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Analysis of Pump Agrigarts Electric Power Control Elements in the Supply of Multi-Storey Houses Water Supply

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ABSTRACT

Today, the world's rapid population growth is leading to an increase in people's need for food and the resources they need to live. In particular, the excess of the demand for drinking water allows us to use it wisely without wasting it. controlling the pressures in the water pipes through optimal control of the connection, aimed at preventing excessive losses.

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The operating parameters of centrifugal pumps can vary over a relatively wide range. An increase in the amount of water transfer leads to a decrease in compression, while a decrease in the amount of transfer leads to an increase in compression. In the characteristic, the compression and transmission are determined by the limit values of the working range (Fig. 1). At the allowable limit values of compression and transmission, the characteristic H = f (Q) is represented by the quadratic parabola equation.

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$$H_n = H_f - S_f\, Q^2 \qquad (1)$$

where compression without H_f-transmission, m; S_f -hydraulic resistance of the pump, mm^3/s.

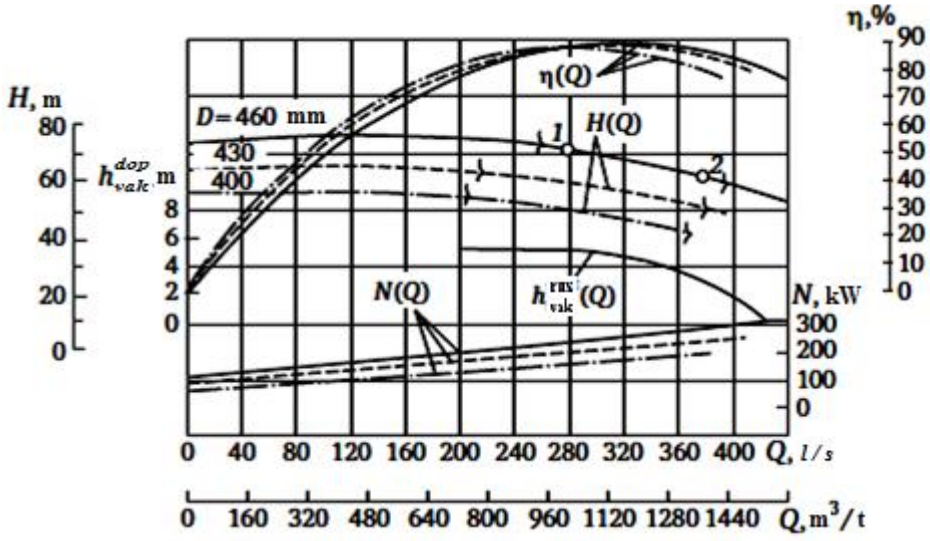

Figure 1. Operating characteristics of a single-stage centrifugal pump.

Compression of the H-pump; Q- amount of water transfer; F-UWR;

h_{vac}^{zin} – allowable vacuummetric suction height; N-power; D -the diameter of the impeller.

Analysis of frequency control elements.

One of the key components of a converter is a diode. The volt-ampere characteristic of an ideal diode is shown in Figure 2.

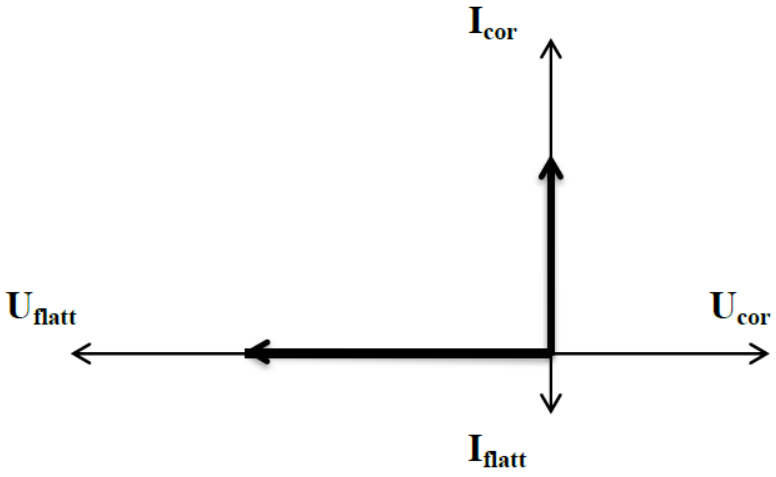

Figure 2.Volt-ampere characteristic of an ideal diode.

