Engineering Specification

Lenovo Engineering Specification 41A7731

Baseline Environmental Requirements for Lenovo Products, Materials and Parts

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Revision History

Date	EC Level	Change Summary
2008-11-19	M07196M	Modified document Title. Table 1 Changed references to PCD to SMD (Supplier Material Declaration) Asbestos - description changed to be consistent with IPC-1752 Brominated Flame Retardants - add “Intentionally Added” and remove all other comments. Mercury/Mercury Compounds - change the description to “Not present except in lambs”; consistent with Table 3. Hexavalent Chromium/Hexavalent Chromium - changed the description to be consistent with description in 41A7733; consistent with Table 3. Polyvinyl chloride (PVC) – removed threshold limit; changed description to reflect no usage in external plastic covers; consistent with Table 3. Polycyclic Aromatic Hydrocarbons (PAH) – moved requirements from Table 3 Red Phosphorous (Red-P) flame retardants – changed description Table 2 “Low Halogen” Substance Requirements – changed description Table 3 Antimony/Antimony Compounds – added phase-out target Beryllium/Beryllium Compounds – added phase-out target Brominated / Chlorinated Flame Retardants (other than PBBs or PBDEs) – changed description to be consistent with Table 3. Change the *Copyright Lenovo Corp. 2006* to *Copyright Lenovo Corp. 2008* EC release dates added under the EC numbers. 2.4.2.4 Additional Requirements for Taiwan – revised to reflect recent updates Figure 4. Four-in-One recycling symbol for Taiwan – updated symbol 2.4.2 Product Design and Labeling Requirements for Batteries - "EU" notation added to EU Battery Directive Mark per EPBA recomendation.
2009-02-10	**M07339F**	Added REACH requirements and information. Updated reference documents. Updated BFR/PVC phaseout plans (beginning 2011); criteria and requirements. Updated rechargeable battery labelling requirements for Japan. Added Product Energy requirements for monitors, external power adapters, PC’s (China, Korea, EU, Switzerland, Australia, New Zealand).
2012-09-26	**Version 6.0**	Updated China WEEE and National Standards reference documents Updated Restricted Substances listings Added Additional Requirements for Children’s Products Updated REACH/SVHC information Updated Battery restrictions for non-removable and button cell batteries Update Battery labeling requirements Update WEEE marking label (remove EU Only) Update China WEEE information and requirements Updated China Product Energy requirements Updated EuP/ErP product energy efficiency requirements Updated External Power Supply (EPS) for Australia, New Zealand, US/DOE, Canada, China. Added California Battery Charger requirements Added Annex DD SVHC Candidate List (June 2012)
2012-10-10	**Version 6.1**	Added Annex EE. Hydrofluorocarbons (HFCs) Correctd Desktop/AIO, Notebook Frame Buffer Width criteria in Table 12.

2013-09-26	**Version 6.2**	Table 1 Updates: Short Chain Chlorinated Paraffins reference to PoPs convention added. Perfluorooctane sulfonates(PFOS) reference to PoPs convention added. Lead carbonates and Lead sulphates reference to REACH annex XVII added. Monomethyl — tetrachlorodiphenyl methane reference to REACH annex XVII added. Monomethyl-dichloro-diphenyl methane reference to REACH annex XVII added. Monomethyl-dibromo-diphenyl methane reference to REACH annex XVII added. 2-(2-butoxyethoxy)ethanol(CAS No. : 112-34-5) prohibited no more than 3% by weight by REACH annex XVII added. Dibutyltin (DBT) reference to REACH annex XVII added. Dioctyltin (DOT reference to REACH annex XVII added. TBT and TPT reference to REACH annex XVII added. CAS number for Dimethyl fumarate corrected. Polychlorinated biphenyls(PCBs) Annex reference corrected. JIG 101 Level A definition/references updated to edition 4.1 , EU Regulation (EC) No 1907/2006 and Annex XVII replaces Directive 76/769/EEC, Marketing and Use of Dangerous Substances. Updated Table 1 references. Corrected Annex references to Polybrominated biphenyls, Polychlorinated biphenyls. Updated requirements for Halogenated diphenyl methanes (refer to Annex D). RoHS definition/references updated to 2011/65/EU. WEEE definition/references updated to 2012/19/EU. Updated and included other jurisdictions with RoHS requirements. Updated RoHS exemption list per Directive 2011/65/EU. Updated REACH SVHC listing per 20 June 2013 Candidate List. Added Annex EE. List of substances subject to REACH Authorisation (current as of the date of this specification. Hydrofluorocarbons (HFCs) listing moved to Annex FF. Added requirements for Austrailia and New Zealand MEPS. Updated EPEAT logo images, specifications, and guidelines.
2014-06-22	**Version 6.3**	Added definition of EEE (Section 1.2) Table 1 Updates: Acids generated from chromium trioxide and their oligomers, Ammonium dichromate, Biocidal product, chromium trioxide, Hexavalent chromium restriction for leather, Potassium chromate, Potassium dichromate, Sodium chromate, Sodium dichromate, Trichloroethylene Table 3 Updates: Regulatory or other references changed to Examples of Industry Uses / Comments 1, 2, 3-Trichlorobenzene, 1, 2, 4-Trichlorobenzene, 2,3-Dibromo-1-propanol, 2,4-Dinitrotoluene, 2-Butanone oxime, 2-Ethylhexyl-2,3,4,5-tetrabromobenzoate (TBB), 4, 4'-Diaminodiphenylmethane (MDA), Arsenic pentaoxide, Arsenic trioxide, Beryllium (CAS 7440-41-7), Beryllium oxide (CAS 1304-56-9), Bis(2-ethylhexyl)tetrabromophthalate (TBPH or BEHTBP), Bisphenol A, Cobalt dichloride, Cobalt metal, Cobalt sulfate, Dibromoneopentyl-glycol, Dibromoneopentyl-glycol, Diethyl phthalate, Diisononyl phthalate (DINP), Di-n-hexyl phthalate (DNHP), Di-n-octyl phthalate (DNOP), Di-n-pentyl phthalate (DNPP), Dioctyltin (DOT) compounds, Formaldehyde, Hydrazine, Indium phosphide, Indium phosphide, Long chain chlorinated paraffins (LCCP),

		Nanomaterials, n-Butyl glycidyl ether, n-Hexane, Nickel sulfamate, Nickel sulphate, Nonylphenols, P-Dichlorobenzene, Perchlorates (Annex MM), Perfluoroalkyl sulfonates (PFASs), Perfluorooctanoic acid (PFOA) and its salts, Polycyclic aromatic hydrocarbons (PAHs), Refractory ceramic fibres, Tetrabromobisphenol A, Tetrabutyltin (TTBT) (CAS 1461-25-2), Toluene (CAS 108-88-3), Tributyltin (TBT) and tributyltin compounds, Triphenyltin (TPT) and triphenyltin compounds, Tris (1,3-dichloro-2-propyl) phosphate (TDCPP), Tris (2, 3-dibromopropyl) phosphate, Tris (2-chloro-1-methylethyl) phosphate (TCPP), Tris (2-chloroethyl) phosphate (TCEP), Vinyl chloride Removed the weight plastic weight exemption for Brominated / Chlorinated Flame Retardants (other than PBBs or PBDEs). Table 5 Updates: Sum of PAHs changed to 18. Ammonium pentadecafluorooctanoate (APFO), Benzyl butyl phthalate (BBP), 1,2-Benzenedicarboxylic acid, dipentylester, branched and linear, 1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear, Bis (2-ethyl(hexyl)phthalate) (DEHP), Cadmium, Cadmium chloride, Cadmium oxide, Cadmium sulphide, Diboron trioxide, Diisopentylphthalate, Di-n-hexyl phthalate (DNHP), 1,2-dimethoxyethane;ethylene glycol dimethyl ether (EGDME), Dipentyl phthalate (DPP), Fatty acids, C16-18, lead salts, Hexabromocyclododecane (HBCDD), Lead monoxide (lead oxide) trioxide, Lead oxide sulphate, Lead titanium trioxide, Orange lead (lead tetroxide), Pentadecafluorooctanoic acid (PFOA), [Phthalate (2-)]dioxotrilead Pyrochlore, antimony lead yellow, Sodium perborate; perboric acid, sodium salt, Sodium peroxometaborate, Tetralead trioxide sulphate Updated Annex C Halogenated aromatic substances Updated Annex BB Tributyl Tin, Triphenyl Tin Updated Annex CC Polycyclic Aromatic Hydrocarbons Updated Annex DD SVHC Candidate List Updated Annex EE List of substances subject to REACH Authorisation Added Annex GG Nonylphenols Added Annex HH Perchlorates Added Section 2.4.2.6: Requirements for Alkaline Batteries Sold in Latin America Updated Section 2.11.1.4 Energy requirements for Flat Panel TVs in China and Section 2.11.4.4 Energy requirement for External Power Supplies in China Updated Section 2.11.4.6 Requirements for California to include the BC mark labeling requirements. Added Section 2.11.6 Requirements for Mexico: Computers, Small Scale Servers, Servers, Storage Products, and peripheral
2014-09-05	**Version 6.4**	Table 1 Update: Red Phosphorous (Red-P) flame retardants restricted from use in all electrical/electronic parts, assemblies, etc.
2015-03-05	**Version 6.5**	Table 1 Update: 600ppm allowance for PBBs, PBDEs, excluding DecaBDE in PCC recyclate and plastic resins. Table 4 Update: Added New SVHC substances. Cadmium fluoride, Cadmium sulphate, 2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320), 2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328), 2-ethylhexyl 10-ethyl-

		4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE), reaction mass of 2-ethylhexyl-10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4- stannatetradecanoate and 2-ethylhexyl 10-ethyl-4-[[2-[(2-ethylhexyl)oxy]-2- oxoethyl]thio]-4-octyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (reaction mass of DOTE and MOTE) General: format, punctuation, grammatical updates/corrections.
2015-07-02	**Version 6.6**	Added 4 phthalates per new Directive (EU) 2015/863 to amend Annex II to EU RoHS 2 (Directive 2011/65/EU). Updated REACH SVHC listing per 15 June 2015 Candidate List: UV-320, UV328, Cadmium fluoride, Cadmium sulphate, DOTE, Reaction mass of DOTE and MOTE, 1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters; 1,2-benzenedicarboxylic acid, mixed decyl and hexyl and octyl diesters with > 0.3% of dihexyl phthalate Table 1 Updates: Azocolourants entry updated, Nonylphenol ethoxylates, Perfluorooctanoic acid PFOAs (REACH restrictions) Table 4 Updates: Toluene diisocyanates, Perfluoro carboxylic acid and related compounds (reporting requirements) Table 7 Updates: New law –Canada Products Containing Mercury Regulations SOR/2014-254 (all battery types) Section 2.6 New law –Canada Products Containing Mercury Regulations SOR/2014-254 (product and packaging label requirements) Table 10 updates: Product and packaging labeling requirements for Canada, US Web page notification requirements for notebook, laptop computers 2.11.4 EPS energy efficiency requirements and standards updated (DOE Energy Conservation Program: Energy Conservation Standards for External Power Supplies) Added: Annex II. Perfluorooctyl acid (PFOA) and salts Added: Annex JJ. Perfluorinated compounds Added: Annex KK. Toluene Diisocyanates Added: Annex LL. Nonylphenol Ethoxylates Updated: Annex DD. SVHC Candidate List Updated: Annex EE. REACH Authorization List of substances
2016-03-25	**Version 6.7**	Update to Article definition Table 1 Updates: Changed restriction for 22 Authorized SVHCs from term “Deliverable” to “Article” Updated GS Mark standard and requirements for Polycyclic Aromatic Hydrocarbons (PAH) Table 4: Updates: The term “Deliverable” has been replaced with “Article” and a note added referring to the September 10, 2015 ruling from the EU Court of Justice. Added -Nanomaterial (new law -Belgium Royal Decree) Additional requirement “Prohibited in Substances and Preparations” added for Cadmium, Hexachloroethane, Nonylphenol ethoxylates, Tris-(aziridinyl)–phosphineoxide, Tris (2,3 dibromopropyl) Updated REACH SVHC listing per 17 December 2015 Candidate List.: 2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV-350) Dicyclohexyl phthalate 2,4-di-tert-butyl-6-(5-chloro benzotriazol -2-yl) phenol (UV-327) Hexamethylene diacrylate Perfluorononan-1-oic acid (2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluorononanoic acid and its sodium and ammonium salts 1,3-propanesultone Table 7 Updates: Zinc silver oxide, zinc air and zinc manganese dioxide button batteries prohibited (Japan Act on Preventing Environmental Pollution of Mercury)

		Added – Battery requirements for Brazil Added SystemX energy efficiency requirements; i.e., Switches, Routers Updated: Annex DD. SVHC Candidate List Updated: Annex EE. REACH Authorization List of substances
2016-10-28	**Version 6.8**	Updated: 2.11.1 System Requirements for China Updated: Restrictions on Polychlorinated naphthalenes Updated: Exemption added for Red-P flame retardants (Plastic mechanical parts) Updated: Reference for Japan's Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. Added: Note 9, Low Halogen Substance Requirements. Added: Low halogen power cord option and label requirements. Updated: Annex Q. Polybrominated diphenyl ethers (PBDEs) Added: Annex MM: Creosote, Coal Tar, Anthracene Etc. Added: Annex NN: Dibutyltin (DBT) Compounds Updated: Dicyclohexyl phthalate threshold and description Updated: Table4. Substances of Very High Concern (SVHC) Updated: Annex DD. SVHC Candidate List Updated: Threshold concentration for HBCDD Updated: Lenovo Guide to Full Material Disclosures (Version 2), new link Updated: Table 4, changed Deliverable to Article
2017-03-30	**Version 6.9**	Updated/corrected reporting threshold for HBCCD in Table 3. Updated/corrected Annex I titles regarding Polychlorinated naphthalene restrictions. Table 4 Update: Added New SVHC substances. • 4,4'-isopropylidenediphenol (bisphenol A; BPA) • Nonadecafluorodecanoic acid (PFDA) and its sodium and ammonium salts • p-(1,1-dimethylpropyl)phenol • 4-heptylphenol, branched and linear [substances with a linear and/or branched alkyl chain with a carbon number of 7 covalently bound predominantly in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof] Updated: Annex DD. SVHC Candidate List
2017-04-10	**Version 7.0**	Updated: Product Energy Efficiency Requirements for Mexico (Sec. 2.11.6.1)
2017-10-02	**Version 7.1**	Table 1 Update: Added Bisphenol A (BPA) , Tris (1,3-dichloro-2-propyl) phosphate, Tris (2-chloroethyl) phosphate, REACH restriction for Decabromo diphenyl ether; Added Taiwan Green Mark material concentration requirements for RoHS substances and Shortchain Chlorinated Paraffins; Added China Environmental Product Labeling material threshold requirements for Medium Chain Chlorinated Paraffins. Table 3 Update: Added Dysprosium and compounds, Neodymium and compounds Praseodymium and compounds,Terbium and compounds, Tris (1,3-dichloro-2-propyl) phosphate (reporting only for cables, adaptors and other connecting devices, storage media such as compact discs, for interactive software, not for mice cables.) Section 2.2.1 Added Lenovo target to eliminate all SVHC's in a concentration of more than 0.1% w/w in the article by December 31th, 2020. Table 4 Update: Added New SVHC substance - Perfluorohexane-1-sulfonic acid and its salts (PFHxS Annex DD: Added new SVHC substance - Perfluorohexane-1-sulfonic acid and its salts (PFHxS); Added Lenovo target to eliminate all SVHC's in a concentration of more than 0.1% w/w in the article by December 31th, 2020.

2018-27-04	**Version 7.2**	Update: Added Sec 2.11.6.2 Mexico EPS efficiency and labeling requirements Update: Added Sec 2.11.9 Server and Data Storage Product (EU Requirements) Update: Annex DD: Added new seven (7) SVHC substances.
2018-28-08	**Version 7.3**	Update: Annex DD: Added new ten (10) SVHC substances. Update: Revised CEC and US DOE BCS requirements. Update: Added Sec 2.11.10 CEC Computer and Monitor efficiency requirements
2019-14-01	**Version 7.4**	Update: Added reference to RoHS 3 effective date for 4 phthaltes (DEHP, DPB, BBP, DIBP). Update: Removed Table 4 Substances of Very High Concern (SVHC) and directed users to link to current listing maintained by EU. Update: Annex DD: Added three (3) new SVHC Candidate substances.
2019-01-05	**Version 7.5**	Update: Table 1: Added Benzene, n-Hexane, Trichloroethylene, Tetrachloroethylene, Methylene Chloride Update: Table 7: Update battery regulation references for alkaline and zinc carbon batteries
2019-09-09	**Version 7.6**	Update: Various url's and hyperlinks to new Lenovo sustainability web pages Update: Table 1 PFOA restrictions, effective dates and link to Annex XVII info. Update: Added Sec 2.1.2.1 China RoHS Conformity Assessment System Update: Sec 2.2.1 - deleted Lenovo target to eliminate all SVHCs in a concentration of more than 0.1% in the article by December 31, 2020. Update: Annex DD: Added four (4) new SVHC Candidate substances. • 2-methoxyethyl acetate, • Tris(4-nonylphenyl, branched and linear) phosphite (TNPP) with ≥ 0.1% w/w of 4-nonylphenol, branched and linear (4-NP), • 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propionic acid, its salts and its acyl halides (covering any of their individual isomers and combinations thereof), • 4-tertbutylphenol. Update: Organohalogen flame retardants added to Table 3 and Annex OO. Update: Added references to Washington and Colorado regulations to Sec 2.11.10.2 Update: Updated Sec 2.11.4.6 BCS definitions and requirements for Canada. Update: Added EPEAT optional criteria requirements for Cadmium (4.1.2.1), Beryllium (4.1.4.1) and Brominated/Chlorinated flame retardants (4.1.5.2). Refer to IEEE STD 1680.1-2018.

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Detailed Chemical Lists with CAS Numbers

Scope

1.0 Scope

1.1 Objectives

This Lenovo Engineering Specification establishes baseline environmental requirements for all *Materials, Parts and Products that comprise a Lenovo hardware Product for which this specification is referenced in a Statement of Work, print, contract or other procurement documents. This specification implements Lenovo's environmental policy objectives and contains some, but not all, environmental legal requirements for Materials, Parts and Products.

Compliance with the requirements in this specification alone may not satisfy the Supplier's responsibilities to Lenovo since this specification does not encompass all environmental legal requirements in various countries around the world for Materials, Parts and Products. This specification also contains some restrictions on Materials and on certain chemicals used in manufacturing. It also requires suppliers to disclose information about the content of certain substances in their products. This specification also includes requirements for batteries, marking of plastic parts, and other product labeling requirements.

It is important to note that in addition to this specification, Lenovo also maintains environmental and/or related requirements in other specifications, contracts or procurement documents

1.2 Definitions

Article - an object which during production is given a special shape, surface, or design which determines its function to a greater degree than does its chemical composition. In reference to EU REACH Substances of Very High Concern (SVHC), when a product is made up of more than one constituent Article, the SVHC concentration above 0.1% weight by weight applies to each constituent Article making up the product.

Battery or accumulator: any source of electrical energy generated by direct conversion of chemical energy and consisting of one or more primary battery cells (non-rechargeable) or consisting of one or more secondary battery cells (rechargeable). This definition is from the EU Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators.

Consumer Product: any article, or component part thereof, produced or distributed (i) for sale to a consumer for use in or around a permanent or temporary household or residence, a school, in recreation, or otherwise, or (ii) for the personal use, consumption or enjoyment of a consumer in or around a permanent or temporary household or residence, a school, in recreation, or otherwise. For exclusions please see the US Consumer Product Safety Act.
[Source: 15 U.S.C. United States Code Title 15 – Commerce and Trade Chapter 47 – Consumer Product Safety]

Deliverable(s): any tangible item(s) delivered by or for a Supplier to Lenovo in accordance with a purchase contract or other agreement with Lenovo. Deliverables include, but are not limited to,

components, materials, parts, and products.

Electrical and Electronic Equipment (EEE): means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current. This definition is from EU Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

EPEAT: Electronic Products Environmental Assessment Tool (EPEAT). EPEAT is a procurement tool designed to help purchasers evaluate, compare and select desktop computers, laptops and monitors based upon their environmental attributes as specified in the IEEE Standard for the Assessment of Personal Computer Products (1680). Refer to: www.epeat.net

Intentionally Added or Intentional Addition shall mean that a substance is deliberately utilized in the production of a Material or Part.

Materials are chemical substances and preparations that are supplied for the production of Parts and Products (for example structural plastics, metals, coatings, paints, adhesives) and chemical substances or preparations that are shipped with Products, such as toner, cleaners, lubricants, oils, and refrigerants.

Not Detected - Below the detection limit of established test standards or appropriate industry wide test methods. In general, these test standards/ methods should achieve trace level detection or at the lowest detection capabilities of the specific sample matrix.

Homogenous Material is a unit that cannot be mechanically disjointed into different materials. The term “Homogenous” means having uniform composition throughout. Examples of homogenous materials are individual types of plastics, ceramics, glass, metals, alloys, resins, and coatings. Mechanically disjointed means that the materials can, in principle, be separated by mechanical actions such as unscrewing, cutting, crushing, grinding, and abrasive processes.

Parts include fabricated Materials, components, devices and assemblies.

Preparation: a mixture or solution composed of two or more substances, for example paint, lubricant or ink. This definition is found in the EU Council Directive relating to restrictions on the marketing and use of certain dangerous substances and preparations and EU Regulation 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Products are stand alone, final assemblies that Lenovo markets under its own brand including complete machines supplied by an original equipment manufacturer (OEM) to Lenovo for sale under a Lenovo brand.

RoHS - an acronym for the European Union Directive 2011/65/EU on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment and subsequent amendments to this Directive.

RoHS substances: substances restricted by European Union Directive 2011/65/EU, "Restriction on the Use of Certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment" Refer to Lenovo RoHS Engineering Specification 41A7733.

REACH: an acronym for the European Commission Regulation Number 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of CHemicals.

Substance: a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition. This definition is found in the EU Council Directive relating to restrictions on the marketing and use of certain dangerous substances and preparations and EU Regulation 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Substance includes such examples as ethanol and metals. Note: metals are included here not in the form of a part or product such as a heat sink or sheet metal cover but as a metal such as aluminum or aluminum alloy. Substance goes beyond a pure chemical compound defined by a single molecular structure. The definition of the substance includes different constituents such as impurities. Also note the word "substance" is used throughout this specification, only the "Substance" with a capital letter refers to this specific definition.

Substance(s) of Very High Concern (SVHC)
1. Substances meeting the criteria for classification in accordance with EU Directive 67/548/EEC:
- Carcinogenic category 1 or 2
- Mutagenic category 1 or 2
- Toxic for reproduction category 1 or 2;

2. Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) in accordance with the criteria set out in Annex XIII of the EU REACH Regulation;
3. Substances- such as those having endocrine disrupting properties or those having PBT properties or vPvB properties which do not fulfill the criteria of 2 above - for which there is scientific evidence of probable serious effects to human health or the environment which give rise to an equivalent level of concern to those of other substances listed in 1 or 2 and which are identified on a case-by-case basis in accordance with the procedure set out in Article 59 of REACH. This definition is from the EU REACH Regulation, Article 57.

WEEE - an acronym for the European Union Directive 2012/19/EU of the European Parliament and of the Council on Waste Electrical and Electronic Equipment.

Threshold Level: concentration level or limit (equal to or) above which the presence of a substance or material in a product or subpart must be declared. Threshold levels are provided in ppm (and mass %). The general conversion used is 1000 ppm = 0.1% by weight.

1.3 Application

This specification applies to all Materials, Parts, and Products supplied for Lenovo brand hardware Products that reference this specification. All suppliers must comply with **Sections 2.1 through 2.2 and 3.0** of this specification and their corresponding tables. In addition suppliers of Parts or Products containing molded thermoplastics must comply with **Section 2.3**. Suppliers of Parts and Products containing batteries must comply with **Section 2.4**. Suppliers of Parts and Products having decorative metal finishes must comply with section 2.5. Suppliers of Parts and Products containing mercury must comply with **Section 2.6**. Suppliers of chemicals must comply with **Section 2.7.** Suppliers of Products and operating chemicals (e.g., toner) must comply with **Section 2.8**. Products defined by the European Union as electrical and electronic equipment (EEE) for the Directive on Waste Electrical and Electronic Equipment (2012/19/EU) must comply with **Section 2.9.** Suppliers are responsible for compliance with this specification in their own operations, in their subcontracted operations, and in the Materials they procure for the manufacture of components, Parts, assemblies, and Products for Lenovo hardware.

Compliance with the requirements in this specification alone may not satisfy the supplier's responsibilities to Lenovo since this specification does not necessarily encompass all applicable environmental requirements for Materials, Parts and Products.

In the event of conflict between this specification and any Lenovo part drawing requirement, suppliers shall immediately notify their Lenovo procurement representative. **Any deviation from the requirements of this specification must have prior written approval by Lenovo's procurement representative.**

1.4 Document Administration

This document is maintained and controlled by Lenovo Global Environmental Affairs.
Technical questions regarding the requirements in this specification may be referred through Lenovo procurement to:

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1.5 List of Documents Referenced in This specification

1.5.1 External Documents

- **Joint Industry Guide (JIG)101 A**
- **European Union Directive 2012/19/EU on waste electrical and electronic equipment (WEEE)**
- **European Union Directive 2011/65/EU on the restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)**
- **EU Regulation 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).**
- **EU Commission Regulation No 1275/2008**
- **Marking for control of pollution caused by EIP Products SJ/T11364 2014**
- **National Standard of the People's Republic of China GB 20943-2007**
- **National Standard of the People's Republic of China GBT 18455-2010**
- **National Standard of the People's Republic of China GB 24850-2010**
- **National Standard of the People's Republic of China GB 25956-2010**
- **National Standard of the People's Republic of China GBT 26572-2011**
- **National Standard of the People's Republic of China GB 28380-2012**
- **Regulations on Recovery Processing of Waste Electrical and Electronic Products (China WEEE)**
- **Regulations on Fund Collecting of Waste Electrical and Electronic Products (China WEEE Fund)Korean e-Standby Program Application Regulation**

1.5.2 Lenovo Documents

Lenovo Information for Suppliers can be found at:
http://www.lenovo.com/global_procurement/us/en/Guidelines/Restrictions_and_Packaging.html

Product Content Restrictions and Packaging Requirements

- Environmental Product Content Restrictions
  - Baseline Environmental Requirements for Materials, Parts and Products, 41A7731
  - RoHS Engineering Specification, 41A7733
  - Lenovo Supplier Material Self-Declaration
  - Lenovo Guide to Full Material Disclosure
  - REACH: SVHC Disclosure

- Packaging Requirements
  - Wooden Packaging - Material Selection, Treatment, and Marking Requirements, 41A0609
  - Expanded Packaging Materials - Prohibited Expansion Agents, 41A0610
  - Packaging Materials, Environmental Requirements, 41A0612
  - Recyclable Packaging Materials - Selection and Identification, 41A0613

Lenovo requires Suppliers to provide Declarations confirming that materials, parts and products meet the requirements of Lenovo's Restricted Materials Specifications. At Lenovo's request, the supplier may be asked to provide additional technical documentation or test results supporting the

declaration.

- Lenovo Supplier Material Self-Declaration
- Lenovo Guide to Full Material Disclosure

2.0 Requirements

2.1 Restricted Substances

2.1.1 Lenovo Restrictions

Table 1, "Restricted Substances," lists restrictions for categories of substances which are restricted for use in Materials, Parts, and Products for Lenovo hardware. The scope of restrictions varies by substance category. Relatively few categories have general bans; most restrictions pertain to limited applications for the substance categories. Details of the restrictions for each category are provided in **Table 1** along with some applicable regulatory references. These references are not intended to be a complete list, but rather examples of the regulations driving these restrictions. Restrictions on chemicals used in manufacturing of Lenovo hardware Products may also be included as specified in the table or notes. Expanded listings of relevant substances in each of the categories are available in the Annexes for this specification referenced in **Table 1**.

