Capacitors

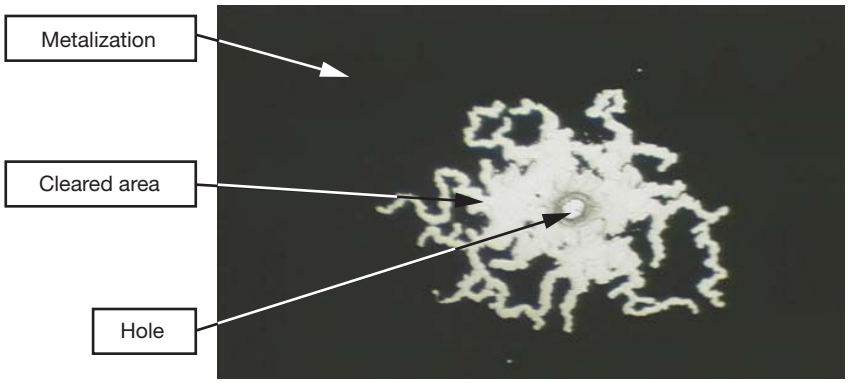
Application Note

Voltage Proof Test for Metalized Film Capacitors

Voltage proof tests, also called “high pot” tests, are used to check if a capacitor has a breakdown failure mode occurring at a certain test voltage. The detection of breakdown is done by a current detection, specified if exceeding a certain limit (cut off current).

For all capacitor technologies that do not have the ability to recover after a partial breakdown, the current flow is continuous at the moment of a breakdown.

However metalized film capacitors have the property to recover after an instantaneous breakdown (partial breakdown) due to the fact that the metalized electrodes (capacitor plates) act as a fuse. For fusing a small current is needed, but is not continuous. This effect is defined as “self healing” and not as breakdown.



Self healing of a metalized electrode in a film capacitor

Therefore in testing these capacitors on a proof voltage, it is always possible that the capacitors have the self healing effect, taking temporarily a peak current, but are completely isolated again after this phenomenon is stopped. To take this in account for qualifying capacitors, in all IEC standards of metalized film capacitors a breakdown is defined only when it is “permanent”. Therefore a note is added for explanation.

Requirement:
There shall be no permanent breakdown or flashover during the test.

Note
- The occurrence of self-healing breakdowns during the application of the test voltages is allowed.

To detect if the behavior is a self healing or permanent breakdown, it is recommended to measure the remaining charging current only at the end of the proof voltage test and to neglect the small current peaks (arcing) before that time. This is defined as the permanent cut off current and usually 10 mA, or otherwise specified. Modern “high pot” test equipments have the function to allow arcing currents before the final permanent breakdown current. As the inrush current could also be regarded as arcing, it is also recommended to reduce the charging voltage slope, usually to < 100 V/s. But in most cases charging within 1 s to 5 s is ok.

APPLICATION NOTE

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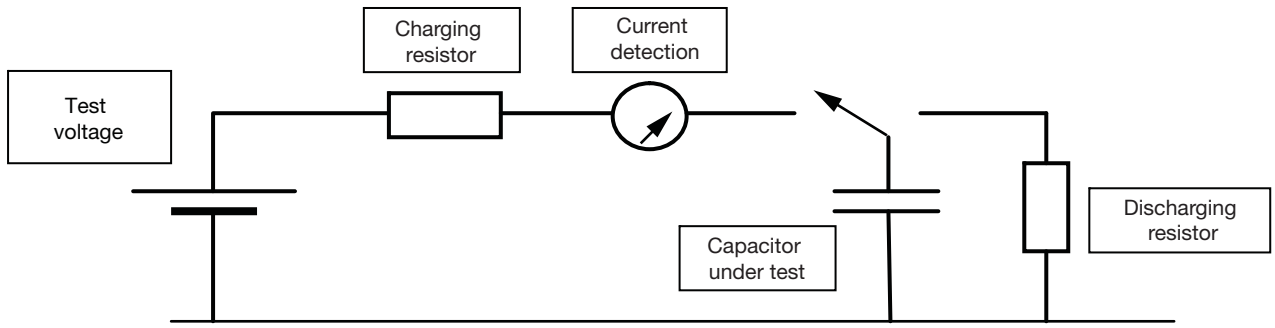
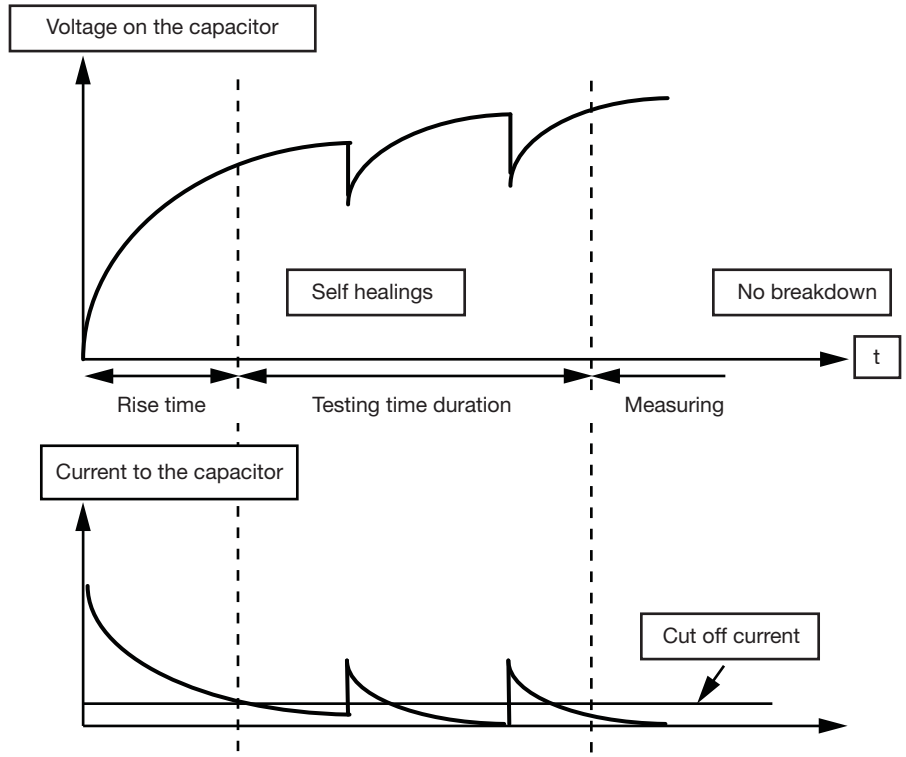
Voltage Proof Test for Metalized Film Capacitors

