ABRAZIBLE DISTRIBUTION OF TWO DIRECTION D-PUMP DRIVES FROM THE CENTER AND THE METHOD OF REDUCING THEM

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Abstract:*In this paper, these muds, which pass through two-way water intake type "D" pumps, which make up the largest part of the pumping stations and devices that lift water for agriculture, cause their internal parts to have a strong abrasive abrasion.*

Key words: *C entrifugal pumps, pump stations, pump impeller, abrasive abrasion.*

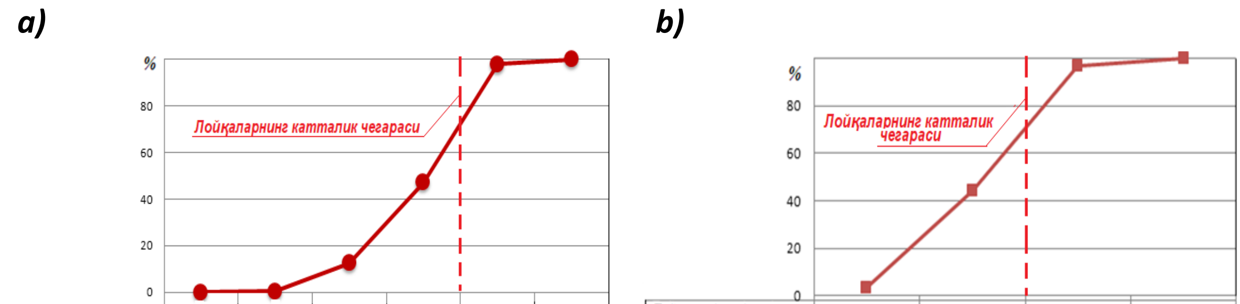
The waters of the main water sources passing through the territory of the country (Amudarya, Syrdarya, Zarafshan) bring with them a large amount of water, which is suspended and slides on the bottom of the river [1,2,3,4,5,6]. These sludges, which pass through the two-way water intake type D pumps, which make up the largest part of the pumping stations and equipment that carry water for agriculture, cause strong abrasive erosion of their internal parts [1,3,4] (Fig. 1).

a) *b)* *c)*

Figure 1. Working wheels of abrasive pumps:the condition of the impeller of a drone operating at the Chinoz post of a-Syrdarya; b, c-Surkhandarya "Pumping stations and power" department Pumps of abrasive pumps at pumping stations.

As a result, the characteristics of the pumps change, ie water consumption-Q, pressure-N, efficiency- η and repair time are reduced. Figure 2 shows the granular composition of the sludge from the water intake of the Amudarya pumping station and from the amulet of the 8th unit of the pumping station "Amu-Zang-2" [3]. According to the rules for the operation of two-way water intake pumps, only 0.1% of the mud with a size of 0.1 mm must pass through these pumps. As can be seen from Figure 2: the amount of mud in the Amudarya that cannot pass through the pump is 47.2% (Figure 2a); in the pump station unit -47.32% [5] (Fig. 2b).

It can be seen that the size and amount of abrasive sludge in all water sources flowing through the territory of the country is several times larger than the size and amount of sludge that can pass through the pumps. This means that parts of different types of pumps in all pumping stations and devices installed throughout the country are subject to abrasive abrasion [5].



Лойқалардаги доналар миқдори, %	0	0,52	12,0	34,68	47,73	5,07
Лойқаларнинг донадорлик таркиби, мм	0	1,0 - 0,50	0,50 - 0,25	0,25 - 0,10	0,10 - 0,05	0,05 - 0,01

Лойқалардаги доналар миқдори, %	3,12	44,2	97,18	100
Лойқаларнинг донадорлик таркиби, мм	0,50 - 0,25	0,25 - 0,10	0,10 - 0,05	0,05 - 0,01

Figure 2. The composition of sludge from the Amudarya and pumping stations:a-mud from the Amudarya and; b- The granular composition of the mud from the 8th unit of the pumping station "Amu Zang-2".

