Consultation 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
LEU	LightingEurope

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]

The following applicants have submitted requests for the renewal of the above mentioned exemption.

Dunkermotoren GmbH request the exemption for:

> Blei als Legierungselement in Kupfer-Zink-Legierungen für Bearbeitungszwecke mit einem Massenanteil von höchstens 1 % Blei für Verzahnungsteile für weitere 5 Jahre.

Five applications were made requesting a renewal of the exemption with the same wording by:

- Bourns, Inc.
- Framo Morat
- LightingEurope;
- PHOENIX Contact GmbH&Co. KG and HARTING KGaA
- Sensata Technologies

A further application submitted did not fulfil the minimum requirements of applications for exemptions stipulated in Annex V of the Directive and shall not be evaluated as such, though the applicant can still make a contribution as part of the stakeholder consultation.

The applications have been subject to a first completeness and plausibility check. The applicants have been requested to answer additional questions and to provide additional information that shall be made available on the request webpage of the stakeholder consultation (http://rohs.exemptions.oeko.info/index.php?id=228).

Mechanical moving components – gears

The applicant Dunkermotoren explains that worm / planetary customised gear units (“*Schnecken- Planeten- Sondergetriebe*”) snail gears (“*Schneckenräder*”), helical gears (“*Schraubräder*”), external and internal geared spur gears (“*außen- und innenverzahnte Stirnräder*”) and parts for engine

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

components ("*Motorenteile*") are manufactured from leaded copper alloys with a lead content of less than 1 % by weight.

Dunkermotoren explain lead to be needed for improved machinability and for improved sliding / friction ("*Gleiteigenschaften*") properties;

Both applicants state that they have tested lead free alternatives, whereas it is understood that Dunkermotoren has already identified an alternative material candidate, which is currently still being tested.

Other components

According to the applicant Bourns Inc., leaded copper alloys are needed for brass shafts and bushings "*other brass applications*". Bourns Inc. explain that the leaded copper alloy can be processed precisely and fast in the screw machines. Besides, lead provides corrosion resistance.

The applicant PHOENIX Contact GmbH&Co. KG and HARTING KGaA indicate contact spring legs, crimp contacts and also gear pinions as applications of leaded copper alloys. PHOENIX Contact GmbH&Co. KG and HARTING KGaA generally refer to the following functions of lead as chip breaker, internal lubricant, increase of corrosion resistance, prevention of cracks, but specify the following characteristics for the following components:

- a high relaxation behaviour achieved with leaded copper alloys reduces the contact forces in spring contacts;
- a higher ductility achieved with leaded copper alloys prevents cracks in crimp contacts;
- in mechanical connecting parts such as e.g. gears, it is claimed that wear resistance is achieved through the use of leaded copper alloys;

Sensata does not specify the components for which the exemption renewal is requested and generally refers to the function of lead in all alloys covered under exemption 6 (steel, aluminium and copper) such as improved "*micro-machining, electrical conductivity, galvanic corrosion resistance, mechanical relaxation, tribological behaviour etc.*".

LightingEurope requests the exemption for contact-pins of various lamps. LEU state that the presence of lead results in a higher ductility of the copper-alloy pins. On the other hand LEU state that lead free alloys are already available on the market by one supplier, raising concern that the current supply would not be able to satisfy the present demand of the market.

Whereas Sensata Technologies and Bourns Inc. did not specify own substitution efforts, PHOENIX Contact GmbH&Co. KG and HARTING KGaA summarized research performed by RWTH Aachen[2] on less favourable machining properties of CuZn42 and CuZn21Si3 alloys.

For details, please check the applicant's exemption requests at:
http://rohs.exemptions.oeko.info/index.php?id=243

The objective of this consultation and the review process is to collect and to evaluate information and evidence according to the criteria listed in Art. 5 (1) (a) of Directive 2011/65/EU (RoHS II), which can be found under:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32011L0065:EN:NOT

[2] Lung, D.; Nobel, C.; Klocke, F. (2013): Entwicklung einer Hochleistungszerspanung für schwerzerspanbare bleifreie Kupferknet- und -gusslegierungen : Schlussbericht der Forschungsstelle(n) Nr. 1, Werkzeugmaschinenlabor (WZL) der RWTH Aachen; http://publications.rwth-aachen.de/record/230384

If you would like to contribute to the stakeholder consultation, please answer the following questions:

Questions

1. Some applicants have requested the renewal of Ex. 6c of Annex III, with the same wording formulation. The applicant Dunkermotoren have requested the renewal of Ex. 6c, however indicate that a lower threshold for the lead content of <1% by weight would also be feasible.

    a. Please specify with which of the proposed formulations you agree. Neither
    b. Please suggest an alternative wording and explain your proposal, if you do not agree with one of the proposed exemption wording. We agree with a lower threshold than the current 4.0 %, but we feel the value should be 2.5% to allow the continued use of UNS C35300 leaded brass alloy
    c. Please explain why you support or object the various proposals. To support your views, please provide detailed technical argumentation / evidence in line with the criteria in Art. 5(1)(a). We feel the exemption needs to be extended at some level of lead because there simply are not viable alternative materials at this time.

