

Consultation Questionnaire Exemption No. 6(c)

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

Abbreviations and Definitions

C36000	Leaded copper alloy, CuZn39Pb3 with a lead content between 2.5 - 3.5%
EEE	Electrical and Electronic Equipment
UP	Umbrella Project
RoHS	Directive 2011/65/EU on the Restriction of Hazardous Substances in Electrical and Electronic Equipment
tpa	tons per annum = tons per year

Background

The Oeko-Institut has been appointed by the European Commission, within a framework contract¹, for the evaluation of applications for exemption from Directive 2011/65/EU (RoHS), to be listed in Annexes III and IV of the Directive.

Bourns Inc. and Rosenberger Hochfrequenztechnik together with PHOENIX CONTACT 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 have 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=358>).

For further details, please check the exemption requests 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

Bourns Inc. and Rosenberger Hochfrequenztechnik and PHOENIX CONTACT on behalf of the “RoHS Umbrella Industry Project” request the renewal of exemption 6(c) for:

“Copper alloy containing up to 4 % lead by weight”

Lead in copper alloys improves the machinability by acting as an internal lubricant and chip breaker and by preventing cracks. Lead also improves the technical performance of parts e.g. increases corrosion resistance and influences stress relaxation behaviour or mechanical deformation.

According to the Umbrella Project, the exemption covers the following copper alloys:

- Leaded brass: copper-zinc-lead alloys are by far the most used leaded copper alloys.

Other leaded copper alloys are used in smaller amounts than brass:

- Leaded bronze: copper-tin-lead alloys;
- Leaded nickel silver: copper-nickel-zinc-lead alloys;
- Leaded copper beryllium: copper-beryllium-lead alloys.

Bourns Inc. is a manufacturer of small passive electronic components for which the following components of leaded copper alloys are needed: bushings, shafts, terminals, terminal strip and rivets. Bourns Inc. explains that leaded copper alloys can be precisely processed in fast screw machines.

The Umbrella Project applies for the renewal of the above-mentioned exemption for electrical and electronic equipment (EEE) of category 1 to 10 with the maximum validity periods. Bourns Inc. applies for EEE of category 1-11 “*depending on EEE manufacturer using electronic components as part of their assembly*” as well with the maximum validity period.

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

Both applicants are not able to give an estimation on the amount of lead placed on the EU market through leaded copper alloys:

- The Umbrella Project states that nearly no “new” lead from primary sources will enter the EU market as the alloys (especially brass) are made from recycled material. The Umbrella Project confirms the numbers reported in the last evaluation in 2015/2016 on “*ca. 2500 tpa lead based on a use amount of leaded alloys in EEE of 100,000 tpa with 2.5% lead threshold is assumed.*” But adds that due to slightly smaller production volumes also the amounts slightly decreased.
- Bourns explains that their electronic components are sold by distribution so that they do not know the number of components including the leaded copper alloy C36000 (CuZn39Pb3²) brass entering the EU.

² The material designation of this alloys is: CuZn39Pb3 with the number CW614N; the alloys contains 2.5-3.5% lead.

However, Bourns Inc. specifies the use of lead by providing a list of the different models of the electrical components that Bourns manufactures, with unit weight in grams and the share of lead of the total unit weight based on the C36000 composition. Thus, the finished units contain between 0,0003 and 0,33 gr lead.

1.2. Technical description

The Umbrella Project generally claims that copper alloys are neither cheap nor light materials and assumes that they will only be used when needed. The Umbrella Project argues that the machinability of the leaded copper alloys is important to produce a specific component/part and makes a substitution impracticable as components/parts made of leaded copper alloys have essential properties e.g. conductivity, relaxation, corrosion, lubricity, for which substitutes have not shown comparable performance.

According to the Umbrella Project, electrical or thermal conductors are the majority of applications of leaded copper alloys in EEE, e.g. all kinds of connections for the transfer of data, signal or power. Furthermore, leaded copper alloys are widely used for specifically designed mechanical parts with small scale features like e.g. cable glands, housing parts, filigree formed accessory parts, etc.

The UP does not provide further specifications for the components made of leaded brass besides examples where substitution has shown special problems, e.g. crimp connections, knurls, gas nozzles and retaining heads.

Bourns Inc. manufactures electronic components such as precision potentiometers, encoders, panel controls, rotary sensors, and trimming potentiometers for which they need leaded copper-zinc alloys (or the "free cutting brass C36000" - CuZn39Pb3) for the following parts:

- Encoders: (shafts, terminals, terminal strip);
- Panel Controls: (brass shafts, strips, rivets);
- Precision Potentiometers: (wiper terminal, terminal, shafts, bushings);
- Rotary Sensors: (bushings);
- Slide Potentiometers (rivets);
- Trimming Potentiometers (shafts);

Bourns Inc. explains that the brass can be precisely processed in fast automatic screw machines.

1.3. Applicant's justification for the requested exemption

The Umbrella Project have performed a standards survey and have identified four lead-free brass alloys basically available that have different mechanical properties compared to leaded copper alloys:

- CuZn21Si3P, is defined with a lead content $\leq 0.1\%$ w/w; this silicon brass is also called Ecobrass; it has a lower electrical and thermal conductivity than leaded copper alloy.
- Three Copper-Zinc alloys are commercially available with a lead content $\leq 0.1\%$ w/w: CuZn40, CuZn42 and CuZn38As which have a higher zinc content. It is important to note that these alloys do not contain a chip breaker such as lead or silicon.

