

## Questionnaire

### Review of Exemption 8(i) Annex II to Directive 2000/53/EC (ELV)

#### **“Lead in solders in electrical glazing applications on glass except for soldering in laminated glazing”**

#### **Background**

Exemption 8(i) was reviewed in 2008 and in 2009 (Öko-Institut 2008 and Öko-Institut 2010). The core of these assessments was whether a lead-free, indium-containing solder proposed by a solder manufacturer can substitute the established lead-containing solder in all applications. A core concern related to the proposed lead-free indium-based solders was their melting point, which, compared to the established lead-containing solders, is much lower. Several test efforts finally resulted in the adoption of the current wording of exemption 8i. The exemption expires on 31 December 2011 and must be reviewed before 2011.

Lead solders within the scope of this exemption are used in various applications, e.g. to fix the electrical connectors to the backlights of vehicles for the backlight heating, or to contact antennas integrated into the windshields of vehicles. The solder must allow a mechanically reliable and electrically conductive interconnect between the glass on the one hand and the electrical contact such as connectors on the other hand. The solder must prevent cracking the glass during the soldering process or afterwards due to the thermal mismatch between the connectors, the solder and the glass. Soldering with lead solders is an established technology.

In the 2008 review of Annex II, a US-based company (Antaya) claimed to have an appropriate lead-free solder based on indium for the application on glass. Antaya hence requested to no longer exempt the use of lead in glazing applications. The automotive industry and their suppliers opposed this request. No clear evidence could be found that Antaya's lead-free solder suffices all technical requirements. It was hence recommended to continue the exemption, but to review it in January 2009. The Commission enacted the exemption as follows:

*Lead in solder in electrical applications on glasses in vehicles type approved before 31 December 2010 and spare parts for these vehicles; to be reviewed in January 2009.*

The stakeholders were asked to agree upon a joint test program and to test the lead-free solders so that the data would be available for the review in January 2009. The stakeholders including Antaya had asked Dr. Otmar Deubzer from Fraunhofer IZM to coordinate and

moderate the test program. He already was familiar with the technical and legislative details, and as a member of a non-commercial research institute, was considered to be neutral.

In the test program, the lead and the lead-free solders performed more or less equally. It was learned at the end of the test program only that Antaya's lead-free indium-based solder had liquidus and solidus temperatures ("melting points") that were around 100°C lower than those of the leaded solder, as shown in Table 1.

Table 1: Composition and melting points of leaded and lead-free solders<sup>1</sup>

Alloy	Liquidus Temperature in °C	Solidus Temperature in °C
25Sn 62 Pb 10Bi 3 Ag	224	160
30Sn 65In 0.5Cu 4.5 Ag	127	109

This new information raised new concerns among the automotive manufacturers and their suppliers that these low melting points would result in failures. The impacts of such low melting points had not been tested in the joint test program. While Antaya presented a test later during the review that should prove the reliability of the low-melting lead-free solder at high temperatures, the other stakeholders did not see their concerns being tackled with this test. It was hence recommended to further grant the exemption until 2012. This would give time to evaluate the lead-free solder in the vehicle manufacturers' qualification programs including the low melting point issue, and to apply for the continuation of the exemption in case the solder could not suffice all requirements. This resulted in the current exemption 8(i), which foresees the review before January 2012.

For this review, it will be essential from the technical point of view whether the automotive manufacturers and their suppliers including Antaya during their qualification programs found new technical data on the reliability of the lead-free solders in the various applications, which the current exemption covers.

If you wish to contribute to the review process, please answer the following questions. Please provide short and concise answers and substantiate your statements with supporting evidence (cf. points mentioned in the Guidance Document).

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<sup>1</sup> Adaptation to scientific and technical progress of Annex II to Directive 2000/53/EC (ELV) and of the Annex to Directive 2002/95/EC (RoHS), Contract No.: 07.0307/2008/517348/SER/G4; Stéphanie Zangl, Martin Hendel, Markus Blepp, Ran Liu, Carl-Otto Gensch, Öko-Institut e.V., Germany; Otmar Deubzer, Fraunhofer IZM, Germany

## Questions

1. Is there any evidence that the lower melting points of the proposed lead-free indium-based solders would require the continuation of the exemption after 31 December 2011? If you provide test results, please explain the background of the tests, in particular how the test conditions relate to real life conditions.
2. Is there any evidence that the use of lead-containing solders is unavoidable for other reasons than the low melting point of the indium-based lead-free solders?
3. Which applications covered by exemption 8i require the continued use of lead-containing solders?
4. If applicable, please provide an alternative wording of exemption 8i and/or a new date for the expiry of the exemption.

Please provide a roadmap showing the future steps you will undertake including a schedule to find appropriate substitutes for the lead-containing solders in the different applications, where you claim the use of lead to be unavoidable after 31 December 2011.

## References

- Öko-Institut 2008                      Excerpt from Lohse, J.; Zangl, S.; Groß, R.; Gensch, C.O.; Deubzer, O. (2008): Ad-aptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC (Final Report), Öko-Institut e.V. for Applied Ecology and Fraunhofer Insitute for Reliability and Microintegration IZM;                      Contract                      N°07010401/2007/470145/ATA/G4; [http://elv.exemptions.oeko.info/fileadmin/user\\_upload/Exe\\_8\\_i\\_2011/Excerpt\\_exe8-i\\_Final\\_report\\_ELV\\_RoHS\\_2010.pdf](http://elv.exemptions.oeko.info/fileadmin/user_upload/Exe_8_i_2011/Excerpt_exe8-i_Final_report_ELV_RoHS_2010.pdf)
- Öko-Institut 2010                      Excerpt from Zangl, S.; Hendel, M.; Blepp, M.; Liu, R.; Gensch, C.O.; Deubzer, O. (2010): Adaptation to scientific and technical progress of Annex II to Directive 2000/53/EC (ELV) and of the Annex to Directive 2002/95/EC (RoHS). Contract No.: 07.0307/2008/517348/SER/G4; [http://elv.exemptions.oeko.info/fileadmin/user\\_upload/Exe\\_8\\_i\\_2011/Excerpt\\_exe8\\_Report\\_ELV\\_RoHS\\_2008.pdf](http://elv.exemptions.oeko.info/fileadmin/user_upload/Exe_8_i_2011/Excerpt_exe8_Report_ELV_RoHS_2008.pdf)