Response to Oeko-Institut 1st Questionnaire

Name and contact details of responsible person for this application & response:

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This response to the 10-August-2015 Oeko-Institut questionnaire is submitted on behalf of Knowles and the participating industry associations and companies listed below.

Amphenol Aerospace		**Filconn**		**Hirel Connectors**	
ITT Cannon		**Glenair Inc.**			

1st Questionnaire (Clarification Questionnaire) Exemption No. 24 (renewal request)

Exemption for „Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors“

Acronyms and Definitions

Background

The Oeko-Institut and Fraunhofer IZM have been appointed within a framework contract[1] for the evaluation of applications for the renewal of exemptions currently listed in Annexes III of the new RoHS Directive 2011/65/EU (RoHS 2) by the European Commission.[1]

Knowles et al. submitted a request for the renewal of the above mentioned exemption, which has been subject to a first evaluation. The information you have referred has been reviewed and as a result we have identified that there is some information missing and have formulated a few questions to clarify some aspects concerning your request before we can start the online consultation.

Please answer the below questions until 24 August 2015 latest or otherwise let us know until when you can provide the requested information.

Questions

1) In the supplementary document to your exemption request you speak of short circuit IR failures. What does the acronym “IR” stand for?

   Reply : IR = Insulation Resistance (test voltage divided by measured leakage current).

2) You tested several lead-free solders without finding an appropriate substitute for lead solders. The best performing lead solders contain up to 50 % indium. Have you ever tested lead-free solders with high indium contents? In the course of the exemption evaluations in Annex II of the End-of-Life Vehicles Directive, such lead-free solders with higher indium contents were proposed for soldering on glass in vehicles (wind shields, backlights, etc.), where microcracks in the glass due to thermal mismatch are a major concern as well. A SnAgIn alloy with around 65 % indium (liquidus temperature 127°C, solidus temperature 109°C) was tested and successfully applied in several cases[2]. Lead-free alloys with lower indium con-

[1] Contract is implemented through Framework Contract No. ENV.C.2/FRA/2011/0020 led by Eunomia

[2] (Zangl, Stéphanie [Öko-Institut e.V.] et al. 28 July 2010) *Adaptation to scientific and technical progress of Annex II to Directive Adaptation Directive2000/53/EC (ELV) and of the Annex to Directive 2002/95/EC (RoHS): Final report - revised version*, with the assistance of Otmar Deubzer, Fraunhofer IZM et al., Adaptation to scientific and technical progress of Directive 2000/53/EC and 2002/96/EC; ELV and RoHS exemption review (Freiburg), Final Report, accessed August 4, 2015, http://elv.exemptions.oeko.info/fileadmin/user_upload/Consultation_2014_1/Ex_3_2010_Review_Final_report_ELV_

tents were taken into consideration as well in order to increase the melting point. Could they be an alternative for your application as well?

Reply : SnIn alloys tend to have low melting points, as indicated by your example above with a solidus / liquidus point of 109 / 127ºC. In component manufacture a high melting point is generally required to i) allow subsequent processing of the component – for example encapsulation cure can be as high as 165ºC, ii) allow subsequent assembly of the component into application, in effect allowing a step soldering process and iii) allow an operating temperature of at least 125ºC for most general applications. The general trend for electronics in applications such as automotive is to have higher operating temperatures requiring higher melting points. 50/50InPb has a solidus / liquidus of 183 / 210ºC making it ideal.

There is a new alloy that has recently been brought to our attention - 77.2Sn20In2.8Ag (eutectic alloy @ 175ºC M.Pt.) We have concerns that the melting point may be too low for many applications (normally you want a liquidus >180ºC), so its potential is limited, and the higher Youngs Modulus of $5.6x10^6$psi (compared to 63Sn37Pb Youngs Modulus of $4.35x10^6$ psi and 95.5Sn/3.8Ag/0.7Cu Youngs Modulus ~ $2.4x10^6$ psi, and both alloys known to cause problems) suggests that excessive stress on the ceramic is still likely, but it is worthy of further investigation.

3) Have there been tests since the last review of the exemption in 2008/2009[3] in order to find alternative pin materials reducing the thermal mismatch between the ceramic, the solder and the pin?

Reply : The pin materials are fixed as copper alloys by application – no other material is acceptable to the industry as offering the appropriate combination of physical and electrical characteristics. Alternative pin materials are not considered an option.

