BIS Department for Business Innovation & Skills

ROHS REGULATIONS

Government Guidance Notes

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Government Guidance Notes

SI 2008 No. 37, as amended

This Guide is intended to assist those placing electrical and electronic equipment on the UK market to understand the application of The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2008, as amended by The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (Amendment) Regulations 2009 (referred to hereafter as "The RoHS Regulations"). It aims to explain the Regulations as interpreted by the Department for Business, Innovation & Skills (BIS).

The Regulations themselves should always be read and understood, as they constitute the law. This Guide is informative, but has no legal authority.

You should refer to the Regulations themselves for a full statement of the legal requirements and in the case of any doubt take independent advice, including your own legal advice. The Regulations may be revised from time to time, so users should take care to keep themselves informed. In this regard, information may be obtained from the Environmental & Technical Regulation Directorate of BIS. Details of contacts for further information are given on page 14.

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RoHS - the law in brief

1. The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2008[1], as amended, ("the RoHS Regulations") implemented the provisions of the European Parliament and Council Directive on the Restrictions of the use of certain Hazardous Substances in electrical and electronic equipment[2] ("the RoHS Directive"), as amended.

2. The RoHS Regulations have banned the putting on the UK market of new Electrical and Electronic Equipment (EEE) containing more than the permitted levels of lead, cadmium, mercury, hexavalent chromium and both polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants since 1 July 2006. There are a number of exempted applications for these substances.

3. Since 1 July 2006, manufacturers have needed to ensure that their products - and the components and subassemblies of such products - comply with the requirements of the Regulations by the relevant date in order to be put on the Single Market. The Regulations have also had an impact on those who import EEE into the European Union on a professional basis, those who export to other Member States and those who rebrand other manufacturers' EEE as their own.

4. These Regulations do not affect the application of existing legal requirements for EEE, including those regarding safety, the protection of health, existing transport requirements or provisions on hazardous waste. In other words, existing legislation on EEE and hazardous substances must also be complied with.

Entry into force

5. The Regulations came into force on **1 February 2008**, but replace similar Regulations[3] that came into force on 1 July 2006.

Requirements

6. The main requirement of the RoHS Regulations is that from 1 July 2006 a producer (as defined in the Regulations) may not put new EEE containing lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), in amounts exceeding the established maximum concentration values, on the market. Certain applications (listed in Annex C and referred to in Regulation 5) are exempt and there is also an exemption for spare parts for the repair of equipment that had been put on the market before 1 July 2006. The Regulations also do not apply to the re-use of equipment that was put on the market before the same date.

7. Producers must be able to demonstrate compliance by submitting technical documentation or other information to the enforcement authority on request and must retain such documentation for a period of four years after the EEE is placed on the market.

Enforcement

8. Responsibility for the enforcement of the RoHS Regulations lies with the Secretary of State for Business, Innovation & Skills, who has appointed the National

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[1] SI 2008 No. 37, as amended by the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (Amendment) Regulations 2009 (SI 2009 No. 581).
[2] Directive 2002/95/EC of 27 January 2003, (OJ No. L37, 13.2.2003, p. 19).
[3] The RoHS Regulations 2006, (SI 2006 No. 1463).

Measurement Office (NMO), an executive agency of the Department, to act on his behalf.

RoHS Regulations

Scope

9. The RoHS Regulations apply to all EEE containing hazardous substances put on the market in the UK on or after 1 July 2006, which falls into any of the eight broad categories listed in Annex A. Annex A also includes indicative (but not exhaustive) examples of products under each of the categories. The Regulations specify a voltage range within which the products in the eight categories must fall in order to come within the scope. This is up to and including 1,000 volts AC or up to and including 1,500 volts DC.

10. The eight broad categories mentioned above reflect eight of the ten categories in Annex 1 of the Waste Electrical and Electronic Equipment (WEEE) Directive.[4] In addition, the RoHS Regulations apply both to electric light bulbs and to household luminaires.

11. The two categories of the WEEE Directive **not** included within the scope of the RoHS Regulations are Medical Devices and Monitoring & Control Instruments. Please note, however, that Article 6 of the RoHS Directive places an obligation on the European Commission to present proposals for including EEE falling within those two categories within the scope of the RoHS Directive, once scientific and technical evidence has demonstrated that such proposals are feasible. In this respect, the Commission asked independent consultants to undertake a study to review the current position. The results of that study were published by the Commission in July 2006 and have now led to the presentation of proposals for a broader general review of the RoHS Directive which are currently under negotiation by the Council and the European Parliament.[5] The conclusion of those negotiations is expected in early 2010.

Assessing products to see if they are included in the scope

12. For many products, the decision on whether they are included within the scope of these Regulations should be reasonably straightforward. However there are a number of products (particularly in specialised or industrial sectors), where there may be significant areas of doubt and uncertainty.

13. An example of a ‘decision tree’ that could be used by producers to help determine whether their products might come within the scope of the RoHS Regulations can be found at Annex B, but it may be necessary to seek independent advice to come to a final decision.

General guidance on the types of products that may be outside the scope of the Regulations

14. Given that the scope of the RoHS Directive is drawn from that of the WEEE Directive it is the view of BIS that certain provisions in the WEEE Directive may apply to EEE within the RoHS Directive so as to limit its scope. There is, however, no express provision in the RoHS Directive to this effect.

[4] Directive 2002/96/EC of 27 January 2003, (OJ No. L37, 13.2.2003, p. 24).

[5] The Commission’s initial proposals for the “recast” Directive, published on 3 December 2008, are available at: **http://ec.europa.eu/environment/waste/weee/index_en.htm**

15. The guidance that follows uses some of the criteria for assessing “grey area” products (those whose inclusion within the scope of the RoHS Directive is in doubt) that have been discussed in the Technical Adaptation Committee (TAC) of Member States and reflects the Commission’s non-legally binding Frequently Asked Questions document on the WEEE and RoHS Directives[6]. It should be noted that this guidance represents the view of BIS and, as with all EC Directives, a definitive view may only be obtained through the courts. Producers must rely on their own legal advice on all questions of scope.

i. *EEE intended to protect national security and/or for military purposes*

   On the basis that there is an express exemption from the categories of Annex 1A of the WEEE Directive in relation to EEE intended specifically to protect national security and/or for military purposes, it is the view of BIS and the Commission that equipment connected with the protection of the essential security interests of Member States and to arms, munitions and war material may, accordingly, be considered to be exempt from the provisions of the RoHS Directive. It should be noted, however, that this exemption would not apply to any equipment that is used to protect national security and/or has a military purpose, but is not designed exclusively for these purposes.

ii. *Products where electricity is not the main power source*

   Many products contain electrical and electronic components, either for additional functionality or as peripheral parts. A simple example could be a combustion engine with an electronic ignition. The definition of EEE in the Regulations extends only to those products that are dependent on electric currents or electromagnetic fields to work properly, meaning that it is the primary power source. When the electric current is switched off, the product cannot fulfil its main function. If electricity is used only for control or support functions, the product could be considered to be outside the scope of these Regulations. In the above example the combustion engine would be considered to be outside that scope.

iii. *Products where the electrical or electronic components are not needed to fulfil the primary function*

   This is related to, but not always the same as the above situation. Some products, particularly toys and novelty items contain an electrical or electronic element that gives added value to the product. Often there are similar products on the market fulfilling the same function, but without these components. Examples might include musical greetings cards or soft toys with electronic components, which still fulfil their primary function without their electronic components and could be considered to be outside the scope of these Regulations.

iv. *Electrical and electronic equipment that is part of another type of equipment*

   The WEEE Directive excludes EEE that is part of another type of equipment that does not fall within the scope of the Directive. On the basis that EEE under RoHS is defined in identical terms, it is the view of BIS and the Commission’s Legal Services that such an exclusion extends to EEE under the RoHS Directive and, consequently, to the RoHS Regulations. Examples of such equipment would be lighting or entertainment equipment for use in

[6] European Commission’s *Frequently Asked Questions on the RoHS and WEEE Directives* published May 2005 and mostly recently revised August 2006. This can be downloaded from http://ec.europa.eu/environment/waste/weee/index_en.htm

vehicles, trains or aircraft. This type of equipment would be excluded as it is designed to be part of a product that falls outside the scope of the Directive.

