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Consultation Questionnaire Exemption No. 6(b)-II

Exemption for „Lead as an alloying element in aluminium for machining purposes with a lead content up to 0,4 % by weight“

Abbreviations and Definitions

Al	Aluminium
EEE	Electrical and Electronic Equipment
Pb	Lead
RoHS	Directive 2011/65/EU on the Restriction of Hazardous Substances in Electrical and Electronic Equipment
UP	Umbrella Project

Background

The Oeko-Institut has been appointed by the European Commission, within a framework contract[1], for the evaluation of applications for exemption from Directive 2011/65/EU (RoHS), to be listed in Annexes III and IV of the Directive.

COCIR, HARTING Stiftung & Co and Pepperl + Fuchs AG on behalf of the “RoHS Umbrella Industry Project” (hereafter referred to as “Umbrella Project”) have submitted a request for the renewal of the above-mentioned exemption, which has been subject to an initial evaluation. A summary of the main argumentation for justifying the request is provided below. The applicants have been requested to answer additional questions and to provide additional information, available on the request webpage of the stakeholder consultation (https://rohs.exemptions.oeko.info/index.php?id=357).

For further details, please check the exemption request and additional information submitted by the applicants on the request webpage of the stakeholder consultation.

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 2), which can be found under:

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

If you would like to contribute to the stakeholder consultation, please review the summary of the argumentation provided and answer the questions that follow.

[1] The contract is implemented through Framework Contract No. ENV.B.3/FRA/2019/0017, led by Ramboll Deutschland GmbH.

1. Summary of argumentation of applicant on the justification of the exemption

1.1. Background

The Umbrella Project, represented by COCIR, HARTING Stiftung & Co and Pepperl + Fuchs AG, applies for the renewal of exemption 6(b)-II of Annex III of the RoHS Directive with its current wording:

> „*Lead as an alloying element in aluminium for machining purposes with a lead content up to 0,4 % by weight*"

The Umbrella Project summarizes that lead in aluminium alloys improves machinability by acting as a lubricant. Through the presence of lead, better chip fracturing and surface finish as well as higher cutting speeds and a longer tool life are achieved. However, in the answer on the clarification questions, the Umbrella Project points out that the renewal request is mainly based on the 3rd criterion of Art. 5 (1) (a) claiming that the total negative environmental, health and consumer safety impacts caused by substitution with bismuth are likely to outweigh the total environmental, health and consumer safety benefits thereof. The Umbrella Project requests the applicability of the exemption for the categories 1 to 10.

1.1.1. Volume of lead to be placed on the EU market through the exemption

The applicant does not specify the volume of lead to be placed on the EU market through the exemption.

Rather the applicant provides estimates that are based on general considerations on the European Al production and the share thereof for industrial sectors. . The Umbrella Project estimates an annual amount of lead of about 90 tonnes, however stating that this is lead in Aluminium which is not recycled. [2] The The Umbrella Project states generally that only a very low amount of leaded aluminium is still required for some niche applications.

1.2. Technical description

The Umbrella Project states that leaded aluminium is still required for some so called "niche" applications but on the other hand that an exhaustive list of applications cannot be provided due to the diverse nature of the end products which utilise components with leaded aluminium.

The applicants explain the required use with technical characteristics that relate in part to manufacturing and in part to the manufactured components:

- Micro-machining;
- Electrical conductivity;
- Galvanic corrosion prevention;
- Corrosion resistance against e.g. chemicals;

[2] "*In Europe about 7,7 million tonnes of Aluminium were produced in 2018. Assuming that about 4,5 million tonnes are in industrial sectors, out of this (based on statistical assumptions) about 450000 tonnes (10%) is not recycled. However, not all of these applications would contain lead up to 0,4%, assuming that 5% of the unrecycled material includes lead up to 0,4% results in 22500 tonnes of aluminium containing lead. Consequentially, this would result in 90 tonnes of lead which is not recycled. In the overall scheme this will have minimal impact as it results in 0,3% of the EU total aluminium production*."

- Mechanical relaxation[3];
- Tribological behaviour;
  - Superior machinability due to factors such as chip fracturing and surface finish;
  - Enhanced cutting tool lifetime;
  - Better wear resistance of components made of leaded aluminium as it reduces friction and wear of surfaces that slide against others (such as connectors);
- Ability to form lightweight, intricate shape parts.

The Umbrella Project does not provide performance indicators for these characteristics / functionalities.

In the answer on the clarification questions, the Umbrella Project specifies the following applications where leaded aluminium is still required:

- Cast and machined aluminium gear boxes from handheld tools made of the Al alloy EN AC-46000-D-F;
- Charge holders for MEMS sensor applications made of EN AW 2007 that are cut of from a rod and have to run at accelerated temperature;
- Stand-offs and spacers that are used to electrically connect parts in medical equipment.

1.3. Applicant's justification for the requested exemption

The Umbrella Project claims that no suitable alternative exists for all applications and argues that "*until all applications are able to trial lead free alloys then the reliability is not ensured.*"

1.3.1. **Availability of alternatives** *(Substitution or Elimination, roadmap to substitution, reliability of substitutes)*

The Umbrella Project mentions cadmium, tin, bismuth and beryllium as possible substitutes.

