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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Function: Material compliance WG chair

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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: 6b and 6b-I

Proposed or existing wording:

6b-I Lead as an alloying element in aluminium containing up to 0,4 % lead by weight, provided it stems from lead-bearing aluminium scrap recycling.

Duration where applicable: 5 years

☐ Other: _____

3. Summary of the exemption request / revocation request

Lead is present as an impurity in aluminium up to 0.4% by weight whose removal or dilution would have a significant negative environmental and health impact. Although there is the trend of reducing lead content in some alloy specifications, some specifications still permit >0.3% lead which are utilised in EUROMOT members parts. Parts with up to 0.4% lead are still used by EUROMOT members as they produce special types of engines some of which are sold annually in only small numbers, as few as one or two per year. Stocks of parts for these special types of engines may last for up to seven years before they are consumed, and new batches of parts are obtained. Some of the parts currently in stock contain between 0.3% and 0.4% lead and so manufacturers need this exemption to allow up to 0.4% lead until these parts are used in finished products that are placed on the market. Without the continuation of the exemption these parts will become waste and have to be disposed of and replaced which has a considerable environmental impact.

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4. Technical description of the exemption request / revocation 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 they are used.

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

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

b. Please specify if application is in use in other categories to which the exemption request does not refer: Yes, in categories 1 - 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: Present as an impurity whose removal or dilution would have a significant negative environmental and health impact.

4. Content of substance in homogeneous material (%weight): Up to 0.4%

5. Amount of substance entering the EU market annually through application for which the exemption is requested: 3.08 to 4.19 tonnes in the EU for EUROMOT members.

EUROMOT has knowledge only of its members products so cannot determine the amount of lead from this exemption for all category 11 products.

Please supply information and calculations to support stated figure.

Two EUROMOT members provided data for 6bI and 6bII.

Manufacturer A: Figures for 6b (not differentiated for 6bI and 6bII).
Total of lead in aluminium parts containing >0.1% lead in one typical engine: 233 grams.

Based on the 2013[1] EUROMOT 68,000 engines are in scope of RoHS sold in the EU and EUROMOT stated in its 2017 lead in sensor request that this figure was unchanged. As such there is 15.84 tonnes placed on the EU + UK market annually. The UK is 7.42% of the EU sales quantity according to Power Systems Research with 2021 information. As such this manufacturer estimates the amount of lead placed on the EU market annually is 14.67 tonnes from both 6bI and 6bII.

Manufacturer B: Provided information for genset engines in range 250 – 550kVA.
This manufacturer estimated that for 6bI they place 60kg of lead annually on the market combined EU and UK market. Based on their estimated market share of 30%, the amount of lead placed on the market by all manufactures would be 200kg.
250 – 550kVA range accounts for 6% of total gensets, therefore using EUROMOTs estimates for EU (excluding the UK) market (also considering Power Systems Research with 2021 information that the UK accounts for 7.42% of EU sales). As such, based on this manufacturers estimation the annual amount placed on the EU market for 6bI is 3.08 tonnes.

This manufacturer estimates for 6bII they place 150kg of lead annually on the EU and UK market. Following the same methodology as outlined above, this would result in 500kg of lead placed on the EU and UK market for all manufacturers and 7.71 tonnes for 6b-II for the EU market.
As such the combined value for 6bI + 6bII total is 10.8 tonnes

In conclusion:
Lead in aluminium used in engines in scope of RoHS for 6bI and 6bII is 10.8 to 14.67 tonnes per year in EU excluding the UK.
Based on manufacturer B's split for 6bI and 6bII:
The amount of lead placed on the EU market for 6bI is between 3.08 to 4.19 tonnes.

Please note that there is significant uncertainty over these figures as many assumptions have had to be made as described above. The ratio of quantities for 6bI and 6bII may be incorrect as some castings are machined so may have been included in the 6bII total, whereas casting alloys are in scope of 6bI.

