

Technical Information

Silicones and alternative, appropriate Sealers

Silicones or organic siloxanes are polymerised compounds based on silicon / oxygen components, which appear in many different forms: oils, greases, compounds, resins or varnishes, elastomers etc.

In electrical construction, silicone varnishes are widely used because they possess rather remarkable properties:

- Very high electric and insulating power, stable throughout an extensive temperature range. These silicones correspond to class H (180 °C - 200 °C / 356 ° F - 392 °F) specifications.
- The breakdown voltage is 5kV.
- Being chemically substantially inert these compounds are unaffected by humidity and various corrosive agents.
- They are easily applied either in a pure state, or diluted in aromatic solvents with or without a catalyst followed, or not, by a simple thermal treatment: a curing of variable duration and temperatures (150 - 300 °C / 300 ° F - 572 °F) according to the required conditions of polymerisation.
- They are flexible and easily accessible.

Effect on brushes

Unfortunately silicones have severely adverse effects on the performance of brushes.

In a totally enclosed compartment without external fresh air an irregular and very high rate of brush wear occurs, which can reach or exceed 10 to 15 times normal.

Wear is especially high when:

- The silicones used as a varnish or insulation conductors, armature bands, slot insulators, wedges, impregnated tape etc. are less stable after polymerisation
- The volume of air available to the machine is restricted
- The internal temperature of the machine and especially that of the commutator (or ring) is high,
- The current passing through the brushes is high.

Causes

According to observations made in laboratories and in the field, is the products of hot distillation of the silicones which bring about the unusual brush wear because of:

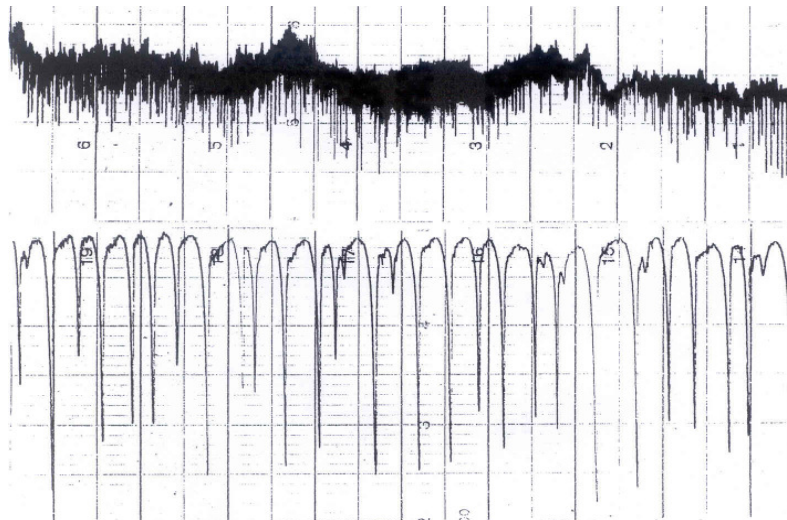
- Condensation on the commutator (or the rings) forming an insulation film which disturbs the passage of the current and causes arcs or sparking underneath the brushes.
- Decomposition of silicone vapour under sparking conditions with the formation of SiO₂, which is a very abrasive agent for the brushes

Technical Information

It has also been confirmed, that:

- Even at a very small vapour pressure corresponding to a non-measurable loss of weight of the silicone varnish, the performance of the brush will be adversely affected in the enclosed and warm environment of a machine on full load.
- Quite high silicone vapour pressure in a closed environment do not have any visible effect to the brushes when the machine is running at minimum load or under no load running periods.

In the laboratory the negative influence of silicone compound materials can be clearly indicated by the course of the voltage drop. The current breakthrough through the insulating silicone layer causes a distinct characteristic of the voltage drop, as can be seen in the following illustration.



SCHUNK offers these tests as a service to its customers.

Remedial actions

Adapted brush grades with self-cleaning additives, which remove the disturbing substance at least from the carbon brush track, may minimise the negative effect. But that is not the real problem solving.

