

Pulsed explosive loading of destructible current-carrying parts of protective switches

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A distinctive feature of the direct-current (dc) circuit breaker developed by the NIIEFA is the use of the detonation energy of a small amount of explosive to activate of the switch and, at the same time, to extinguish the electric arc, which is achieved due to the design of the switching section where the destructible element and explosive charge are coaxially arranged and the free volume is filled with the demineralized water under a pressure. The design of the dc circuit breaker is protected by the Russian Federation patent No. 2755454. These features determined the application area of the dc circuit breaker as a back-up switching device being a part of the current commutation complexes providing the extraction of energy from the superconducting coils forming magnet systems of modern tokamaks in case of a quench or other abnormal operating conditions. Failure of the extraction of energy from superconducting coils can potentially lead to the damage of the whole fusion facility, therefore the requirements imposed on the reliability of the back-up switches are significantly high (0.99 with a confidence probability of 0.9). This work is devoted for study of the impact of detonation processes for the destruction of the current carrying elements of that type of switches with the aim of subsequent optimization of their design, which is essential for the further development and expansion of their application areas.