

A Simulator for Testing High-Voltage Equipment to the Action of Fast Pulse Disturbances with Power On

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Many believe that low-voltage technical systems incorporating semiconductor devices are most sensitive to the action of pulse disturbances with power on, while high-voltage equipment appears to be immune to such disturbances, whether the operating voltage is on or not. This opinion is based on the results of tests of high voltage equipment on the action of disturbances in the absence of an operating voltage. Realistically, fast (less than 1 microsecond) pulse influences, capable of initiating spark short circuits, do not represent serious danger to high voltage equipment in absence of an operating voltage. However in real conditions these short circuits can be transformed to an arc overlapping under the action of an operating voltage. As a result, destruction of insulation and failure of the high-voltage equipment can take place. Such effects can result in catastrophic phenomena in power supply systems. Therefore research of the joint action of pulse disturbances and an operating voltage on elements of high-voltage power systems (insulators of power lines, transformer of substations, etc.) is necessary.

A special experimental installation has been developed for carrying out such research. This installation forms a voltage disturbance pulse (duration – 50...500 ns, peak – up to 400 kV) and several half-cycles of an operating voltage of a 10 kV power line, simultaneously. A system of synchronization permits the formation of the short voltage pulse at any phase of the operating voltage.

Experiments have shown that the electric characteristics of insulators degrade after overlapping. Repeated overlapping causes a decrease of the insulator breakdown voltage level and the degradation of the parameters of insulators. Destruction of an insulator may be a consequence of such effects.