TYPICAL TEST CIRCUIT



TYPICAL VOLTAGE AND CURRENT GRAPH FOR A SELF HEALING CAPACITOR



APPLICATION NOTE

For technical questions, contact: dc-film@vishay.com
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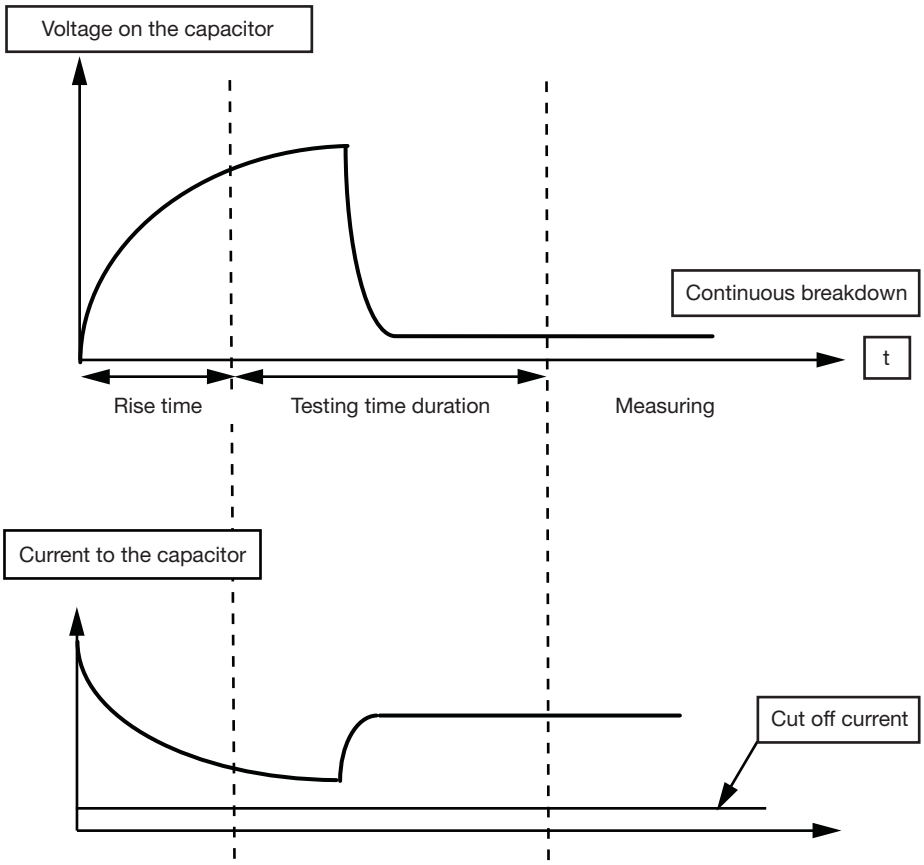
Voltage Proof Test for Metalized Film Capacitors

TYPICAL VOLTAGE AND CURRENT GRAPH FOR A CAPACITOR WITH CONTINUOUS BREAKDOWN



VOLTAGE PROOF TEST FOR CAPACITORS IN PARALLEL

Voltage proof tests are done and guaranteed for individual components. The capacitors are so designed that in case of a self healing effect, they can take just enough energy from the own capacity without damage.

In case the capacitors are connected in parallel, than the free energy is a multiple of the single capacitance energy and can flow in an uncontrolled way to the self healing area. This can damage and in worst case destroy the capacitor. Therefore as a general rule the proof voltage must be reduced. For information about the reduced proof voltage in function of the number of capacitors in parallel per capacitor family, contact dc-film@vishay.com

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