As a result of the analysis of the limit sizes of mud in rivers and the possible size and amount of mud in the operation of pumps and water temperature, the size and amount of mud mixed with water in the main water sources passing through the territory of the country type pumps do not correspond to the size and amount of possible turbidity, ie they are much larger than the size and amount of turbidity that can pass through the pump (d = 0.1 ÷ 0.2 mm, P% = 0.1 ÷ 0.5): In the Amudarya, the amount of mud larger than 0.1 ÷ 2.0 mm - 10.0 ÷ 93.5%, the amount of mud between 0.1 ÷ 0.001 mm - 6.5 ÷ 9.9%; In Syrdarya, the amount of muds larger than 0.1 ÷ 2.0 mm - 3.4 ÷ 93.4%, the amount of mud between 0.1 ÷ 0.001 mm - 6.6 ÷ 96.6%; In the Zarafshan river, the amount of muds larger than 0.1 ÷ 2.0 mm - 0.7 ÷ 60.0%, the amount of mud between 0.1 ÷ 0.001 mm - 40.0 ÷ 99.3% [5].

Abrasive abrasion of pumps can be reduced in the following ways:

- installation of dampers in the channels leading to the water to the pumping stations, trapping muds of a size that can not pass through the pumps;

-preparation of the pump and its parts from abrasive abrasion-resistant materials;

-development of various abrasion-resistant materials on the basis of nanotechnology and manufacture of the pump and its parts;

- Modifications to the design of the pump and its parts, etc.

Testing of methods and constructions developed against abrasive abrasion is carried out by field and laboratory tests.

Field tests to study the abrasive wear of the pumps at the pumping station were carried out at the Yangier pumping station in Namangan district, which is managed by the Namangan Pumping Stations and Energy Department. The pump station is equipped with pumps type D 1D1600-90. Pumps of this brand are produced in two different revolutions (n_1 = 980 and n_2 = 1450 rpm) and with three different diameter wheels. The main parameters of the pumps are given in Table 1, and the operating characteristics are shown in Figure 3.

Basic parameters of 1D1600-90 brand pumps.

Brand of the pump	Q, m^3/hour	$H_{ум.}$,	n,rot./min	η, coef. of perform.	n, rot/min	N, kWxhour	$D_{иш\ ғил.}$, mm	$\Delta h_{м.б.}$, mm	G, kg
Д1600-90	1000	40,0	980	85	980	140	540	5,0	1165
Д1600-90	1584	56,0	1450	89	1450	480	540	7,1	1165

This pumping station should be able to lift 445 (1000 m^3 / h) liters of water to a height of 56 m. As you can see in Figure 3, this type of pump with a number of revolutions of n_1 = 980 rpm cannot meet the demand.

The required height and water consumption can be provided only by the pump type 1D1600-90 with the number of revolutions n_1 = 1450 rpm. However, the required impeller of the pump 1D1600-90 selected for the pump station was not selected, i.e. the impeller diameter D = 540 mm was selected.

A pump with a impeller diameter D = 540 mm lifts 445 liters of water to N = 90 m (Fig. 3b). Once the impeller pumps of this diameter have been installed, this can be done by closing the valves mounted on the pressure pipe of the pump units to obtain the required water consumption. Closure of more than 10% of the installed pressure in the pressure pipe leads to the following negative consequences:

- as a result of stressful operation of the pump unit, its electric motor and low-temperature melting parts may be deformed;

-sludge in the water passing through the pump and its parts under high pressure can erode them very quickly;

- The pump unit must be operated under constant supervision so that the negative consequences do not lead to a major accident.

A 1D1600-90 pump with a impeller diameter D = 458 mm had to be selected to bring the required water consumption to the specified height.

In order for the Yangi Er pump station to be able to carry 445 liters of water to a height of 56 m, the pumps must be driven to the outer diameter of the impeller. We use similarity formulas to determine the height and water consumption that the pump station must carry and the magnitude of the burst. We write these formulas for the following case: two geometrically similar, similar formulas for pumps with equal number of revolutions but equal diameters of the impellers ($n^{асл} = n^{нус}$; $D_2^{асл} \neq D_2^{нус}$).

Similarity formula for water consumption – $\frac{Q^{асл}}{Q^{нус}} = \left(\frac{Д_2^{асл}}{Д_2^{нус}}\right)^3$

(1)

Similarity formula for pressure – $\frac{H^{асл}}{H^{нус}} = \left(\frac{Д_2^{асл}}{Д_2^{нус}}\right)^2$ (2)

Similarity formula for power – $\frac{N^{асл}}{N^{нус}} = \left(\frac{Д_2^{асл}}{Д_2^{нус}}\right)^5$ (3)

similarity formula for efficiency – $\eta^{асл} = \eta^{нус}$ (4)

Using these formulas, it is possible to calculate the required water consumption, water lift height, and the corresponding power and efficiency coefficients.

