IMPROVING THE EFFICIENCY OF HYDROPOWER DEVICES

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Abstract: Currently, the world is paying special attention to the efficiency of pumping stations. One of the most urgent problems is reducing the electricity consumption of pumping devices.

Key words: pump device, pump operation, pipelines.

According to the International Agency for Renewable Energy, 56% of the world's irrigated land is pumped, and in this regard, developing countries in Africa, India, the Middle East and other regions are the most efficient for solar pumping. and recognized as one of the environmentally "clean" sources [1].

60% of irrigated land areas in the Republic of Uzbekistan are supplied with water using pumping stations, and 8 bln. kWh of electricity is consumed [2]. In the conditions of such a large amount of energy consumption, it is one of the important tasks to carry out large-scale scientific and research activities aimed at increasing the efficiency of pumping stations, achieving energy efficiency of equipment, and reducing operating costs.Hozirgi kunda foydalanib kelinayotgan nasos stansiyalari tahlil qilinganda quyidagi kamchiliklar bilan foydalanilayatgani aniqlandi:

the pumping station is not equipped with grates that catch the leaks in the incoming water;

- in order to ensure the necessary water level in the lower river, a blocking structure (water level adjustment) was not built at the source;

- despite the fact that the suction pipes of the pumps are installed with siphons, because it has not been used in starting and operating the pumps, the pumps are being used with continuous cavitation;

In order to eliminate these shortcomings, a number of measures are being implemented by the government of our republic. For example, in the Decision of the President of the Republic of Uzbekistan No. PF-6024 dated July 10, 2020, along with "...increasing the energy efficiency of water management pumping stations and reducing operating costs...", they also state, "...alternative energy resources, including the use of solar batteries... [2].

In particular, the shortcomings identified in the pumping station are mainly due to the lack of the above-mentioned facilities. Because the lack of fences that catch the waste in the water increases the possibility of various wastes flowing with the water (plants and roots, empty polyethylene bottles from drinking water, etc.) entering the pumps. We all know the negative consequences of various fluids entering the pump...

To eliminate this shortcoming, the pumping station should be equipped with drain traps and they should be cleaned on time.

In order to ensure the necessary water level in the lower part, the barrier structure is not built at the source, the water level drops below the target minimum level, the suction height of the pumps increases and the part of the suction pipe buried in the water is reduced. As a result, air enters the pump and causes cavitation.

In order to eliminate this shortcoming, it is necessary to build a structure that adjusts the water level to the source.

The suction pipes of pumps of pumping stations are designed with siphon pipes to make it easier to start the pumps and to prevent cavitation. However, the ejectors intended for installation on the upper part of the siphon are not installed. For this reason, today the pumping station is used without completely expelling the air accumulated in the upper part of the siphon. That is, the hole above the siphon is manually closed as much as possible with the remaining water between the pump and the siphon, and the pump is started. In this case, when the water stored in the suction pipe is transferred to the discharge pipe with the help of a pump, the siphon part of the suction pipe does not work completely due to the created vacuum pressure, and it passes a certain amount of consumption. The narrowing of the surface of the flow section causes an increase in speed and pressure loss. If the pumping station was completed and put into operation as envisaged in the project, the pumping station would be used in an efficient mode. Because, when the system is used correctly, it is not only easy to start the pumps. Perhaps, with the help of a suction pipe with a siphon equipped with an ejector, it is possible to continuously remove the air that entered the suction tract even when the pumps are working.

In order to eliminate this shortcoming, we recommend using the following scheme (Fig. 1) for the pumping station. According to this scheme, for the first start of centrifugal pumps with a positive suction head, the part of the suction pipe from the pump to the siphon and the pump are filled with water. Water filling is not required for subsequent launches. The reason is that when the pump is stopped, due to the raised siphon part of the suction line, sufficient water is kept in the suction line and the pumps for starting. To start such pumping stations, it is checked whether the valve in the pressure pipeline is tightly closed. The centrifugal pump is started when the valve is closed.