In some extreme cases even so called cleaning brushes can be used. Brushes with a very high content of abrasive ingredients are mixed with standard brush grades.

Technical Information

The only real remedy consists in suppressing the cause, that is to say, to prevent the accumulation of silicone vapour around the brush.

- Either by not using silicones for totally enclosed motors,
- Or by ventilating the brushes with fresh air in permanent and plentiful supply.

To sum up, avoid any restriction of air, since in a warm confined space, even fully polymerised silicones will slowly decompose.. In fact, in open machines adequately ventilated, the use of silicones has never been found to give any difficulties in brush operation.

Use of Silicone as a carbon brush component

The main feature of silicon compound concerning their application in carbon brushes is their high breakdown voltage (5kV) and the high elasticity. Especially the breakdown voltage is not reached by any other material. The value for Viton® (Teflon) or glas-fiber tubes is only 1kV.

All silicone brush tops and insulation tubes are temperature treated and do not contain volatile silicone compounds.

Alternative sealant

Usually the air ducts for the cooling air are sealed with sealers. Due to the mentioned reasons quite often silicone containing sealers give rise to brush problems like sparking and high brush wear.

SCHUNK has tested a series of appropriate sealers as alternatives to silicone compounds.

The main prerequisites are:

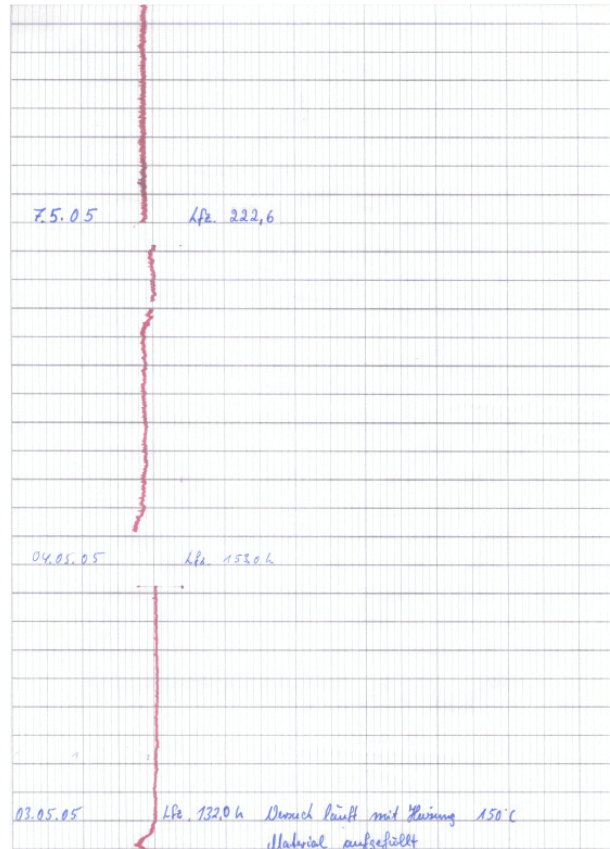
- No influence on the brush performance
- Easy to handle
- Elastic
- World-wide procurable

In extended laboratory tests we now found an adequate alternative, which we can recommend to our customers. The sealant is designated

Terostat-MS930.

During our tests no significant influence on the brush performance was to be seen. The course of the voltage drop was without any findings.

Technical Information



The material is based on polymers which are cured to an elastic product by the normal humidity.

The sealant is supplied in standard cartridges and should be world-wide accessible.

Further information you may find in the internet with the keywords Teroson or Terostat.

Compact

- Silicones are toxic for carbon brushes.
- They form an insulation film. By brush sparking silicones can be decomposed to SiO_2
- Brush wear can rise to 10 to 15 times normal
- Abrasive brush grades can give some improvement
- Good ventilation with fresh air will also improve the situation
- Real remedy is the renunciation of silicones
- SCHUNK recommends **Terostat-MS 930** as an alternative sealant.