

Questionnaire 1 (Clarification) for Renewal of Exemption 34 of Annex III (TMC)

Table 1: Currently valid exemption wordings

No.	Exemption	Scope and dates of applicability
III-34	Lead in cermet-based trimmer potentiometer elements	<p>Applies to categories 1 to 11.</p> <p>Expires on:</p> <ul style="list-style-type: none"> - 21 July 2021 for categories 1-7 and 10, - 21 July 2021 for categories 8 and 9 other than in vitro diagnostic medical devices and industrial monitoring and control instruments, - 21 July 2023 for category 8 in vitro diagnostic medical devices, - 21 July 2024 for category 9 industrial monitoring and control instruments, and for category 11.

Acronyms and Definitions

Cat.	Category, referring to the categories of EEE specified in Annex I of the current RoHS Directive
COM	European Commission
EEE	Electrical and electronic equipment
IMCI	Industrial monitoring and control instruments
Lead-free	Not containing lead in the applications in scope of the exemption to be reviewed

1. Background

Bio Innovation Service, UNITAR and Fraunhofer IZM have been appointed¹ by the European Commission through for the evaluation of applications for the review of requests for new exemptions and the renewal of exemptions currently listed in Annexes III and IV of the RoHS Directive 2011/65/EU.

TMC submitted a request the renewal of the above exemption for cat. 9 industrial monitoring and control instruments (IMCI) with the wording, scope and validity period shown in the below table:

¹ Implemented through the specific contract 070201/2020/832829/ENV.B.3 under the Framework contract ENV.B.3/FRA/2019/0017

Table 2: Requested exemption renewal

No.	Requested exemption	Requested scope and dates of applicability
III-34	Lead in cermet-based trimmer potentiometer elements	Applies to category 9 industrial monitoring and control instruments. Expires on 21 July 2031 (= 2024 +7 years) for category 9 industrial monitoring and control instruments.

Exemption 34 was reviewed by Baron et al. (2022)². They recommended its renewal like listed in **Error! Reference source not found.** below.

Table 3: Renewal of current exemption 34 recommended by Baron et al. (2022)

Exemption formulation	Duration
Lead in cermet-based trimmer potentiometer elements	21 July 2024 for all categories

Source: Baron et al. (2022)

The European Commission (COM) have not yet officially published their decision as to the adoption of the above recommendation. The COM wish the consultants to assess in this current review round whether there are any substantial reasons in line with Art. 5(1)(a) against the adoption of recommendations resulting from previous reviews in 2020 to 2022 for EEE of categories 8, 9 and 11.

As result of a first review of the submitted information we identified that some information is missing. Against this background the questions below are intended to clarify some aspects concerning the request at hand.

We ask you to kindly answer the below questions until 30 October 2023 latest.

2. Questions

1. Could you please confirm that Table 2 correctly reflects the requested renewal of the exemption?

² C.f. Öko-Institut,
https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_24/RoHS_Pack-24_final_16022022.pdf



TMC reply to question 1:

TMC would like to reiterate that all submitted renewal applications, including the renewal application for RoHS exemption III-34, request the renewal of the exemption for category 9 industrial monitoring and control instruments in its existing wording with the subsequent maximum renewal period of 7 years.

Table 2 therefore correctly reflects TMC’s renewal request.

- 2. Exemption 34 was reviewed by Baron et al. (2022). They recommended its renewal like listed in **Error! Reference source not found.**

If the review shows that TMC’s arguments justify the renewal of the exemption, the consultants would recommend the below wordings, scopes and expiry dates. These expiry dates may be adapted to the specific situation of cat. 9 in the scope of TMC’s renewal request. **Error! Reference source not found.** reflects the resulting wordings, scopes and validity periods in consistency with the state of science and technology assessed by Baron et al. (2022) and with their recommendations.

