# Exemption Request Form

Date of submission: 20 January 2023

## 1. Name and contact details

### 1) Name and contact details of applicant:


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### 2) Name and contact details of responsible person for this application (If different from above):


Company: EUROMOT

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Name: Anna Wik

E-Mail: anna.wik@volvo.com

Function: Material compliance WG chair

Address: As above


This exemption request is submitted with the support of:

EGMF European Garden Machinery Federation

AEM Association of Equipment Manufacturers

## 2. Reason for application:

Please indicate where relevant:

☐ Request for new exemption in:

☐ Request for amendment of existing exemption in

☒ Request for extension of existing exemption in: Annex III

☐ Request for deletion of existing exemption in:

☐ Provision of information referring to an existing specific exemption in:

☐ Annex III ☐ Annex IV

No. of exemption in Annex III or IV where applicable: 6a

Proposed or existing wording:

Lead as an alloying element in steel for machining purposes containing up to 0.35%.

Duration where applicable: 5 years

☐ Other: _____

## 3. Summary of the exemption request

Lead is used in steel alloys as a machining aid to allow deep drilling and/or high-speed operations, and to aid hot workability in a number of different components in internal combustion engines, associated components and end-products in which these are used. EUROMOT products are commonly used in highly demanding conditions including exposure to contaminants, high vibration, and high mechanical loads, while being required to operate for extended periods of time and sometimes without the opportunity for servicing of parts. Many of the applications are critical, such as back-up generators or operate in highly dangerous environments such as mining and construction. As a consequence of this, design changes to all components needs to be rigorously formally assessed, especially as alternative alloys are not always identical drop-in replacements to the lead-based alloys. Therefore, it is always necessary for EUROMOT's members to carry out research and testing to determine whether each potentially suitable substitute is able to offer the required technical performance.

If the properties of the alternative alloy are significantly different such that either the engine design needs to change, or this could potentially affect reliability or emissions, then it may be necessary to gain approval for the engines made with alternative alloy parts as required by engine emissions legislation.

Alternative alloy compositions to include bismuth, increased sulphur (with and without tellurium), tin (with low and high copper), phosphorus and calcium give inferior performance. Bismuth especially has the additional concerns regarding its environmental impact, which is worse than lead, and its availability.

EUROMOT Members have indicated that they are making initial progress on developing alternatives, but additional time is required to undertake the required assessments and testing. These timescales vary between manufacturers due to the number of affected parts and the technical requirements of those parts and ranges from between 5 and 7 years.

# 4. Technical description of the exemption request

## (A) Description of the concerned application:

1. To which EEE is the exemption request/information relevant?

   Name of applications or products: Internal combustion engines, associated components and end-products in which these are used

   a. List of relevant categories: (mark more than one where applicable)

   | | |
   |---|---|
   | ☐ 1 | ☐ 7 |
   | ☐ 2 | ☐ 8 |
   | ☐ 3 | ☐ 9 |
   | ☐ 4 | ☐ 10 |
   | ☐ 5 | ☒ 11 |
   | ☐ 6 | |

   b. Please specify if application is in use in other categories to which the exemption request does not refer: Yes, this exemption is also used for categories 1 to 10.

   c. Please specify for equipment of category 8 and 9:

   The requested exemption will be applied in

   ☐ monitoring and control instruments in industry

   ☐ in-vitro diagnostics

   ☐ other medical devices or other monitoring and control instruments than those in industry

2. Which of the six substances is in use in the application/product?

   (Indicate more than one where applicable)

   ☒ Pb ☐ Cd ☐ Hg ☐ Cr-VI ☐ PBB ☐ PBDE

3. Function of the substance: Lead improves machinability in machining processes allowing deep drilling and/or high-speed operations. The lead provides a great hot workability as well, which is essential in certain production processes.

4. Content of substance in homogeneous material (%weight): Up to 0.35%.

5. Amount of substance entering the EU market annually through application for which the exemption is requested:

In 2013, the import of steel products for machining purposes amounted to approximately 73,000 tonnes[1]. EUROMOT does not have more recent figures specific to machining, however EUROFER data on EU consumption levels of steel indicates that this has risen by 8.9% over the course of 2013 to 2022[2].