- **Cadmium** is not further detailed because it is itself RoHS restricted.
- **Tin** is mainly argued as providing less favourable mechanical properties to the material (causing cracking in machined parts when exposed to stress and high temperature; causing surface darkening on annealing and increasing the susceptibility to corrosion).
- **Bismuth** is the main substitute; the Umbrella Project states that "*based on the feedback of a few companies, about 2/3 of aluminium parts have been already transferred from leaded to unleaded aluminium. In these cases, bismuth is used instead.*" However, the Umbrella Project further argues that bismuth has limited availability due to its being defined as a critical raw material. The Umbrella Project claims that Bismuth has a more negative overall health and environmental impact (see section 1.3.2).

  On the machinability level, the Umbrella Project states that the manufacturability of bismuth alloys for some alloy types is similar to lead containing alloys: "*However to fully understand the quality*

[3] The Umbrella Project explains that mechanical relaxation is measurement of the viscoelastic response of the material which offers an approach for analysing the microstructure and the fatigue behaviour of a material.

of a machined surface after machining it is essential to know for each alloy type the microstructure which has not been fully investigated for all alloys and uses."

According to the.

- **Beryllium** is also not further detailed because the Umbrella Project concludes that it has similar toxicity to lead and also limited availability.

The Umbrella Project provides a list of lead-free aluminium alloys (wrought alloys as they are designated with a four-digit number). These alloys rely on bismuth and / or tin. There is no further assessment of technical performance presented. Rather general statements are given such as e.g.

- "*In some alloys tin is used as a substitute to lead often in combination with bismuth. However, in turning and machining tests long and continuous stripes were observed which cause very poor machinability*."
- "*The lack of availability of bismuth and lead-free aluminium alloys would support the assessment that the technical performance of tin alloys is not as closely matched to the traditional lead containing aluminium alloys*."
- "*Some alloys have been substituted by lead free compositions like e.g. AW-6026 to AW-6026LF as lead free alternative with high bismuth content. However, this is not possible for all applications currently*."

Another substitution option is indicated as aluminium foam compositions (without the inclusion of lead), however without giving further information. UP explains that aluminium foam compositions are currently only available as sheets and that testing is needed for complex structures.

As for the reliability of substitutes, the Umbrella Project claims that some products need to be requalified such as e.g. medical devices where the Medical Devices Regulation requires a re-approval by a Notified Body. The roadmap for substitution is also specified for medical devices, indicating a total time of 5 years with the following stages: testing of alternative alloy; testing of components made with the new alloy; redesign of the component/device (reasonable that minor changes are required); system performance and reliability testing and global approvals.

1.3.2. **Environmental and health arguments** *(also LCA aspects)*

The UP claims that there are negative environmental and health impacts of bismuth and refers to an LCA that compares the life cycle stages mining, purification, and refining of different metals. According to the Umbrella Project, the total negative environmental, health and consumer safety impacts caused by substitution with bismuth are likely to outweigh the total environmental, health and consumer safety benefits thereof.

Furthermore, the UP claims that the use of bismuth containing alloys can negatively affect recycling of aluminium and might increase the waste to be landfilled, however without providing further information.

1.3.3. Socioeconomic impacts

The UP expects an increase in direct production costs because lead-free alloys may require more energy for machining, cause greater tool wear and create more scrap. Further the UP claims that Bismuth is around 7 to 17 times more expensive than lead and states that "*if the demand for bismuth increases and the demand for lead decreases, the price of bismuth may become even higher*." The UP also claims that for medical devices this could impact on EU patients' health, but without giving further information.

2. Questions for stakeholders

1. The applicant has requested the renewal of an exemption currently listed in RoHS Annex III (see exemption specific page accessible through the links above):

    a. Do you agree with the scope of the exemption as proposed by the applicant?

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

    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.

2. Please provide information concerning possible substitutes or elimination possibilities at present or in the future so that exemption could be restricted or revoked:

    a. Please detail substitution and elimination possibilities and for which part of the applications in the scope of the requested exemption they are relevant.

    b. Please provide information on research to find lead-free alternatives (substitution or elimination) that may cover part or all of the applications in the scope of the exemption request at present or in the future.

    c. Please provide a roadmap of such on-going substitution/elimination efforts and research (phases that are to be carried out), detailing the current status as well as the estimated time needed for further stages.

3. The Umbrella Project states that "*this renewal request is based on the fact that only a very low amount of leaded aluminium is still required for some niche applications*." In the answer to the clarification questions, the Umbrella Project specifies the following exact applications where leaded aluminium alloys are still needed (see the summary above for more details):

    - Cast and machined aluminium gear boxes from handheld tools;
    - Charge holders for MEMS sensor applications;
    - Stand-offs and spacers to electrically connect parts, such as heat sinks, in medical equipment.

    Would it be possible to narrow down the scope of the exemption to these three specific applications?

a. Please explain why you either support or object the proposal to narrow the scope of the exemption to specific applications.

b. To support your views, please provide detailed technical argumentation / evidence in line with the criteria in Art. 5(1)(a) to support your statement.

c. If the list is not exhaustive, please specify additional applications for which this exemption is needed.

4. According to the Umbrella Project, the 3rd criterion of Art. 5(1) applies to the renewal request because the total negative environmental, health and consumer safety impacts caused by substitution with bismuth are likely to outweigh the total environmental, health and consumer safety benefits thereof.

    a. Please explain why you either support or object the proposal to narrow the scope of the exemption to specific applications.

    b. Please provide detailed information to support your statement.

5. Please provide any further information and/or data that you think is of importance to substantiate your views.

In case parts of your contribution are confidential, please provide your contribution in two versions (public /confidential). Please also note, however, that requested exemptions cannot be granted based on confidential information!

Finally, please do not forget to provide your contact details (Name, Organisation, e-mail and phone number) so that Oeko-Institut can contact you in case there are questions concerning your contribution.