development and research of a high-current high-voltage fuse based on eec for the iter fast discharge system [[1]](#footnote-1)\*)

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The ITER superconducting magnetic system consists of 18 toroidal field coils (TF), 6 poloidal field coils (PF) and 6 central solenoid modules (CS). In case of superconductivity loss, the magnetic energy stored in the coils should be removed in order to protect them from overheating. This is achieved by connecting power energy-absorbing resistors in series with the coils using the fast discharge system consisting of switches, a counterpulse battery and an RC circuit that limits switching overvoltages [1, 2].

The fuse is connected in series with the snubber circuit to switch off an emergency current in a case of an electrical breakdown of the circuit capacitor. The fuse is an unmanageable one-time switch, the operation of which is based on the interruption of current during an electrical explosion of a current-carrying conductor (EEC).

The report presents the results of the development and research of a high-current high-voltage fuse based on EEC designed to protect against short-circuit currents of individual elements of the power equipment of the fast discharge system of ITER. In accordance with the requirements of ITER, the fuse is designed for use in a pulsed operation mode and, in a case of a short circuit, should cut off the current with an amplitude up to 30 kA, ensuring a long interruprion of the electrical circuit with a voltage up to 9 kV. The report provides the design description of the developed fuse, considers the main technical solutions that ensure its compliance with the requirements for dielectric strength, switching currents and switch-off time, the results of experimental research of switching characteristics, and also determines the dielectric strength in a pulsed operation mode with an application of voltage after switching-off.

Switching tests carried out on the fuse prototypes demonstrated its reliable operation in the given parameters. The design simplicity of the fuse made it possible to ensure the reliability of the product and its relatively small dimensions. The fuse will be used as a protective element in the ITER fast discharge system.

References

1. I. Song, A. Roshal, V. Tanchuk, J. Thomsen, F. Milani and I. Benfatto. The fast discharge system of ITER superconducting magnets. 2011 International Conference on Electrical Machines and Systems, 2011, p. 1-6.
2. C. Neumeyer et al., ITER power supply innovations and advances, 2013 IEEE 25th Symposium on Fusion Engineering (SOFE), 2013, p. 1-8.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/E/ru/IZ-Sapozhnikov.docx) [↑](#footnote-ref-1)