УДК 621.891

EXPERIMENTAL VERIFICATION OF DIAGNOSTIC SIGNS OF THE TECHNICAL STATE OF HST-90, 112 SET ON FORESTRY MACHINES

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ЕКСПЕРИМЕНТАЛЬНА ПЕРЕВІРКА ДІАГНОСТИЧНИХ ОЗНАК ТЕХНІЧНОГО СТАНУ ГСТ-90, 112 ВСТАНОВЛЕНИХ НА ЛІСОГОСПОДАРСЬКІХ МАШИНАХ

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Technical condition of hydrostatic transmissions (HST) affects the productivity of forestry machines and fuel consumption [1]. Technical condition of axial piston pumps (PP-90,112) and motors (MP-90,112), largely determines the performance of machines in general, because affects the speed of their movement. DSTU 2193-93 [2], defines the limit values for the flow rate for the pump and the overall efficiency for the motor, upon reaching which the operation of the hydraulic drive should be terminated. The specified parameters should not decrease by more than 20% from the initial state.

Analysis of literature sources devoted to the problem of reducing the flow rates of hydraulic pumps and efficiency hydraulic motors in operation, makes it possible to assert that the main reason for the termination of the operation of the HST is internal leaks of the working fluid through worn, increased clearances and couplings from the high pressure (discharge) area to the low pressure (suction) area.

In works [3-5] structural and parametric identification of the volumetric hydraulic drive as an object of diagnostics has been performed. The transient process in the pump and motor is described by oscillatory links of the second order. Based on the transfer functions, the differential equations of the transient process are obtained. This paper provides solutions to the differential equations of the transient process for the pump and motor.

On the basis of the carried out mathematical modeling, diagnostic features for pumps PP-90,112 and motors MP-90, 112 were substantiated.

The diagnostic features of the PP-90,112 pumps include [6]: transient time; amplitude of pressure fluctuations; the value of the current pressure in the steady state; the value of the maximum pressure during the transient process; the time when the pressure reaches its maximum; rate of increase in fluid pressure downstream of the pump during load transient (the hydraulic motor is braked and delivers the rated torque).

The diagnostic features of the MP-90,112 motors include [6]: transient time; the amplitude of oscillations of the angular frequency of rotation of the rotor of the motor; the value of the current value of the angular frequency of rotation of the motor rotor at steady state; the value of the maximum angular frequency of rotation of the rotor of the motor during the transient process; the time when the angular frequency of rotation of the rotor of the motor reaches its maximum; the rate of increase in the angular speed of the rotor of the motor during the transient process under load (the hydraulic motor is braked and develops the rated torque).

In work [7] experimental bench tests of HST-90,112 sets taken out of service and received for repair were carried out, as well as those that have undergone major repairs, which showed that the distributions of the values of the pump delivery rates and efficiency motors obey the normal distribution law. The minimum value of HTS sets is set equal to 13, which ensures the reliability and reproducibility of test results.

The purpose of the HST bench tests is to confirm the informativeness of the developed diagnostic method using a microprocessor-based measuring complex with the calculation of the reproducibility of the results according to the Cochran criterion and the relative diagnostic error.

For testing, according to the recommendation of work [7], 13 sets of HST-90 and 13 sets of HST-112 were randomly selected, which were installed on the bench.

Before testing, the pumps and motors were cleaned and washed from external contamination, installed on the bench and started up in the first mode, i.e. no load on the motor shaft. In the absence of a volumetric flow by the pump in the range of rotation of the pump shaft n= 1500 ± 50 rpm the actuation of the pressure valve of the feed pump 1,5 MPa was monitored, as well as the pressure in the control and make-up lines, which with the neutral position of the control lever should be 1,2 – 1,5 MPa. At the same time, the pressure in the pump casing must be within 0,25 MPa, and the pump casing must be sealed.

A positive technological feature of the developed diagnostic method is the absence of depressurization of the hydraulic system during the installation of sensors, and, therefore, the elimination of air ingress into the system, which greatly simplifies the diagnostic process.

After installing the HTS set on the stand, the first test run was carried out without load on the hydraulic motor shaft with a three-fold repetition and an operating time of at least 3 minutes at each turn-on. After the first three runs, the presence of air bubbles in the hydraulic tank was visually assessed. In the presence of air bubbles, measures were taken to remove them from the system. HST tests began in the absence of air bubbles and the temperature of the MGE-46 V hydraulic fluid within 50±5˚C.

