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

Results previous evaluation
Exemption No. 16

"Lead in linear incandescent lamps with silicate coated tubes"

(Excerpt from ERA Report 2004)

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2.3 Light bulbs

This review applies to filament light bulbs which are excluded from the WEEE Directive. Filament lamps are used for general illumination in households and businesses as the light source in some types of luminaries. They are also used in a wide range of electrical equipment, for example in torches (tools), within illuminated switches and as indicators in consumer, IT, and other types of equipment. They are produced as relatively large bulbs such as the example in Figure 4 and as small (miniature) lamps, which can be attached to equipment by various means such as by soldering to PCBs by surface mount technology.

2.3.1 Inclusion of filament lamps within the scope of the RoHS Directive

Many filament lamps are currently made with lead-free glass and either lead-free or high melting temperature solders (>85% lead) and so there is no reason why these should not be within the scope of the RoHS Directive. Some lamp manufacturers are in the process of changing their product range.

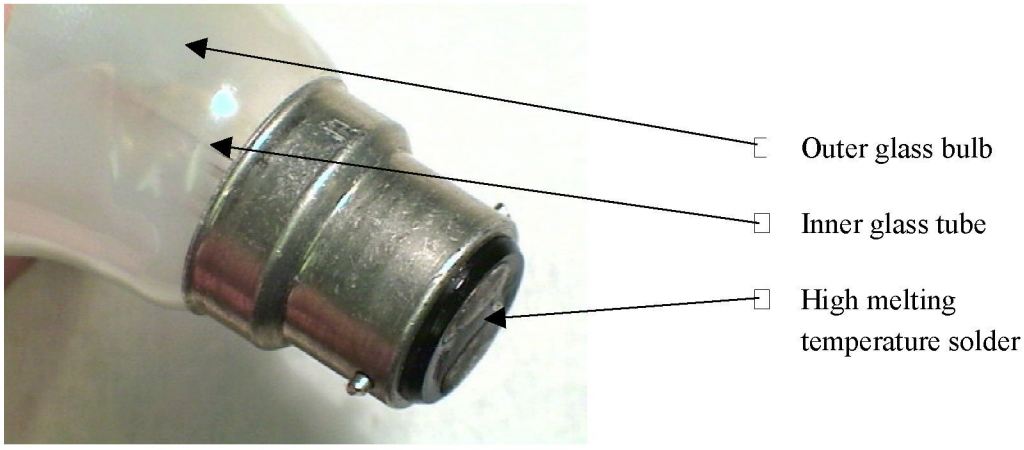

Figure 4. Filament light bulb

Standard filament or incandescent light bulbs can be made using lead-free glass. The composition of the glass used for the outer bulb is lead-free and the inner glass tube, which is used to create the low pressure atmosphere within the lamp and to support the filament wires is also lead-free but has a different composition, frequently with a high barium content. Barium is classified as "harmful" but is generally regarded as less harmful than lead:

- Occupational Exposure Standard for barium = 0.5 mg Ba/m^3. (8 hour time weighted average)
- Maximum Exposure Limit for Lead = 0.15 mg Pb/m^3. (8 hour time weighted average)

High melting temperature solders (>85% lead) are used on lamps which operate too hot for a lead-free solder although some lamp types now use lead-free solder.

Fluorescent and mercury lamps are covered by separate exemptions (for mercury within lamps and for lead in fluorescent tubes only), but there are some special lamps which use lead for other applications and manufacturers have asked for six new exemptions for these types. Only one of these is for a type of filament lamp and this is reviewed here.

It is clear that there is no technical reason why filament lamps should not be within the scope of the RoHS Directive. There is an issue over the adequacy of supply of the special glass used inside the bulbs but this should be resolved by the 1st July 2006 deadline. However, lamp manufacturers have not known with certainty that filament bulbs would be within the scope of RoHS because of the requirement for the European Commission to review light bulbs in item 10 of the RoHS Directive Annex and so some may have delayed converting production processes to "lead-free". They should be able to convert to lead-free production before the 1st July 2006 but stocks of lead-containing slow-moving bulb types may remain after 1st July 2006. Some of the older lamps made with lead will not have been incorporated into new products put onto the market before the RoHS deadline and after this date these cannot be used in products that are made for the EU market. These can however be used as spare parts in equipment that is put onto the market before 1st July 2006.

2.3.2 Request for exemption for linear incandescent lamp with silicate coated tube

An example of this type of lamp and a typical application are shown in Figure 5.