Equipment that is part of another type of equipment or system is considered to be outside the scope of the Directive where it does not have a direct function outside the other item of equipment or system and that other item of equipment or system is itself outside the scope of the Directive.

Equipment may also be part of a fixed installation. A "fixed installation" may be a combination of several pieces of equipment, systems, products and/or components (or parts) assembled and/or erected by a professional assembler or installer at a given place to operate together in an expected environment and to perform a specific task, but not intended to be placed on the market as a single functional or commercial unit.

In such a case, the elements of a system that are not discernible EEE products in their own right or that do not have a direct function away from the installation are excluded from the scope of the Regulations.

v. *Batteries*

The RoHS Directive restricts the use of the named hazardous substances in new electrical and electronic equipment, but in the view of the European Commission does not apply to batteries. This includes batteries that are permanently fixed into the product, as well as removable batteries. Under the treatment requirements of the WEEE Regulations, batteries must be removed from any separately collected waste electrical and electronic equipment. A European Commission Directive, adopted in September 2006, introduced further requirements on battery and electrical equipment manufacturers. The Batteries and Accumulators & Waste Batteries and Accumulators Directive[7] restricts the use of certain materials in most types of batteries put on the market and also includes provisions requiring their easy removal from equipment. The Directive also introduces treatment and recycling obligations, alongside collection targets.

The UK has implemented the Directive through two sets of Regulations. The Batteries and Accumulators (Placing on the Market) Regulations 2008[8] implements the technical requirements for new batteries and equipment containing them and the Waste Batteries and Accumulators Regulations 2009[9] implements the requirements for the collection and treatment of waste batteries.

Exemptions

16. The RoHS Regulations do not apply: -

- To large-scale stationary industrial tools. (This is a machine or system, consisting of a combination of equipment, systems, products and/or components installed by professionals, each of which is designed, manufactured and intended to be used only in fixed industrial applications.)

- To spare parts for the repair of EEE that was placed on the market before 1 July 2006. It should be noted that, following discussions in the TAC, the

[7] Directive 2006/66/EC of 6 September 2006, (OJ No. L266, 26.9.2006, p.1).
[8] SI 2008/2164
[9] SI 2009/890

European Commission and Member States have agreed that this exemption extends to parts that expand the capacity of and/or upgrade EEE placed on the market before that date provided the EEE concerned is not put on the market as a new product.

- To the reuse of EEE that was placed on the EU market before 1 July 2006.

- To the specific applications of lead, mercury, cadmium, hexavalent chromium and PBDE set out in the Annex to the RoHS Directive, as amended by nine Commission Decisions[10]. These specific applications are explained in more detail in Annex C of these Guidance Notes.

Possible future exemptions

17. Since the RoHS Directive was published in February 2003, the European Commission has received many requests from industry for exemptions of additional specific applications of the hazardous substances. These requests extend the list in the original Annex to the Directive, once they have been agreed and adopted as Commission Decisions.

18. The Commission has already reviewed many of the requests and, as a consequence, has published the nine separate Commission Decisions that are listed in footnote 10 below.

19. These current Regulations incorporate both those exemptions which have already been adopted and any further exemptions which may be agreed[11] while they remain in force, as the Department has taken advantage of new provisions so as to refer to the exempt applications listed in the RoHS Directive Annex "as amended from time to time". While this has removed the need for further amendments to the UK Regulations each and every time new exemptions are agreed, Annex C of these Guidance Notes will be amended and reissued whenever a new exemption is agreed.

Definitions

20. The definitions of "**electrical and electronic equipment**" and "**hazardous substances**" can be found within the RoHS Regulations.

21. The definition of "**producer**" can also be found within the RoHS Regulations, but it should be noted that whoever exclusively provides financing under or pursuant to any finance agreement shall not be deemed to be a producer unless he also acts as a producer within the meaning of sub points (i) to (iii) of that definition.

22. "**Put on the market**" is not defined in the Regulations or in the Directive, but it is being interpreted in the same way as the term 'placing on the market', which is defined in the European Commission's *"Guide to the implementation of directives*

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[10] Commission Decisions 2005/717/EC of 13 October 2005, (OJ No. L271, 15.10.2005, p.48); 2005/747/EC of 21 October 2005, (OJ No. L280, 25.10.2005, p.18); 2006/310/EC of 21 April 2006, (OJ No. L115, 28.4.2006, p.38); 2006/690/EC, 2006/691/EC & 2006/692/EC, (OJ No. L283, 14.10.2006, pages 47, 48 and 50); 2008/385/EC, (OJ No. L136, 24.5.2008, p. 9); 2009/428/EC of 4 June 2009, (OJ No. L139, 5.6.2009, p.32); and 2009/443/EC of 10 June 2009, (OJ No. L148, 11.6.2009, p.27). The exemption formally given by point 2 of Commission Decision 2005/717/EC for "DecaBDE in polymeric applications" was annulled by a judgment of the European Court of Justice with effect from 30 June 2008, (for further detail see OJ No. C116, 9.5.2008, p. 2).

[11] Adopted and published as Commission Decisions in the EC Official Journal.

based on the New Approach and the Global Approach" [12] (commonly referred to as the "Blue Book"). This says that 'placing on the market' is the initial action of making a product available for the first time on the Community market, with a view to distribution or use in the Community.

23. A product is placed on the Community market when it is made available for the first time. This is considered to take place when a product is transferred from the stage of manufacture with the intention of distribution or use on the Community market. Thus, imports for own use are also considered as being placed on the market at the moment they enter the Community. Moreover, the concept of placing on the market refers to each individual product, not to a type of product, and whether it was manufactured as an individual unit or in a series.

24. The transfer of the product takes place either from the manufacturer, or the manufacturer's authorised representative in the Community, to the importer established in the Community or to the person responsible for distributing the product on the Community market. The distribution chain can also be the commercial chain of the manufacturer or the authorised representative. The transfer may also take place directly from the manufacturer, or authorized representative in the Community, to the final consumer or user.

25. The product is considered to be transferred either when the physical hand-over or the transfer of ownership has taken place. This transfer can be for payment or free of charge, and it can be based on any type of legal instrument. Thus, a transfer of a product is considered to have taken place, for instance, in the circumstances of sale, loan, hire, leasing and gift.

Maximum Concentration Values

26. For the purposes of the RoHS Regulations, a maximum concentration value of up to 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, PBB and PBDE and of up to 0.01% by weight in homogenous materials for cadmium will be permitted in the manufacture of new EEE. These values were established through the adoption of a Commission Decision on 18 August 2005.[13]

27. "**Homogeneous material**" means a material that cannot be mechanically disjointed into different materials.

28. The term "**homogeneous**" is understood as "of uniform composition throughout", so examples of "homogeneous materials" would be individual types of plastics, ceramics, glass, metals, alloys, paper, board, resins and coatings.

29. The term "**mechanically disjointed**" means that the materials can, in principle, be separated by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes.

30. Using these interpretations, a plastic cover (for example) would be a 'homogeneous material' if it consisted exclusively of one type of plastic that was not coated with or had attached to it (or inside it) any other kinds of materials. In this case, the maximum concentration values of the RoHS Regulations would apply to the plastic.

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[12] The *Guide to the implementation of directives based on the New Approach and the Global Approach* can be downloaded from http://ec.europa.eu/enterprise/newapproach/legislation/guide/index.htm

[13] Commission Decision 2005/618/EC of 18 August 2005, (OJ No. L214, 19.08.2005, p.65).

31. On the other hand, an electric cable that consisted of metal wires surrounded by non-metallic insulation materials would be an example of something that is not ‘homogeneous material’ because mechanical processes could separate the different materials. In this case the maximum concentration values of the RoHS Regulations would apply to each of the separated materials individually.

32. A semi-conductor package (as a final example) would contain many homogeneous materials, which include the plastic moulding material, the tin-electroplating coatings on the lead frame, the lead frame alloy and the gold-bonding wires.

Compliance

33. Producers must demonstrate compliance with the Regulations by providing the enforcement authority (on request) with satisfactory evidence of such compliance in the form of relevant technical documentation or information. The UK has adopted self-declaration as the basis of the compliance regime. The enforcement authority is undertaking market surveillance activities to detect non-compliant products and is also conducting tests for this purpose.