Table 1.	**Restricted Substances**	
Chemical Substance Category	**Details of Restriction**	**Regulatory/ Industry References**
Acids generated from chromium trioxide and their oligomers. Group containing: Chromic acid (CAS 7738-94-5); dichromic acid (CAS 13530-68-2); oligomers of chromic acid and dichromic acid (CAS not yet assigned)	Prohibited at or above 0.1% weight by weight of the Article..	1
Acrylamide (CAS 79-06-1)	Shall not be used as a substance or constituent of mixtures in a concentration equal to or greater than 0.1% by weight for grouting applications.	1
Ammonium dichromate (CAS 7789-09-5)	Prohibited at or above 0.1% weight by weight of the Article.	1
Arsenic and compounds (Annex S)	Prohibited in wood products and paints.	1, 2
Asbestos (Annex A)	Prohibited Must not be used. Report any content.	1, 2, 3 JIG 101 Ed. 4.1
Azo colorants (Annex B)	Azodyes which may release one or more aromatic amines (listed in 1B, 1J, 2 Annex B (1)) are prohibited above 30 ppm in textile	1, 2 JIG 101 Ed. 4.1

	and leather articles which may come into direct and prolonged contact with human skin. Azodyes (listed in Annex B (2)) are prohibited in concentrations above 0.1% by weight in colorants for textile and leather articles (e.g., fabrics for headphones and wrist straps).	
Benzene (CAS 71-43-2)	Prohibited in Manufacturing and in clothing or related accessories, and textiles which under normal or reasonably foreseeable conditions of use come into contact with human skin - concentration limit of 5 mg/kg. Disposable textiles, not for clothing, are exempt.	1
Benzenamine, N-phenyl-, reaction products with styrene and 2,4,4-trimethylpentene (CAS 68921-45-9)	Prohibited	15
Benzidine, CAS No 92-87-5, and its salts	Prohibited	1, 2, 12, 15,38
Benzo[a]pyrene (CAS No 50-32-8)	Prohibited in wood based materials in excess of 0.5 milligrams per kilogram of dry matter.	2
Benzyl butyl phthalate (BBP) (CAS 85-68-7)	Prohibited at or above 0.1% by weight (or 1000ppm) in homogeneous materials.	1
Biocidal product as defined in EU Regulation 528/2012 concerning the making available on the market and use of biocidal products	Prohibited on or in Deliverables, for example, prohibited for use as a treatment on Deliverables where the biocidal product is expected to remain on the Lenovo Deliverable. This restriction shall not apply to treated articles where the sole treatment undertaken was the fumigation or disinfection of premises or containers used for storage or transport and where no residues are expected to remain from such treatment on the Lenovo Deliverable.	41
Bis (2-ethylhexyl) phthalate (DEHP) (CAS 117-81-7)	Prohibited at or above 0.1% by weight (or 1000ppm) in homogeneous materials.	1
Bisphenol A (BPA) (CAS 80-05-7)	Prohibited in Frequently Handled Cables and frequently handled parts and products, e.g., mice, mouse pads, and keyboards. This prohibition applies to dermal exposure levels at or above 3 micrograms/day.	14
2-(2-butoxyethoxy)ethanol (DEGBE) (CAS 112-34-5)	Prohibited at or above 3% weight by weight of the Deliverable.	1
Brominated Flame Retardants: • Polybrominated biphenyl (PBBs) • Polybrominated diphenyl ether (PBDEs) including Decabromobiphenyl Ether (DecaBDE)	Prohibited RoHS Substances: no exemptions Any content must be reported 600ppm max in post consumer plastic feedstock and post consumer content plastic resin only (excluding DecaBDE). Subject to approval. Taiwan Green Mark Products：10 ppm in homogenous material for >25g plastic component	1, 14 JIG 101 Ed. 4.1 45
Cadmium/Cadmium Compounds (Annex L)	100 ppm or Intentionally Added in homogenous material RoHS Substance: allowance made for RoHS exemptions EPEAT Products: 50 ppm in homogenous material * Desktop/AIO/Workstation/Notebook/Monitor: shall not use any exempted cadmium applications under the EU RoHS Directive. For restrictions in battery applications see Table 7	Annex L 1, 2, 12, 28 EPEAT 4.1.2.1 ((IEEE STD 1680.1-2018) California Health and Safety Code sections 25214.9-25214.10.2

	Prohibited in Substances and Preparations Taiwan Green Mark Products：10 ppm in homogenous material for >25g plastic component	37 45
Chromium trioxide (CAS 1333-82-0)	Prohibited at or above 0.1% weight by weight of the Article.	1
Creosote, coal tar, tar oils and anthracene substances (see Annex MM for list)	Prohibited for the treatment of wood.	1, 2
Decabromo diphenyl ether (CAS number 1163 19 5)	Decabromo diphenyl ether is prohibited in computer plastic housings at any detectable level. Computer plastic housings also includes attachments to the housings such as buttons (e.g. Power on and off), drive bezels (e.g. DVD and tape drive bezels) and snap in logos. Prohibited in Substances, Preparations and Products (other than computer plastic housings which have a more restrictive level, see above) at levels at and above 0.1% by weight. Prohibited in an Article, or any part thereof, in a concentration equal to or greater than 0.1% by weight. (This specific prohibition does not apply to electrical and electronic equipment within scope of EU Directive 2011/65/EU RoHS.) Lenovo prohibits the Intentional Addition of Deca BDE in any Homogeneous Material.	19, 22, 23, 43, 44 1, 22, 44 1 Lenovo Requirement
4,4'-Diaminodiphenylmethane (MDA) (CAS 101-77-9)	Prohibited at or above 0.1% weight by weight of the Article.	1
Diarsenic pentaoxide (CAS 1303-28-2)	Prohibited at or above 0.1% weight by weight of the Article.	1
Diarsenic trioxide (CAS 1327-53-3)	Prohibited at or above 0.1% weight by weight of the Article.	1
Dibutyl phthalate (DBP) (CAS 84-74-2)	Prohibited at or above 0.1% by weight (or 1000ppm) in homogeneous materials.	1
Dibutyltin (DBT) compounds (Annex NN)	Prohibited in Mixtures and Articles where the concentration in the Mixture or Article, or part thereof, is greater than the equivalent of 0.1% by weight of tin.	26
Diisobutyl phthalate (DIBP) (CAS 84-69-5)	Prohibited at or above 0.1% by weight (or 1000ppm) in homogeneous materials.	1
Dimethylfumarate (CAS 624-49-7)	Prohibited in Products, Parts, and Deliverable greater than 0.1 mg/kg of the weight of the Product, Part or Deliverable. Prohibited in pouches (e.g., desiccants) and in chemicals, Substances, and Preparations.	1, 31
2,4-Dinitrotoluene (CAS 121-14-2)	Prohibited at or above 0.1% weight by weight of the Article.	1
Dioctyltin (DOT) compounds (e.g., dioctyl tin oxide CAS 870-08-6 and dioctyltin dilaurate (CAS 3648-18-8)	Prohibited in concentrations greater than the equivalent of 0.1% by weight of tin in: 1. Textile articles intended to come into contact with skin, and 2. Two-component room temperature vulcanization molding kits (RTV-2 molding kits).	26
Formaldehyde CAS No 50-00-0	Materials capable of releasing formaldehyde into the air, under reasonably foreseeable conditions of use at concentrations reaching or exceeding 0.1ppm are prohibited. The use of formaldehyde in textiles intended for skin contact is prohibited (e.g. Wrist straps and headphones) above 120 mg/kg formaldehyde. The use of formaldehyde in wood applications may not be used if	25 11, 32 20,21

	the formaldehyde emission caused by the wooden materials exceeds 0.1 ml/m3 (ppm) in the air of a test chamber. Formaldehyde emission standards in Composite Wood must not exceed the following limits (see Section 2.12 for more details): Hardwood Plywood Veneer Core - 0.05ppm Hardwood Plywood Composite Core - 0.05ppm Particleboard - 0.09ppm Medium Density Fiberboard - 0.11 ppm Thin Medium Density Fiberboard - 0.13 ppm	24
Halogenated aromatic substances (Annex C)	Prohibited from use in capacitors and transformers above 500 ppm for monohalogenated or 50 ppm for polyhalogenated aromatic substances in materials of the component.	1, 2
Halogenated diphenyl methanes (Annex D)	Prohibited	1, 12
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (alpha HBCDD, beta HBCDD, gamma HBCDD) (CAS 25637-99-4, 3194-55-6, 134237-50-6, 134237-51-7, 134237-52-8)	Prohibited at or above 0.01% weight by weight of the Article.	1
Hexachlorobenzene (CAS 118-74-1)	Prohibited except if incidentally present.	15,37
Hexachlorobutadiene (CAS 87-68-3)	Prohibited	10, 15
Hexachloroethane (Annex F)	Prohibited in manufacturing or processing of nonferrous metals. Prohibited in Substances and Preparations	1, 2, 15 37
n-Hexane (CAS 110-54-3)	Prohibited in Manufacturing	
Hexavalent Chromium/Hexavalent Chromium Compounds (Annex M)	Intentionally Added in homogenous material RoHS Substance: allowance made for RoHS exemptions Intentional Addition is prohibited by Lenovo in paints and plastic resins. EPEAT Products: 500 ppm in any Homogenous Material Prohibited in leather articles or articles containing leather parts coming into contact with skin in concentrations equal to or greater than 3 mg/kg (0.0003% by weight) of the total dry weight of the leather. Taiwan Green Mark Products：10 ppm in homogenous material for >25g plastic component	1 JIG 101 Ed. 4.1 California Health and Safety Code sections 25214.9-25214.10.2 EPEAT 4.1.5.1 ((IEEE STD 1680.1-2018) 45
Hydrofluorocarbons (Annex EE)	Prohibited in non-refillable containers, foams, and non-confined, direct evaporation systems containing refrigerants.	30
Lead chromate (CAS 7758-97-6) (Please note hexavalent chromium and lead are prohibited for use in Deliverables.	Prohibited at or above 0.1% weight by weight of the Article.	1
Lead chromate molybdate sulphate red (Color Index Pigment Red 104) (CAS 12656-85-8)) (Please note hexavalent chromium and lead are prohibited	Prohibited at or above 0.1% weight by weight of the Article.	1

for use in Deliverables.		
Lead/Lead Compounds (Annex N)	1000 ppm or Intentionally Added in homogenous Material RoHS Substance: allowance made for RoHS exemptions Paint: Intentionally Added External PVC cables, wire coatings: 300 ppm Visual Display Units for EPEAT products: 0.005% (50 ppm) by weight (not homogenous) For restrictions in battery applications see **Table 7** GENERAL LEAD: 100ppm LEAD PAINT 90ppm Taiwan Green Mark Products: For >25g plastic component: 2ppm in homogenous material; 20ppm in post-consumer plastic material or add glass fiber plastic material for those safety component which have high temperature requirements	Annex N 1, 12 JIG 101 Ed. 4.1 California Health and Safety Code sections 25214.9-25214.10.2 EPEAT 4.1.4.1((IEEE STD 1680.1-2018) Public Law 110–314 (Consumer Product Safety Improvement Act of 2008) 45
Lead sulfochromate yellow (Color Index Pigment Yellow 34) (CAS 1344-37-2, see Annex II for deleted CAS numbers.) (Please note hexavalent chromium and lead are prohibited for use in Deliverables.	Prohibited at or above 0.1% weight by weight of the Article.	1
Mercury/Mercury Compounds (Annex O)	Must not be present; except in lamps. RoHS Substance: allowance made for RoHS exemptions In exempt applications, labeling requirements and maximum content limits apply (see **Section 2.6**); when present in an approved application, Lenovo must be supplied with a data sheet on mercury content. For mercury restrictions in batteries, see **Table 7** Taiwan Green Mark Products：10 ppm in homogenous material for >25g plastic component	Annex O 1, 2, 8, 9, 12, 13, 17, 18, 39 JIG 101 Ed. 4.1 45
Methylene Chloride (Dichloromethane) (CAS 75-09-2)	Prohibited in Manufacturing and in Substances, Mixtures, Preparations, Field Use Materials, and Chemical Product Supplies, including but not limited to adhesives, paints, and cleaning agents	1, 2, 28
Middle Chain Chlorinated Paraffins	China Environmental Labeling Products: 1000ppm for >25g plastic component	46
2-(2-methoxyethoxy)ethanol (DEGME) (CAS 111-77-3)	Prohibited in paints, paint strippers, cleaning agents, and self-shining emulsions in concentrations equal to or greater than 0.1% by weight.	1
Monomethyl- dibromodiphenyl	Prohibited in Substances, Mixtures, and Articles.	26

methane bromobenzylbromo-toluene, mixture of isomers (Trade name DBBT) (CAS 99688-47-8)		
Monomethyl-dichloro- diphenyl methane (Trade names Ugilec 121 and Ugilec 21) (CAS 81161-70-8)	Prohibited in Substances, Mixtures, and Articles.	26
Monomethyltetrachlorodiphenyl Methane (Trade name Ugilec 141) (CAS 76253-60-6)	Prohibited in Substances, Mixtures, and Articles.	26
Nanomaterials. Substance produced in nanoparticular state: a substance containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range of 1 nanometer (nm) to 100 nm, with the exception of natural, nonchemically modified substances and the substances of which the fraction between one nanometer and one hundred nanometers is a by-product of human activity. Fullerenes, graphene flakes and single and multi-walled carbon nanotubes with one or more external dimensions below 1 nm shall be deemed to be substances produced in nanoparticular state. Other common nanomaterials include silver nanoparticles, iron nanoparticles, titanium dioxide, aluminum oxide, cerium oxide, zinc oxide, silicon dioxide and dendrimers with external dimensions listed above.	Prohibited in Articles and complex objects (an object consisting of a set of Articles) where a fraction of at least one of the substances produced in nanoparticular state exceeding 0.1 % of the mass originally contained in the Article or complex object is released.	40
Nickel (Annex E)	Nickel finishes are prohibited on Product surfaces that are designed to be in prolonged contact with skin	1
Nitrogen trifluoride (CAS 7783-54-2)	Prohibited in Preparations and Articles.	2
Nonylphenol ethoxylates (Annex LL)	Prohibited in textile articles in concentrations equal to or greater than 0.01% by weight of the textile article or of each part of the textile article. Prohibited in Substances, Mixtures, and Preparations.	1 37
Ozone-Depleting Substances (CFCs, HCFCs, HBFCs, carbon tetrachloride, etc.) (Annex F)	Prohibited for Products to contain or be manufactured with these substances	2, 5, 6, 7, 12 JIG 101 Ed. 4.1
Pentachlorophenol (CAS No 87-86-5) and its salts and esters	Prohibited in the treatment of wood. Prohibited in wood based materials in excess of 3 milligrams per kilogram of dry matter. Prohibited in textiles and leather articles Prohibited in chemicals Prohibited	1, 2, 10 47, 49 48
Perfluorinated compounds (Annex JJ has a complete list of regulated substances)	Prohibited	30
Perfluorocarbons (PFC) (Annex G)	Must not be contained in Products; not prohibited from use in production of Products in which the gas is not present in the final	4, 27, 30

	Product	
Perfluorooctane sulfonates (PFOS) and salts, C8F17SO2X (X=OH, metal salt, halide, amide and other derivatives including polymers), or Compounds that contain C8F17SO2, C8F17SO3 or C8F17SO2N, (for a list of PFOS CAS numbers see OECD ENV/JM/MONO(2006) 15 at http://appli1.oecd.org/olis/2006doc.nsf/linkto/env-jm-mono(2006)15	Prohibited as a Substance or as a constituent of Preparations. Prohibited in products or parts. The above shall not apply to the following applications: photoresists or anti reflective coatings for photolithography processes, and photographic coatings applied to films, papers or printing plates. Refer to the EU Directive and the Canada Regulations referenced for more details on these requirements and exemptions.	1, 2, 10, 15, 33, 36
Perfluorooctanoic Acid (PFOA) (CAS 335-67-1) and its salts (Annex II)	Prohibited in Substances, Constituents of Substances, or Mixtures in a concentration equal to or above 25 ppb of PFOA including its salts or 1000 ppb of one or a combination of PFOA-related substances. Shall not be used in the production of or placed on the market in an Article in the concentrations listed above. (The restriction for Article is effective July 4, 2020). See EU Regulation 1907/2006 Annex XVII # 68 for more details of the restrictions, effective dates, limited exemptions and descriptions of PFOA substances.	1
Phenol, 2- (2H - benzotriazol -2-yl) - 4,6-bis (1,1-dimethylethyl)- (CAS No 3846-71-7)	Prohibited in decorative laminate, adhesives, paints, printing inks, inked ribbon, and molded plastic products.	10
Phthalates: Benzyl butyl phthalate (BBP) (CAS 85-68-7), Bis (2-ethylhexyl) phthalate (DEHP) (CAS 117-81-7), Dibutyl phthalate (DBP) (CAS 84-74-2), Diisobutyl phthalate (DIBP) (CAS 84-69-5)	Prohibited, when summed together, at or above 1000ppm in a homogeneous material. (Please note these substances are prohibited elsewhere in this specification. The more restrictive level applies, which will generally be this entry.)	1
Polybrominated Biphenyls (PBBs) (Annex P)	Prohibited	1, 2, 12, 10, 15 33, 37 JIG 101 Ed. 4.1
Polychlorinated naphthalenes, $C_{10}H_{8-n}Cl_n$ where “n” is greater than or equal to1 (Annex I)	Prohibited Any PCNs (1 or more chlorine atoms) must not be used.	10 JIG 101 Ed. 4.1 Lenovo Requirement
Polychlorinated biphenyls (PCBs) (Annex H)	Prohibited. (Please note PCBs are prohibited by other regulations; see halogenated aromatic substances in Table 1 and Annex O.)	1, 10, 12, 33, 34
Polychlorinated terphenyls (PCTs)	Prohibited	1, 12, 15
Polycyclic Aromatic Hydrocarbons (PAH) Benzo[a]pyrene Benzo[e]pyrene Benzo[a]anthracene	 Category 1 (<0.2mg/kg) Materials intended to be put in the mouth,or materials of toys with intended longterm skin contact (longer than 30 s)	Annex CC. German AfPS GS 2014:01 PAK for GS

Benzo[b]fluoranthene Benzo[j]fluoranthene Benzo[k]fluoranthene Chrysene Dibenzo[a,h]anthracene Benzo[g,h,i]perylene Indeno[1,2,3-c,d]pyrene	Category 2 (<0.5mg/kg) Materials not covered by category 1, with foreseeable skin contact for longer than 30 seconds (long-term skin contact) or repeated short-term skin contact1) Category 3 (<1mg/kg) Materials not covered by category 1 or 2 with foreseeable skin contact up to 30 seconds (short term skin contact)	certification
Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Pyrene, Anthracene, Fluorathene Naphthalene	Category 1 (<1mg/kg sum) Materials intended to be put in the mouth,or materials of toys with intended longterm skin contact (longer than 30 s) Category 2 (<10mg/kg sum) Materials not covered by category 1, with foreseeable skin contact for longer than 30 seconds (long-term skin contact) or repeated short-term skin contact1) Category 3 (<50mg/kg sum) Materials not covered by category 1 or 2 with foreseeable skin contact up to 30 seconds (short term skin contact)	
Sum of 18 PAHs***	Category 1 (<1mg/kg) Materials intended to be put in the mouth,or materials of toys with intended longterm skin contact (longer than 30 s) Category 2 (<10mg/kg) Materials not covered by category 1, with foreseeable skin contact for longer than 30 seconds (long-term skin contact) or repeated short-term skin contact1) Category 3 (<50mg/kg) Materials not covered by category 1 or 2 with foreseeable skin contact up to 30 seconds (short term skin contact)	
Potassium chromate (CAS 7789-00-6)	Prohibited at or above 0.1% weight by weight of the Article.	1
Potassium dichromate (CAS 7778-50-9)	Prohibited at or above 0.1% weight by weight of the Article.	1
Polyvinyl chloride (PVC) (Annex Y)	External covers for Lenovo products must not contain Polyvinyl Chloride (PVC). Sheathing for wires and cables, connectors, and electronic components are exempt from this requirement.	Lenovo Commitment
Radioactive Substances (Annex Z)	Intentionally addition is prohibited	JIG 101 Ed. 4.1
Red Phosphorous (Red-P) flame retardants in: Printed circuit boards, printed circuit assemblies, electrical and electronic components, packaging materials such as encapsulates, die attach materials, underfill epoxies and substrates Exemption: Does not apply to	Intentionally addition is prohibited	Lenovo Requirement

mechanical case parts; i.e., covers		
Sodium chromate (CAS 7775-11-3)	Prohibited at or above 0.1% weight by weight of the Article.	1
Sodium dichromate (CAS 7789-12-0 and 10588-01-9)	Prohibited at or above 0.1% weight by weight of the Article.	1
Shortchain Chlorinated Paraffins (Annex J)	Prohibited at or above 0.1% weight by weight of the Article. If present below 0.1% by weight of the product, it must be only incidentally present. Taiwan Green Mark Products：10 ppm in homogenous material for >25g plastic component	1, 2, 12, 36 JIG 101 Ed. 4.1 15 45
Substances subject to REACH Authorization found in Annex XIV of REACH regulation and amendments (Annex EE) in this specification lists current authorized substances as of date of this specification)	Prohibited at or above 0.1% weight by weight of the Article.	1
Sulphur hexafluoride (CAS 2551-62-4)	Prohibited in Preparations and Articles. Prohibited in foams and nonrefillable containers.	2, 27, 30
Tetrachlorobenzenes (CAS numbers included in Annex C)	Prohibited	15
Tetrachloroethylene (perchloroethylene) (CAS 127-18-4)	Prohibited in Manufacturing and in Substances, Mixtures, Preparations, Field Use Materials, and Chemical Product Supplies, including but not limited to adhesives, paints, and cleaning agents	10, 28
Trichloroethylene (CAS 79-01-6)	Prohibited in Manufacturing and in Substances, Mixtures, Preparations, Field Use Materials, and Chemical Product Supplies, including but not limited to adhesives, paints, and cleaning agents.	10, 28
Toluene (CAS 108-88-3)	Prohibited as a Substance or constituent of Preparations in concentrations equal to or greater than 0.1% by mass in adhesives and spray paints.	1
Tributal Tin (TBT) and Triphenyl Tin (TPT)	Prohibited in Articles, or part thereof, where the concentration in the article is greater than the equivalent of 0.1% by weight of tin.	1, 15 JIG 101 Ed. 4.1
Tributyl Tin Oxide (TBTO) (Annex K)	Intentional Addition is prohibited in chemical products	10 JIG 101 Ed. 4.1
Tris (1,3-dichloro-2-propyl) phosphate (CAS 13674-87-8)	Prohibited above 0.1% by mass in any product component. Exempt from this requirement are cables (except cables for mice), adaptors and other similar connecting devices and storage media, such as compact discs, for interactive software, such as computer games. This substance is prohibited in cables for mice. If a replacement flame retardant for this substance is used, it cannot be a substance classified as a “known to be a human carcinogen” or “reasonably anticipated to be a human carcinogen” as listed by the US National Toxicology Program in the US Department of Health and Human Services; classified as “carcinogenic to humans” or “likely to be carcinogenic to humans” by the US Environmental Protection Agency; or identified by the US Environmental Protection Agency or the US National Institutes of Health as causing birth defects, hormone disruption, neurotoxicity, or harm to reproduction or development.	14, 42
Tris (2,3 dibromopropyl) phosphate CAS No 126-72-7 and Tris-(aziridinyl) - phosphineoxide CAS No 545-55-1	Prohibited from use in textile articles intended to come into contact with skin, e.g. Wrist straps and headphones. Prohibited in Substances and Preparations	1, 12, 35 37

Tris(2-chloroethyl) phosphate (CAS 115-96-8)	Prohibited at or above 0.1% by mass in any product component. This restriction does not apply to desktop and laptop computers, audio and video equipment, calculators, wireless telephones, game consoles, handheld devices incorporating a screen that are used to access interactive software and their associated peripherals, and cables, adaptors and other similar connecting devices (except cables for mice). This substance is prohibited in cables for mice. (Note: If a replacement flame retardant for this substance is used, it cannot be a substance classified as a "known to be a human carcinogen" or "reasonably anticipated to be a human carcinogen" as listed by the US National Toxicology Program in the US Department of Health and Human Services; classified as "carcinogenic to humans" or "likely to be carcinogenic to humans" by the US Environmental Protection Agency; or identified by the US Environmental Protection Agency or the US National Institutes of Health as causing birth defects, hormone disruption, neurotoxicity, or harm to reproduction or development.)	14, 42

Regulatory references for Table 1

1. EU Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) will replace the above Directive.
2. Switzerland Ordinance on Risk Reduction related to the Use of certain particularly dangerous Substances, Preparations and Articles (Ordinance on Risk Reduction related to Chemical Products (ORRChem) of 18 May 2005.
3. United States Toxic Substances Control Act; Occupational Safety and Health Act (29 CFR 1910.1001-1051).
4. Statutory Order no. 552 of 2 July 2002 Regulating Certain Industrial Greenhouse Gasses (Denmark).
5. EU Regulation (EC) No. 2037/2000.
6. Section 611 of the 1990 amendments of the Clean Air Act (United States); 40 CFR Part 82.
7. Law Concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures (Law No. 53 of May 20, 1988) (Japan).
8. No. 553 Decree of 9 September 1998, comprising regulations regarding products containing mercury (Decree on Product Containing Mercury, 1998 Environmentally Hazardous Substances Act) Netherlands.
9. The Mercury-containing Products (Certain) Ordinance (SFS 1991:1290) Sweden.
10. Japan's Act on the Evaluation of chemical substances and Regulation of Their Manufacture, etc. (Act No. 117 of October 16, 1973).
11. The Netherlands 178 Besluit van 22 maart 2001, houdende vaststelling van het Warenwetbesluit formaldehyde in textiel.
12. Norway Product Control Regulation Chapter 2. Restricted Substances and Preparations.
13. Connecticut Public Law 02-90, The Mercury Education and Reduction Act.
14. California Safe Drinking Water and Toxic Enforcement Act of 1986.
15. Canada Environmental Protection Act, 1999. Prohibition of Certain Toxic Substances Regulations, 2005. Updated 2008-05-29.
16. State of Washington Title 70 RCW An act relating to phasing out the use of polybrominated diphenyl ethers.
17. Louisiana Mercury Risk Reduction Act of 2006.
18. Rhode Island Mercury Education and Reduction Act.
19. Maine Public Law Chapter 296 Section 1. 38 MRSA 1609.
20. Austria - BGB I 1990/194: Formaldehydeverordnung, 2, 12/2/1990.
21. Germany: LMBG B 82.02-1 Untersuchungen von Bedarfsgegenständen; Bestimmung der Formaldehydabgabe aus textilen Bedarfsgegenständen; Ausgabe: 1985-06.
22. Norway Regulation amending regulation of 1 June 2004 No 922 relating to restrictions on the use of chemicals dangerous to health and environment and other products.
23. Minnesota 325E.387 Ban on deca-BDE in computer enclosures.
24. California Regulation 93120 Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.
25. USA 29 CFR 1910.1048 Toxic and Hazardous Substances - Formaldehyde.
26. EU Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Annex XVII.
27. Austria Ordinance on bans and restrictions of partly fluorinated and fully fluorinated hydrocarbons and of sulfur hexafluroide

447/2002, with amendments 246/2005, 86/2006 and 139/2007.
28. Sweden. The Chemical Products Ordinance 1998:944 to 2009:14.
29. Public Law 110–314 (Consumer Product Safety Improvement Act of 2008): http://www.cpsc.gov/cpsia.Pdf
30. EU Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases.
31. EU Commission Decision 2009/251/EC Products containing the biocide dimethylfumarate.
32. Lithuanian Hygiene Norm HN 96:2000.
33. EU Commission Regulation 757/2010 of 24 August 2010 amending Regulation No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes I and III.
34. EU Regulation No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC.
35. Canada Hazardous Products Act.
36. Stockholm Convention on Persistent Organic Pollutants (UNEP/POPS/POPRC.2/INF/6).
37. EU Regulation No 649/2012 of 4 July 2012 concerning the export and import of hazardous chemicals.
38) USA 40 CFR Part 721.1660 Benzidine-based chemical substances.
39) Environment Canada Canadian Environmental Protection Act, 1999 “Products Containing Mercury Regulations”
40) Belgium Royal Decree concerning the placing on the market of substances produced in nanoparticular state.
41) EU Regulation No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.
42) Washington DC Carcinogenic Flame Retardant Prohibition Amendment Act of 2016.
43) Oregon SB 596 Relating to decabrominated diphenyl ether amending ORS 453.005, 453.025 and 453.085.
44) Maryland Act concerning Environment – Decabrominated Diphenyl Ether – Prohibitions.
45) Taiwan Green Mark Standard for Desktop No. 66, M-09
46) HJ2536-2014 Technical Requirement for Environmental Labeling Products Computers and Displays
47) EU Commission Regulation 757/2010 of 24 August 2010 amending Regulation No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes I and III.
48) EU Regulation 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (recast).
49) India Regulation of Persistent Organic Pollutants Rules, 2018.

2.1.2 EU RoHS

The DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 bans the use of the following in new electrical and electronic products put on the market after July 1, 2006:

- **Lead (Pb),**
- **Mercury (Hg),**
- **Cadmium (Cd),**
- **Hexavalent chromium (Cr_{+6}),**
- **Polybrominated biphenyl (PBB) flame retardants and**
- **Polybrominated diphenyl ether (PBDE) flame retardants.**
- **Bis (2-ethylhexyl) phthalate (DEHP)[1]**
- **Butyl benzyl phthalate (BBP) [1]**
- **Dibutyl phthalate (DBP) [1]**
- **Diisobutyl phthalate (DIBP)[1]**

[1] On 4 June 2015, the EU commission published a new Directive (EU) 2015/863 to amend Annex II to EU RoHS 2 (Directive 2011/65/EU) to add the following 4 phthalates onto the list of restricted substances. Restriction become effective July 22, 2019.

Lenovo **Engineering Specification 41A7733** provides the detailed requirements.

Certain substances affected by the European Commission's Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) are already restricted by other regulations at concentration levels that are more stringent than those associated with RoHS compliance. **Table 1** presents the requirements for these substances as defined by certain existing legislation and/or Lenovo internal standards.

2.1.2.1 Other Jurisdictions

There are other jurisdictions, other than the EU Member States, with RoHS types of requirements. The list below is not complete and is provided for information only. In some jurisdictions the product scope and requirements are different from the scope and requirements of the EU Directive. Deliverables to Lenovo which cite this specification must meet the requirements of this specification irrespective of the jurisdiction where the Deliverable is transferred to Lenovo.

- Multiple US States
- New York City
- People's Republic of China
- European Economic Area (EEA) States
- European Free Trade Association (EFTA) States
- EU Candidate Countries - Albania, Montenegro, Macedonia, Serbia, and Turkey
- EU potential Candidate Countries – Bosnia and Herzegovina, KosovoBrazil
- Korea
- Ukraine
- Vietnam
- India
- Japan
- Thailand

2.1.2.1 China RoHS Conformity Assessment System

According to Arrangements for the Implementation of the RoHS Conformity Assessment System for Electrical and Electronic Products (hereinafter referred to as "Arrangements"), which are hereby announced. All products that are included in the Management Catalogue of Electrical and Electronic Products(EEP) that Should Meet the RoHS Standards and are shipped out of factory or imported after November 1, 2019 shall meet the requirements of the Arrangements.

Modes of Conformity Assessment

- The unified voluntary RoHS certification scheme introduced by the State for EEPs (hereinafter referred to as "State-introduced voluntary certification")

- The supplier's declaration of RoHS conformity for EEPs (hereinafter referred to as "SDoC")

The supplier of an EEP included in the Management Catalogue shall choose the State-introduced voluntary certification mode or SDoC mode to complete the RoHS conformity assessment. Product conformity information should be submitted to China RoHS public service platform within 30 days after the product is put on the market. And Enterprise self-declaration and technical support documents are conformity information for SDoC mode.

Labels of Conformity Assessment
The below Design I will be used as the conformity assessment label for the products undergoing the State-introduced voluntary certification, and The identification of the certification authority in the box should be confirmed with the corresponding certification authority. While Design II will be used as the conformity assessment label for the products going through the SDoC procedure.

Vector drawings of basic patterns of green product identification can be downloaded on the information platform. Green product labels can be scaled up or down, and should be clearly identifiable after labeling.

Unless otherwise required by relevant systems or certification bodies, enterprises can independently choose any manufacturing process (such as printing, molding, etc.) to use or display the green product logo on the product body, nameplate, packaging, attached documents (such as instruction manual, qualification certificate, etc.), operating system, electronic sales platform, etc.

The color of green product logo should be white background plate, green pattern.

Design II

Design I

For China RoHS and China RoHS Conformity Assessment related requirement,please refer to http://www.cesi.cn/rohs/page/fgptbz.jsp?catalog=/001/001-008/001-008-006/001-008-006-001

2.1.3 Additional Requirements for “Low Halogen” Products

Lenovo's plans require the elimination of brominated and chlorinated flame retardants (BRFs, CFR) and polyvinyl chloride (PVC) in new products starting in 2010. These plans are dependent upon the identification and availability of safe, environmentally proven alternative materials that do not compromise product safety, reliability or performance. The alternative materials identified must also be:

- Equal to or better than existing materials in quality, reliability, performance
- Cost competitive
- Available in high volume
- Continue to meet applicable regulatory requirements, international fire safety standards and agency certification requirements.

Lenovo "Low Halogen" materials, parts and products must meet all of the following requirements:

Table 2. "Low Halogen" Substance Requirements

Substance	Threshold Level	Reference
All Printed Circuit Board (PCB) and substrate laminates materials must meet Bromine (Br) and Chlorine (Cl) requirements for low halogen as defined in IEC 61249-2-21. Printed Circuit Board (PCB) and substrate laminates do not include the solder mask. Solder mask is considered a separate homogenous plastic material. Bromine (Br) Chlorine (Cl)	. Maximum concentration of 900 ppm (0.09%) by weight Maximum concentration of 900 ppm (0.09%) by weight Note: Combined total concentration of bromine and chlorine must not exceed 0.15 % (1500ppm) by weight	• IEC 61249-2-21 • JEDEC - JEP709 • EPEAT 4.1.5.2 - (IEEE STD 1680.1-2018)
All other materials and components, with the exception of Printed Circuit Board (PCB) and substrate laminates, must meet the following requirements: Bromine (Br) in Brominated Flame Retardants (BFRs) Chlorine (Cl) in Chlorinated Flame Retardants (CFRs) or Polyvinyl Chloride (PVC)	Less than 1000 ppm (0.1%) by weight in homogenous materials Less than1000 ppm (0.1%) by weight in homogenous materials	• IEC 61249-2-21 • JEDEC - JEP709 • JIG 101 Ed. 4.1 • EPEAT 4.1.5.2 - (IEEE STD 1680.1-2018)

Note:

1. Halogens fluorine (F), iodine (I), and astatine (At) are not restricted
2. Any materials and components other than PCB laminates and prepreg materials fall under item 2 "All other." in Table 2 above.
3. A listing of BFR compounds may be found in the Joint Industry Guide (JIG) 101-A Annex (www.eia.org)
4. Low Halogen materials, parts and products require a unique part number to differentiate them from "non-low-halogen" versions
5. Suppliers must submit a Part Change Notice (PCN) identifying alternate materials
6. Supplier must complete and provide a Lenovo Supplier Material Declaration showing Br and Cl < 900 ppm by weight in any Printed Circuit Board laminates; Br in BFRs < 1000 ppm, Cl in

CFRs < 1000 ppm, Cl in PVC < 1000 ppm in homogenous material for other components and materials.