The following process occurs after the pump unit is started. The pump-5, which has created a large pressure, drives the water towards the pressure pipe-1. The water hitting the closed valve-2 moves under high pressure towards the plug installed in the upper part of the pump. The water moving out of the plug at a high speed (because the diameter of the pipe is 15-20 times smaller than the diameter of the suction pipe) is transferred to the ejector-9. The water entering the ejector begins to turn into a water-

air mixture at a high speed through the jacks (the slit in it is several times smaller than the diameter of a small pipe). The water-air mixture coming out of the jet at a high speed begins to take the air rising from the suction pipe-8 with it. As a result, the air in the suction pipe becomes rarefied, and with the help of the atmospheric pressure pressing on the surface of the water, the water begins to gradually rise up. First of all, water-air mixed mass begins to flow from the water filling system. After a certain time (1.5-2.0 minutes), water without air mixture comes out of the pipe, indicating that the pump and suction pipe are full of water. After that, the indicator of the manometer installed in the pressure pipe is controlled. If the indicator of the manometer remains unchanged, the valve installed in the pressure pipe of the pump is fully opened.

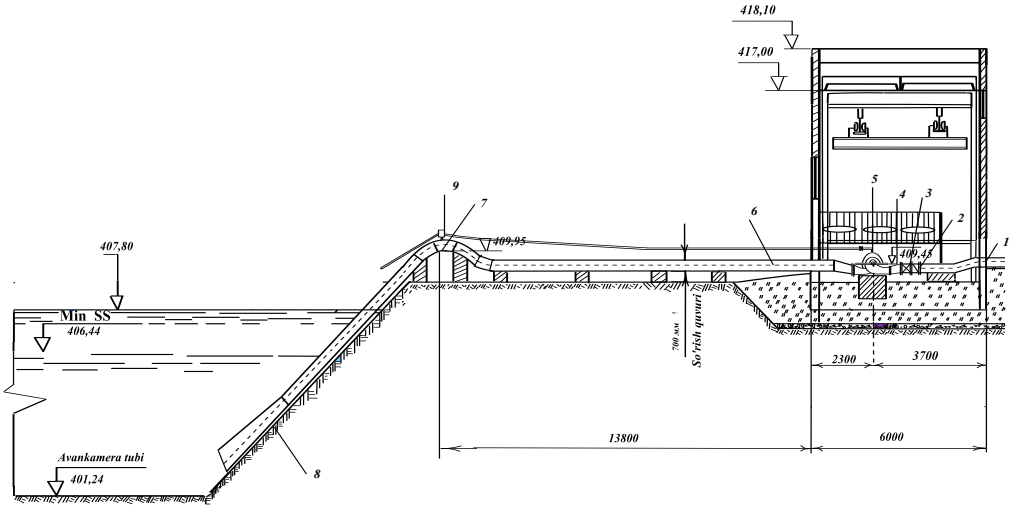

Figure 1. Filling the pumping unit with water using a flow pump.

a-pump device; 1 pressure pipe; 2-wheel drive; 3-reverse valve; 4-assembly link; 5th pump; 6-suction pipe; 7th turning elbow; Entrance to the 8th intake pipe; 9-flow pump-ejector.

When a pumping station is used with this device, it becomes easier to start the pumps, there is no air left in the siphon part of the suction pipe, and it starts to pass water in full section. If the ejector is activated when the water level drops and the pump cavitates, the air continuously entering the suction pipe will be sucked by the device to eliminate the cavitation in the pump.

In addition, in order to prevent cavitation in the pumping station, it is advisable to install level sensors at the minimum and maximum levels of the lower level. Because, with the help of these sensors, taking into account the change in levels, the consumption of pumps is adjusted or the number of working pumps is reduced and cavitation is eliminated in them. When the water level in the lower reservoir reaches the maximum level, the number of pumps in use can be increased.

If the recommendations for the use of pumping stations are followed, it is ensured

that the pumps are used in a highly efficient mode and a reduction in annual operating costs is achieved.

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