6. Name of material/component: Aluminium casting alloys that contain up to 0.4% lead

[1]https://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Pack_11/Request_2016-1/RoHS_Lead_Bearings_Exemption_Request_Form_EUROMOT_2015-07-27.pdf

7. Environmental Assessment: _____

LCA: ☐ Yes

☒ No

(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[2]). 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 engines and their aluminium alloys parts that are used by EUROMOT members need to comply with RoHS[3]. Therefore, suppliers of aluminium 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 the 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.

The alloys covered by exemption 6b-I are lower purity and made mainly from scrap aluminium which may contain lead. Each of the many standardised aluminium alloy compositions is produced by selection of batches of scrap and sometimes also by dilution with pure primary aluminium metal. These alloys are used to make castings. Engine manufacturers either make their own castings from alloy ingot or more often use specialist suppliers of cast parts. As the majority of these parts are used in end-products that are excluded from EU RoHS or the ELV Directives, no lead restrictions apply. As such, EUROMOT's members' suppliers have not previously had a need to determine the actual lead content of casting alloys that they acquire from their suppliers. In addition to this EUROMOT members suppliers have had little incentive to actively search for substitute alloys that provide the required performance and have a lower lead content.

Substitution is not a simple process, as will be explained below in section 6. Manufacturers of engines that are in scope of exemption 6b-I and their supply chain share many similarities with the automotive and aerospace industries. These manufacturers' sectors sell complex products that are made from thousands of parts and components which are sourced from suppliers that

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[2] 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.

[3] These engines are also not used in road vehicles in scope of the EU End of Life Vehicle (ELV) Directive.

also supply to the automotive and aerospace sectors. End-use products that require exemption 6b-I have long lifecycles, high cost, contain large numbers of parts, products have high variability in design and are made in relatively low volumes. End-uses are often in harsh and dangerous environments demanding extreme reliability. Since supply chains are to a large extent shared with automotive (light duty vehicles in scope of ELV and heavy-duty vehicles excluded from both ELV and RoHS), any exemption expiry dates imposed on industry's use of lead in aluminium alloys used in engines will be technically impractical if these are not the same dates as for the corresponding ELV exemptions. Once an alternative alloy is identified, the reliability of the parts in engines must be verified as described below.

Aluminium production from bauxite ore is extremely energy intensive, but this process is used to manufacture high-purity aluminium metal that is used to make a wide range of alloys. These alloys are mainly used for wrought products and contain relatively low levels of additives. One additive that has been widely used is lead added as a machining aid.

When old used equipment containing aluminium alloys reaches end of life, it is highly desirable to recover and recycle the aluminium metal. This is strongly encouraged by the EU and UK Circular Economy Policies. Pieces of aluminium metal can be separated by various processes from other materials, such as by using eddy current separators, and then the separated aluminium scrap metal is recycled. Recycling usually involves melting and then adjusting the composition to produce specific alloy specifications. It is however exceedingly difficult to remove most metallic additives from aluminium and so recycling tends to produce lower purity alloys than those produced using solely primary aluminium. As lead has been widely used for many decades as an additive in aluminium alloys, scrap metal often contains lead. The lead concentration in aluminium can be reduced commercially only by dilution by addition of primary aluminium. Impurity removal has been demonstrated to be technically possible by using high energy-consumption processes such as vacuum distillation, but these processes have not been commercialised.

Secondary aluminium is used to make a wide range of alloys which tend to be used for casting as the higher impurity content is not deleterious to the performance. These impurities may include lead. There are many casting aluminium alloy specifications listed in standards and each composition has specific types of uses. Many of these specifications allow lead to be present such as for the following types of components which are used by EUROMOT's members as engine parts:

Examples of engine components that use cast aluminium alloys that contain lead include:

- Covers, for example for control units, the front covers of engines and for turbochargers,
- Housings, such as for pumps, lawn mowers, and other parts,
- Brackets, arms and various plates and rods that are parts of engines, etc.

