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FAST DISCHARGE UNIT CURRENT PULSE GENERATOR FROM TOROIDAL FIELD WINDINGS *)

[1]Kuz`menkov V., [1]Alekseev D., [1]Latmanizova Yu., [2]Miklyaev S., [1]Semenov A.

[1]Join Stock Company «D.V.Efremov Institute of Electrophysical Apparatus», mail@niiefa.spb.su

[2]«Project Center ITER», Institution of the State Atomic Energy Corporation Rosatom, support@iterrf.ru

During the operation of the ITER tokamak, direct currents of tens of kiloamperes must be switched both for plasma formation at the beginning of each operational cycle and for fast discharge in the event of a normal phase in the superconducting winding. To address these challenges, NIIEFA JSC has developed a wide range of devices utilizing various principles, schemes, and switching methods.

A special focus is placed on the equipment that switches toroidal field winding currents, located in Building 11. This building is subject to complex combined external effects on the equipment, including enhanced magnetic fields, temperature and humidity variations, and vibrations. Therefore, additional tests are required to certify the devices situated here.

Explosive devices [1] are used for emergency fast discharge from the TF winding, employing the detonation energy of explosives for switching. The operation of this device is triggered by an electric detonator, which necessitates generating a current pulse of over 600 A with a duration of 300 ns and a rise rate of at least 3×10^9 A/s (Figure 1). Furthermore, for proper operation, the generator, designed according to the high-frequency high-voltage resonant converter scheme, must provide galvanic isolation of the output from ground potential for a test voltage of 28 kV at a frequency of 50 Hz.

NIIEFA JSC has developed a Current Pulse Generator (Figure 2) that meets the electrical parameters and satisfies the necessary criteria for external influences; magnetic, climatic, and vibration tests have been successfully conducted.

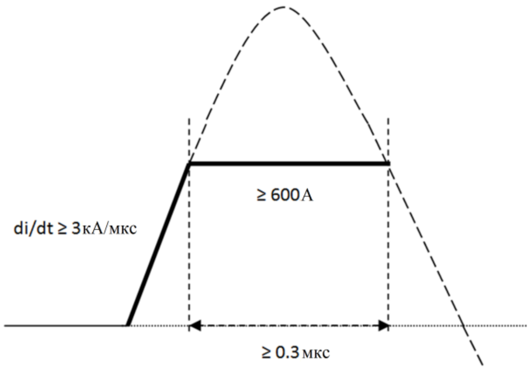

Figure 1 – Current pulse required for initiating the electric detonator

Figure 2 – Current Pulse Generator

References

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