Figure 5. Linear incandescent lamp and typical application

These lamps have been manufactured for over 65 years. They are a decorative lamp which provides a white light as a result of the silicate coating attached to the inside of the soda lime glass tube. This coating is attached to the glass with a material containing lead. The silicate powder has a high melting temperature and is attached to the glass by melting the lead-containing bonding material. The bonding material must fuse and form a good bond at a temperature below the glass melting temperature. Lead oxide was originally used as a constituent of the glass as it produces glass which is colourless and has a low melting temperature. It forms glassy materials with a wide range of other

oxides which is why it bonds well to the glass tube and the silicate coating. Lead oxide, therefore, is the ideal choice of material for this application and is why it was originally used.

There are now many glass compositions which are lead-free. These alternatives have different compositions to lead glasses and it is not usually possible simply to replace lead with another element and retain all of the glass characteristics. Commonly used oxides in lead-free glass include those of barium, bismuth, zinc and titanium. Most of these alternatives give a glass with melting temperatures significantly higher than can be achieved with lead and so are not suitable for this bonding application. Bismuth is often used as an alternative to lead but tends to produce glass with a yellow colour and can reduce transparency to visible light. Lamp manufacturers have also evaluated zinc oxide compositions for bonding. This gave poor non-uniform bonding, a yellow colour and reduced light transmission by about 20%.

Lead is technically the only material currently available that can be used to produce this type of lamp. This is consistent with the bonding materials used in cathode ray tube production. Lead is used as an essential component of the glass frit to form a bond between the front and the cone - an application which is exempt under the RoHS Directive.

Alternative lamps have also been considered as an alternative to this application. Linear incandescent lamps are in some ways similar to fluorescent tubes; both have similar dimensions and produce white light. However there are differences:

- Fluorescent lamps have metal end caps so do not provide the same decorative effect as shown in Figure 5.
- Fluorescent lamps have higher light output efficiency, clearly an advantage where the lamp is used for long periods although this is less significant in applications where the lamps are on for short periods.
- Fluorescent lamps require additional electrical equipment such as choke coils, ballasts, etc. These are not required for incandescent lamps.

2.3.3 Summary of the case for an exemption

Most types of incandescent light bulbs are already produced with lead-free glass and either lead-free solder or solder containing >85% lead and so exempt from the RoHS Directive. Therefore, there are no technical reasons why incandescent light bulbs should not fall within the scope of the RoHS Directive.

Other types of lamp are already within the scope of this Directive. Filament light bulbs are used as components within other products that will be required to comply with the RoHS directive and so stocks of lead–containing bulbs will need to be used well before the RoHS deadline, this will leave those manufacturers who have not already switched to lead-free, little time to develop alternative products.

One exemption request for a particular type of straight incandescent lamp has been reviewed. This lamp uses lead in a material used to bond a white silicate coating to the inside of the glass tube. Technically, this appears to be the only material that provides a good bond, is colourless and allows maximum light transmission. These lamps are used for their decorative affect. Fluorescent tubes have similar visual characteristics and have better energy efficiency but require additional equipment to function.

4. Proposed guidelines to define the scope of exemptions

The following sections provide clarification of the scope of each exemption.

4.1 Mercury in straight fluorescent lamps for special purposes

Straight fluorescent lamps not intended for general illumination. Examples include:

- LCD backlights
- Light sources in scanners, printers, photocopiers and fax machines
- Disinfection lamps
- Medical/therapy lamps
- Pet care lamps (such as those used within aquaria)
- Lamps for use at low temperature
- Extra long lamps which contain > 10mg of mercury
- Amalgam lamps

4.2 Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission as well as network management for telecommunications

A proposed definition of the scope has been produced by equipment manufacturers with input and some amendments by ERA. This is given in Appendix 1. Equipment that is covered by this exemption is of the type which is intended for continuous use for at least 10 years and has a high reliability. Personal computers, laptops, telephones, etc. are not covered by this exemption.

4.3 Light bulbs

This refers to filament or incandescent light bulbs. These can be included in the scope of the RoHS Directive. An exemption for one type of filament lamp has been reviewed. These are straight filament lamps that use lead to attach a silicate coating to the interior of the glass tube.

4.4 Compliant pin connector systems

This title has been rewritten since "VHDM" is a trade mark and this exemption request is for all types of compliant pin and press-fit connectors. Compliant-pins are used as connections in multi-way connectors. The compliant pins are of various designs and have electroplated tin or tin/lead coatings which are inserted into a matching array of plated through holes in printed circuit boards to make an electrical and mechanical connection. These connectors are designed to make multiple reliable