Analysis of the diagnostic results, which were carried out at different temperatures of the working fluid, allows us to assert that the minimum error in diagnosing hydraulic pumps and hydraulic motors is typical for tests when the temperature of the working fluid is 30±5°C. This is due to the high viscosity of the liquid at this temperature, and therefore with less internal leaks. This conclusion is confirmed by the decrease values for the pump and for the motor, which are less than the values obtained at a liquid temperature of 50±5°C.

Analysis of similar values obtained at a temperature of 80±5°C talks about the opposite process. Due to a decrease in the viscosity of the working fluid, internal leaks increase significantly, and this also affects the diagnostic accuracy, the relative diagnostic error increases to 5%.

To improve the accuracy of diagnostics, it is necessary to set the boundaries of the temperature change of the working fluid during the measurement of diagnostic parameters with a hydrotester. This value can be a temperature of 50±5°C, which is the average temperature of the fluid in the hydraulic tank during operation. This limitation will be applied when developing a technological process for diagnosing hydraulic drives HST-90, 112 forestry machines.

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UDC 630*26

THE RESTORATION AND RECONSTRUCTION OF VEGETATION IS THE KEY TO ECOLOGICAL BALANCE OF RESERVOIR RIPARIAN ZONE

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ВІДНОВЛЕННЯ ТА РЕКОНСТРУКЦІЯ РОСЛИННОСТІ – КЛЮЧ ДО ЕКОЛОГІЧНОГО БАЛАНСУ ПРИБЕРЕЖНОЇ ЗОНИ ВОДОЙМИ

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Reservoir riparian zone is one of the most important wetland systems by artificial control, the biodiversity was mainly affected by reservoir discharge water rhythm, has obvious periodicity. Therefore, it is of positive significance to understand the regulation of retrograde succession of vegetation and to select suitably and stress-resistant species to improve the species coverage and abundance and biodiversity in the reservoir riparian zone.

Hoag, et al. (2001) [1] divided the riparian zone into five sections according to the relationship between vegetation and moisture, Toe Zone, Bank Zone, Overbank Zone, Transitional Zone, and Upland Zone. In a riparian ecosystem, not all of these 5 sections will occur, but several wills. Correspondingly, the vegetation distributed on different sections also showed different characteristics, and the gradient distribution trend of trees, shrubs, amphibians, and emergent plants were also shown from land to water (Li S. Z., et al., 2019) [2].

Hydrological condition is the core factor for the formation, change, and succession of the riparian zone. Lakes act on the riparian zone through water impingements and other physical effects, creating different habitats of the riparian zone. The propagules of different plants spread with the movement of hydrology and the fragmented riparian zone habitats formed different plant community structures and pioneer species. Similarly, the distribution of plant community after formation will act on the physical and chemical processes of hydrology in turn (Gurnell A.M., et al. 2012 [3]; Nilsson C., et al., 2012 [4]).

The relationship between plant community and hydrology and geomorphology is still the focus of many scholars. David M. Merritt et al. (2010) [5] achieved good results in predicting the occurrence and development of riparian zones by establishing the response relationship between river flow and plant communities in different riparian zones. However, this method has limitations and its scope of application are very limited. Su X. L. et al. (2020) [6] compared the characteristics of plant communities in the natural flooded area and the non-natural flooded area in the Three Gorges Reservoir, and found that the plants in the non-natural flooded area showed strong ecological resilience.

Jian Z. et al. (2018) [7] systematically observed the variation trend of plant species in the Three Gorges Reservoir ravines riparian zone from 2008 to 2015, and the results showed that the composition of plant species in the reservoir riparian zone was affected by the new hydrological environment, and determined that *Bermudagrass* or its community the combination were the most suitable species for survival.

The vegetation in the riparian zone plays an important buffer role in the whole ecosystem and is a crucial link in the ecosystem cycle. Many scholars believe that as long as the vegetation coverage and biomass of the riparian zone are improved, better ecological benefits can be achieved, and this is the most effective way to repair the riparian zone (Zhang Y. X., 2017) [8]. Scholars have done a lot of research on the selection of suitable plants in the riparian zone in order to screen out the optimum plants with strong resistance to stress.