It appears that the diode is on or off. In the open state, the voltage drop across the diode is zero. When closed, the current flowing through it is zero. Today, a diode is a semiconductor diode. It is made up of semiconductor layers of different conductivities. Silicon and germanium are commonly used as semiconductor materials. The addition of various additives results in electronic conductivity (n-type semiconductor) or perforated conductivity (p-type semiconductor). The principle of operation of

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semiconductor devices is based on the interaction of semiconductors with different conductivities.

Depending on the operation of the diodes are divided into:

1. Semiconductor uncontrolled valves.

2. Transistors.

3. Controlled semiconductor valve thyristors.

These semiconductor valves are divided into low frequency, high frequency, pulsed, fast and others. Thyristor are divided into single-acting or double-acting (closing). Single-acting thyristor can be switched from closed to open using a control signal. Dual-action thyristor have the advantage of switching from a closed state to an open state or from an open state to a closed state using a signal.

In view of the above, a simple uncontrolled diode consists of a single p-n junction, and the volt-ampere characteristic of a real diode is shown in Figure 3.

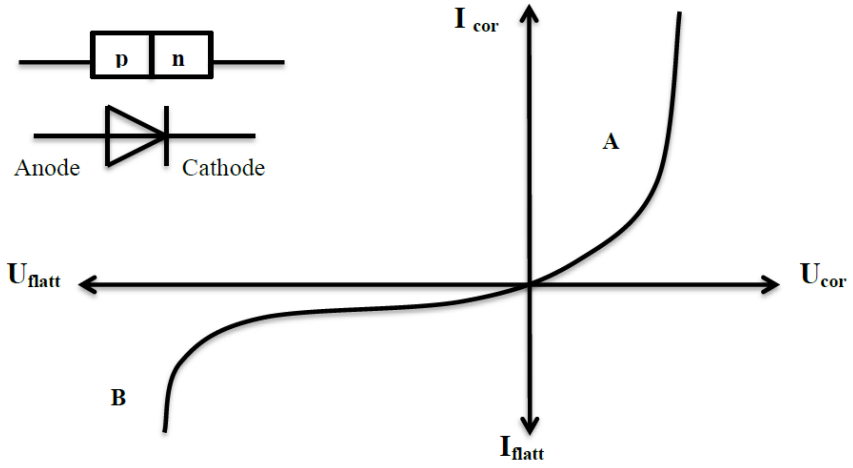

Figure 3.Volt-ampere characteristic of the diode.

This description consists of right (A) and reverse (B) branches. The lower the voltage drop across the diode on the right branch, the smaller the reverse current on the reverse branch. When the value of the reverse voltage reaches a certain value, the reverse current increases sharply, and at the p-n junction, a thermal breakdown occurs and the valve's one-way conduction property is lost.

At certain times, the diodes can be connected in series or in parallel (see Figure4).

