

TECHNOLOGICAL ASSURANCE OF DIMENSIONAL ACCURACY IN MACHINE PARTS

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This article investigates the dimensional accuracy and economically justified tolerances in the manufacturing and assembly of machine parts, emphasizing their impact on production efficiency and operational performance. The study highlights the necessity of re-evaluating part accuracy requirements by predicting dimensional changes due to wear and analyzing the functional influence of clearances in mechanical assemblies. By optimizing dimensional relationships and controlling tolerances, both durability and cost-effectiveness in the production process can be significantly improved.

Particular attention is given to the techno-genetic transformation of dimensional accuracy from workpiece to final part surfaces, especially in high-precision machining. The formation of micro-geometric characteristics is determined by inter-operation inheritance and the precision of previous technological steps. Modern numerically controlled machines with enhanced rigidity are essential for achieving the required accuracy and surface integrity.

The paper also explores how various machining processes generate characteristic “hidden” and “apparent” micro-errors, influenced by input parameters and physical-mechanical conditions. The real contact area between surfaces, including plastically deformed micro-protrusions, critically affects part longevity.

Finally, the study underscores the scientific and technical importance of ensuring high dimensional and shape accuracy, particularly in parts operating under extreme conditions. Special emphasis is placed on the honing process and its impact on surface microstructure, reliability, and performance of machine elements.

References

1. Eziz, S. Sh. Kinematic features of the lapping process and determination of its basic parameters // – Moskow: Computational Nanotechnology, – 2020. №3 (Vol.7), – p. 11-16 <https://urvak.org/articles/compu-5261-vypusk-3-kinematicheskije-osobennosti-pr/>
2. Rasulov N.M., Nadirov U.M., Alekberov M.Z. Generalized Assessment of Machined Surfaces Quality. Russ. Engin. Res. 40, 822-825 (2020). <https://link.springer.com/article/10.3103/S1068798X20100202>
3. Rasulov N.M, Nadirov U.M, Alakbarov M.Z. Improving the efficiency of grinding teeth by copying with the control of dynamic technological connections. /SOCAR Proceedings. Special Issue 1 (2022) 029-035. DOI: 10.5510/OGP2022SI100697. <https://proceedings.socar.az/en/journal/85>
4. Eziz, S. Sh. Theoretical studies of the dynamic characteristics of the internal lapping process // – Magnitogorsk: Vestnik of Nosov Magnitogorsk State Technical University, – 2020. №2 (Vol.18), – p. 30-37 <https://vestnik.magtu.ru/en/archive/86-archive/no-2-2020/1095-30.html>