CAUSES OF UNSTABLE HYDRAULIC PROCESSES IN PUMPING STATION PRESSURE PIPES

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INTRODUCTION

The strategy is intended to implement the tasks in the priority directions and achieve the main targets and indicators set in the concept of water management development for 2020-2030.

The strategy includes a number of infrastructural, political, institutional and capacity development measures covering the sustainable management of the country's water resources and the improvement of the irrigation sector, as well as programs and comprehensive measures aimed at the development of the country's water resources management and irrigation sector in 2021-2023 .

More than 55 percent of the land used for agriculture in our republic is irrigated with the help of more than 1,690 pumping stations. Since the main and auxiliary equipment installed in pumping stations have been used for 35-40 years despite the exhaustion of the working resource, their operating costs are increasing year by year .

In the process of deepening market economy reforms in our republic, growing agricultural products, improving their quality, applying advanced practices and new irrigation techniques, rational and efficient use of land and water resources are areas of strategic importance . Therefore, the design, construction and effective use of pumping devices and stations remains one of the most urgent issues of today

The state of research of the main parameters of the stable operation mode of the pumping station and the reasons affecting their decrease

The pumping station consists of a complex of complex hydromechanical and energetic equipment and hydrotechnical structures that provide water from the source and convey it to the consumer with the help of machines. Several complex hydromechanical and energy machines and equipment, auxiliary equipment, suction and pressure pipe communications, lifting crane, control and control-measuring devices, communication and automation tools are located in the building of the pumping station.

Depending on the importance of pumping stations in water management systems, they can be divided into types of irrigation, drying, water supply, sewage, vertical well and hydromechanization pumping devices and stations. The main equipment of pumping stations are the pump units installed on them (pump, engine, transmission between them).

Centrifugal pumps with blades are widely used in sectors of the national economy, including agriculture and water management . In conclusion , it can be said that the shovel pumps are compact, light, cheap, have less abrasive and impact parts, easy to connect with the engine, quick start-up and adjustment, smooth fluid transfer, simple to use and low cost, high FIK, discharge of contaminated liquids. It is widely used in the public economy due to its advantages such as availability, reliable and long-term operation. At the present time, the pressure of up to 3500 m and the liquid transfer 40 m ^{3} /s and more are produced. The stable operation mode of the pumping station (Fig. 1.1) is determined by the correspondence of the main parameters of the pump: liquid transfer Q, pressure N, power N and cavitation reserve Δh_{to} the maximum useful coefficient of operation (FIK) η . The liquid consumption of the pump (Q) is the amount of liquid pumped out by the pump in a unit of time. Pump fluid consumption is determined in units of m ^{3} /s, l/s, m $^{3\,/h.}$ The liquid consumption of the pump is determined using various devices (Venturi tube, conical tube, diaphragm, volume meter, Pitot tube, induction and ultrasonic water consumption meters) installed in the pressure pipe.

For example, the following general formula is used to determine Q with equipment with a compressed cross-sectional area (venturi tube, conical tube, diaphragm) (m ^{3} /s):

$$Q = \mu F \sqrt{2g\Delta h}$$

where, Δh is the pressure difference between the inlet and compressed sections of the measuring device, m; *F* - compressed cross-sectional surface, m ^{2} ; *m* is the coefficient of water consumption, determined by experiments or a reference for a standard measuring device - given in the literature.

The height of the geometric rise of water N_g is equal to the difference between the marks of the water levels in the upper $\nabla ЮСС$ and lower basins: $\nabla ПСС$

$$H_Г = \nabla ЮСС - \nabla ПСС,$$

or $$H_G = h_s + h_x$$

where h_s and h_x – geometric suction and driving heights, m.

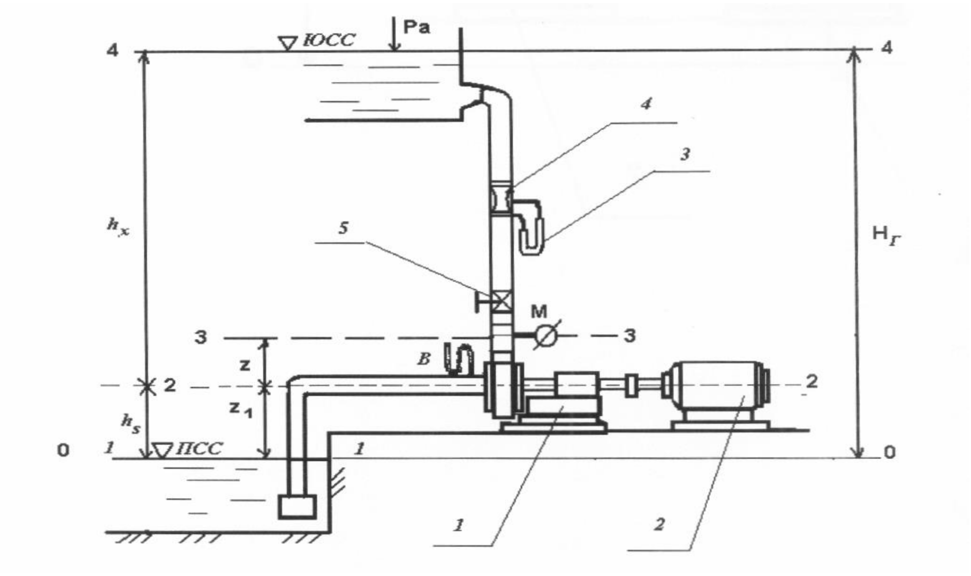
h_s from the bottom water level to the axis of the pump is called the geometric (geodesic) suction height. Height from the pump axis to the upper water level h_x called geometric (geodesic) driving height.

