

## Adaption to scientific and technical progress under Directive 2002/95/EC

Stakeholder contribution for **exemption 5** “Lead in glass of cathode ray tubes, electronic components and fluorescent tubes”,

**exemption 6** “Lead as an alloying element in steel containing up to 0,35 % lead by weight, aluminium containing up to 0,4 % lead by weight and as a copper alloy containing up to 4 % lead by weight”

and **exemption 7** “Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead), lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission as well as network management for telecommunications and lead in electronic ceramic parts (e.g. piezoelectronic devices)”

submitted 31 March 2008  
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## EU Directive 2002/95/EC « RoHS »

Exemption 5 : Lead in glass of electronic components

### 1- Electronic components : *Resistors*

VISHAY manufactures :

- a. Vitreous enamelled resistors
- b. Thick film resistors  
containing lead oxide (PbO)

#### a. Vitreous enamelled resistors

VISHAY vitreous enamelled resistors must withstand extreme temperatures (450°C) and high current pulses (10 times nominal power during 10 seconds) for high reliability applications (traction, telecom-protection, petroleum research, automotive,...)

Lead (PbO) is contained in the enamel used as a coating

#### 2a. Amount of Lead

Enamelled resistance (one model for instance) :

- total weight : 2.25 g
- enamel weight : 0.294 g
- PbO weight : from 0.073 g to 0.147 g
- Content of PbO in the homogeneous material : from 25% to 50%
- Annual production volume : some millions of parts
- Annual consumption of PbO : few tonnes
- Sales volume into the EU ( % ) : 80%

#### 3a. Specific function of Lead in enamel

Like PbO in glasses.

Gelöscht: AND DISCRETE  
SEMICONDUCTORS

VISHAY SA

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ONE OF THE WORLD'S LARGEST MANUFACTURERS OF **DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS**



4a. **What technical characteristics do substitutes need to fulfil as a minimum requirement ?**

- Mechanic characteristic (dilation coefficient) and physical characteristic (temperature of firing ) with the same cost.

5a. **Provide evidence that manufacturers have put effort in research on alternatives for lead. Are there any results?**

- Survey with enamel manufacturers without success.

6a. **Are manufacturers still investigating alternatives ?**

**If Yes : provide a roadmap**

**If No : explain an justify**

- After spending 2 man years of research and testing of available substitutes, we see no adequate replacement for PbO for this application.

7a. **Assuming the current exemption will be given an expiry date, what date do you think is technologically feasible for industry ?**

Impossible to answer now.

b. **Thick film resistors**

VISHAY thick film resistors are designed for power applications and thick film is the technology for a lot of variable resistors (trimmers and potentiometer) for the track.

Lead (PbO) is contained in the resistive paste

2b. **Amount of Lead**



Thick film resistance :

- total weight : 1.97 g
- resistive paste weight : 0.002 g
- PbO weight : 0.0007 g
- Content of PbO in the homogeneous material : 35%
- Annual production volume : Some Millions of parts
- Annual consumption of PbO : few tonnes
- Sales volume into the EU ( % ) : 70%

3b. **Specific function of Lead in thick film resistance**

- Stability, ductility, temperature coefficient with the same cost.

4b. **What technical characteristics do substitutes need to fulfil as a minimum requirement ?**

- We need to keep all our electrical performance for our end products.

5b. **Provide evidence that manufacturers have put effort in research on alternatives for lead. Are there any results?**

- Survey with ink paste manufacturers without success.

6b. **Are manufacturers still investigating alternatives ?**

If Yes : provide a roadmap

If No : explain an justify

- after spending 1 man year of research and testing of available substitutes, we see no adequate replacement for PbO for this application

7b. **Assuming the current exemption will be given an expiry date, what date do you think is technologically feasible for industry ?**

Impossible to answer now.



## EU Directive 2002/95/EC « RoHS »

### Exemption 6 : Lead as an alloying element.....

#### 1- Electronic components : *Variable Resistors*

VISHAY manufactures precision variable resistors containing a lot of mechanical parts for sensors applications.

Lead is contained in the alloy used in the mechanical parts: axle, bearings,...

#### 2. Amount of Lead

- Annual production volume : millions of parts.
- Annual consumption of PbO : impossible to quantify easily.
- Sales volume into the EU ( % ) : 60%

#### 3. Specific function of Lead in the alloy

- Lead is used for its “self lubricating properties” ensuring high durability and reliability which are essential for sensors.

#### 4. What technical characteristics do substitutes need to fulfil as a minimum requirement ?

- Substitutes must fulfil the same “self lubricating properties” with the same cost.

#### 5. Provide evidence that manufacturers have put effort in research on alternatives for lead. Are there any results?

- No other metal has been found to perform identical “self lubricating properties”.

#### 6. Are manufacturers still investigating alternatives ?

**If Yes : provide a roadmap**

**If No : explain an justify**

- after spending 1 man year of research and testing of available substitutes, we see no adequate replacement for PbO for this application.



**7. Assuming the current exemption will be given an expiry date, what date do you think is technologically feasible for industry ?**

No answer now.



## EU Directive 2002/95/EC « RoHS »

### Exemption 7 : Lead in high melting temperature type solders

#### 1- Electronic components : *High power Resistors*

VISHAY manufactures high power resistors mounted on heat sinks (dissipators)

Lead is contained in the solder (more than 85% by weight) used in the mounting process of the high power resistance on the heat sink.

#### 2. Amount of Lead

- Annual production volume : Millions of parts
- Annual consumption of PbO : hundred of kg.
- Sales volume into the EU ( % ) : 60%

#### 3. Specific function of Lead in the solder

- High melting temperature type solder is used to prevent “de-soldering” from the heat sink when the high power resistance is soldered into electronic circuits by the equipment manufacturer. Ductility of high melting temperature solder containing lead is important to prevent generation of “cracks” between the resistor and the heat sink.

#### 4. What technical characteristics do substitutes need to fulfil as a minimum requirement ?

- Substitutes must fulfil the same properties (ductility) and same soldering temperature with the same cost.

#### 5. Provide evidence that manufacturers have put effort in research on alternatives for lead. Are there any results?

- No other solder has been found to perform identical properties.



**6. Are manufacturers still investigating alternatives ?**

**If Yes : provide a roadmap**

**If No : explain an justify**

- after spending 1 man year of research and testing of available substitutes, we see no adequate replacement for PbO for this application.

**7. Assuming the current exemption will be given an expiry date, what date do you think is technologically feasible for industry ?**

No answer now.