34. There is no prescribed method to demonstrate compliance or marking requirements. There are also no registration obligations, but producers may wish to consider the role that both materials declarations and component or material analysis could play.

Materials declarations

35. Producers of EEE could obtain an assurance from their suppliers that any materials, components, assemblies or equipment provided do not contain more than the permitted level of any of the six restricted substances, except where the application of any of those substances comes within the scope of the RoHS Regulations’ exempted applications. Producers are required to keep appropriate records for a period of up to four years after the particular EEE product was put on the market.

36. A variety of materials declarations for suppliers are being developed by industry at the moment. Some finished or end product manufacturers have already started to publish such data on their websites.

Producer analysis

37. Producers of EEE to be placed on the UK market may wish to undertake (or ask a third party to undertake) their own analysis of the components or materials that they use in their products. This action may be undertaken either to verify supplier declarations or to establish the presence or otherwise of the restricted substances in those cases where no declaration is available. It may also be undertaken if there are doubts over the reliability of declarations.

38. Producers or third parties may employ any suitable analytical technique in order to establish that their products comply with the maximum concentration values of the six restricted substances. The criteria for analysis will depend on the quantity of product put onto the market (less for small producers than for large producers), the relationship with suppliers, the risk of a banned substance being present, and the potential impact of that substance on the environment. Producers must ensure that they understand and take into account any limitations of the analytical technique they use.

39. At Annex D, you will find an example of a flow chart that has been designed to clarify the compliance process and could help producers determine when analysis of components might be advisable.

Enforcement

40. It is the duty of the National Measurement Office, acting on behalf of the Secretary of State for Business, Innovation & Skills, to enforce these Regulations.

41. Various powers of enforcement are available, including: -

- Making test purchases.
- Requiring the production of compliance documentation and other information which may provide evidence as to whether or not the Regulations have been complied with in a particular case or class of cases.
- Inspecting processes and performing analytical tests.
- Issuing a compliance notice requiring certain action to be taken.
- Issuing an enforcement notice requiring non-compliant goods to be withdrawn from the market or prohibiting or restricting the placing of non-compliant goods on the market.

Offences and Penalties

42. The RoHS Regulations introduced the following offences:

i. Contravening or failing to comply with the prohibition on hazardous substances in the RoHS Regulations, or with an enforcement notice, could result in those held responsible facing a fine up to the statutory maximum (currently £5,000) on summary conviction or an unlimited fine on conviction on indictment.

ii. Those failing to submit compliance documentation at the request of the enforcement authority may be liable on summary conviction to a fine up to level five on the standard scale (currently £5,000).

iii. Procedural offences (obstruction of an enforcement officer, providing false or misleading information to the enforcement authority) are also punishable on summary conviction by a fine up to level five on the standard scale.

43. As an alternative, or in addition, to any of the above penalties, the court may, in certain circumstances, make an order requiring a person convicted of the offences referred to in paragraph 42 (i) and (ii) above to remedy the matters which have given rise to the commission of the offence. In addition, the court may order a person convicted of the offences referred to in paragraph 42 (i) above to reimburse the enforcement authority's costs of investigating the offence.

44. The defence of 'due diligence' is available where a person can show he took all reasonable steps and exercised all due diligence to avoid committing an offence. This may include reference to an act or default of, or reliance on information given by, a third party, in which case it must be accompanied by such information identifying the third party, as is information in the possession of the defendant.

45. The Regulations also provide for the ‘liability of persons other than the principle offender’, including a provision that where a company or other body corporate commits an offence, those concerned in its management and responsible (consciously or by negligence) for the commission of the offence, may also be prosecuted as individuals.

Contact points for further information

Department for Business, Innovation & Skills
Eco-design and Product Regulation Unit
Environmental & Technical Regulation Directorate
1 Victoria Street
London SW1H 0ET

Tel: +44 (0) 20 7215 5000

Email: sustainability@bis.gsi.gov.uk

Website: www.bis.gov.uk/whatwedo/sectors/sustainability

The National Measurement Office's RoHS Enforcement Team
– a Government service working with electrical and electronic equipment manufacturers to deliver compliance with the RoHS Directive in the UK

RoHS Enforcement Team
NMO
Stanton Avenue
Teddington
TW11 0JZ

Tel: +44 (0) 20 8943 7227

Email: rohs@nmo.gov.uk

Website: www.rohs.gov.uk

Envirowise Telephone Helpline

0800 585 794 (UK calls only)

Website: www.envirowise.gov.uk

This Helpline is a telephone enquiry service, funded by the Government, providing a comprehensive information and signposting service for firms seeking advice on a wide range of environmental issues that may affect their business.

Annex A

Categories of electrical and electronic equipment covered by the RoHS Regulations

1. **Large household appliances**

   (Such as large cooling appliances; refrigerators; freezers; other large appliances used for refrigeration, conservation and storage of food; washing machines; clothes dryers; dish washing machines; cooking; electric stoves; electric hot plates; microwaves; other large appliances used for cooking and other processing of food; electric heating appliances; electric radiators; other large appliances for heating rooms, beds, seating furniture; electric fans; air conditioner appliances; other fanning, exhaust ventilation and conditioning equipment)

2. **Small household appliances**

   (Such as vacuum cleaners; carpet sweepers; other appliances for cleaning; appliances used for sewing, knitting, weaving and other processing for textiles; irons and other appliances for ironing, mangling and other care of clothing; toasters; fryers; grinders, coffee machines and equipment for opening or sealing of containers or packages; electric knives; appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body care appliances; clocks, watches and equipment for the purpose of measuring, indicating or registering time; scales)

3. **IT and telecommunications equipment**

   (Such as centralised data processing; mainframes; minicomputers; printer units; personal computing; personal computers, including the CPU, mouse and keyboard; laptop computers, including the CPU, mouse and keyboard; notebook computers; notepad computers; printers; copying equipment; electrical and electronic typewriters; pocket and desk calculators; other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means; user terminals and systems; facsimile; telex; telephones; pay telephones; cordless telephones; cellular telephones; answering systems; other products or equipment of transmitting sound, images or other information by telecommunications)

4. **Consumer equipment**

   (Such as radio sets; television sets; video cameras; video recorders; hi-fi recorders; audio amplifiers; musical instruments; other products or equipment for the purpose of recording or reproducing sound or images, including signals or other technologies for the distribution of sound and image than by telecommunications)

5. **Lighting equipment, (including electric light bulbs and household luminaires)**

   (Such as luminaires for fluorescent lamps; straight fluorescent lamps; compact fluorescent lamps; high intensity discharge lamps, including pressure sodium lamps and metal halide lamps; low pressure sodium lamps; other lighting equipment for the purpose of spreading or controlling light)

6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)

(Such as drills; saws; sewing machines; equipment for turning, milling, sanding, grinding, sawing; cutting; shearing; drilling; making holes; punching; folding; bending or similar processing of wood, metal and other materials; tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses; tools for welding, soldering or similar use; equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means; tools for mowing or other gardening activities)