7. Supplier shall provide Lenovo a **Test Report** from a qualified, independent laboratory upon request
8. Reactive TBBPA for printed circuit boards is exempt, until acceptable alternative materials are identified
9. Substitute flame retardant and PVC materials shall meet "low halogen" requirements and shall not contain red phosphorous or antimony compounds as a rule. Red phosphorous in plastic parts such as case parts is exempted.

Exemptions:
Reactive TBBPA for printed circuit boards until acceptable alternative materials are identified.
Server and Third-party option products.
Parts for standard, "non-low-halogen" products are exempt .

Low halogen power cord is available as an option upon customer's requirements. The term of "Low Halogen" must appear on the label of low halogen power cord as shown in the example below.

2.1.4 Additional Requirements for "Children's" Products

Any product that will be marketed to K-12 schools or other education customers, or which otherwise might be used by children, must meet children's product requirements for the geographies in which it will be sold. These include, but are not limited to, the following substance restrictions which are in addition to the other restrictions and limits outlined in this specification.

Children's Product Requirements:

- Ensure CPSIA testing conducted by approved third party lab and include test report in PCRB.
  - Testing/analysis must include leads and phthalates.
  - Power cords and AC adapters sourced from all suppliers must also be tested.
- Paint must be under CPSIA limits (see Table 1)
- Cables and other accessible parts must have less than 90 ppm lead
- Must not contain Bisphenol A (BPA) (see Table 3) nor p-nonylphenol

- No mercury lighting or other use of mercury

2.2 Supplier Full Material Disclosure Declarations

Suppliers must declare the presence of certain of substances in its Lenovo hardware Products to meet regulatory reporting requirements and customer requirements for Product content disclosures.. Lenovo's Supplier Material Declaration process and template is available on-line at www.lenovo.com – About Lenovo – Global Procurement – Product Content Restrictions.

Lenovo's Requirements for Suppliers:

All materials, parts and products incorporated into Lenovo products or bundled with Lenovo products as part of a delivered solution are required to meet the requirements of applicable laws and regulations, Lenovo's Specification 41A7731 Baseline Environmental Requirements for Materials, Parts and Products and Lenovo RoHS Specification 41A7733.

Suppliers are expected to complete and return an IPC 1752A XML Full Material Disclosure (FMD) via the Green Data Exchange (GDX), refer to Lenovo Guide to Full Material Disclosures (Version 2).

At Lenovo's request, the supplier must be able to provide technical documentation in the form of internal design controls, supplier declarations, or analytical test data.

Additional requirements for EPEAT products:

Desktop, notebook, workstation and computer monitor products designated to be registered under the Electronic Products Environmental Assessment Tool (EPEAT) require additional Supplier Verification information shown in the Lenovo Supplier Declaration. EPEAT is a procurement tool designed to help large volume purchasers evaluate, compare and select desktop computers, laptops and monitors based upon their environmental attributes as specified in the IEEE Standard for the Assessment of Personal Computer Products (1680). The registration criteria and list of registered products are provided at www.epeat.net.

Substances in **Table 3** are included in industry standardized product content declarations for electronic products, or other regulatory or Lenovo requirements. Lenovo requires that these substances be quantified and reported by suppliers if they are present in a supplier's product at concentrations greater than the specified thresholds per **Table 3** in any individual Part in the item supplied to Lenovo. For example, if the item supplied to Lenovo is a power supply, then the substances in **Table 3** should be reported to Lenovo if they occur above the specified thresholds in any of the individual Parts (e.g., fan, circuit board, fasteners, connectors) of the power supply.

If the supplier determines that substances in **Table 3** are present in any Parts of the Product above their respective specified thresholds, **then the absolute weight in grams of the substance present**

in the Part supplied to Lenovo shall be reported to Lenovo. Absolute weights, rather than weight percentages or ppm, shall be reported to allow aggregation of the data with that from other Parts that comprise the final Lenovo Product.

Table 3. Reportable Substances		
Reportable Substance	**Threshold for reporting in non-restricted applications***	**Examples of Industry Uses / Comments**
Antimony/Antimony Compounds (Annex R)	1000 ppm (0.1%)	• Solder alloy • CRT glass
Antimony trioxide (CAS 1309-64-4)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant, e.g., in plastic housings and chip encapsulant. Often used in combination with brominated flame retardants. • Opacifying agent for glass, ceramics and enamels • Pigments • Catalyst for polyethylene terephthalate and vulcanization of rubber
Arsenic/Arsenic Compounds (Annex S)	1000 ppm (0.1%)	• Dopant in semiconductor manufacture • Gallium arsenide is used as semiconductor substrate
Arsenic pentoxide (CAS 1303-28-2)	1000 ppm (0.1%) in a homogeneous material	• Solution in the manufacturing of metal adhesives, wood preservatives, and in printing and dyeing.
Beryllium metal (CAS 7440-41-7)	1000 ppm (0.1%) in a homogeneous Material EPEAT Products: 1000 ppm (0.1%) in a homogeneous Material	• Heat transport and heat sinking applications, gears, and cogs • EPEAT 4.1.1.1 - ((IEEE STD 1680.1-2018)
Beryllium/Beryllium Compounds (Annex T)	200 ppm (0.02%)	• Substrate for integrated circuits • Lightweight housings
Beryllium copper alloys	1000 ppm (0.1%) in a homogeneous material	• Connectors • Electrical contacts and springs
Beryllium oxide (CAS 1304-56-9)	1000 ppm (0.1%)	• Insulator • Structural ceramic
Bis(2-ethylhexyl)tetrabromophthalate (TBPH or BEHTBP) (CAS 26040-51-7)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant in polyurethane foam • Plasticizer for PVC • Adhesives
Bismuth/Bismuth Compounds (also alloys) (Annex U)	1000 ppm (0.1%)	• Solder alloy
Bisphenol A (CAS 80-05-7)	1000 ppm (0.1%) in a homogeneous Material	• Used in synthesis of epoxy and plastic resins, e.g., polycarbonate, polyesters

	Bisphenol A (BPA) must not be used in thermal paper.	• Antioxidant in some plasticizers • Polymerization inhibitor in PVC • Precursor for the flame retardant tetrabromobisphenol A • Carbonless paper
Brominated Flame Retardants: • Polybrominated biphenyl (PBBs) • Polybrominated diphenyl ether (PBDEs) including Decabromobiphenyl Ether (DecaBDE)	Prohibited RoHS Substances: no exemptions Any content must be reported	• Flame retardant
Brominated / Chlorinated Flame Retardants (other than PBBs or PBDEs). Note: suppliers must report use of brominated flame retardants and provide CAS number or ISO 1043-4 code (Annex V)	1000 ppm (0.1%) by weight in homogenous material See Table 2 in 2.1.3 Additional Requirements for "Low Halogen" Products. Plastic materials in aproduct exceeding 0.5 g shall not contain greater than 1000 ppm chlorine or greater than 1000 ppm bromine at the homogeneous level,	• Flame retardant • Exception: Servers and reactive TBBPA for printed circuit boards are exempt from the Low Halogen requirements. • EPEAT 4.1.5.2 - (IEEE STD 1680.1-2018)
2-Butanone oxime (CAS 96-29-7)	1000 ppm (0.1%) in a homogeneous material	• Paints, varnishes, stains and coatings • Wood preservatives • Adhesives, silicone sealants and printing inks • Corrosion inhibitors • Urethane polymers
n-Butyl glycidyl ether (CAS 2426-08-6)	1000 ppm (0.1%) in a homogeneous material	• Epoxy resin formulations for coatings, adhesives, binders, sealants, fillers and resins
Cadmium	EPEAT Products: 50 ppm in homogenous material For restrictions in battery applications see **Table 7**	• All applications; e.g. plating and surface coating applications. • EPEAT 4.1.2.1 - (IEEE STD 1680.1-2018)
Cobalt dichloride (CAS 7646-79-9)	1000 ppm (0.1%) in a homogeneous material	• Cobalt plating and cobalt based pigments and drier compounds (desiccants). Pneumatic panels for indicating water contamination.
Cobalt metal (CAS 7440-48-4)	1000 ppm (0.1%) in a homogeneous material	• Electroplating
Cobalt sulfate (CAS 10124-43-3; 13455-64-0 monohydrate; 10026-24-1 heptahydrate)	1000 ppm (0.1%) in a homogeneous material	• Preparation of pigments for glass and porcelain • Used in storage batteries • Electroplating baths

		• Use in sympathetic ink
4, 4'-Diaminodiphenylmethane (MDA) (CAS 101-77-9)	1000 ppm (0.1%) in a homogeneous material	• Epoxy hardening agent • Production of high performance polymers • Curative for neoprene • Hardener in adhesives • Preparation of isocyanates and polyisocyanates
Decabromodiphenyl ethane (DBDPE) (CAS 84852-53-9); synonyms e.g., Benzene, 1,1'-(1,2-ethanediyl)bis [2,3,4,5,6pentabromo-; Please note this substance is not to be included in the Brominated Flame-Retardant entry in this table, but rather as its own separate entry here.	Any level of DBDPE must be reported	• Adhesives and sealants • Plastic and rubber materials • Polymers used for electronic and electrical applications
2,3-Dibromo-1-propanol (CAS 96-13-9)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant
Dibromoneopentyl-glycol (CAS 3296-90-0)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant in unsaturated polyester resins, in molded products, and in rigid polyurethane foam.
P-Dichlorobenzene (CAS 106-46-7)	1000 ppm (0.1%) in a homogeneous material	• Precursor to the high performance polymer poly (p-phenylene sulfide) • Disinfectant
Dicyclohexyl phthalate (CAS 84-61-7)	At or above 0.1% weight by weight of the Article.	• Plasticizer in plastisol, PVC, rubber and plastics.
Diethyl phthalate (CAS 84-66-2)	1000 ppm (0.1%) in a homogeneous material	• Plasticizer
Diisodecyl phthalate (DIDP) (CAS 26761-40-0 and 68515-49-1)	1000 ppm (0.1%) in a homogeneous material	• Plasticizer (e.g., for PVC) • Paints, sealing compounds, and textile inks
Diisononyl phthalate (DINP)	1000 ppm (0.1%) in a homogeneous material	• Plasticizer (e.g., for PVC)
Di-n-hexyl phthalate (DNHP) (CAS 84-75-3)	1000 ppm (0.1%) in a homogeneous material	• Plasticizer
2,4-Dinitrotoluene (CAS 121-14-2)	1000 ppm (0.1%) in a homogeneous material	• Production of flexible polyurethane foam • Plasticizer
Di-*n*-octyl phthalate (DNOP) (CAS 117-84-0)	1000 ppm (0.1%) in a homogeneous material	• Constituent of phthalate mixtures
Di-*n*-pentyl phthalate (DNPP) (CAS131-18-0)	1000 ppm (0.1%) in a homogeneous material	• Plasticizer
Dioctyltin (DOT) compounds (e.g., dioctyl tin oxide CAS 870-08-6 and dioctyltin dilaurate CAS 3648-18-8)	1000 ppm (0.1%) in a homogeneous material	• Textiles • Vulcanization molding kits
Dysprosium (CAS 7429-91-6) and compounds	1000 ppm (0.1%) in a homogeneous material	• Magnets, lasers, and hard disk drives
2-Ethylhexyl-2,3,4,5-tetrabromobenzoate (TBB) (CAS 183658-27-7	1000 ppm (0.1%) in a homogeneous material	• Flame retardant in polyurethane foam
Formaldehyde (CAS 50-00-0)	1000 ppm (0.1%) in a homogeneous material	• Wood • Textiles
Hexabromocyclododecane (HBCDD), (e.g., CAS 25637-99-4, 3194-55-6, 134237-50-6, 134237-51-7, 134237-52-8.)	100 ppm (0.01%) in a homogeneous material	• Flame retardant in extruded and expanded polystyrene

		and flexible polyurethane foam
n-Hexane (CAS 110-54-3)	1000 ppm (0.1%) in a homogeneous material	• Used as solvents in cleaning agents in the printing and textile industry. • Used in glues for the leather industry. • Used in quick-drying glues and rubber cement.
Hexavalent chromium (Cr+6)	EPEAT Products: 500 ppm in any Homogenous Material	• EPEAT 4.1.5.1 - (IEEE STD 1680.1-2018)
Hydrazine (CAS 302-01-2)	1000 ppm (0.1%) in a homogeneous material	• Nickel plating • Polymerization of urethane • Corrosion inhibitor
Hydrofluorocarbons (HFCs) having up to 6 carbons	Any Intentional Addition and any presence as a gas.	• Refrigerant
Indium phosphide (CAS 22398-80-7)	1000 ppm (0.1%) in a homogeneous material	• Semiconductor
Lead	300 ppm or Intentionally Added in homogenous Material Paint: Intentionally Added Visual Display Units for EPEAT products: 0.005% (50 ppm) by weight (not homogenous) For restrictions in battery applications see **Table 7**	External PVC cables, wire coatings EPEAT 4.1.4.1((IEEE STD 1680.1-2018)
Long chain chlorinated paraffins (LCCP; generally C 18-28) (also referred to as Long-chain chlorinated alkanes) (e.g., CAS 85535-86-0)	1000 ppm (0.1%) in a homogeneous material	• Metal working applications • Plasticizer • Leather • Paints and coatings • Sealants • Rubber applications
Magnesium/Magnesium Alloys (Annex W)	1000 ppm (0.1%)	• Surface coating • Computer casings
Mercury **	Must not be present; except in lamps. RoHS Substance: allowance made for RoHS exemptions In exempt applications, labeling requirements and maximum content limits apply (see **Section 2.6**); when present in an approved application, Lenovo must be supplied with a data sheet on mercury content. For mercury restrictions in batteries, see **Table 7**	Annex O 2, 8, 9, 13,14, 39 JIG 101 Ed. 4.1
Nanomaterials intended to be released under normal or reasonably foreseeable conditions of use. Nanomaterials are defined as natural, incidental or manufactured material	Any amount intended to be released under normal or reasonably foreseeable conditions of use.	• Carbon black in hoses, tubes, vibration mounts, pigments, inks, paints, and

containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50% or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm – 100 nm. In addition, fullerenes, graphene flakes and single wall carbon nanotubes with one or more external dimensions below 1 nm are considered nanomaterials.		rubber based adhesives and sealants. • Nanosilver for antimicrobial properties. • Synthetic amorphous silica as a filling agent. • Aluminum oxide in rubber, paints, varnishes, catalysts, and plastics. • Cerium dioxide in catalysts, paints, coated steel, and coating agents. • Carbon nanotubes in paints and coating agents. • Titanium dioxide in plastics, coated electronic components, catalysts, paints, and inks. • Zinc oxide in ceramics, adhesive tapes, paints, inks, and plastics.
Neodymium (CAS 7440-00-8) and compounds	1000 ppm (0.1%) in a homogeneous material	• Hard disk drives, lasers, violet color in glass and ceramics, ceramic capacitors, magnets and any application
Nickel sulfamate (CAS 13770-89-3)	1000 ppm (0.1%) in a homogeneous material	• Nickel plating
Nickel sulphate CAS 7786-81-4 (anhydrous), 10101-97-0 (hexahydrate), 10101-98-1 (heptahydrate)	1000 ppm (0.1%) in a homogeneous material	• Nickel plating
Nonylphenols (Annex GG)	1000 ppm (0.1%) in a homogeneous material	• Lubrication oil additive • Emulsifier • Wetting and dispersing agent • Antistatic agent • Demulsifier and solubiliser
Organohalogen flame retardants (additive, non-polymeric only) in plastic electronic casings only (Annex OO). Please note: several of these substances listed in Annex OO are restricted by other regulations and are listed in Table 1of this specification. Reporting here is only for those substances not restricted.	Any Intentional Addition in plastic electronic casings for Consumer Products (see definition section for Consumer Product definition)	• Flame retardant in plastic
Perchlorates (Annex HH)	6ppb in a material	• Coin cell batteries • Acoustic foam
Perfluoro carboxylic acid and related compounds (PFCAs) for a list of PFCA CAS numbers see OECD Annex 4 at http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=env/jm/mono%282006%2915&doclanguage=en	1000 ppm (0.1% by mass) in Deliverables	• Water, oil and grease repellant • Surfactant • Spreading/ wetting agent.
Perfluoroalkyl sulfonates (PFASs) (for a list of PFAS CAS numbers see OECD at http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=env/jm/mono%28200	1000 ppm (0.1% by mass) in Deliverables	• Semiconductor applications • Flame retardant in resins

6%2915&doclanguage=en		
Perfluorooctanoic acid (PFOA) and its salts (Annex II and for a more extensive list of PFOA CAS numbers see OECD at http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=env/jm/mono%282006%2915&doclanguage=en)	1000 ppm (0.1% by mass) in Deliverables	• Semiconductor applications
Praseodymium (CAS 7440-10-0) and compounds	1000 ppm (0.1%) in a homogeneous material	• Hard disk drives, lasers, violet color in glass and ceramics, ceramic capacitors, magnets and any application
Phthalates (Annex X)	1000 ppm (0.1%)	• Plasticizer in plastics (e.g., PVC) • PVC electrical cables • Solder paste • Sealants, varnishes, paper coating, inks, resins and adhesives.
Plant based materials	Includes wood and paper based materials excluding paper used in publications and packaging and corn/soy based plastics and rubbers. Import of plant based materials into US requires special declaration. Notify Lenovo if and wood or paper materials are used (except in publications and packaging).	US Lacey Act
Polycyclic aromatic hydrocarbons (PAHs) (e.g., phenanthrene CAS 85-01-8) (Annex LL) Please note this substance grouping has prohibited applications listed in Table 1. This entry is for reporting of all other non-restricted applications or levels below the restricted amount	1000 ppm (0.1%) in a homogeneous material	Dyes, plastics, coal tars, and creosote.
Polyvinyl chloride (PVC) (Annex Y)	1000 ppm by weight in homogenous material See Table 2 in 2.1.3 Additional Requirements for “Low Halogen” Products.	• Plastic • Insulator • Windows on cell phones • Housings for IT equipment • Electrical cables • Flexible CD jackets
Radioactive Substances (Annex Z)	Any Intentional Addition	• Promethium 147 as an over-voltage device • Measuring devices • Gauges • Detectors • Optical properties (e.g., thorium)
Refractory Ceramic Fibres; Special Purpose Fibres, [Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+MgO+ BaO)	Content less or equal to 18 % by weight	• Insulation material in high temperature applications
Selenium/Selenium Compounds (Annex AA)	1000 ppm (0.1%)	• diodes and light detectors (lead selenide)

		• Historically used as photoelectric coating
Terbium (CAS 7440-27-9) and compounds	1000 ppm (0.1%) in a homogeneous material	• Hard disk drives, lasers, green phosphors, and magnets
Tetrabromobisphenol A (CAS 79-94-7)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant • Epoxy resins in printed circuit boards
Tetrabutyltin (TTBT) (CAS 1461-25-2)	1000 ppm (0.1%) in a homogeneous material	• Stabilizer for PVC
Toluene (CAS 108-88-3)	1000 ppm (Please note that in Table 1 toluene is prohibited as a Substance or constituent of Preparations in concentrations equal to or greater than 0.1% by mass in adhesives and spray paints.)	• Adhesive • Paints/varnishes • Coatings • Silicon sealants
Toluene Diisocyanates (see Annex KK for all inclusive list of CAS numbers)	1000 ppm (0.1%) in a homogeneous material	Chemical intermediate in the production of polyurethane
Tributyltin (TBT) and tributyltin compounds (Annex BB)	Any Intentional Addition in chemical products	• Antibacterial and antifungal agents, antifoulant • Paint, pigment, and stabilizer
1, 2, 3-Trichlorobenzene (CAS 87-61-6)	1000 ppm (0.1%) in a homogeneous material	• Solvent • Dye carrier • Heat transfer medium
1, 2, 4-Trichlorobenzene (CAS 120-82-1)	1000 ppm (0.1%) in a homogeneous material	• Solvent • Dielectric fluid • Dye carrier • Synthetic transformer oil Lubricant • Heat transfer medium • Wood preservatives
Triphenyltin (TPT) and triphenyltin compounds (Annex BB)	Any Intentional Addition in chemical products	• Antiseptic and antifungal agent • Paint, pigment, and stabilizer
Tris (2-chloroethyl) phosphate (TCEP) (CAS 115-96-8)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant, plasticizer, and viscosity regulator in polyurethane, polyester resins, polyacrylates, polyvinyl chloride, cellulose derivatives, and thermoplastic resins. Also in adhesives, paints, varnishes, and epoxy.
Tris (2-chloro-1-methylethyl) phosphate (TCPP) (CAS 13674-84-5)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant, e.g., for polyurethane
Tris (2, 3-dibromopropyl) phosphate (CAS 126-72-7)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant, e.g., synthetic textiles and plastics • Phenolic resins • Paints, paper coatings, and rubber
Tris (1,3-dichloro-2-propyl) phosphate (TDCPP) (CAS 13674-87-8)	1000 ppm (0.1%) in a homogeneous material	• Flame retardant, e.g., in textiles and polyurethane foam.

Vinyl chloride (CAS 75-01-4)	1000 ppm (0.1%) in a homogeneous material	• Chemical intermediate used in production of polyvinyl chloride

* Restricted applications are defined in **Table 1**.

** Mercury is only permitted in lamps. The threshold for mercury reporting reflects regulations cited in **Table 1** which are currently more stringent than RoHS maximum concentration limits.

2.2.1. Substances of Very High Concern (SVHC) in Articles - Reporting Requirements

Lenovo requires suppliers to identify if any Substances of Very High Concern (SVHC) present in an Article (Deliverable) at or above the 0.1% weight by weight (w/w) concentration and report the name and CAS number of the SVHC candidate and the quantity on the Supplier Material Declaration (IPC-1752A form) for the Deliverable. See **Annex DD** for a list of SVHC which must be reported on the Supplier Material Declaration. The table in this annex has a list of SVHC Candidate substances which may potentially be present in Information Technology (IT) equipment.

The current candidate list of REACH SVHC as published by the European Chemicals Agency is located at:

Http://echa.europa.eu/chem_data/candidate_list_table_en.asp

Annex DD in this specification has the list of 201 SVHC Candidate Substances as of the date of this document. Please check the web site for updates since this list is subject to change. Annex EE is the list of 69 unique substances/entries subject to REACH Authorization (current as of the date of this specification) and which are prohibited at or above 0.1% weight by weight of a Deliverable.

If an SVHC is present in a Article at or above the reporting concentrations, the Supplier must provide a customer communication to Lenovo meeting the requirements of Article 33 of the EU REACH Regulation.

EU REACH Regulation Number 1907/2006 can be found at http://reach.jrc.it/legislation_en.htm
The EU provides guidance documents for REACH, specifically guidance documents for Substances in Articles as well as the candidate list for SVHC at https://echa.europa.eu/guidance-documents/guidance-on-reach
Additional information about REACH can be found at the European Chemicals Agency web site at http://echa.europa.eu/

2.3 Marking of Hardware Plastic Parts

Hardware plastic Parts molded and/or fabricated from thermoplastic materials and weighing 25 grams or more must be marked in accordance with the International Organization for Standardization's international standard ISO 11469, 2000-05 "Plastics- Generic identification and marking of plastics products." The marking convention of ISO 11469 is outlined in the following sections. Marking is optional for Parts weighing less than 25 grams, however, all Parts having adequate surface area for coding should be marked. **Marking requirements do not apply to cable**

and cable assemblies or experimental tooling. The marking of protective packaging materials is not in the scope of this specification.

2.3.1 Coding Method

The marking shall be made by injection molding, stamping, or other means of permanently affixing the information in a readily visible area on non-decorative or nonfunctional surfaces.
Marking in a readily visible area means that the marking can be seen on the disassembled plastic Parts. Use of labels with adhesives for coding Parts is not allowed.

Notes:

1. When two or more resins may be used for production of a Part, identification of the actual resin used for fabrication is required.

2. If the Parts must be plated or painted on the internal surface, it may not be possible to have a readily visible injection molded-in marking. In such cases, it may be necessary to code the Parts with a stamp or other means of permanently affixing the information. If the Parts must be painted with a decorative paint, it must be indicated on the internal surface with an appropriate means (for example, stamp) that the Part has been painted.

2.3.2 Symbol to Signify Recyclability

To indicate that the plastic Material used for the fabrication of the Part is recyclable, the two symbols “>” and “ <” (normally used to indicate *greater than* and *less than*) will be used. These symbols are shown in **Section 2.3.3**. Marking with these symbols indicates that the Part Material is recyclable. **Note:** The size of the symbol is optional as long as it is clearly legible.

2.3.3 Resin Generic Identification

Resin identification will be marked on Parts using the symbol for polymer type in between the symbols > and < as shown in the example of polycarbonate/ABS blend below.

> PC+ABS <

The symbols for the plastic Materials shall be selected from Part 1 of international standard ISO 1043, *Plastics-Symbols and abbreviated terms*. Symbols of plastics not appearing in ISO 1043-1 shall be selected from ASTM D 4000, *Classification System for Specifying Plastic Materials*; and ASTM D 1600, *Terminology Relating to Abbreviations, Acronyms and Codes for Terms Relating to Plastics*. See **Table 5** “Commonly Used Resins” for typical examples.

Table 5. Commonly Used Resins	
Generic Family Name	**Polymer Symbol**
Polyamide	PA

Polycarbonate	PC
Poly(phenylene ether)	PPE
Polymethylmethacrylate	PMMA
Polystyrene	PS
Polyvinyl chloride	PVC
Acrylonitrile/Butadiene/Styrene	ABS
Polycarbonate + Acrylonitrile/Butadiene/Styrene	PC +ABS
Polycarbonate with 10% glass fiber	PC - GF10

When two or more resins may be used for production of a Part, identification of the actual resin used for fabrication can be displayed by arrows. See **Table 6** for examples.

Table 6. Examples of Completed Plastic Part Markings	
Example	**Marking**
Single material used in production of Part	> ABS-FR(17) <
Two or more generically different materials allowed for production of Part	Arrow points to actual material used in production. > ABS-FR(17) < –> > PC + ABS – FR(40) <

2.3.4 Additives Generic Identification

Additives identification shall be marked on Parts using the generic symbols from the series of international standards ISO 1043-2, 1043-3 and 1043-4. For example, a blend of polycarbonate/ABS with halogen-free organic phosphate flame retardant compounds is marked with the following code:

> PC+ABS-FR(40) <

2.4 Additional Requirements for Batteries

2.4.1 Battery Content Restrictions

Table 6 "Restrictions on Content of Batteries" lists restrictions on content of batteries sold by Lenovo. Also, all batteries contained in Parts or Products covered by this specification shall meet the requirements of **Table 7.**

Table 7. Restrictions on Content of Batteries	
Battery Type	**Restrictions**
All Battery Types	• No intentionally-introduced mercury • ≤ 0.0005% mercury by weight. [1, 5, 11, 13, 15] • 0.001% cadmium by weight (Note the lower cadmium restrictions for some battery types below)[1] • Only battery types which are exempted from all hazardous materials transport regulations (surface and air), i.e., not classified as a hazardous material (for purposes of transport) or dangerous good, can be used.
Nonremovable batteries or accumulators, unless the battery is nonremovable due to user safety or other principal purpose.	• ≤ 0.0005% cadmium by weight [5] • ≤ 0.1% lead by weight [5] • ≤ 0.0005% mercury by weight [5]
Alkaline batteries	• 0.200% lead by weight [16]

	• 0.001% cadmium by weight [16] • 0.0001% mercury by weight [16]
Alkaline zinc manganese dioxide	• ≤ 0.001% cadmium by weight[4, 6] • 0.004% lead by weight [2, 6, 9] • 0.0001% mercury by weight [2, 6, 9]
Alkaline manganese button cell battery with mercury added	Prohibited [7]
Button Cell Batteries	• ≤ 0.0005% cadmium by weight • must not exceed 25 mg mercury per battery (until December 31, 2015) • ≤ 0.0005% mercury by weight in homogeneous materials (beginning January 1, 2016)
Lead Acid (Pb), Sealed	Must be classified as non-spillable and meet the requirements of US Code of Federal Regulation, 49 CFR 173.159a and IATA Special Provision A67.
Mercuric oxide button cell battery	Prohibited [7]
Nickel Cadmium (Ni-Cd)	Restricted to applications where no technically feasible alternative exists. Use requires written approval of a Lenovo procurement representative unless battery(ies) have been specified by an Lenovo print or specification.*
Nickel Metal Hydride (Ni-MH)	≤ 0.025% cadmium by weight
Silver oxide mercury added button cell batteries, including silver oxide button cell batteries designated SR357, SR364, R371, SR377 and SR395	Prohibited [7]
Zinc-air button cell battery with mercury added	Prohibited [7, 8]
Zinc Carbon Batteries sizes R6, R14, R20	• ≤ 0.200% lead by weight [2] • ≤ 0.001% cadmium by weight [4, 16] (R6, R14 and R20) • ≤ 0.0001% mercury by weight [3]
Zinc silver oxide, zinc air and zinc manganese dioxide button batteries	• Prohibited [12] • ≤ 0.005% mg/g mercury [10]
Non-alkaline zinc manganese dioxide	• ≤ 0.001% cadmium by weight [4, 6, 9] • ≤ 0.100% lead by weight [2, 6] • ≤ 0.0005% mercury by weight [2, 6]

Note - the regulations cited below are only a sample of the regulations pertaining to batteries. They are provided for example purposes only.

1) EU Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators.
2) Argentina National Legislature Act 26.184 on the manufacturing, assembly and importing of batteries.
3) New York Battery Reduction and Elimination. New York State Consolidated Laws. Environmental Conservation
4) Austrian Battery Ordinances 514/1990, as amended by BGB1 No. 3/1991(4 January, 1991) and BGB1.II Nol. 495/1999 (28 December 1999) of the Ordinance of Federal Ministry for Environment, Youth and Family.
5) Switzerland Ordinance on Risk Reduction related to the Use of certain particularly dangerous Substances, Preparations and Articles.
6) Brazil Resolution Number 401 of November 4, 2008 Batteries.
7) Maine Act Concerning Mercury-added Button Cell Batteries.
8) 2011 Wisconsin Act 201 relating to zinc air button cell batteries
9) GB 24427-2009 Limitation of mercury, cadmium and lead contents for alkaline and non-alkaline zinc manganese dioxide batteries. National Standards of the People's Republic of China

10) GB 24428-2009 Limitation of mercury contents for zinc silver oxide, zinc air and zinc manganese dioxide button batteries. National Standards of the People's Republic of China
11) Canada Products Containing Mercury Regulations SOR/2014-254
12) Japan Act on Preventing Environmental Pollution of Mercury
13) Ecuador Technical Regulations RTE INEN 105 (1R) Cells and Batteries, Primary and Secondary
14) Columbia Decree 2133-2016 Control measures for the importation and commercialization of mercury and the products that contain it
15) EU Regulation 2017/852 of 17 May 2017 on mercury
16) Columbia Resolution Number 0172 Technical Regulation No 0172 of January 23, 2012.

