Name and contact details of responsible persons for the application and response

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The response to the 12-August-2015 Oeko-Institute questionnaire is submitted on behalf of the participating industry associations and companies listed below:

Avago Technologies Limited		**IPC-Association Connecting Electronics Industries**	
Communications and Information network Association of Japan (CIAJ)		**Japan Business Council in Europe (JBCE)** ID: 68368571120-55	
DIGITALEUROPE ID: 64270747023-20		**Japan Business Machine and Information System Industries Association (JBMIA)** ID: 246330915180-10	
European Committee of Domestic Equipment Manufacturers (CECED) ID: 04201463642-88		**Japan Electrical Manufacturers´ Association (JEMA)**	
European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry (COCIR) ID: 05366537746-69		**Japan Electronics and Information Technology Industries Association (JEITA)** ID: 519590015267-92	
European Copper Institute (ECI) ID: 04134171823-87		**Knowles**	
European Garden Machinery industry Federation (EGMF) ID: 82669082072-33		**LIGHTINGEUROPE** ID: 29789243712-03	
European Partnership for Energy and the Environment (EPEE) ID: 22276738915-67		**Littelfuse**	
European Passive Components Industry Association (EPCIA) ID: 22092908193-23		**Orgalime, the European Engineering Industries Association** ID: 20210641335-88	
European Power Tool Association (EPTA) ID: 85810161889-67		**WirtschaftsVereinigung Metalle (WVM)** ID: 9002547940-17	
European Semiconductor Industry Association (ESIA) ID: 22092908193-23		**ZVEI - German Electrical and Electronic Manufacturers´ Association** ID: 94770746469-09	
Information Technology Industry Council (ITI) ID: 061601915428-87			

1st Questionnaire Exemption No. 6c (renewal request)

Exemption for „Copper alloy containing up to 4 % lead by weight“

Abbreviations and Definitions

EEE Electrical and Electronic Equipment

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]

PHOENIX Contact GmbH&Co. KG and HARTING KGaA have 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.

Questions

1. Please specify the applications for which PHOENIX Contact GmbH&Co. KG and HARTING KGaA request the exemption for:
    a. Please describe the type of components that are manufactured of leaded copper alloys by PHOENIX Contact GmbH&Co. KG and HARTING KGaA.
    b. In which Electrical and Electronic Equipment (EEE) are these components used?
    c. Please provide an exhaustive list of applications for EEE made from leaded copper alloys for which the exemption is needed.
    d. Is the requested exemption also relevant for components manufactured by other companies (i.e., from the stakeholders supporting your exemption, do some represent other suppliers of such components or are you aware of other suppliers which shall benefit from the renewal of the exemption)?

…We request renewal for the existing RoHS Exemption 6(c) wording "Copper alloy containing up to 4% lead by weight" for categories 1 to 7, 10 and 11 of Annex I for an additional validity period of 5 years. For these categories, the validity of this exemption may be required beyond this timeframe.…

We apologize the misunderstanding that seems to exist on the scope of the renewal request. The extension of exemption 6c was requested on behalf of a very high number of stakeholders as shown by the endorsing organisations. Jürgen Husemann and Michael Müller are only the contact persons. Thus the renewal request should not be understood in a way that it would cover only products of Phoenix Contact GmbH & Co. KG and HARTING KGaA.

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

In this view, questions 1 a - d can unfortunately not be answered in an exhaustive way. In electrical and electronic industry there is no common database on the chemical composition of single parts. In addition the diversity of products is very high as RoHS covers diverse types of EEE and their components. These components are used in different industries with different requirements, organisations and structures. The consequence of this situation is that it is not possible to provide a list of components or equipment that contains leaded copper alloys.

As already the diversity of products with leaded copper alloys is high, the number of requirements on the components is even higher. As shown in article 5 of RoHS, all EEE have to be safe and reliable. Often several legal requirements are applied to the products. In addition a much higher number of standards have to be fulfilled by the equipment. Here a high variety of requirements exists for the different product types.

This can be exemplified for E-Mobility plugs. Here DIN EN 62196-1 can be applied. This standard gives minimum values for contact and withdrawal forces. They are of very high importance for safety and usability of the plug. The fulfilment of these requirements cannot be deduced from general or tabulated terms. This is only one example for a requirement that is specific for one product type while for other product types other specific requirements exist. Due to the high number of applications this can unfortunately not be generalised.

In most cases the component manufacturer choses the material due to the characteristics required for the specific component. The EEE manufacturer uses this component to build the EEE. As in the supply chain often several stages between the component manufacturer and the EEE manufacturer exist the component manufacturer often does not know in which applications the component is used. On the other hand the EEE manufacturer normally does not know for which specific reasons the component manufacturer choose the material as this is the specific know-how of the component manufacturer.
As one of many examples this can be explained very well on the phenomenon of machinability. The component manufacturer choses a specific material because with the technology that is state of the art and that is available for the component manufacturer the specific component can be manufactured very well from this material. However for the manufacturer of the finished EEE the machinability may not be the key issue as it buys the already machined component and checks other requirements on this component.
Thus there are manifold reasons why leaded copper alloys are chosen as material for EEE and their components. Due to the high complexity of the supply chain and the decisions that result in the choice of a specific material it is unfortunately not possible to identify or even estimate the applications that use leaded copper alloys.