7. Toys, leisure and sports equipment

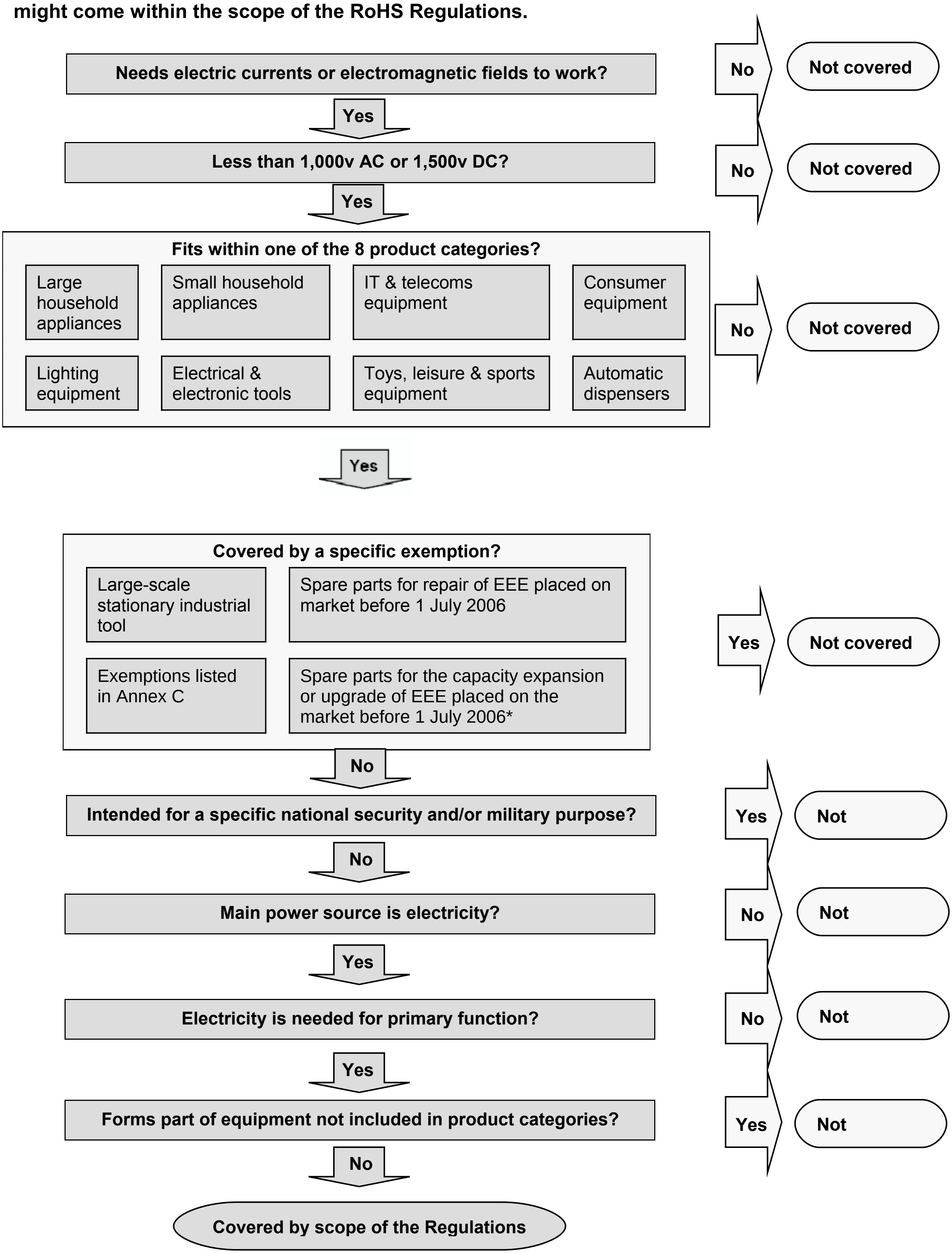
(Such as electric trains or car racing sets; hand-held video game consoles; video games; computers for biking, diving, running, rowing, etc.; sports equipment with electric or electronic components; coin slot machines)

8. Automatic dispensers

(Such as automatic dispensers for hot drinks; automatic dispensers for hot or cold bottles or cans; automatic dispensers for solid products; automatic dispensers for money; all appliances which deliver automatically all kind of products)

Annex B

A 'decision tree' that could be used by producers to decide whether or not a product might come within the scope of the RoHS Regulations.



*While these exclusions are not expressly provided for in the Directive, it is the view of BIS that they apply. It should be noted, however, that a definitive legal interpretation is only available from the court. Producers should rely on independent legal advice on compliance.

Annex C

Guidance on the specific applications of lead, mercury, cadmium and hexavalent chromium that are exempt from the requirements of the RoHS Regulations: -

1. **Mercury in compact fluorescent lamps not exceeding 5 mg per lamp.**

   A compact fluorescent lamp (CFL) is usually defined as a single-ended fluorescent lamp with a bent discharge tube of small diameter, of around 10-16 mm, to form a very compact unit. These lamps can be either integral, whereby the lamp and ballast are combined (also known as self-ballasted or self-supporting), or pin-based.

   For the purpose of this exemption, CFLs can contain no more than 5 mg of mercury per lamp.

2. **Mercury in straight fluorescent lamps for general purposes not exceeding:**
   - **10 mg in halophosphate lamps**
   - **5 mg in triphosphate lamps with a normal lifetime**
   - **8 mg in triphosphate lamps with a long lifetime.**

   A straight, or linear, fluorescent lamp is a fluorescent lamp of straight tubular form and bi-pin electrical connections at either end.

   The colour properties of straight fluorescent lamps are determined by the phosphors used to coat the inside of the tube. Halophospate and triphospate are examples of such fluorescent materials.

   Straight fluorescent lamps for general purpose can be defined as lamps used for general lighting solutions, in contrast to lamps used for special purposes (see item 3 below).

3. **Mercury in straight fluorescent lamps for special purposes.**

   Examples of such lamps are LCD back light lamps, disinfection lamps, medical/therapy lamps, pet care lamps (e.g. aquaria lamps), lamps with special components (e.g. integrated reflectors or external protection sleeves), lamps with special ignition features (e.g. designed for low temperatures), long length lamps (length > 1800mm) and amalgam lamps.

   In this context, there is no restriction on the quantity of mercury in these lamps.

4. **Mercury in other lamps not specifically mentioned in this Annex.**

   Examples of other lamps containing mercury are high intensity discharge (HID) lamps (e.g. sodium lamps and metal halide lamps), circular fluorescent lamps and U-shaped fluorescent lamps.
   In this context, there is no restriction on the quantity of mercury in these lamps.

5. **Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.**

   Lead, or more specifically lead oxide, is often used in glass for electrical and electronic equipment to obtain specific characteristics, such as radiation protection (CRTs, medical applications), filtering (photography, image processing) and strengthening purposes (e.g. production of fluorescent tubes). This exemption has been introduced because viable alternatives for these applications have not yet been identified.

   For clarity, the exemption applies to lead as a constituent in the glass used in cathode ray tubes, lead as a constituent in the glass used in electronic components and lead as a constituent in the glass used in fluorescent tubes.

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.**

   Lead is often used as an alloying element to obtain specific properties of a metal alloy. This exemption applies to the use of lead in steel up to 0.35% by weight, in aluminium up to 0.4% by weight and in copper alloys up to 4% by weight. In the context of this exemption, ‘percentage by weight’ has to be interpreted as ‘the percentage of lead per homogeneous material per discreet part’. For example, if the steel housing of a computer consists of two separate parts, each part can contain up to 0.35% lead by weight of that part.

7. **Lead in high melting temperature type solders (i.e. lead based alloys containing 85% by weight or more lead).**

   For the purposes of applications 7, 8 and 9 in this Annex, it is useful to clarify the term ‘solder’. In these Guidance Notes, ‘solder’ is defined as “alloys used to create metallurgical bonds between two or more metal surfaces to achieve an electrical and/or physical connection”. In this context, the term ‘solder’ also includes all materials that become part of the final solder joint, including solder finishes on components or printed circuit boards.

   The high melting temperature type solder exemption has been introduced to allow the use of lead in solders for specific applications (such as in power semiconductor package manufacturing), for which viable lead-free alternatives have not yet been identified. This exemption is permitted as there are no alternative alloys with similar melting point and which are ductile. The high electrical conductivity and unique mechanical properties of such a high melting point tin-lead alloy make the material malleable and better able to withstand both temperature and physical stress. Such properties ensure fewer defects during manufacturing and high reliability throughout the life of the component, thereby also resulting in fewer components going into the waste stream.

8. **Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission as well as network management for telecommunication.**

   See definition of ‘solder’ given for application 7 above.

This exemption has been introduced to allow the use of lead in solders for professional, high reliability applications, such as servers and network infrastructure equipment, for which viable lead-free alternatives have not yet been identified.

In this context, a '**server**' is seen as a computer that meets one of the technology criteria that are set out in section (a) below, and the functional criteria set out in section (b) below.

(a) Technology criteria for a server

1) Designed and placed on the market as a Class A product as per EN55022:1994 under the EMC Directive 89/336/EEC (intended primarily for use in the professional environment) and designed and capable of having a single or dual processor capability (one or more sockets on board); or
2) Designed and placed on the market as a Class B product (intended primarily for use in the domestic environment) as per EN55022:1994 under the EMC Directive 89/336/EEC and designed and capable of having at least dual processor capability (two sockets on board).

