

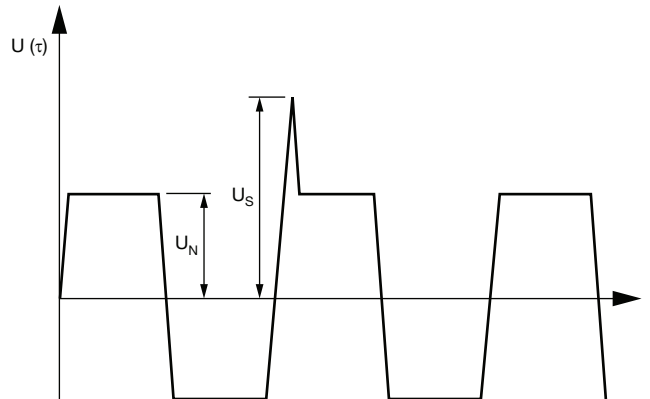


## An Explanation of MKP Technology (AC)

By Kevin Rubenberger

### AC APPLICATION

AC capacitors are periodically recharged during operation. They serve as damping or snubber capacitors for suppression of undesirable voltage spikes as well as line and harmonic filters in frequency converters.



### Definitions:

- **Rated voltage  $U_N$**   
Maximum operating peak voltage of either polarity of a reversing or non-reversing voltage
- **Non-recurrent surge voltage  $U_s$**   
Peak voltage induced by switching or any other disturbance of the system, which is allowed for a limited number of times and for durations shorter than the basic period

### STANDARDS

The capacitors listed in this catalog are subject to the international standards for capacitors for power electronics (PEC).

- IEC / EN 61071
- IEC / EN 61881-1

### TECHNOLOGY AND DESIGN

#### MKP Dielectric

The preferred dielectric material for PECs is polypropylene. It is a special high temperature film with a thin metallization on one side. The metallization has an optimized structure in a mixture of aluminum / zinc and in the ohmic profile, which depends on the demands of the application and capacitor.

#### Self-Healing Effect

As a result of the self-healing effect, the capacitor is fully operational after an electrical breakdown. A breakdown generates a small electric arc, which evaporates the metallization around the area of breakdown in only a few microseconds and at very low energy. The localized increase in gas pressure caused by the high temperature of the arc blows the gaseous metallization away from the breakdown point. By means of this process, a metal-free, non-conductive isolation crescent is formed, which enables continuous full operation of the capacitor.



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### Winding Element

All self-healing capacitors are comprised of one or more individual cylindrical winding elements. For contacting the elements in parallel or in series, a solderable lead (Pb)-free metal base layer is sprayed onto the front sides of the winding elements. The process of metal spraying is called “schooping.” The connection of the windings in parallel or in series is accomplished by means of a highly flexible copper material. In this way the capacitors are able to fulfill the highest demands of current load, low inductive characteristics, low ohmic drop and shock, and vibration-proof performance.

### Filling Material

After mounting the stack of winding elements into the cases, the capacitors are dried under a vacuum, and gas-impregnated with N<sub>2</sub> (nitrogen) before filling.

- **Dry casing**

Most self-healing capacitors in rectangular cases, and a number of capacitors in cylindrical cans, are filled with a soft resin mainly based on vegetable castor oil. The casting compound R25 developed by Vishay remains elastic throughout the entire life of the capacitor. This elastic casting compound offers outstanding shock and vibration protection for the internal structure and long lasting protection against the penetration of moisture into the electrical components of the capacitor. A very good thermal conductivity of the casting compound enables maximum capacitor loads under high temperature stress conditions. The casting compound can be treated as ordinary waste.

- **Vegetable oil**

For capacitors with tear-off protection, preference is given to impregnation using a specially produced and stabilized vegetable oil.

### Reliability

The operating reliability of the capacitor is determined by the number of failures, within an adequately large batch, expected to occur after a specified time (life expectancy). DIN 40040 has replaced the previous term “operating reliability” by the new term “reference reliability.”

### Failure Ratio

The failure ratio is the relationship between the number of failed capacitors and the total number of capacitors used. It applies to a particular capacitor only and the load duration cited (life expectancy). The figure quoted in the data lists is an average, which is generally not exceeded if examining an adequately large number of capacitors.

### FIT

FIT = failures in time

The failure rate in FIT indicates the maximum failed components within  $1 \times 10^9$  component operation hours.