EMI SHIELDING GASKETS: BEYOND MIL-G-83528A

A new conductive elastomer EMI shielding material with heat aging performance beyond that specified in MIL-G-83528 has been developed.

Manford Eaton, ORCUS, Inc., Kansas City, MO

INTRODUCTION

The main purpose of an EMI gasket is to reduce the electrical resistance between two mating metal flanges. As the volume resistivity of the gasket material decreases, the shielding effectiveness increases.

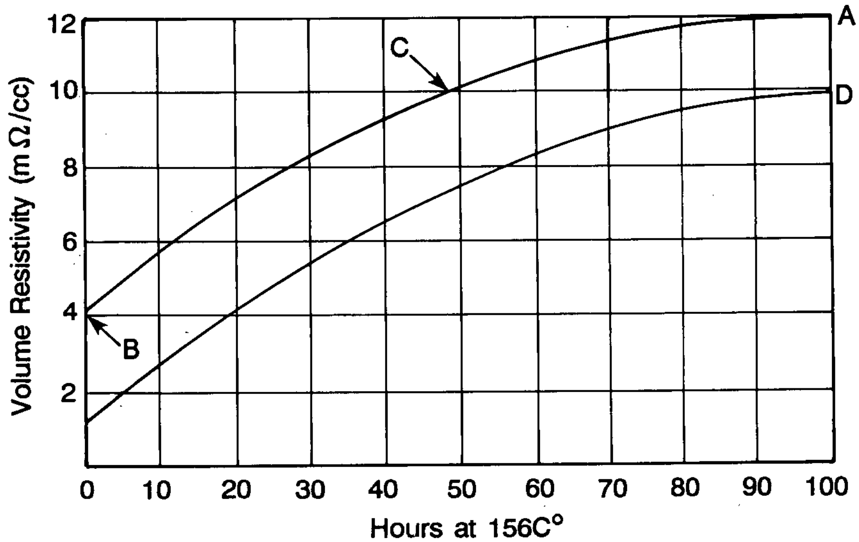
The volume resistivity of shielding material tends to increase with use at elevated temperatures. If the gasket volume resistivity increases dramatically, gasket failure results. This is the main cause of failure in EMI conductive particle shielding gaskets, as well as other gasket types.

This problem has been well documented in a number of case histories. Partly in response to these problems, a new MIL-SPEC has recently been issued (MIL-G-83528), establishing requirements for qualification and quality performance of conductive elastomer materials.[1]

MIL-G-83528 is a military specification which covers electrically conductive discrete particle elastomers used for EMI shielding gaskets. Originally written around commercial products available at the time it was issued, only one firm was initially able to meet the specification. More recently, additional firms have succeeded in conforming to the specification.

CONDUCTIVE ELASTOMER MATERIAL

This article describes a recently developed material which exhibits much less degradation of its volume resistivity by heat aging than specified in MIL-G-83528A. Many EMI elastomers have low volume resistivity initially, but at elevated temperatures the resistivity rises rapidly beyond MIL-G-83528A limits.



Curve A - Curve of Well-plated Filler which will Pass MIL-G-83528A.

Point B - MIL-G-83528A Specification Limit for Silver-plated Copper Material Before Heat Aging Test.

Point C - MIL-G-83528A Specification Limit for Volume Resistivity After 48 Hours at 156.25°C.

Curve D - Curve of New Cu/Ag Elastomer.

Figure 1. Results of Heating Aging Tests.

MIL-G-83528 specifies that the material be tested (Paragraph 4.6.15) for 48 hours at 1.25 times the maximum operating temperature (unflanged condition). For silver-plated copper material the maximum operating temperature is 125°C, which would yield 156.25°C. Some manufacturers state that the material is tested at 300°F, which is 148.9°C. Significantly different results can be obtained.

Volume resistivity tests on the new

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material were conducted per the MIL-SPEC using a digital ohmmeter and the pressure probe technique. The results of the heat-aging tests are presented in Figure 1.

TEST RESULTS

A material having lower initial volume resistivity and lower resistivity after heat aging will give significantly better shielding than presently available materials.

As illustrated in Figure 1, a silver-plated copper material meeting the MIL-G-83528A specification would have an initial volume resistivity of no more than 4 milliohms. After 48 hours at 156°C, the volume resistivity would have increased to no more than 10 milliohms.

The initial volume resistivity of the new material was 1.26 milliohms. The material remained at less than 10 milliohms for more than 96 hours, twice as long as required by MIL-G-83528A. This result is of considerable importance because, as stated, shielding effectiveness depends in large part on volume conductivity of the gasket material. For example, at a flange interface resistance of 1 milliohm, shielding is degraded by about 15 dB. At an interface resistance of 10 milliohms, 42 dB of shielding is lost. The overall interface resistance is composed of:

- the resistance between the cover flange and the EMI gasket;
- the gasket material volume resistivity; and
- the resistance between the enclosure flange and the gasket.

If the flanges are correctly prepared so that they present only small interface resistance, the shielding performance will depend mainly on gasket volume conductivity.

The new material had a Shore A durometer of 69. Other characteristics, such as shielding effectiveness and tensile strength, do not significantly vary from MIL-G-83518A specifications.

CONCLUSION

Since this material will withstand 96 hours at 156°C rather than the 48 hours specified in MIL-G-83528A, the material probably could be used at higher maximum use temperatures than any commercially available silver-plated copper material and still pass the MIL-SPEC. This is a significant advancement since silver-plated copper material offers better shielding effectiveness than other material types. Also, the new material appears to have a lower corrosion potential than conventional silver-plated copper materials and even less than silver-plated aluminum types. ■

REFERENCES

1. Chomerics Catalog. "Critical Issues," Woburn, MA.