(b) Functional design criteria for a server

1) Designed and capable of operating in a mission-critical, high-reliability, high-availability application in which use may be 24 hours per day and 7 days per week, and unscheduled downtime is extremely low (minutes per year).

   Examples of typical server functions are the provision of network infrastructure, gateway or switching services, the hosting and management of data on behalf of multiple users, or the running of server-capable operating systems (e.g. as for a web server).

It is the view of BIS that this exemption is viewed as applying to lead in the solder of the whole of the computer and its components including processors, memory boards, power converters, power supplies, enclosed housings, modular power subsystems and adapter cards. It would also seem to apply to the lead in the solder of the components that are integrated into the whole computer or that are sold separately for use in an exempt server. The lead in the solder of cable assemblies, and all connectors and connector assemblies used to provide interconnections for the server, would also be covered by this exemption.

It should be noted that this exemption is not viewed as applying to parts or components that are peripheral to the server, nor does it apply to parts or components when they are used other than in an exempt server.

For the purpose of the RoHS Regulations, a **'storage or storage array system'** is viewed as any storage device or subsystem that meets one of the following criteria:

1) Designed and placed on the market as a Class A product as per EN55022:1994 under the EMC Directive 89/336/EEC; or

2) Designed and placed on the market as a Class B product as per EN55022:1994 under the EMC Directive 89/336/EEC and designed to meet one of the following two criteria: -

a) Any storage device capable of accepting direct or switched input from more than one computer, for example fibre channel and SCSI devices, or

b) Any storage fabric or switching device for interconnecting storage devices to server products.

It is the view of BIS that this exemption is viewed as applying to the whole of the device or subsystem and their components including processors, memory boards, power converters, power supplies, enclosed housings, modular power subsystems and adapter cards. It would also seem to apply to the components that are integrated into the whole storage or storage array system or that are sold separately for use in an exempt storage or storage array system. Cables and cable assemblies, and all connectors and connector assemblies used to provide interconnections for the storage or storage array system, would also be covered by this exemption.

It should be noted that this exemption does not apply to parts or components that are peripheral to the storage or storage array system, nor does it apply to parts or components when they are used other than in an exempt storage or storage array system.

For the purpose of the RoHS Regulations, **'network infrastructure equipment for telecommunication purposes'** is viewed by BIS as equipment meeting one of the two following criteria:

1) Any system used for routing, switching, signalling, transmission, or network management or network security; or
2) Any system which can simultaneously enable more than one end user terminating equipment to connect to a network.

It is also any such system in a network, <u>except</u> for end user terminating equipment such as voice terminals and facsimile machines.

This would include all servers, power suppliers, display devices and similar electronic units that are incorporated into network infrastructure equipment. It would also include all cables and cable assemblies, and all connectors and connector assemblies used to provide interconnections for network infrastructure equipment but is not intended to include desktop or notebook computers, telephones, fax machines or consumer – type modems or switches etc.

9. Lead in electronic ceramic parts (e.g. piezoelectronic devices).

Ceramic materials are used in a variety of electronic devices including capacitors, insulators, piezoelectrics, magnets and integrated circuit packages. Some of these ceramic materials contain lead, for example lead zirconate titanate and lead magnesium niobate. The specific chemical composition and manufacturing process of these materials determine their electrical parameters, such as dielectric constant and the dissipation that is essential for the functioning of the component in which they are used. Hence, lead used in the ceramic parts of electronic components in electrical and electronic equipment is exempt from these Regulations.

10. Cadmium and its compounds in electrical contacts and cadmium plating except for applications banned under Directive 91/338/EEC (OJ No. L 186, 12 July 1991, p. 59) amending Directive 76/769/EEC (OJ No. L262, 27 September 1976, p. 201) relating to restrictions on the marketing and use of certain dangerous substances and preparations.

Directive 91/338/EEC amending Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations, gives the following definition of cadmium plating: "Within the meaning of this Directive, 'cadmium plating' means any deposit or coating of metallic cadmium on a metallic surface." This definition is seen as applying for the purpose of the RoHS Regulations.

Subsequently, the Marketing and Use Directive (as amended) bans the use of cadmium plating in a variety of product sectors.

As a result, in this context cadmium plating is viewed as being permitted for electrical contacts in all the WEEE categories to which the RoHS Regulations apply except for products manufactured in the household goods and central heating and air conditioning plant sectors because the latter are restricted by the Marketing & Use Directive. However, that Directive does allow the use of cadmium plating for "electrical contacts in any sector of use, on account of the reliability required of the apparatus on which they are installed."

11. Hexavalent chromium as an anti-corrosion of the carbon steel cooling system in absorption refrigerators.

As absorption cooling works on several different types of energy sources such as gas, kerosene, batteries or electricity, absorption fridges are often used in recreational vehicles (e.g. motor homes and caravans) or remote places where electricity is not available. Another typical application is for minibars in hotel rooms as these fridges are virtually noiseless.

The applied heat and use of a water-ammonia mixture results in a corrosive environment that warrants the use of hexavalent chromium. This exemption has been introduced, since viable alternatives for this specific application have so far not been identified.

12. Lead in lead-bronze bearing shells and bushes.

Lead-bronze bearing shells and bushes are used, amongst others, in compressors for stationary refrigeration and air conditioning equipment. Typical characteristics of such compressors include a long design life (over 50,000 hours for residential applications and over 100,000 for commercial applications) and a hermetic sealing to prevent refrigerant leakage and ensure reliable, uninterrupted operation without service for up to 15 years. Combined with the unique technical aspects of the refrigeration cycle (dry-starts, miscibility of the lubricant, repeated condensing and boiling, etc.), the bearings need excellent self-lubrication properties to meet the high durability and reliability requirements. Due to its lubricious nature, the use of lead as a bearing constituent is critical in these applications. This exemption has been introduced because so far no suitable alternative has been identified, although other materials have been extensively tested.

13. Lead used in compliant pin connector systems.

Compliant pin contacts are used to attach connectors or components to a double-sided printed circuit board. This connector system avoids the need for soldering during manufacturing, thereby avoiding the overheating of components and damaging the integrity of the connectors and board material and allows separation for repair. Such pins are coated with a tin-lead alloy to ensure good electrical conductivity, maintain sufficient spring-back force and facilitate insertion of the pins into the boards. The use of tin-lead also reduces the risk of tin whiskers, which may affect reliability.

This exemption has been introduced because suitable alternatives to the tin-lead alloy have not yet been identified.

14. Lead as a coating material for the thermal conduction module c-ring.

A thermal conduction module c-ring serves a specific purpose in the manufacturing of high performance electronic modules. Such modules are the key components of a mainframe central processing unit and typically contain multiple chips. The c-ring functions as a hermetical seal, continuously dissipating heat and preventing oxidation of solder joints.

While substitutes for lead in this application have been investigated, no feasible alternative has so far been identified.

15. Lead and cadmium in optical and filter glass.

Lead and cadmium are used in optical glass and filter glass to obtain specific properties and meet quality standards, for a wide variety of applications including in the photo industry (e.g. camera lenses), in projectors, scanners, printers and copiers.

This exemption has been introduced because suitable alternatives for many of these applications have not yet been identified.

16. Lead in solders consisting of more than two elements for the connection between the pins and the package of microprocessors with a lead content of more than 80% and less than 85% by weight.

Microprocessors are mounted onto boards or substrates by way of a socket. Such sockets require that a large number of pins (up to 950) are mounted onto the microprocessor for completing the necessary electrical connections. The high customer quality demands for these products mean that such packages are extensively tested, which necessitates high adhesion strength of the pins. This is even more critical at higher pin counts and the application of lead in the proportions specified in this exemption is essential to achieve the necessary properties.

Substitute materials without lead are used by some manufacturers but for high pin counts, the development of alternatives before 1 July 2006 would create significant quantities of waste. This exemption has been introduced to allow for the development of alternative designs without generating excessive amounts of waste.

17. **Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit Flip Chip packages.**

Flip chips are attached to their packages or PCBs using very small solder bumps and many types use solder bumps containing lead. Lead is used for two main reasons. Its ductility reduces the risk of damage to brittle parts of flip chip circuitry. Lead also protects against the possibility of thermal fatigue, which results from cyclic temperature changes and is not well understood with lead-free solders. High melting point solder bumps are attached using solder containing typically 37 – 40% lead to the package because this combination has a high resistance to a phenomenon called "electromigration" which in higher power flip chip packages would otherwise cause premature failure of the device. The solder connections to the chip are known as level 1 and level 1 flip-chip connections may contain lead. The external solder connections between packages and PCB known as level 2 are excluded from this exemption as viable alternatives have been developed.

