

Alternative Energy Source of Auxiliary Systems of the Pumping and Hydroelectric Power Stations Using Jet Pumps

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EXECUTIVE SUMMARY

This chapter describes technology that ensures reliable pumping of drainage and sewage water during electromechanical and hydro-mechanical transients from blocks of the hydroelectric power stations and pumping stations. As an alternative source of energy, it is proposed to use the energy of the liquid column of the pressure penstock of the stations, and as an auxiliary, to use jet pumps. Transmission of energy to the suction stream is carried out without direct usage of electrical and mechanical energy. During total shutdown of electric power, reliable evacuation

of drainage and seepage water and reduction the influence of electromechanical and hydro-mechanical transients on power equipment and pipelines can be ensured with the use of self-regulating jet pumps over a period of several days; this cannot be accomplished by any other pump. The scientific results of the research are recommended to allow efficient use of water and energy resources and to ensure reliable operation of the power equipment of stations, especially in the events of sudden power outages.

INTRODUCTION

To provide reliable and trouble-free operation of the main equipment and structures of pumping and hydroelectric power stations, auxiliary drainage systems are provided. As an alternative source of energy, it is proposed to use the energy of the liquid column of the pressure penstock of the stations, and as an auxiliary, to use jet pumps. At the same time, taking into account the special significance and importance of the work of the hydroelectric power stations and pumping stations drainage systems, a technology is implemented that ensures reliable pumping of drainage and sewage water from all blocks of the stations and from canals, with efficient hydraulic automation in any combination of hydraulic units' work.

About 1500 pumping stations and about 50 hydroelectric power stations are operated in the Republic of Uzbekistan, many of which are related to the first and second class of hydraulic facilities, i.e. they are the objects of state importance, and any accidents can lead to catastrophic consequences or significant economic damage.

The pumping stations are among the main electric power consumers in the Republic of Uzbekistan. From about 50,7 billion kWh/year the electricity supplied to consumers in Uzbekistan (<http://uzbekenergo.uz/ru/activities/indicators>, 2019) approximately 7,8 billion kWh/year or 16% are spent for covering the demands of water management organizations containing more than 1500 state irrigative pumping stations (http://agro.uz/ru/information/about_agriculture/420/5856, 2019). All of them are now under the jurisdiction of the Ministry of Water Resources of the Republic of Uzbekistan. At these pumping stations about 5000 pump units are established. Their total power is about 3.8 million kW and the general water delivery is about 7000 m³/s.

In Uzbekistan 2.4 million hectares out of total 4.3 million hectares of irrigated lands now are irrigated by means of pumping stations. Annually about 55 billion m³ of irrigating water are pumped. This volume consists of 24 billion m³ pumped by the first lifting, and 31 billion m³ by the subsequent liftings of pumping stations stages.

Such a significant consumption of electricity by pumping stations, gives the problem of energy conservation to them a status of special importance and relevance.

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