The actual lead content will vary within the permitted range depending on the scrap materials available to the alloy manufacturer, whose aim is to meet the alloy specification with minimal use of primary metal. When the RoHS Directive was adopted, exemption 6b was granted to allow the presence of up to 0.4% lead in aluminium alloys and this exemption has been renewed because lead still occurs in aluminium scrap. The total amount of lead present in aluminium scrap globally is not known but is likely to have decreased in the last 20 years as manufacturers have replaced lead in wrought alloys where this has been technically possible. However, any batch of scrap aluminium metal may contain lead and the concentration may be 0.4% or higher, especially if it consists of old machined parts. The alloy manufacturer will need to use virgin metal to dilute the lead content if no scrap aluminium with a lower lead content is available in order to meet the alloy specification's upper limit for lead (and other impurities) as well as the maximum concentration permitted by the RoHS exemption.

Some casting alloy standards specify limits to their lead content; however some standards do not specify a maximum lead content and instead specify a maximum total value for all unspecified constituents (some specify maxima for unspecified impurities, but others do not).

One example of a casting alloy that is used by EUROMOT members is EN 1706 AC 46500 which is usually used for high pressure diecasting as it can be used to make thin-walled components with complex geometries. This alloy was specified by EU (and UK BS) standard EN 1706 until the 2020 revision with up to 0.35% lead for this alloy[4], but this concentration was reduced to 0.29% by the 2020 revision. Any parts made to EN 1706 before the standard was changed in 2020 will contain up to 0.35% lead. Changes to this standard has changed several other casting alloys by lowering the maximum lead content. When EN 1706 does not specify a maximum lead content, it allows only low concentrations of unspecified impurities which would include lead but some other standards from the rest of the world allow higher concentrations. Two example alloys are US ANSI 319 and the Japanese standard ADC12 which both specify 0.5% as the maximum of all unspecified constituents with no limit on unspecified impurities, so lead is potentially permitted to be present at up to this value.

An issue specific to EUROMOT's members is that they manufacture many special types of engines some of which are sold annually in only small numbers, as few as one or two per year. However, some of the castings that are used to make these are made in moderately large numbers for these applications by suppliers and then kept in stock until needed. Stocks of parts for these special types of engines may last for up to seven years before they are consumed, and new batches of parts are obtained. Some of the parts currently in stock contain between 0.3% and 0.4% lead and so manufacturers need this exemption to allow up to 0.4% lead until these parts are used in finished products that are placed on the market, otherwise, they will become waste and have to be disposed of and replaced. This would be an issue for parts made to EN 1706 before the 2020 revision and change of the maximum lead content. Some of these parts will contain >0.3% lead as was permitted by this standard when they were manufactured but they may not be used in end-products that are placed on the EU market for many years.

It is important to note although the majority of global casting alloy standards that have limits for lead of 0.3% or less the current limit of 0.4% needs to be retained until all parts that have

[4] https://www.acmealloys.com/wp-content/uploads/2020/08/51-Commonly-Used-Aluminium-Alloys-omposition-and-Suggested-Properties.pdf

been identified as having >0.3% lead can be replaced with different alloys that are equally reliable and can meet the 0.3% limit. It will also be necessary for EUROMOT members and their customers who use these engines in new equipment have consumed current stocks of parts that contain 0.3 – 0.4% lead. This will require time for substitution testing to determine reliability, described in section 6 as well as consumption of stocks of older parts.

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

Lead is present in the scrap aluminium used to make many types of parts that are used in engines, although if castings are machined, the lead will act as a lubricant as a secondary benefit.

Alloys are selected for a combination of many different technical performance characteristics with each alloy having a different range of properties. These include:

- Ability to cast thin sections and complex shapes
- Corrosion resistance
- Anodising
- Tensile strength, yield strength, elongation, all of which depend on the temper of the alloy parts
- Hardness
- Machinability as a secondary benefit
- Suitability for brazing or welding
- Optimisation of cast filling (i.e. to avoid voids and porosity)
- Ability to use required casting method (e.g. high- or low-pressure die-casting, investment casting, sand casting, etc)

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. Engines at end of life have a positive metal value whereas disposal to landfill entails a cost and so a high proportion of engines are collected and recycled, although not always by the original engine manufacturer. The closed-loops are in effect industry-wide as it is not possible for bearing or engine manufacturers to guarantee take back of their own bearings 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: Some spare parts are recovered and refurbished to be used in refurbished engines or may be used as replacement components.