18. **Lead in linear incandescent lamps with silicate coated tubes.**

An incandescent lamp generates light using a glowing filament heated to white-hot by an electrical current. This light-giving process is known as incandescence.

A linear incandescent lamp is a tubular filament lamp with pin connectors at either end. The glass is coated on the inside with silicate that contains lead. The lead assists in binding the silicate to the glass.

In this context there is no restriction on the use of lead in these lamps.

19. **Lead halide as radiant agent in High Intensity Discharge lamps for professional reprography applications.**

High Intensity Discharge (HID) lamps produce light by striking an electrical arc across tungsten electrodes housed inside a specially designed inner fused quartz or fused alumina tube. This tube is filled with both gas and metals. The gas aids in the starting of the lamps and the metals produce the light once they are heated to a point of evaporation.

Certain HID lamp types contain lead-iodide (PbI2) as a component in the filling. These lamps are used in professional U.V. applications: the curing, reprography and label printing industries. The lead is used for creating the correct lamp emission spectrum and lamp effectiveness.

In this context there is no restriction on the use of lead halide as a radiant agent in these lamps.

20. **Lead as activator in the fluorescent powder (1% lead by weight or less) of discharge lamps when used as sun tanning lamps containing phosphors such as BSP ($BaSi_2O_5$:Pb) as well as when used as speciality lamps for diazo-printing reprography, lithography, insect traps, photochemical and curing processes containing phosphors such as SMS ($(Sr,Ba)_2MgSi_2O_7$:Pb).**

Discharge lamps work by sending an electric current through a special gas. Depending on the gas, this either generates light directly or the current generates ultra-violet light, which is converted to visible light by fluorescent powders.

Lead is used as an activator in fluorescent powders for two classes of special fluorescent lamp products: -

1. Sun tanning lamps contain phosphors such as BSP ($BaSi_2O_5$:Pb), with an emission peak of 350 nm; and
2. Certain specialty lamps (applications: diazo-printing reprography, lithography, insect traps, photochemical and curing processes) contain the phosphors such as SMS ($(Sr,Ba)_2MgSi_2O_7$:Pb), generating a broad emission peak centred at 360 nm.

The presence of lead creates the proper lamp emission spectrum and optimum lamp effectiveness.

This exemption applies to the use of lead as an activator in the fluorescent powder of discharge lamps used in the above applications up to 1% by weight.

21. Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-Hg as auxiliary amalgam in very compact Energy Saving Lamps.

There are two main parts to a compact fluorescent lamp (CFL): the gas-filled tube and the magnetic or electronic ballast. Electrical energy from the ballast flows through the gas in the tube causing it to give off ultraviolet light. The ultraviolet light excites a white phosphor coating on the inside of the tube. This coating then emits a visible light, which is the final product of the CFL.

Very compact Energy Saving Lamps (ESL) with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and PbSn-Hg as auxiliary amalgam

The substances (both main & auxiliary amalgams) control the Hg-vapour pressure inside small CFLs, stabilizing the light output and lamp effectiveness over a wide temperature range. This makes it possible to replace incandescent lamps by CFLs in a wide range of applications, both indoor and outdoor.

In this context there is no restriction on the use of lead in the form of an amalgam or auxiliary amalgam in these lamps.

22. Lead oxide in glass used for bonding front and rear substrates of flat fluorescent lamps used for Liquid Crystal Displays.

Lead is currently used in the glass panel of Liquid Crystal Display (LCD) screens. Two glass substrates are bonded with high precision by inserting glass spacers in between, to keep the same gap. Lead is used there to prevent overheating of the glass, which would result in image distortion and malfunction. It is found in the form of a solder with a concentration of 70% lead by weight, used to create a safe electrical contact on the plane glass surface. Lead containing glass solder is also used to assemble the flat-panel glass envelope.

In this context there is no restriction on the use of lead in the form of an oxide in the glass.

23. Lead and cadmium in printing inks for the application of enamels on borosilicate glass.

Borosilicate glass items are printed with scales and warnings in order to improve usability and ensure consumer safety. These markings must be permanently readable.

The printing on the glass uses an ink, which is fired and melts together with the glass surface, and contains significant amounts of lead oxide (37-48% by weight) and cadmium oxide (11% by weight). Applications using this process to print onto borosilicate glass include: coffee jugs; water boilers; electric water kettles; lamp covers; laser tubes; ozone tubes; and medical devices.

In this context, there is no restriction on the use of lead and cadmium in the printing inks.

24. Lead as impurity in RIG (rare earth iron garnet) Faraday rotators used for fibre optic communications systems until 31 December 2009.

Optical isolators are used in high speed fibre optic communication systems to reduce the noise caused by reflectance phenomena. Rare earth iron garnet (RIG) crystal is used in optical isolators in order to maximise noise reduction. RIG crystal is also found in other optical passive devices such as optical circulators, optical attenuators and optical switches that are used for fibre optic communication systems.

The RIG crystals are produced using the Liquid Phase Epitaxy (LPE) method. The lead oxide is used as a solvent (or flux) in crystal growth. The raw materials are melted with the flux. As a result of this process, lead is inevitably found in the RIG crystal as an impurity.

About 5 mg iron garnet crystal is used in each optical passive device, and lead is included as lead oxide. The concentration is about 0.5 to 1% by weight of the crystal.

In this context, there is no restriction on the use of lead as an oxide in the manufacture of rare earth iron garnet crystals for this application but it is limited to 31 December 2009.

25. Lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with NiFe lead frames and lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with copper lead frames.

The electrical terminations of virtually all electronic components (integrated circuits, memory “chips,” diodes, resistors for example) must be plated with a thin layer of metal to make them capable of being soldered to the printed circuit board. Today, these terminal platings are most commonly comprised of a tin-lead (Sn-Pb) alloy.

One of the main reasons lead is included in the plating is to mitigate the formation and growth of tin “whiskers”. Tin whiskers are electrically conductive, crystalline structures of tin that sometimes grow from surfaces where tin (especially electroplated tin) is used as a final finish.

Tin whiskers have been observed to grow to lengths of several millimetres (mm) and in rare instances to lengths up to 10mm. Numerous electronic system failures have been attributed to short circuits caused by tin whiskers that bridge closely-spaced circuit elements maintained at different electrical potentials.

Lead is used as a whisker suppresser in electroplated Sn coating. The concentration of Pb in the plating alloy is typically below 20%, and the thickness of the plating is only about 10 micrometers.

These tin whiskers can cause functional failure of electronic products once they grow long enough to create short circuits between adjacent electrical terminations. Fine-pitch parts are the most susceptible to such failures because the distance between the conductive leads is small. Modern electronic equipment requires the use of such fine-pitch parts to meet the computation speed and/or small size requirements of the market.

For the purpose of this exemption, fine-pitch components are defined as those with electrical terminations spaced with centres 0.65 mm or less apart. In such parts, the distance between adjacent leads is considerably smaller than the centre-to-centre spacing, and is typically 125 to 300 micrometers.

26. Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors.

RFI signal line filters are manufactured by soldering axial leads into machined ceramic multi layer through hole devices (discoidal capacitors or planar arrays) and mounting into metal bodies or connector shells.

Due to the novel construction of the capacitor, it is necessary to use ductile solders to make these solder joints so as to prevent the ceramic cracking as a result of tensile stresses generated during the cooling of the assembly.

The solders used contain lead along with other alloys (primarily indium) to maintain the ductility required. These solders are typically 50% lead and 50% indium.

In this context there is no restriction on the use of lead in the form of lead in solders for these components.

27. Lead oxide in plasma display panels (PDPs) and surface conduction electron emitter displays (SED) used in structural elements; notably in the front and rear glass dielectric layer, the bus electrode, the black stripe, the address electrode, the barrier ribs, the seal frit and frit ring as well as in print pastes.

