Adaptation to scientific and technological progress under Directive 2002/95/EC

Joint response from EICTA and AeA Europe to the general and specific questionnaires

relating to exemption 12
"Lead as a coating material for the thermal conduction module C-ring"

DATE: 31 March 2008

Content

General questionnaire

NB: This response is based on IBM®* zSeries®* High End Servers, and does not represent any other application that may be used in the electronics or other industries.
*IBM and zSeries are registered trademarks of International Business Machines Corporation.

1. For which substance(s) or compound(s) should the requested exemption be valid?	This exemption covers lead coating that is electroplated onto Inconel ®* seal rings having a "C" cross section and used in some IBM high performance computers. [cf. Goodwin, P., Strudwick, P., Skipper, R., "Technical Adaptation under Directive 2005/95/EC (RoHS) Investigation of exemptions," ERA Report 2004-0630, 2004, §2.5 and Figure 7, pp 38-39; hereinafter referred to as "ERA"] *"Inconel" is a registered trademark of Special Metals Corporation.
2. What is the application in which the substance/compound is used for and what is its specific technical function?	Lead coating is used on C-rings that are unique components of IBM High End Server Thermal Conductivity Modules (TCM's). [ERA, §2.5, p 38]
3. What is the specific (technical) function of the substance/compound in this application?	Lead coating provides a hermetic seal by filling small surface irregularities in the glass ceramic substrate, copper hat or C-ring body and facilitates movement during thermal excursions incident to TCM operation by lubricating the C-ring to hat and C-ring to ceramic substrate interfaces. [ERA §2.5.2, p 40]
4. Please justify why this application falls under the scope of the RoHS Directive (e.g. is it a finished product?	The C-ring coating is pure lead, which is specifically restricted by the RoHS directive. A C-ring is not a finished product; it is a component.
- Is it a fixed installation?	No
- What category of the WEEE Directive does it belong to?).	WEEE Category 3 "IT and telecommunications equipment"
5. What is the amount (in absolute number and in percentage by weight) of the substance/compound in:	See answer to Specific Question #2.
i) the homogeneous material[1]	
ii) the application, and	
iii) total EU annually for RoHS relevant applications?	

6. Please check and justify why the application you request an exemption for does not overlap with already existing exemptions respectively does not overlap with exemption requests covered by previous consultations.	Not applicable.
7. Please provide an unambiguous wording for the (requested) exemption.	"Lead as a coating material for the thermal conduction module C-ring"
8. Please justify your contribution according to Article 5 (1) (b) RoHS Directive whereas:	
o Substitution of concerned hazardous substances via materials and components not containing these is technically or scientifically either practicable or impracticable;	After more than four years of research and development efforts, tin, as a Pb-free alternate material, has been developed for future applications. The first system with a Pb-free C-ring was announced on 26 February 2008. Because of markedly different performance requirements, each generation of High End computer equipment is a unique design. The time required to develop, qualify and implement tin replacement C-rings for systems currently in production will extend beyond the projected manufacturing life of those systems. Therefore, it is technically impracticable to retrofit existing product with a Pb-free alternative C-ring.
o Elimination or substitution of concerned hazardous substances via design changes is technically or scientifically either practicable or impracticable;	Compromising the hermeticity of TCM seals by not allowing seal conformance to surface irregularities and by not lubricating surfaces as they move relative to one another in normal usage thermal cycling has been demonstrated to cause system failures. TCM's with compromised hermetic seals such that the chips and chip connections were exposed to ambient atmosphere resulted in unpredictable and unacceptably lower reliability performance. Addition of a protective filler material to isolate the chips and chip connections from ambient atmosphere would preclude rework to address latent chip failures in the manufacture and assembly process. Therefore, a hermetic seal using C-ring technology is the only feasible way to achieve the 100,000 power-on-hours design point of these High End servers.
o Negative environmental, health and/or consumer safety impacts caused by substitution are either likely or unlikely to outweigh environmental, health and/or consumer safety benefits thereof (If existing, please refer to relevant studies on negative or	If it were technically feasible to be implemented in a timely manner in current product, substitution of tin as a C-ring coating would not adversely affect the environment or human safety and health.

