

## ANALYSIS OF CONSTRUCTIVE ELEMENTS OF HOUSING PARTS PROCESSED ON CNC MILLING MACHINE

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*The constructive elements of housing parts processed on computer numerical control (CNC) milling machine have been considered. The analysis was made showing the frequency of usage of certain elements in the housing parts manufactured by OJSC "Izmeritel"*

Housing parts make up to 20% in the general nomenclature of the parts manufactured in machine-building. The laboriousness of manufacturing these parts is 5-10 times higher than the laboriousness of manufacturing parts of other classes, due mainly to the widespread use of milling operations [1].

The use of CNC machines allows to reduce the amount of labor by dozens of times. When developing control programmes for these machines, it is necessary to have a classifier for the most frequently encountered constructive elements of bodies subjected to milling.

The housing part is a box-shaped part having one or more base holes with which other parts can be mounted inside the housing in a certain kinematic correlation, as well as the bodies of drive and distributive systems characterized by the presence of working apertures called basic [2, 3]. However, it should be taken into account that the housing part may not contain the base holes, nor be the case of the drive or distributive system.

In its turn, a constructive element (CE) of a part is local changes in its shape or surface in order to give it additional properties in the manufacture, assembly or exploitation [3, 4].

A wide variety of CE is used in housing parts. The most common constructive elements in parts are presented as follows:

1) A cavity is the internal space of the body intended for the location of impellers, guiding apparatuses and the passage of water, steam or gas. Also, this CE is often called "pocket" or "sample". It is worth noting that the cavity does not always have impellers and other elements specified in the definition.

2) A chamfer is the edge of a part cut on-the-miter. The chamfer angle is chosen based on constructive purposes, but often it is 45°.

3) A fillet is a smooth transition from one part of a surface to another along the specified radius. This CE is designed for removing sharp edges, facilitating assembly and giving aesthetic appearance.

4) A groove is a groove on a part surface of a different trajectory and often a square, rectangular or circular cross section. They are preferably designed for sealing rings and retaining lubricant (if a moving part is installed in the housing) in the body parts. Also a slit can be considered as a groove, that is a narrow groove cutting through the wall of the body.

5) A mortise is a groove in the part where a constructive element is located on the lateral surface or face. The grooves are of various types: open, closed, keyed, etc. They are used for moving joints of parts.

6) A boss is a protrusion on the surface of the cast piece designed to create a reference plane for the fasteners. Also, this CE is often used as a necessary technological element in the processing of parts. For example, when milling the first side of the body part, the workpiece is clamped in the vice by the boss.

7) A bead is a narrow ledge moving along the edge of a part. Beads are designed to limit the movement of one part along another, to make more dense and rigid assembly of this part with others, and in some cases for greater tightness.

8) A hole is the term according to GOST 25346 conventionally used to refer to the internal elements of parts (including non-cylindrical elements). A circular hole in the cross section is an opening in which any cross-section is a circle. There are stepped, deaf, threaded and other holes.

9) A thread is a relief surface formed on the cylindrical or conical surface of a part when cutting a groove of a certain profile along a screw line. There are various types of threads: metric, conical, tubular, trapezoidal, round, inch, pitched, single- and multi-thread, left and right.

10) A face is a surface having only two measurements, so that between any two points it is possible to direct a line that is completely soluble with this surface, or a subject that is a surface having a planar shape [5].

11) A ledge is a part of something that forms a step, a notch [6].

Presence of a particular CE has a great influence on the design process and creating a control programme for CNC machines.

The analysis of 26 parts produced by CNC milling machines at OJSC "Izmeritel" is carried out in order to determine the frequency of using the above-described structural elements in them.

The results of the analysis are presented in the form of a graph in Fig. 1.

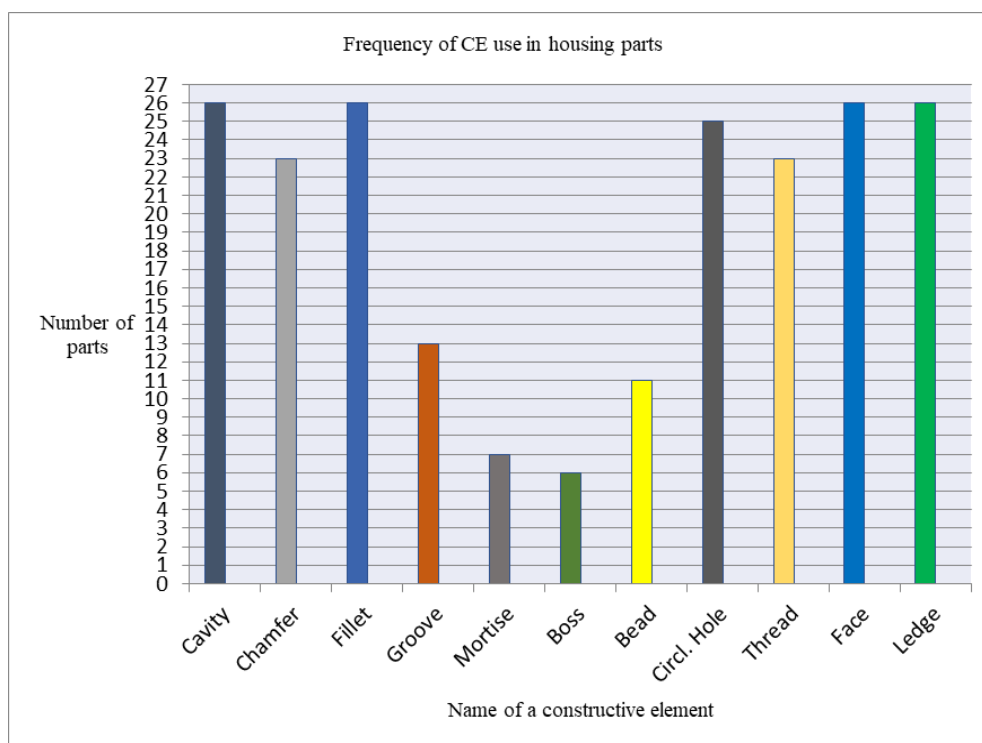


Fig. 1. Frequency of CE use in housing parts

As shown in the graph, in all the components there are 4 elements: a cavity, a fillet, a face, a ledge. Then there are holes with a circular cross section, thread and chamfer - 96% and 88% respectively (in threaded holes presence of a chamfer is mandatory). Grooves are present only in 50% of the parts, beads - 42%, and mortises and bosses – 27% and 23% of the parts.

#### Conclusion

The face as a constructive element is present in all the parts, and not only in the hull, since it is the main CE. The presence of the cavity, ledge and fillet in all the parts analyzed in this article suggests that they are the basic CE for this type of product. Presence of other CEs (grooves, mortises, bosses, etc.) is conditioned, first of all, by the requirements presented in this part, as well as by the functions that it performs.

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