Organization and sequence of performance," from which the annual saving has been about 350 thousand rubles.

Any shortcomings revealed by the inspection are considered as violations of the standard, and these are discussed at the monthly quality-control meetings.

Any modern production process involves a great many means of measurement, and there is an urgent need for further improvement in product quality, so the metrological service has undertaken research to define the technical level of the means of measurement actually in use. These studies led to the formulation of a document: "Methods of quantitative evaluation of the state of means of measurement and recommendations on improvements." This approach has revealed various shortcomings in the metrological support, but also ways of eliminating them. Another document is entitled: "Methods of determining and calculating the economic aspects of the activities of the metrological service." It is estimated that the activities save the organization about one million rubles per year.

It therefore appears that this metrological-support subsystem within the general quality-control system has provided improved product quality; during the first five months of 1978 alone, about 400 different products received the State Award of Quality. Nearly 2000 products classified in the highest category are now produced in Latvia.

METROLOGICAL SUPPORT TO A COMPREHENSIVE QUALITY-CONTROL SYSTEM

AT THE RIGA 'KOMPRESSOR' PLANT

A. N. Papazov

This plant began the definition of its quality-control system early in 1975; the 15 services in the plant collaborated in the project, and each was assigned a group of standards appropriate to its speciality. These services were also subsequently responsible for the introduction and observance of standards for production technology, as well as for the technical level of the latter. The standardization service was responsible for formulating the systems specification, generating the draft, and providing guidance on methods.

A working coordination group was responsible for managing the work on this system, collaboration between the services, consideration of the drafts for the production-technique standards, and evaluation of the technical level of the latter; this was headed by the deputy-chief engineer, who was also the principal designer in the organization. The group included the head of the special designs section, the head of the quality-control section, the principal technologists, the principal economists, the director of production, the principal metrologists, the director of the standardization office, and the head of the production-technology section. Drafts of the production-technique standards were submitted for discussion, with the responses recorded on cards, which were submitted to the working coordination group. The cards and the associated comments were discussed, and the corresponding draft standards were either accepted or returned to the services for revision.

The definition of the system began with an analysis of the state of quality control, particularly to define the bottlenecks in production; this also indicated urgent tasks. Technological level charts were also drawn up in accordance with [1] for all divisions of the plant, which provided a comparison of the qualitative parameters with the best existing Soviet and foreign analogs, and these were used in combined quality parameters. The last themselves served for the definition of quality-improvement measures. In particular, it was found that acceptance-checking of brought-in components was unsatisfactory, and the same applied for materials and semifinished products.

Reliable acceptance monitoring requires definition of all such materials and so on together with the appropriate methods of determining parameters and of the methods for monitoring the latter, which itself involves agreements with all the suppliers; further, a unified

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system was drawn up for metrological certification on nonstandard equipment (test systems for acceptance on receipt and passing for shipping).

This analysis itself revealed various other problems related to the utilization of new components and the completion of development on prototypes, including certification in-house, the examination and analysis of advertisements, and metrological and other preparations for routine production.

The comprehensive approach implied by this system is on the basis that the quality of any product should be laid down at the design stage, be guaranteed during manufacture, and be maintained during use. This approach thus provided standards for use throughout the organization, which provide the essence of the quality-control system.

The specification for the system laid down the standards for production techniques and the stages of definition of the latter; the system was essentially based on 72 such production-technique standards, which govern the stages involved in design, production, operation, and so on.

The metrological service was concerned with the definition of eight of these standards that dealt with metrological support to production; also, some aspects of metrological support were reflected in standards drawn up by other services. In such cases, the metrological service provided guidance on methods or on the writing of part of the specifications.

The standards developed by the metrological service formed a subsystem in the general quality-control system, particularly for design and production.

The metrological standards forming part of the design subsystem reflect metrological preparation for production at all stages of design, and in particular they involve metrological evaluation of design documents and other engineering documents, definition of rules for choosing means of measurement, and evaluation of the level of metrological support required by the process.

The metrological standards for the second subsystem reflect the metrological support during production and envisage centralized planning and execution of test and repair operations for all types of measuring instrument; in addition, they involve metrological certification of nonstandard test facilities and evaluation of the general level of metrological support to any product.

The level of metrological support to each product was evaluated in collaboration with the designer, the production technologist, and the production supervisor, in addition to the heads of the production-preparation unit and the metrology organization. Supervision of the operations was carried out in accordance with a graph that laid down the frequency of surveys, which themselves were dependent on the complexity of the component or unit, but which in any case were not less often than once a year.

In the case of checks by the original designer, a particular search was made for any deviations that adversely affected the qualitative or quantitative aspects of the metrological support to the process, as well as any deviations from the specifications laid down in the design and standardization documents. The significance of any such deviations was evaluated, along with trends and scope for immediate correction, by means of appropriate calculations. The characteristics used for this purpose were the level of metrological support, which was envisaged as the ratio of the general metrological-support parameter to the corresponding base parameter:

\[ Y = \left( \frac{A}{A_b} \right) \times 100, \]

where \( Y \) is the level of metrological support to the process, \( A \) is the generalized parameter, and \( A_b \) is the base parameter, each of which is established by metrological evaluation.

These two parameters are governed by the characteristics of the measuring and test systems used in manufacturing components, units, and complete assemblies:

\[ A = abc \text{ and } A_b = a_b b_c b, \]

where \( a \) is the coefficient representing the correspondence between the means of measurement.