4) You describe that for some applications it has been possible to replace solder with mechanical connections, and you mention spring clips.
   a) What other mechanical connections can be used besides spring clips?
   b) Can you please describe the areas/applications where these mechanical connections can be used in order to demarcate them from those applications that require solders?

Reply :

a) Canted coiled springs have been used in some applications and fulfil the same function as a spring clip. There are no other purely mechanical methods of connecting to the smooth plated inside bore of the ceramic capacitor and the plated surface of the through lead.

b) It Is not possible to provide rules to demarcate the applications. There are too many factors that have to be taken into account – component size, contact (pin) size, working voltage, pin pitch, required capacitance / filtering performance and whether the clip can be

RoHS_28_07_2010.pdf; or https://circabc.europa.eu/sd/d/a4bca0a9-b6de-401d-beff-6d15bf423915/Corr_Final%20report_ELV_RoHS_28_07_2010.pdf, page 151 sqq.

[3] For details see report of (Carl-Otto Gensch, Öko-Institut e. V., et al.), with the assistance of Stéphanie Zangl, Rita Groß, Anna Weber, Öko-Institut e. V., and Otmar Deubzer, Fraunhofer IZM (19 February 2009), page 214 sqq.

isolated from any sealants, epoxies or coatings that are required to achieve the desired performance within the available size envelope.

Generally, smaller single line devices have to be soldered to achieve the performance in the available package size in the same way that small electronic circuits have to be soldered rather than utilise mechanical connections. Larger filtered units for example multi-way filtered connectors, may use mechanical connections if the mechanical and electrical requirements allow it. However there is a general trend for smaller connectors with tighter pitches that preclude the use of mechanical connection due to the physical and electrical requirements.

Please note that answers to these questions are to be published as part of the available information relevant for the stakeholder consultation to be carried out in the course of the evaluation of this request. If your answers contain confidential information, please provide a version that can be made public along with a confidential version, in which proprietary information is clearly marked. Please take into account that any recommendation on the continuation or revocation of exemption can be based on publicly available information only.

References

(Carl-Otto Gensch, Öko-Institut e. V., et al. 19 February 2009) *Adaptation to scientific and technical progress under Directive 2002/95/EC: Final Report*. With the assistance of Stéphanie Zangl, Rita Groß, Anna Weber, Öko-Institut e. V. and Otmar Deubzer, Fraunhofer IZM. Freiburg: . Accessed July 14, 2015. http://ec.europa.eu/environment/waste/weee/pdf/final_reportl_rohs1_en.pdf; http://ec.europa.eu/environment/waste/weee/pdf/report_2009.pdf.

(Gensch, Carl-Otto [Öko-Institut e.V.], et al. 2015) “7th Adaptation to Scientific and Technical Progress of Exemptions 8(e), 8(f), 8(g), 8(h), 8(j) and 10(d) of Annex II to Directive 2000/53/EC (ELV): Report for the European Commission DG Environment under Framework Contract No ENV.C.2/FRA/2011/0020.” Accessed August 10, 2015.

(Zangl, Stéphanie [Öko-Institut e.V.] et al. 28 July 2010) *Adaptation to scientific and technical progress of Annex II to Directive Adaptation Directive2000/53/EC (ELV) and of the Annex to Directive 2002/95/EC (RoHS): Final report - revised version*. With the assistance of Otmar Deubzer, Fraunhofer IZM et al. Adaptation to scientific and technical progress of Directive 2000/53/EC and 2002/96/EC; ELV and RoHS exemption review. Freiburg: . Final Report. Accessed August 4, 2015. http://elv.exemptions.oeko.info/fileadmin/user_upload/Consultation_2014_1/Ex_3_2010_Review_Final_report_ELV_RoHS_28_07_2010.pdf; or https://circabc.europa.eu/sd/d/a4bca0a9-b6de-401d-beff-6d15bf423915/Corr_Final%20report_ELV_RoHS_28_07_2010.pdf.

(Gensch, Carl-Otto [Öko-Institut e.V.], et al. 2015); https://circabc.europa.eu/sd/a/86a233f1-93ce-41e7-b4f2-06609a144e1e/ELV-Exemptions_Amended_Final_2015-06-29.pdf; http://elv.exemptions.oeko.info/fileadmin/user_upload/Final_Report/ELV-Exemptions_Amended_Final_2015-06-29.pdf