

Consultation Questionnaire Exemption 7(c)(I) of RoHS Annex III

Table 1: Currently valid wording of the exemption

No.	Exemption	Scope and dates of applicability
III-7(c)(I)	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound	Applies to categories 1 to 11 (except applications covered under point 34) and expires on <ul style="list-style-type: none"> - 21 July 2021 for categories 1-7 and 10, and for category 8 other than in vitro diagnostic medical devices and cat. 9 other than 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 II 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 application in scope of the exemption to be reviewed
NRMM	Non-road mobile machinery (NRMM)
Pb	Lead

1. Background and objectives of this review

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

TMC requested the renewal of the exemption with its current wording for the maximum validity of 7 years for cat. 9 industrial monitoring and control instruments (IMCIs). Werfen asked for a 5 year renewal of the exemption for cat. 8 in-vitro diagnostic medical devices (IVDs) for the analysis of whole blood. In their clarification questionnaire, Werfen explained that tests conducted between the time of the exemption application and the time when the clarification questionnaire was answered, showed that lead-free alternatives w did not perform as expected. Werfen therefore amended their exemption request asking for a 7 year duration for the renewed exemption.

EUROMOT wish the exemption to be renewed for the maximum validity period of 5 years for use in specific parts of cat. 11 equipment (engines, engine components and ancillary components and in end-products in which they are used).

The applicants were requested to respond to clarification questionnaires prior to this stakeholder consultation to complete missing information. These questionnaires along with the exemption applications and – if submitted - supporting evidence and information from other stakeholders are accessible on the online consultation web page.

The stakeholder consultation is part of the review process for the exemption request at hand. It addresses third parties – not the applicants – to provide and to evaluate information and evidence according to the criteria listed in Art. 5(1)(a) of Directive 2011/65/EU.²

Exemption 7(c)(I) was reviewed by Baron et al. (2022)³, who recommended to renew the exemption as illustrated in the below table.

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

² Directive 2011/65/EU (RoHS) available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32011L0065:EN:NOT>

³ C.f. Öko-Institut, https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_22/RoHS_Pack-22_final_report_amended_February_2022.pdf

Table 2: Recommended renewal of exemption 7(c)(I) in the last review in 2022

Ex. No	Exemption formulation	Duration
7(c)-I	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound	Expires on 21 July 2024 for all categories
7(c)-V	Electrical and electronic components containing lead in a glass or glass matrix compound that fulfils the following functions: <ul style="list-style-type: none"> 1) protection and electrical insulation in glass beads of high voltage diodes and glass layers for wafer on the basis of a lead-zinc-borate or a lead-silica-borate glass body,* 2) for hermetic sealings between ceramic, metal and/or glass parts 3) for bonding purposes in a process parameter window for < 500°C combined with a viscosity of 10^{13,3} dPas (so called "glass-transition temperature") 4) used as resistance materials such as ink, with a resistivity range from 1 Ohms/square to 1 Mega Ohms/square, excluding trimmer potentiometers** 5) used in chemically modified glass surfaces for Microchannel Plates (MCPs), Channel Electron Multipliers (CEMs) and Resistive Glass Products (RGPs). 	Expires on 21 July 2026 for all categories
7(c)-VI	Electrical and electronic components containing lead in a ceramic that fulfils the following functions (excluding items covered under item 7(c)-II, 7(c)-III and 7(c)-IV of this annex): <ul style="list-style-type: none"> 1) piezoelectric lead zirconium titanate (PZT) ceramics 2) providing ceramics with a positive temperature coefficient (PTC) 	Expires on 21 July 2026 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 wishes 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 the above recommendation for EEE of categories 8, 9 and 11. This implies that the consultants will assess whether the validities of exemptions whose renewal is requested for cat. 8, 9 or 11 may exceed the validities recommended in the previous review (Table 2). Table 3 reflects the potential scope and wordings if the exemptions are

recommended to be renewed for cat. 8 IVDs for the analysis of whole blood, cat. 9 IMCI, and for cat. 11.