- ☒ The following parts are refurbished for use as spare parts: Any engine part that is required for refurbishing or repair
- ☒ The following parts are subsequently recycled: Any part that is damaged, worn out or no longer needed

☐ Article cannot be recycled and is therefore:

- ☐ Sent for energy return
- ☐ Landfilled

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

☐ In articles which are refurbished ______

☒ In articles which are recycled Between 3.08 to 4.19 tonnes

Based on the assumption of a stable market, such that the quantity of lead used in new engines will be similar to the amount reaching the end of life. It is important to note that professional engines at end of life are recycled as aluminium scrap and lead is recovered in the EU by aluminium recycling processes.

☐ 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

Three options are considered here:

1). Lead removal from aluminium alloy

In its exemption 6b-I renewal request submitted January 2020, the Umbrella Project considered several methods:

- Mechanical separation (only suitable for removal of other materials such as lead/acid batteries)
- Phase separation (research only at present and will be highly energy intensive)
- Electrochemical refining (laboratory scale technology only currently, and will be highly energy intensive)
- Vacuum distillation (has been scaled up to pilot scale but shown to be highly energy intensive)

At the laboratory scale, removal of lead from aluminium alloys has been shown to be technically feasible but all of these processes use more energy than would be used to produce primary metal from bauxite which is already carried out on a large-scale and is proven technology. The reasons for not utilising primary metal to dilute the lead content are explained below.

A recent (2022) review of aluminium alloy purification processes[5] has been published. This review includes vacuum distillation which it states is suitable for removal of some elemental impurities including lead, but it states that even after this has been researched for many years, no commercially viable process exists. No other method described in this review is stated to be suitable for lead separation. Research is continuing but at present, no commercially viable lead removal process exists.

2). Use of primary metal to dilute lead concentration

Primary aluminium metal produced from bauxite ore contains an extremely low concentration of lead and this can be used to dilute aluminium scrap to reduce the lead content. However, the environmental and health impacts of the manufacture of primary aluminium are very much more negative than the process of melt refining of aluminium scrap in which impurities that do not harm performance are allowed. This has been proven by several published life cycle

[5] Melt refining and purification processes in Al alloys: a comprehensive study" J. Wu et.al., Mater. Res. Express 9 (2022) 032001 Downloaded from https://iopscience.iop.org/article/10.1088/2053-1591/ac5b03/pdf

assessments including a very comprehensive study by European Aluminium[6], which has been independently assessed. The report shows, for example:

Primary energy use for production of 1 tonne primary aluminium	**Primary energy use for production of 1 tonne secondary aluminium**
8.54 GJ	156 MJ

This demonstrates that primary metal production consumes 18 times more energy than the production of parts from scrap by melting. This is significant as energy generation globally emits greenhouse gases and toxic substances into the air (especially where coal is used[7]), including lead, arsenic, cadmium, and mercury[8]. Not only is global warming known to be very damaging to the environment and human health, but the emitted toxic substances are also deposited onto the ground where crops are grown, and airborne dust may be inhaled. Therefore, energy generation from fossil fuels is very harmful to human health and the environment. Production of secondary aluminium emits much smaller quantities of hazardous substances globally than primary metal production due to the much lower energy consumption required. It is therefore always preferable to use recycled aluminium, and this is EU and UK circular economy policy.

3). Achieving a lower lead content in refined scrap metal

European Aluminium's members claim that they can now achieve 0.3%, presumably as there is sufficient aluminium scrap metal arising in Europe that enables this limit to be achieved. However, EUROMOT's members and their suppliers are located not only in Europe, but also in North America and Asia, where it is not yet confirmed that this limit can always be met. Furthermore, parts are sourced globally, not only from Europe. Some US and Asian standards for casting alloys allow >0.3% lead as outlined above.

