Stakeholder contribution to renewal Exemption 7.a: lead in high melting temperature type solders

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1. The applicants requested the renewal of exemption No. 7a of Annex III with the same wording: “Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)". Should an exemption be granted it is to be added to Annex III of the RoHS Directive.
a. Do you agree with the scope of the exemption as proposed by the applicant?

Yes. Bosch Security Systems requests a prolongation for the RoHS-exemption 7a: lead in high melting temperature type solders

b. Please suggest an alternative wording and explain your proposal, if you do not agree with the proposed exemption wording.

This exemption should stay unchanged or alternatively the specific use in applications like could be added: lead in high melting temperature type solders used in high-power transducers (loudspeakers).

c. Please explain why you either support the applicant’s request or object to it. To support your views, please provide detailed technical argumentation / evidence in line with the criteria in Art. 5(1)(a) to support your statement.

Justification:

Problem

High power transducers (both low and high frequency) used for Professional Sound application are used with power amplifiers capable of producing output greater than 200V and 30 A. This amount of energy creates a significant amount of heat dissipated in the voice coil as shown in figure 1 below. The temperature profiles for these different low frequency transducers exceeding the melting point of the highest temperature Pb free solder in less than 100 seconds, this results in catastrophic failures. In addition the solder used must be compatible for copper and Aluminum wire.

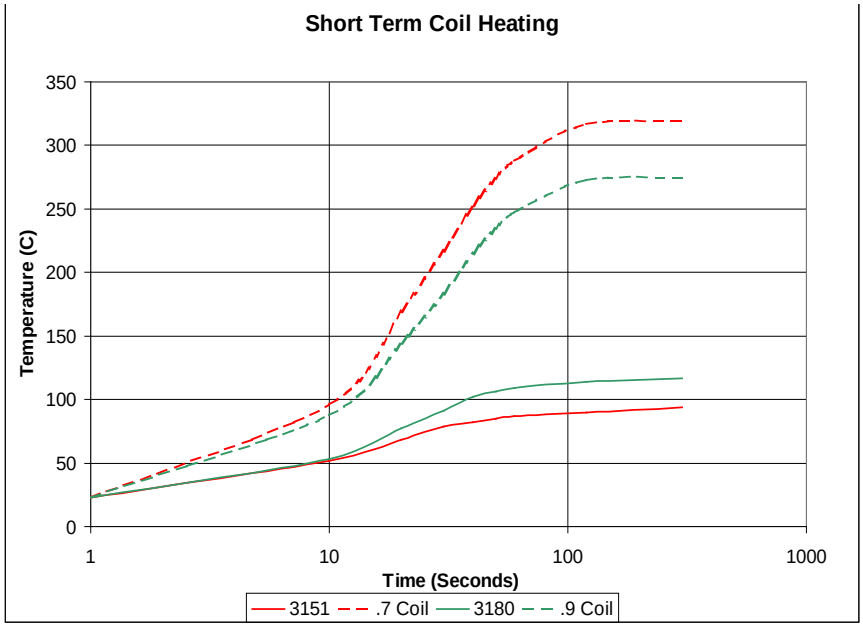

Figure 1

Why we cannot use connection techniques other than solder:

In our high power loudspeaker designs it is necessary to transition between a high flexibility, high cross sectional area conductor down to the very fine gauge wire used to make the coil of wire that provides the electromotive force to drive the transducer. These solder joints must be made in close proximity to the magnet wire coil of turns for a variety of reasons.

At the top of the coil, the end closet to where the diaphragm is connected. A primary reason for the proximity is structural integrity. The fine gauge magnet wire is often not able to withstand the high amounts of vibrational energy in the coil structure. This magnet wire can be Aluminum, Copper-clad Aluminum, or Copper. All of these magnet wires experience bending fatigue. If the solder joint is too far from the coil of magnet wire this lead out section of wire will mechanically fail due to highly repetitious bending modes. These fractures can create an electrical arc across the break in the wire that can ignite nearby materials.

Below the coil of wire there is simply not enough space to move the solder joint away. Adding more length would increase the depth of the permanent magnet circuit and even if that was feasible/possible we then would face even worse mechanical issues that at the other end of the coil. Since the support structure under the wire is only supported on one end the motion would be much greater.

This proximity in conjunction with the high temperatures of the magnet wire in the coil make HMP solder a necessity.

Current activities

New designs for low frequency transducers will move lead wire solder joints away from high temperature areas where non Pb solder can probably be used, but this approach has not been proven and is not applicable for high frequencies transducers. Non Pb solders are researched and tracked to see if they can be used, if there is possibility it can be used it will prototyped and tested. We do not think we can transition from Pb solder in the foreseeable future.