Table 4: Renewal of current exemption 34 like recommended by Baron et al. (2022) (modified)

No. ³	Recommended Exemption	Recommended scope and dates of applicability
III-34	<i>Lead in cermet-based trimmer potentiometer elements</i>	Applies to category 9 industrial monitoring and control instruments. Expires on 21 July 2024 (+X) for category 9 industrial monitoring and control instruments

X can be maximum 7 years

Baron et al. (2022)⁴ recommend the short 3 years validity period for all categories of EEE to align the expiry dates and to motivate producers of EEE to provide information for the specification and possibly restriction of the exemption scope. If the COM publishes the official decision as to the renewal of

⁴ C.f. Öko-Institut, https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_24/RoHS_Pack-24_final_16022022.pdf

exemption III-34, it can be reasonably assumed that it will be granted leaving sufficient time to request the renewal of the exemption for all categories of EEE.

Do you agree with this approach? It may help to clarify the state of the art of this exemption also for cat. 9 IMCI, possibly providing technically sound arguments for its renewal beyond the next expiry.

TMC reply to question 2:

TMC does not agree with this approach. Included within the exemption renewal request we identified that currently the only available alternative to the Thick-Film (Cermet) potentiometer was a Polymer Thick-Film (PTF) device. A PTF device could approach the electrical characteristics required (though inferior) but the environmental characteristics were significantly different – humidity tolerance was an order of magnitude worse off ($\pm 10\%$). This would render a PTF device unusable in a significant portion of cat. 9 Industrial products with examples provided within the renewal submission.

Furthermore, we did not rely only on the current availability of alternate components but conducted a worldwide study with FINDEST to search for a suitable replacement for lead oxide (PbO) in potentiometer devices or similar electronic components. The details were also provided in the renewal submission and identified that most potential alternatives were eliminated because they would have been regrettable substitutions (toxic) or had a melting point too high for the current substrate materials. At this time, no such alternative film technology exists and are commercially available unless the consultants are aware of a technology that did not come up in our worldwide search.

It should be noted that the total mass of PbO used within the cermet resistors is less than 10g per year for all cat. 9 Industrial products within the EU, but the total impact of a non-renewal of this exemption is monetized in the range of 524 million EUR and 749 million EUR. When a lead-free substitution becomes available, the substitution process would take a minimum of 5-7 years – also detailed in the renewal submission. Hence, the request for the full 7-year extension is requested, with the expectation of a further renewal request after that to accommodate that substitution process if a suitable alternative were to become available during the next renewal period. To renew with any other time period would make no practical sense at this time.



3. *As to potential substitutes, you mention that only Sodium Bismuth Titanate has the potential to be used but would require further investigation. Bismuth Oxide is another alternate though the toxicity needs to be assessed to see if it would be a regrettable substitution.*

- a. Bismuth has been used for decades meanwhile in solders and other materials applied in EEE, in parts as substitute of lead. So far there are no clear hints that bismuth is toxic to a degree that would justify calling such substitution regrettable ones.

Do TMC have any clearer evidence as to the toxicity of bismuth in the use in EEE?

TMC reply to question 3:

The reference to Sodium Bismuth Titanate potential as an alternative thick film to PbO but would require further investigation was not referring to its potential toxicity as this did not come up within the FINDEST research data. Rather it was the need to develop a different manufacturing process to be developed and scaled to production quantities as the thick film alternative melting point was very close to the substrate melting point. This could require the thick film to substrate application to be done in an inert atmosphere or a vacuum to avoid thermal damage to the substrate.

4. You state that the sodium bismuth titanate also technically requires further investigation.

TMC reply to questions 4 (a)-(c):

With reference to the response in question 2, cat 9. Industrial producers are very small consumers of these cermet potentiometers and therefore have limited insight or influence as to the state of cermet alternate development by the component manufacturers.

