PERFORMANCE STATUS ANALYSIS OF HIGH PRESSURE RUKAVS IN HYDRAULIC SYSTEM

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Abstract
This article explores the high – pressure rukav (HPR)s in hydraulic excavators used in mining enterprises with external environmental-climatic effects, resistance to steep particles and hydraulic shocks generated by blasting processes, and the ability to withstand internal pressure.

Keyword: HPR, hydraulic pressure, excavator, quarry, external influences, rukav, working fluid.

Introduction

Analysis of the work of Quarry hydraulic excavators being used in the world shows that 54% of the total failure of excavators operating in cold-climate areas is associated with hydraulic system failures. The failures of the parts of the hydraulic system of the quarry hydraulic excavator are divided into the following groups [1-5]:

– high pressure rukava, pipe and fittings (fittings) failures in their connection part;
–violation of hermetization in the system (salniks, uplotnitels);
–hydronasos faults;
–hydromotor failures;
–failures in hydroconductors;
–control hardware failures;

High-pressure rukavs (HPR) are capils with temperatures ranging from -40 °C to +100 °C and act as conveying gaseous liquids under high pressure. One of a group of high pressure elastic tubes, it is designed to use mineral and synthetic types of hydraulic, aqueous emulsion, various lubricating oils and liquid fuels under pressure. Currently, skirts in the world are produced with an internal diameter of 4 mm to 51 mm and a length of 200 mm to 300 meters. They are capable of operating from 3 MPa to 70 MPa pressure. [6-10]

The rubber products contained in Rukav often reduce the reliability of the dense connection due to constant deformation and the fact that this effect gradually reduces the constant strength of the strength and the modulus of elasticity in the connecting parts with non-moving fittings. The increase in temperature accelerates the decrease in the constant strength of the consistency. A decrease in temperature slows down. But in this case, the elasticity of the rubber product is reduced several times. As a result, the reliability of the dense connection also increases. The influence of these factors is causing the malfunctions found in the hydraulic systems of hydraulic mining machines used in mines in our country. Most malfunctions of hydraulic systems are caused by leakage and contamination of working fluids. [11-15]

Figure 1 shows that the RH-40e brand excavator works in a state of expired replacement of the rukavs in the connecting sleeves of the connected skirts on the working members, and is connected in the nipple sleeves with a sequin. The movement of the working fluid from the part of the nipple on the side of the Saw leads to a change in temperature and a change in the nature of the rubbers on the inner layer. The change in the position of the reinforcement wire frame in the outer part of the rubber layer on the outer side, interacting with moisture, temperature, dust in the external environment, leads to interruptions from the connecting parts of the skirts, which do not withstand pulsed hydraulic shocks. The duration of operation of high pressure rukavs is 16,000 motosoats provided. Currently, the duration of operation of HPRs in hydraulic mining machines used in mines in our country is up to 36,000 motor vehicles or up to failure. [16-20]

Figure 1. The state of connection of the skirts in the working organs of the excavator of the RH-40E brand

Mine blasting processes and the impact effects of rimmed rocks in the zaboi work process can cause rukavs to be willed or to cause no significant amounts of damage. But the damage to the rukavs at an imperceptible level is caused by the effect of the external environment over time that the reinforcing carcass wires break through microsangling, causing the outer rubber to dry out and crack. This results in ruptures of the rukavs without withstanding the pulsed pressures in the hydraulic system. In Figures 2 we can see these cases.

Figure 2. The condition of the rukavs with the loss of reliable working capacity of their external rubber.

Studies on the connecting parts of the skirts show that the inner rubber layer crushes the nipple protrude at the end of the inner transition a change in diameter is occurring. It was observed that in parts of the interaction of the shrinkage areas with rubber and nipple, a break in the rubber layer and a crushing of the wires of the reinforcing carcass occurs, as shown in the photo in Figure 3.

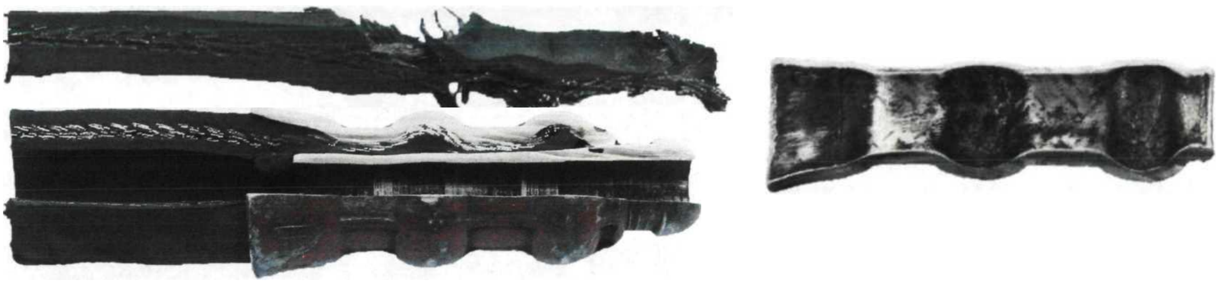

Figure 3. Appearance of cases attached with Rukav and connection fittings

Based on the results of the study of HPR samples, the following conclusions can be drawn. In most cases, the assembly of the fittings is carried out by the force of excessive compression of the coupling, which is a decrease in the diameter cross section of the nipple through hole, as well as crushed traces of the reinforcing wire are observed on the inner surface of the coupling. The existing methods of assembling the connection armature are carried out with an excessive degree of compression of the inner rubber layer of the rukav, which leads to its partial decay and, as a result, to a violation of the quality of compaction. The use of inner ribbed couplings leads to the failure of the reinforcing frame due to linear interaction with layers of intersecting wires, which leads to the cutting of the wires and a decrease in the strength of the inner chamber.