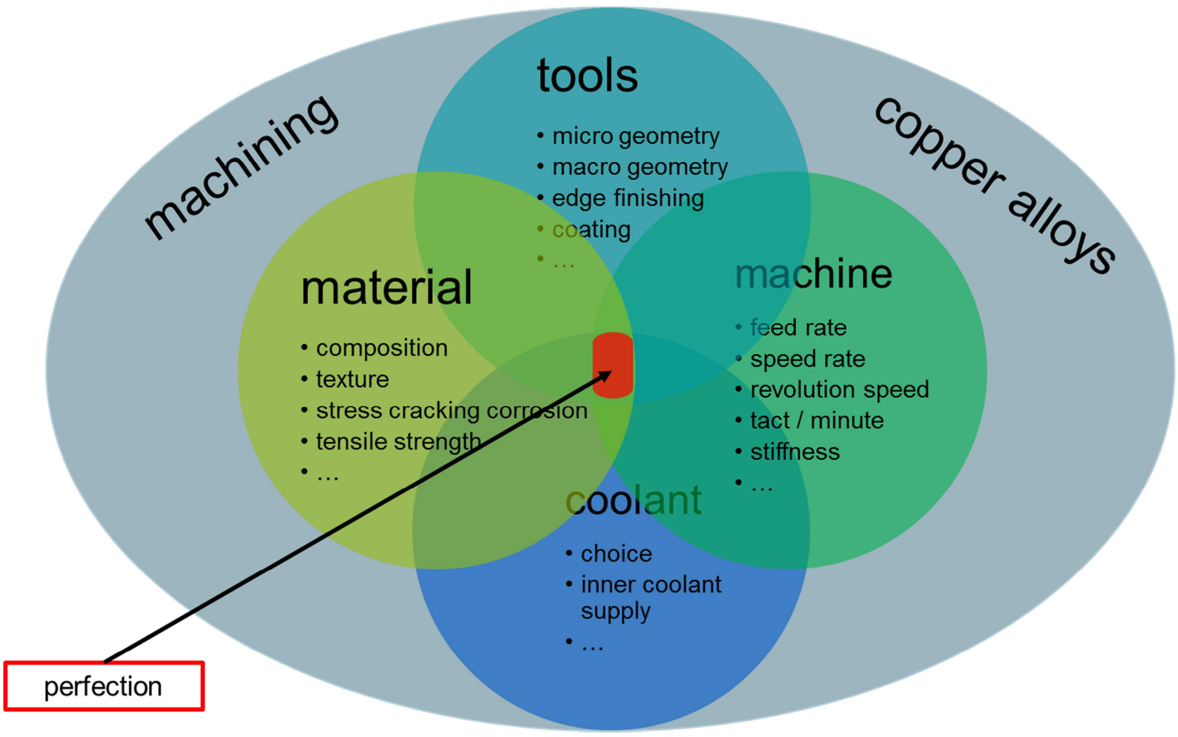
2. Please detail the technical properties /qualities that are provided by lead which are of importance for each application.
   As for machinability, please specify which machining processes are applied and specify where the absence of lead would affect the efficiency of the machining process.

As shown in the renewal request the importance of technical properties depends on the application. Even for similar applications this importance can strongly differ. Thus an answer for each application can unfortunately not be given. For several applications the technical properties are described in the renewal request.
Every macroscopic property has a microscopic reason. While for some macroscopic properties like

the chip form the microscopic reasons are well understood this is not the case for many other properties. There is more research necessary to understand the technical properties that are provided by the addition of lead. The user of the copper alloys is normally not able to make research on the microscopic properties of a material

For machinability it was shown that so called micro-machining, e.g. the drilling of small diameter holes, is not possible for the available lead-free copper alloys. For bigger parts there are several other requirements like surface quality whose requirements depend on the specific application. In addition also for bigger parts often micro-machining is required.

For the use normally not one isolated property of the material is recognised but it is a combination of different properties. It depends on a further combination of different variables if these properties are acceptable for the use. For example the machinability is not one isolated property but it depends on material, tool, coolant, machining technology and of course of the part that is to be made. Thus the change of one parameter also causes changes in the other parameters. This can cause further consequences like negative environmental impacts due to the use of lubricants or higher energy consumption. Picture 1 illustrates the complexity the machining process:



Picture1: Different parameters that have to be recognised for the machining.

3. You summarize different research efforts for substitution and elimination. Please summarize the testing efforts with lead free copper alloys in table form, providing relevant properties /qualities for the applications at hand and clarifying where substitutes failed.

Nearly all of the stakeholders endorsing the application on RoHS exemption 6c are not basic material producers. Thus they do not have the possibility to develop a material. Electrical and electronic industry can communicate requirements to the material producers but it cannot develop a material by itself. Thus what was done is tests on all available lead-free copper alloys. As shown above, the number of applications is much too high for first tests being application-specific. Thus basic requirements have been chosen that have to be fulfilled. Unfortunately so far none of the available lead-free copper alloys showed sufficient behavior in this basic research. The results are shown in the renewal request.