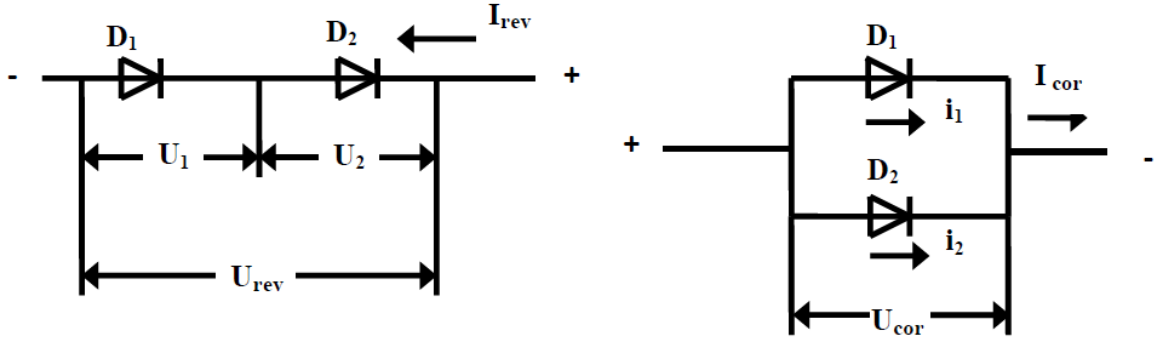

Figure 4.Diodes connected in series and in parallel.

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Normally, the parameters of diodes of the same model do not match, so the currents flowing through the diodes connected in series are $U_1 \neq U_2$, and the currents flowing through the diodes connected in parallel are $I_1 \neq I_2$.

Controlled thyristors are basically a four-layer semiconductor structure with three electrodes. One of these electrodes is called the anode, the other is called the cathode, and the third is called the control electrode. The shape and frequency of the output voltage of such devices are divided into those that depend on the form and frequency of the mains voltage and those that do not. Inverters that do not depend on mains voltage are called stand-alone inverters. Inverters that depend on mains voltage are called imitation or non-autonomous inverters. In this category of inverters, the switching of current from one thyristor to another is due to the alternating current mains voltage, so the frequency of the current at the output of the inverter is equal to the frequency of the mains voltage. In autonomous inverters, the switching of current from one thyristor to another is performed using a special switching device, the frequency of the current at the output of the inverter is determined by the frequency of control pulses.

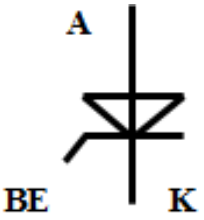

Figure 5.Thyristor overview.

1. The thyristor must be under the correct voltage;

2. An input signal must be given to the input of the thyristor under direct voltage, ie to the control electrode-cathode.

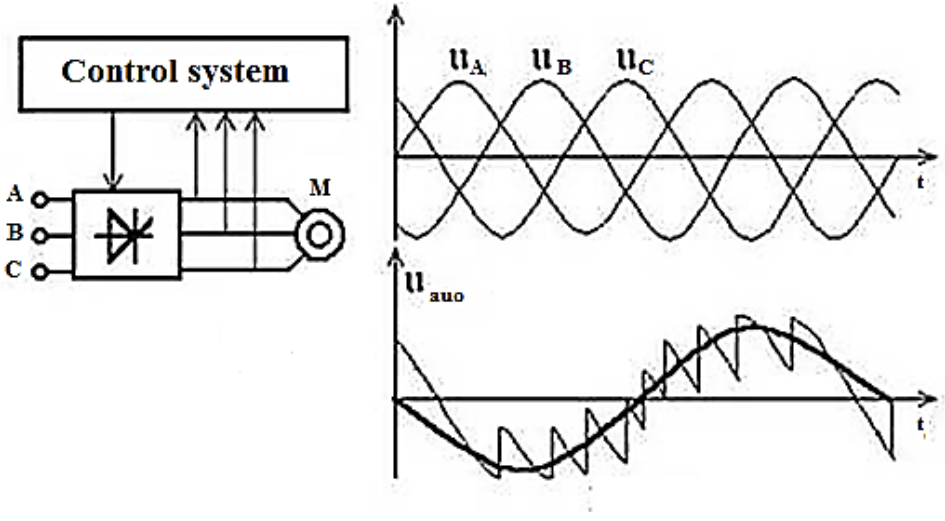

Figure 6.Frequency control scheme and diagram of the pump electric drive.

The main element of the frequency-adjustable electric drive is a frequency converter, which changes the almost constant parameters U_1 voltage and frequency f_1 to the parameters U_2 and f_2 required for the control system of the pumping unit. The frequency of rotation of the electric motor connected to the output of the converter changes in proportion to the frequency f_2.

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