Assuming that the lead content in steel for machining purposes is between 0.2 and 0.35%, this means that the lead annually entering in the EU market through the import of free cutting steels can vary between 159 to 278 tonnes for all uses. These figures do not correspond solely to steel intended for EEE (which it was not possible to estimate) and encompass steel intended for other applications such as automotive applications.

EUROMOT has knowledge only of its members products, which based on members uses, the amount of lead from both free-machining and galvanised steels is estimated to be 700 kg per annum. It should be noted that this estimate is not for all of Category 11, which is unable to be calculated in part due to is less precise scope compared to other RoHS Categories.

6. Name of material/component: Steel

7. Environmental Assessment:

The previous Umbrella Project (UP) exemption requestion request[3] pointed out a number of benefits of using lead in free-machining steel which include:

- The addition of lead into low carbon free cutting steels enhances machinability and can increase the production rate of a component by up to 40% depending upon part and machining process design, and
- A potential reduction in energy usage of approximately 27% when machining parts using leaded versus non-leaded steel.

A partial LCA was provided previously by the UP which is still considered valid although it did not cover end of life aspects[3]. This is cited as supporting evidence only.

LCA: ☐ Yes
☒ No

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[1] Data from previous exemption request form, Exemptions #6(a) & #6(a)-I on behalf of the organisations participating in the RoHS Umbrella Industry Project ("the Umbrella Project"), 17 January 2020. Source: EUROFER statistics considering the CN codes related to free cutting steel semi-finished products.

[2] European Steel in Figures 2022, EUROFER, https://www.eurofer.eu/publications/brochures-booklets-and-factsheets/european-steel-in-figures-2022/. The graph on page 25 shows EU steel consumption rose from 134.1 million tonnes in 2013 to 146.1 million tonnes in 2021. This a rise of 8.9%.

[3] Assessment of the environmental impact of leaded and non-leaded low carbon free cutting steels including energy used during machining. Annex 1 of previous exemption request form, Exemptions #6(a) & #6(a)-I on behalf of the organisations participating in the RoHS Umbrella Industry Project ("the Umbrella Project"), 17 January 2020.

**(B) In which material and/or component is the RoHS-regulated substance used, for which you request the exemption or its revocation? What is the function of this material or component?**

Description of the supply chain and product sectors

EUROMOT members manufacture engines used in a wide variety of end-applications including heavy goods vehicles, excavators, emergency generators, compressors, pumps, and tools (portable and stationary[4]). The majority of these engines have end-uses that are excluded from the scope of RoHS as they are forms of transport or non-road mobile machinery as defined by the RoHS Directive. As a result, only a small proportion of steel parts that are used by EUROMOT members need to comply with RoHS[5]. Therefore, suppliers of either machined components to EUROMOT members have had little incentive to actively search for lead-free substitutes that provide the required performance to meet the limited market for the small proportion of parts that are required to comply with the lead restriction.

The basic designs of many types of engines manufactured by EUROMOT members are used in end-products that are both in-scope of RoHS and other end-products that are excluded from RoHS. However, there are many variations in these designs of these engines, using a variety of special components. Some parts are used in only one type of engine but there are also many types of engine that use common parts.

Manufacturers of engine in scope of this exemption and their supply chains share many similarities with the automotive and aerospace industries. These manufacturers' sectors sell complex products comprised of thousands of parts and components, sourced from supply chains which overlap with the automotive and aerospace industries. However, applications served by this exemption are characterised by longer lifecycles, higher costs, larger number of parts, higher variability and lower volume of products, and end-use applications which operate in harsh and dangerous environments demanding extreme reliability.

Since supply chains are to large extent shared with automotive (light duty within ELV-scope and heavy duty outside ELV-scope) and machinery (non-ELV and non-RoHS scope) industries, deadlines for use of lead in steel alloys used in engines even before the corresponding ELV-exemption expire is technically impracticable. Once the use of an alternative material is ensured in the electronic component, still the reliability of the part in the engine needs to be verified as described below.

Where machined steel parts are used

Machining steels are used in a diverse range of final applications within fixed engine installations equipment, including finished products, fixed installations etc. EUROMOT

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4 Many types of professional tools that use combustion engines are excluded from RoHS as Non-Road Mobile Machinery (as defined by RoHS), but the status of some types is unclear, and some are "semi-mobile" machinery which is probably in scope.