The front substrate consists of the bus electrode and the dielectric layer for the protection of the bus electrodes. The rear substrate consists of the address electrode, the dielectric layer, the barrier rib and fluorescent material. By sealing the front and rear substrates together, a gas (usually Ne-Xe) is injected into the panel. PDPs emit light by producing an ultraviolet ray that excites the fluorescent material. The main substance of PDP material consists of PbO, SiO2, B-2 O3, Al2O3, CaO, TiO2, ZnO, etc.

PbO renders the melting point lower with its presence in the paste and tends to optimize the sintering characteristics of the material.

In this context there is no restriction on the use of lead in the form of PbO in these components.

28. Lead oxide in the glass envelope of Black Light Blue (BLB) lamps.

Black light (also Wood's light) is the common name for a lamp emitting electromagnetic radiation that is almost exclusively in the soft near ultraviolet range, and very little visible light.

BLB lamps produce black light that peaks in the soft ultraviolet at a wavelength of 365 nm, with almost no light in the visible spectrum; they appear deep purple violet to the human eye when operating, and black when turned off. These lamps are used to excite UV-sensitive paints and dyes and for other purposes, especially in special effects, security applications, and medicine.

The amount of PbO in the glass envelope is typically 20 wt%, = 18 wt% Pb.

The lead in the form of PbO is essential for creating the proper lamp emission: optimal optical properties: maximum transmission of UV light, and minimum visible light transmission.

In this context there is no restriction on the use of lead in the form of PbO in these components.

29. Lead alloys as solder for transducers used in high-powered (designated to operate for several hours at acoustic power levels of 125 dB SPL and above) loudspeakers.

Most professional/commercial transducers are designed to operate at high output levels in severe environments. At these high acoustic power levels and severe environmental conditions, the transducer’s solder joints are subjected to continuous mechanical and thermal stresses. These extreme stresses are often aggravated by the extreme temperature environments to which fire and military use are frequently subjected.

Alloys containing lead are used as electrical/mechanical solders to attach copper-clad aluminium and copper voice-coils to tinsel wires in electro-acoustic transducers used for commercial and professional fire and security sounders, and other sound applications such as military headsets. The alloys are Sn63Pb37 and Sn60Pb40 with lead content between 37 and 40%.

In this context there is no restriction on the use of lead in the form of alloys as a solder in these transducers.

30. Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC[14].

The use of lead in glass leads to a high refractive index (brilliancy), a strong dispersion and a high transmission of the light. Additionally, the use of lead in glass introduces further favourable thermal and mechanical properties in melting, forming, cutting and in post-processing.

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[14] Directive 69/493/EEC, (OJ No. L326, 296.12.1969, p.36), as last amended by the 2003 Act of Accession.

In electric and electronic equipment this form of glass is used in pure (colourless) or coloured form for decorative and/or functional purposes, such as lamps, chandeliers, decoration of mobile phone covers, clocks and watches.

According to Council Directive 69/493/EEC, full lead crystal consists at least of 28% lead calculated as lead oxide (therefore >30% lead oxide).

Lead is bonded in the silicate matrix of glass and therefore immobilised and not biologically available. The absolute amount of lead depends on the mass of the article.

In this context there is no restriction on the use of lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC.

31. Cadmium alloys as electrical/mechanical solder joints to electrical conductors located directly on the voice coil in transducers used in high-powered loudspeakers with sound pressure levels of 100 dB (A) and more

This exemption allows for the use of special high melting point solders that contain about 70% cadmium, to solder the voice-coil wires of a novel design of small and light-weight but high-powered loudspeakers. The loudspeakers that require this exemption are a patented design and operate at close to 300°C and with very high g-forces due to the vibration of the loudspeaker. Few cadmium-free solders have a suitable melting temperature; even so-called high melting point solders which are covered by the exemption mentioned in paragraph 7 above melt at about 300°C. The light-weight design is achieved by the use of aluminium wires and the few cadmium-free solders with a suitably high melting point such as zinc/aluminium are too aggressive and dissolve the aluminium.

32. Lead in soldering materials in mercury free flat fluorescent lamps (which e.g. are used for liquid crystal displays, design or industrial lighting)

This exemption permits the use of lead in the material used to form a gas tight bond for a new type of flat fluorescent lamp that is mercury free and has an unusually long life. Research has not yet identified a material that can form a permanent gas tight bond without lead. Although referred to as a “soldering material”, this is a lead based low melting point glass with ~70% lead oxide which melts on heating the lamp assembly to form the bond and seal the lamp. These lamps can be used as backlights for LCDs, as well as for lighting and other applications. They are thicker than the narrowest types of special straight fluorescent lamps that do need to contain mercury and are used where there is limited space available such as in laptop computers. Lead in these special lamps is already covered by the exemption in paragraph 22 above, but this exemption allows lead in special thin flat lamps but only for LCD.

33. Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes

The optical windows of Argon and Krypton lasers are sealed using special glass frit materials that contain lead oxide. Frit seals are made with low melting point glasses in powder form and these form a glass bond when heated to above their melting point. The optical windows and the laser tube are both quartz and only seals made with lead based glass provide the correct combination of properties that allow the vacuum tight bond to be made and precisely align the windows with a high yield.

Argon and Krypton lasers are used as tools for cutting materials. They are also used for medical applications such as eye surgery although medical lasers are in Category 8 of the WEEE Directive and, therefore, currently outside the scope of the RoHS Directive.

34. Lead in solders for the soldering of thin copper wires of 100 µm diameter and less in power transformers

Copper transformer wires are connected to terminals by soldering but copper dissolves in the liquid solder. In the time taken to make a solder joint, it is possible for all of the copper to dissolve if the wire is very thin resulting in weak bonds. The rate at which copper dissolves depends on the solder composition, the temperature and time at high temperature. The rate of dissolution is faster in lead-free solder than in tin/lead solder at the same temperature. The slowest dissolution rate is achieved with tin/lead solder alloys that also contain ~3% copper. Standard lead-free solders with <1% copper dissolve the copper wire much more rapidly. Another issue is that it can take longer to make a lead-free bond than a tin/lead bond so that more copper dissolves. High power transformers use very fine wires and generate high voltage and so the solder bond must be domed to avoid arcing and this increases the time required to make the bond. To burn off the enamel coatings used on fine copper wires requires the use of a high temperature and this also increases the copper dissolution rate. Enamel coated transformer wires of 100 µm diameter or less cannot be soldered with lead-free solders as too much copper dissolves resulting in a weak bond and so solders containing lead must be used.

35. Lead in cermet-based trimmer potentiometer elements

Cermet based potentiometers are electronic components used to provide an adjustable electrical resistance. This type of potentiometer is the only type suitable for high current, high humidity or high temperature operation. The device contains a cermet disc with a resistive coating of ruthenium oxide with lead oxide that is applied as a paste which is heated to melt the lead oxide to give a strong, wear-resistant bond. The lead imparts the necessary wear resistance and a stable electrical resistance. Similar coatings of lead with ruthenium oxide are widely used in chip resistors which are generally regarded as being covered by RoHS exemption 7c (lead in electronic ceramic parts) but neither the applicant nor the Commission could determine if the cermet potentiometer application was covered by RoHS exemption 7c or by RoHS exemption 5 (lead in glass of cathode ray tubes, electronic components and fluorescent tubes) and so this exemption has been granted to allow the use of lead in the resistive materials of cermet potentiometers.

36. Cadmium in photoresistors for optocouplers applied in professional audio equipment until 31 December 2009

This exemption is for professional audio equipment such as audio amplifiers and is granted only until 31 December 2009. The input to the amplifier from, for example, a microphone or a musical instrument needs to be electrically isolated from the output circuitry and so the signal is transferred optically with an opto-coupler. The opto-couplers covered by this exemption contain a light emitting diode (LED) that emits visible light which is detected by a photocell with a light sensitive layer containing cadmium sulphide/selenide. The electrical resistance of the cadmium sulphide /selenide layer changes when exposed to visible light and this change in electrical resistance provides the isolated analogue signal for the audio equipment. This exemption does not cover the more common types of opto-couplers that contain LEDs and silicon photodiodes which cannot be used in these types of professional analogue audio circuits.