- a. What is the status of this material's applicability as substitute for cermet in trimmer potentiometers? What are restrictions and other issues still to overcome?
 - b. Is there a current roadmap available for the research?
 - c. Could you please let us know the TMC activities in the above context?
5. You state that polymer thickfilm (PTF) is the closest alternative to cermet for potentiometers with infinite resolution. The related table on page 13 shows properties of this material. You state that the environmental characteristics alone make PTF unsuitable for many trim pot applications in laboratories.
- a. Could you please elaborate more on this aspect?

TMC reply to question 5(a):

Section 3.1 of the exemption renewal dossier addresses this aspect in detail but can be summarized below.

Trim potentiometers are typically factory set and must remain within tolerance based on the environmental conditions that they are exposed to, including:

- Applications requiring or even generating humidity, for example CO₂ incubators and environmental chambers that use RH sensors that utilize these trim pots. Bioreactors also utilize sensors to accurately measure temperature, humidity, pressures, and other critical parameters in the production of active pharmaceutical ingredients while subject to humidity.
- Storage and transport of the equipment including the ISTA transport vibration tests and thermo cycling with transport temperatures up to 70°C. Humidity can also vary significantly during phase of the product life.



- Cat 9. Industrial equipment can be used both inside and outside (field instrumentation) and is subject to all the environmental conditions that this represents, but the accuracy of the measurement cannot alter. Even for internal lab equipment, the accuracy of equipment must be stable for operating temperature conditions of 30°C, up to 80% RH (normal condition) or up to 40+°C and 90+ % RH (non-condensing) if it is able to be used in tropical countries. As specialist equipment manufacturers, products are typically manufactured in one location but distributed globally.

- b. If the material is unsuitable for many trim pot laboratory uses, please let us know for which ones it would be an alternative. We ask you to kindly refrain from arguing that substitution is considered as impracticable if the one material (cermet) cannot be replaced by a single other one. This argument was discussed often in earlier reviews and dismissed as not being compliant with the requirements of Art. 5(1)(a).

TMC reply to question 5(b):

With reference to the answer for 5(a), this would apply to all cat 9. Industrial products. In some situations, equipment may be used in a climate-controlled environment, but there are practically no products that are intended to be *only* used in those environments. Those products would also be subject to the transport and storage issues described in 5(a). The only way this could not be required, is if calibration would need to be done after install at a specific location at the customers site, but the only type of equipment that this would be applicable to would be large scale industrial equipment, or equipment exclusively for building in to a facility, both applications are actually out of scope of the RoHS directive.

6. In addition, TMC conducted an AI assisted research on potential other suitable alternatives. Could you please let us know about the outcome of this research?

TMC reply to question 6:

Section 3.4 of the exemption renewal dossier provided detailed response to the outcome of the FINDEST search for alternatives. This included the criteria used, the outcome and the list of potential materials including the summary of the findings, copied below:

Of the alternates investigated, most were eliminated either because they were also toxic or had a melting point too high for current substrate materials and the manufacturing processes employed. Only Sodium Bismuth Titanate has the potential to be used but would require further investigation. Bismuth Oxide is another alternate though the toxicity needs to be assessed to see if it would be a regrettable substitution. However, in both cases we currently have not identified any alternates cermet resistor that employ these materials and are commercially available.

Please note that answers to these questions will be published as part of the evaluation of this exemption 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.

We ask you to kindly provide the information in formats that allow copying text, figures and tables to be included into the review report.

3. References

Baron et al. (2022): Study to assess requests for renewal of seven (-7-) exemptions 18(b), 18(b)-I, 24, 29, 32 and 34 of Annex III and exemption 34 of Annex IV of Directive 2011/65/EU (Pack 24) – Final Report Under the Framework Contract: Assistance to the Commission on technical, socio-economic and cost-benefit assessments related to the implementation and further development of EU waste legislation Author(s): Yifaat Baron, Carl-Otto Gensch, Andreas Köhler, Ran Liu, Clara Löw, Katja Moch, Oeko-Institut e. V. (Pack 24). retrieved from https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_24/RoHS_Pack-24_final_16022022.pdf. [Accessed: 08.09.2023].