measurement problem, conditions of its implementation, the required measurement precision, cost of measuring equipment and the possibility of its purchase, its productivity, reliability, the expected economic advantages of its application, the required qualifications of operators, possibility of ensuring metrologically the proposed measurements, etc.

If it is also taken into account that the rate of growth of the measured quantities' nomenclature is considerably faster than that of the mass-produced measuring equipment for their direct measurement, that high-precision indirect and combined measurements require operators with special metrological knowledge and skill, that the productivity and reliability of combined and indirect measurements are considerably lower than those of direct measurements, that the state metrological service specifies standard testing methods and corresponding measuring equipment only for mass-produced instruments approved by the state inspection agencies for application in the country, it becomes obvious that the provision of modern industrial enterprises with measuring equipment and the organization of its efficient use and, therefore, of its metrological servicing constitutes an aggregate of engineering problems with a specific content for each enterprise. Let us call for the sake of brevity the scientific and technical content of these problems—industrial metrology, and the experts engaged in their solution—production metrologists.


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The measuring equipment used under conditions of modern industrial production is intended for: 1) the possible solution of a number of typical measurement problems over a wide range of measured quantities and measurement conditions (these means of measurement are known as standard or universal, generally applied means); 2) the utilization of automation, control, and regulation equipment as indispensable component parts of the means of production; 3) the solution of specific nontypical measurement problems (specialized measuring equipment, also known as nonstandard equipment).

Standard measuring equipment is mass-produced at specialized instrument-making plants, which consider it as a merchandise. In order to ensure a large scale of their products, the developers of standard measuring equipment provide it with wide ranges and make it universal and suitable for solving the largest possible number of different measurement problems. The users of this measuring equipment do not, as a rule, utilize all the universal possibilities available in the equipment.

The development and organization of the standard measuring equipment's mass production requires large expenditure and time measured in years.

The quality of standard measuring equipment is specified by standards and controlled by the state metrological-service agencies at its development, production, utilization, and repair stages.

Standard measurement equipment comprises a reliable foundation for industrial measurements, however, increased industrial production, application of new types of products, scientific-research and testing work require a larger number of measuring, testing, and adjusting operations which are either not provided with appropriate standard measuring equipment, or entail uneconomic or ineffective expenditure. Specialized (nonstandard) measuring equipment is produced and used for all such numerous specific measurement problems. As a rule this equipment is designed in factory laboratories and design offices.

In utilizing standard and producing specialized measuring equipment it is necessary to bear in mind that such means have a material value, but do not produce such values. They serve to obtain information and it is necessary that this information should be in fact required, that it should contain the data which could serve for an objective evaluation of the most important parameters used for determining quality, that it should supply data for raising efficiency, increasing productivity and eliminating deficiencies, that it should reveal conditions affecting the course of production or utilization of articles and provide the opportunity of maintaining these conditions within appropriate boundaries. It is necessary that the measured information should provide the possibility of evaluating quality and help to attain the required level of quality with minimum expenditure.

The maximum economic effectiveness is produced by measures entailing the use of measuring equipment for preventative purposes; i.e., for purposes which could obviate unnecessary expenditure and losses. Therefore, in selecting measuring equipment and the organizational forms of metrological activity, it is necessary to aim at obtaining information which serves to discover and eliminate causes capable of producing losses, instead of reducing measurements to finding existing defects, i.e., losses.

It is necessary to obtain measurement information at the earliest production stages, to measure at the precise time and in the place where information can be used as soon as and as effectively as possible.

It is necessary to revise the widely-held opinion that industrial measurements should serve only for testing finished products and for checking whether they correspond to the specifications of designers or customers. The modern production metrologists who ensure the required measurements at all the production stages should differ substantially from the technical-control division worker or metrologists of the state inspection agencies. They should obtain support from innovators and rationalizers and work creatively in close contact with designers, technologists, economists, and workers in the departmental and state inspection agencies. The complexity and diversity of the problems solved by production metrologists require from them not only technical, scientific, and economic knowledge, but mainly initiative and enterprise. Neither must they substitute designers, technologists, or inspectors. They should work in cooperation with them, but not as passive observers or supervisors who check other people's blunders and errors.

A production metrologist should consider himself as an organic part of the production process, and he should exert and assert himself in such a manner that metrological activities at plants should not be considered as an inevitable evil and overhead expenditure, but as one of the most important levers for raising the productivity and efficiency of manufacture.