EUROMOT's members and suppliers also have stocks of older parts (as explained above in section 4B), that were made several years ago (for example, before the EN 1706 standard's lead limits were reduced) and some of these parts contain 0.3% to 0.4% lead. If the RoHS limit were to be lowered to 0.3% before these are used in end-products with these engines that are

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[6] https://european-aluminium.eu/media/3341/environmental-profile-report-for-the-european-aluminium-industry.pdf

[7] Coal accounts for a high percentage of electricity generation for primary aluminium globally, mainly due to production in China – see table 2 of https://link.springer.com/article/10.1007/s11367-015-1003-7

[8] For example, see https://www.gem.wiki/Heavy_metals_and_coal and https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5751006/

placed on the market, they will become waste. If an unused part becomes waste, the following will need to occur:

Table 1 Impact of component waste

Impact	Part becomes waste and has to be replaced by a new part
Materials used	Double the quantity of metal is processed, the original part and its replacement. Melting aluminium can generate wastes and emissions to air (as does primary metal production)
Energy consumption	Melting aluminium for casting consumes energy. The total quantity used is doubled by having to remelt the original part as well as from making a replacement part. Energy generation emits global warming gases and pollutants.
Waste generated	The original part will become waste as it has not yet been placed on the market, as well as the replacement when it reaches end of life. The total quantity of waste is therefore doubled.

Another important issue is the overall global impact of reduction of the lead limit for this exemption. Currently there is a shortage of aluminium scrap[9] and so almost all available scrap metal is used. By sorting and segregating this scrap, the range of casting alloys is produced. Lead metal that is present in scrap cannot be removed and so 100% of this lead will be present in the global secondary aluminium metal produced unless some of this aluminium scrap metal is not used and goes to landfill. Sending scrap aluminium alloy to landfill is very unlikely to happen and so the impact of the EU/UK reducing the lead limit of this exemption will mean that alloys with >0.3% lead will be used elsewhere either in countries without such a limit or in the EU/UK in products that are not subject to lead restrictions. Therefore, there would be no overall global reduction in the amount of lead within aluminium alloys in use globally and so no overall benefit to human health or the environment. The overall amount of lead in scrap aluminium is gradually decreasing as manufacturers switch to alternative lead-free machining alloys, but

[9] Shortage of aluminium for packaging looms, BIR hears - letsrecycle.com, November 2021

because of the long lifetimes (20 – 30 years) of many types of commercial equipment, it is not possible to predict when a limit of 0.3% will be achievable globally.

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

Reliability is particularly important because engine components can experience severe stresses due to large temperature fluctuations and vibration, as well as being exposed to corrosive environments.

Substitution by lower lead-content alloys is not straightforward. Each part used by EUROMOT's members is required to have specific properties to ensure long term reliability. Examples of required properties are listed above in section 4(C). EUROMOT's members cannot use parts made using different alloys until prototypes have been made, assessed, and tested to ensure that the properties and performance meet the specific requirements for each part. If the composition change is relatively small and the properties and performance found to be satisfactory, then these parts could be used to make new engines as the qualification of the engine would ensure the technical characteristics are suitable.

However, if any changes are significant, such as having to use a totally different type of alloy, the temper needs to be changed (as this can affect corrosion resistance[10]), the casting method or the shape or design of the part is changed, then more comprehensive testing will be needed and it may be necessary to gain re-approvals for the engine under the EU Non-Road Mobile Machinery (NRMM) Emissions Regulation (Regulation (EU) 2016/1628) (and the UK equivalent).

Significant changes may be necessary because the properties of aluminium casting alloys are very dependent on composition as well as any subsequent heat treatment used to "temper" the parts. These can affect not only strength and hardness, but also machinability, corrosion and welding and anodising performance.

EUROMOT's members have found in the past that laboratory testing of components may not always be reflected by field trials in engines as engine testing in the field can be unexpectedly severe and so this type of testing is essential for long term reliability to be assured. EUROMOT's members are currently assessing the cast aluminium parts that they use and are evaluating possible alternatives but at present, this work is incomplete and so the reliability of substitutes is not yet known.

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7. Proposed actions to develop possible substitutes

[10] This is stated in EN 1706; temper T4 should be avoided if the parts are heated to 70 - 160°C and thereafter exposed to corrosive media (which is likely for external components).

