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Nondestructive Test Determines Overload Destruction Characteristics of Current Limiter Fuses

A nondestructive test method has been devised to predict the clear time of electrical current limiters, that is the time required for the current limiters to blow (open the circuit) when subjected to a given overload (e.g., two, four, or six times the rated current of the limiters in this application). This method provides a reliable means for predicting the clear time of individual current limiters under overload conditions and for quality control of production-lot quantities of these units. Standard nondestructive electrical measurements have not been capable of accurately predicting the clear times of overload current limiters. In one destructive method commonly used, one or more units from each production lot are subjected to actual overloads for the time required to open the circuit. This test is unreliable because it not only destroys the current limiters sampled, but also assumes that all of the units in each production lot have the same characteristics as the samples tested to destruction.

The new test method is based on an empirical relationship between the voltage rise across a current limiter for a fixed time interval (and fixed current overload) and the time to blow. The tester consists of crystal controlled precise time bases for controlling square wave current pulses. The limiter is subjected to these square wave current pulses of controlled time duration of length such that clearing of the fuse will not result. This test will insure that the limiter will withstand transients without clearing. Voltage wave forms across the limiter are monitored during the test with an oscilloscope.

In order to determine the relationship of the clear time to the voltage rise characteristic, a representa-

tive number of current limiters are each subjected to a pulse corresponding to the specified overload condition, and the resulting voltage rise characteristics are measured from the oscillograph. The duration of the pulse applied to each of the limiter units in this (first) stage of the test must be sufficiently short to avoid blowing or damaging the units. The same limiters are then each subjected to a voltage pulse of the same height (corresponding to the same overload condition) as in the previous measurement, but for a sufficient time to blow the units (to open the circuit). The resultant measured clear times values are then plotted against the measured pulse heights to obtain a least square-fit regression line. Any desired number of current limiters of the same type (from the same lot) may then be nondestructively tested by measuring the pulse height of each unit as in the first stage. The measured pulse height for each unit is then used to determine the corresponding clear time from the regression line.

Note:

This nondestructive test method may be applicable to other electrical components exhibiting dynamic characteristics which are power-limited.

Patent status:

Title to this invention has been waived under the provisions of National Aeronautics and Space Act [42 U.S.C. 2457(f)], to the Electra-Midland Corporation, Independence, Kansas.

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