The Umbrella Project argues that no new lead-free copper alloy became available in the last five years since the last evaluation of the exemption in 2015/2016.³

Bourns Inc. argues that no substitutes have been identified that showed the same machinability in automatic screw machines; the machinability is not further specified e.g. by speed or tool life.

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

The Umbrella Project specifies the less favourable properties of the lead-free alloys as follows:

- The high zinc content in the alloys CuZn37, CuZn40 and CuZn42 cause several changes to the mechanical behaviour e.g.:
 - A higher hardness together with long chip formation causes a higher wear or a break of tools: Special tools with chip breaker partly helped to overcome the problems, however, for the occurrence of chatter marks, burrs or edges no solutions were found.
 - A lower cold forming ability makes the material unsuitable for crimping as cracks from the conductor until the edge of the connection and at the outside surface were reported from several manufacturers.
- The silicon brass (Ecobross) CuZn21Si3P has a lower electrical and thermal conductivity and is therefore not used for electrical or thermal conductors. In mechanical parts/components, the machinability of CuZn21Si3P is indicated at 70 – 75% of the leaded copper alloy CuZn39Pb3/C36000. For drilling of small bores, no practicable solution has yet been found and applying the five-step drilling strategy proposed by the Ecobross manufacturer a maximum number of 25,000 bores of one drill whereas the Umbrella Project specifies the requirement to be at 1.000.000 bores before the drill has to be changed; thus Ecobross was not found to be practicable. Since the last evaluations of this exemption in 2015/2016, possible adaptations in the machining processes were used by companies for in-house research and development but no working solution was reported to the Umbrella Project.

For Bourns, the use of Ecobross is not possible for the following reason: The distributor of Ecobross only provides bars with the smallest diameter of 0.250; however, Bourns require a diameter size of 0.075; using 0.250 bars would result in 91% waste if machined down to 0.075.

Other substitutes mentioned by the applicants but not further explored are the following:

- The alloy CuZn38As is applied in some drinking water applications as Arsenic hinders de-zincification; this requirement is not relevant in EEE; besides, the high toxicity of arsenic this alloy is not used in EEE.
- Lead-free alloys with high copper content, e.g. C18625 with 99.4% w/w copper are much softer than brass which results in a lower strength and shows long chip formation.
- Stainless steel has a lower machinability of 40-50% compared to leaded brass.

³ When asked for clarification, the Umbrella Project noted that “other lead-free copper alloys are under development and have been tested by partnering companies/associations. But these alloys mostly only exist on lab scale and/or partnering associations/companies did not report them as promising or research is ongoing.”

- Bourns Inc. mentions different material such as aluminium, zinc die cast and nickel silver but state that all three alternatives have a higher raw material cost and a slower machining rate which reduces the overall capacity the company can manufacture and shortens tool life.

The Umbrella Project dedicates one chapter of the application to “Examples for Successful Substitution” where feedback from a survey among the 50+ partnering associations of the Umbrella Project is cited. The electrical and electronic manufacturers' associations reported no examples of successful substitutions. One citation states that this topic should be better addressed directly to the members of metal industry associations and component manufacturers within the Umbrella project.

From mechanical engineering associations, statements indicate that one company was able to mostly substitute leaded copper alloys, another partly and still another company applies low leaded copper alloys for some applications. When asked for clarification, the Umbrella Project specifies the following components/parts where substitution could be reached: for mechanical parts, bearings, housings, couplings and spindles and by another company cast or forged and machined counterweights used in air conditioning and refrigeration compressors when space allows the use of lead-free material.

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

The Umbrella Project claims that for leaded copper alloys a closed loop exists and that semi-finished goods of leaded brass are nearly entirely produced from recycled material. The Umbrella Project claims that a sudden restriction of leaded brass would cause an adverse effect as the required material could not be made by direct recycling anymore.

Bourns Inc. refers to information that cover e.g. an Environmental Product Declaration of copper alloys, comments on the socio-economic analysis on classification and labelling of lead in copper alloys and (refers to a life cycle assessment (LCA) on metals covering the life cycle stages mining, purification and refining that all however do not directly relate to the exemption request.

1.3.3. **Socioeconomic impacts**

Both applicants mention direct costs related to substitution but without further substantiating their statements:

- The Umbrella Project claims that investments in new machines would be difficult for small and medium sized enterprises; changes in the production process might require additional manual work that further increases direct costs (“especially problematic for companies in regions with high salaries”).

Besides, the Umbrella Project also raises the aspect of the direct recycling of chips that derives as pre-consumer waste from the machining processes. According to the Umbrella Project, mixing of silicon brass and leaded brass chips would impede a direct recycling; they argue that a parallel use of both alloys are not practicable.

- Bourns Inc. mentions as direct costs a higher raw material price, higher prices if machining is slower and/or tool life shortened.

2. Questions for stakeholders

1. The applicants have 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 applicants?
 - 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. 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.