We also use similarity formulas to calculate the water consumption and water lift height by turning the impeller of the pump. When the diameter of the impeller of the pump is cut, all its characteristics change (decrease), ie:

$H_B > H_A > H_C$; $Q_B > Q_A > Q_C$; $\eta_B > \eta_A > \eta_C$;

When recalculating the characteristics of the pump to the diameter of the new impeller, we use the similarity formulas (1) and (2).

Once the impeller is cut, all the operating characteristics of the pump will change. Figure 4 shows a graph of the diameter of the impeller cut at different percentages and the change in its characteristics.

We find the shear dimensions of the impeller by the following formulas:

$\frac{Д_A^{кес}}{Д_B^{бер}} = \frac{Q_A^{кес}}{Q_B^{бер}}$ бундан, $Д_A^{кес} = Д_B^{бер}\frac{Q_A^{кес}}{Q_B^{бер}}$; (5)

$\frac{Д_A^{кес}}{Д_B^{бер}} = \sqrt{\frac{H_A^{кес}}{H_B^{бер}}}$ бундан $Д_A^{кес} = Д_B^{бер}\sqrt{\frac{H_A^{кес}}{H_B^{бер}}}$. (6)

Shear size of impeller diameter:

$\Delta Д = Д_B^{бер} - Д_A^{кес}$. (7)

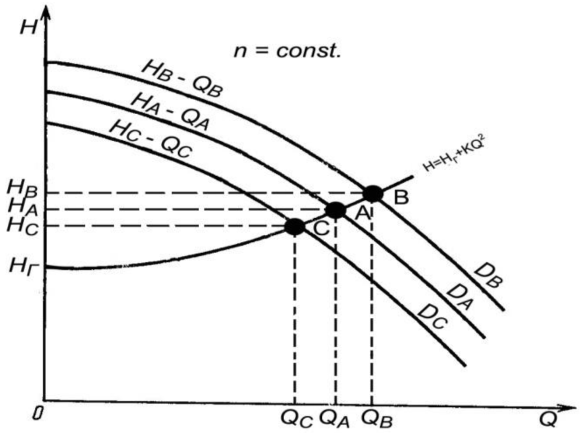


Figure 4 Graph to determine the calculated water consumption and water lift height by cutting the diameter of the impeller.

Permissible cut size:

$$\Delta Д\ \% = \frac{Д_В^{бер} - Д_А^{кес}}{Д_А^{кес}} \cdot 100\%$$ found. (8)

Figure 5 shows the cutting diagram of the impeller, the given diameter $D_B^{бер}$, the cut diameter $D_A^{кес}$ and the cut size $_\Delta D$.

Once the allowable cut size (9) is determined by formula, the impeller is placed on the machine. The cut size is determined on the impeller and the impeller is reduced based on this notation.

Figure 3a, b shows the characteristics of impellers of different diameters with a constant number of revolutions of the pump 1D1600-90.

Thus, in pumps whose water consumption and water lift balance are greater than the calculated water consumption and water lift balance, their impeller is cut so that the abrasive erosion is not high and there is no water and energy loss..

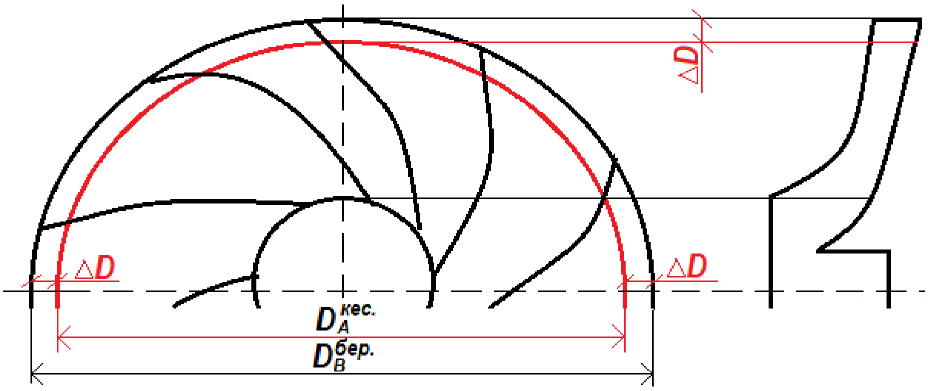


Figure 5 Pump impeller cutting scheme.

CONCLUSIONS:

1. The amount and size of mud in all water sources in the country is several tens of times greater than the amount and size of mud that can pass through the pump.

2. Pumps at all pumping stations installed on water sources have abrasive abrasion.

3. The amount of abrasive abrasion in pumps with overpressure and water consumption is higher than that of pumps operated at rated pressure and water consumption.

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