37. Mercury used as a cathode sputtering inhibitor in DC plasma displays with a content up to 30 mg per display until 1 July 2010

Most plasma displays on the market, including plasma TVs, are AC types which do not contain mercury. However this exemption applies to DC type plasma displays which contain small amounts of mercury. DC plasma displays that show information (eg numbers) are quite different to AC plasma television displays. Inside the display, DC voltages are applied between anodes and cathodes to generate the plasma. With DC, the charge flows in one direction so that electrons hitting the cathode slowly erode the surface by a process referred to as "sputtering". Mercury vapour within the plasma display effectively retards sputtering of the cathodes giving the display an acceptable life. No alternative materials have yet been found to replace mercury. The exemption is granted only until 1 July 2010 because research into substitute materials is underway.

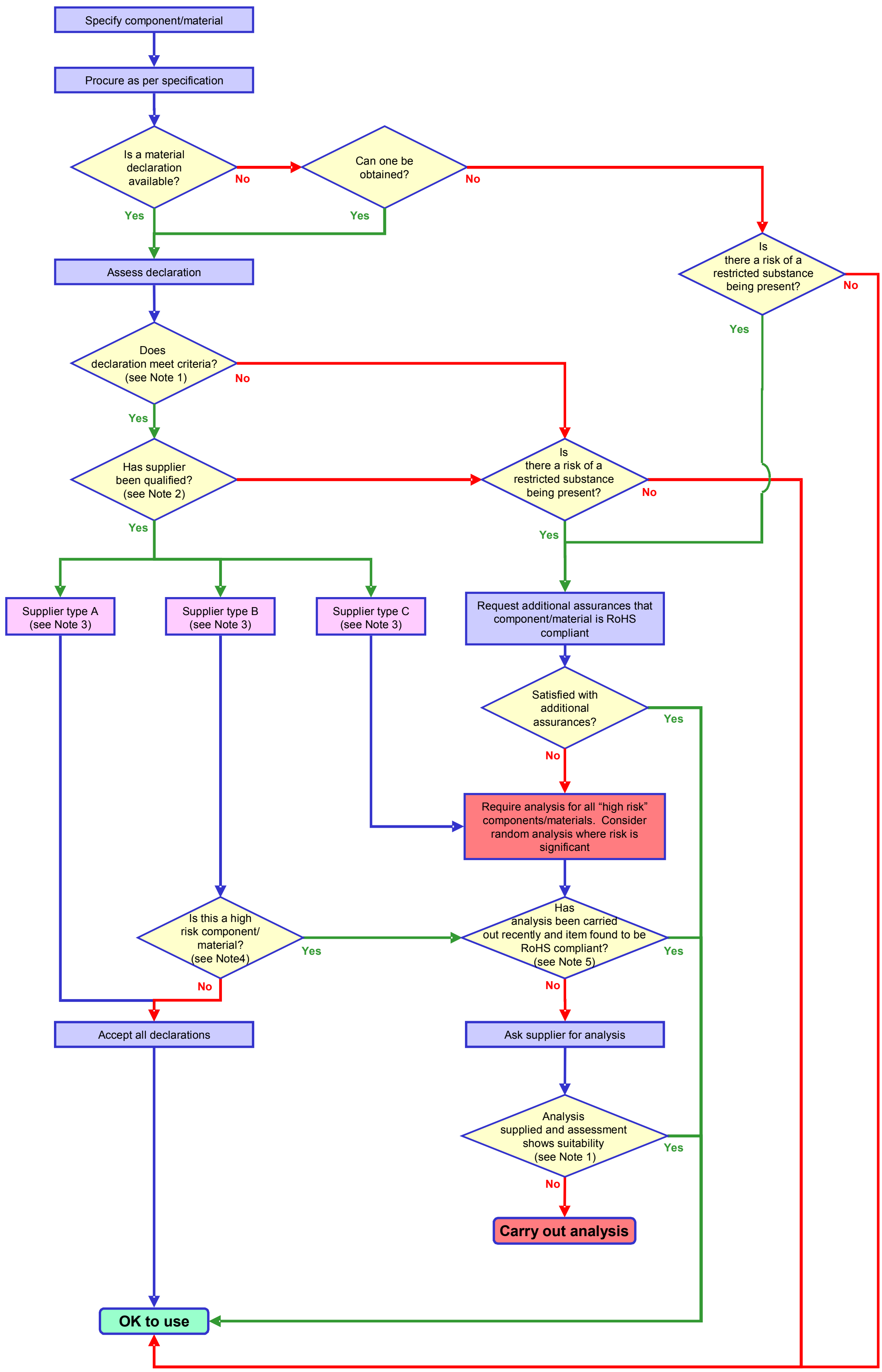
38. Lead in the plating layer of high voltage diodes on the basis of a zinc borate glass body

High voltage glass diodes are made with a special type of glass based on zinc borate with ~2.5% lead. The glass composition is designed to match the thermal expansion coefficient of the component's terminals. The terminals are electroplated with a tin coating and during assembly, small quantities of lead from the glass diffuse into the tin coating giving it a composition with up to 0.3% lead. Although the lead in the glass of the diode is covered by exemption No. 5 of the RoHS Annex, the lead that has diffused into the tin coating is not covered by any other existing exemptions.

39. Cadmium and cadmium oxide in thick film pastes used on aluminium bonded beryllium oxide

Hybrid circuits based on alumina substrates are widely used in electronics but for certain specific and demanding applications, beryllium oxide substrates are required. The hybrid circuit consists of a number of layers of insulators, dielectrics and metals that are applied to create the electrical circuit. Semiconductor dies are attached to the circuitry commonly with fine aluminium wires that are bonded to the metal conductors of the hybrid circuit using ultrasonic wire-bonding. The materials of the hybrid circuitry must bond strongly to each other and to the substrate and not de-bond during the thermal processing or when aluminium ultrasonic wire-bonding is carried out. Traditionally, hybrid materials have contained lead and cadmium oxide to form low melting point glasses that melt during processing to create a strong bond. RoHS compliant hybrid materials have been developed that are suitable for the more common alumina substrates but none are yet available that are suitable on beryllium oxide.

Annex D – An example of a flow chart that might be used as part of an organisation's compliance procedures (see notes on next page).



Notes to accompany the compliance flow chart:

Note 1 - Assessment of materials declarations and suppliers analysis certificates

- Declarations and analysis certificates must be assessed for accuracy. As the forgery of analysis certificates is not unknown, expect to see the following information:
  - Declarations and analysis data based on homogeneous materials
  - A statement that all six RoHS substances are absent and a list of maximum concentration values
  - If an exemption is utilised, a statement to that effect specifying which one this is
  - Supplier name and contact details

Note 2 – Supplier Qualification

- Has the supplier been qualified?
  Most manufacturers will already have a defined process of supplier qualification as part of their quality system. This system needs to be extended to capture information critical to RoHS. This could be based on audit, past experience, etc.

- Supplier audit guidance
  - Aim is to determine if a supplier understands the requirements of the RoHS Regulations and has procedures in place that minimise risk
  - May be carried out in person or remotely
  - Industry accreditations for RoHS may be acceptable although these do not guarantee compliance
  - Any audit should consider how your suppliers assess their suppliers

Note 3 – Supplier Qualification Categorisation

- As an output of the qualification process, suppliers are categorised according to their performance. This example suggests three categories:
  - Type A: supplier has very good understanding of RoHS, comprehensive and effective systems in place to ensure RoHS compliance and carries out selective analysis of high risk components/materials
  - Type B: Supplier has good understanding of RoHS and has a system for ensuring RoHS compliance but may be lacking in some respect, e.g. does not analyse high risk components/materials
  - Type C: Supplier does not understand RoHS requirements or does not have system to ensure compliance and does not check incoming components/materials or declarations

Note 4 – High Risk Components/Materials

- High risk components/materials include the following <u>examples</u>:
  - PVC
  - bright red, orange or yellow plastic
  - ABS
  - aluminium and galvanised steel with a yellow “tint”

Note 5 – Analysis Requirements

- The need for regular analysis depends on the risk of non-compliance as well as the risk to the environment. Therefore components/materials used in large numbers will require more frequent scrutiny (and possibly analysis) than those used in small numbers.
- Due diligence does not expect analysis of every component/material, this would be unreasonable but where there is a risk of non-compliance, the frequency that analysis should be carried out may depend on the potential risk to the environment so that components/materials used in very large numbers would need to be analysed more often than components/materials used in small numbers.