2.4.2 Product Design and Labeling Requirements for Batteries

All batteries contained in Parts and Products covered by this specification shall be designed for easy identification and removal. Batteries must be classified as nonhazardous (for purposes of transport) by all modes of transport as required and data (safety data sheets for all batteries, plus UN38.3 test reports for lithium batteries) used to classify batteries as nonhazardous in transport must be supplied to Lenovo upon request. For further information on this, please contact the Lenovo Hazardous Materials Transportation Coordinator.

Suppliers of Deliverables with lead acid batteries must provide Lenovo with a Material Safety Data Sheet (MSDS) which is current, e.g., less than 3 years old, and conforms to US Occupational Safety and Health Administration requirements in 29 Code of Federal Register 1910. A copy of this MSDS must accompany lead acid batteries which ship to a Lenovo customer, including end use customers, Business Partners, and OEM customers. The MSDS must also be available upon request in Spanish.

All Non-Spillable Wet Batteries purchased for use in Lenovo or non-Lenovo equipment must be non-regulated for shipment per IATA Special Provision A67; 49 CFR 173.159 (d); and all other application transportation regulations. The battery and external package must be marked "NONSPILLABLE" or "NONSPILLABLE BATTERY" according to 49 CFR 173.159 (d) (2). All Lithium Batteries purchased for use in Lenovo or non-Lenovo equipment must be non-regulated for shipment per IATA Special Provision A45; 49 CFR 173.185 (b) or (c); and all other applicable transportation regulations. Bulk shipments of Lithium cells or batteries must be in quantities of 12 or less and have a gross package weight of 5 kg or less for all field use shipments. This requirement does not apply to Lithium battery or cell shipments used to support manufacturing operations as long as all transportation regulations are met.

IMPORTANT: The U.S. Department of Transportation (USDOT) prohibits the shipment of primary (non-rechargeable) lithium batteries and cells on passenger aircraft for both foreign and domestic passenger-carrying aircraft entering, leaving, or operating in the United States according to 49 CFR 172.102 Special Provision A100. In addition, the package must also be marked "PRIMARY LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" when transported by highway, rail, vessel and cargo aircraft in the U.S. Per 49 CFR 173.185 (b)(5) or (c)(4). Secondary (rechargeable) lithium batteries and cells are only permitted on passenger aircraft for both foreign and domestic passenger-carrying aircraft entering, leaving, or operating in the United States with a gross package weight not exceeding 5 kg according to 49 CFR 172.102 Special Provision A100.

Documentation from the manufacturer/supplier of the battery must be provided to Lenovo clearly stating that the part number being purchased by Lenovo meets all the requirements which make the battery non-hazardous for shipment by IATA, 49 CFR, and any other applicable regulation such as ADR, IMDG, TDG, etc. Data (industry test reports) used to classify batteries as non-hazardous in transport must be supplied upon request.

All rechargeable primary batteries must be labeled with a reference to Lenovo's website for further information on recycling. For example, the label may read: "Please see www.lenovo.com/lenovo/environment for more information about recycling options in your area." Variations on this label require Lenovo GEA approval.

Batteries shall have appropriate labels affixed, including but not limited to

1. Battery type and chemistry (IEC standard name is acceptable for button cells, e.g., CR2032, BR1225, see IEC 60086-2),
2. Manufacturer name,
3. Capacity rating on all batteries with the exception of coin cell
    a. All batteries must, at a minimum, have the capacity displayed in Ah on a label with a minimum size of 1 mm x 5 mm,
    b. Lithium ion batteries also require the specific marking format of Wh, and

4. Other markings, hazard warnings, and information as required by applicable laws and regulations.

Battery labels or markings must be printed visibly, legibly and indelibly. The battery marking shall be located on or adjacent to each battery unless otherwise noted in this Section. Deliverables containing batteries that are not readily identifiable must be clearly labeled on the exterior to indicate the presence of a battery inside. In battery packs, individual cells may be labeled (in cases where multiple manufacturers or chemistries cannot clearly be identified using a single label for the pack) or one label may be used for the pack.

If a label design is specified by Lenovo in a Part print, drawing or assembly specification, the specified label on the print or assembly specification must be affixed. In the absence of a battery label specified by Lenovo in a Part print, the supplier shall refer to country requirements. For reference, the following **Sections 2.4.2.1 - 2.4.2.5** summarize battery marking requirements for selected geographies.

2.4.2.1 Marking Requirements for the EU, Brazil, Turkey, and other jurisdictions
Instructions must be provided in the Product or Part hardware publications, showing how batteries can be removed safely and informing the customer of the type of battery in the Deliverable.

In the European Union, a mark indicating separate collection must be printed on all batteries or accumulators. See **Figure 1**. The mark must (1) consist of a crossed-out wheeled bin container; (2) cover 3% of battery or accumulator's largest side area, and be of a maximum size of 5 cm x 5 cm; (3) for cylindrical cells, cover 3% of half the surface area of battery or accumulator, and

maximum size of 5 cm x 5 cm; and (4) where the mark would be smaller than 0.5 cm x 0.5 cm, a separate mark measuring at least 1 cm x 1 cm must be printed on the package.

In addition, batteries and accumulators containing heavy metals must be marked with specific symbols for heavy metal content: Hg for mercury content greater than 0.0005% mercury; Cd for cadmium content greater than 0.002% cadmium; Pb for lead content greater than 0.004% lead. These symbols must be printed beneath the separate collection mark and must be at least 1/4 of the size of the separate collection mark.

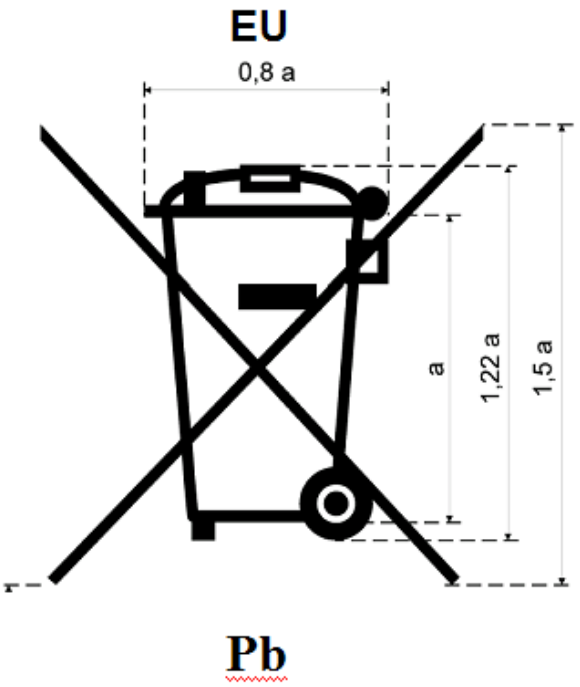


Figure 1. Collection mark and heavy metal content marking for a battery containing lead.

The capacity rating must be labeled on all portable batteries. Portable battery is defined by the EU Directive 2006/66/EC on batteries and accumulators to mean any battery, button cell, battery pack or accumulator that is sealed, can be hand carried, and is neither an industrial battery or accumulator nor an automotive battery or accumulator. Capacity rating (e.g., Watt-hour, Wh) for button or coin cell batteries may be located on the packaging if space is not available on the battery.

2.4.2.2 Labeling Requirements for the United States

2.4.2.2.1 Requirements for Rechargeable Ni-Cd and Small Sealed Lead Acid Batteries

In the United States, the Mercury-Containing and Rechargeable Battery Management Act (Public Law 104-142) establishes national, uniform labeling requirements for rechargeable Ni-Cd, small sealed lead acid batteries, and products containing these regulated batteries as a primary energy

supply. Products that include an internal uninterrupted power supply (UPS) device are exempt. Regulated batteries must display three chasing arrows or a comparable recycling symbol and the text indicated in **Table 8** for the respective regulated items. No size or color requirements for the recycling symbol are specified in the regulation. EPA publication EPA530-K-97-009, "Implementation of the Mercury-Containing and Rechargeable Battery Management Act" depicts the three chasing arrows symbol shown in **Figure 2**.

Figure 2. Three chasing arrows symbol as cited by the U.S. EPA for the U.S. Battery Act

The required labeling must appear on the packaging of the Products containing regulated batteries that are not easily removable, and on the packaging of regulated batteries that are sold separately from such Products, if the labeling on the Product or battery is not visible through the packaging.

Table 8. Texts for Battery Marking for the U.S. Battery Act	
Regulated Item	**Text**
Nickel-cadmium batteries*	Nickel-cadmium or Ni-Cd with the phrase BATTERY MUST BE RECYCLED OR DISPOSED OF PROPERLY
Lead acid batteries	Pb or the words "LEAD," "RETURN," and "RECYCLE", and if the batteries are sealed, the phrase "BATTERY MUST BE RECYCLED."
Products containing regulated lead-acid batteries that are not easily removable	"CONTAINS SEALED LEAD BATTERY. BATTERY MUST BE RECYCLED."
Product containing Ni-Cd batteries that are not easily removable	"CONTAINS NICKEL-CADMIUM BATTERY. BATTERY MUST BE RECYCLED OR DISPOSED OF PROPERLY."

* Unless specifically called out on an Lenovo print or specification, nickel cadmium batteries may not be used in Parts and Products covered by this specification.

2.4.2.2.2 Requirements for Rechargeable Lithium Ion Batteries Sold in US and Canada

Lenovo is a licensee of the Rechargeable Battery Recycling Corporation (RBRC) for rechargeable lithium ion batteries sold in the US and Canada. As part of this program, all Lenovo rechargeable lithium ion batteries offered for sale in the US and Canada must bear the Rechargeable Battery Recycling Corporation (RBRC) seal (**Figure 3**). This requirement applies to rechargeable lithium ion batteries that will be included in products as well as batteries that will be sold as stand alone parts or replacements.

The seal must be placed on the battery itself. It should also be placed on battery packaging, in user manuals, and in informational materials wherever possible. The seal must be at least 13mm in diameter and must have white space around the seal at least equal to the width of the outer ring of the seal. The seal must contain the RBRC toll free number (1-800-822-8837), the word "RECYCLE," and the battery chemistry as illustrated in **Figure 3** below.

US & Canada Only

US & Canada Only

Figure 3. RBRC seals for rechargeable lithium ion batteries (color or black and white).

Lenovo requires the additional text "**US & Canada Only**" to appear below the seal when Products are sold outside the US or Canada. The size of the lettering "**US & Canada Only**" shall have a minimum text height of 2mm. Helvetica font, 8 or 10 points is recommended. Text is to be centered under the seal but must not touch the seal.

2.4.2.2.3 Requirements for Batteries Containing Perchlorate

Many manganese dioxide lithium coin cell batteries used in Lenovo applications such as desktop and laptop computers contain perchlorate. The use of any material, part, or product containing perchlorate triggers specific labeling and notification requirements in the US. California's Perchlorate Contamination Prevention Act requires that all perchlorate containing materials and products containing perchlorate be labeled with or accompanied by the following statement:

Perchlorate Material - special handling may apply, See www.dtsc.ca.gov/hazardouswaste/perchlorate

The statement must appear on either (1) a label conspicuously applied to the exterior of all outer shipping packages and on consumer packages or (2) the statement may be included on a document included with the shipment such as an owners manual or package insert. The above statement must be used verbatim and must accompany every Lenovo part or product containing perchlorate that will be shipped in the US.

2.4.2.3 Requirements for Batteries Sold in China

The Regulation on Mercury Content Limitation for Batteries requires all domestically manufactured and imported alkaline batteries sold in China to be marked to indicate mercury content using Chinese characters equivalent to "low mercury" (if the mercury content is less than 0.025% of the weight of the battery) or "mercury free" (if the mercury content is less than 0.0001% of the weight of the battery).

2.4.2.4 Additional Requirements for Taiwan

All batteries sold in Taiwan are required to have the "Four-in-One" recycling symbol. See **Figure 4**.

The “Four-in-One” recycling symbol must be printed in any solid color (monotone), must be square in shape with each side not smaller than 0.5 cm in packaging and 1.5 cm in user manuals and product literature. The recycle symbol should be placed on the battery.

Figure 4. Four-in-One recycling symbol for Taiwan

Electronic products with embedded dry cells must be affixed with Four-in-One Recycling Symbol on the product packaging, product labels or instruction books. Nearby the Four-in-One Recycling Symbol, the Chinese characters for “Please Recycle Batteries” must be indicated. See Figure 4.1.

Figure 4.1 Four-in-One recycling symbol and words for Taiwan

2.4.2.5 Requirements for Rechargeable Batteries Sold in Japan

Rechargeable sealed lead acid, nickel cadmium, nickel metal hydride, and lithium ion batteries sold inside Japan shall be labeled according to the Ordinance No. 95 of Ministry of Economy, Trade, and Industry under the Law for the Promotion of the Effective Utilization of Resources (Law No. 48, 1993 as amended, 2001). These requirements are summarized in the Tables and Forms below. Sealed lead acid batteries with greater than 234,000 coulombs charge and small coin type rechargeable batteries that are contained inside Products are exempted from the special Japanese labeling requirements of this section. Recommended background color of label is silver (PANTONE877C) or gray (PANTONE421C) for sealed lead acid, yellowish green (PANTONE389C) for sealed nickel-cadmium, orange (PANTONE1375C) for sealed nickel-hydrogen, and blue (PANTONE312C) for sealed lithium storage battery.

In case of Li-ion battery, it is recommended the following two digits be added.
Indication of Li-ion battery : Li-ion XY Near the three arrow mark, indicating "X: the maximum amount of metal contained in the positive electrode" and "Y: the metals which disturb the recycling of main metals" with two numbers.

1st Number(X): Max. amount of metal contained in the positive electrode
- 0: Cobalt
- 1: Manganese
- 2: Nickel

2nd Number(Y): metals which disturb recycling main metals
- 0: None
- 1: In case the total "Tin(Sn)" content in the cell(s) is more than 1.0 wt% per battery pack weight
- 2: In case the total "Phosphorous(P)" content in the cell(s) is more than 0.5 wt% per battery pack weight

See **Figure 5** for detail specifications for symbol and battery type.

Table 9.	**Battery Label Requirements for Japan**
Class of the Specified Labeled Product	
Storage batteries not covered by using plastic or other materials and storage batteries covered by using plastic or other materials with height of less than 10mm	**Battery type**
Sealed lead storage batteries covered by using plastic or other materials with height of 10mm or more	**Symbol with Battery type**
Sealed nickel-cadmium storage batteries covered by using plastic or other materials with height of 10mm or more	
Sealed nickel-hydrogen storage batteries covered by using plastic or other materials with height of 10mm or more	
Sealed lithium storage batteries covered by using plastic or other materials with height of 10mm or more	

Figure 5. Chasing Arrows recycling symbol and Battery type for Japan

2.4.2.6 Requirements for Alkaline Batteries Sold in Argentina, Colombia, Paraguay

Alkaline batteries are banned in Argentina, Colombia and Paraguay and should not be distributed there directly (factory) or indirectly (distribution center). For use of Alkaline batteries in other Latin America countries please check with Lenovo LA Global Environmental Affairs.

2.4.2.7 Requirements for Brazil

Lead acid, nickel cadmium, mercury oxide, alkaline manganese, and zinc manganese batteries or

accumulators shall be labeled in accordance to the requirements for the European Union, see previous section for the EU. In addition, these batteries must be clearly and indelibly labeled in Brazilian Portuguese with the following information:

- Identification of the importer and manufacturer,
- Warning about risks to human health and the environment, and
- Requirement to return the battery, after use, to the reseller, manufacturer, or importer.

If there is insufficient space on the batteries to put the above information then this information must be on the packaging and in the product manual shipped with products.

The manufacturer of these batteries must:

- Register in the Brazil Federal Technical Register of Activities that are Potentially Contaminating or that Use Environmental Resources.
- Test the batteries in accordance to Chapter 1, Section 3 of Brazil Resolution Number 401 of November 4, 2008 (and Article 3 of Brazil Normative Instruction (NI) No. 8) at an in-country (Brazil) INMETRO accredited laboratory. The testing results must be submitted annually to Lenovo, the Brazil National Institute of Metrology and Standards (INMETRO), and the Brazil Institute of the Environment and Renewable Natural Resources (IBAMS). Please note this testing requirement applies only to lead acid, zinc manganese and alkaline manganese batteries and accumulators only. (This testing also applies to nickel cadmium and mercury oxide batteries which are not allowed in Lenovo products.)
- Submit a battery management plan to the required Brazil environmental agency (IBAMA).
- Include in the packaging, in Brazilian Portuguese, information about the symbols, warnings on the risks to human health and the environment, and the necessity to return the battery after use to the reseller, manufacturer or importer.

2.5 Requirement for Decorative Metal Finishing

Powder coating is the preferred material for decorative metal finishing of Lenovo hardware products. This includes the finishing of decorative metal parts and OEM products. Exceptions to this requirement are applications where production volumes don't justify using the powder coating process; a unique color, texture, or "feel" (e.g., soft-touch) is specified; or conductive (e.g., electrostatic discharge (ESD), electromagnetic compatibility (EMC)) functional coatings are required. Powder coatings are not applicable, at this time, for the finishing of plastic parts). Contact your Lenovo procurement representative to identify the Lenovo approved powder coating supplier and qualified color matched materials for decorative metal finishing of Lenovo hardware products.

2.6 Requirements for Parts and Products Containing Mercury

While most mercury-containing components are prohibited from Lenovo hardware Products (see Table 1), mercury is allowed in energy efficient lamps. The use of a mercury-containing component must be reported to your Lenovo procurement representative to ensure that the applicable legal requirements are met for Products containing mercury. All Parts or Products containing mercury

must be labeled in English and French per the requirements of Table 10 for certain U.S. State and Canadian laws. Appropriate text as defined in Table 10 must be added to user and service manuals (or instructions for projector replacement lamps) for mercury-added Products indicating which Product components contain mercury, directing the Product owner to dispose of the Product per local regulations, proving safe handling procedures and measures to be taken in case of accidental breakage of the lamp; and a link to options available for recycling. Information must be in English and French in at least 10 point font or 3 mm in height or greater, and must be enclosed by a border. Product packaging for products with mercury added lamps that are easily removable by the consumer (such as projectors and projector replacement lamps) and packaging for all mercury containing replacement parts must also be labeled per the requirements of Table 10.

Please contact Lenovo Global Environmental Affairs for approval prior to releasing any products with mercury containing lamps other than notebook computers, all-in-one desktops, and displays as prior permit applications and notifications may need to be filed.

Table 10 provides a list of those Lenovo Product categories that are known to contain mercury and provides exact requirements for label wording, label font size, and user manual text. Labels and manual text for Product categories not listed in **Table 10** must be reviewed and approved by your Lenovo procurement representative.

Table 10. Mercury Added Product Labeling Information for the United States and Canada

Product Type	Mercury Location	Mercury Amount	Product Label Requirements	Package Label Requirements	User / Service Manual Requirements
Laptop / Notebook Computer*	Fluorescent lamp in Display module	0-5 mg per lamp; 1-3 lamps per product Eco Labels such as “EU Flower” and Nordic Swan” requires that each bulb has <3.0 mg of Hg.	* Label Wording- “This product contains a lamp(s) which contains mercury; dispose according to local, state, or federal laws.” * The symbol Hg must be readily visible on the product in a font size of at least 10 points with characters that are at lease 3 mm in height or withing a pictogram of at least 7 mm in height.  * Label Location -	* Statement Wording - "The fluorescent lamp in the liquid crystal display contains mercury; dispose according to local, state or federal laws.” Contains mercury / Contient du mercure.” •Statements must be 10 point font and 3mm in height or greater. •Statements must be in English and French and enclosed by a border.	* Statement Wording - "The fluorescent lamp in the liquid crystal display contains mercury; dispose according to local, state or federal laws.” * Contains mercury / Contient du mercure. La lampe fluorescente de l'écran à cristaux liquides contient du mercure; disposer selon les lois locales, étatiques ou fédérales.” * Instructions on safe handling procedures and measures to be taken in case of

			Bottom of product; must be clearly visible. * Label Construction – Per requirements of UL 969 Standard, “Marking and Labeling Systems ” * Label font size must be 10 point and 3 mm in height or greater.		accidental breakage of mercury lamp, including the address of a website where that information is available. * Recycling instructions and reference to www.lenovo.com/recycling * Statement must be 10 point font and 3 mm in height or greater.
Flat Panel LCD Display	Fluorescent lamp in Display module	0-5 mg per lamp; 2-12 lamps per products	* Label Wording- “This product contains a lamp(s) which contains mercury; dispose according to local, state, or federal laws.” * The symbol Hg must be readily visible on the product in a font size of at least 10 points with characters that are at lease 3 mm in height or withing a pictogram of at least 7 mm in height.  * Label Location - Bottom of product; must be clearly visible. * Label Construction – Per requirements of UL 969 Standard, “Marking and Labeling	* Statement Wording - "The fluorescent lamp in the liquid crystal display contains mercury; dispose according to local, state or federal laws.” Contains mercury / Contient du mercure.” •Statements must be 10 point font and 3mm in height or greater. * •Statements must be in English and French and enclosed by a border.	* Statement Wording - "The fluorescent lamp in the liquid crystal display contains mercury; dispose according to local, state or federal laws.” * Contains mercury / Contient du mercure. La lampe fluorescente de l'écran à cristaux liquides contient du mercure; disposer selon les lois locales, étatiques ou fédérales.” * Instructions on safe handling procedures and measures to be taken in case of accidental breakage of mercury lamp, including the address of a website where that information is available. * Recycling

			Systems ” * Label font size must be 10 point and 3 mm in height or greater.		instructions and reference to www.lenovo.com/recycling Statement must be 10 point font and 3 mm in height or greater.
Mercury containing replacement parts for notebooks and flat panel LCD monitors	Fluorescent lamp	0-5 mg per lamp	* None for replacement parts	* Replacement part package must be labeled with “This part contains a lamp which contains mercury; dispose according to local, state, or federal laws."	* None for replacement parts
Digital Projectors (LCD Data and Video), Video Projector Replacement lamp assembly, and Video Projector Replacement Lamp, or any other type of mercury containing device **Please notify Lenovo Global Environmental Affairs prior to use of any digital projector metal arc lamps. Prior approval must be granted by Global Environmental Affairs to release products using these lamps.**				Lenovo currently does not manufacture and sell Digital Projectors or their replacement parts or other mercury containing devices. Prior to releasing and/or selling any Lenovo logoed mercury containing product or part, please contact Lenovo Global Environmental Affairs to confirm proper legal notifications, labels, and other requirements have been met.	

* **US Sales Webpage Requirements:** The US sales webpage information for this product must include the statement “The fluorescent lamp in the liquid crystal display contains intentionally added mercury; dispose according to local, state or federal laws. Contains mercury / Contient du mercure.”

For Canada, the following information is required in a readily visible location on the product and package:

a) The statement “Contains mercury / Contient du mercure”
b) Safe handling procedures and the measures to be taken in case of accidental breakage, the address of a website where that information is available, or contact information for a person who can provide that information;
c) The options available for the disposal and recycling of the product in accordance with the laws of the jurisdiction where the disposal or recycling is to take place, the address of a website where that information is available, or contact information for a person who can provide that information;
d) A statement that the product should be disposed of or recycled in accordance with the applicable laws; and
e) Symbol “Hg” in a font size of at least 10 points with characters that are at least 3 mm in height or within a pictogram of a least 7 mm in height.

The above information for Canada, must be in both English and French Canadian; in a font size of at least 10 points with characters that are at least 3mm in height, that are legible and indelible and that

are impressed, embossed or in a color that contrasts with the label's background or the color of the product; be enclosed by a border, and be easily distinguishable from other graphic material on the product or its package. See the Canada regulation for further details if the product or package is too small, or there is no package to accommodate the information. Annual reporting and a permit is required to import mercury containing products into Canada after November 7, 2015.

In some jurisdictions, at the point of sale of a Product containing mercury, notification must be given to the customer that the product contains mercury. Contact your Lenovo representative for more details or requirements.

2.7 Requirements for Chemicals

The following requirements apply to any

- Chemical used to maintain or service hardware Products. Examples include adhesives, cleaning solvents or solutions, lubricants, and paint
- Chemical contained in a Product or assembly which is not normally consumed but may require replacement of the chemical to maintain operation of Product or assembly. Examples include silicone grease for heat radiation sealing, refrigerants, lubricants, biocides, or corrosion inhibitors in a closed looped system.

The chemical's individual container or individual protective packaging must be labeled with:

- The chemical name as it appears on the associated Material Safety Data Sheet(s)
- The name and address of the appropriate chemical manufacturer, supplier or other responsible party, (in some cases, Lenovo may designate the responsible party) and
- Appropriate hazard warnings as applicable.

The label must be provided in English at a minimum. The label may also be required to have text in other languages and format as required by law or regulation in countries outside the U.S.
The Supplier shall work with the Lenovo chemical representative through the Lenovo procurement representative to ensure proper labeling. In some cases, Lenovo may specify the label and its contents.

A Material Safety Data Sheet (MSDS) for the chemical must be supplied to the Lenovo procurement representative or other Lenovo designated representative. The MSDS must be provided in English at a minimum and comply with legal requirements for information content and format. The MSDS may be required in other languages and formats as required by law or regulation in countries outside the U.S. The supplier shall work with the appropriate Lenovo chemical representative through the Lenovo procurement representative to ensure proper format, information content, and translation requirements. In some cases, Lenovo may specify the language and format of an MSDS.

Chemical FUMs are materials stocked by Lenovo to support customers. Some examples include cleaners, adhesives, glues, paint, oils, alcohol, and chemicals in kits. Chemical FUMs must be packaged according to this specification including the following:

a. They must be packaged in field use units (usually a unit of one) so that Lenovo can reship them in the same package.

b. Under special circumstances, Lenovo Purchasing may permit the use of a single combination package that consolidates **multiple** inner containers inside a **single** outer container. Such configurations may be acceptable due to the small physical package size, shipping quantity or other factors as defined by Lenovo. In this instance, only government approved third-party test laboratories are permitted to authorize and certify the UN specification package. Authorization to use a combination package, which consists of multiple inner packages in a single outer package, must be provided by Lenovo Purchasing in writing.

c. A FUM containing liquids must use combination packagings, as single packaging is restricted by some airlines.

d. Packaging, labeling and marking must be compliant with all transportation regulations where materials will be shipped (ie IATA / 49 CFR / ADR....). All FUM packaging, labeling and marking must be compliant with IATA regulations as purchased from the supplier no matter where it is intended to be shipped.

e. The net quantity per package shall not exceed the standard maximum net quantity per package as allowed on “Passenger and Cargo Aircraft”, as defined by IATA regulations. The net quantity per package is not required to meet IATA Limited Quantity requirements.

2.8 Product Chemical Emissions

Chemical emissions analyses shall be performed on Products and supplies (e.g. toner), but are not necessary for Parts or subassemblies of Lenovo hardware Products. Products covered by this specification shall not emit chemicals during normal use conditions which exceed the threshold values or requirements listed in U.S. 29 CFR 1910 (tables Z 1-3) (see http://www.gpoaccess.gov/cfr/index.html) or the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) (see http://www.calepa.ca.gov/). Product chemical emissions requirements are delineated in ECMA 328: Detection and Measurement of Chemical Emissions From Electronic Equipment (see http://www.ecma-international.org/).

2.9 WEEE Marking

2.9.1 Affected Products and Jurisdictions

Electrical and electronic equipment (EEE) that is put on the market in the European Union after August 13, 2005, and that is listed in the category of IT and telecommunications products in Annex 1B3 of the EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) is subject to the requirements for product markings in accordance with the Directive. In addition to the products specified in Annex 1B3 of the WEEE Directive, stand alone options that operate external to the products listed in Annex 1B3 (e.g., keyboards, monitors, mice, external drives) should also be marked. Components and internal parts of the stand alone equipment listed in Annex 1B3 do not need to be marked.

Lenovo requires the use of the WEEE markings on Products sold in non-EU countries to be

qualified by adding the text “EU Only” below the solid bar as shown in **Figure 6**. Contact your Lenovo procurement representative to confirm the latest requirements for WEEE marking implementation for affected Products.

2.9.2 WEEE Marking Elements

The marking of EEE to comply with the WEEE Directive requires all three of the following:

1) the crossed-out wheeled bin symbol in accordance with Annex IV of the WEEE Directive per Article 10(3). The symbol of the crossed-out wheeled bin is the same as required for the battery collection mark in the EU (see **Figure 1**).

2) a unique identification of the producer such as a brand name, trademark, company registration number or other suitable means recorded in EU member state’s register of producers per Article 12(1) of the Directive and

3) the date of manufacture/put on the market.

European Standard EN 50419:2005 identifies three options for the indication of the date of manufacture/put on the market:

A) Indicate the date of manufacture or date put on the market in un-coded text in accordance with EN 28601 (This European Standard is equivalent to ISO 8601) or other coded text, for which the code shall be made available for treatment facilities; or

B) Use the solid bar symbol as shown in **Figure 6** below in conjunction with the crossed out wheeled bin symbol. The height (h) of the solid bar shall be the greater of 0.3a or 1 mm. The bar must only be used in conjunction with the crossed out wheeled bin to indicate that the product is put on the market after August 13, 2005.

C) Use both options A) and B).

All three marking elements (the crossed-out wheeled bin, the producer identification, and the date of manufacture/put on the market or the solid bar under the crossed out wheeled bin) must be present on the Product; however, the specific placement of these markings is not prescribed other than for the relationship of the solid bar to the crossed-out wheeled bin if the bar symbol is used.

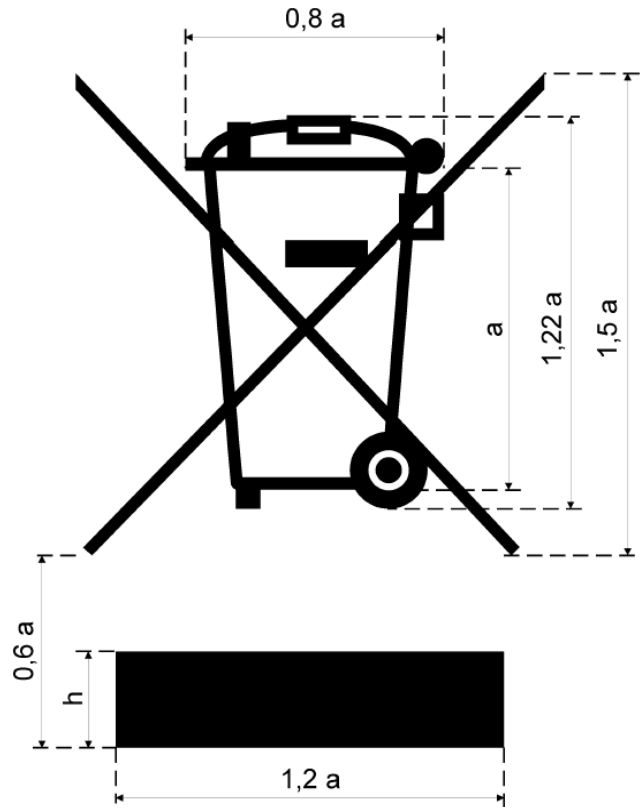


Figure 6. The marking and dimensional relationship of the solid bar symbol for indication of products manufactured or put on the EU market after August 13, 2005.

The markings must be visible, durable, legible, and indelible; that is, each marking element must be located on a permanent portion of the Product such as a frame member or chassis that cannot be removed or exchanged. Markings can be located behind a door or cover, but must be viewable without the use of a tool by a customer or operator.

European Standard 50419:2005 also prescribes that the marking must meet minimum marking durability requirements. The marking must remain legible after rubbing by hand for 15 seconds with a piece of cloth soaked with water and again for 15 seconds with a piece of cloth soaked with aliphatic solvent hexane. If marking plates or labels are used, after this test they shall not show curling.