Table 3: Renewal of current exemption 7(c)(I) for cat. 8, 9 and 11 based on the recommendation of the last review in 2021/2022

No. ⁴	Recommended Exemption	Recommended scope and dates of applicability
III-7(c)(I)	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound	Applies to categories 1 to 11. Expires on 21 July 2024 for categories 1 to 11.
III-7(c)(V)	<p>Electrical and electronic components containing lead in a glass or glass matrix compound that fulfils the following functions:</p> <ol style="list-style-type: none"> 1. protection and electrical insulation in glass beads of high voltage diodes and glass layers for wafer on the basis of a lead-zinc-borate or a lead-silica-borate glass body,* 2. for hermetic sealings between ceramic, metal and/or glass parts 3. for bonding purposes in a process parameter window for < 500°C combined with a viscosity of 10 13,3 dPas (so called “glass-transition temperature”) 4. used as resistance materials such as ink, with a resistivity range from 1 Ohms/square to 1 Mega Ohms/square, excluding trimmer potentiometers** 5. used in chemically modified glass surfaces for Microchannel Plates (MCPs), Channel Electron Multipliers (CEMs) and Resistive Glass Products (RGPs). 	<p>Applies to categories 1 to 11 from 22 July 2024 on.</p> <p>Expires on</p> <ul style="list-style-type: none"> - 21 July 2026 for categories 1 to 8 and 10. - 21 July [2026 + X] for cat. 11. - 21 July [2026 + Z] for category 9 industrial monitoring and control instruments.
III-7(c)(VI)	<p>Electrical and electronic components containing lead in a ceramic that fulfils the following functions (excluding items covered under item 7(c)-II, 7(c)-III and 7(c)-IV of this annex):</p> <ol style="list-style-type: none"> 1. piezoelectric lead zirconium titanate (PZT) 2. ceramics 3. providing ceramics with a positive 4. temperature coefficient (PTC) 	<p>Applies to categories 1 to 7, cat. 8 in-vitro diagnostic medical devices for the analyses of whole blood and to cat 11 from 22 July 2024 on.</p> <p>Expires on</p> <ul style="list-style-type: none"> - 21 July 2026 for categories 1 to 8 other than in-vitro diagnostic medical devices, and 10.

⁴ The numbering of the various exemption sub-clauses is introduced in the current review to facilitate addressing the various exemption parts.



- 21 July [2026 + X] for cat. 11.
- 21 July [2026 + Y] for cat. 8 in-vitro diagnostic devices for the analysis of whole blood.
- 21 July [2026 + Z] for cat. 9 industrial monitoring and control instruments.

X can be maximum 3 years.

Y can be maximum 4 years.

Z can be maximum 5 years.

To contribute to this stakeholder consultation, please answer the below questions until 11 December 2023.

Please also see the applicants' request form and clarification questionnaire response and – if submitted – further information on the consultation web page⁵.

2. Questions

1) *Werfen confirm that exemption 7(d)(VI)(1) covers their application, and they request the 2026 expiry date recommended by Baron et al. (2022) to be extended to 2030 (= 2023 + 7).*

- a. Do you agree that exemption 7(c)(VI)(1) fully covers the uses of lead in cat. 8 IVDs for the analyses of whole blood that are currently covered by exemption 7(c)(I)?

We are no experts concerning IVDs and blood analysis, but we think, that there are probably applications where no satisfying, reliable and long term stable substitute for PZT ceramics is available.

- b. Would exemptions 7(c)(V) and 7(c)(VI) cover all uses of lead in the scope of exemption 7(a) in cat. 8 IVDs for the analyses of whole blood?

