A model is proposed for selecting measuring instruments used in estimating product quality on the basis of stability in the production process, which allows one to determine the performance of acceptance monitoring.

Key words: total quality management, quality assurance, acceptance monitoring, technological process stability.

The economic and technical successes of a firm are determined by many factors, including the match of the products to the demands and specifications of customers, together with the obligations of the manufacturer as regards guarantee and operating lives, low proportion of rejects, production stability, and also obedience to other quality criteria, which together ensure that the firm has a long future on the market.

Quality has followed a path [1] from acceptance checking (start of the past century), and then statistical methods (1920s) leading to product certification (1950s) and process guarantees (1980s) to certification of quality management systems in the concept of total quality management (TQM) from the 1990s [2]. At present, TQM constitutes a comprehensive pattern for quality attainment. Definitions given by many researchers are extremely varied, but the basic one is the Baldrige criterion. At present, Baldrige’s ideas have been introduced in a new version (2000) of the series 9000 ISO standards. Also, in an ongoing process of quality improvement 6σ criterion, Business Process Reengineering/Redesigns (BPR), Total Productive Maintenance (TPM), Quality Function Deployment (QFD), and also Benchmarking, Kairyo, Kaizen, 7 Management tools, 5S, and many others are used as component parts or independent methodologies.

The measures taken by firms would be unthinkable without appropriate metrological support to measurements, monitoring, and testing, which is realized by metrological services.

In Russian practice, great value attaches to the activities of the metrological services since the 1970s and 1980s. In that period, there was a movement by manufacturers for defect-free product manufacture (Saratov Aviation Plant), which attained an international response in “Zero defects.” A very interesting part has been played at the international level by the Lvov Comprehensive Product Quality Management System (PCMS). This has been introduced at various organizations with support from the research institutes of the USSR State Standard Commission and has covered all stages in the product life cycle, with documentation of the rules for the production stages. At the same time as the PCMS, there was the state system for product certification. That activity and its regulatory support became the basis for the series 9000 ISO standards in the 1994 version.

Unfortunately, one has to accept that the entry of Russia into market relationships has been characterized by a marked reduction in the scales of metrological operations, which is due to producers losing interest in product quality and tending to raise amounts to get quick profits.

The situation now is somewhat different: our market has reached saturation, and prices for goods of a particular type have been minimized, and consumer goods sales are practiced everywhere. Manufacturers have sensed the advantages of certified goods and have extended their appreciation of quality. Under these conditions, they are responsive to competition, which has posed new tasks on the quality of goods and production stability. However, many manufacturers have not devoted appropriate attention to metrological services, which are the main link in supporting quality. In our tradition, quality is attained in the main by the latest production technologies, machines, mechanisms, and strict administration. An objective evaluation shows that our organizations fairly widely use old technologies, and the introduction even of small improvements has an effect in raising quality, which satisfies the manufacturer and does not lead to the organization of large-scale and major work on quality. Foreign experience shows that a business cannot be kept on the market solely by using high technologies, which have become a universal phenomenon on the basis of the scope for investment. To attain competitiveness, it is important to emphasize management technologies, in which quantitative evaluations enable one to perform clearly designed actions. This determines the status of metrological services.

Before we formulate tasks for the metrological service and determine criteria for evaluating its activities in current quality management systems (QMS), we should clarify the meaning of QMS.

In 2001, Russia introduced GOST R ISO 9000-2001 “Quality management systems: Basic concepts and dictionary” as well as GOST R ISO 9001-2001 “Quality management systems: Specifications.” Those versions of the standards replaced the versions of 1996 and were distinguished by substantial democratic structure in system construction, which allows one to incorporate the specialization of the business and can realize eight principles: customer orientation; managerial leadership; involving the workers; a process approach; a systems approach to management; ongoing improvement; taking decisions based on facts; and mutually beneficial relationships with suppliers. A major difference of the new version is the process approach in place of the previously required 20 elements in the quality system. The standards quite clearly formulate the specifications for the system, which envisages definition and introduction of various regulatory documents. These may be acquired in a typical form, and the formal definition of the QMS does not represent difficulty. However, a real QMS is the result of restructuring the management and taking additional measures, with the practical upgrading of the system, which may take not less than two or three years. Computer technologies accelerate the implementation of many processes and stabilize their realization, which can be used also in QMS [3].

This TQM concept involves certifying the local QMS, which in the main confirms obedience to the Baldrige criteria, where the certification shows correspondence with the requirements of the ISO standards on ecology, and where there are national or other prizes for quality awarded, and where specifications are met for various current quality methodologies. Baldrige’s criteria have served as the reference for the European quality prizes, first awarded in 1992.

Ongoing quality improvement is a difficult problem and involves various modern methodologies. For example, the Motorola Corporation in the mid-1980s became the initiator of the Six Sigma methodology [4–6], which provided a marked reduction in defects during manufacture, and in 1988 received the National Baldrige Award for quality. The Motorola innovation led to their adopting the Six Sigma trademark. Sigma as a probability concept characterizes the variations in the technological process with respect to the tolerances. This has become very informative and convenient throughout the world as an indication of quality. Some researchers see in Six Sigma an alternative to TQM [5, chapter 3, “Why does Six Sigma live and conquer where TQM used to dominate?”]. The process corresponding to Six Sigma (6σ) has a form in which 99.9997% of the final product is free from defects [5, 6].

In Russian industry, for many years we have had our own experience, traditions, technologies, and organizational techniques for attaining quality. In particular, virtually every business has a technical monitoring section (TMS), which is intended to detect and discard poor quality products. This TMS evaluates the finished product and makes appropriate measurements for the purpose. The accuracy class of the measuring instruments (MI) is set from statistical tests, which serve to estimate the systematic and random errors (from the spread as a rule at the 3σ level). Errors in the MI lead to errors of the first and second kinds in rejecting products, which determine the risks of manufacturer and customer.

World-level technological processes (Six Sigma) of themselves provide high stability in product quality, and sometimes the traditional activity of the TMS in rejecting unsatisfactory items by the use of MI of inadequate accuracy may unjustifiably increase the risks of manufacturer and customer.