5 These engines are not used in road vehicles that are in scope of the EU End of Life Vehicle (ELV) Directive, so the substance restrictions of this directive do not apply.

members uses range from simple parts to complex shaped products that requiring machining to achieve the necessary shape for the component concerned. Examples of steel parts used by EUROMOT's members and reliant on this exemption include:

- Air compressors
- Air intakes and exhausts
- Alternator parts
- Bolts, nuts, screws
- Brackets, mechanical assemblies (e.g., flanges, blocks, rocker arms, tensioners)
- Component housings and covers (e.g., oil or fuel filter, heater, flywheel)
- Connectors, unions, and inserts
- Gaskets (e.g., cylinder head)
- Hose assembly components
- Parts of fuel filters
- Pumps and hydraulic components (e.g., valves, injectors, tubes, pipes, pistons, springs, stems, stators, yokes, nipples, armatures)
- Shaft, gears and shaft intake assemblies
- Spacers and fixings (e.g., spacers, plugs, sleeves, bushes, locking pins)
- Turbochargers

The component surfaces are machined, as they often have demanding dimensional requirements, such as being perfectly flat such that it is able to mate with corresponding flat surfaces to prevent fluid leaks. Dimensional tolerances are also technically required due to the long-term functioning of the parts, which if the tolerances are not achieved can result in component failure. One such example is screws for electronic equipment must have a machining tolerance of at least ±0.01mm due to the vibrations the component will experience in service.

**(C) What are the particular characteristics and functions of the RoHS-regulated substance that require its use in this material or component?**

The fundamental need is for high quality machinability which is provided by the lubricant effect of lead in steel. This makes it much easier to machine at lower temperatures and without chattering and thus provide better technical results. These characteristics are fundamentally connected to the properties of the machined alloy used and thus to the use of lead in its composition which enables this. The previous Umbrella Project (UP) exemption request provides more details on this.[3]

Machinability can be considered as meaning any of the following: a reduced cutting force when machining steel, appropriate chip formation (length and force), facilitation of a smooth surface finish, facilitation of a good dimensional achievement under commercial production conditions or reduced "tool wear" during the machining operation. Machining encompasses a number of production operations including turning, grinding, rough forming, fine forming, drilling, and parting. Leaded steels are considered to provide the best performance at lower cutting speeds, with high-speed steel tools and in deep hole drilling in particular. As such they are the materials of choice for high tolerance parts used in high reliability applications such as those which EUROMOT members make.

Lead has been the traditional default addition to a range of alloys to provide free- machinability across the breadth of the engineering, particularly where the quality of finish is demanding. As such the technical rationale for the use of lead is very similar, however the demands placed on EUROMOT products in the field and more demanding. These demands can be considered under the following headings:

<u>Demanding Operating Conditions</u>

EUROMOT products are commonly used in conditions which would be considered extreme for most uses of machined parts:

- High particulate contaminant levels from dust to grit and larger objects (e.g. in mining), for more details as to indicative levels of debris expected the EUROMOT exemption 42 should be referenced.
- High levels of broad-spectrum vibration from low frequency impacts (e.g. in harvesting equipment or diggers), to continuous high frequency vibration (e.g. in generators and compressors)
- Presence of water other external contaminants (e.g. by the sea, on sewage farms, in mining operations)
- High mechanical loads leading to accelerated wear (e.g. in mining and construction)
- Requirement to operate and high-performance levels under all ambient temperature conditions and sometimes more extreme temperatures (e.g. poorly ventilated areas and underground), sometime with significant cyclic thermal loading. Temperatures can range from -40°C due to engines operating in Northern Europe in winter conditions, and up to 150°C due to the heat generated by the engine.

<u>Operational reliability</u>

- Equipment is required to operate for extended periods (with some applications requiring use for months continuously and with product lifetime of sometimes several tens of years) under these demanding conditions
- Maintenance in the field can be problematic (access, dangerous working environments, need for facilities to disassemble and fix, cleanliness)

<u>Criticality of application</u>

The consequences of failure or unreliability can have severe consequences in many uses, including:

- Compressors and standby/back-up generators in critical facilities such as hospitals and mining, and
- Operating in highly dangerous environments such as mining and construction.

All the above considerations mean that the design of any system needs to be carefully considered and any changes to a design, for example as a result of substance substitution needs to be formally assessed with rigour at every level from component design and manufacture, assembly in a part, integration in a sub assembly and in the final product too.

