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Economic Indicators of Recommendations for Increasing the Efficiency of Pumping Stations

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ANNOTATION

The article deals with the problems of increasing pumping units operation efficiency at the expense of reducing the rate of wear parts of centrifugal and axial pumps by structural changes of individual units, by improveding the hydraulic characteristics of water inlet structures and organization of water supply accounting.

KEY WORDS: *pumping aggregate, serve of pump, pressure, output-input ratio, chempump, axial pump, impellers, stuffing-box, opening, wear, directing wall, economic efficiency, vacuum-gauge, manometer.*

Introduction

There are 1621 pumping stations under the Ministry of Agriculture and water resources of the Republic, which transfer water to 53 of the lands used in agriculture. In addition to these, 7612 vertical well pumping units are supplied, as well as over 8,000 small internal pumping stations and installations in a quarter of the agricultural land where water consumer associations and farms operate.

In agriculture the average consumption per year is 11.0 billion.kW.more than 8.2 billion of electricity per hour.kW.the clock is equal to the total energy consumption of pumping stations, which is 20% of the electricity produced in the Republic. 75% of the funds allocated for the exploitation of the water resources complex per year, that is, 586.4 billion. the sum is spent on the operation of state pumping stations. Therefore, our country occupies one of the leading places in the world in terms of machine irrigation [1,2].

Calculations have shown that the useful working coefficient (UWC) of pumping stations in irrigation systems decreased by 1% to 4.5...5 billion per year. The sum causes excessive spending. Currently, due to the fact that the resource of the operation of the units installed in the pumping stations in the irrigation system has passed the regulatory level, they are used with performance indicators of the (UWC), which have decreased to 8...20 percent. This in turn causes the costs of using pumping stations to be exceeded.

This article describes the economic efficiency of hydraulic processes of water-conducting structures requiring scientifically based solutions, hydromechanical processes of the internal components of pumps and solutions of some problems associated with the lack of control over the transfer of water to pumping units.

The activities to be carried out should be aimed at reducing the cost of the main technical and economic indicator of the pumping station - the transmitted water. It is necessary that the entire set of measures applied by the above processes ensure an improvement in the energetic performance of the

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pump unit, that is a high level of fixation. Because the UWC of the pump is a universal dimensionless indicator connecting three main sizes (water transfer, pressure and power), which determines the efficiency of its operation.

The experience of using multi-year pumping stations shows that many of them are working on a water transmission much lower than the project performance.

The working efficiency of the pumps is determined by the degree of permissible limit bending of their working details. The main factors that determine the repair and restoration work of centrifugal and axial pumps are the degree to which their working wheel is mowed by the compaction part and the forming details of the side slit. Because with the expansion of the structural slits of the working wheels, the amount of fluid re-leakage from them increases proportionally. This leads to a decrease in the energy performance of the pumps (water transfer Q and pressure N) and an increase in the costs of their use.

The results of studies on the protection of the centrifugal pump working wheel compaction part in the proposed method are shown that when purified water is transferred to the compartment between the impellers and the compaction ring in the hydrocyclone, the expansion of the compaction slit is sharply reduced i.e. 1.5...Provides 2 times less eating [1,2,3,6].

Experimental section

If the expansion of the compaction slit for 3.5 months of use in a pump of a typical structure is equal to 3.15 mm, the compaction slit according to the proposed scheme is 1.95 mm. In doing so, it was considered cost-effective to carry out the repair of the pump details after 3 months of use. When using this construction in a single centrifugal pump of the 200D – 90 model, it is estimated that 3 million units per year. The sum provides an opportunity to obtain an economic effect.

