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# 1st Questionnaire (Clarification Questionnaire) Exemption No. 37 (renewal request)

## Exemption for „Lead in the plating layer of high voltage diodes on the basis of a zinc borate glass body“

### Acronyms and Definitions

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| HVD | High voltage diode(s) |

### Background

The Oeko-Institut and Fraunhofer IZM have been appointed within a framework contract[1] for the evaluation of applications for the renewal of exemptions currently listed in Annexes III of the new RoHS Directive 2011/65/EU (RoHS 2) by the European Commission.[1]

GE et al. submitted a request for the renewal of the above mentioned exemption, which has been subject to a first evaluation. The information you have referred has been reviewed and as a result we have identified that there is some information missing and have formulated a few questions to clarify some aspects concerning your request before we can start the online consultation.

Please answer the below questions until 27 August 2015 latest or otherwise let us know until when you can provide the requested information.

### Questions

1) You indicate the use of lead under this exemption with a small share of the 350 kg of lead used in glass. Please provide a rough calculation to substantiate this statement.

   Answer:
   We indicated we were a small fraction of the ~350 tons (not kg) from exemption 7(c)-I which was an “extremely worst case estimation”.

   We estimate the overall amount of lead in the plating of HVDs to less than 0,4 kg per year (annual production worldwide).

   Rough calculation as follows:
   Weight of plating (terminal finish) of such a diode is about 3mg. Lead content in this plating is around 2000ppm. This accounts to about $6x10^{-3}$ mg i.e. $6x10^{-9}$kg lead in the terminal finish per diode.

[1] Contract is implemented through Framework Contract No. ENV.C.2/FRA/2011/0020 led by Eunomia

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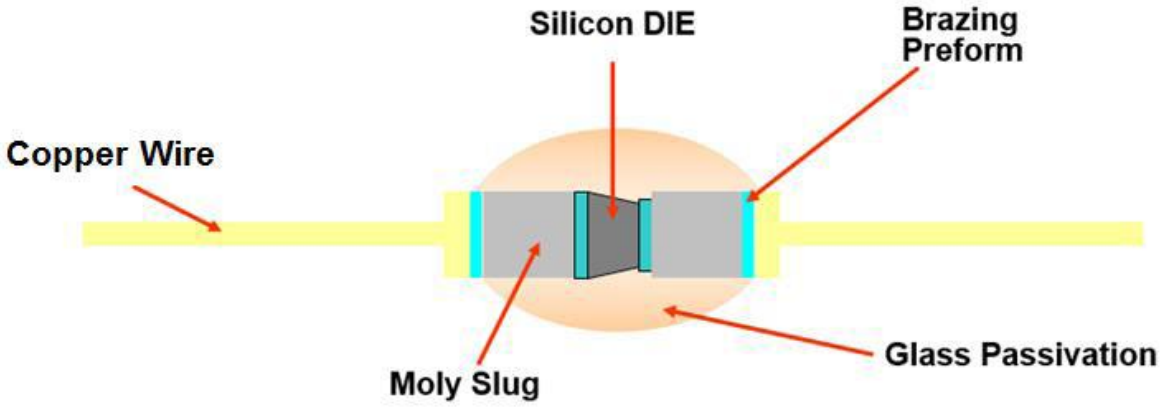
Assumption: 60 million pieces annual usage of such diodes worldwide (estimated from the known run-rate of a component manufacturer and its estimated share of world market)

→ 60 million pieces x $6x10^{-9}$kg lead ~ 0,36kg lead per year worldwide

2) Please provide a cross-section of an HVD showing the construction/design and indicate/explain the various materials or material layers.

Answer:
Please find below a cross-section drawing of such a HVD and description of the various components / materials.




3) Please explain the production process of HVD.

Answer:
A silicon chip is alloyed between two moly slugs which are brazed to copper wires. A glass bead is formed around the chip and the Mo slugs. Finally the wires are plated.

4) How can high voltage diodes be differentiated from other diodes that are not “high voltage” and therefore do not require this exemption?

