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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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EXCERPT
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4.16 Exemption No. 9b

"Lead in lead-bronze bearing shells and bushes"

4.16.1 Description of exemption

Lead-bearing shells and bushes are currently exempted both, form the requirements of the RoHS as well as of the ELV Directive (entry no. 4 Annex II); however the wording differs slightly. Therefore during the last review of the Annex of the ELV Directive it was recommended to take care of a harmonisation of the wording reflecting similar or identical technical specifications [2].

Referring to automotive applications Sander et al. concluded in 2000, that applicability of lead-free solutions for bearing shells and similar anti-frictional parts could only be proven in some application fields. Furthermore, it was pointed out, that when substitution of lead by other alloying elements was considered, the main criteria were functional requirements during the use of the product (emergency lubrication) rather than costs [1].

As result of the review of the ELV Directive it was concluded that there is currently a dynamic phasing out of lead-containing bearing shells and bushes leading to the recommendation that only in very specific cases a prolongation would be necessary. The resulting proposal for a revised wording was as follows [2]: "Lead in Bearing Shells und Bushes for engines, transmissions and A/C compressors: 01.07.2011 [Review date: 07/2009]"

4.16.2 Justification by stakeholders

In the current review of the RoHS exemptions two contributions in relation to lead in lead-bronze bearing shells and bushes were received:

- In their joint industry contribution COCIR, Eucomed and EDMA argued for a continuation of the exemption with reference to the specific requirements to medical devices. The current exemption would be needed for table elevation mechanics in XRay, CT, MR and PET [3].
- Emerson Climate Technologies, Inc. applied for a continuation of the current exemption, too. While the company would be committed to converting all its bearings to lead-free compositions, there would be specific products where major obstacles from satisfying the October 2009 deadline occurred. Key reasons were the long qualification time required to assure reliability and durability and the absence of an adequate lead-free candidate for several applications [4]. The following products were specified concretely in this context:
  - "Stationary Residential Air Conditioning and Commercial Refrigeration: Environmental cooling or heating systems for households (not window units) are composed

of a condensing unit on the outside of the building and an evaporator inside the house. Heat pumps are included in this category.

– Stationary Commercial Air Conditioning: Same general configuration as above only applied to hospitals, businesses, factories, offices etc.. The units are also typically larger than residential.

– Stationary Small-Unit Refrigeration: Low temperature cooling or heating for commercial applications. Examples are: Dental air compressors, Commercial display cabinet freezers, ice machines, ultra-low temperature medical and research preservation (blood storage etc.), body temperature control for medical applications, cooling for medical examination equipment such as MRI, computer cooling, semiconductor production and in food preservation.

– Stationary Large-Unit Refrigeration: Same as above only larger systems. Examples are reach-in or walk-in grocery store refrigerated boxes for food preservation and medical blood storage."

- On request Emerson provided additional data describing the state of substitution process. The current state reflecting the requirements and the results of candidates for substitution is summarised as follows: [8]

	Candidates										
Requirement	A	B	C	D	E	F	G	H	I	J	K
Chemical Resistance	1	1	1	1	UE	2	2	UE	2	1	UE
Compatibility (scuffing resistance with steel)	1	1	1	1	1	2	2	UE	2	2	UE
Conformability	1	2	1	1	1	1	2	UE	2	2	UE
Embedability	1	2	1	1	1	1	2	UE	2	2	UE
Machinability	3	3	3	3	3	2	2	UE	2	1	UE
Friction Mitigation In Refrigerant Diluted Oil	1	UE	UE	UE	UE	UE	UE	UE	UE	UE	UE
Cavitation Resistance	2	1	2	UE	UE	1	1	UE	1	1	UE
Long-term wear resistance	2	1	2	UE	UE	1	1	UE	1	UE	UE
Contact Fatigue Resistance	2	1	2	UE	UE	2	1	UE	1	1	UE

UE: Under Examination
1: Acceptable Results
2: Marginal Results at high loading
3: Unacceptable Results

EMERSON

- In this contribution, the key technical reason to prolong the exemption is described as follows: liquid refrigerant is a strong solvent that can remove vital compressor oil from the bearings causing inadequate lubrication and increased friction. Yet, as friction increases, the efficiency diminishes and premature failure may ensue. In addition, field repairs due to bearing failures may result in refrigerant leakage. [8]
- This position is supported by another manufacturer of commercial compressors; in order to complete the qualification of RoHS compliant bearings in their compressors a 2 years prolongation of the exemption would be needed. [7]
- Another leading manufacturer claimed the RoHS conformity of comparable products already in 2006 [6]. However, although being requested several times this company could not provide more details on this issue.
- The Swedish Ministry of the Environment [5] indicates that according to a Swedish company there were lead-free alternatives to leaded copper alloys available on the market. The company stated that the alternative copper alloyed material would be both easy to machine and would not carry the brittleness normally associated with Bismuth or Bismuth-based bronze substitutes. Through the use of the alternative alloys it would be possible to replace lead in most copper alloys, not only in bronze alloys.

4.16.3 Critical review and Recommendation

Basically it has to be taken into account that in a lot of bearing applications lead could be substituted successfully. Therefore the question arises whether the specific requirements of the products mentioned in the contribution described above lead to the situation that in these cases substitution fails.

Considering the products appointed by Emerson it must be taken into account that there are specific conditions obviously leading to the situation, that substitution is still ongoing. Taking this into account the contractor recommends to continue the existing exemption, but to narrow the scope specifically to those applications, where refrigerants are used:

“Lead in bearing shells and bushes for refrigerant-containing compressors for HVACR applications, with expiry date of 31. July 2014.”

4.16.4 References

[1] Sander, J. et al.; Heavy Metals in Vehicles (Final Report); Ökopol – Institut für Ökologie und Politik GmbH, Hamburg, Germany; Report compiled for the Directorate General Environment, Nuclear Safety and Civil Protection of the Commission of the European Communities Contract No B4-3040/2000/300649/MAR/E.3. Hamburg 2000

[2] Lohse et al.; Adaptation to Scientific and Technical Progress of Annex II Directive 2000/53/EC. Contract N°07010401/2007/470145/ATA/G4. Freiburg 2008

[3] Joint Industry contribution to the ÖKO Institute's consultation on the Actual Exemptions from the RoHS Directive. Brussels, April 1, 2008

[4] Emerson Climate Technologies, Inc.; Stakeholder Consultation On Adaptation To Scientific And Technical Progress Under Directive 2002/95/Ec On The Restriction Of The Use Of Certain Hazardous Substances In Electrical And Electronic Equipment For The Purpose Of A Possible Amendment Of The Annex Exemption 9b (Lead In Lead-Bronze Bearing Shells And Bushes). 20 March 2008

[5] Regeringskansliet, Ministry of the Environment; Memorandum to Stakeholder consultation on RoHS exemptions. 1st April 2008

[6] Mitsubishi Electric Europe B.V.; e-mail to Öko-Institut, 30/Oct/2008

[7] Danfoss Commercial Compressors; e-mail to Öko-Institut, 28/Nov/2008

[8] Emerson Climate Technologies, Inc.; e-mail to Öko-Institut, 27/Nov/2008