LINEAR AND ANGULAR MEASUREMENTS

SPECIAL PROBLEMS IN MEASURING THE GEOMETRY OF WORKPIECES PRODUCED ON THE BASIS OF FOREIGN DOCUMENTATION

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The principal differences between the definitions and rules for specifying the form and location tolerance of surfaces on the basis of Russian GOST standards, the standards of the International Standards Organization, and standards issued by foreign countries are considered. These differences must be taken into account in measurements and estimations of the geometrical precision of workpieces and in the use of imported devices.

Measurements of the form and geometric dimensions of workpieces in machine construction are among the most critical and complex of all operations. Because of increasingly stricter constraints on the performance and useful life of machinery, the volume of these measurements is, naturally, increasing.

Constraints imposed in drawings and in design, process, and normative documents must be taken into account in order to make the correct selection of methods and means of measurement and to decrease or entirely eliminate procedure errors. In turn, these documents must be based on standardized determinations of form and location deviations and form and location tolerances. Thus, standardization of the terminology in the area of geometric deviations and tolerances, the basic principles of normalization, and conventional notation and rules used to specify form and location tolerances has assumed increasing importance.

Over the past 20-30 years, a broad international and national normative foundation has been created through the efforts of technical committees of the International Standards Organization (ISO), including those of Technical Committee 3, "Tolerance and Fit," Technical Committee 10, "Technical Drawings," and Technical Committee 57, "Properties and Measurement Methodology for Surfaces, and also within the framework of national standardization programs of different countries, e.g., Russia, Great Britain, USA, Germany, and others. This foundation has proven useful in the creation of unified normalization and measurement of the precision of form and location of surfaces.

The documents ISO 1101, ISO 2692, and ISO 5459 [1-3] are the basic ISO standards for setting norms of geometric precision of surfaces. The national standards of foreign countries correspond virtually entirely to these ISO standards. As part of their text, the principal state standards on form and location tolerance of surfaces also include all the main principles of these ISO standards. This circumstance serves to maintain informational compatibility between Russian and foreign technical documentation on geometric tolerances, and also makes it possible to use foreign means of measurement of geometric deviation, including the relevant computer software. This is especially important in the case of devices used to control the geometry of rotary workpieces (e.g., out-of-round gauges, out-of-cylindricity gauges) and plate-measuring gauges, which are now produced mainly by foreign firms and are equipped with built-in computers.

An exhaustive solution of questions related to maintaining the geometric precision of workpieces requires the creation of normative documents on methods and means of measurement and control of geometry on the national as well as on the international level. Among the Russian normative documents we may cite GOST 28187−89 and GOST 16085−80 [6, 7], a group of procedural documentation related to methods of measurement of individual types of deviation (rectilinearity, roundness, levelness, cylindricity, longitudinal profiles of cylindrical surfaces, degree of parallelism, perpendicularity) as well as...
Fig. 1. Designations of separate (a) and overall parallelness tolerance (b), i.e., combined with levelness, on the basis of Russian state standards, ISO standards, and ASME (U.S.) standards.

Fig. 2. Specifying location segments according to ISO 5459: (a) point; (b) line; (c) area; (1) measured workpiece; (2) locating element of measuring device.

as the measurement of geometric deviation using plate-measuring gauges and devices equipped with computers. For example, GOST 28187–89 [6] establishes general principles for selecting measurement methods, measurement constraints entailed by