

## 1st Questionnaire (Clarification Questionnaire) Exemption No. 8b (renewal request)

### *Exemption for „Cadmium and its compounds in electrical contacts“*

#### Acronyms and Definitions

Cd                      Cadmium

#### Background

The Oeko-Institut and Fraunhofer IZM have been appointed within a framework contract<sup>1</sup> 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.<sup>1</sup>

Sensata 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 20 August 2015 latest or otherwise let us know until when you can provide the requested information.

#### Questions

- 1) Cadmium-containing electrical contacts are used in several applications.
  - a) Please provide an overview on all applications of electrical contacts (with cadmium (Cd) or cadmium-free) (for example thermal cutoffs, etc.) including those, if possible and applicable, which Sensata does not produce itself.

*Sensata applications cover Thermal Sensing Controls, Thermal Motor Protectors, Motor Starter Relays, and Thermal Circuit Breakers.*
  - b) Please give an overview on other (major) manufacturers of the above products/applications that use electrical contacts.

*Most major suppliers of air-conditioning, refrigeration, home appliances, lighting , industrial fractional motors, HVOR.*
  - c) Please mark those applications which Sensata has successfully converted to Cadmium-free contacts, or will do so in 2016.

*Sensata has initiated conversion of products that are only certified as Thermal Motor Protectors. Total conversion of Thermal Motor Protectors is not expected to be completed by the end of 2016 due to the number of customers and end applications.*

---

<sup>1</sup> Contract is implemented through Framework Contract No. ENV.C.2/FRA/2011/0020 led by Eunomia

2) What are other (major) manufacturers of the above products/applications that use cadmium contacts?  
*Multiple global suppliers of Thermal Sensing Controls, Thermal Motor Protectors, Motor Starter Relays and Thermal Circuit Breakers.*

3) The annex of the RoHS Directive 2002/95/EC (RoHS I) was reviewed in 2008/2009 including exemption 8, which resulted in the specification of the exemption into exemption 8a) and 8b)<sup>2</sup>. At that time, it was already clear that substitution and elimination of Cd in contacts in the new exemption 8b – which was taken over into Annex III of the recast RoHS Directive 2011/65/EU (RoHS II) - was viable, but required time as no drop in solution was possible. Sensata explains in its exemption request that most of its product could be converted to Cd-free versions already. Why does Sensata still ask for the continuation of the exemption without any scope restrictions?

*Sensata has successfully identified Cd free solutions for Thermal Motor Protectors since the exemption request was submitted. Continuation of the exemption is requested for Thermal Sensing Controls, Motor Starter Relays, and Thermal Circuit Breakers.*

4) In the supplement document of your exemption request you present the below Table 1.

**Table 1: Sensata cadmium-free contacts**

Sensata Technologies Cadmium Free History					
Products Effected by EU RoHS					
	2000	2005	2008	2014	2016
No. of Sensata Products that fall under EU RoHS for Cadmium Contacts	73	73	77	73	73
Products with Cadmium Free Contacts	27	39	47	45	62
Products with Contacts containing Cadmium	46	34	30	28	11
Estimated kg of Cadmium in Products Sold Worldwide	1,538	1,456	979	920	350
	Summary of Changes				
No. of Cadmium Free Products	37%	53%	61%	62%	85%
Converted to Cadmium Free		12	4	2	17

Source: Sensata Technologies

The table shows progress in the introduction of cadmium-free contacts until 2008 (time of the last review of the exemption), but no or little progress in the following six years between 2008 and 2014.

Please explain this gap.

*Product evaluation with Cd free contacts has continued during the time period in question and no new products with AgCdO have been introduced. Elimination of Cadmium in Electrical Contacts in protective*

<sup>2</sup> 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 115 sqq.