2. Please describe in which applications leaded copper alloys are used in EEE.

    a. Please provide an exhaustive list of applications and describe their typical characterisations. PennEngineering is a designer and manufacturer of specialty fasteners. See our product literature at the link below for an overview of our product. In particular, see bulletin K for fasteners used in EEE and see bulletin SI for our highest volume brass fasteners

    http://www.pemnet.com/comp_lit_files/

    b. Please specify the functionality of lead in these applications (e.g. specific function and properties, performance criteria, etc.). The majority of our brass parts have geometry which cannot be produced by forging. These brass parts are machined from leaded brass bar on multi-spindle automatic screw machines or single spindle CNC lathes. Leaded brass offers the following advantages in our machining environment.
        - ○Significantly longer tool life leading to higher efficiency (less downtime)
        - ○Better surface finish
        - ○ Significantly higher surface speed
        - ○ Significantly higher feed rate

    c. As for machinability, please specify which machining processes are applied and specify where and how the absence of lead would affect the efficiency of the machining process. Machining processes we use include the following:
        - ○Turning
        - ○Drilling
        - ○ Knurling (straight, diagonal and diamond)
        - ○ Form tapping
        - ○Cutoff

    Absence of lead would have a negative effect on all of the above machining operations, but from our experience would be most significant on drilling and form tapping.

3. Please indicate how much lead would be used under these applications per annum. If data is not available, please provide estimations for the EU market. We currently use combined total of approximately 420,000 lb of leaded brass alloys 353 (UNS C35300) and 360 (UNS C36000) per year. Nominal lead content is 2.0 % for 353 alloy and 3.1 % for 360 alloy. Using properly weighted lead amounts for each alloy this is approximately 8,500 lb of lead per year. This amount is global, we estimate that approximately 25 % of our sales of leaded product goes to EEE in the EU

4. Are there technical developments that allow a further reduction of lead? Can the limit of 4% be reduced for the full application range or for a certain application group? If not, please explain why this is currently technically or scientifically impossible / impracticable. In our brass machining environment we have found 353 to be an acceptable alternative to 360 brass and therefore we support lowering the exemption value from 4.0 % to 2.5 %.

5. Please provide information concerning possible substitutes or developments that may enable reduction, substitution or elimination, at present or in the future, of leaded copper alloys:

    a. In this regard, please clarify for alternatives if they would be applicable to the full range or only to part of the application range of leaded copper alloys in EEE.
    b. Please provide quantitative data as to application specifications (performance indicators relevant to various properties) to support your view.

    We have experimented with lead free ECO brass and found it to machine significantly worse than 353 leaded brass.

6. Please provide information as to research initiatives which are currently looking into the development of possible alternatives for some or all of the application range of leaded copper alloys:

    a. Please explain what part of the application range is of relevance for such initiatives (in what applications may substitution be possible in the future).
    b. Please provide a roadmap of such on-going research (phases that are to be carried out), detailing the current status as well as the estimated time needed for further stages.
    As a fastener supplier development of new free machining brass grades is outside of our capability. However, we do monitor the industry and try new grades when they become commercially available in the small bar sizes we use.

7. It can be understood that the following properties are of importance in applications for which leaded-copper alloys are used at present, or for the manufacture of such applications:

- In manufacture of applications where machinability is of importance:
  - ductility properties;
  - lubrication properties;
  - chipping properties;
- In the use of applications:
  - Ductility properties;
  - Corrosion resistance properties;
  - Lubrication properties;

a. Please confirm that this list is exhaustive, or alternatively clarify what additional properties are of relevance for applications of leaded copper alloys; For threaded inserts installed into plastic with heat, the high thermal conductivity of brass is important. Brass facilitates quick cooling so the adjacent plastic solidifies before the insert moves from the desired position and orientation.

   Also, for applications in which a fastener serves as an electrical conductor, electrical conductivity of brass is an important attribute. Although conductivity varies greatly with the copper alloy, the 353 and 360 alloys we use are rated at 26.1% IACS which gives them a nearly three-fold advantage over steel fasteners rated at only 9.9% IACS. Brass offers a very significant advantage over the stainless steel alloys we use which are rated at 3% IACS or less.

b. For each property please specify what performance is required so that it is clear how to compare between possible substitutes and leaded copper alloys – i.e. for each property please indicate a performance indicator as well as the acceptable level of performance that needs to be exhibited by substitutes; For our product, values for these parameters are not established.

c. Please indicate if there exist interrelations between certain properties and if these would impact the range of acceptable performance; No input

d. Please if the exemption formulation could be adapted to reflect the need for these properties in relevant applications and propose a formulation respectively; No input

   Overall comment on question 7: In our case we elect to use brass material for some fasteners for one of the following three reasons:
   - Higher thermal conductivity than stainless steel
   - Better corrosion resistance than steel when both are unplated
   - Higher conductivity than steel or stainless steel

8. Are there any other aspects you deem to be of importance for the requested exemption?

If the exemption is modified or eliminated we respectfully request the maximum transition period currently allowed by the EU RoHS Directive of 18 months. If possible, we request an even longer transition period. Most of our leaded brass fasteners are commercial off the shelf items sold through distribution. There is currently inventory of brass fasteners with up to 3.7 % lead (UNS C36000 maximum lead content) in the distribution channels that will be unacceptable to the vast majority of our customers if it is no longer RoHS compliant by exemption. Our customers will stop accepting non-complaint product many months before it becomes non-complaint in order for them to build their product and place it on the market before the exemption expiration date.

In case parts of your contribution are confidential, please clearly mark relevant text excerpts or provide your contribution in two versions (public /confidential).

Finally, please do not forget to provide your contact details (Name, Organisation, e-mail and phone number) so that Oeko-Institut/Fraunhofer IZM can contact you in case there are questions concerning your contribution. Please also note, however, that requested exemptions cannot be granted based on confidential information!

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