No, we do not agree, that all applications are covered. We think, that there are applications and high sophisticated analysis tools/methods, which require very high sensitive sensors with very high amplification (survey from Analog Devices attached to this consultation). These high amplifications are only possible with high ohmic feedback resistors (made by SRT) with lead containing resistor paste. If it is the goal to further

⁵ Consultation web page: <https://rohs.biois.eu/requests2.html>

subdivide and specify the existing exemption III-7(c) 1 in order to have more progress in smaller subdivisions than at least the formulation of III-7(c)(V)4 has to be changed:

<p>III-7(c)(V)</p>	<p>Electrical and electronic components containing lead in a glass or glass matrix compound that fulfils the following functions:</p> <p>.....</p> <p>.....</p> <ul style="list-style-type: none"> - 4. used as resistance materials such as ink or paste, with a resistivity range from 1 Ohms/square to 1 Mega Ohms/square, - Used as contact, passivation and wrap-around contact material (pastes, inks) and <p>Used as resistance materials such as ink or paste, with a resistivity range below 1 Ohms/square and above 1 Mega Ohms/square,</p> <p>excluding trimmer potentiometers**</p> <p>.....</p> <p>.....</p>	<p>Applies to categories 1 to 11 from 22 July 2024 on.</p> <p>Expires on</p> <ul style="list-style-type: none"> - 21 July 2026 for categories 1 to 8 and 10. - 21 July [2026 + X] for cat. 11. - 21 July [2026 + Z] for category 9 industrial monitoring and control instruments. - Unlimited for all categories 1 to 11 until leadfree inks/pastes are publicly available in these resistive ranges.
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2) *EUROMOT state in their answers to the clarification questionnaire that the scopes of exemptions 7(c)(V) and 7(c)(VI) are likely to be too restrictive for their members' uses in EEE of cat. 11. EUROMOT members are not able to determine whether these renewed exemptions would cover all uses of lead in the scope of the current exemption 7(c)(I) as they use a wide variety of electronic components utilising exemption 7(a). Electronics suppliers do not provide information as to whether these would be covered by exemptions 7(c)(V) and 7(c)(VI). EUROMOT therefore request the renewal of exemption 7(c)(I) for five years.*

a. Do you agree to the above reasoning?

Yes, we agree to the reasoning, because a lot of electronic equipment may have lead in the components e.g. thick film resistors and others.

b. The proposed exemptions 7(c)(V) and 7(c)(VI) are not intended to restrict the scope compared to exemption 7(c)(I) where lead-free alternatives are not available, but to specify the applications that are currently in the scope of exemption 7(c)(I).

Why then do you restrict the resistive range to min. 10hm/square and max. 1Mhm/square ?? There is a huge life below 10hm/square and

above 1 MOhm/square, where no alternative is available. Approx. 70% of our revenue is done with resistor values above 1MOhm. In terms of number of parts it is over 60 Million per year, a big part of it going into fire detection devices and sensor devices (see also survey from Analog Devices). And for thick film resistors you need contact pastes, passivation pastes and wrap-around paste, which all contain lead in the glass frit..

Do you know of any applications in cat 11 which were covered by exemption 7(c)(I) but would not be in the scopes of exemptions 7(c)(V) and 7(c)(VI)?

Yes, we know a lot of applications in cat. 9 and 11 especially in the field of sensor technologies, where the old exemption 7(c)(I) covers all possible applications but the new formulated exemptions 7(c)(V) and 7(c)(VI) does not. E.g. signal amplification of very small current, charge or voltage signals are only possible with high ohmic feedback resistors over 1MOhm.

- 3) *TMC do not agree with the recommendation presented in Table 3 for cat. 9 IMCI. Exemption 7(c)-I is the most frequently used exemption in cat. 9 industrial monitoring and control instrumentstest; most electronic products contain this exemption because of the broad range of applications. There is no single substitute available that would be suitable to all the applications identified. TMC therefore applies for a renewal of exemption 7(c)(I) for the maximum validity period, as it considers the criteria of RoHS art. 5(1)(a) are met.*
- a. Do you agree to the above reasoning?

Yes, we agree to the above reasoning. The range of applications is really very high. We are delivering into these catergorie a lot of our products, where you have lead in the component. And we are using measurement instruments for example Digitalmultimeters, Electrometers, Wheatstone Bridges aso., which are 10 to 15 years old or even older. And we plan to use them the next several years, because they are very expensive and nevertheless very good.

- b. The proposed exemptions 7(c)(V) and 7(c)(VI) are not intended to restrict the scope compared to exemption 7(c)(I) but to specify the applications that are currently in the scope of exemption 7(c)(I).