2.9.2.1 China WEEE

The Regulations for the Administration of the Recovery and Disposal of Waste Electric and Electronic Products (hereinafter the “Regulations”) have been adopted at the Executive Meeting of the State on August 20th, 2008. The Regulations was effective as of January 1st, 2011. (No.551 Order of the State Council of the People’s Republic of China).

The State implements a system of recovery by multiple channels and centralized disposal with respect to waste electric and electronic products. And the State will establish a fund for the disposal of waste electric and electronic products to be used as allowance for the recovery and disposal of electric and electronic products. The manufacturers of electric and electronic products, consignees of import electric and electronic products or their agents shall, as required, perform their obligations of contributing to the fund or waste electric and electronic products disposal.

Affected products
The recovery and disposal of and any activities in relation to the waste electric and electronic products listed in the Catalogue of Waste Electric and Electronic Products for Disposal shall be governed by the Regulations. Scope of products: Microcomputer, including:
1) Monitor for desktop microcomputer
2) Host-display integrated desktop microcomputer
3) Laptop microcomputer (including PDA)
4) Other devices for processing of information

Marking
Add the descriptive text for China WEEE in the SWG and UG of products to declare that Lenovo provide the service for the recycle. If any update in the regulations, follow the latest requirements.

2.10 Electronic Product Environmental Assessment Tool (EPEAT) Marking

Products which meet the requirements of the EPEAT program may exhibit the appropriate certification mark on the product, product manual, product promotional materials or packaging. Lenovo Global Environmental Affairs must be contacted to determine the level of EPEAT compliance (if at all) and ensure product is registered in EPEAT database prior to the use of any EPEAT certification mark. Only one form of the mark should be used in any one publication (either preferred mark or optional mark).

2.10.1 EPEAT Mark Specifications

- The green EPEAT logo is the primary identifier, and should be used when representing the EPEAT brand holistically.
- Three logo variations distinguish the tiers of the EPEAT rating system: EPEAT Bronze, EPEAT Silver and EPEAT Gold. It's critical that the correct logo variation be associated with each product, and that the tier identifications for all products are kept current.
- Downloadable files of all logos are available to licensees online and by contacting Lenovo Global Environmental Affairs..
- Artwork should never be altered or redrawn.

Logo Colors

- The logos should be reproduced in full color in all materials, electronic or printed, where full color is available.
- The CMYK (for print) and RGB (for screen) values provided must be used when the logos

appear in color.

- If your printing method requires the use of singlecolor artwork, the logo must be printed using black ink only. Files for black-only EPEAT logos are available for download.

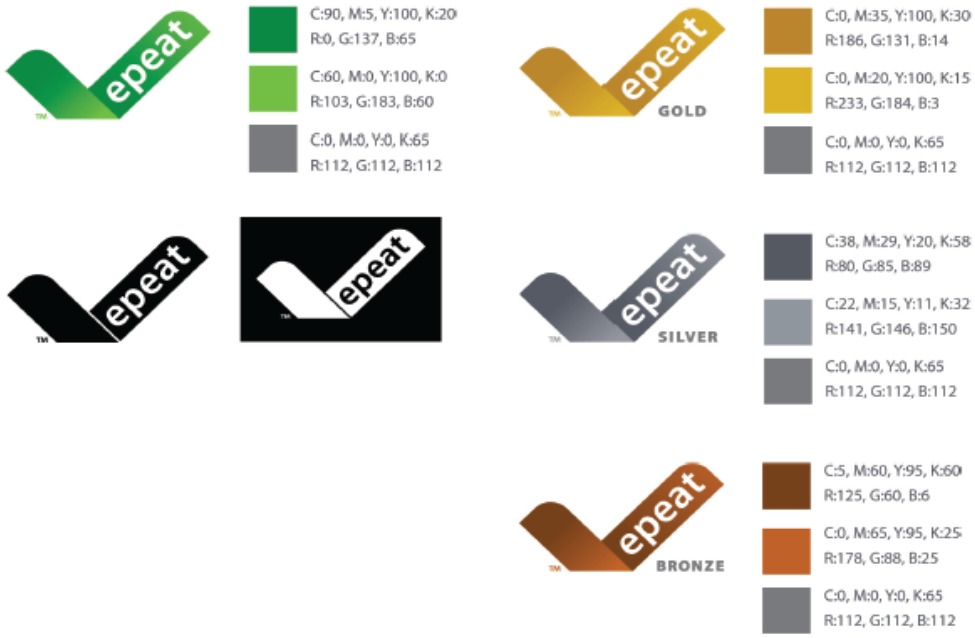
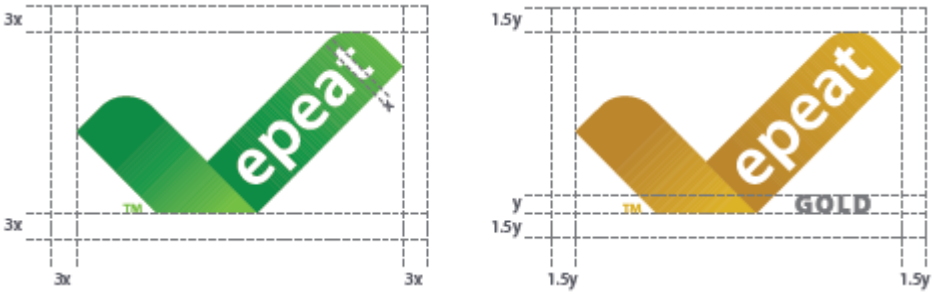


Figure 7. EPEAT markings.

Logo Guidelines

Clear Space

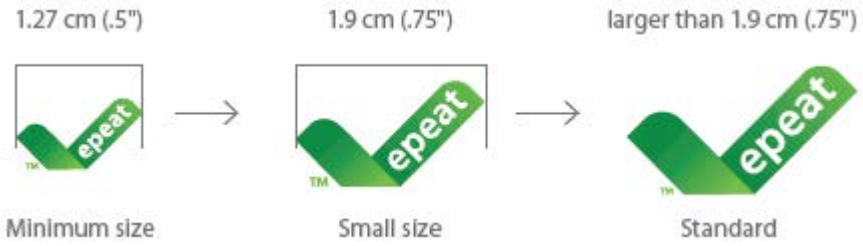
- Always maintain clear space around the EPEAT logo to protect it from distracting graphics or typography.
- For the green primary identifier, measure clear space by using the width of the ascender in "t" as a unit.
- For the Gold, Silver and Bronze logos, measure clear space using the height of the text label (the word GOLD, in the example to the right) as a unit.



Minimum Size

- Use the adjusted “small size” artwork when the logo is between 1.27 cm (.5") and 1.9 cm (.75") in width, measured from end to end of the check mark.

- For use on a physical label (for applying to a product or product packaging, for example) never reproduce the logo smaller than 1.27 cm (.5") in width. When using the logo on a website, we also recommend retaining a minimum width of 1.27 cm (.5").



2.11 Product Energy Requirements

The following sections summarize requirements for selected geographies.

2.11.1 System Requirements for China

2.11.1.1 Monitors

Computer monitors shall meet the energy efficiency requirements of Sections 4.2 and Section 4.4 in the National Standard of the People’s Republic of China GB 21520-2015. The scope of this standard includes computer monitors with general purpose use, both cathode ray tubes and liquid crystal displays used for computers using normal electrical network voltages and to display equipment with modulator/receivers mainly used for computers.
The standard is not applicable to monitors for engineering, medical and industry use.

Definition

Off-mode: The mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when the appliance is connected to the main electricity supply and used in accordance with the manufacturer’s instructions.

Enhance-performance display: Display Type 1, which can meet the following requirements.

1) horizontal view angle is equal or greater than 160 degree when contrast is 60:1
2) intrinsic resolution >= 2,700,000 Pixel/Inch
3) colour gamut>=75%

Standard display: Display Type 2, which can not meet the following requirements simultaneously.

1) horizontal view angle is equal or greater than 160 degree when contrast is 60:1
2) intrinsic resolution >= 2,700,000 Pixel/Inch

3) colour gamut>=75%

Calculation

Energy consumption per unit time will be determined by using the formula below:

$$P_i = \frac{E_i}{t}$$

P_i- energy consumption per unit time (W);
E_i- energy consumptions (Wh);
t- time consuming (h)

Energy Efficiency will be determined by using the formula below:

$$E_{ff} = \frac{S \times L}{P_w}$$

Eff- energy efficiency (cd/W);
S- display screen area (m^2);
L- display screen brightness (cd/m^2);
P_w- energy consumption per unit time of working mode (W)

Requirements

Monitors manufactured after October 1st, 2016 must meet Grade 3's requirements of the National Standard of the People's Republic of China GB 21520-2015. See Table 11 in this section about Grade 3's requirements.

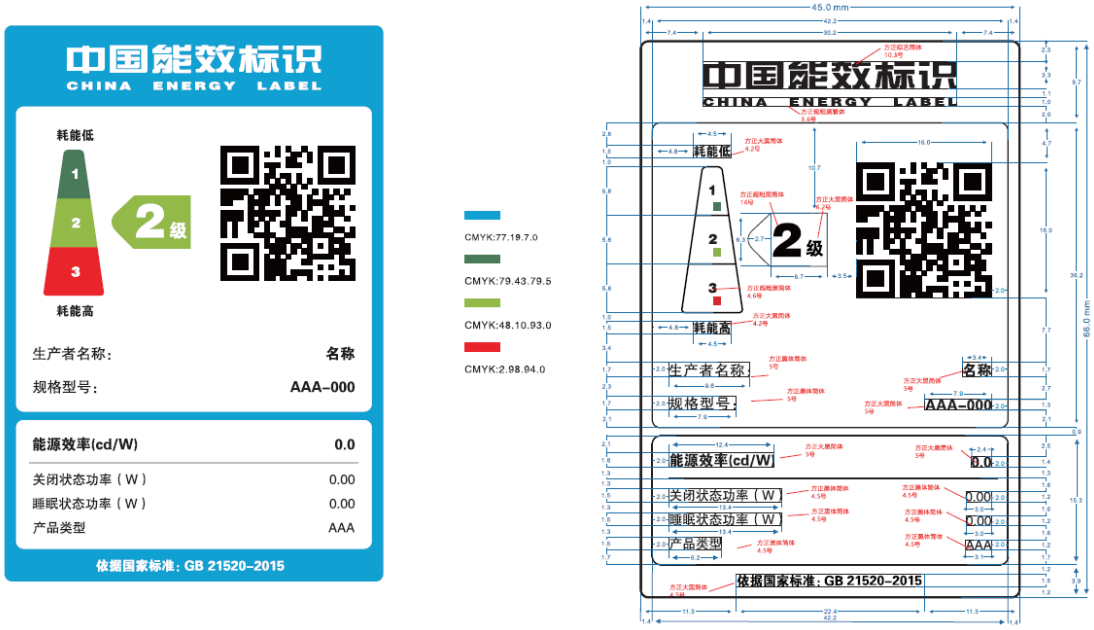
Table 11. Minimum Energy Efficiency Requirements for Monitors

Monitor Type	Energy efficiency /(cd/W)			Off mode	Sleep mode
	Grade 1	Grade 2	Grade 3		
Standard	2.0	1.5	1.0	0.5W	0.5W
Enhance-performance	1.5	1.0	0.50	0.5W	1.2W

Label Requirement

Monitors manufactured after October 1st, 2016 shall be tested, reported, registered, and labeled with China Energy Label in accordance with GB21520-2015 and the requirement of the Implementation Rules on China Energy Label for Computer Monitor. See Figure 8 below for an example label.

Figure8a. Example of China Energy Label



Note: The label pattern takes Grade 2 as an example and actual energy efficiency grade shall be depended on product energy efficiency information.

The label shall be colorful with blue and white background, with the dimension of 66 × 45mm

1) The label name: China Energy Label
2) The label must include below contents
   a. Name of Manufacturer (or Abbreviation);
   b. Product Model
   c. Energy Efficiency Grade
   d. Energy Efficiency (cd/w);
   e. Off mode power consumption
   f. Sleep mode power consumption
   g. Category of Product (Standard display or Enhanced performance display)
   h. Reference No. of National Standard on Energy Efficiency
   i. QR code

3) The label can be on the product, or on the minimum packaging, or displayed at least two seconds on the monitor when turning on.
4) The label shall be put on the product webpage in accordance with the product if it can be sold by internet.
5) The label shall be made by copper plate paper with weight of 80g or heavier.
6) The label shall be stuck with self-adhesive glue.
7) The label or the information in the label shall also be included in the product instructions if product has, otherwise are not.

Every monitor shipped out of the factory or imported shall be stuck with label. The label can be printed by manufacturer or importer. And the manufacturer or importer shall be responsible for the quality of the label. If used in product description, package and brochure, the label can be enlarged and reduced in proportion, and can be printed in monochrome color. However, the characters in label shall be legible and identifiable.

2.11.1.2 Desktops (Including AIO Desktops) and Laptops Computers

Desktop computers including AIOs and laptop computers shall meet the energy efficiency requirements of Section 3.3 in the National Standard of the People's Republic of China GB 28380-2012. The scope of this standard includes desktop computers for common purpose, all-in-one microcomputers ("AIO") with display function, and laptop computers.

This standard is not applicable to Work Station, to Industrial Personal Computer (IPC), to microcomputers with two or above discrete GPUs as well as microcomputers with rated power greater than 750 W. This standard is also not applicable to portable computers and AIOs with screen size of less than 0.2946m (11.6 inch).

Definition

Off-mode: The power consumption level in the lowest power mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when the appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions. For systems where ACPI standards are applicable, Off Mode correlates to ACPI System Level S5 state.

Sleep Mode: A low power state that the computer is capable of entering automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices with a latency of < 5 seconds from initiation of wake event to system becoming fully usable including rendering of display. For systems where ACPI standards are applicable. Sleep mode most commonly correlates to ACPI System Level S3 (suspend to RAM) state.

Idle Mode: The mode in which the operating system and other software have completed loading, a user profile has been created, the machine is not asleep, and activity is limited to those basic applications that the system starts by default.

Desktop Computer: A computer where the main unit is intended to be located in a permanent location, often on a desk or on the floor. Desktops are not designed for portability and utilize an external computer display, keyboard, and mouse. Desktops are designed for a broad range of home and office applications.

All-In-One Computer ("AIO"): A desktop system in which the computer and computer display function as a single unit which receives its ac power through a single cable. This kind of desktop computers come in one of two possible forms: (1) a system where the computer display and computer are physically combined into a single unit; or (2) a system packaged as a single system

where the computer display is separate but is connected to the main chassis by a dc power cord and both the computer and computer display are powered from a single power supply. As a subset of desktop computers, All-In-One computers are typically designed to provide similar functionality as desktop systems.

Laptop Computer: A computer designed specifically for portability and to be operated for extended periods of time either with or without a direct connection to an ac power source. Laptop computers must utilize an integrated display and be capable of operation off of an integrated battery or other portable power source. In addition, most laptop computers use an external power supply and have an integrated keyboard and pointing device. Laptop computers are typically designed to provide similar functionality to desktops, including operation of software similar in functionality as that used in desktops. Tablet PCs, which may use touch-sensitive screens along with or instead of other input devices, are considered Laptop Computers in this specification.

Typical Energy Consumption (TEC): A method of testing and comparing the energy performance of computers, which focuses on the typical electricity consumed by a product while in normal operation during a representative period of time. For Desktops and Laptops, the key criterion of the TEC approach is a value for typical annual electricity use, measured in kilowatt-hours (kWh), using measurements of average operational mode power levels scaled by an assumed typical usage model (duty cycle).

Category
See Table 12 in this section about product category.

Table 12 Product Category

Category	Definitions	
	Desktops and AIO Desktop Computers	**Laptop Computers**
A	All desktops don't meet the definition of Category B, Category C, and Category D will be considered as Category A.	All laptops don't meet the definition of Category B and Category C will be considered as Category A.
B	Equal to 2 Physical Cores; and Greater than or equal to 2 gigabytes (GB) of System Memory.	A Discrete GPU
C	Greater than 2 Physical Cores. In addition to the requirement above, models qualifying under Category C must be configured with a minimum of 1 of the following 2 characteristics: 1) Greater than or equal to 2 gigabytes (GB) of System Memory; and/or 2) A Discrete GPU.	Greater than or equal to 2 Physical Cores; Greater than or equal to 2 gigabytes (GB) of System Memory; and A Discrete GPU with a Frame Buffer Width equal to or greater than 128-bit.
D	Greater than or equal to 4 Physical Cores.	

	In addition to the requirement above, models qualifying under Category D must be configured with a minimum of 1 of the following 2 characteristics: 1) Greater than or equal to 4 gigabytes (GB) of System Memory; and/or 2) A Discrete GPU with a Frame Buffer Width equal to or greater than 128-bit.	

TEC Requirements

Desktops and Laptops manufactured after September 1st, 2012 must meet Grade 3's requirements of the National Standard of the People's Republic of China GB28380-2012. See Table 13 in this section about Grade 3's requirements.

Table 13. Minimum Efficiency Standards for Desktops and Laptops

Category		TEC		
		Grade 1	Grade 2	Grade 3
Desktops and AIO Desktop Computers (kWh)	A	98.0+ΣEfa	148.0+ΣEfa	198.0+ΣEfa
	B	125.0+ΣEfa	175.0+ΣEfa	225.0+ΣEfa
	C	159.0+ΣEfa	209.0+ΣEfa	259.0+ΣEfa
	D	184.0+ΣEfa	234.0+ΣEfa	284.0+ΣEfa
Laptop Computers (kWh)	A	20.0+ΣEfa	35.0+ΣEfa	45.0+ΣEfa
	B	26.0+ΣEfa	45.0+ΣEfa	65.0+ΣEfa
	C	54.5+ΣEfa	75.0+ΣEfa	123.5+ΣEfa
ΣEfa: Sum of power factors with additional functions				

Calculation

TEC will be determined by using the formula below:

$$E_{TEC} = \left(8760/1000\right) \times \left(P_{off} \times T_{off} + P_{sleep} \times T_{sleep} + P_{idle} \times T_{idle}\right)$$

where all Px are power values in watts, all Tx are time values in % of year, and the TEC E_{TEC} is in units of kWh and represents annual energy consumption based on mode weightings in Table 14.

Table 14 Percentage for Each Mode

Tx	Desktops	Laptops
T_{off}	55%	60%
T_{sleep}	5%	10%
T_{idle}	40%	30%

Power factors with additional functions will be determined using the Table 15 below:

Table 15 Power factors with Additional Functions

Function	Desktops	Laptops	Instruction

		A	B	C	
Memory	1.0/(GB)×(system memory-basic memory)	0.4/(GB)×(system memory-basic memory)			It is applicable when system memory greater than basic memory. 1) The basic memory of Category A, B and C of desktops is 2GB. 2) The basic memory of Category D of desktops is 4GB 3) The basic memory for laptops is 4GB.
Discrete GPU	46	-	4	-	G1
	70	-	12	-	G2
	95	-	24	37	G3
	140	-	36	49	G4
	394	-	146	159	G5
Storage	25*number of HDD	3*number of HDD			additional HDD=number of HDD-1

Discrete GPU will be determined by using the Table 16 below:

Table 16 Discrete GPU Category

Category	FBBW
G1	FBBW≤16
G2	16<FBBW≤ 32
G3	32<FBBW≤ 64
G4	64<FBBW≤ 128
G5	FBBW>128

FBBW will be determined by using the formula below:

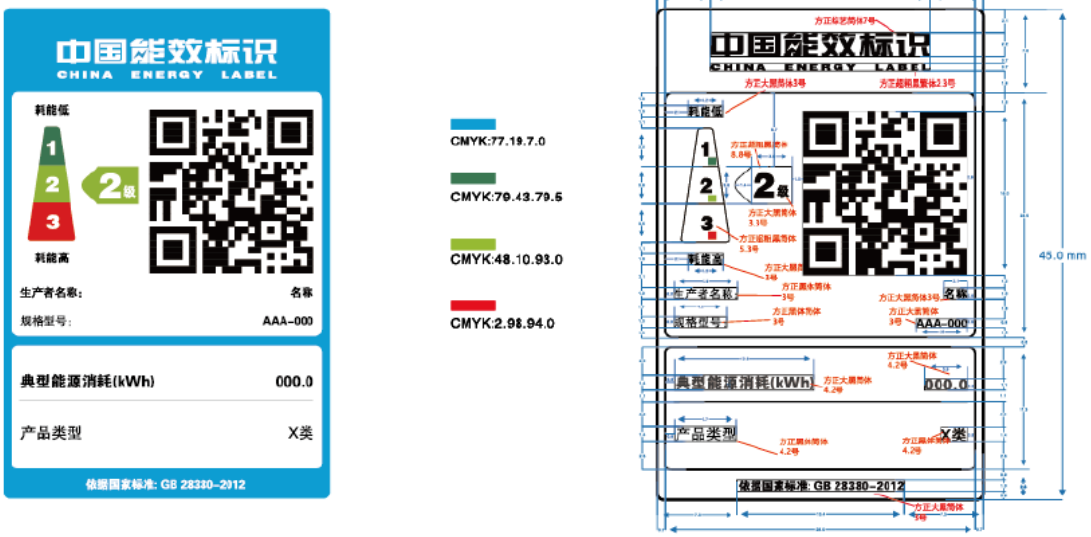
$$FBBW = (DR \times DW) \div (8 \times 1000)$$

FBBW- Memory Bandwidth (GB/s);
DR- VRAM equivalent frequency (MHz);
DW- Bus Width (Bit)

Label Requirement

Microcomputers manufactured after October 1st, 2016 shall be tested, reported, registered, and labeled with China Energy Label in accordance with GB28380-2012 and the requirement of the Implementation Rules on China Energy Label for Microcomputer.
See Figure 8b below for an example label.

Figure 8b. Example of China Energy Label



Note: The label pattern takes Grade 2 as an example and actual energy efficiency grade shall be depended on product energy efficiency information.

The label shall be colorful with blue and white background, with the dimension of 45 × 30mm

1) The label name: China Energy Label
2) The label must include below contents
   j. Name of Manufacturer (or Abbreviation);
   k. Product Model
   l. Energy Efficiency Grade
   m. TEC (kWh);
   n. Product Catogery
   o. Reference No. of National Standard on Energy Efficiency
   p. QR code
3) The label can be on the product or on the minimum packaging
4) The label shall be put on the product webpage in accordance with the product if it can be sold by internet.
5) The label shall be made by copper plate paper with weight of 80g or heavier.
6) The label shall be stuck with self-adhesive glue.
7) The label or the information in the label shall also be included in the product instructions if product has, otherwise are not.

Every microcomputer shipped out of the factory or imported shall be stuck with label. The label can be printed by manufacturer or importer. And the manufacturer or importer shall be responsible for the quality of the label. If used in product description, package and brochure, the label can be enlarged and reduced in proportion, and can be printed in monochrome color. However, the characters in label shall be legible and identifiable.

2.11.1.3 Printers and Fax Machines

Printers and Fax machines shall meet the energy efficiency requirements of section 4.2 in the National Standard of the People's Republic of China GB21521-2014.
This standard is applicable to the product working in 220V/50Hz with standard size.
This standard is not applicable to the product as follow.

a. Supplied by the battery or network interface (such as USB, IEEE1394 interface).
b. With DFE
c. Output speed faster than 70p/m
d. The number of needles of printing head greater than 48

Definition

Off-mode: The mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when the appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions.

Active mode: The mode in which the product is carrying out useful work in response to a) prior or concurrent user input or b) prior or concurrent instruction over the network.

Ready mode: The mode in which the operating system turning from active mode after working is done.

Sleep mode: A low power state that the product is capable of entering automatically after a period of inactivity or by manual selection.

Standby mode: A power state with the energy consumption no higher than sleep mode. This state can be the off-mode or the ready mode or sleep mode.

Printing/fax speed: The number of A4 paper was printed per minute

Calculation

1) TEC will be determined by using the formula below:

$$TEC = \left[\left(E_d \times 5\right) + \left(P_s \times 48\right)\right]/1000$$

TEC- typical energy consumption (kW.h);
E_d- energy consumption in one day (W.h);
P_s- the average power in one hour after entering sleep mode (W)

2) E_d will be determined by using the formula below:

$$E_d = E_{dj} + 2E_f + E_s$$

E_{dj}- energy consumption by completing total working tasks in one day (Wh);
E_f- energy consumption of the period from completing last working task to entering in sleep mode

(Wh);
E_s- energy consumption of sleep mode in one day (Wh)

3) E_{dj} will be determined by using the formula below:

$$E_{dj} = E_{jl} \times 2 + \left[\left(M_{jd} - 2\right) \times E_j\right]$$

E_{jl}- energy consumption by completing the first working tasks (Wh);
M_{jd}- the number of typical working task completed in one day;
E_j- average energy consumption (Wh)

4) E_s will be determined by using the formula below:

$$E_s = \left\{24 - \left[\left(M_{jd} / 4\right) + \left(t_i \times 2\right)\right]\right\} \times P_s$$

t_i- the time of the period from completing fourth working task to entering in sleep mode (h)

5) E_j will be determined by using the formula below:

$$E_j = \left(E_{j2} + E_{j3} + E_{j4}\right) / 3$$

E_{j2}- energy consumption by completing the second working tasks (Wh);
E_{j3}- energy consumption by completing the third working tasks (Wh);
E_{j4}- energy consumption by completing the fourth working tasks (Wh);

6) M_{jd} will be determined by using the Table 17 below:

Table 17 M_{jd} Category

Print speed (p) (paper/min)	M_{jd}
0<p≤8	8
8<p≤32	P
p>32	32

7) P_{OM} will be determined by using the formula below:

$$P_{OM} = \frac{E_s}{t_s}$$

E_s- energy consumption of sleep mode (W.h);
t_s- time used for testing Es (h)

8) $\sum P_{fa}$ will be determined by using the Table 18 below:

Power factor with additional function ($\sum P_{fa}$) can only be selected no more than three basic value, others will be considered as additional value.

Table 18. Power Factor with Additional Function Determination

Additional function	P_{fa} (W)	Instruction for additional function
the transmission rate of wired interface < 20Mbps	0.2	data or network interface, including USB1.*, IEEE488 and IEEE1284 interface, Parallel, Centronics, R32 and etc.
20Mbps =< the transmission rate of wired interface < 500Mbps	0.4	data or network interface, including USB2.*, IEEE1394 and 100Mb Ethernet interface
the transmission rate of wired interface >= 500Mbps	0.5	including USB3.x and 1Gb Ethernet interface
Other wired interface	0.2	including flash memory card, smart card reader and digital camera interface
Fax modem	0.2	Only applicable to Fax machine and MFP
RF interface	2.0	including Bluetooth and 802.11interface
infra-red data interface	0.1	Including TrDA
wireless phone	0.8	this factor can only be used once when the wireless microphone volume product can be connected were not considered
every 1GB memory	0.5	determined by the total memory capacity
scanning techniques	0.5	Only applicable to Fax machine and MFP. This factor can be used once
power supply with DC output function	0.02*(Pout - 10)	Only applicable to Pout is greater than 10W. Poot is sum of internal& external power nominal rated DC output power.
touch panel display	0.2	Applicable to monochrome and colorful panel
Internal disk drive	0.15	products containing internal storage medium like disk drives, DVD drive, ZIP drive

9) P_{std} will be determined by using the formula below:

$$P_{std} = E_{srd} / t_{std}$$

E_{std}- energy consumption of standard mode (W.h);
T_{std}- the time used for testing E_{std} (h)

TEC Requirements

1) Product using thermo-sensitive, thermo-sublimation, electronic image, solid wax spray, thermal transfer technology and high performance ink jet technology manufactured after Jan. 1st, 2015 must meet Grade 3's requirements of the National Standard of the People's Republic of China GB 21521-2015. See Table 19 in this section about Grade 3's requirements.

Table 19. Minimum Energy Efficiency Requirements for Printers by using TEC method.

产品类型	输出速度(p) 页/min	典型能耗 kW·h		
		1级	2级	3级
单色复印机、单色打印机、单色传真机	$p \leqslant 5$	≤0.20	≤0.30	≤1.00
	$5 < p \leqslant 20$	≤0.03×i+0.03	≤0.04×i+0.10	≤0.06×i+0.65
	$20 < p \leqslant 30$	≤0.03×i+0.02	≤0.06×i−0.30	≤0.10×i−0.20
	$30 < p \leqslant 40$	≤0.06×i−0.90	≤0.11×i−1.80	≤0.10×i−0.20
	$40 < p \leqslant 65$	≤0.09×i−2.10	≤0.16×i−3.80	≤0.35×i−10.30
	$p > 65$	≤0.09×i−2.10	≤0.20×i−6.40	≤0.35×i−10.30
彩色复印机、彩色打印机、彩色传真机	$p \leqslant 10$	≤0.70	≤1.30	≤0.10×i+2.80
	$10 < p \leqslant 15$	≤0.04×i+0.30	≤0.06×i+0.70	≤0.10×i+2.80
	$15 < p \leqslant 30$	≤0.04×i+0.30	≤0.15×i−0.65	≤0.10×i+2.80
	$p > 30$	≤0.09×i−1.20	≤0.20×i−2.15	≤0.35×i−5.00
单色多功能一体机	$p \leqslant 5$	≤0.30	≤0.40	≤1.50
	$5 < p \leqslant 30$	≤0.03×i+0.15	≤0.07×i+0.05	≤0.13×i+0.85
	$30 < p \leqslant 50$	≤0.08×i−1.40	≤0.11×i−1.15	≤0.35×i−6.00
	$p > 50$	≤0.09×i−1.90	≤0.25×i−8.15	≤0.35×i−6.00
Multicolor multi-function equipment	p≤10	<=1.00	<=1.50	<=0.10*I+3.50
	10<p≤15	<=0.02*I+0.80	<=0.10*I+0.50	<=0.10*I+3.50
	15<p≤30	<=0.06*I+0.20	<=0.13*I+0.05	<=0.19*I+2.00
	p>30	<=0.09*I-0.70	<=0.20*I-2.05	<=0.35*I-3.00

Note1: The difference between high performance ink jet technology and conventional ink jet technology is whether to have a nozzle array across the width of the page or drying medium ink by

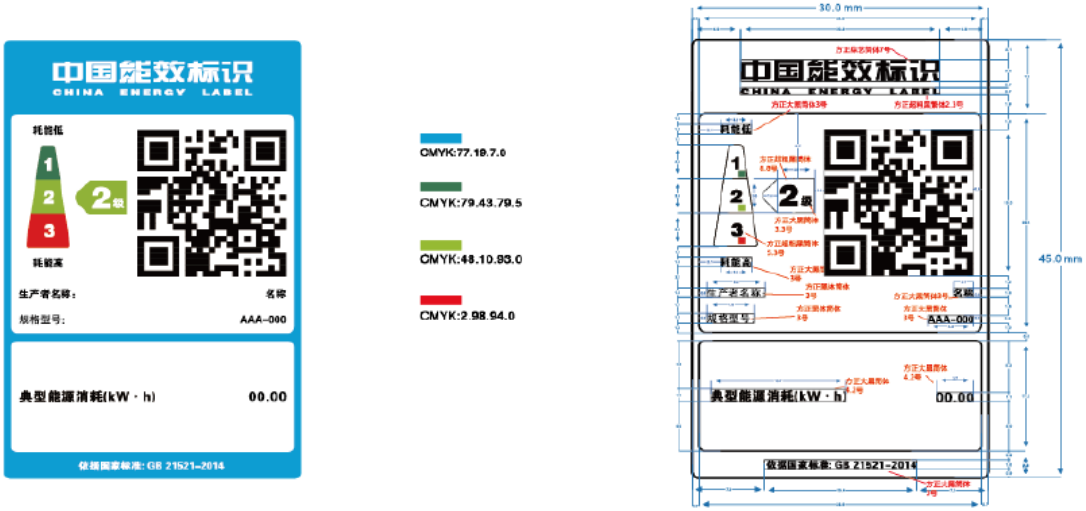
using increase medium heating technology
2) Product using ink jet or stylus beating technology manufactured after Jan. 1st, 2015 must meet Grade 3's requirements of the National Standard of the People's Republic of China GB 21521-2015. See Table 20 in this section about Grade 3's requirements.