## 5. Information on Possible preparation for reuse or recycling of waste from EEE and on provisions for appropriate treatment of waste

**1) Please indicate if a closed loop system exist for EEE waste of application exists and provide information of its characteristics (method of collection to ensure closed loop, method of treatment, etc.)**

Within the commercial internal combustion engine sector, there is in effect a closed loop system for the recycling of mixed metal components generated during the rebuild process and at end of life. These closed loops operate industry wide as it is not possible for engine manufacturers to guarantee take back of their own engine for recycling, however the metals are recovered by traditional metal recycling processes that occur within the EU and are reused. Therefore, a closed loop as understood by Article 4.5 of RoHS does not exist.

**2) Please indicate where relevant:**

☐ Article is collected and sent without dismantling for recycling

☒ Article is collected and completely refurbished for reuse Some engines are refurbished

☒ Article is collected and dismantled: To recover spare parts which are then used in refurbished engines.

- ☐ The following parts are refurbished for use as spare parts:
- ☐ The following parts are subsequently recycled:

☐ Article cannot be recycled and is therefore:

- ☐ Sent for energy return
- ☐ Landfilled

**3) Please provide information concerning the amount (weight) of RoHS sub-stance present in EEE waste accumulates per annum:**

☐ In articles which are refurbished ______

☒ In articles which are recycled 700 kg

Professional engines at end of life are recycled as metal scrap and lead is recovered in the EU by steel recycling processes. The number of engines and quantity of lead are not recorded consistently in the EU, so a calculation on quantities is difficult, especially as the engines reaching their end of life currently are over 30 years old. In a stable market, the quantity of lead used in new engines will be similar to the amount reaching the end of life.

☐ In articles which are sent for energy return ______

☐ In articles which are landfilled ______

## 6. Analysis of possible alternative substances

### (A) Please provide information if possible alternative applications or alternatives for use of RoHS substances in application exist. Please elaborate analysis on a life-cycle basis, including where available information about independent research, peer-review studies development activities undertaken

Functional sufficiency of alternatives

As explained in the UP exemption requestion request[3], the conclusions of previous research referenced in the UP request are also applicable to EUROMOT related applications. This is because the basic requirements for machinability are the same. This research considered the main supposed alternatives to lead; bismuth, increased sulphur (with and without tellurium), tin (with low and high copper), phosphorus and calcium.

The general conclusion of these tests is that leaded steels showed the best performance in tests at lower cutting speeds, with high-speed steel tools and in deep hole drilling. Non-leaded alternative grades generally gave inferior performance. For more information see section 6(A) of the UP exemption.

Of all the alternatives, bismuth is best able to substitute lead, however, the hot workability of bismuth steels is reduced compared to leaded steels. The reduced hot workability of bismuth steels effectively means that it is not possible for a steel roller to produce a bar with the same machining properties and surface integrity as steel containing lead. Therefore, the expected energy cost associated with bismuth is higher as well as potentially higher error rates leading to increased waste.

New and other research on alternatives

Other research, including more recent research, suggests that research on substitutes is ongoing and that technical issues continue to be raised which means that substitution would not be appropriate from a technical perspective alone:

- A comparative study of the machinability of different free cutting steels to realise their real behaviour and potential as alternatives to conventional steels.[6] This considered three leaded free-machining steels (SAE 12L14, 11L17, and 11L41) containing 0.22 to 0.24% lead with a resulfurized steel (SAE 1144), and a low-carbon steel. The results showed that the presence of lead extended the tool life at low and medium cutting speeds between two and four times depending on the free-machining steel. Self-lubrication compounds were observed at the rake face of the cutting tool after machining leaded steels and SAE 1144.

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[6] Dry machinability analyses between free cutting, resulfurized, and carbon steels, D. Martinez Krahmer, G. Urbicain & A. J. Sánchez Egea. Materials and Manufacturing Processes, Volume 35, 2020 - Issue 4, 26 February 2020. https://upcommons.upc.edu/bitstream/handle/2117/185705/29_Dry_machinability_analyses_between_free_cutting_resulfurized_and_carbon_steels_2020.pdf?sequence=1

- Satisfactory machining results were obtained using CMnCr steel alloyed with 0.08 wt % Bi[7] however no comparison with leaded alloys was provided. They note that there are only a limited number of suppliers which would limit its development further. Even if the issue of supply was to be resolved, the alloy would need to be evaluated further before it could be considered as a viable alternative.
- Alloys containing bismuth, tin, copper, chromium, sulphur, and others were thought to have been developed with in some cases comparable[8], and in others worse properties comparing to leaded free-machining steels[9]. However more research was seen to be needed to be carried out to improve machinability and consistent technical performance of those new materials further.

