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

EXCERPT
of final report 2009

Final report

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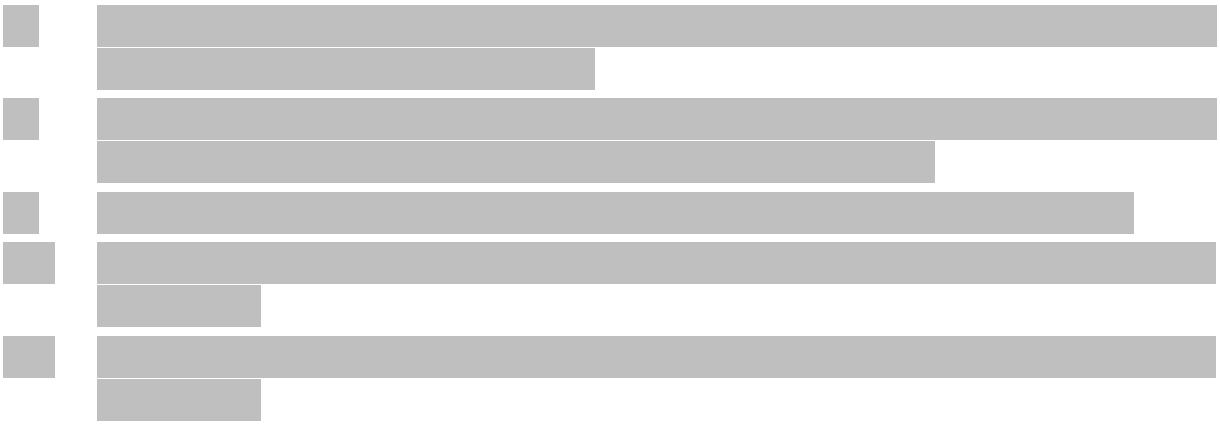

4.18 Exemption No. 12

“Lead as a coating material for the thermal conduction module c-ring”

This exemption was evaluated 2004 by ERA [1]. IBM, who uses this exemption in high end computers, had explained in 2004 that it wanted to replace those computers, which use the lead coated C-ring by new series computers without leaded C-ring some time in 2009. IBM therefore requested the exemption until 2010 [1]. The exemption was granted without an expiry date.

4.18.1 Description of exemption

The most important part of an IBM main-frame computer is an array of high performance microprocessor chips and memory chips which are mounted on a glass-ceramic substrate. To ensure the fastest signal transmission between the central processing units (CPU) and the associated memory, these devices are mounted as bare chips as close together as possible in an array with an area of 150 mm square.

The processor and memory chips generate a significant amount of heat, typically 1.4 kW, and therefore must be cooled efficiently. The computer otherwise cease to function if it overheated. The cooling is achieved by the Thermal Conduction Module (TCM). Cooling of the bare silicon chips is achieved by conduction of heat through a thermally conducting paste into a liquid cooled copper “hat”. As the silicon chips are not encapsulated, the module as a whole has to be hermetically sealed to protect the active surface of the chips, to ensure that the grease does not dry out and to prevent oxidation of the bumps, silicon and chip circuitry. This is achieved with a high vacuum, which is maintained by the lead coated C-ring seal.