(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.

EUROMOT's members are in the process of identifying the chemical composition of the cast aluminium parts that they use. The lead content appears to be variable, with many parts and components meeting the proposed 0.3% upper limit, whereas there are some parts with >0.3% and up to 0.4%.

Some manufacturers have not yet completed this work so do not yet know how many parts they will need to make, assess and test using alternative casting alloys.

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

Once manufacturers have identified parts that use alloys with 0.3% – 0.4% lead, they will need to carry out the following work:

- Determine whether the alloy currently used can be sourced with <0.3% lead and whether this will affect essential performance requirements. This may be possible by either sourcing the component from a different supplier, or by the current supplier selecting batches of scrap metal with lower lead content after chemical analysis. The latter option may not always be possible as suppliers may not be willing to do this if most of their production is for products excluded from the RoHS Directive.
- If it is not possible to guarantee that the currently used alloy will always contain <0.3% lead, if the alloy specification does not limit lead to this value or below. As all alloys have slightly different performance and properties, assessment and testing of prototypes will be required. The timescale will vary depending on how significant the changes and the types of engine and the end-uses are. This will involve some or all of the following:
    - Selection of alloys based on published properties
    - Production of prototype parts and laboratory testing to determine suitability
    - Re-tooling if required, selection and approval of new suppliers, etc.
    - Construction of engines using prototype parts and bench testing to determine reliability
    - Field trials in end-use equipment
    - If substitute alloys require significant changes, such as re-design, then approvals under the NRMM Emissions legislation will be required. This will take as long as it takes for a new engine design.

    The timescales for these stages vary between 18 months and eight years depending on the type of component.
- Timescales for above:
    - Without NRMM Emissions Regulation re-approval up to seven years
    - With approvals eight years. This may be longer as approvals will be required globally as usually each design of engine is sold world-wide, not only in the EU.
    - As a minimum, to consume existing stocks of components, an additional 7 years is required from the date when substitutes with verified reliability are available.

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 Lead metal is a REACH SVHC

☒ 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: _____

(B) Elimination/substitution:

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

☐ Yes. Consequences? _____

☒ No. Justification: Reliability is not assured until full testing is complete and satisfactory performance demonstrated. Parts made with alternative alloys have to be assessed, tested and possibly also engines 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 is not assured until full testing is complete and satisfactory performance demonstrated. Parts made with alternative alloys have to be assessed, tested and engines possibly approved before they can be used.

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: Yes
   2) Health impacts: Yes
   3) Consumer safety impacts: No

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

Several life cycle assessments have been carried out that compare primary and secondary aluminium. If secondary alloys cannot be used due to lead restriction, then primary metal will be needed to dilute the lead content (see section 4 above). The life cycles of the two options are compared below:

Table 2 Life cycle assessments[11]

Lifecycle stage	Use of primary aluminium	Use secondary aluminium as much as possible
Mining to production of parts	Uses 18 times more energy with associated impacts on global warming, hazardous substance emissions, etc.	Much smaller environmental and health impacts mainly due to lower energy requirement
Use phase	No impact	No impact on users who will not touch engines when in use. Also, there will be no lead emissions to air during use. Maintenance workers will handle parts but usually wear gloves. As used engines are always dirty, workers will wash hands after work if gloves not worn. Lead metal is not absorbed by dermal contact
End of life	No impact	Melting aluminium alloy at end of life for reuse will occur whether this exemption is renewed or not and so there will not be an impact overall.

Therefore, considering all lifecycle phases, reuse of secondary aluminium will have the least impact on health and the environment.

[11] Comparative life cycle assessments have been produced by European Aluminium and others but give few details on hazardous substance emissions (see reference 6). However the EU Industrial Emissions Directive Best Available Techniques Reference (BAT BREF) Document gives details of the emissions and pollution caused by both primary and secondary aluminium production. https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC107041_NFM_bref2017.pdf

(C) Availability of substitutes:

a) Describe supply sources for substitutes: Aluminium alloy suppliers

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: