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ADJUSTING THE RELATIVE POSITION OF THE NODES OF A VERTICAL MILLING MACHINE TO ENSURE THE QUALITY OF PARTS PROCESSING

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Abstract: *The article describes the methods and methods for setting up the units of universal milling machines to ensure the necessary accuracy of processing.*

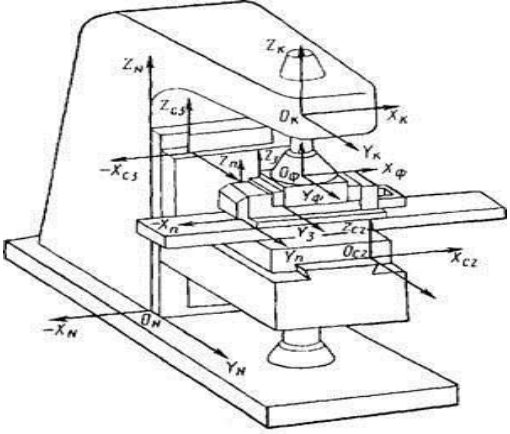
Keywords: *machine tool, milling machine, vertical milling machine, milling, machine setting.*

The purpose of the work is to familiarize undergraduates in the direction of preparation 5A320201-Technology of mechanical engineering and equipment (for production) with the rules for metrological adjustment of universal vertical milling machines to ensure the quality of processing parts. The content of this article will allow undergraduates to master the skills in the competencies provided for by the above educational standard.

The fundamental factor of technological quality assurance is the accuracy of the machine, which, in turn, is ensured by special settings. The procedure for setting up the machine units, their metrological parameters and devices for implementing the settings are shown in the machine data sheets.

Consider examples of accuracy settings for a 6P12 vertical milling machine designed for milling planes, various kinds of grooves, grooves and other surfaces of parts.

On fig. 1. shows a vertical milling machine, where the closing link during milling is the distance between the cutting edges of the cutter and the mounting base of the workpiece.



Rice. 1. Trajectories of the main and auxiliary movements of the vertical milling machine 6P12

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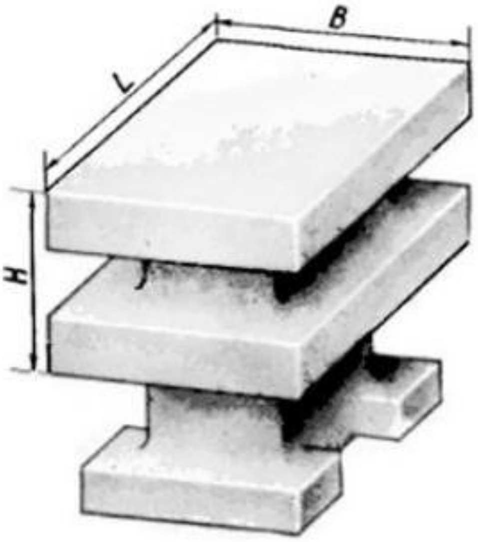
Provided that milling is carried out due to the longitudinal movement of the table, among the parts included in the dimensional chain, the spindle and the longitudinal table each have one degree of freedom. The spindle rotates and the table moves forward and backward.

To determine the quality of processing, machine tests are carried out.

Testing of machines is provided when working under load and is carried out under conditions that are close to operational, i.e., adequate to real milling. When testing under load of vertical milling machines, rough and finish milling is performed. It should be noted that during rough milling, the load is provided up to the rated power of the drive, and with a short-term overload of the electric motor of the drive of the main movement, no more than 25% higher than the rated power.

Accuracy and the possible degree of roughness of the machined surfaces of parts are provided by tests for the accuracy of the machine itself. In this case, three planes of the sample are processed with an end mill, which are mutually perpendicular. The cast iron blank shown in Fig. 2.

Rice. 2. Sample mold for checking the accuracy of the vertical milling machine



The flatness of the treated surfaces is checked with a straightedge, probe or tiles; parallelism to the base - using an indicator; mutual perpendicularity of the planes - using a square and a probe.

The tolerance of parallelism of the machined upper plane to the base, as well as the perpendicularity of the side (also end) planes, should not be more than 0.02 mm over a length of 150 mm. Requirements are provided by the processing of test pieces (Fig. 2), after which they are measured to evaluate the result.

The condition of the working surface of the machine table also affects the accuracy of processing, since the fixture with the installed part is fixed on the surface of the table.

Checking the working surface of the table for flatness is shown in fig. 3. The ruler is installed on the working surface of the table with a calibration edge, while two precisely processed tiles of equal height are placed under the ruler. Using plane-parallel tiles or a probe, check the clearance at different

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points between the table surface and the bottom edge of the ruler. Permissible deviation - no more than 0.03 mm for a length of 1000 mm in any direction.

Rice. 3. Scheme for checking the flatness of the working surface of the table

Milling machines are subject to high demands on the accuracy of work. At the same time, it should be noted that the accuracy of the dimensions, location and shape of the surfaces of parts that are processed on a milling machine depends not only on the accuracy of the machine itself, but also on a number of other factors. However, the accuracy of the machine has a significant impact on the accuracy of processing.