positive impacts caused by substitution).	
9. Please provide sound data/evidence on why substitution / elimination is either practicable or impracticable (e.g. what research has been done, what was the outcome, is there a timeline for possible substitutes, why is the substance and its function in the application indispensable or not, is there available economic data on the possible substitutes, where relevant, etc.).	In all new High End Server systems, Pb-free C-rings are already committed as "plan of record." (See General Question #11) Implementation of Pb-free C-rings into existing product is not practical due to the required long lead time for qualification. Current production High End servers with Pb containing C-rings are used in such applications as surface and air transportation systems control; energy production and delivery systems; real time financial transactions associated with major banks, securities exchanges and affiliated organizations; and governmental defense and security entities. These applications require extra-ordinarily intensive and highly reliable servers functioning without interruption over extended life times. If alternate C-ring technology were not properly qualified prior implementation into systems destined for such applications, it would compromise the high reliability performance requirement, resulting in catastrophic systems failures. Catastrophic failure of any of these systems would significantly compromise human safety and could lead to significant injury and death. This high reliability requirement results in extemsive development and qualification testing, which takes several years of simulation. Hence, implementation of Pb-free C-rings into existing systems is expected to extend beyond the manufacturing lifetime of current product.
10. Please also indicate if feasible substitutes currently exist in an industrial and/or commercial scale for similar use.	No.
11. Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes were available by 1 July 2006 or at a later stage.	Tin coated lead-free C-rings were first available with the introduction of High End product that was announced 26 February 2008. For additional detail, see Specific Question #1.
12. Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.	There are no legal restrictions to the alternative materials used in lead-free IBM C-ring technology.
13. Please indicate benefits / advantages and disadvantages of such substitutes.	The benefit is that current scientific knowledge indicates tin is environmentally benign and non-toxic, as contrasted to the previously used lead.
14. Please state whether there are overlapping issues with other relevant legislation such as e.g. the ELV Directive that should be taken into	No.

account.	
15. If a transition period between the publication of an amended Annex is needed or seems appropriate, please state how long this period should be for the specific application concerned.	In order to qualify a Pb-free C-ring for a new application, it must undergo extensive reliability testing that takes years to complete. After the C-ring has been certified to be reliable in a particular TCM, then the manufacturing facilities for that TCM must be converted to the new component. Also, the production cycle time of a High End TCM is many months, resulting in a large number of TCM's being in the manufacturing channel at any given time. Taking these factors together, an estimated transition period cannot be less than four years.

Specific questionnaire

1. Please state whether you consider this statement to be still valid. Is a **phase-out** of lead in this application by 2009 still technically feasible? Assuming the current exemption will be given another **expiry date**, what date do you think is technologically feasible for industry?	As stated in ERA §2.5.4, p 42, the IBM strategy in 2004 was to design future High End modules with fewer chips, having fewer risk sites, that would obviate the need of rework. This would allow use of IBM's non-C-ring technology in future applications. The ever-growing demand for more intense computing power has mitigated that strategy. While fewer chips are indeed required, their size and complexity have resulted in more rather than fewer risk sites. In parallel IBM did continue development of alternative C-ring coating materials, and was able to have tin ready in time for implementation on the most recent zSeries product announced 26 February 2008. This timetable is somewhat later than originally anticipated in 2004, so this innovation was not available for other products now in the market place. Due to the extremely long development, qualification and implementation cycles necessary for the high reliability High End products, it is now estimated that lead-containing C-rings can be eliminated from existing products in 2012.
2. Do you consider it to be still necessary to specify that after the exemption may have expired the use of lead containing spare parts for **repairs and upgrades** still should be allowed?	It is requested that repair and / or upgrade of TCM's manufactured under this exemption since 1 July 2006 are and will continue to be exempted from RoHS requirements for the useful life of the products, so long as the net amount of lead in the module does not substantially increase. This is necessary because all repair / replacement TCM's have been or will have been manufactured before the product is declared "end of life," and the production facilities are / will be dismantled, rendering it impossible to retrofit existing repair / replacement TCM's with a Pb-free alternative. In addition, as previously stated, Pb-free alternative technology cannot be qualified in a timely manner to capture TCM's that are have been or are currently in production.
3. Please state the **amount of lead** used per application, the lead content in the homogeneous material, the annual production volume as well as the number of applications related to exemption 12 put on the EU market annually.	The C-ring coating is 100% lead and comprises ≤ 3 grams. Lead constitutes approximately 37% of the weight of the C-ring, and approximately 0.1% of the total TCM weight. It is currently estimated that < 2.0 kilograms of Pb per annum will be shipped to EU countries as a C-ring constituent. This compares favorably with the 2004 worldwide estimate of 10 kilograms of lead per annum being utilized in this application. [ERA, §2.5.2, p 41]
4. Please explain the current status of **research and development** to substitute lead in this application. Please justify in detail if the exemption is still necessary. In this case, please provide a **roadmap** with activities, milestones	A lead-free substitute using tin has been developed, qualified and as of 26 February 2008 implemented in all future IBM High End Server offerings. This is the entire product line that uses the C-ring technology. However, this exemption is still necessary for existing product for which adequate reliability testing and manufacturing phase-in will extend until approximately 2012. If successful testing and manufacturing phase-in permit, implementation will occur as soon as possible before

and an expiry date towards the substitution of lead in this application.	2012.