Influence of roughness on operational properties of details

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Abstract. The roughness has significant effect on operational properties of details. For increase in wear resistance and durability of cars and mechanisms, it is necessary to provide appropriate roughness of a surface of details. In this article influence of roughness on some properties of details is considered: on contact deformation, stability against corrosion, wear resistance and on other indicators.

Shows results of long-term operation of production of the machine-building industry of different function that, parameters of a condition of a blanket strongly affects reliability and durability of details of cars and, respectively, products in general. This results from the fact that the majority of operational characteristics of details substantially depend on quality of a surface.

The surface quality of parts is a complex indicator determined by such characteristics as macrogeometry, surface roughness and waviness, the state of the surface layer.

On the finished and machined surface of the part there are always irregularities of different types and sizes, depending on the methods of machining, in contrast to the surface depicted in the drawing [1].

During the cutting process, the metal layer is deformed and the structure changes [2]. The degree of hardening and depth of the hardened layer depend on the processing methods, modes and cutting speed, the geometry of the working edge of the tool and the properties of the starting metal [3].

Deviations from the theoretical form can be of three groups: macrogeometric-deviations from the correct geometric shape; waviness – as a result of vibrations and unevenness of the cutting process; microgeometric, formed as a result of the impact of the cutting edge of the tool on the treated surface.

For increase in wear resistance and durability, it is necessary to provide appropriate roughness of a surface of details. The details with a surface having big roughness are exposed to bigger wear during operation, than the details having a plain surface. It can be explained with the fact that the area of a support of a rough surface is less, than equal as surfaces adjoin among themselves only combs [4].

Also, the details of roughness which are available on a surface and defects promote further concentration of tension which can exceed the strength of metal and be a cause of destruction of a detail [5].

The roughness step taken as a roughness must be very small, relative to the base length of the entire surface. There are three types of object roughness:

1) Initial-occurs as a result of the technological sequence of processing of the product by various abrasives.
2) Operational (ES) - acquired roughness during operation of the part, as a result of wear and working friction.
3) Equilibrium is a type of ES that can be reproduced in stationary friction conditions.

Despite their small size, such irregularities have a significant impact on the performance properties of parts (ESD). The results of the study of the effect of surface roughness on some ESD can be seen in table 1.

Table 1 - Influence of Roughness on Operational Properties of Details

| №  | Operational properties of details | Influence of roughness on operational properties of details |
|----|---------------------------------|----------------------------------------------------------|
| 1  | The corrosion firmness          | Has a considerable impact. Corrosion of details in atmospheric conditions are formed easier and go quicker on roughly processed surfaces. As a rule, on purely processed surfaces, the corrosion resistance is higher. |
| 2  | Contact deformation             | Strongly affects contact rigidity of joints of the interfaced details. Reducing roughness and waviness, increase bearing detail surfaces for 80 – 90% is possible and by that to increase contact rigidity. |
| 3  | Friction and wear               | The value of working wear increases. Wear is affected by the shape of micro-irregularities and their direction. Peaked wear faster than flat-topped. |
| 4  | Fatigue strength (up)           | Irregularities affect the stress concentration and the formation of fatigue cracks. Insufficient up will lead to rapid breakage, causing failure of the machines. |
| 5  | The stability of the stationary landings | When pressing parts is smoothing of asperities leading to a decrease of the actual tensioning. In this regard, a decrease in the strength of the connection of parts is detected with more rough surfaces. |
| 6  | Thermal conductivity           | There is a decrease in the thermal conductivity of the joints. |
| 7  | Tightness of joints (HS)        | There is a decrease in contact stiffness and HS, due to a decrease in the actual contact area. |

But, also it is necessary to remember that not in all cases the purely processed surface is the most wear-resistant, as the retention of lubricant under different friction conditions depends on the micro-roughness available on the surface. And therefore, depending on specific conditions of friction, it is necessary to pick up optimum roughness of a surface. Parameters of roughness are determined in GOST 2789-73 "Roughness of a surface. Parameters, characteristics and designations" [6].

Analyzing results, it is possible to draw a conclusion that the roughness has significant effect on various properties. Also it is necessary to remember that influence of roughness it is essential also to economy as repair and restoration of worn-out details can be quite often more expensive, than production of the new car. It is possible for this reason, exact determination of value of roughness - one of important problems of metrology.

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