The above studies are indicative of the research undertaken to date.

Approval of alternatives

It is known that lead-free machining alloys are marketed by alloy manufacturers and are being used. However, these alloys are not always drop-in replacements to the lead-based alloys. Therefore, it is always necessary for EUROMOT's members to carry out research and testing to determine whether each potentially viable substitute is suitable.

If the properties of the alternative alloy are significantly different such that either the engine design needs to change, or this could potentially affect reliability or emissions, then it may be necessary to gain approval for the engines made with alternative alloy parts as required by the EU engine emissions legislation.[10]

Environmental impact

There has been much discussion about the suitability of lead-free machining alloys and whether these substitutes have a larger negative impact on the environment and health than current lead-based alloys. The relative environmental impact of bismuth and lead, based on life cycle assessment, are given in Table 1 (as quoted in the UP-exemption request but still valid). It is apparent that the impact of bismuth is worse than lead on all metrics assessed. Note that this study did not consider impacts beyond the point of supply.

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7 The Effect of Bismuth on Technological and Material Characteristics of Low-Alloyed Automotive Steels with a Good Machinability, Vladislav Kurka, Zdeněk Kuboň, Ladislav Kander, Petr Jonšta,Ondřej Kotásek. Metals 2022, 12(2), 9 February 2022. https://doi.org/10.3390/met12020301

8 A new free-machining steel containing bismuth and calcium, May 2016. Materials Science Forum 857:251-255. A.V.Ryabov, A.A. Dyakonov, M.G.Vakhitov. http://dx.doi.org/10.4028/www.scientific.net/MSF.857.251

9 Lead-Free Free-Cutting Steels as Modern Environmentally Friendly Materials; Dragana Živkovića, Nada Štrbaca, Sabahudin Ekinovićb, Edin Begovićb. Ecologia, January 2011, https://www.academia.edu/22452867/Lead_Free_Free_Cutting_Steels_as_Modern_Environmentally_Friendly_Materials

10 Engines utilising this exemption are also in scope of the Non-Road Mobile Machinery (NRMM) Emissions Directive, 2016/1628/ EC. The NRMM Directive sets requirements relating to gaseous and particulate pollutant emission limits, relating to carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx) and particulates (PT). Engines are also required to have type-approval by Member State competent authorities to certify that they meet the essential technical requirements of the legislation.

Table 1. Comparison of bismuth and lead metal environmental and health impacts[11]

| Impact | Units | Lead | Bismuth | Bismuth / lead ratio |
|---|---|---|---|---|
| Fresh water eutrophication | kgP-eq/kg | 0.0022 | 0.022 | 10.00 |
| Cumulative energy demand | MJ eq/kg | 18.9 | 697 | 36.88 |
| Terrestrial acidification | kg $SO_2$ eq/kg | 0.028 | 0.38 | 13.57 |
| Global Warming Potential | kg $CO_2$-eq/kg | 1.3 | 58.9 | 45.31 |

Availability

Bismuth is a ‘critical raw material’ as defined by the European Commission (2017) and is in limited supply. More than 80% of bismuth is mined and produced in China[12] (82% according to the CRM Alliance[13]). It is also a by-product of, and so directly linked to, the production of lead. Therefore, if the usage of lead were to decline in the future, production rates of bismuth would be proportionately impacted.

**(B) Please provide information and data to establish reliability of possible substitutes of application and of RoHS materials in application**

To date no substitutes have been identified that can effectively replace lead in free cutting steels in all applications. For more information see the previous UP exemption request.

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## 7. Proposed actions to develop possible substitutes

**(A) Please provide information if actions have been taken to develop further possible alternatives for the application or alternatives for RoHS substances in the application.**

The steel industry is developing lead-free machining alloys which EUROMOT members and their suppliers are at an early stage of assessing for suitability and reliability. This is not straightforward due to the operational environment and an expected service life of up to and beyond 20 years in EUROMOT applications.

