METHODS OF SAVING ELECTRICAL ENERGY IN PUMPING SYSTEMS OF HYDRAULIC STRUCTURES

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Annotation: *The article presents a solution to energy and resource savings issues, taking into account the main factors that directly affect the normal operating mode of the pumping device(minimizing the local and longitudinal hydraulic resistance values in the pipe system and determining the corresponding flow average speed value).*

Keywords: *Pump, aggregates, electric enirgia,napor, water consumption, speed and acceleration.*

Annotatsiya: *Maqolada nasos qurilmasi normal ish rejimiga bevosita ta’sir ko‘rsatadigan asosiy omillar(quvurlar tizimida mahalliy va uzunlik bo‘yicha gidravlik qarshilik qiymatlarini minimumga yetkazish va unga mos oqim o‘rtacha tezligi qiymatini aniqlash)ni hisobga olib energiya va resurs tejamkorlik masalalari yechimi keltirilgan.*

Kalit so’zlar: *Nasos, agregatlar, elektr enirgiya, napor,suv sarfi, tezlik va tezlanish.*

The efficient use of electrical energy in pumping systems of hydraulic structures is considered one of the most important issues in modern water management. The growth of the population, the expansion of irrigated lands, and the increasing demand for water supply have significantly raised the amount of electricity consumed by pumping stations. In some regions, 30–60 percent of the operating costs of hydraulic facilities are attributed to the energy consumption of pump units, which further emphasizes the economic and technical significance of this problem.

Pumping units often operate outside their optimal working conditions due to variable water discharge, fluctuating head requirements, and seasonal demand changes. As a result, excessive energy consumption, hydraulic losses, pump wear, and a decline in overall efficiency are observed. In particular, outdated pumps, improperly selected motors, non-automated control systems, and poor maintenance practices further reduce energy efficiency. Therefore, improving the energy performance of pumping equipment has become not only a technical necessity but also a crucial task related to economic stability and environmental safety.

Overall, improving the energy efficiency of pumping equipment in hydraulic structures is one of the key factors in ensuring sustainable management within the water sector. The comprehensive implementation of technical and organizational measures not only reduces electrical energy consumption but also significantly enhances the reliability, service life, and overall operational performance of pump units. This article analyzes the main methods and technologies applied to save electrical energy in pumping systems, as well as their effectiveness.

Pumps are widely used in water, rural and oil farms, water supply and other industries Organization of the meiori mode of operation of pumps, increasing productivity and saving electricity consumed is an urgent issue. This work is devoted to the solution of this issue.

Pumps push fluid through the push pipe and deliver it through the drive (pressure) pipe to an area (facility) located at a certain distance and balance. When doing this, part of the pumping capacity will be spent on overcoming hydraulic and local resistance along the length of the pipes. The pump capacity is proportional to its napori and is defined as follows.

$$N_H = \frac{9,81 Q_H H_H}{\eta_H}, кВт \qquad (1)$$

here Q_H -

pump work productivity m^3/s; nH pump F.I.K- H_H pump is napori equivalent to below.

$$H_H = H_Г + h_{йўк}, \text{ м} \qquad (2)$$

H is the geometric rising height of water, m

at the expense of hydraulic and local resistance in the pipe system, the vanishing part of the pump napor, m; (2) the formula is calculated by the following formula

$$h_{йўк} = \left(\sum \lambda_i \frac{l_i}{d_i} + \sum \zeta \right) \frac{v_i^2}{2g}, \text{ м} \qquad (3)$$

$$\sum \lambda_i \frac{l_i}{d_i} + \sum \zeta \to \min$$

where i (i=1,2,3,…N) -is the diameter of the pipes, the length, and, correspondingly, the mean velocity of the fluid; $\sum \lambda, \sum \zeta$ is the sum of the hydraulic and local resistance coefficients. (3) if the value of the sum in the formula reaches a minimum, that is, if the condition is met, the Nhmigor in the Formula (1) decreases and the electricity that will be spent on the pump will be saved. To achieve this goal in this work, it is recommended to do the following:

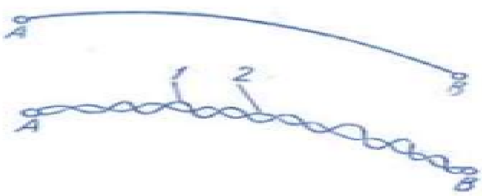

Figure 1. Features of Turbulent movement

1. When designing and building a Naporli pipe system, it is necessary to choose their optimal construction, that is, to achieve as little as possible the number of sharp turns, expansions, narrows, etc. on the vertical and gorizantal plane in long sections;

2. when calculating" λ", it is necessary to determine exactly which hydraulic resistance zone the fluid flow belongs to, and apply the formula for calculating " λ " for that zone;

3. Development of measures to reduce the values of the Ghadir-Budur coefficients of pipes (the use of modern chemical methods) and prevent their increase during the period of exploitation.

4.It is necessary to determine such values of the flow rate of the fluid in equipment (screws, reverse valves, etc.), where the fluid flow is deformable and forms local resistances, so that the values of the local resistance coefficient in them reach a minimum ($\sum \zeta \rightarrow$min) ;

$\sum \zeta \rightarrow$ to achieve min, the flow rate of fluid from the local resistor must satisfy such a condition:

$$v = \sqrt{\frac{2(P_1 + P_{TCБ})}{\rho \cdot \sqrt{\zeta_{\min}} \cdot \left(2 + \sqrt{\zeta_{\min}}\right)}} \; ;$$

where P_1 is the fluid flow pressure of a given cross-section;

$P_{тсб}$ - saturated liquid vapor pressure;

$\zeta_{\min}$ - the minimum value of the local resistance coefficient is.

6.In order to transfer the required amount of fluid by the length of the pipe, the choice of the optimal diameter of the pipe and the optimal speed of the fluid, resulting in the minimum of the value "λ" ($\lambda \rightarrow$ min), etc.

Conclusion

The use of the above recommendations in the design and construction of pipe structures consisting of a pipe system and operating under pressure will pay off. In addition, the performance of pumps and F.I.K. helps to increase and economy the electricity that will be spent.

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