Checking the radial runout of the spindle axis is shown in fig. 4. To check the spindle runout, the indicator device must be mounted on the stationary part of the machine so that the measuring pin is in contact with the cylindrical surface of the end control mandrel, which, in turn, is inserted into the spindle bore with a tapered shank. After that, turn on the rotation of the spindle. The runout is measured at the end of the rotating spindle, as well as at a distance L from it. Permissible deviations should not exceed 0.01 mm at the end of the spindle; 0.015 mm at a distance of 150 mm - these data must be maintained for a spindle with a front bearing journal diameter of up to 50 mm 0.02 mm at a distance of L = 300 mm for a spindle with a front bearing journal diameter of more than 50 mm.

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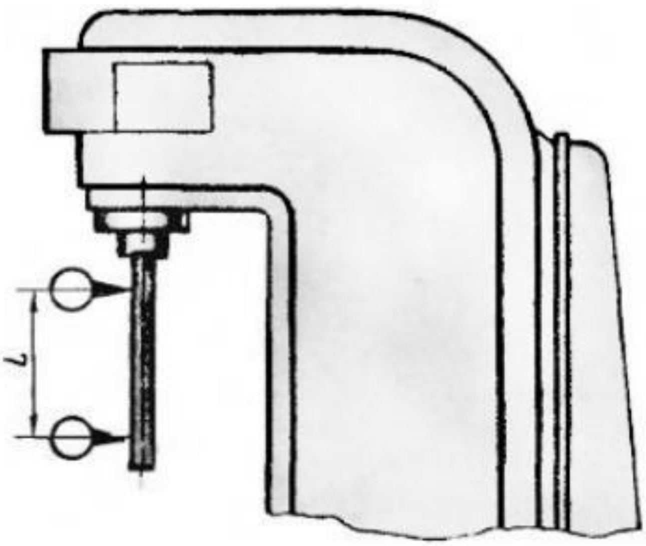

Rice. 4. Scheme for checking the radial runout of the spindle axis

Checking the perpendicularity of the axis of rotation of the spindle to the working surface of the table is shown in fig. 5. A special control mandrel with an indicator is fixed on the spindle, while the measuring pin should touch the working surface of the table. When measuring, the spindle, together with the indicator, is rotated by 360^0. The check is made when the console is locked on the bed, and the slide is on the console. Note that each measurement is made in 2 positions of the indicator, which are offset relative to the spindle in the transverse plane and the longitudinal one. The measurement result is determined as the arithmetic mean of the measurement results at diametrically opposite positions of the indicator relative to the spindle. Measurements are made in the upper and lower positions of both the spindle and the table. The rotary headstock is set to the zero position during measurements. Permissible deviations for machines with a table width over 160 mm on a diameter of 300 mm - 0.02 mm in the longitudinal plane and 0.03 mm in the transverse plane. Note that in the transverse plane, the spindle is allowed to tilt only towards the bed.

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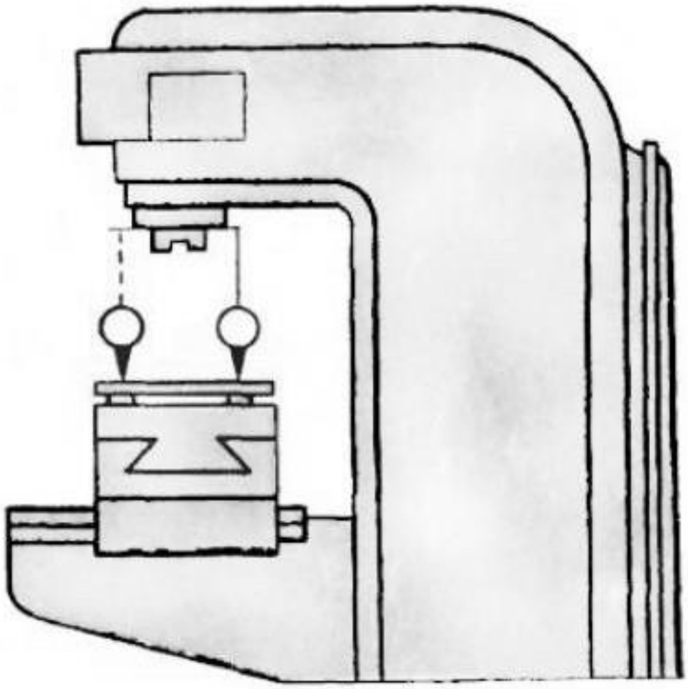

Rice. 5. Scheme for checking the perpendicularity of the axis of rotation of the spindle to the working surface of the table

According to the passport data, properly configured vertical milling machines ensure the accuracy of processing and the relative position of surfaces within 7-8 degrees of accuracy, which is sufficient for parts of medium accuracy.

In the above article, the ways of setting up vertical milling machines were considered to ensure the required accuracy and improve the quality of processing parts on vertical milling machines, showing the settings diagrams, the instruments and fixtures used. Particular attention is paid to numerical indicators of permissible deviations in the relative position of machine nodes and indicators of accuracy and roughness of the surfaces of parts processed on tuned machines. The material of this article is useful for students and undergraduates of technical universities to study the methods of setting up the specified equipment in order to ensure the quality of processing, and the material of the article may also be useful to engineers of machine-building enterprises for practical use.

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