Answer to Q4:
Difference of those special HVD compared to “conventional” diodes is the special “glass bead design”. The glass bead serves as both package and passivation. “Conventional” diode layout is a diode chip soldered between plugs or leadframes embedded in a moulded package. Major features of such HV diodes are

- Those HV diodes can be built up to breakdown voltages of several kV which cannot be achieved using “conventional” diode packages
- The special “glass bead” design of those diodes provides hermetical sealing of the chip i.e. that package.

5) Does exemption 7c-I fully cover the scope of exemption 37? In other words, could exemption 37 be included into 7c-I?

Answer:

- Considering formal wording of 7c-1 and 37 we interpret that 7c-1 does not cover the scope of exemption 37 because 7c-1 deals with "Pb in glass and ceramics" and 37 deals with migration from Pb in glass to "Pb in tin plating" during the plating process.
- Additionally, changes to the exemption numbering scheme would be difficult to manage by suppliers, OEMs and tool sets.

HOWEVER

- exemption 37 is **STRICTLY LINKED** to exemption 7c-1. Lead content in the whole part is the same before and after plating. But lead is transferred during the plating process from the glass body to the terminal finish.

6) Please provide information on research and results of lead-free materials or alternative processes related to the above requested exemption that were conducted since the first and last review of the exemption in 2007[2] in order to achieve RoHS compliance.

Answer:

Experiments with various glass types without lead have been conducted in cooperation with glass suppliers. Eliminating lead in the glass would then also eliminate contamination of the plating. All attempts failed. Major problems which occurred by using glass types without lead were:

- bubbles and voids in the glass which can lead to sparks, i.e. shorts along the chip junction
- cracks in the glass
- poor electrical characteristics due to high leakage currents

7) Besides substitution, elimination, i.e. the use of alternative technologies, is a principle way to avoid the use of lead, e.g. via a redesign of electronic circuits so that these HVD are no longer required, or any other means. What is the electrical/electronic function of HVD, and are there ways to eliminate their use?

Answer:

HVDs are used in high voltage power supplies, inverters, converters and freewheeling diode applications. We believe there will always be a need for HVDs.

**Please note that answers to these questions are to be published as part of the available information relevant for the stakeholder consultation to be carried out in the course of the evaluation of this request. If your answers contain confidential information, please provide a version that can be made public along with a confidential version, in which proprietary information is clearly marked. Please take into account that any**

[2] (Carl-Otto Gensch, Stéphanie Zangl, and Otmar Deubzer 2007) "Adaptation to scientific and technical progress under Directive 2002/95/EC: Final report," Öko-Institut e.V. (Freiburg), accessed August 11, 2015, http://ec.europa.eu/environment/waste/weee/pdf/rohs.pdf, page 58 et sqq.

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**recommendation on the continuation or revocation of exemption can be based on publicly available information only.**

## 1. Bibliography

(Gensch, Carl-Otto, Stéphanie Zangl, and Otmar Deubzer 2007) "Adaptation to scientific and technical progress under Directive 2002/95/EC: Final report." Accessed August 11, 2015. http://ec.europa.eu/environment/waste/weee/pdf/rohs.pdf.

## *Response to Fraunhofer Institut 1st Questionnaire*

**Name and contact details of responsible person for this application & response:**


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|---|---|---|---|
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**This response is to the 13 August 2015 questionnaire is submitted on behalf of myself and the participating industry associations and companies listed below.**

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|---|---|---|---|
| | | **Information Technology Industry Council (ITI)**<br>ID Number : 061601915428-87 | **DIGITALEUROPE**<br>ID number: 64270747023-20 |
| **IPC – Association Connecting Electronics Industries** | **Avago Technologies Ltd.** | **European Passive Components Industry Association (EPCIA)**<br>ID number:<br>22092908193-23 | **ZVEI - German Electrical and Electronic Manufacturers´ Association**<br>ID number: 94770746469-09 |
| | **European Committee of Domestic Equipment Manufacturers (CECED)**<br>ID number: 04201463642-88 | **European Semiconductor Industry Association (ESIA)**<br>ID Number:<br>22092908193-23 | **European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry (COCIR)**<br>ID number: 05366537746-69 |

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