Solid-State High-Voltage Crowbar Utilizing Series-Connected Thyristors*

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High-voltage (HV) crowbars in HV power supplies can often be found in assemblies that are constructed by using series ignitrons or HV switch tubes. They are normally connected across the output of the HV power supplies to protect the load, such as a gyrotron, tetrode, etc., in the case of a HV load fault. Solid-state HV crowbars are now in development. Presented in this paper is one being developed by General Atomics that has thirty SCRs connected in series to withstand a normal operation voltage of 100 kVdc. The SCRs are triggered at the same time to their full conduction in less than 5 microseconds starting from the time when the crowbar receives the signal to fire. The selected SCRs are capable of turning-on in approximately 2 μs with a current rise of 1.2 kA/μs. The crowbar assembly can be set up to operate in either positive or negative polarity. In a typical application, simulations show that the crowbar can limit the energy into a load fault to less than four joules. The electrical design will be discussed including selection of the SCRs. For the mechanical design, both positive and negative assemblies will have the same dimensions and the same components, but the SCRs are installed in opposite directions. The estimate dimensions of the crowbar assembly are 46 in. H x 13 in.W x 13 in. D. The crowbar assembly is to be constructed and electrical tests will be performed, the results of which will also be presented.

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