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TECHNICAL REQUIREMENTS FOR POWER EQUIPMENT

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ABSTRACT. This work is devoted to the analysis of technical requirements for power equipment, their coordination with customer requirements or taking into account real working conditions. Provides information about the temperature regime, taking into account the cooling medium. Standards for hydrogenerators are analyzed. Noise parameters and their estimation are taken into account.
Key words: standard, parameter, medium, stator, sound level meter.

Introduction. Getting electricity using renewable energy sources has become one of the main problems today. Because its solution means not only an improvement in the economic condition, but is also a necessary condition for the entire system of society's life. The use of technical devices, their adjustment and technical use requires the implementation of many mandatory standards and regulations. Even when creating laboratory benches, it is necessary to take into account the requirements for electrical protection values, noise indicators, technical skills of personnel, requirements for the power supply system, type and equipment of the room.

A hydro generator usually has a common shaft with a hydraulic turbine. The hydroelectric generator converts the mechanical energy of the hydraulic turbine into electrical energy. Hydroelectric power stations in the USSR, as a rule, use three-phase synchronous generators. Hydrogenerator consists of a rotor with a pole system and a stator with a uniformly distributed rod winding. When the rotor rotates, the magnetic field created by the poles crosses the rods of the stator winding, in which an electromotive force is induced. When the hydrogenerator is connected

to the electrical network with energy consumers, current will flow through the stator winding, creating an electrical load on the generator.

Low-speed (speed of rotation up to 100 rpm) and medium (speed of rotation from 100 to 200 rpm) generators are almost always vertical, which is determined by the optimal layout of the unit of low-pressure and medium-pressure HPPs. High-speed (rotational speed over 200 rpm) generators of high-pressure plants are produced both vertically and horizontally. Capsular generators placed in a capsule washed by water of the straight-axis flow path of a hydroturbine are machines with a horizontal shaft [2].

The choice of the type and parameters of generators is based on [1]. Its action extends to the countries of the former Union, including Uzbekistan. Responsible for implementation on the territory of Uzbekistan is Uzgostandart. This standard is applied instead of GOST 5616-81 and GOST 17525-81, and also complies with IEC 34-1-83.

This standard applies to the following:

- it is possible to use three-phase synchronous salient-pole generators (including generator-motors) with a frequency of 50 Hz,

- rated voltages should be 0.4; 0.63; 3.15; 6.3; 10.5; 13.8; 15.75; 18 and 20kV.

The value of the nominal coefficient can be the following:

0.8 - hydrogenerators and generator-motors 125 MW A and below,

0.85 - hydro generators with a capacity of 125 MW A to 360 MW A,

0.9 - hydro generators with a capacity of more than 360 MW A,

0.95 - hydro generators with a capacity of 20 MW A and less,

0.98 - capsule generators with a capacity of more than 20 MV A.

This coefficient in the motor mode should be set in the attached terms of reference or in the technical specifications for a specific type of reversible machines.

When choosing a hydrogenerator in the mode of a synchronous compensator with underexcitation, reactive power should be determined from the highest value of the current flowing through the rotor. The same approach is applied to the generator-engine. When a hydrogenerator operates in the mode of a synchronous compensator with overexcitation, the reactive power must be calculated as in the case of operation with underexcitation.

The operating mode in the temperature control area (in this case understood as the cooling medium)

must be open (+40°C) and closed (+35°C) (position 1.8), and the temperature of the water entering for cooling the active parts may not be 45° C (directly for cooling) or to the air cooler and heat exchanger - not higher than 28°C.

This requirement makes it possible to achieve an improvement in the operating conditions of the hydrogenerator (operating mode S1 according to GOST 183).

When operating under conditions other than those required by this standard, the nominal value of the cooling medium is given in the technical task or specifications, and must also be given in the operational documentation. Based on the conditions put forward by the consumer, it is allowed to take hot air for space heating (in this case, it should be understood as a hydroelectric power station room). All changes are indicated in the terms of reference or specifications for hydro generators of a particular type (position 2.2). The heat resistance class of the insulation of the rotor and stator windings must be at least class B according to GOST 8865, and the excitation system and the requirements for parameters can be set in agreement with the consumer (sometimes with the equipment customer). In this case, you must adhere to the requirements of GOST 21558.

Noise indicators are set according to [4]. This standard, unlike [2], is valid on the territory of three countries (the Russian Federation, the Republic of Belarus, the Republic of Uzbekistan). It considers the types of noise spectra - broadband and tonal. The second type has discrete tones, which can be used for practical purposes (control of parameters at the workplace) with a change step of at least 10 dB.

The second type of noise can be divided into oscillating, intermittent, impulsive (on the sound level meter, “impulse” and “slow” differ by at least 7 dB) [6]. This standard is valid on the territory of our country (Uzstandard).

For all types of premises (control rooms, training rooms, workshops, and others) and the type of activity, noise indicators are given [5].

Given the order and methods of measurement, the following can be cited:

- when cooling with water leaving the windings of the rotors and the stator core, the temperature is measured with a thermometer and the heat resistance must be within 65 ° C / 65 ° C (class B and F, respectively),

- with indirect air cooling of the rotor windings, it is necessary to use

thermal-converting resistances and the heat resistance must be within 120 ° C / 140 ° C (class B and F, respectively),

- when using indirect air and forced air cooling of the rotor windings, resistance must be applied and the heat resistance must be within 130°C/145°C (class B and F, respectively).

- if there is active steel in the stator structure with indirect air and direct water cooling of the stator windings, it is necessary to use resistance thermal converters (similar to indirect air cooling with those heat resistance values.

This table is calculated for conditions when observing no more than two long-term overloads per year relative to the nominal value of the current in the stator (position 2.7 [2]).

Based on the above, the following conclusions can be drawn:

- the experimental setup must comply with the requirements of the standards [1,2,4-6],

- placement and operation of hydrogenerators must be carried out in compliance with the necessary requirements [1,5-6],

- standardization of hydro generators operation processes allows to increase the level of results analysis.

In conclusion, it should be noted that the standardization of equipment, the conduct of the experiment, and the necessary conditions makes it possible to quickly resolve issues related to the consideration of procedural issues.

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