A limited number of EUROMOT Members have indicated that they are making initial progress on alternatives:

- One indicates that they have been using lead-free parts since 2016 although not across their whole inventory, with parts limited to commercial off the shelf components of hose and pipe connection parts, plugs and bolts. This same equipment manufacturer is still

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[11] Nuss P, Eckelman MJ (2014) Life Cycle Assessment of Metals: A Scientific Synthesis. PLoS ONE 9(7): e101298. https://doi.org/10.1371/journal.pone.0101298

[12] Study on the EU's list of Critical Raw Materials (2020), JRC. https://rmis.jrc.ec.europa.eu/?page=crm-list-2020-e294f6

[13] https://www.crmalliance.eu/bismuth

utilising lead containing parts for more complex assemblies and specifically designed components for their engines.

- Another indicates they will be starting testing parts in 2023.
- A third Member has identified three potential substitute alloys in cooperation with three suppliers, but these are yet to be assessed.
- Other members are engaging with their supply chains to determine if alternatives are suitable but have not identified any suitable alternatives at this point.

It is important to note that, when one supplier qualifies lead-free alternatives in their application, it does not necessarily mean that other manufacturers are able to use lead-free alternatives. This is as a consequence of the different operational environments and technical demands different end products serve. It is therefore important that each manufacturer is able to determine if an alternative has any negative impact on their end product.

It was pointed out that often several hundred parts from over a hundred suppliers need to be assessed. In many cases the part forms part of a more complex assembly (e.g. turbocharger) meaning that it is not just the Member's supplier who is involved but possibly several layers of sub supplier behind them. At each of these layers the suitability of the substitute needs to be assessed. It is also the case that existing parts have been assessed as technically required under other legislation (e.g. ELV) where the majority of uses occur.

Material testing and development activities necessarily take many years to complete to ensure the necessary technical performance if the changes are large, and so far is incomplete. Work to identify, assess and test potential substitutes is discussed below.

**(B) Please elaborate what stages are necessary for establishment of possible substitute and respective timeframe needed for completion of such stages.**

The following will be required before lead-free substitute parts can be used in end-equipment. This work is required before modified engines can be sold in the EU and in the UK. It may also be necessary for much lengthier trials to be carried out to comply with emissions legislation. The current situation is that each EUROMOT member may use up to several hundred types of steel parts. Research will be needed with each part to:

1. Identify one or more lead-free substitute alloys that have comparable properties and performance and appear to meet any essential technical requirements. These requirements will depend on the specific applications of the component and where the end-products are used. Any one part is likely to be used in several end-products and be used under a variety of environmental conditions.
2. Make prototype parts and assess for quality, dimensional accuracy, surface finish, strength, corrosion resistance and any other property that is essential for the parts made using this alloy. If considerable changes are required, an update to the tooling for the part could be required which adds considerable time to undertake. For one manufacturer, this is expected to be the case for the flywheel housing.

3. Reliability testing. These are in-house tests carried out to ensure that parts are suitable and meet manufacturer's specifications.
4. If a change to the alloy is not trivial (e.g., if the properties are different or a design change is needed), it is likely that manufacturers will need to build prototype engines using new parts and field test these. This is because they have found previously that laboratory testing does not always identify long term field failure issues, which are identified only when tested in real engines. If this is the case, field testing of up to a year is sometimes required.
5. Additional sourcing time is sometime needed for certain components of up to a year to allow the supply chain to adapt to the changes and be able to supply parts in the quantities which end product manufacturers require them in.
6. If necessary, testing of modified engines to comply with the NRMM Emissions Regulations.
7. Request re-approvals, if necessary, which is estimated to take anywhere from 24-33 weeks.

The time required for all of the above for each manufacturer will depend on how many lead-based alloy parts are identified, how successful is the work to identify suitable substitutes and if re-approvals are needed. This timescale will vary between manufacturers because some will discover more parts that need replacement than others and also the availability of trained engineers who are capable of doing this work will always be limited and will also vary.