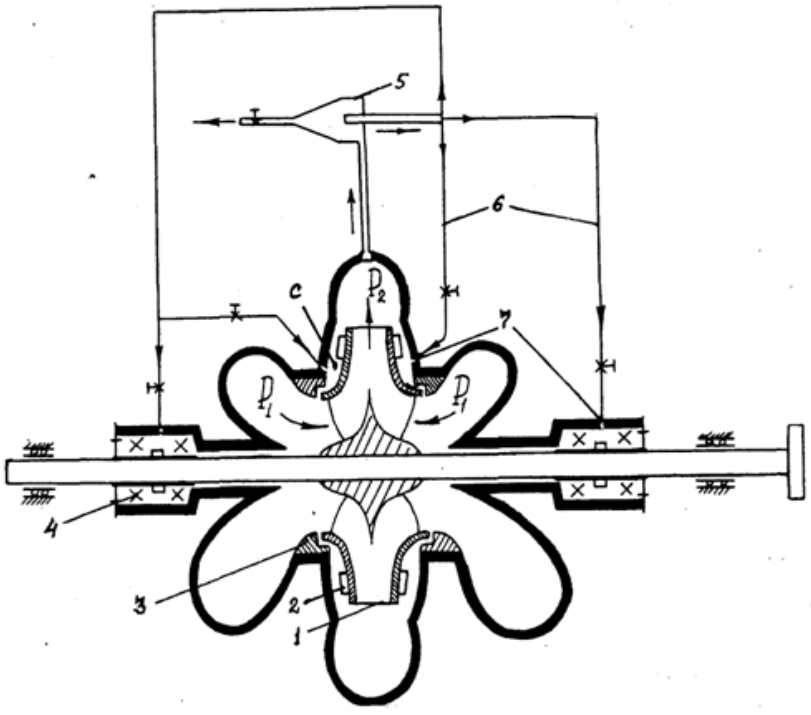

Figure 1. Scheme of the method of protection of the elements of the working wheel of the pump "D" from the center in cavitation-abrasive mowing: 1 - working wheel, 2-impellers, 3-grinding ring, 4-salnik, 5-hydrocyclone, 6-quenched water transfer pipelines, 7-studs.

In addition, with the transmission of the pump to the salniks from purified water in the hydrocyclone, the reduction of the intake of the protective sheath and the salnik stopper and their service life is

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3.5...There was an increase of 4 times. This in turn facilitates the cocktail of the attendant staff and reduces the stopping times of the pumping units during the growing season [1,5].

The main reason for the decrease in the working efficiency of axle pumps is the rapid expansion of the side slit between the working wheel compartment and the shovels. Therefore, on the basis of experiments with the aim of reducing the cavitation – abrasive mowing of the details of the axial pump working wheel side slit, its perfect construction was proposed – a scheme with a carved partition and wings installed on the side of the front part of the working wheel shovels.

Positive results were also achieved when this structural scheme form was tested on the SNP – 500/10 working wheel diameter 500 mm axial pump device used in production conditions, that is, at the end of the irrigation season (in September), the width of the side slit of the working wheel of the pumps is usually 1.1 compared to the pump in..1.4 mm less and water transmission 45...It was found to be 46% higher.

In conclusion, it can be said that the axial pump slit elements in the structure, in which the wings are installed on the side of the pressure part of the carved compartment and working wheel springs, provide a reduction in the intake and provide an opportunity to obtain an economic effect of 621 thousand rubles per pump unit with a working wheel diameter of

The practice of using pumping stations shows that the ability of pumps to transfer water is reduced due to the fact that small particles of sand and silt contained in the irrigation water sink in the water intake structure. Increased hydraulic resistance and reduced water transfer caused by air suction of pump units due to muddy subsidence in the water intake units and water intake of pumping stations lead to an increase in electrical energy consumption, as well as to the fact that due to vibration, excessive costs for repairing pumps and cleaning structures from mud increase the cost of water several times.

Based on the analysis of the spectra of speeds in different cases, it was recommended to apply a flow-directional walled compartment constriction, in which the suction pipe of the pump rises from the bottom to the suction pipe for a vertically located water intake compartment and is installed at an angle to the horizontal axis of the compartment at a distance

When the proposed technical device is applied:

- increased level of impact of the inlet hole the reduction of hydraulic resistances due to the washing of small sand and muddy particles that precipitate in the bottom layer of the stream and changing the angle of entry into the flow suction pipe allows pump units to increase water transfer by 8.3% and the UWC by 5.2%.
- the suction pipe has a minimum water level immersion depth of the pipe mouth to be formed from a layer of still (“dead”) water around the inlet part 25...It reduces construction costs due to being 30% less and prevents the formation of UAV air funnels.
- five-unit irrigation system equipped with centrifugal pumps of D4000-95 ($22HD_c$) installed in the water intake units with a flow guide Wall annual cost efficiency of 18.4 million for the pumping station. Will make up the sum.

In the current market economy, one of the problems of particular importance was considered to take into account the amount of water transfer of pump units in machine-driven water transmission irrigation systems, since the cost of water transferred every 1 meter of cubic is currently an average of 15...It is 60 sum.