Table 20. Minimum Energy Efficiency Requirements by using OM method.

Technology	Energy Efficiency Grade					
	Grade 1		Grade 2		Grade 3	
	P_{OM}	P_{Std}	P_{OM}	P_{Std}	P_{OM}	P_{Std}
ink jet	$0.6+\sum P_{fa}$	0.5	$1.0+\sum P_{fa}$	0.5	$1.4+\sum P_{fa}$	1.0
stylus beating	$0.6+\sum P_{fa}$	0.5	$2.6+\sum P_{fa}$	0.5	$4.6+\sum P_{fa}$	1.0
$\sum P_{fa}$ sum of power factor with additional function						

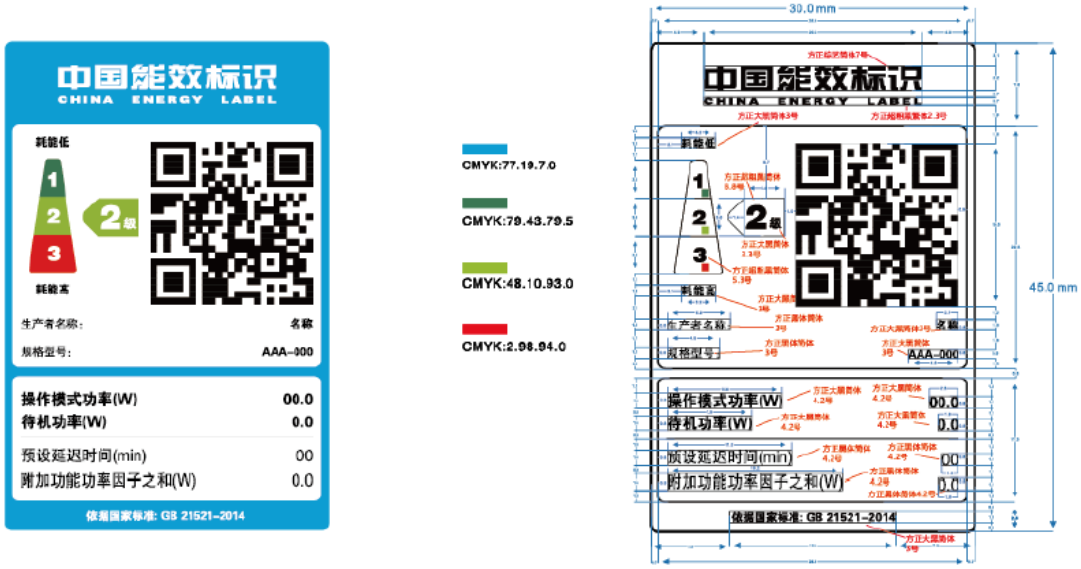
Label Requirements
Printers, Fax Machines and Copy Machines manufactured after Oct. 1st, 2016 shall be tested, reported, registered, and labeled with China Energy Label in accordance with the GB21521-2015 and the requirement of the Implementation Rules on China Energy Label for Printers, Fax Machines and Copy Machines. See Figure 9 and Figure 10 below for an example label.

Figure 9. Example of China Energy Label for High Performance Ink Jet Technology*



*Note: The label is applicable to product using thermo-sensitive, thermo-sublimation, electronic image, solid wax spray, thermal transfer technology and high performance ink jet technology

Figure 10. Example of China Energy Label for Stylus Beating Technology*



*Note: The label is applicable to product using ink jet or stylus beating technology

Product using thermo-sensitive, thermo-sublimation, electronic image, solid wax spray, thermal transfer technology and high performance ink jet technology should meet following requirements:
The label shall be colorful with blue and white background, with the dimension of 45× 30mm.

1) The label name: China Energy Label
2) The label must include below contents
   a. the name of the manufacturer
   b. product model
   c. energy efficiency grade
   d. TEC
   e. code number of National Standard applied
   f. QR code
3) The label can be on the product, or on the minimum packaging.
4) The label shall be made by copper plate paper of 80g or heavier.
5) The label shall be stuck with self-adhesive glue.
6) The label or the information in the label shall also be included in the product instructions if product has, otherwise are not.

Product using ink jet or stylus beating technology should meet following requirements:
The label shall be colorful with blue and white background, with the dimension of 45× 30mm

1) The label name: China Energy Label
2) The label must include below contents
   a) the name of the manufacturer
   b) product model
   c) energy efficiency grade

d) P_{OM}
e) P_{Std}
f) default delay time
g) sum of power factor with additional function
h) Code number of National Standard of Energy Efficiency applied
i) QR code

3) The label can be on the product, or on the minimum packaging.
4) The label shall be made by copper plate paper of 80g or heavier.
5) The label shall be stuck with self-adhesive glue.
6) The label or the information in the label shall also be included in the product instructions if product has, otherwise are not.

Every printer, fax machines and copy machines shipped out of the factory or imported shall be stuck with label. The label can be printed by manufacturer or importer. And the manufacturer or importer shall be responsible for the quality of the label. If used in product description, package and brochure, the label can be enlarged and reduced in proportion, and be printed in monochrome color. However, the characters in label shall be legible and identifiable.

2.11.1.4 Flat Panel TVs

Flat Panel TVs shall meet the energy efficiency requirements of Sections 4.2 and section 4.4 in the National Standard of the People's Republic of China GB 24850-2013. This standard is applicable to LCD TV and plasma TV with common using purpose. This standard is also applicable to the LCD or plasma display device without tuner which has TV function.

Definition

On mode: The mode in which the operating system and other software have completed loading, a user profile has been created, the machine is not asleep, and activity is limited to those basic applications that the system starts by default.

Passive standby mode: A power state without sound and image. This state can be switched to the off-mode or on mode by using RC or other external signals.

Passive standby power: The active power of passive standby mode, by using the testing method defined by this standard.

On mode static power (Pj): the active power of playing static image testing in the state of on mode, by using the testing method defined by this standard.

On mode dynamic power (Pd): the active power of playing dynamic sequence testing in the state of on mode, by using the testing method defined by this standard.

Fluctuation values of power (△P): (Pj-Pd)/Pj*100%

Calculation

Fluctuation values of power (△P) will be determined by using the formula below:

$$\triangle P = \frac{\left|P_j - P_d\right|}{P_j} \times 100\%$$

P_j- on mode static power (W);
P_d- on mode dynamic power (W)
△P - fluctuation values of power

On mode power (P_k) will be determined by using the Table 21 below.

Table 21 On Mode Power

△P / 30%	≤30	>30
P_k / W	P_d	$P_k = P_d$, if $P_d > P_j$; Otherwise, $P_k = P_j$

Energy Efficiency will be determined by using the formula below:

$$Eff = \frac{L \times S}{P_k - P_s}$$

Eff- energy efficiency (cd/W);
S- display screen area (m2);
L- display screen brightness (cd/m2);
P_k- energy consumption of on mode (W)
P_s- energy consumption of signal processing (W)
Note: P_s will be 4 when input is using through simulative RF port; P_s will be 8 when input is using through digital RF port; for others P_s will be 0.

Energy Efficiency Index for LCD TV will be determined by using the formula below:

$$EEI_{LCD} = \frac{Eff}{Eff_{LCD,ref}}$$

EEI_{LCD}- energy efficiency index for LCD TV, 1;
$Eff_{LCD,\ ref}$- energy efficiency baseline index, 1.1cd/W

Energy Efficiency Index for plasma TV will be determined by using the formula below:

$$EEI_{PDP} = \frac{Eff}{Eff_{PDP,ref}}$$

EEI_{PDP}- energy efficiency index for plasma TV, 1;

$Eff_{PDP, ref}$- energy efficiency baseline index, refer to below Table 22.

Table 22 Energy Efficiency Baseline Index

inherent resolution	>= 1920*1080	others
$Eff_{PDP, ref}$ (cd/W)	0.320	0.450

Energy Efficiency Requirements

Product manufactured after Oct. 1st, 2013 must meet Grade 3's requirements of the National Standard of the People's Republic of China GB 24850-2013. See Table 23 in this section about Grade 3's requirements.

Table 23. Minimum Energy Efficiency Requirements for LCD TV and plasma TV

EEI	Energy Efficiency		
	Grade 1	Grade 2	Grade 3
EEI_{LCD}	2.7	2.0	1.3
EEI_{PDP}	2.0	1.6	1.2

Effective date	Power Consumption Limit
Power of passive standby mode	<=0.50

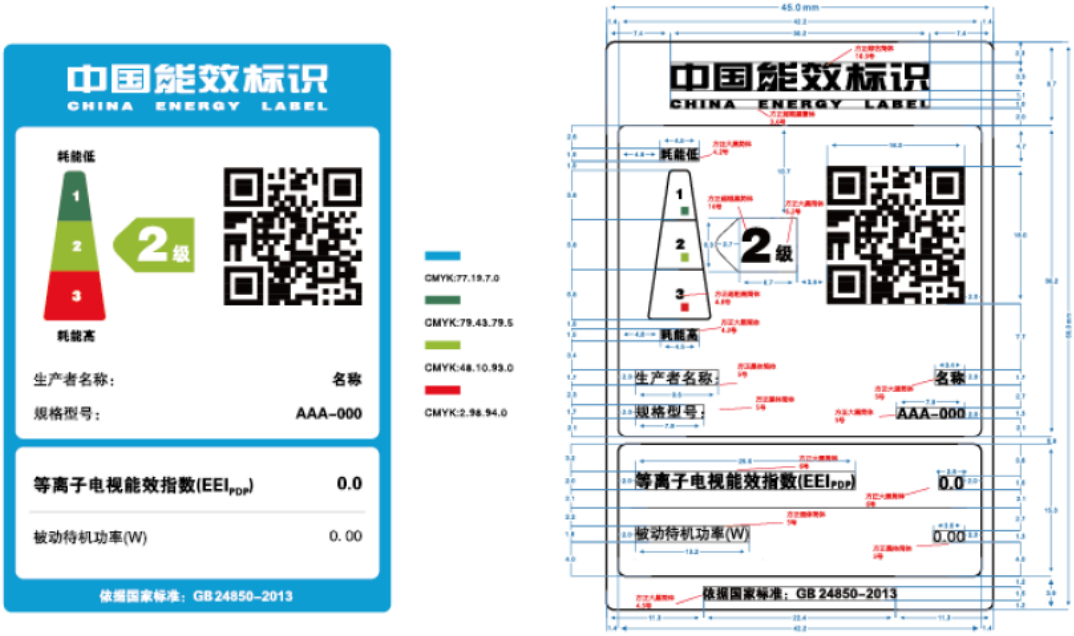
Note: the EEI value should keep the two significant figures

Label Requirements

Flat Panel TVs manufactured after Oct. 1st, 2016 shall be tested, reported, registered, and labeled with China Energy Label in accordance with the GB24850-2013 and the requirement of the Implementation Rules on China Energy Label for Flat Panel TVs. See Figure 11a and Figure 11b below for an example label.

Figure 11a. Example of China Energy Label

Figure 11b. Example of China Energy Label



The label shall be colorful with blue and white background, with the dimension of 66×45mm

1) The label name: China Energy Label

2) The label must include below contents
   a. the name of the manufacturer
   b. product model
   c. energy efficiency grade
   d. EEI
      i. EEI_{LCD}
      ii. EEI_{PDP}
   e. power of passive standby mode
   f. code number of National Standard applied
   g. QR code
3) The label can be on the product, or on the packaging, or displayed at least two seconds on the monitor when turning on.
4) The label shall be made by copper plate paper of 80g or heavier.
5) The label shall be stuck with self-adhesive glue.
6) The label or the information in the label shall also be included in the product instructions if product has, otherwise are not.

Every Flat Panel TV shipped out of the factory or imported shall be stuck with label, and be explained in product User Guide. The label can be printed by manufacturer or importer. And the manufacturer or importer shall be responsible for the quality of the label. If used in product description, package and brochure, the label can be enlarged and reduced in proportion, and be printed in monochrome color. However, the characters in label shall be legible and identifiable.

2.11.2 Requirements for Korea

Standby Product meeting standby power criteria : e-Standby Warning Label Products (Mandatory)

In 2008, certain products were designated as requiring mandatory energy efficiency labeling. Therefore, besides the best e-standby product labeling program (voluntary), manufacturers or importers of certain MKE and KEMCO designated electric appliances (“e-Standby Warning Label Products”) must test covered products by a designated testing institution and report the testing result to KEMCO. If the standby power falls short of the e-standby power reduction criteria the manufacturer or importer is legally obliged to attach an e-Standby Warning Label.

MKE and KEMCO designated the following 7 products as e-Standby Warning Label Products: computers, monitors, printers, multifunction devices, televisions, set top boxes, and microwave ovens. However, this mandatory labeling system became effective only with respect to televisions as of August 28, 2008; it will further become effective with respect to the remaining six products as of July 1, 2009. In addition, beginning January 1, 2010, almost all target products of the e-Standby Program will become the target products of the e-Standby Warning Label system.

Definitions

Computer - Computers with nameplate output power of power supply less than equal to 1,000W. Covers mainly computers sold commercially or for household use in the market, including personal computers, notebook computers, and including integrated computer systems. Computers for network servers, workstations and computers in standby mode awaiting instructions remotely are excluded

Monitor - Electrical appliance with rated power consumption of 1000W or less, consisting of a display screen (CRT, LCD, PDP, etc.) to display the output information from the computer via one or more input terminals such as VGA or DVI terminal, and its associated electronic equipment. This includes those with both computer monitor and TV functions, either with a focus on computer monitor as the primary function or with equal dual function. Integrated computer systems (where computer and monitor combined into a single unit), network monitor and monitors embedded with special functions including VoIP are excluded.

Requirements

Computers and Monitors must be labeled according to Annex VII of the Korean e-Standby Program Application Regulation, August 28, 2008 with a warning logo if the monitors do not meet the requirements in the following tables:

Table 24. Low Power Performance Requirements		
Category	**Watts in Sleep Mode**	**Watts in Off mode**
Monitor	<2.0W	<1.0W

Category	**Sleep mode**		Watts in off mode
	Default time	Watts in low power mode	
Personal Computers(Laptop)	≤30 min	≤1.7W	≤1.0W
Personal Computers(Desktop)	≤30 min	≤4.0W	≤2.0W
Integrated Computer System	≤30 min	≤4.0W	≤2.0W

Note: When applying the standards listed in table above to computers shipped to the market, additional allowable tolerance of +0.7W is given at sleep and off modes for computers with WOL (Wake on Lan) function.

The figure below has an example warning logo. The minimum diameter of the logo is 2.5cm. The logo is to be labeled on the front or top side of the product. The logo may be monochrome, the predominant color of the product's surface, or in the colors suggested by the Korean e-Standby Regulation.

Figure 12. Example of a Warning Logo for e-Standby Power Program Target Products**.**

The manufacturer of the monitor shall submit the appropriate reporting forms as required to the Korea Energy Management Corporation (KEMCO).

2.11.3 Requirements for the EU, Switzerland, Norway, Turkey, Israel, and other jurisdictions

This section applies to Energy Using Products (EUP) including information technology equipment intended primarily for use in the domestic environment (see Annex I of EU Commission Regulation No 1275/2008.)

Definitions
Electrical and electronic household and office equipment - means any energy-using product which:

(a) is made commercially available as a single functional unit and is intended for the end-user;
(b) falls under the list of energy-using products of Annex I (in EU Regulation (EC) No 1275/2008);
(c) is dependent on energy input from the mains power source in order to work as intended; and
(d) is designed for use with a nominal voltage rating of 250 V or below.

This definition is from EU Commission Regulation (EC) No 1275/2008. Energy-using products in Annex I include information technology equipment intended primarily for use in the domestic environment which means products classified as Class B per EN55022 in EU Directive 89/336/EEC for Electromagnetic Compatibility (EMC). Examples of products which may be classified as Class B include monitors, workstations and laptops. EU Regulation 1275/2008 for ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment can be found at:
Http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:EN:PDF

Requirements
Electronic equipment, such as monitors, workstations and laptops which are EMC Class B Information Technology equipment as defined in EN 55022:2006+A1:2007 or EN 55022:2010 and newly releasing must meet the following requirements:

1. Power consumption in off-mode shall not exceed 0.50 W,
2. Power consumption in standby mode with a reactivation function shall not exceed 0.50 W,
3. Power consumption in standby mode providing only information or status display shall not exceed 1.00 W, and
4. When equipment is not providing the main function, or when other energy-using product(s) are not dependent on its functions, equipment shall, unless inappropriate for the intended use, offer a power management function that switches equipment after the shortest possible period of time into standby mode, or off mode, or another condition which does not exceed the applicable power consumption requirements for off mode and/or standby mode when the equipment is connected to the mains power supply.

Electronic equipment, such as monitors, workstations and laptops which are EMC Class B Information Technology equipment as defined in EN 55022:2006 or EN 55022:2010 and currently

shipping as of September 1, 2009 must meet the following requirements:

1. Power consumption in off-mode shall not exceed 1.0 W,
2. Power consumption in standby mode with a reactivation function shall not exceed 1.0 W,
3. Power consumption in standby mode providing only information or status display shall not exceed 2.00 W, and

The product must be marked with the CE conformity marking. See the following Figure. The CE mark must have a height of at least 5 mm. The CE marking must be affixed to the EuP. Where this is not possible, it must be affixed to the packaging and to the accompanying documents.

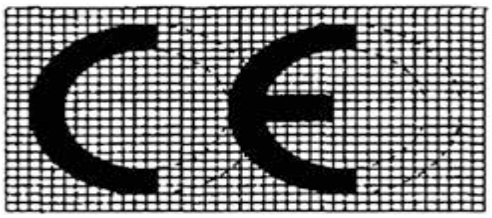


Figure 13. Example of CE Conformity Marking.

The following technical documents must be provided to Lenovo:
A. Declaration of Conformity (DoC) to EU Regulation 1275/2008 as required by EU Directive 2009/125/EC. The DoC must include:
i. Name and address of the manufacturer or of its authorized representative;
ii. A description of the model sufficient for unambiguous identification;
iii. Where appropriate, the references of the harmonized standards applied;
iv. Where appropriate, the other technical standards and specifications used;
v. Where appropriate, the reference to other EU Community legislation providing for the affixing of the CE mark that is applied;
vi. Identification and signature of the person empowered to bind the manufacturer or its authorized representative.
B. Statement indicating which energy efficiency tier (or both) the DoC applies to (see the first two paragraphs of this section for energy efficiency tier information), and
C. The technical documentation showing efficiency data must be provided. The technical documentation must meet the requirements of Annex IV of EU Commission Regulation No 1275/2008. For Israel, testing must be conducted at an approved Standards Institute of Israel (SII) testing facility in Israel and the results provided to Lenovo.

2.11.4 External Power Supplies, Adapters and Chargers

2.11.4.1 Requirements for USA/ Australia/ New Zealand

Definitions

External Power Supply (EPS) – A single voltage external AC to DC or AC to AC power supply is a device designed to convert line voltage AC input to a lower AC or DC voltage, converting to only 1 AC or DC output at a time, is sold with or intended to be used with a separate end-use product that constitutes the primary load, is contained in a separate physical enclosure from the

end use product, is connected to the end-use product via removable or hard wired male/female electrical connection, cable, cord or other wiring, and has a nameplate output power less than or equal to 250 watts. Please note, for Australia and New Zealand only, these countries have an additional phrase for the definition of an EPS. The EPS must have an input from a mains supply. The EPS must have an integral mains plug to be within scope of the Australia/NZ requirements.

Requirements

External power supplies manufactured after February 10, 2016 must meet the requirements of the Department of Energy - 10 CFR Part 430, RIN: 1904-AB57, Docket ID, ERE-2008-BT-STD-0005. The efficiency standards are listed below.

Table 25. Direct Operation External Power Supply Efficiency Standards (Beginning February 10, 2016)		
Single-voltage External AC-DC Power Supply, Basic Voltage		
Nameplate Output Power (Pout)	**Minimum Average Efficiency in Active Mode** ***(expressed as a decimal)***	**Maximum Power in No-Load Mode [W]**
Pout ≤ 1 W	≥ 0.5 × Pout + 0.16	≤ 0.100
1 W < Pout ≤ 49 W	≥ 0.071 × ln(Pout) - 0.0014 × Pout + 0.67	≤ 0.100
49 W < Pout ≤ 250 W	≥ 0.880	≤ 0.210
Pout > 250 W	≥ 0.875	≤ 0.500
Single-Voltage External AC-DC Power Supply, Low-Voltage		
Nameplate Output Power (Pout)	**Minimum Average Efficiency in Active Mode** ***(expressed as a decimal)***	**Maximum Power in No-Load Mode [W]**
Pout ≤ 1 W	≥ 0.517 × Pout + 0.087	≤ 0.100
1 W < Pout ≤ 49 W	≥ 0.0834 × ln(Pout) - 0.0014 × Pout + 0.609	≤ 0.100
49 W < Pout ≤ 250 W	≥ 0.870	≤ 0.210
Pout > 250 W	≥ 0.875	≤ 0.500
Single-voltage External AC-AC Power Supply, Basic Voltage		
Nameplate Output Power (Pout)	**Minimum Average Efficiency in Active Mode** ***(expressed as a decimal)***	**Maximum Power in No-Load Mode [W]**
Pout ≤ 1 W	≥ 0.5 × Pout + 0.16	≤ 0.100
1 W < Pout ≤ 49 W	≥ 0.071 × ln(Pout) - 0.0014 × Pout + 0.67	≤ 0.100
49 W < Pout ≤ 250 W	≥ 0.880	≤ 0.210
Pout > 250 W	≥ 0.875	≤ 0.500
Single-Voltage External AC-AC Power Supply, Low-Voltage		
Nameplate Output Power (Pout)	**Minimum Average Efficiency in Active Mode** ***(expressed as a decimal)***	**Maximum Power in No-Load Mode [W]**
Pout ≤ 1 W	≥ 0.517 × Pout + 0.087	≤ 0.100
1 W < Pout ≤ 49 W	≥ 0.0834 × ln(Pout) - 0.0014 × Pout + 0.609	≤ 0.100
49 W < Pout ≤ 250 W	≥ 0.870	≤ 0.210
Pout > 250 W	≥ 0.875	≤ 0.500
Multiple Voltage External Power Supply		
Nameplate Output Power (Pout)	**Minimum Average Efficiency in Active Mode** ***(expressed as a decimal)***	**Maximum Power in No-Load Mode [W]**
Pout ≤ 1 W	≥ 0.497 × Pout + 0.067	≤ 0.300
1 W < Pout ≤ 49 W	≥ 0.075 × ln(Pout) + 0.561	≤ 0.300
Pout ≥ 49 W	≥ 0.860	≤ 0.300

The power supply and packaging must be labeled according to the International Efficiency

Marking Protocol. In keeping with the above efficiency standards, the power supply must have a marking of IV or higher. The marking is determined by comparing the unit's active and no load test data with the performance requirements of the International Efficiency Marking Protocol scale. The marking shall be permanently shown on the nameplate of the power supply. The font should be a plain serif font such as Times Roman. The size must be legible and indelible in a color that contrasts with the nameplate background. The label must include the manufacturer's name, model number, and Date of Manufacture. Further information about the International Efficiency Marking Protocol can be found at: http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/International_Efficiency_Marking_Protocol.pdf

The manufacturer must register each model or family of models in Australia, New Zealand and other jurisdictions as required (e.g., Arizona, New York, and Oregon.) The state of Oregon requires the manufacturer of a single voltage AC to DC power supply to certify with a letter that the product is compliant and has been tested. The supplier must provide Lenovo with a copy the Energy Efficiency test results, used to verify the supply meets the IV mark criteria. See the following web site for more details for registration in Australia: http://www.energyrating.gov.au/regulations/

In addition to the above, a Class A EPS must meet the US Department of Energy rule for Certification, Compliance and Enforcement Requirements for Certain Consumer Products and Commercial and Industrial Equipment, 75 Federal Register Regulation 652.

A Class A EPS is defined as an EPS which meets the following criteria:

- Designed to convert line voltage AC input into lower voltage AC or DC output;
- Sold with or intended to be used with , a separate end-use product that constitutes the primary load;
- Contained in a separate physical enclosure from the end-use product;
- Connected to the end-use product via a removable or hard-wired male/female electrical connection, cable, cord, or other wiring;
- Nameplate output power 250 watts or less; and
- Able to convert to only one AC or DC output voltage at a time

Class A EPS does not include any device that –

- Requires Federal Food and Drug Administration listing and approval as a medical device in accordance with section 513 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360c); or
- Powers the charge of a detachable battery pack or charges the battery or a product that is fully or primarily motor operated.

Class A EPSs must meet the energy requirements in Table 25 above. Exceptions to this include EPSs which were:

- Manufactured during the period beginning on July 1, 2008, and ending on June 30, 2015; and

- Made available by the manufacturer as a service part or a spare part for an end-use product –
  - That constitutes the primary load; and
  - Was manufactured before July 1, 2008.

Class A EPSs which are in scope of this requirement as cited above must be certified by the manufacturer to the US Department of Energy with test results and a compliance statement. See US 10 CFR Part 429 Subpart B Certification, 429.10 through 429.71 for more information at http://ecfr.gpoaccess.gov/cgi/t/text/textidx?c=ecfr;sid=11d3a1f4f775aa25c0e125fe9dab140d;rgn=div5;view=text;node=10%3A3.0.1.4.17;idno=10;cc=ecfr

Test procedures for energy efficiency measurements as cited in US 10 CFR Part 430, must be followed for External Power Supplies and Battery Chargers. Please refer to the following web site for more details:
http://www1.eere.energy.gov/buildings/appliance_standards/residential/battery_external.html

2.11.4.2 Requirements for Canada

Definitions

External Power Supply (EPS) means a power supply device that

a) is designed to convert line voltage AC input to a lower voltage DC or AC output,
b) is able to convert to only one DC or AC output voltage at a time,
c) is designed to be used with a household or office end-use product that constitutes the primary load,
d) is encased in an enclosure separated from that end-use product and is connected to that product by an electrical connection, and
e) has a nominal output power of 250 W or less.

An EPS does not include a device

a) that powers the charger of a detachable battery pack of an end-use product,
b) that charges the battery of an end-use product that is fully or primarily motor operated,
c) that is an accessory to a medical device as defined in section 1 of Canada Medical Devices Regulations, or
d) that is a power sourcing equipment as defined in IEEE 802.3-2008 Standard for Information Technology – Telecommunications and Information Exchange Between Systems.

The scope is limited to EPSs designed for household and office end-use products.

Replacement External Power Supply means an external power supply that

a. is marked for replacement of a specified end-use product that was manufactured before July 1, 2010, and
b. is imported or shipped in quantities of less than fifty units.

Security External Power Supply is an EPS that is manufactured before July 1, 2017 and

a) is designed to convert line voltage ac input into lower voltage ac output,
b) has a nominal output power of 20 W or more, and

c) is designed for and marketed with equipment that operates continuously in on mode to perform any of the following principal functions:
   i. monitor, detect, record or provide notification of any intrusion on or access to real property or physical assets or notification of threats to personal safety resulting from that intrusion or access,
   ii. deter or control access to real property or physical assets or prevent the unauthorized removal of physical assets, or
   iii. monitor, detect, record or provide notification of any physical threats to real property, physical assets or personal safety, including fire, gas, smoke and flooding.

A Security EPS does not include an EPS for equipment that is designed and marketed with a built-in alarm or theft deterrent feature if the equipment's principal functions are not any of the functions mentioned above. There is an exemption for no-load power requirements for Security EPSs manufactured before July 1, 2017. See regulation for more details.

Requirements
External power supplies must meet the following requirements (not applicable to replacement EPS manufactured before July 1, 2013)

Table 26: EPS Efficiency Requirement for Canada		
External Power Supply Energy Efficiency Standard		
Nameplate output (nominal power Ln)	**Minimum average efficiency in active mode** (decimal equivalent of a percentage)	**Maximum power in no-load mode** (not applicable to security EPS)
<1 watt	0.5 *Ln (nameplate output)	0.5 watt
≥1 watt and ≤51 watts	0.09*Ln (nameplate output) + 0.5	0.5 watt
>51 watts	0.85	0.5 watt

Verification Requirements
The EPS must bear a verification mark indicating that the energy efficiency reporting requirements have been verified. The verification mark is the mark of a Standards Council of Canada (SCC) accredited certification body that administers an energy performance verification program for EPSs. The use of the Roman numeral IV is accepted as an alternative to the energy efficiency verification mark for EPSs if:

- the Roman numeral is clearly indicated on the product according to the ENERGY STAR® protocol, and
- the product performance is initially verified by an SCC accredited certification organization offering an EPS energy efficiency verification program.

Additional information about the ENERGY STAR® protocol can be found at http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/International_Efficiency_Marking_Protocol.pdf

A model number must be clearly marked on the product which can be traced to the certification body's energy performance verification. This certification must be provided to Lenovo. The manufacturer or the dealer of the External Power Supply must submit to Natural Resources Canada an energy efficiency report, which must include:

a) product name,
b) manufacturer name,
c) brand name,
d) model number,
e) nominal output, in volts, at highest and lowest output setting,
f) nominal output, in watts, at highest and lowest output setting, if applicable,
g) whether the output is AC or DC,
h) the average efficiency at highest and lowest output setting,
i) no load power in watts,
j) whether it is a replacement external power supply or a security EPS,
k) if a replacement EPS or a security EPS, the end-use equipment and the brand and model number of that equipment,
l) roman numeral mark, if applicable,
m) whether the product bears a verification mark
n) name of the certification body associated with verifying the Roman numeral mark or that authorized the verification mark that appears on the product.

A dealer who imports external power supplies into Canada must include on the customs release document:

a) product name (i.e., EPS)
b) model number
c) brand name
d) address of the dealer importing the product
e) purpose for which the product is being imported (e.g., for sale of lease in Canada without modification)

Replacement EPSs, which meet the definition above are exempt from MEPS until July 1, 2013, however, they must be registered prior to and reported at the time of import. Initial registration does not need to include an efficiency report, or any of the electrical parameters that would be required for production hardware. See the reporting requirements above for EPSs, the required elements for Replacement EPSs would include items (a) through (d) and (i) through (k).

2.11.4.3 Requirements for Korea

Definitions

Adapter – A single voltage external power supply (AC-DC or AC-AC) under 150 W (nameplate output power) without any charging function.

Charger – Single voltage external power supply (AC-DC) with charging function to charge a lithium ion battery and has an input of 20W.

Requirements

Adapters (external power supply without charging) shall meet the requirements found in the table below.

Table 27. Minimum Energy Performance Standards for Adapters	
Minimum Energy Performance Standards (MEPS)	
Output power on name plate (P_{no})	**Running Efficiency (On mode energy efficiency)**
$0<P_{no}<1W$	$>0.49 \times P_{no}$
$1W<P_{no}<49W$	$>[0.09 \times Ln(P_{no})] + 0.49$
$49W<P_{no}<150W$	>0.84

Output power on name plate (P_{no})	**Maximum Standby Power (Power consumption on No-Load Mode)**
$0<P_{no}<10W$	<0.5W
$10W<P_{no}<150W$	<0.75W

Chargers (external power supply with charging function to charge Li-Ion Battery) must meet the requirements found in the table below.