The predicted timescales for these activities ranges from between 5 and 7 years. The longer timeframes are required when:

- Tooling for the parts is required to be changed,
- Field testing is required as part change is significant,
- Certain manufacturers have a larger number of affected components so the cumulative amount of work needing to be undertaken is larger. Wherever possible multiple parts will be tested concurrently to ensure the timely completion of the qualification, but each technical parameter must be tested which varies between parts which can create complex testing regimes. In addition to this there are sometime limitations to the number of tests which can be undertaken at any one time by each manufacturer.
- Components (such as air intakes and exhausts) trigger the requirement to update emissions testing and re-certification.

## 8. Justification according to Article 5(1)(a):

**(A) Links to REACH: (substance + substitute)**

1) Do any of the following provisions apply to the application described under (A) and (C)?

☐ Authorisation

☒ SVHC Lead metal is a REACH SVHC

☒ Candidate list

☒ Proposal inclusion Annex XIV

☐ Annex XIV

☐ Restriction

☐ Annex XVII None relevant to this exemption renewal request

☐ Registry of intentions

☐ Registration

2) Provide REACH-relevant information received through the supply chain. Name of document:

Based on the current status of Annexes XIV and XVII of the REACH Regulation, the requested exemptions would not weaken the environmental and health protection afforded by the REACH Regulation. The requested exemptions are therefore justified as other criteria of Art. 5(1)(a) apply.

**(B) Elimination/substitution**

1. Can the substance named under 4.(A)1 be eliminated?

☐ Yes. Consequences? ______

☒ No. Justification:

Reliability of substitutes is not assured. Parts made with alternative alloys have to be assessed, tested and engines possibly approved before they can be used.

2. Can the substance named under 4.(A)1 be substituted?

☐ Yes.

☐ Design changes:

☐ Other materials:

☐ Other substance:

☒ No. Justification: Reliability of substitutes are not assured

3. Give details on the reliability of substitutes (technical data + information): Not assured until testing is completed and results are satisfactory)

4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to

1) Environmental impacts:

See answer to question 6A. As mentioned earlier, the lack of hot workability of possible substitutes is a very significant technical disadvantage. This issue alone is enough to dismiss the possibility of using bismuth as a replacement of lead. It is also important to consider the wider environmental implications of the selection of the material. The lower energy consumption of machining leaded steels means that there is a potential benefit of reduced electricity consumption and $CO_2$ emissions in fabrication.

2) Health impacts: _____
3) Consumer safety impacts: _____

⇨ Do impacts of substitution outweigh benefits thereof?
Please provide third-party verified assessment on this:

It is unclear whether lead-free 'alternatives' are better or worse than potential alternatives. The LCA in the UP-exemption renewal request makes it clear that lead-free alloys are more beneficial up to point of supply but does not cover impacts beyond that point.[3]

**(C) Availability of substitutes**

a) Describe supply sources for substitutes: _____
b) Have you encountered problems with the availability? Describe: Not applicable
c) Do you consider the price of the substitute to be a problem for the availability?
☐ Yes ☐ No
d) What conditions need to be fulfilled to ensure the availability? See answers to previous questions

**(D) Socio-economic impact of substitution:**

⇨ What kind of economic effects do you consider related to substitution? See answer below

☐ Increase in direct production costs
☐ Increase in fixed costs
☐ Increase in overhead
☐ Possible social impacts within the EU
☐ Possible social impacts external to the EU
☐ Other: _____

⇨ Provide sufficient evidence (third-party verified) to support your statement:

If this exemption is not renewed, engine and end-product manufacturers will be forced to stop selling products that do not comply with RoHS. At this stage, it is not known which products would be affected but this could affect many types of end-users. For example, construction and other industries may not be able to operate if essential equipment is not available. If supply of emergency generators is affected, this may affect, for example, hospitals who use these when there are power cuts. Unavailability will either pose a safety risk during essential surgical operations and will pose a risk to patient's survival or these operations and also other medical procedures (such as MRI examinations and monitoring patients in intensive care) may not be possible if emergency generators are not available. Manufacturers of affected engines and end-products would also be negatively affected causing loss of jobs and possibly some also by loss of competitiveness. Due to the uncertainty over which products would be affected, it is not possible for EUROMOT to determine quantitative impacts.

## 9. Other relevant information

**Please provide additional relevant information to further establish the necessity of your request:**

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## 10. Information that should be regarded as proprietary

**Please state clearly whether any of the above information should be regarded to as proprietary information. If so, please provide verifiable justification:**

No information given in this application is regarded as proprietary.