We need the exception extended

Although we started research two years prior to RoHS being required we have not discovered an alternative to the Pb based solder we currently use. Several our products using these transducers are sold in Europe and are used in large installations including stadiums (World Cup stadiums for last four series use Electro Voice product), they have EN54 certifications for life safety applications.

Pictures of the Application

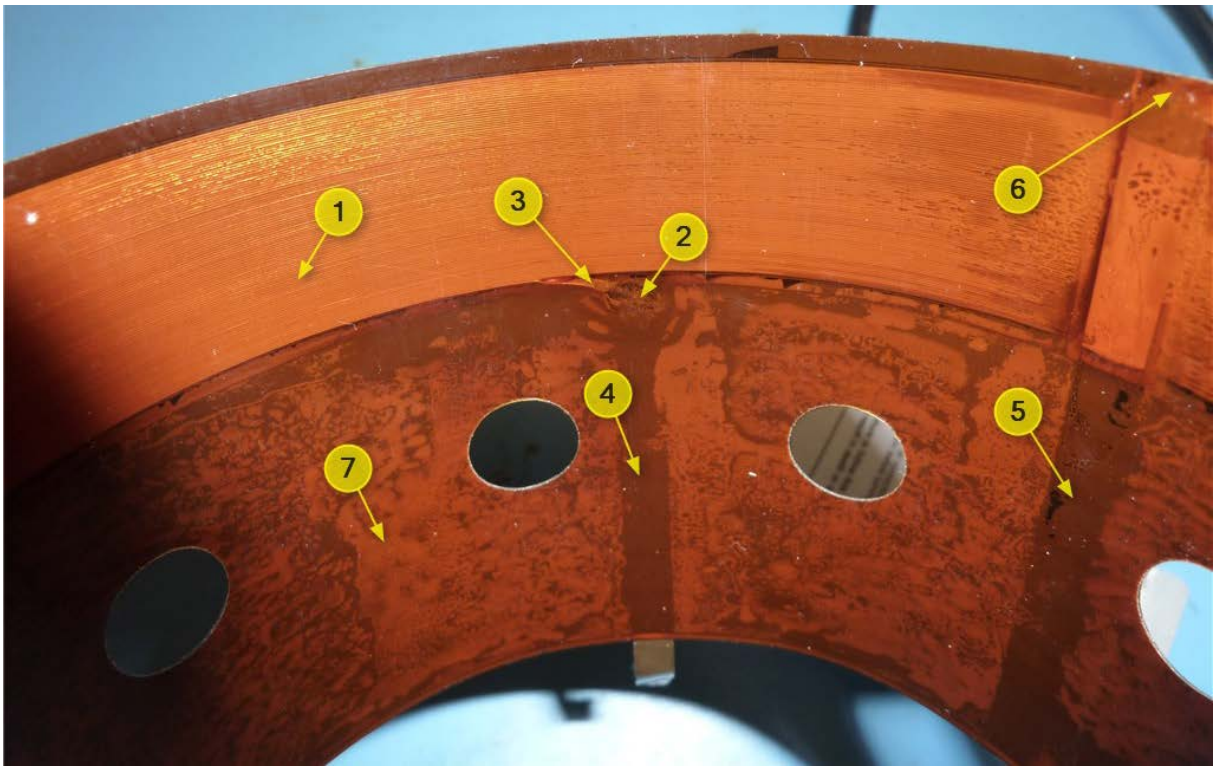

Image of the inner diameter of a typical high power woofer voice coil.

In this image;

1) Shows the coil of magnet wire. Visible through the coil bobbin (item 7).
2) The Upper solder joint. This joint is layered between the bobbin (7) and another high temperature resistance electrically insulating polymer. The magnet wire (3) is soldered to the flexible conductor (4) with HMP solder.
3) The magnet wire splitting off the coil (1) to go to the upper solder joint (2)
4) .1mm x 6mm flexible conductor (e.g. Phosphor Bronze.)
5) Same as 4 but extending under the coil of wire to make Lower Solder Joint (6)
6) The Lower Solder joint. This joint is layered between the bobbin (7) and a high temperature resistance adhesive. The magnet wire (3) is soldered to the flexible conductor (5) with HMP solder.
7) Bobbin – High temperature resistance polymer (e.g. Polyimide film)

Image of the Outer Diameter of a typical high power woofer voice coil.

In this image you can see the black area which is the high temperature adhesive that overcoats the Lower Solder Joint and the magnet wire as it splits away from the coil of wire.