Table 28. Minimum Energy Performance Standards for Chargers	
Minimum Energy Performance Standards (MEPS)	
$0<P_{in}<10W$	<0.5W
$10W<P_{in}<20W$	<0.75W

Adapters and Chargers must be tested and labeled in accordance with the Korean Regulation on Energy Efficiency Labeling and Standards, July 31, 2008. The required label is in the Figure below. The label shall be on the front or top of the product. Please note that “ABC-12345” represents the model number of the external power supply. If the model number is already shown on the unit, then the line text with the model number can be eliminated on this label. The KC mark does not need to be right next to the Korean text but does need to be on the front or top of the unit.

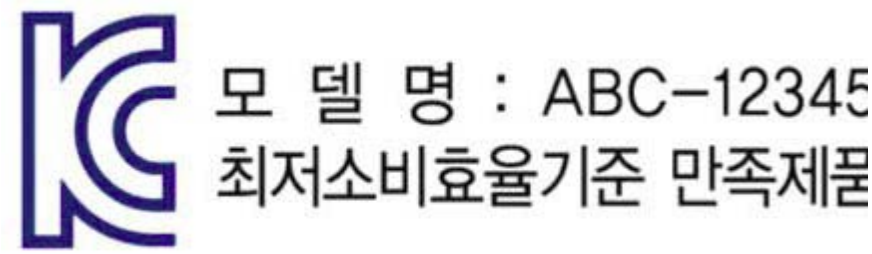


Figure 14. Korea Energy Label for Adapters and Chargers.

2.11.4.4 Requirements for the EU and Switzerland (Lot 7)

The section applies to external power supplies (EPSs) irrespective of the EMC classification of A or B. This section does not apply to uninterruptable power supplies (UPSs).

Definitions

External power supply - device which meets all of the following criteria:
1. It is designed to convert alternating current (AC) power input from the mains power source into lower voltage direct current (DC) or AC output;
2. It is able to convert to only one DC or AC output voltage at a time;
3. It is intended to be used with a separate device that constitutes the primary load;
4. It is contained in a physical enclosure separate from the device that constitutes the primary load;
5. It is connected to the device that constitutes the primary load via a removable or hard-wired male/ female electrical connection, cable, cord or other wiring;
6. It has nameplate output power not exceeding 250 Watts;
7. It is intended for use with electrical and electronic household and office equipment as referred to in EU Regulation (EC) No 1275/ 2008 Article 2(1).

Requirements

External power supplies must meet the following requirements (effective April 2010):
1. The no-load condition power consumption shall not exceed 0.50 W
2. The average active efficiency shall be not less than:
a. 0.500 * P_O, for P_O < 1.0 W;
b. 0.090 * Ln(P_O) + 0.500, for 1.0 W < P_O < 51.0 W;
c. 0.850 for P_O > 51.0 W.

1. The no-load condition power consumption shall not exceed the following limits (effective April 2011):

	AC-AC EPSs, except low voltage EPSs	**AC-DC EPSs except low voltage EPSs**	**Low voltage EPSs**
P_O < 51.0 W	0.50 W	0.30 W	0.30 W
P_O > 51.0 W	0.50 W	0.50 W	Not Applicable

2. The average active efficiency shall be not less than the following limits:

	AC-AC and AC-DC EPSs, except low voltage EPSs	**Low voltage EPSs**
P_O < 1.0 W	0.480 x P_O + 0.140	0.497 x P_O + 0.067
1.0 W < P_O < 51.0 W	0.0626 x Ln(P_O) + 0.622	0.075 x Ln(P_O) + 0.561
P_O > 51.0 W	0.870	0.860

The product must be marked with the CE conformity marking. See Figure 13. The CE mark must have a height of at least 5 mm. The CE marking must be affixed to the EPS. Where this is not possible, it must be affixed to the packaging and to the accompanying documents.

The following technical documents must be provided to Lenovo:
1. Declaration of Conformity (DoC) to EU Regulation 1275/2008 as required by EU Directive 2005/32/EC. The DoC must include:
i. Name and address of the manufacturer or of its authorized representative;
ii. A description of the model sufficient for unambiguous identification;
iii. Where appropriate, the references of the harmonized standards applied;
iv. Where appropriate, the other technical standards and specifications used;
v. Where appropriate, the reference to other EU Community legislation providing for the affixing of the CE mark that is applied;
vi. Identification and signature of the person empowered to bind the manufacturer or its authorized representative.

2. The technical documentation showing efficiency data must be provided. The technical documentation must meet the requirements of Annexes I and II of EU Commission Regulation No 278/2009 and Switzerland Energy Regulation Appendix 2:11.

EPSs which are packaged as service or spare parts must clearly indicate the primary load product for which the EPS is intended to be used with.

2.11.4.5 Requirements for China

External Power Supplies shall meet the energy efficiency requirements of Sections 4.1 in the National Standard of the People's Republic of China GB 20943-2013. This standard is applicable to product with rated output power lower than or equal to 250W. This standard is NOT applicable to product used for industrial equipment, medical device and others with special functions.

Energy Efficiency Requirements

External Power Supplies manufactured after Sep. 1st, 2014 must meet table 28's and table 29's requirements of the National Standard of the People's Republic of China GB 20943-2013. See table 28 and table 29 in this section.

Table 29. Minimum Average Energy Efficiency Requirements for EPS

Rated Power	**Product Classification**	**Minimum Average Efficiency**
$0 < P_O \leq 1W$	Rated Voltage < 6V and Rated Current≥550mA	$0.497 \times P_O + 0.067$
	Others	$0.480 \times P_O + 0.140$
$1W < P_O \leq 49W$	Rated Voltage < 6V and Rated Current≥550mA	$0.0750 \times \ln(P_O) + 0.561$
	Others	$0.0626 \times \ln(P_O) + 0.622$

49 < P_O ≤ 250W	Rated Voltage < 6V and Rated Current≥550mA	0.86
	Others	0.87

Table 30. Minimum Average Energy Efficiency Requirements of No-Load model for EPS

Rated Power	No load power	
0 < P_O < 50W	AC output	0.5
	DC output	0.3
50W ≤ P_O ≤ 250W	0.5	

2.11.4.6 Battery Chargers (including Battery Back-up Units and Uninterruptible Power Supplies)

Requirements for California, Oregon, Canada and British Columbia

References

California Energy Commission (CEC) Appliance Efficiency Regulations.
California Regulatory Advisory Backup Battery Charger Systems October 31, 2018
Oregon Act relating to minimum energy efficiency standards
Oregon House Bill 3025 Enrolled Relating to energy efficiency standards for battery charger systems, amending Oregon Revised Statutes (ORS) 469.229
Canada Energy Efficiency Regulations 2016, Amendment SOR/2018-201
Canada Standards Association (CSA) C381.2-17 Energy performance of battery-charging systems and uninterruptible power supplies
Notice from NRCan for Energy Efficiency Regulations
British Columbia Energy Efficiency Act, Standards for Small Battery Charging Systems
British Columbia Regulatory Bulletin Energy Efficiency Standards Regulation Amendment March 2018

Battery Chargers: California

The California Appliance Efficiency Regulations (California Code of Regulations [CCR], Title 20, Sections 1601 to 1609) contain definitions, test methods, energy efficiency standards, certification requirements, and marking requirements for state-regulated battery charger systems and federally regulated battery chargers. The California Energy Commission has modified these regulations to align the state requirements with the U.S. Department of Energy's requirements for these products. (See Docket #18-AAER-02 [Appliance Efficiency Standards Rulemaking for Portable Electric Spas and Battery Chargers]; Docket #18-AAER-10 [Amendments to Title 20 Appliance Efficiency Regulations Rulemaking].)

This regulatory advisory applies to two types of products:

1. Federally regulated battery chargers are battery chargers manufactured on or after June 13, 2018, to which a federal efficiency standard applies. A federally regulated battery charger is

defined as, “a device that charges batteries for consumer products, including battery chargers embedded in other consumer products.” (10 C.F.R. § 430.2; see also 10 C.F.R. § 430.32(z) for efficiency standards.) Examples include cell phone battery chargers, electric toothbrush battery chargers (wet-inductive), and power tool battery chargers. Under federal law, the date of manufacture means either the date of manufacture if manufactured in the United States, or the date of import into the United States.(10 C.F.R. § 430.2, definition of “manufacture.”)

2. State-regulated small battery charger systems are products meeting California’s definition for a “small battery charger system” and that are not federally regulated battery chargers. Examples include forklift battery chargers, dry-inductive battery chargers, and battery chargers for nonconsumer products. Small battery charger systems are defined in Section 1602(w) of Title 20 of the CCR. This regulatory advisory is not applicable to state-regulated battery charger systems that are battery backups or non-federally regulated uninterruptible power supplies.

Manufacturers may voluntarily certify federally regulated battery chargers to MAEDbS using the new appliance sub-type on or after June 13, 2018.

Beginning January 1, 2019, all federally regulated battery chargers must appear in MAEDbS to be lawful for sale or offer for sale in California. Products not included in the federal scope that meet the definition of a battery charger system will remain regulated as state-regulated battery charger systems and may be referred for enforcement if they are not certified to MAEDbS.

See California Energy Commission Appliance Efficiency Regulations for more details, including further definitions and effective dates. Web site is at http://www.energy.ca.gov/appliances/. Some effective dates are referenced later in this section.

Definitions

À la carte charger means a battery charger that is individually packaged without batteries. À la carte chargers include those with multi‐voltage or multi‐port capability.

Battery or battery pack means an assembly of one or more rechargeable cells intended to provide electrical energy to a product, and may be in one of the following forms: (a) detachable battery: a battery that is contained in a separate enclosure from the product and is intended to be removed or disconnected from the product for recharging; or (b) integral battery: a battery that is contained within the product and is not removed from the product for charging purposes.

Battery backup or uninterruptible power supply charger (UPS) means a small battery charger system that is voltage and frequency dependent (VFD) and designed to provide power to an end use product in the event of a power outage, and includes a UPS as defined in IEC 62040‐3 ed.2.0. The output of the VFD upon which the UPS is dependent changes in AC input voltage and frequency and is not intended to provide additional corrective functions, such as those relating to the use of tapped transformers.

Battery charger system (BCS) means a battery charger coupled with its batteries or battery chargers coupled with their batteries, which together are referred to as battery charger systems. This term covers all rechargeable batteries or devices incorporating a rechargeable battery and the chargers used with them. Battery charger systems include, but are not limited to:

1) electronic devices with a battery that are normally charged from ac line voltage or dc input voltage through an internal or external power supply and a dedicated battery charger;
2) the battery and battery charger components of devices that are designed to run on battery power during part or all of their operations;
3) dedicated battery systems primarily designed for electrical or emergency backup; and
4) devices whose primary function is to charge batteries, along with the batteries they are designed to charge. These units include chargers for power tool batteries and chargers for automotive, AA, AAA, C, D, or 9 V rechargeable batteries, as well as chargers for batteries used in larger industrial motive equipment and à la carte chargers. The charging circuitry of battery charger systems may or may not be located within the housing of the end-use device itself. In many cases, the battery may be charged with a dedicated external charger and power supply combination that is separate from the device that runs on power from the battery.

Except those:

1) used to charge a motor vehicle that is powered by an electric motor drawing current from rechargeable storage batteries, fuel cells, or other portable sources of electrical current, and which may include a nonelectrical source of power designed to charge batteries and components thereof. This exception does not apply to autoettes, electric personal assistive mobility devices, golf carts, or low speed vehicles, as those vehicles are defined in Division 1 of the California Vehicle Code;
2) that are classified as Class II or Class III devices for human use under the Federal Food, Drug, and Cosmetic Act and require U.S. Food and Drug Administration listing and approval as a medical device;
3) used to charge a battery or batteries in an illuminated exit sign, as defined in Section 1602(l);
4) with input that is three phase of line ‑ to ‑ line 300 volts root mean square or more and is designed for a stationary power application;
5) that are battery analyzers; or
6) that are voltage independent or voltage and frequency independent uninterruptible power supplies (UPS) as defined by International Electrotechnical Commission (IEC) 62040 ‑ 3 ed.2.0.

Inductive charger system means a small battery charger system that transfers power to the charger through magnetic or electric induction.

Large battery charger system means a battery charger system (other than a battery charger system for golf carts) with a rated input power of more than 2 kW.

Small battery charger system means a battery charger system with a rated input power of 2 kW or less, and includes golf cart battery charger systems regardless of the output power.

USB charger system means a small battery charger system that uses a Universal Serial Bus (USB) connector as the only power source to charge the battery, and is packaged with an external power supply rated with a voltage output of 5 volts and a power output of 15 watts or less.

Definitions (Canada)
Backup battery charger means a device that (a) is incorporated into an end-use product, including a device that is incorporated into an uninterruptible power supply or that uses an external power supply, that is designed to operate continuously using mains power; and (b) recharges a battery that is used to maintain the continuity of electrical power to the end use product such that the product can continue its full or partial operation in the event of a failure of mains power.

Battery charger means a device that charges the battery of a wheelchair, golf cart, low speed vehicle or any other end-use product. It does not include any of the following:
(a) a device that charges the battery of a vehicle other than a wheelchair, golf cart or low speed vehicle;
(b) a device that charges the battery of a medical device;
(c) a wireless battery charger, other than a wireless battery charger that is inductive and designed for wet environments; or
(d) a backup battery charger.

Battery Charger is a device that charges batteries for consumer products, including battery chargers embedded in other consumer products. [Source: CSA C381.2-17 Energy Performance of battery-charging systems and uninterruptible power supplies]

Requirements
Large Battery Charger Systems manufactured on or after January 1, 2014 shall meet the performance values in:

1. Table W-1 of the CEC Appliance Energy Regulation.
2. ORS 469.233 Section 10, chapter 418, 19(a), updated 2015.

Table W - 1
Standards for Large Battery Charger Systems

Performance Parameter		Standard
Charge Return Factor (CRF)	100 percent, 80 percent Depth of discharge	CRF≤ 1.10
	40 percent Depth of discharge	CRF ≤ 1.15

Power Conversion Efficiency	Greater than or equal to: 89 percent
Power Factor	Greater than or equal to: 0.90
Maintenance Mode Power (Eb = battery capacity of tested battery)	Less than or equal to: 10 + 0.0012Eb W
No Battery Mode Power	Less than or equal to: 10 W

The following Small Battery Charger Systems shall meet the applicable performance values in Table W-2 of the California Energy Commission Appliance Efficiency Regulations:

- consumer products that are not USB charger systems with a battery capacity of 20 watt‐hours or more, and are manufactured on or after February 1, 2013;
- consumer products that are USB charger systems with a battery capacity of 20 watt‐hours or more and are manufactured on or after January 1, 2014; and
- those that are not consumer products and are manufactured on or after January 1, 2017.

Exceptions to these Small Battery Charger requirements are à la carte charger that are:

a) provided separately from and subsequent to the sale of a small battery charger system manufactured before the effective date of the applicable standard in Section 1605.3(w)(2);
b) necessary as a replacement for, or as a replacement component of, such small battery charger system;
c) is provided by a manufacturer directly to a consumer or to a service or repair facility; and is manufactured no more than five years after the effective date in Section 1605.3(w)(2) applicable to the particular small battery charger system for which the à la carte charger is intended as a replacement or replacement component. These chargers shall not be required to meet the applicable standard in Section 1605.3(w)(2) and Table W‐2.14 of the California regulations.

Table W‐2
Standards for Small Battery Charger Systems

Performance Parameter	Standard
Maximum 24 hour charge and maintenance energy (Wh) (Eb = capacity of all batteries in ports and N = number of charger ports)	For Eb of 2.5 Wh or less: 16 × N
	For Eb greater than 2.5 Wh and less than or equal to 100 Wh: 12 x N +1.6Eb
	For Eb greater than 100 Wh and less than or equal to

	1000 Wh: 22 x N+1.5Eb
	For Eb greater than 1000 Wh: 36.4 x N +1.486Eb
Maintenance Mode Power and No Battery Mode Power (W) (Eb = capacity of all batteries in ports and N = number of charger ports)	The sum of maintenance mode power and no battery mode power must be less than or equal to: 1x N+0.0021xEb Watts

Inductive charger systems manufactured on or after February 1, 2013, shall meet either the applicable performance standards in Table W-2 or shall use less than 1 watt in maintenance mode, less than 1 watt in no battery mode, and an average of 1 watt or less over the duration of the charge and maintenance mode test.

Battery Backup and Uninterruptible Power Supplies manufactured on or after February 1, 2013, for consumer products and January 1, 2017, for products that are not consumer products shall consume no more than 0.8+0.0021 x Eb watts in maintenance mode where Eb is the battery capacity in watt‐hours.

The appliances must be tested in accordance with Sections 1603 and 1604 of the California Energy Commission Appliance Efficiency Regulations at an approved test laboratory or an approved industry certification program.

Battery chargers in scope of these requirements must be certified in the California Energy Commission's Modernized Appliance Efficiency Database System (MAEDBS). In Docket #18-AAER-02, the Energy Commission adopted regulatory changes to modify the marking requirements for battery chargers to require that only state-regulated battery charger systems be marked with a "BC" inside of a circle. Federally regulated battery chargers become covered by the U.S. Department of Energy on June 13, 2018; however, the Energy Commission anticipates that the changes to the California regulations will not take effect until October 1, 2018, after they are approved by the Office of Administrative Law. Therefore, Energy Commission staff will not refer for enforcement federally regulated battery chargers manufactured on or after June 13, 2018, that are not marked with a (BC).

State-regulated battery charger systems must continue to comply with the requirement to mark the device with a "BC" inside of a circle, as required under Section 1607(d)(10) of Title 20 of the CCR.

For British Columbia (BC): Products manufactured on or after June 2, 2018, are exempt from the energy efficiency verification label requirement including verification by the designated tester that the product meets the efficiency standard. The label exemption allows products which are compliant

with the US Department of Energy (DOE) standards to be imported into BC without additional third-party testing. The BC energy device categories (product classes) and corresponding efficiency standard (maximum Unit Energy Consumption) are aligned with the US DOE battery charger standard (10 CFR 430.32 (z)). The testing procedure for all product categories is CSA C381.2-17 which is aligned with the U.S. DOE test standard (US CFR Title 10, Part 430, Subpart B, Appendix Y).

For Canada (requirements apply to battery chargers manufactured on or after June 13, 2019):

A battery charger must have a unit energy consumption (UEC) that is less than or equal to that set out for the battery charger's product class in Table C.1 of CSA C381.2-17. Canada has adopted the definition for battery chargers as listed in CSA C381.2-17. See definition above.

Information, as listed in the Canada Energy Regulation must be submitted to the respective Canadian minister –

a) its product class;
b) its rated battery energy (E), expressed in watt-hours;
c) its unit energy consumption expressed in kilowatt-hours per year;
d) its power, expressed in watts, when it is in active mode, maintenance mode and standby mode, respectively; and
e) if an external power supply was used to test the battery charger, the power supply's model number and the name of its manufacturer

Labeling

The labeling and marking requirements apply to all products that are within the scope of the adopted regulation. The requirements are that the marking be legible and permanently affixed. There are no specific size, font, or color requirements as long as the marking is legible. An example of an acceptable mark is shown below:

Placement of the mark should go either on the product (i.e., nameplate) or the product packaging and the front page of the publication.

Effective dates of this regulation vary, please see regulation for details.
https://www.energy.ca.gov/appliances/documents/2018-06-07_Battery_Chargers_Advisory.pdf

Requirements for Battery Chargers for USA (US DOE)

References

US 10 CFR Part 430 Energy Conservation Standards for Battery Chargers

See regulations for additional definitions, requirements, effective dates, and updates.
https://www.regulations.gov/document?D=EERE-2008-BT-STD-0005-0256

Definitions
Battery charger means a device that charges batteries for consumer products, including battery chargers embedded in other consumer products.

Consumer product means any article (other than an automobile, as defined in Section 501(1) of the Motor Vehicle Information and Cost Savings Act):
(1) Of a type—
(i) Which in operation consumes, or is designed to consume, energy or, with respect to showerheads, faucets, water closets, and urinals, water; and
(ii) Which, to any significant extent, is distributed in commerce for personal use or consumption by individuals;
(2) Without regard to whether such article of such type is in fact distributed in commerce for personal use or consumption by an individual, except that such term includes fluorescent lamp ballasts, general service fluorescent lamps, incandescent reflector lamps, showerheads, faucets, water closets, and urinals distributed in commerce for personal or commercial use or consumption.

Requirements
Battery chargers manufactured on or after June 13, 2018, must have a unit energy consumption (UEC) less than or equal to the prescribed ‘‘Maximum UEC’’ standard when using the equations for the appropriate product class and corresponding rated battery energy as shown in the following table:

DOE § 430.32(z)(1)[7]				
[PC]	Product Class ("PC") Description	Rated Battery Energy (Ebatt**)	Special Characteristic or Battery Voltage	Maximum UEC (kWh/yr) (as a function of Ebatt**)
1	Low-Energy	≤ 5 Wh	Inductive Connection*	3.04
2	Low-Energy, Low-Voltage	< 100 Wh	< 4 V	.1440 * Ebatt + 2.95
3	Low-Energy, Medium-Voltage		4-10 V	For Ebatt < 10 Wh, 1.42 kWh/y Ebatt ≥ 10 Wh, .0255 * Ebatt + 1.16
4	Low-Energy, High-Voltage		> 10 V	.11 * Ebatt + 3.18
5	Medium-Energy, Low Voltage	100 – 3000 Wh	< 20 V	.0257 * Ebatt + .815
6	Medium-Energy, High- Voltage		≥ 20 V	.0778 * Ebatt + 2.4
7	High Energy	> 3000 Wh	-	.0502 * Ebatt + 4.53

2.11.5 Requirements for Austrailia and New Zealand

2.11.5.1 Minimum Energy Performance Standards: Computer and Monitors

Minimum Energy Performance Standards (MEPS) for computers and Monitors will be implemented on October 1, 2013 in Australia and New Zealand.

Computers and Monitors must be registered on www.energyrating.gov.au before they are available for sale.

2.11.5.1.1 Computers

Requirements for computers

Computers must meet the requirements of the Standard AS/NZS 5813.2 and must be tested to the Standard AS/NZS 5813.1.

Standards can be purchased from www.standards.co.nz and www.saiglobal.com.

Non-compliant computer stock imported into, or manufactured in Australia and New Zealand before October 1, 2013 may continue to be sold. Second-hand sales are not covered by the Regulations.

The MEPS will cover all computers that are imported or manufactured in New Zealand for sale or hire, including:

- desktop computers

- notebooks
- small scale servers.

The following computers do not need to comply with MEPS:

- personal digital assistants (PDAs)
- palmtop computers and smartphones
- games consoles
- blade, slate or thin client computers
- workstations
- computers that are not connected to mains voltage or by external power supply.

Alternative requirements for small production runs
There will be "deemed-to-comply" provisions for computer models where less than 200 units are manufactured per year. The model must be registered on the energy rating website. However it will be exempt from typical energy consumption (TEC) requirements if it uses an internal power supply that meets the standard below, or an external power meeting the requirements of energy performance mark V.

AS/NZS 5814.1:2012 sets out Method of Measurement for internal power supplies.
AS/NZS 4665.1:2005 sets out the test method and energy performance mark for external power supplies.
There is no requirement to register the internal power supply, however it must qualify as an internal power supply that meets or exceeds:

85 per cent efficiency when tested at 20 per cent of rated power;
88 per cent efficiency when tested at 50 per cent of rated power;
85 per cent efficiency when tested at 100 per cent of rated power; and
power factor of 0.9 when tested at 100 per cent of rated power.

Labeling
There are no labeling requirements for computers.

How to register
All computers manufactured in or imported on or after October 1, 2013 must be registered.

More information on registering a computer is available at: www.energyrating.gov.au/programs/e3-program/energy-rating-labelling/submit/

A test report is not required to be submitted as part of the registration process. However, manufacturers or importers are required to provide a copy of the test report to the Regulator on request. For this reason it is recommended that an electronic copy of the test report be uploaded when making a registration application.

Instructions on the use of the on-line registration system are available at:
www.energyrating.gov.au/resources/program-publications/?viewPublicationID=2139

2.11.5.1.2 Monitors
Requirements for Monitors
Monitors must meet the requirements of the Standard AS/NZS 5815.2 and be tested to the Standard AS/NZS 5815.1.

Standards can be purchased from www.standards.co.nz or www.saiglobal.com.

The standards are intended to cover all computer monitors that are imported or manufactured in Australia and New Zealand for sale or hire, that are up to 152 cm (measured diagonally across).

Labeling

Monitors up to 76 cm across must comply with MEPS (in on-mode) and labeling.

Larger monitors (between 76 cm and 152 cm across) only need to display an energy rating label and meet standby levels (1W when off, 2W on standby).

* ***Electronic labelling (where the energy rating label appears as an image on the screen or in a video loop) is allowed but must be approved by the regulator.***

The following monitors will not need to comply with MEPS and labeling:

- Monitors larger than 152 cm across.
- Products with an integrated television tuner are classified as televisions and are already subject to MEPS and labelling.
- Electronic displays used exclusively for digital signage, advertising or digital picture frames.
- High performance or specialised electronic displays.
- Displays used in public settings.

How to register
All monitors manufactured in or imported on or after October 1, 2013 must be registered and be supplies with an energy rating label.

More information on registering a monitor is available at: www.energyrating.gov.au/programs/e3-program/energy-rating-labelling/submit/

A test report is not required to be submitted as part of the registration process. However, manufacturers or importers are required to provide a copy of the test report to the Regulator on

request. For this reason it is recommended that an electronic copy of the test report be uploaded when making a registration application.

Instructions on the use of the on-line registration system are available at:
www.energyrating.gov.au/resources/program-publications/?viewPublicationID=2139

2.11.6 Requirements for Mexico

2.11.6.1 Computers, Small Scale Servers, Servers, Storage Products, and peripherals

Requirements
Equipment and Appliances must contain, in a clear and visible manner, basic information (in Spanish) regarding:

1. The energy consumption per unit of time in operation;
2. The energy consumption in standby mode, per unit of time, if applicable.
3. The type of energy or power used, which should indicate the measurement units, unless by its operational nature, the type of power or energy is evidently identifiable, in which case it will not be necessary to include this requirement on the labeling;
4. Quantity of the good, product or service offered by the equipment per unit of energy consumed when applicable.

The manufacturer must submit the forms found in the Mexico Catalog of the Equipment and Apparatus for which the manufacturers, importers, distributors and sellers should provide information about power consumption and forms for providing information to the Mexico National Commission for Efficient Energy Use (CONUEE). A copy of this form must be supplied to Lenovo.

Products which do not meet the definition of Specialized products must be labeled (in Spanish) with the above energy consumption and quantity of service provided per unit of energy consumed.

Definitions
Equipment and Appliances means products cited in the Mexico Catalog of Equipment and Appliances, for which Manufacturers, Importers, Distributors and Marketers, must include information regarding their energy consumption.

Specialized products means equipment, spare parts, accessories and additions, that are not sold to the general public, but to a specific client due to its level of technical specialization, and which are set up considering the requirements and specifications of the customer; in addition, the entities requiring this kind of equipment shall previously get from their supplier(s) the features of any such equipment, including energy consumption.

2.11.6.2 EPS efficiency and labeling requirements (NOM 029-ENER-2017)

Scope

Covers external power supplies that are sold in the Mexican market by converting AC voltage to a single fixed DC voltage (or allowing the user to manually select different output voltages) with a maximum output power of 250W as a separate product or component of the end product.

Requirements

Must comply with the energy efficiency values for the active power mode and not surpass the power values in no-load mode, as indicated in the table below:

Classification according to the level of output voltage	Nominal output voltage in DC	With an output power (P_o)	Efficiency Level	Minimum energy efficiency level in active mode, greater than or equal to:	The maximum power limit in no-load mode, less than or equal to:
USB output voltage	5.0 V ± 0.25 V	Less than or equal to 1.0 W	V	0.497 x P_o + 0.067	0.30
			VI	0.517 x P_o + 0.087	0.10
		Greater than 1.0 W and less than or equal to 49.0 W	V	0.075 x [L_n (P_o)] + 0.561	0.30
			VI	0.0834 x [L_n (P_o)] - 0.0014 x P_o + 0.609	0.10
		Greater than 49.0 W and less than or equal to 250.0 W	V	0.86	0.50
			VI	0.87	0.21
Low output voltage	Less than 6.0 V	Less than or equal to1.0 W	V	0.497 x P_o + 0.067	0.30
			VI	0.517 x P_o + 0.087	0.10
		Greater than 1.0 W less than or equal to 49.0 W	V	0.075 x [L_n (P_o)] + 0.561	0.30
			VI	0.0834 x [L_n (P_o)] - 0.0014 x Po + 0.609	0.10
		Greater than 49.0 W and less than or equal to 250.0 W	V	0.86	0.50
			VI	0.87	0.21
Generic output voltage	Greater than or equal to 6.0 V	Less than or equal to 1.0 W	V	0.480 x P_o + 0.140	0.30
			VI	0.5 x P_o + 0.16	0.10
		Greater than 1.0 W less than or equal to 49.0 W	V	0.0626 x [L_n (P_o)] + 0.622	0.30
			VI	0.071 x (L_n (P_o)) - 0.0014 x Po + 0.67	0.10
		Greater than 49.0 W and less than or equal to 250.0 W	V	0.87	0.50
			VI	0.88	0.21

Marking

All external power supplies in scope of the Mexican Official Standard must be marked on the body of the product or with a legible and indelible data plate with the data listed below. It must be adhered or mechanically attached to the enclosure or housing on the main body of the external power supply in a visible place. The minimum information that the marking of the external power supply must have is:

- Name of the manufacturer or distributor, or a logo or registered trademark;

- Model or commercial identification designated by the manufacturer or distributor and used for commercial identification;
- Electrical data, nominal input voltage, and frequency.
- Marking of energy efficiency level V or VI, in roman numbers; (as appropriate);
- Nominal electrical data of the electrical output voltage, electrical power and/or the electric current output intensity.

The mark must be indelible and legible after manual rubbing of the mark for fifteen seconds with a rag soaked in water. The data plate must be made of a material that permanently guarantees the legibility of the information, and that does not become degraded over time under normal environmental conditions.

External power supplies in scope of this Mexican Official Standard that are directly sold to the public, individually, that is, not as a piece or accessory of a product for end-use, must bear the information as listed below. This label is additional to the marking that must be done as listed above. The information can be imprinted or affixed, or placed on the product, or packaging or instructions or user manuals, or in the regulatory information included with the product. The energy efficiency information must contain the following, as a minimum, in a legible and indelible manner. (Please see Exemption entry in this Section for additional exempted EPS information.)

Label information:
ENERGY EFFICIENCY, in capital letters.
Complies with NOM-029-ENER-2017
Level of energy efficiency V or VI, in Roman numbers.

Below is an example of a label in accordance with this standard. The label must be written in Spanish.

Exemptions
This Mexican Official Standard NOM 029-ENER-2017 does not apply to external power supplies:

a) That are designed to deliver an output AC electrical voltage;
b) That are equipped with some type of battery or battery pack (including removable ones) that is physically connected to the power supply;
c) That are equipped with switch for choosing the battery type (or chemical) and an indicator light or meter that shows a battery's charge status (a product with a built-in selector switch for battery types and a meter that shows the status of the battery charge);
d) Designed for special uses that are part of the equipment and apparatus that are not sold directly to the public, and that are marketed towards business users or institutions that install

or operate the equipment directly, or share responsibility with the supplier, in accordance with the technical features and specifications that have been presented and authorized by the Department that issues this standard.

2.11.7 Switches

2.11.7.1 Requirements for Japan

These requirements are from Japan Ordinance No. 39 of the Ministry of Economy, Trade and Industry (METI) amending the Japan Enforcement Regulation of the Law Concerning the Rational Use of Energy. English translation is not yet available from the Japan Ministry.