Do you know of any applications in cat. 9 monitoring and control instruments which were covered by exemption 7(c)(I) but would not be in the scopes of exemptions 7(c)(V) and 7(c)(VI)?

Yes, we know a lot of applications in cat. 9; especially in the field of sensor technologies, where the old exemption 7(c)(I) covers all possible applications but the new formulated exemptions 7(c)(V) and 7(c)(VI) does not. Monitoring instruments need sensors, otherwise they do not monitor. For example pressure, temperature, particles, dust, smoke,... And there are existing very delicate sensor solutions for tiny signals. For example a photodiode in low level light situations. There you have a very small current signal in the pA range, where you need an amplification in the range of 10 Million or more. But even more you need this in a tiny package,

because otherwise the sensor is too big and the response time is too long. This is only possible with high ohmic feedback resistors over 1M Ω .

- 4) Looking at all categories of EEE (1 to 11): Are you aware of any applications of lead in the scope of the current exemption 7(c)(I) that require the use of lead but would not be covered by the scopes of the recommended exemptions 7(c)(V) or 7(c)(VI)?

Yes, also in the other categories of EEE there might be components with lead (See my answers in 3b), which are used for measuring and monitoring. We have one customer which falls into category 4 (microphones) and who is ordering 3G Ω and 22M Ω in different sizes.

Also we have one customer who orders size 0402 with 200G Ω . The resistive area of this component is approx. 350 μm times 350 μm . Within this area it is not possible to use a 1M Ω paste and print a meander in such a way that you will get 200G Ω . For this you have to print approx. 200 000 squares which is not achievable even if one square has a size of only 10 μm . Other production technologies with this spatial resolution and high ohmic resistivity are not known to me.

- 5) As part of the evaluation, socio-economic impacts shall also be compiled and evaluated. For this purpose, if you have additional information on socioeconomic aspects that are expected to arise if the exemptions are not granted as requested by Werfen and EUROMOT, please provide details in respect of the following and specifying whether you refer to the Werfen or EUROMOT request:

- a. What are the volumes of EEE in the scope of the requested exemptions which are placed on the market per year?

We do not have data or information to that.

- b. What are the volumes of additional waste to be generated should the requested ex-emption not be renewed or not be renewed for the requested duration?

We do not have data or information to that.

- c. What are estimated impacts on employment in total, in the EU and outside the EU, should the requested exemption not be renewed or be renewed for less than the re-requested time period? Please detail the main sectors in which possible impacts are expected – manufacturers of equipment in the scope of the exemption, suppliers, re-tail, users of MRI devices, etc.

Impact would that manufacturer of electronics, which need for example high ohmic resistors for sensors (e.g. fire detectors, exhaust measurement, analytical measurement methods and other) are not able anymore to build these electronic devices. This will hinder or stop at all innovation in many areas of high sophisticated analysis tools (see survey of Analog Devices).

- d. Please estimate additional costs associated should the requested exemption not be renewed, and how this is divided between various sectors (e.g. private, public, industry: manufacturers, suppliers, retailers).

This is not a question of additional cost, this is a question of ability/possibility at all if there is no substitute available. Up to now there is no publicly available leadfree resistive paste at and above 10MOhms; and I guess that the big manufacturer of thick film resistors do not have such a paste, because the market share is so tiny in comparison to the standard values. Also, the big manufacturers of thick film paste are not interested in developing such a paste. They will not develop it or sell it to us. So if we cannot buy such a paste, there will be no resistors in this range and in consequence no electronics.

- 6) TMC provided a socioeconomic analysis related to the above exemption request. The document is available online in the consultation folder for this exemption.

Do you agree with the underlying method, data and conclusions?

- 7) Any additional information which you would like to provide?

See request/application of SRT !

Please note that answers to these questions can be published on the stakeholder consultation website and in the review report. 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.

Please do not forget to provide your contact details (Name, Organisation, e-mail and phone number) so that the project team can contact you in case there are questions concerning your contribution.

It would be helpful for the review process if you could kindly provide the information in formats that allow copying text, figures and tables to be included in the review report.