Foydalanilgan adabiyotlar:

1. Н.Г. Гринчар. Методы и срества повышения эксплуатационной надежности гидроприводов дорожных и строительных машин. Дисс. док. т.н. 2007. Стр-29.
2. И.Мажибрада Разработка модели оценки эффективности управления систем технического обслуживания и ремонт одноковшовых карьерных гидравлических экскаваторов. Дисс. кан. т.н. 2018. Стр-34-35.
3. Li Guoping, Zhang Qingwei, Ma Xiao Combination of Fault Tree and Neural Networks in Excavator Diagnosis // TELKOMNIKA, Vol. 11, No. 4, April 2013, pp. 1787~ 1796.
4. Hogan, P. A., Burrows, C. R., Edge, K. A., Atkinson, R. M., Montakhab, M. R., & Woollons, D. J. (1996). Automated fault tree analysis for hydraulic systems. Journal of Dynamic Systems, Measurement and Control: Transactions of the ASME, 118(2), 278-282.
5. Azamatovich A. N. et al. RELIABILITY ANALYSIS OF THE MAIN COMPONENTS OF HYDRAULIC SYSTEMS OF MINING MACHINES //Finland International Scientific Journal of Education, Social Science & Humanities. – 2023. – Т. 11. – №. 4. – С. 2118-2122.
6. Abduazizov N.A., Toshov J.B. Analysis of the influence of the temperature of the operating liquid on the performance of hydraulic excavators // “GORNIY VESTNIK UZBEKISTANA”, 2019, №3 (78) pp. 89-91
7. Азаматович Н. и др. Исследование влияния величины загрязнения рабочей жидкости на надежность горных машин //research and education. – 2022. – Т. 1. – №. 8. – С. 95-103.
8. Абдуазизов Н.А. Разработка методов повышения эффективности карьерных гидрофицированных экскаваторов на основе оптимизации их гидравлических систем Узбекистан // Дисс. док. техн. наук. – Алмалык, 2020. – 200 с.
9. Слесарев Б. В. Обоснование параметров и разработка средств повышения эффективности эксплуатации карьерных гидравлических экскаваторов: автореф. дис. … канд. техн. наук. — М.: Институт горного дела, 2005. — 24 с.
10. Кривенко А. Е., Занг Куок Кхань. Исследование влияния температурного режима рабочей жидкости гидросистемы на эффективность работы карьерного гидравлического экскаватора // Горный журнал. 2020. № 12. С. 78–81.
11. Занг Куок Кхань, Кривенко А. Е., Пудов Е. Ю., Кузин Е. Г. Разработка модели оценки эффективности системы охлаждения рабочей жидкости гидравлического карьерного экскаватора // Горный журнал. 2021. № 12. С. 64–69.
12. Rakhutin M.G., Giang Quoc Khanh, Krivenko A.E., Tran Van Hiep. Evaluation of the influence of the hydraulic fluid temperature on power loss of the mining hydraulic excavator. Journal of Mining Institute.2023. Vol. 261, p. 374-383.
13. Abduazizov N.A., Dzhuraev R.U., Zhuraev A.Sh. Study of the effect of temperature and viscosity of the hydraulic fluid of hydraulic systems on the reliability of mining equipment. Gornyi vestnik Uzbekistana. 2018. N 3 (74), p. 58-60 (in Russian). DOI: 10.13140/RG.2.2.11942.96329.

14. Juraev A. Study of the Effect of Hydraulic Systems Operation on the General Performance of a Hydraulic Excavator. The American Journal of Engineering and Technology. 2021. Vol. 3. Iss. 10, p. 36-42. DOI: 10.37547/tajet/Volume03Issue10-07
15. Raykhanova G. Y., Djuraev R. U., Turdiyev S. A. Development and experimental results of a new construction of the element of protection of the base of the jave part of quarry excavators //The American Journal of Engineering and Technology. – 2022. – T. 4. – №. 04. – C. 58-67.
16. Turdiyev S. A., Djuraev R. U. Experimental results on the effectiveness of an improved excavator bucket tooth design //The American Journal of Engineering and Technology. – 2022. – T. 4. – №. 03. – C. 1-13.
17. Raykhanova G. Y., Djuraev R. U., Turdiyev S. A. Development of a new design of cutting elements for quarry excavator buckets and results of its experimental research //The American Journal of Engineering and Technology. – 2022. – T. 4. – №. 04. – C. 68-78.
18. Turdiyev S. A. Gidravlik yuritmaning tashqi tarmoq tavsifini hisoblashni asoslash //Innovative Development in Educational Activities. – 2023. – T. 2. – №. 5. – C. 327-333.
19. Raykhanova G. Y., Dzhuraev R. U., Turdiyev S. A. Study of the loads on buckets and cutting elements of quarry excavators during digging and cutting //Academic research in educational sciences. – 2022. – T. 3. – №. 4. – C. 1123-1132.
20. Turdiyev S. A., Akhmedov S. T. Fundamentals of external network characteristics of hydraulic system //Educational Research in Universal Sciences. – 2023. – T. 2. – №. 1 SPECIAL. – C. 87-93.