PROPOSALS FOR REDUCING EMERGENCY STOPPAGES OF HYDROGENERATORS AT UKRAINE HYDRO POWER PLANTS

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Before the war, hydropower occupied the third place in the Ukraine energy complex after thermal and nuclear power plants. The installed capacity of hydroelectric power plants (HPPs) and hydro-accumulating power plants (HAPPs) of Ukraine was 7-9% of the total capacity of the country's unified energy system (UES); the average annual electricity production of HPP/GAPP was equal to 10.8 billion kWh. The destruction of Ukrainian HRPs raised the question of the feasibility of their restoration after the war. That is why it is so important to know the role of HPPs/HAPPs in the general electric power system and to understand the ways of increasing their reliability based on the analysis of the causes of emergency shutdowns. HPPs/HAPPs belong to renewable energy sources, but unlike solar and wind power plants, they produce electricity with stable indicators, with a sufficient degree of purification from high harmonics. They provide UES balancing, frequency and emergency reserves. So, in February 2021, when the units of the Zaporizhzhya TPP were shut down due to a fire, the lost power was picked up by HRPs. In a similar situation on January 25, 2022, during the emergency shutdown of two NPP units, it was the rapid introduction of hydraulic units that ensured the stable operation of Ukraine's UES.

The conducted analysis of failures and emergency stops at HPPs/HAPPs allows to identify the most frequent causes of emergency stops due to hydro generators:

1) damage to the friction surface of the generator bearing segments due to incorrect installation of the segments and due to a violation of centering;

2) destruction of the stator winding rods insulation as a result of contact with the core pressure fingers, which occurred due to the attachment weakening of the pressure finger to the pressure plate;

3) cliff of the jumpers of the rotor damper winding due to their incorrect installation, fig. 1;

4) leakage in the oil coolers of the generator bearing due to bad flaring of the cooler tubes;

5) insulation breakdowns of stator and rotor windings due to dusting or wetting of the insulation due to the formation of condensate or rupture of the cooler pipes;

6) short-circuit with burnout of the brush apparatus due to the accumulation of graphite dust and incorrect selection of the brush's hardness.

Therefore, the analysis of failures of hydro generators allows us to conclude about the possibility of prolonging their operation, despite significant wear and tear. Because in modern conditions it is impossible to replace with new equipment, and the main reasons for the failure of hydro generators are insufficient quality maintenance and repairs, which can be corrected.

Fig. 1. Cliff of the jumpers of the rotor damper winding