4. You mention as application example bearings and bushes. Bearings and bushes are covered by the RoHS exemption 9b that specifies the application as follows: "*Lead in bearing shells and bushes for refrigerant- containing compressors for heating, ventilation, air conditioning and refrigeration (HVACR) applications*". In the 2008 review, Ex. 9b was formulated as "Lead in lead-bronze bearing shells and bushes", however the scope of the exemption was limited to HVACR applications as a result of the review for which it was understood that additional time was needed for the phase-in of substitutes. In the meantime, exemption 9b has also been requested for renewal for a further 3 years explaining that this period is required to allow substitutes to be tested to establish reliability. Against this background it is assumed that for other than HVACR applications, substitutes became available as early as 2008, whereas bearings and bushes for HVACR applications would fall under 9b.

    a. Do you refer to HVACR applications or to other applications?

    b. Please explain the application of leaded copper alloys for bearings and bushes intended for EEE in more detail.

It is known that for special bearing shells and bearing linings exemption 9b is applicable. For these components often copper alloys with a lead content higher than 4% are used (lead bronze). At the moment for these or similar applications it is not possible to completely switch to lead-free materials. A reduction of the lead content can be possible in particular cases in the future. The possible applications of leaded copper alloys for bearings, bushings and similar components in EEE are quite diverse thus no exhaustive overview is available.

5. Please explain why information on the amount of lead applied per year in copper alloys is not available at PHOENIX Contact GmbH&Co. KG and HARTING KGaA. Is it possible to provide an estimation e.g. via the number of components, their average size and the average lead share within the alloy manufactured by PHOENIX Contact GmbH&Co. KG and HARTING KGaA?

As shown in answer 1 it is unfortunately not possible to identify exhaustively the components and EEE that use leaded copper alloys. As consequence the amount of lead per year cannot be calculated. An estimation based on the data of only two companies would not reflect the situation of the E&E-industry.

6. It can be understood that common characteristics can be specified to groups of applications for which lead-free copper alloys cannot be applied, such as machinability requirements (understood to be relevant for components with smaller size and more complex shapes); corrosion resistance, etc. To reflect the type of applications for which the exemption is still needed (or the type of properties of relevance for articles in which substitutes cannot be applied):

a. Is it possible to characterize the applications of leaded copper alloy in remaining applications on the basis of (small) dimensions, design complexity or other dimension and form characterisations?

Machinability is probably the mostly known characteristic of leaded copper alloys. But as the research and tests on the use of lead-free copper alloys for EEE showed there are several other properties that are for specific applications even more important. In a very simplified way it can be said: "Machinability is important to produce a product that looks like the intended product. For the product working in the intended way, many other properties have to be given." This was shown by examples of electrical conductivity, relaxation, crimp ability, etc. Thus unfortunately the use of leaded copper alloys cannot be limited to small articles or articles with a less complex shape. First it cannot be generalized that "big" articles would not need micromachining. Second there are many other requirements in addition to machining that may make the use for small as well as bigger components impossible.

b. Could the exemption be further specified by adding a size/weight threshold e.g. such as "Copper alloy containing up to 4% lead by weight in parts with a weight below XXX gr or in parts with a volume below XXX mm3.

As shown in answer 6a this is unfortunately not possible. From the weight or size of a part it cannot be followed if lead-free copper alloys can be used.

c. Could the exemption be further specified by detailing the unique properties achieved through the addition of lead and by specifying a performance threshold above or below which lead would be needed?

For leaded and lead-free copper alloys the machinability index is available as a first hint on the machinability. It was shown by RWTH Aachen and in the renewal request that this index is only a first hint. That index has four differently weighted criteria and it depends strongly on the use. For the other possibly required characteristics there is no index. Thus a "performance threshold" is not available for copper alloys and it cannot be provided. As the required properties depend on the use of the alloy it cannot be generalised.

7. You state that "*Furthermore leaded brass is to nearly 100% made from recycled material. Without exemption 6c copper alloys for electric and electronic equipment could not, as it is common today, easily be made from recycled copper alloys. Thus the urban stock which is one of the most important sources for copper in Europe could not be used as it is possible today.*"

d. To support this statement, please provide data regarding the global supply and demand of copper in general and more specifically of recycled copper;

The global supply of refined copper in 2014 is ca. 22 Mt in ratio of ca. 18 Mt primary to ca. 4 Mt secondary (source http://www.icsg.org/index.php/component/jdownloads/finish/165/871).

e. Furthermore, please also provide data regarding the global or EU relevant amounts of copper alloys in general and more specifically leaded-copper alloys required per annum for the manufacture of EEE.

The supply for copper alloys of the 4 biggest regions (China, US, EU, Japan) in 2014 is ca. 5 Mt. The EU supply of copper alloys in 2014 is ca. 1.6 Mt (source http://www.coppercouncil.org/prod1.aspx).

The yearly production of leaded brass in Europe for all sectors is ca. 800 000 t and there are millions of tonnes in the urban stock.

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 as part 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.