*devices as drop-in replacements is a complex technical issue. The progress made up until 2008 was in products that were Cadmium-free from the outset or products where the solution was more readily found. The effort between 2008 and 2014 was focused on those products where the identification of a drop in Cd free replacement was more technically challenging.*

- 5) Sensata states that products without an approved Cd-free alternative include ten temperature sensing controls and one motor starter relay.
- Are these motors applied in the automotive sector only, or also or exclusively in other sectors covered by the RoHS Directive?  
*These products are not applied to the automotive sector but to applications covered by the RoHS Directive.*
  - Are these products not yet converted only because of a lack of appropriate Cd-free contact materials, or due to conservative design requirements of customers (i.e. your customers requiring that their product must not need to undergo any design changes to allow the use of Cd-free contacts)?  
*They are not converted because of the difficulty in meeting a combination of application and certification agency (UL, ENEC) requirements.*
  - Why must these 11 products be converted into Cd-free products instead of replacing them by newly designed Cd-free versions?  
*These products are used in a range of applications by multiple customers in varied geographical regions. In most of the markets served by Sensata, applications are made on a case by case basis requiring regulatory agency approval. The introduction of newly designed products would result in the loss of decades of qualified applications. The market requires a drop in replacement as it is not feasible to re-qualify this decades long legacy.*
- 6) Sensata explains that only a few suppliers are capable of producing Cd-free contacts with the multilayer contact structure as required by Sensata's products.
- Is this multilayer structure unique to Sensata products, or do other manufacturers use it as well?  
*It is believed that the multilayer structure is used by some other manufacturers.*
  - Who are the suppliers of cadmium-free contact materials?  
*Sensata has been working with Umicore Corp., Checon Corp, Hongfeng, and Sino-1.*
- 7) Your and other exemption requests mention alternative Cd-free contact materials besides AgSnO<sub>2</sub> and AgNi alloys, i.e. silver metal oxide systems with silver tin indium or fine silver. Please explain whether and where these alloys could be scientifically/technically appropriate Cd-free solutions.  
*The AgSnO<sub>2</sub> term is being used as general description for Silver Tin alloys with a variety of additives such as Indium. AgNi alloy is being used as a general description and includes multiple ratios of Ag and Ni. Fine Ag has limited current carrying capacity and is only applied in low power applications. Multiple AgSnO<sub>2</sub> and AgNi materials have been tested as part of the test programs.*
- 8) You state in your exemption request that "Because of the cost adder to use Silver Cadmium Oxide as a replacement to Fine Silver or Silver Nickel alloys, the use of Silver Cadmium Oxide in contacts is already reserved to those applications that require it."
- In your above statement, it is not quite clear what shall replace what.  
*Fine Ag and AgNi alloys were applied when they met the application needs. AgCdO was used as the next alternative when required.*
  - What would be the absolute material price difference, and the approximate price difference in the final product resulting from the replacement? What is the system cost of the compared systems?  
*The material cost impact varies with product type and contact material. Sensata has not applied for the exemption extension because of material cost concerns.*

- 9) You state that the current density influences the amount of heat generated by a given current. Products without *approved Cd free* contacts have higher current density. Increasing contact diameter, face layer thickness, or both reduces the current density and the temperature increase of the contact. The contact diameter cannot be increased significantly due to the physical size constraints of the product's envelope. You will test the increase of the face layer thickness in the next test phase, but you claim that this will not correct the contact force concern.
- a) Which contact material is used in the contacts without approved Cd-free contact material exhibiting higher current density:
    - i. A Cd-free material that is not approved?
    - ii. A Cd-containing material?  
*The contacts in these products use AgCdO face contact material.*
  - b) The contact diameter cannot be increased due to the size of the product. Why can the product size not be increased in this case?  
*Increasing the product size in essence creates a new product which would need to be evaluated and qualified by customers. As stated previously, the market is driving toward a drop in replacement solution because of the legacy applications.*
  - c) Why would an increase in face layer thickness not correct the contact force?  
*The product's operating temperature is based on the amount of the bimetal disc deflection. Increasing the contact thickness would change the disc deflection and its operating temperature.*

**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/final_reportl_rohs1_en.pdf);  
[http://ec.europa.eu/environment/waste/weee/pdf/report\\_2009.pdf](http://ec.europa.eu/environment/waste/weee/pdf/report_2009.pdf).