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Research of Hydrounits Details Wear Resistance

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Abstract

In article the technique of carrying out and results of the realized extreme experiment by determination of wear size of the friction surfaces samples imitating surfaces of hydraulic actuator details in transport technological machines depending on temperature of hydraulic oils is described. The most operated factors of a variation are revealed and practical recommendations about providing optimum technical condition of hydrocars details are made.

Keywords: Thermal regulation, working liquid, hydraulic actuator

Introduction

One of the most important directions of ensuring operability of hydraulic actuator units of modern cars and the equipment is increase of wear resistance of their details due to improvement of their greasing mode by use of working liquids rational temperatures under operating conditions.

For research of wear of the resource defining interfaces a – "case-gear wheel" of a hydraulic pump and establishment of quantitative communication between temperature, abrasive concentration in oil, loading in interface and wear the full-factorial experiment was realized according to the developed technique.

Researching methodology

Experiment had extreme character. The polynomial of the second order was used as a response function. To reduce of experiences number the experiment was made according to the plan, close to D-optimum, with experience in the center of the plan [4].

The cylindrical rollers, made from the low-alloyed steel, and the blocks – from foundry aluminum were chosen as samples. Laboratory installation was executed on the basis of the friction machine. In the test camera the heat exchange element through which hot water from the thermostat was pumped was stated.

The demanded temperature condition was provided with mixing of cold and hot water in the mixer or change of cold water consumption. Oil temperature in the camera was taken by the thermocouple made of material on the basis of chrome, copper and nickel and was registered an electronic potentiometer.

Measurement of samples surface hardness of was taken on the hardness gage on Rockwell's method. The roughness of samples surface was measured on the profilometer. The weight method which consisted in definition of weight decrease by weighing on analytical scales was applied to wear determination.

Results and discussion

After computer mathematical processing of experiment results the regression function in the coded look was received [4,3]

$$i = 0{,}29 \cdot x_1^2 + 0{,}12 \cdot x_3^2 - 0{,}04 \cdot x_1 + 0{,}21 \cdot x_2 + 0{,}2 \cdot x_3 + 1{,}07.$$

The received function brought to natural values of factors has an appearance

$$i = 0{,}00033\ t_м^2 + 0{,}47 \cdot P^2 - 0{,}03 \cdot t_м + 1{,}94 \cdot C - 0{,}96 \cdot P + 2{,}02,$$

where $t_м$ – oil temperature in the capacity, °C;

P – load of a block, kN;

C – concentration of an abrasive in oil, %.

As a result of carrying out laboratory researches of M-10G2 oil, the computer processing of experimental data the dependences of the friction moment on oil temperature is received, from which it is obvious that there is an temperature interval, in which friction moment is the smallest. Therefore, energy consumption decrease can be reached by regulation of oil temperature condition.

Using the regression function, and having fixed at the same time two factors from three at the main level, dependences on influence of each factor separately on wear of samples are received.

At reduction of loading in contact samples wear decreases (figure 1). Dependence has nonlinear character. However under production conditions it isn't possible to influence wear by loading change in contact of the interfaced details.

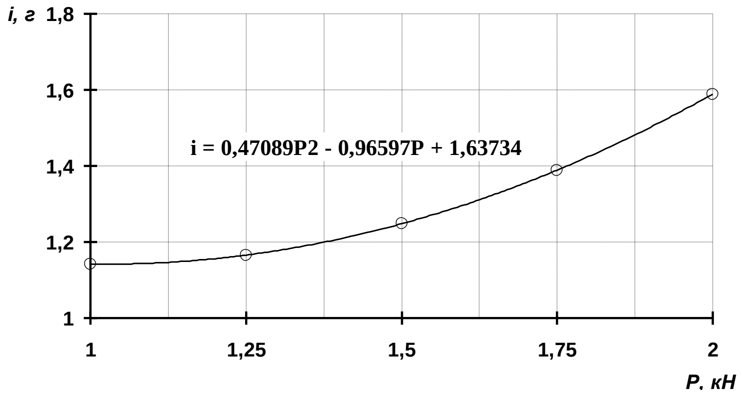

Figure 1 – Dependence of friction surfaces samples wear (i) from the top sample load (P), at T = 50°C and C = 0,03%

At an oil temperature near 50°C the area with the smallest wear is observed (figure 2) that is explained by the best intake of low-viscous oil in a friction zone, the best heat sink and more intensive removal of wear products from friction surfaces.

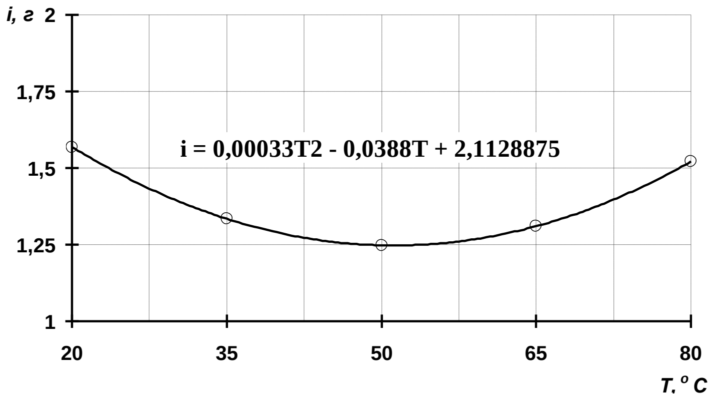

Figure 2 – Dependence of friction surfaces samples wear (i) from temperature of oil (T), at C = 0,03% and P = 1,5 kN

The increase of abrasive concentration in oil leads to growth of friction samples wear on linear dependence (figure 3).

Therefore, to reduce mobile interfaces wear it is necessary to take measures for prevention of abrasive particles receipt in oil under operating conditions, but completely it is impossible to exclude their receipt [1,2].

It is also established that with reduction of abrasive impurity concentration in oil influence of oil temperature on abrasive wear increases.

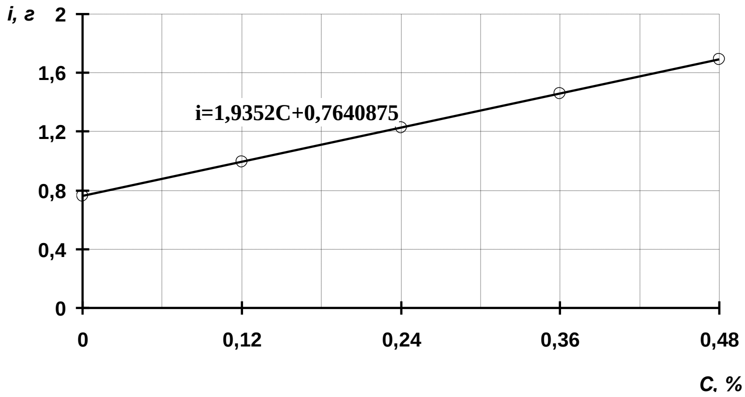

Figure 3 – Dependence of friction surfaces samples wear (i) from abrasive concentration in oil (C), at P = 1,5 kN, tm = 50^{o}C

Conclusion

After the analysis of the received results the optimum area of friction knot work was found, it is accepted wear conditions which corresponds to loading 0,8... 1,3 kN, oil temperature 40...63^{o}C and concentration of abrasive impurity in oil – 0,03% of weight.

Thus, from three considered factors only oil temperature is the most operated factor, and thermal regulation of working liquid in a hydraulic system allow to solve the problem of increasing of wear resistance of hydraulic system units details.

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