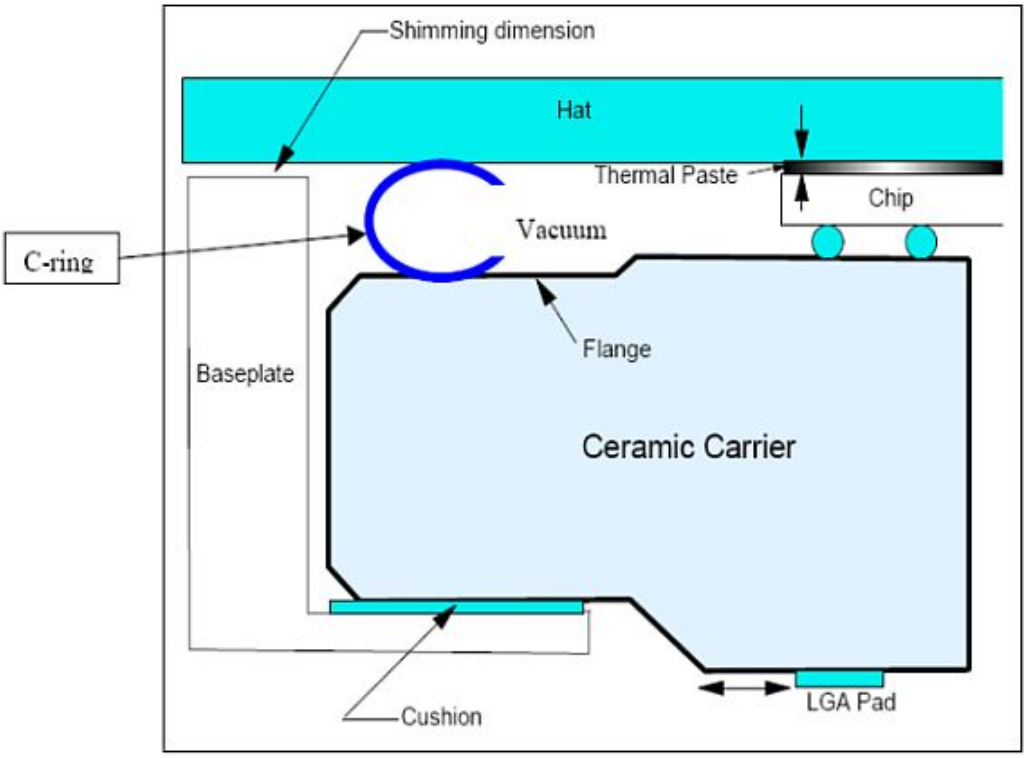

Figure 23 Cross section of a thermal conduction module with C-ring [1]

The very complex high performance chips cannot be adequately tested until they have been mounted in the module. On most of the assembled modules, a small number of defect chips need to be replaced. This means that the modules have to be dismantled, sometimes several times. The C-ring seal is inserted between the upper and lower plates of the modules to enable a demountable but sealed system. [1]

The lead coating on the C-ring 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. [1]

The C-ring coating is 100% lead and comprises a maximum of 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 less than 2.0 kilograms of Pb per annum will be shipped to EU countries as a C-ring constituent. [2]

4.18.2 Justification by stakeholders

EICTA [2] explains that, as mentioned in the 2004 evaluation [1], the IBM strategy in 2004 was to design future high end modules with fewer chips. This would result in fewer risk sites, that would obviate the need of rework. IBM's C-ring technology would thus have become dispensable 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. The C-ring technology could thus not be phased out and is still required. [2] IBM hence had to change its strategy and had to stick to the C-ring technology. Instead of eliminating the C-ring technology, it had to be changed over to lead-free C-rings. After more than four years of research and development efforts, tin, as a Pb-free alternate material, has been developed for future applications. [2]

EICTA states that a lead-free substitute using tin was qualified and as of 26 February 2008 implemented in IBM's entire product line using the C-ring technology. For all server products going forward in time, Pb-free C-ring technology is "plan of record." No future offerings are planned with Pb-containing C-rings.

Nevertheless, EICTA [2] claims exemption 12 still to be necessary for existing products. The qualification of the lead-free C-ring technology in February 2008 was somewhat later than originally anticipated in 2004, so this innovation was not available in time for the products that are now in the market place. EICTA [3] says that there are server products that have been on the market for a number of years (legacy product) that still utilize SnPb C□rings.

The time needed to develop, qualify and implement Pb-free C-rings in these products had been projected not to be complete until 2012. As progress has been made, that projection is now revised to 31 Dec 2011, which EICTA [3] proposes as the expiry date for this exemption.

Because of markedly different performance requirements, each generation of high end computer equipment is a unique design. 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. Taking these factors together, an estimated transition period cannot be less than three years resulting in an expiry date for the exemption in the end of 2011. [2], [3]

EICTA [3] explains that a new product offering is not a direct replacement for a legacy product. The new product has different features and performance characteristics than are included in the legacy product. Therefore, each product fulfils a different need, and both products are sold concurrently for some period of time.

