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RESEARCH OF THE VALUE OF RAW MATERIAL LOSSES AND INTENSITY OF TOOL WEAR WHEN PROFILING NATURAL STONE PRODUCTS

Examining the market of natural stone, we can conclude that recently, the tendency has been growing significantly to order the service of profiling when decorating stone products, designed primarily for installation as kitchen surfaces, countertops, window sills, and niche stoves. This service is most often ordered to increase the service life of natural stone products. Profiling is an effective preventive method, as it allows to remove the sharp edge from the surface of the finished product, resulting in increased decorative properties over a long service life, primarily by preventing chipping of the face of the product during its operation. Therefore, taking into account the above aspects, it is reasonable to assume that at this stage of development of the stone industry considering consumer needs, it will be relevant to study the profiling process for decorating natural stone products to establish optimal types of profiles in terms of value, labor intensity and raw material losses in their implementation [1].

The study of raw material losses and the rate of the working tool wear when performing profiling of different sizes (Fig. 1.) were performed on the basis of the company "Granitdrev". Profiling operations were carried out using a PLC-600 edging machine with a working tool in the form of diamond cutters of standard sizes, granodiorite slabs of the Pokostivskiy deposit were used as the processed products.

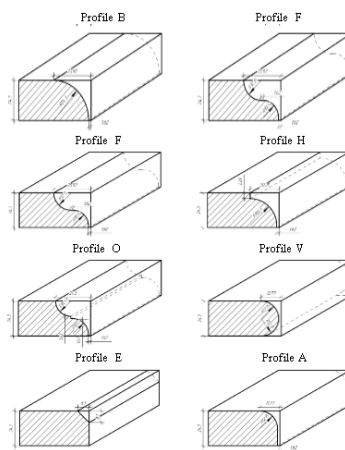


Fig.1. Types and key dimensions of the studied profiles

The determination of the amount of losses is based on the analysis of the geometric dimensions of the working tools of different types and the analysis of the linear dimensions of the workpiece plates. Therefore, the essence of this analysis was to draw the profiled products on a scale of 1:1 and determine the area of the part of the plate, which is removed during profiling. It should be noted that during the manufacture of profiles B, F, H, O, V and A there is a gap of 2 mm, which is due to the design features of the cutters. This gap

provides more uniform and aesthetically pleasing appearance of the product profile. In addition, this gap increases the amount of raw material losses and reduces the service life for the working tool, so this gap should be taken into account both when building profiles and when determining the amount of losses and tool consumption. The determination of the amount of raw material losses in this study will be mainly caused by the area of the workpiece plate, which is removed during its profiling. Under normal conditions, this area can be found as the area of individual simplified geometric figures in the cross-sectional plane of the profile [2].

The process of determining tool wear is more complex, and consists not of analytical but of practical research. The essence of the study is to determine the thickness of the working layer of the tool worn over a certain operating cycle with the help of appropriate measuring instruments. The value of the working tool wear, when performing a certain amount of work is described, using a number of appropriate values, which include: the thickness of the working layer of the tool before the work cycle; the thickness of the working layer of the tool at the end of the work cycle and the actual work performed during the cycle.

The calculation of the amount of raw material losses in the process of performing the technological operation of profiling was carried out at the rate of m^3 per one running meter (Table 1.1). The basis for calculating the amount of tool wear is to compare the thickness of the working layer of the tool before the start of the work cycle and after its completion. Since each of the experimental situations had different values of the length of the work cycle, a unified value was calculated, which characterizes the value of tool wear for the same work cycle, that is, the value of tool wear per running meter was determined [3].

Table 1.1

The value of raw material losses and the intensity of tool wear when profiling natural stone products

№ з/п	Profile type	Amount of raw material losses, m^3 / m.p.	Tool wear intensity, mm / m.p.
1	Profile B	0,00025	0,21
2	Profile F	0,00050	0,22
3	Profile H	0,00029	0,17
4	Profile L	0,00018	0,12
5	Profile O	0,00045	0,25
6	Profile V	0,00016	0,18
7	Profile E	0,00005	0,10
8	Profile A	0,00011	0,17

The largest amount of raw material losses is observed during the manufacture of profiles of type F and O, namely 0.0005 and 0.00045 m^3 / m.p. Instead, the lowest amount of raw material losses is observed during the manufacture of profiles of type E and A, namely 0.00005 and 0.00011 m^3 / m.p. As for the production of profiles of type B, F, L and V, the amount of raw material losses is in the range from 0.00016 m^3 / m.p. to 0.00029 m^3 / m.p.

Based on the results obtained, it can also be concluded that the amount of losses is determined mainly by the area of the part of the plate that is removed during profiling.

The most intensive tool wear is facilitated by the use of profiles of type O, F and B, obviously, this is due to the fact that when drilling these profiles, the contact area of the cutter with the area of the workpiece plate is the largest. Accordingly, the lowest intensity of tool wear is observed when using cutters of type E and L.

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