SILICONES

TECHNICAL NOTE ■ STA BE 16-45 GB

SPECIFIC PROPERTIES

Silicones or organic siloxanes are polymerised compounds from the radicals:

$$\begin{array}{c} R \\ R\ Si\ O- \\ R \end{array} \quad \begin{array}{c} R \\ -O\ Si\ O- \\ R \end{array} \quad \begin{array}{c} R \\ -O\ Si\ O- \\ O \end{array} \quad \ldots \quad (R = \text{monovalent organic Radical})$$

which appear in many different forms: oils, greases, compounds, resins or varnishes, elastomers...

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

- Very high dielectric and insulating power, stable throughout an extensive temperature range. These silicones correspond to class H (180°C - 200°C) specifications.
- 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) according to the required conditions of polymerisation.

EFFECT ON BRUSHES

Unfortunately, silicones can have severely adverse effects on the running 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 for insulating 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 rings) is high,
- the current passing through the brushes is higher.

CAUSES

According to observations made in the laboratories and in practice, it 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 insulating film which disturbs the passage of the current and causes arcs or sparking under the brushes.

– decomposition of silicone vapour under sparking conditions with the formation of SiO_2, which is a very abrasive agent for the brushes.

It has also been confirmed that:

– Even at a very vapour pressure corresponding to an unmeasurable loss of weight of the silicone varnish, the performance of the brush will be adversely affected in the encloses and warm environment of a **machine on full load**.

– Quite high silicone vapour pressure in a closed environment do not have any visible effect on the brushes when the **machine is running at minimum load or under no load running periodes**.

CURES

Two remedies have been suggested in order to neutralise the effect of silicone vapour.

– Impregnation of the brushes by a soluble mineral compound which combines with the silicone to form a stable gaseous compound.

But these impregnating agents sometimes noticeably modify the behaviour of the brush or more exactly the characteristics of the skin that is formed by it.

– Use a pilishing brush of marked abrasiveness in order to remove the contamination left by the silicones.

But such brushes may cause commutator or ring wear when running at reduced load.

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 un 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; however, they are stable in an oxidising atmosphere up to about 250°C.

In fact, on open machines adequately ventilated, the use of silicones has never been found to give any difficulties in brush operation.

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