In addition, some sales contracts contain explicit obligations that specific products will continue to be marketed for a definite period of time to allow customers to increase the capacity of their server installations using the same equipment. EICTA [3] demands that those contractual obligations must be honoured. Due to the time constraints allowed for this response, EICTA [3] did not have the details of the contractual requirements for the system in question, but based on standard practice EICTA estimates that it may be necessary to offer this system at a minimum through the end of 2010. Present plans are to market legacy server products into 2012. [3]

EICTA [2] requests that repair and / or upgrade of TCM's high end servers 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. 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. [2]

4.18.3 Critical review

In February 2008, IBM had qualified lead-free C-rings for thermal conduction modules. On the component level, the substitution of lead in thermal conduction C-rings hence is scientifically and technically practicable.

All of IBM's new generation servers using C-ring thermal conduction modules are equipped with this lead-free technology, and the exemption is no longer required for these products. The stakeholders, however, claim that a new product offering is not a direct replacement for a legacy product. As each product fulfils a different need, both products are sold concurrently for some time. In addition, according to the stakeholders, some sales contracts contain explicit obligations that specific products will continue to be marketed for a definite period of time to allow customers to increase the capacity of their server installations using the same equipment. The stakeholders demand that those contractual obligations must be honoured. They ask the exemption to be continued until 31 December 2011 at least.

The consultants assume a different point of view to maintain consistence with the requirements of Art. 5 (1) (b) and with the previous reviews of exemption requests. New models of products may be different in performance, but, as high end servers are designed to serve specific needs, the new models must be assumed to serve those needs as well as a minimum requirement. Otherwise, they would not be new models, but a completely new product that does not have a predecessor and serves a completely new and different market. The exemption was granted in 2006 for the use of lead in the C-rings of thermal conduction modules. The exemption therefore was and is restricted to the component level. If lead can be replaced on this component level and the component be qualified for use, the exemption is no longer justified, the more if at the same time products (not components only) are on the market that do not depend on this exemption.

The reviewers therefore do not see how the sales of older models using leaded C-rings could be justified in line with Art. 5 (1) (b) if at the same time new models with lead-containing C-rings are on the market proving that the substitution of lead in this application is technically practicable.

The stakeholders claim that sales contracts contain explicit obligations that specific products will continue to be marketed for a definite period of time to allow customers to increase the capacity of their server installations using the same equipment. EICTA [3] demands that those contractual obligations must be honoured.

Art. 5 (1) (b) would allow an exemption, if the negative health and/or consumer safety impacts caused by substitution are likely to outweigh the health and/or consumer safety benefits thereof. There is, however, no technical evidence that the sales of lead-containing C-ring servers is necessary in order not to jeopardize consumer health and safety to a degree that would outweigh the benefits of the lead-substitution. Legally, contractual obligations to deliver identical products for a period of time may be a serious issue for manufacturers, but an exemption based on such an argument would not be in line with Art. 5 (1) (b). Further on, manufacturers can be expected to take into account the temporary character of exemptions and thus not go into contractual obligations which are not sure to be accomplishable.

Given the overall situation, the consultants do not see the continuation of exemption 12 in line with the requirements of Art. 5 (1) (b). The substitution of lead in thermal conduction module C-rings is technically practicable.

4.18.4 Recommendation

The consultants recommend repealing exemption 12. The substitution of lead in thermal conduction module C-rings is technically practicable. The continuation of the exemption would therefore not be in line with Art. 5 (1) (b).

The exemption was originally recommended to expire in the end of 2009. It was granted without an expiry date. Assuming that the Annex of the RoHS Directive will be officially amended until the end of 2009, it is recommended that exemption 12 expires on 30 June 2010. This leaves time after the official amendment of the Annex in the RoHS Directive to notify customers of the official cancellation of the exemption and to prepare for it.

The repair of equipment put on the market with leaded C-rings prior to the expiry of the exemption should be allowed beyond this date, following the principle in Art. 2 (3) in the RoHS Directive.

The consultants therefore propose the following wording for the exemption:

Lead as a coating material for the thermal conduction module C-ring until 30 June 2010, and for the repair, or to the reuse, of electrical and electronic equipment put on the market before 1 July 2010.

4.18.5 References

[1] Paul Goodman et al.: Technical adaptation under Directive 2002/95/EC (RoHS) – Investigation of exemptions; final report Dec. 2004;
Document “ERA Report 2004-0603.pdf”

[2] EICTA et al. online stakeholder document
“Exemption_12_EICTA_and-others_1_April_2008.pdf”

[3] EICTA stakeholder document “EICTA reply to questions on ex-12 21-10-08.pdf”