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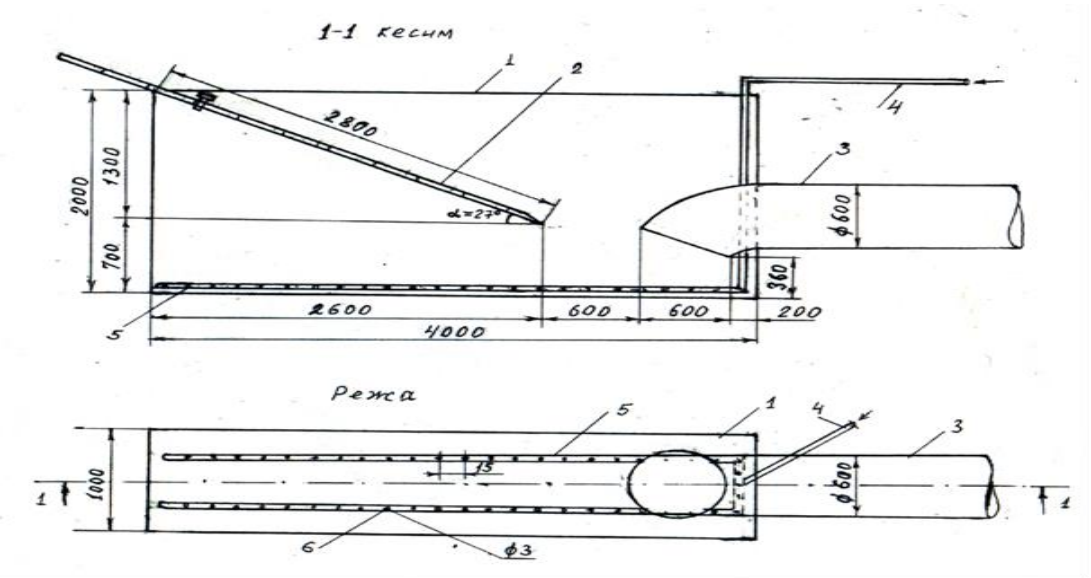

Figure 2. Dimensions of the water intake compartment with a flow guide wall: 1 - water intake compartment, 2 – flow diverter wall; 3 – suction pipe of the pump; 4 – water transfer pipe for sediment washing; 5 - sediment washing pipe; 6 – flushing water outlet openings.

At most pumping stations, the transfer of water to the pumps is taken in accordance with its values in the description given by the plant, which in turn leads to major errors.

Water transfer of pumping units in the practice of using pumping stations 15 during the season of crop irrigation...It was found to decrease by 30% [1,3,4,6,7,8]. This situation sharply affects the decrease in the yield of agricultural crops. The fact that the water consumption of a large number of pumping stations in the irrigation systems of our republic is a very low percentage of the supply of measuring instruments does not give an opportunity to solve the problem of obtaining water accounting. For example, 41 of the 512 units installed in pumping stations built in the Andijan region until 1990 were equipped with ultrasonic water consumption meters of type *UZR-V* and 9 with induction (electromagnetic) water consumption measuring instruments of type IR-56. But none of them are currently in a working condition.

Based on the analysis, a new method of calculating the water transfer of electrified pump units based on the theory of energy balance of hydraulic machines was proposed [2].

Finding out the water transfer of the pump unit in this proposed method is reliable, simple, affordable and does not require complex tools and highly qualified service. The pump uses an ammeter, voltmeter, manovakuummet and manometer in use at the stations, allowing the water transfer of the pump unit to be found with sufficient level accuracy. The feasibility of this method from other methods is that costs for water measuring devices and instruments, their repair will not be spent, the staff of the service worker will be reduced and the measurement accuracy will be higher.

The simplified calculation method for determining the water transfer of pumping units is 2 million rubles when a five-aggregate pump is applied to the station. The sum is taken for an annual economic effect.

Based on the calculations, the working wheel of Type D pump has a protective design of the compaction part when the 5-unit pump is applied at the station, the cost of 3 million. It has been established that the sum can have an annual economic effect. The proposed construction of the working wheel and compartment of the axial pump applied five-aggregate pump the annual cost efficiency of the station is 2.5 million, will make up the sum.

The newly recommended design of the five-unit Station water intake units with centrifugal D4000-95

pumps is 18.5 million, the sum gives an economic effect.

The annual economic effect that is obtained when all the activities recommended for each of the five-aggregate pumping stations equipped with centrifugal and axial pumps are applied is 47 million, when the price change coefficient after 2005 is calculated by multiplying by 1.8. sum and when the pump is applied to the pumping stations of the Republic scale, it is several billion, will make up the sum.

Conclusions

The annual economic effect that is obtained when all the activities recommended for each of the five-aggregate pumping stations equipped with centrifugal and axial pumps are applied is 47 million, when the price change coefficient after 2005 is calculated by multiplying by 1.8 sum and when the pump is applied to the pumping stations of the Republic scale, it is several billion, will make up the sum and this is a new recommended design of the water intake units of the five-unit station, where centrifugal D4000-95 pumps are installed, costs 18.5 million, the sum gives an economic effec

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