If liquid from atmospheric pressure more than R monomeric pressurized to the bowl is released , then static pressure equal to

$$H_Г = \nabla ЮСС - \nabla ПСС + \frac{P}{\gamma}$$

this where g is the liquid comparison weight (g= rg =9806 N /m ^{3});

R - in the container monomeric pressure , Pa;



pumping device scheme i : pump 1; 2-electric engine; 3- diffmanometer; 4-Venturi tube; 5th lock

of the pump pressure (N) from it passing each per kg of liquid given to the amount of specific energy it is said . Measurement unit : m of water column , kgs/cm ^{2} , mPa. of the pump pressure in two different ways defined : practical method ie work standing on devices pressure measure using tools (manometer, vacuum meter). to determine accounting method ie when designing full geodetic transmission height and in pipes resistances sum as to determine

Practical method with of the pump pressure to determine

The full specific energy of the pump suction section 2-2 with respect to the equalization plane 0-0.

$$E_s = \frac{P_s}{\gamma} + \frac{V_s^2}{2g} + h_S$$

Full specific energy in the part 3-3 of the transmitter part of the pump with respect to the equalized plane 0-0 (Fig. 1.1):

$$E_x = \frac{P_x}{\gamma} + \frac{V_x^2}{2g} + h_S + Z$$

where, R_s and V_s are the absolute pressure and fluid velocity in the suction (Pa and m/s), respectively; P_x and V_x are the absolute pressure and fluid velocity in the transmitter (Pa and m/s), respectively; h_s - suction height, m; z and z_1 - the height between the vacuum gauge and the manometer .

The pressure of the pump is equal to the difference in specific energies at the outlet and inlet parts:

$$H = \frac{P_x - P_s}{\gamma} + Z_o + \frac{V_x^2 - V_s^2}{2g}$$

R $_a$*/ g* to the right side of this equation , then R_x-R_a=R_{man} – manometric pressure in excess of atmospheric pressure and R_a-R_s=R_{vak} - taking into account that vacuumometric pressure is less than atmospheric pressure, we create the following formula:

$$H = h_{вак} + h_{ман} + Z + \frac{V_x^2 - V_s^2}{2g}$$

this on the ground $h_{вак} = \frac{P_{вак}}{\gamma}$ and $h_{ман} = \frac{P_{ман}}{\gamma}$ - vacuum meter and m of the manometer water column indicators .

Determining the pressure of the pump by calculation method. For this, we create two Bernoulli equations for sections 1-1 and 2-2 in the suction part, and 3-3 and 4-4 in the pressure part with respect to the leveling plane 0-0:

$$\frac{P_a}{\gamma} + \frac{V_{n.c}^2}{2g} = h_s + \frac{P_s}{\gamma} + \frac{V_s^2}{2g} + \Sigma h_{ws}$$

$$h_s + Z + \frac{P_x}{\gamma} + \frac{V_x^2}{2g} = H_Г + \frac{P_a}{\gamma} + \frac{V_{ю.c}^2}{2g} + \Sigma h_{wx}$$

where *S h* $_{ws}$ and *S h* $_{wx}$ are pressure losses in suction and pressure pipes, m; $V_{n.c}$ and $V_{yu.c}$ - water velocities in the lower and upper basins, m/s.

In vane pumps, cavitation bubbles form near the surfaces of the impellers where the fluid flow pressure drops to a critical value, and they move with the flow to the high-pressure parts. Under the influence of high pressure, the vapors inside the bubble turn into liquid, that is, they condense. As a result of high-speed aspiration of liquid particles from all sides to the space in the formed bubble, their collision and pressure increase in the amount of several thousand atmospheres occurs, that is, the bubble bursts. As a result of this, a micro-current that has a high speed and hits the metal surfaces is formed. The speed of the micro-stream is so high that in this place the liquid becomes "cumulative", that is, has the properties of a solid body and absorbs the metal surfaces.

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