Definitions

Switch – Switching apparatus specified by a Cabinet Order set forth in Paragraph 1 of Article 78 of the Law shall be defined in Article 21 in Enforcement Ordinance of the Law Concerning the Rational Use of Energy as below:
(xxiii) Switching apparatus (referring to apparatus which transmit and receive telecommunication signals and are capable of selecting, in the transmission of telecommunication signals, such a path as is provided for in the preceding item (i) for each destination from among a plurality of paths through which the said apparatus may
transmit telecommunication signals and of transmitting telecommunication signals to each destination through the said path selected (limited to such apparatus used exclusively for telecommunications via the Internet, excluding those capable of wireless communications and other matters specified by an Ordinance of the METI)).

The exclusion from application for switching apparatus prescribed by an Ordinance of the METI as set forth in Article 21, item (xxiii) of the Enforcement Order shall be as follows:
(i) Those which do not transmit or exchange any Ethernet frames;
(ii) Those which transmit and exchange Internet Protocol packets;
(iii) Those with connection ports for transmitting and/or receiving telecommunications signals, half or more of which use a two-wire connection mode;
(iv) Those designed to be capable of being incorporated into items such as a housing or computer;
(v) Those intended to control a device that wirelessly relays telecommunication signals;
(vi) Those intended mainly for use as a power supply, as specified by the Minister of Economy, Trade and Industry.

Requirements

Switch suppliers must provide to Lenovo the following information with respect to the energy efficiency ratio of an applicable Switch in order to meet the Japanese Energy Savings law:
(a) Product names, including manufacturer’s name,
(b) Category letter and the Standard Energy Efficiency Ration,
(c) Line speed for a port during measurement and the number of ports per line speed,
(d) Maximum effective transmission speed at a frame length of 1,518 bytes, (e) Maximum supply capability achieved by Power over Ethernet (limited to Switches with the Power over
Ethernet function), and

(f) Energy efficiency ratio.
The above information must be included in a prominent location in a product catalog where either the performance of the Switch is indicated or in a document used for the selection of a Switch.

Requirements for the EU and other CE Marking jurisdictions
References
EU Commission Regulation No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment
EU Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products
Jordan JSNO 2090/2013 Technical Regulation on eco-design requirements for energy related products
Jordan JSNO 2109/2013 Technical Regulation on eco-design requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment

2.11.8 Routers
Requirements for Japan
These requirements are from Japan Ordinance No. 39 of the METI amending the Japan Enforcement Regulation of the Law Concerning the Rational Use of Energy. English translation is not yet available from the Japan Ministry.

Definitions
Router – Router apparatus specified by a Cabinet Order set forth in Paragraph 1 of Article 78 of the Law shall be defined in Article 21 in Enforcement Ordinance of the Law Concerning the Rational Use of Energy as below:
(xxii) Routing apparatus (referring to apparatus which transmit and receive telecommunication signals and are capable of identifying, in the transmission of telecommunication signals, the path that is the most appropriate of the existing plurality of paths to the destination apparatus according to circumstances such as the conditions of the said paths, and of transmitting the said telecommunication signals through the said path identified as being the most appropriate (limited to such apparatus used exclusively for telecommunications transmission via the Internet, excluding those used for connecting a communication terminal to the Internet via a telephone line for the purpose of telephoning an Internet-access service provider to connect the said communication terminal to the Internet, and other matters specified by an Ordinance of the METI.))

Exclusions from application for the Routing apparatus prescribed by an Enforcement Regulation of the METI as set forth in Article 48, item (20) of the Enforcement regulations shall be as follows:
(i) Those which do not transmit or exchange Internet Protocol packets;
(ii) Those which transmit Internet Protocol packets at a speed, in terms of the maximum sum of signal bits of the said packets transmitted per unit time, in excess of 200 megabits per second (excluding those listed in item (vi));
(iii) Those equipped with a device intended for the use of Asynchronous Transfer Mode that cannot be easily removed;
(iv) Those with the capability to superimpose a high-frequency current of 10 kilohertz or higher upon

a power line;
(v) Those with connection ports for transmitting and/or receiving telecommunication signals, at least three of which (excluding such connection ports which use Internet Protocol) are intended for transmitting and/or receiving audio signals;
(vi) Those which wirelessly transmit Internet Protocol packets at a speed, in terms of the maximum sum of signal bits of the said packets transmitted per unit time, in excess of 100 megabits per second;
(vii) Those with the capability to use an artificial satellite;
(viii) Those with the capability to multiplex and then transmit 53 subcarriers or more by an orthogonal frequency division multiplex system;
(ix) Those with the capability to set up a virtual closed network;
(x) Those designed to be capable of being incorporated into items such as a computer.

Requirements
Router suppliers must provide Lenovo the following information with respect to the energy efficiency ratio of an applicable Router to meet the Japanese Energy Savings law:

(a) Product names, including manufacturer's name,
(b) Category letter and the Standard Energy Efficiency Ratio,
(c) Availability of 2.4 GHz band wireless output power (for Routers falling under category C, limited to cases of 2.4 GHz band wireless transmission only or of simultaneous transmission of waves of the two frequency bands),
(d) Availability of 5 GHz band wireless output power (for Routers falling under Category C, limited to cases of 5GHz band wireless transmission only or of simultaneous transmission of waves of the two frequency bands), and
(e) Energy efficiency ratio.

The above information must be included in a prominent location in a product catalog where either the performance of the Router is indicated or in a document used for the selection of a Router.

2.11.9 Servers and Data Storage Product Requirements for the EU

EU Working Document for the Consultation Forum on potential ecodesign requirements for servers and data storage products.

Definitions
Server - means a computing product that provides services and manages networked resources for client devices, such as desktop computers, notebook computers, desktop thin clients, internet protocol (IP) tele-phones, smart phones, tablets, telecommunication, automated systems or other servers. A server is typically placed on the market for use in data centers and office and corporate environments. A server is primarily accessed via network connections, and not through direct user input devices, such as a keyboard or a mouse; A server has the following characteristics:

(a) Is designed to support server operating systems (OS) and/or hypervisors, and targeted to run user-installed enterprise applications;
(b) Supports error-correcting code (ECC) and/or buffered memory (including both buffered dual in-line memory modules (DIMMs) and buffered on board (BOB) configurations);
(c) Is placed on the market with one or more power supplies;

(d) All processors have access to shared system memory and are independently visible to a single OS or hypervisor.

Data storage product - means a fully-functional storage system that supplies data storage services to clients and devices attached directly or through a network. Components and subsystems that are an integral part of the data storage product architecture (e.g., to provide internal communications between controllers and disks) are considered to be part of the data storage product. In contrast, components that are normally associated with a storage environment at the data center level (e.g. devices required for operation of an external storage area network) are not considered to be part of the data storage product. A data storage product may be composed of integrated storage controllers, data storage devices, embedded network elements, software, and other devices. A data storage product is a unique configuration of one or more stock keeping units, sold and marketed to the end user as a data storage product.

2.11.9.1 Specific ecodesign requirements for servers and data storage products

PSU efficiency and power factor requirements

From 1 January 2020, for Servers and Data storage products the internal PSU efficiency at 20%, 50% and 100% rated load level and the power factor at 50% rated load level shall not be less than the values reported in the Table below.

Minimum PSU efficiency and power factor requirements from 1 January 2019

	Minimum PSU efficiency				Minimum power factor
% of rated load	10%	20%	50%	100%	50%
Non redundant	-	90%	92%	89%	0.90
Redundant	-	88%	92%	88%	0.90

Material efficiency requirements

From 1 January 2019, manufacturers shall ensure that welding or firm gluing is not used as joining or sealing technique for the following types of components, when present:

(a) HDD and SSD
(b) Memory
(c) Processor (CPUs)
(d) Motherboard
(e) Chassis

(f) Expansion cards/graphic cards
(g) Power supply

Accessing components shall be ensured by documenting the sequence of dismantling operations needed to access the targeted components, including for each of these operations: type of operation, type and number of fastening technique(s) to be unlocked, and tool(s) required;

- From 1 January 2019, data deletion of potentially reusable data storage equipment (i.e. hard drives and solid state drives) shall be made possible by securing availability of built-in software based data deletion tool(s).
- From 1 January 2019, the latest version of firmware necessary for upgrading and to test the functionality and compatibility of different components in the server shall be made available.

2.11.9.2 Specific ecodesign requirements for servers with one or two processor sockets

Idle State Power
From 1 January 2019, the idle state power (P_{idle}) of servers shall not exceed the value calculated using the following equation:

$P_{idle} = P_{base}+P_{add\_i}$

Where P_{base} is the basic idle state power allowance in the first Table below, and P_{add_i} is the idle state power allowance for additional components, as determined is the second Table below.

Base idle state power allowances

Product type	Base idle state power allowance, P_{base} (W)
1-socket servers	37
1-socket resilient servers	130
2-socket servers	85
2-socket resilient servers	297
Blade or multi-node servers	105

2.11.9.3 Information to be provided by manufacturers

See detailed information in Annex II here.

Additional Idle Power Allowances for Extra Components

System characteristics	Applies to	Additional idle power allowance
Additional power supplies	Power supplies installed explicitly for power redundancy	10 W per power supply
Drives (HDD or SSD)	Per installed HDD and SSD	4.0 W per HDD and SSD
Additional memory	Installed memory greater than 4 GB	0.25 W per GB
Additional buffered DDR channel	Installed buffered DDR channels greater than 8 channels	4.0 W per buffered DDR channel
Additional I/O devices	Installed devices greater than two ports of ≥ 1 Gbit, onboard Ethernet	< 1 Gbit: No Allowance
		= 1 Gbit: 2.0 W / Active Port
		> 1 Gbit and < 10 Gbit: 4.0 W/ Active Port
		≥ 10 Gbit: 8.0 W/Active Port

2.11.10 Requirements for California
2.11.10.1 Computers

Scope/Requirements
Effective Date for Implementation: **January 1, 2019**

Desktop computers, thin clients, mobile gaming systems, portable all-in-ones, and notebook computers.

Comply with Table V-7

Energy Consumption Standards for Desktop Computers, Thin Clients, Notebook Computers, Mobile Gaming Systems, and Portable All-in-Ones

Computer Type	*For models manufactured on or after January 1, 2019, and before July 1, 2021, the measured annual energy consumption shall be less than or equal to the values below.*	*For models manufactured on or after July 1, 2021, the measured annual energy consumption shall be less than or equal to the values below.*
Desktop Computers, mobile gaming systems, and thin clients with an ES of 250 or less	50 kWh/yr + applicable adders in Table V-8	50 kWh/yr + applicable adders in Table V-8
Desktop Computers, mobile gaming systems, and thin clients with an ES of more than 250 but no more than 425	80 kWh/yr + applicable adders in Table V-8	60 kWh/yr + applicable adders in Table V-8
Desktop Computers, mobile gaming systems, and thin clients with an ES of more than 425 but no more than 690	100 kWh/yr + applicable adders in Table V-8	75 kWh/yr + applicable adders in Table V-8
Notebook computers and portable all-in-ones	30 kWh/yr + applicable adders in Table V-8	30 kWh/yr + applicable adders in Table V-8
Minimum power factor of a computer power supply that is not a federally-regulated external power supply	0.9 measured at full load	0.9 measured at full load

Be shipped with power management settings that do both of the following:

1) Transition the computer into either the computer sleep mode or computer off mode measured in Section 1604(v)(5) within 30 minutes of user inactivity. If the transition is to a computer sleep mode, that sleep mode shall either:

    a. Be a computer sleep mode as described in ACPI as S3; or

    b. Consume power less than or equal to the values shown in Table V-6.

2) Transition connected displays into sleep mode within 15 minutes of user inactivity.

    (c) If the model is shipped at the purchaser's request with either a limited capability operating system or without an operating system, or if the model is not capable of having an operating system, the model is not required to comply with Section 1605.3(v)(5)(B).

    (d) Desktop computers and thin clients assembled before July 1, 2021, entirely from parts manufactured before September 1, 2018, are not required to comply with Section 1605.3(v)(5)(A).

Alternative Computer Sleep Mode Power Limits

Computer Type	*Maximum Power Consumption (watts)*
Workstations, Mobile Workstations, High Expandability Computers, Small-Scale Servers	10 + 0.03 * C where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Desktop Computers, Thin Clients, Mobile Gaming Systems	5 + 0.03 * C where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Notebook Computers, Portable All-In-Ones	2.5 + 0.03 * C where C is the system memory capacity in gigabytes minus 16 gigabytes. If C is less than zero, use zero for the value of C. If a discrete GPU is present in the system, the maximum power consumption limit shall be increased by an additional 2 watts.

2.11.10.2 Monitors

Scope/Requirements for California, Washington, and Colorado

References
California Appliance Efficiency (CEC) Regulations – Appliance Efficiency Rulemaking for Computers, Computer Monitors, and Signage Displays. Regulation and details are located at: http://www.energy.ca.gov/
Washington Appliance Efficiency Standards Chapter 286, Laws of 2019
Colorado Revised Statutes Article 7.5 Water and Energy Efficiency Standards

Effective Date for Implementation (California): July 1, 2019

Requirements
Computer monitors manufactured on or after July 1, 2019, shall comply with the energy efficiency standards in CEC Appliance Efficiency Rulemaking for Computers, Computer Monitors, and Signage Displays in Section 1605.3 including Table V-4. Medical computer monitors are not required to comply with Section 1605.3(v)(4) or the test procedures in Section 1604(v)(4).

Manufacturers of Computer monitors, and Medical computer monitors must comply with the certification requirements in Section 1606 (Filing by Manufacturers with the State of California) for each of the products sold or offered for sale in California as well as the marking requirements in Section 1607 (manufacturer's name, model number and date of manufacture).

Rack mounted displays are out of scope of this regulation.

- shall comply with all of the following:

$E_{on} \leq (E_{on\_max} + E_{EP} + E_{Game} + E_{OLED} + E_{Curve})$

- E_{EP} is the enhanced performance display allowance in watts as determined in Table V-5,
- E_{Game} is the gaming monitor allowance in watts as determined in Table V-5,
- E_{OLED} is the OLED monitor allowance in watts as determined in Table V-5, and
- E_{Curve} is the curved monitor allowance in watts as determined in Table V-5.

Allowance	Computer Monitor Type	2019.07.01 ~ 2021.01.01	2021.01.01~
E_{EP}	Enhanced Performance Display with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors)	0.3 X E_{on_max}	0.2 X E_{on_max}
	Enhanced Performance Display with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors)	0.75 X E_{on_max}	0.6 X E_{on_max}
E_{Game}	Gaming Monitors without incremental hardware-based assistance	0.3 X E_{on_max}	0.2 X E_{on_max}
	Gaming Monitors with incremental hardware-based assistance	0.35 X E_{on_max}	0.3 X E_{on_max}
E_{OLED}	OLED monitor	0.3 X E_{on_max}	0.2 X E_{on_max}
E_{Curve}	Curved monitor	0.3 X E_{on_max}	0.2 X E_{on_max}
Touch functionality	1 watt allowance ***per mode*** in modes where touch functionality is enabled		

- shall comply with all of the following:
- (B) Consume less than or equal to 1.2 watts in computer monitor sleep mode and computer monitor off mode power combined.
- (C) Be shipped with a screen luminance less than or equal to 200 cd/m^2 ± 35 percent. A manufacturer may ship with additional features enabled, even if they were turned off in testing.
- (D) Computer monitors with touch screen capability are allowed an additional 1 watt allowance per mode in modes where touch functionality is enabled.
- shall comply with all of the following:
- (E) EXCEPTIONS to Section 1605.3(v)(4): The following computer monitors are not required to comply with Section 1605.3(v)(4) but shall comply with the test procedures in Section 1604(v)(4), the certification requirements in Section 1606, and the marking requirements in Section 1607:
  - 1. KVMs.
  - 2. KMMs.
  - 3. Very high performance monitors.
- (F) EXCEPTION to Section 1605.3(v)(4): Medical computer monitors are not required to comply with Section 1605.3(v)(4) or the test procedures in Section 1604(v)(4) but shall comply with the certification requirements in Section 1606 and the marking requirements in Section 1607.

The Computers and Displays regulations are in affect and can be referenced here (sections 1602, 1604, 1605.3, etc).

Requirements for the EU and other CE Marking jurisdictions
References
EU Commission Regulation No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment
EU Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products
Jordan JSNO 2090/2013 Technical Regulation on eco-design requirements for energy related products
Jordan JSNO 2109/2013 Technical Regulation on eco-design requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment

2.12 Environmental Notifications - Customer Hardware Publications

Customer Hardware Publications for Lenovo Logo Deliverable**s** must include specific Environmental Notices. Suppliers providing Lenovo with customer hardware publications must contact their Lenovo Procurement representative or the author of this specification for details.

3.0 Notification Procedures

If the Material, Part, or Product being supplied to Lenovo does not meet one or more of the applicable requirements in this ES, the supplier must immediately notify the Lenovo procurement representative. This also applies if the supplier or a subcontractor(s) makes changes in their operations that will cause a Material, Part, or Product to no longer comply with this ES. If any Material, Part, or Product contains any substances in applications restricted by **Tables 1 or 2**, or contains any mercury, suppliers must immediately report such information to their Lenovo procurement representative.

4.0 References

Argentina National Legislature Act 26184. Published 21 December 2006. Prohibitions on the manufacturing, assembly and importing of batteries and primary batteries.

Australian Ozone Protection and Synthetic Greenhouse Gas Management Act of 1989
http://www.environment.gov.au/atmosphere/ozone/legislation/commonwealthleg.html
Austrian Battery Ordinances 514/1990, as amended by BGB1 No. 3/1991(4 January, 1991) and BGB1.II Nol. 495/1999 (28 December 1999) of the Ordinance of Federal Ministry for Environment, Youth and Family.

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California Code of Regulations, title 22, division 4.5: Chapter 33. Best Management Practices for Perchlorate Materials.
Http://www.dtsc.ca.gov/LawsRegsPolicies/Title22/index.cfm

California Safe Drinking Water and Toxic Enforcement Act of 1986:
Http://www.oehha.org/prop65/law/P65law72003.html

Canada Prohibition of Certain Toxic Substances Regulations, 2005. Canadian Environmental Protection Act, 1999.
Http://laws.justice.gc.ca/en/showtdm/cr/SOR-2005-41//?showtoc=&instrumentnumber=SOR-2005-41

Connecticut Public Law 02-90, The Mercury Education and Reduction Act
http://www.ct.gov/dep/cwp/view.asp?a=2708&q=324028&depNav_GID=1638

Denmark Statutory Order no. 552 of 2 July 2002 Regulating Certain Industrial Greenhouse Gasses
http://glwww.mst.dk/homepage/

EU Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast)
http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:174:0088:0110:EN:PDF

EU Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)
(recast) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0038:0071:en:PDF

EU Commission Decision 2005/618/EC of 18 August 2005 amending Directive 2002/95/EC of the European Parliament and of the Council for the purpose of establishing the maximum concentration values for certain hazardous substances in electrical and electronic equipment.
Http://europa.eu.int/comm/environment/waste/weee_index.htm

EU Commission Decision 2005/717/EC of 13 October 2005 amending for the purposes of adapting to the technical progress the Annex to Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
Http://europa.eu.int/comm/environment/waste/weee_index.htm

EU Commission Decision 2005/747/EC of 21 October 2005 amending for the purposes of adapting to technical progress the Annex to Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
Http://europa.eu.int/comm/environment/waste/weee_index.htm

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Http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_037/l_03720030213en00190023.pdf

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Http://ec.europa.eu/environment/waste/weee/index_en.htm

EU Commission Directive 2006/122/ECOF of 12 December 2006 amending for the 30th time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (perfluorooctane sulfonates) http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2006:372:SOM:en:HTML

EU Council Directive 76/769/EEC, on the approximation of the laws, regulations and administrative provisions of the Member States relating to the restrictions on the marketing and use of dangerous substances and preparations
http://eur-lex.europa.eu/LexUriServ/site/en/consleg/1976/L/01976L0769-20030215-en.pdf

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Http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_266/l_26620060926en00010014.pdf

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Http://eur-lex.europa.eu/JOIndex.do?year=2006&serie=L&textfield2=396&Submit=Search

EU Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators
http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_266/l_26620060926en00010014.pdf

EU Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_396/l_39620061230en00010849.pdf

EU: Regulation (EC) No. 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.
http://eur-lex.europa.eu/LexUriServ/site/en/consleg/2000/R/02000R2037-20041224-en.pdf

EU Commission Directive 2006/122/ECOF of 12 December 2006 amending for the 30th time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain

dangerous substances and preparations (perfluorooctane sulfonates) http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2006:372:SOM:en:HTML

Florida Statutes Title XXIX, Chapter 403.7192 Batteries; requirements for consumer, manufacturers, and sellers.
Http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=Ch0403/SEC7192.HTM&Title=->2007->Ch0403->Section%207192#0403.7192

Lenovo Packaging Specification 41A0613 - Recyclable Packaging Materials, Selection and Identification
http://www.lenovo.com/global_procurement/us/en/Guidelines/Restrictions_and_Packaging.html

Lenovo Information for Suppliers web site:
http://www.lenovo.com/global_procurement/us/en/information_suppliers.html

Japan Ordinance No. 95 of the Ministry of Economy, Trade, and Industry under the Law for the Promotion of the Effective Utilization of Resources (Law No. 48, 1993 as amended, 2001).
Japan Law Concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures (Law No. 53 of May 20, 1988)

Japan's Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. (Act No. 117 of October 16,1973). This law is also called Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances or Chemical Substances Control Law. All substances covered in this law must be prohibited or restricted according to this law.
http://www.safe.nite.go.jp/jcheck/list6.action?category=211

Louisiana Mercury Risk Reduction Act of 2006
http://www.legis.state.la.us/billdata/streamdocument.asp?did=399136

Maine Public Law Chapter 296 Section 1. 38 MRSA 1609 An Act to Protect Pregnant Women and Children from Toxic Chemicals released into the home.
http://janus.state.me.us/legis/ros/lom/LOM123rd/PUBLIC296.asp

Maine Title 38, Chapter 24, Subchapter 4, 2165 Regulation of certain dry cell batteries
Http://janus.state.me.us/legis/statutes/38/title38sec2165.html

Maryland Title 6 of the Environment Code, Subtitle 11 Rechargeable Batteries, 6-1101 - 1114.
Http://www.dsd.state.md.us/comar/Annot_Code_Idx/EnvirIndex.htm

Minnesota Statutes 115A 9155 - Disposal of certain dry cell batteries. 115A 9157 - Rechargeable batteries and products.
Http://ros.leg.mn/revisor/pages/forms/getstatute.php

Netherlands, The, No. 553 Decree of 9 September 1998, comprising regulations regarding products containing mercury (Decree on Product Containing Mercury, 1998 Environmentally Hazardous Substances Act)
http://www2.vrom.nl/docs/internationaal/kwikbesluit_engels.pdf

Netherlands, The, 178 Besluit van 22 maart 2001, houdende vaststelling van het Warenwetbesluit formaldehyde in textiel.

New Jersey Dry Cell Battery Management Act; NJSA 12:1E-99.5 - 206
Http://lis.njleg.state.nj.us/cgi-bin/om_isapi.dll?clientID=27915686&depth=2&expandheadings=off&headingswithhits=on&infobase=statutes.nfo&softpage=TOC_Frame_Pg42

New York Battery Reduction and Elimination. New York State Consolidated Laws. Environmental Conservation
Http://caselaw.lp.findlaw.com/nycodes/c37/a125.html

Norway Product Control Regulation Chapter 2. Restricted Substances and Preparations
http://www.sft.no/seksjonsartikkel____30217.aspx

Organization for Economic Cooperation and Development. OECD ENV/JM/MONO(2006)15, 12 April 2006. Preliminary List of PFOS, PFAS, PFOA and Related Compounds and Chemicals that may degrade to PFCA.
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Http://www.aeanet.org/governmentaffairs/gajl_Packaging_GB18455_2001ENG.asp

People's Republic of China - Management Methods for Controlling Pollution by Electronic Information Products
Chinese: Http://www.mii.gov.cn/art/2006/03/02/art_521_7344.html
English: Http://www.aeanet.org/governmentaffairs/gabl_ChinaRoHS_FINAL_March2006.asp

People's Republic of China - Ministry of Information Industry - Electronic Information Products Classification and Explanation
Chinese: Http://www.mii.gov.cn/art/2006/03/16/art_1221_8441.html
English: Http://www.aeanet.org/governmentaffairs/gabl_HK_Art3_EIPTranslation.asp

People's Republic of China SJ/T 11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products
Http://www.aeanet.org/governmentaffairs/gajl_MCV_SJT11363_2006ENG.asp

People's Republic of China SJ/T 11364-2006 Marking for Control of Pollution Caused by Electronic Information Products

Http://www.aeanet.org/governmentaffairs/gajl_LABELING_SJT11364_2006ENG.asp

People's Republic of China SJ/T 11365-2006 Testing Methods for Toxic and Hazardous Substances in Electronic Information Products (draft version)
Http://www.aeanet.org/governmentaffairs/gajl_ChinaRoHS_TestingMethods_August2006.asp

Rhode Island Mercury Education and Reduction Act
http://www.rilin.state.ri.us/Statutes/TITLE23/23-24.9/INDEX.HTM

Sweden Mercury-containing Products (Certain) Ordinance (SFS 1991:1290)

Switzerland Ordinance on Risk Reduction related to Chemical Products (ORRChem)
Http://www.bafu.admin.ch/chemikalien/01410/01411/index.html?lang=en

United States Section 611 of the 1990 amendments of the Clean Air Act http://www.epa.gov/air/caa/

United States Mercury-Containing and Rechargeable Battery Management Act (Public Law 104-142)
http://www.epa.gov/epaoswer/hazwaste/state/policy/pl104.pdf

United States Toxic Substances Control Act; Occupational Safety and Health Act (29 CFR 1910.1001-1051)
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9696

Vermont Statutes Title 10. Chapter 159. Subchapter 1. 6621b. Regulation of dry cell batteries and 6621c Lead Acid Batteries; collection for recycling.
Http://www.leg.state.vt.us/statutes/sections.cfm?Title=10&Chapter=159

Washington, Revised Code, Title 70, Public Health and Safety. An Act relating to phasing out the use of polybrominated diphenyl ethers.
Http://www.leg.wa.gov/pub/billinfo/2007-08/Pdf/Bills/Session%20Law%202007/1024-S.SL.pdf

Australia/New Zealand Minimum Energy Performance Requirements for External Power Supplies
http://www.energyrating.gov.au/regulations/legislation/legislation-for-e3-under-gems/
http://www.energyrating.gov.au/regulations

United States Federal US statue 42 U.S.C. 6291(36), US Department of Energy rule for Certification, Compliance and Enforcement Requirements for Certain Consumer Products and Commercial and Industrial Equipment, 75 Federal Register Regulation 652

United States CA Code of Regulations, Title 20 Section 1601-1608

United States Oregon Minimum Energy Efficiency Standards for State-regulated appliances and equipment Canada Energy Efficiency Act, Energy Efficiency Regulations

Korea - Korean Regulation on Energy Efficiency Labeling and Standards, July 31, 2008.

European Union Commission Regulation EC No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies

ANNEXES: Detailed Chemical Lists with CAS Numbers

Unless specifically indicated as complete for the chemicals affected, these annex listings are not exhaustive.

Annex A. Asbestos

Asbestos	1332-21-4
Actinolite	77536-66-4
Amosite (Grunerite)	12172-73-5
Anthophyllite	77536-67-5
Chrysotile	12001-29-5
Crocidolite	12001-28-4
Tremolite	77536-68-6

Annex B. Azo colorants

Note: The EC azo dyes ban applies to:
1.) Certain azo colorants that by reductive cleavage of azo groups may release one of the following 22 aromatic amines, and 2.) The Azodye compound listed in the second table of this annex.

1. List of regulated aromatic amines	
biphenyl-4-ylamine	92-67-1
benzidine	92-87-5
4-chloro-o-toluidine	95-69-2
2-naphthylamine	91-59-8
o-aminoazotoluene	97-56-3
5-nitro-o-toluidine	99-55-8
4-chloroaniline	106-47-8
4-methoxy-m-phenylenediamine	615-05-4
4,4'-methylenedianiline	101-77-9
3,3'-dichlorobenzidine	91-94-1
3,3'-dimethoxybenzidine	119-90-4
3,3'-dimethylbenzidine	119-93-7
4,4'-methylenedi-o-toluidine	838-88-0
6-methoxy-m-toluidine	120-71-8
4,4'-methylene-bis(2-chloroaniline)	101-14-4
4,4'-oxydianiline	101-80-4
4,4'-thiodianiline	139-65-1
o-toluidine	95-53-4
4-methyl-m-phenylenediamine	95-80-7
2,4,5-trimethylaniline	137-17-7
o-anisidine	90-04-0
4-amino azobenzene	60-09-3
2. List of regulated azodyes	
mixture of Disodium- (6- (4- anisidino) -3- sulfonato -2- (3,5- dinitro- 2-oxidophenylazo) -1-naphtholato) (1- (5-chloro -2-oxidophenylazo) -2-naphtholato) chromate (1-); (molecular formula C39H23ClCrN7O12S.2Na); Trisodium bis (6- (4-anisidino) -3- sulfonato -2- (3,5- dinitro-2-oxidophenylazo) -1- naphtholato) chromate(1-) (molecular formula C46H30CrN10O20S2.3Na)	118685-33-9 Not available

Annex C. Halogenated aromatic substances

Polychlorinated biphenyls (PCB)(Note: PCBs are prohibited by other regulations, see PCBs in Table 1 and Annex H)	See Annex H

Halogenated diarylalkanes -	
Monomethyl tetrachloro diphenyl methane ade name: Ugilec 141	76253-60-6
Monomethyl dichloro diphenyl methane Trade name: Ugilec 121, Ugilec 21	81161-70-8
Monomethyl dibromo dipenyl methane Trade name: DBBT	99688-47-8
Halogenated benzenes -	
Chlorobenzene (Monochlorobenzene, MCB)	108-90-7
Dichlorobenzene, 1,2- (ortho-DCB)	95-50-1
Dichlorobenzene, 1,4- (para-DCB)	106-46-7
Pentachlorobenzene	608-93-5
Tetrachlorobenzene, 1, 2, 4, 5-	95-94-3
Tetrachlorobenzene, 1, 2, 3, 5-	634-90-2
Tetrachlorobenzene, 1, 2, 3, 4-	634-66-2
Trichlorobenzene, 1, 2,4 -	120-82-1
Trichlorobenzene, 1, 2, 3-	87-61-6
~~Hexachlorobenzene~~	~~118-74-1~~

Annex D. Halogenated diphenyl methanes

Monomethyl tetrachloro diphenyl methane ade name: Ugilec 141	76253-60-6
Monomethyl dichloro diphenyl methane Trade name: Ugilec 121, Ugilec 21	81161-70-8
Monomethyl dibromo dipenyl methane Trade name: DBBT	99688-47-8

Annex E. Nickel

Nickel	7440-02-0
Nickelacetate	373-02-4
Nickelcarbonate	3333-67-3
Nickelcarbonyl	13463-39-3
Nickelhydroxide	12054-48-7, 11113-74-9
Nickelocene	1271-28-9
Nickeloxide	1313-99-1
Nickelsulfide	12035-72-2
Other nickel compounds	-

Annex F. Ozone Depleting Substances

Chlorofluorocarbons (CFCs):	
Trichlorofluoromethane (CFC-11) and its isomers	75-69-4 DR[2] 62185-70-0 DR[2] 79620-41-0 DR[2] 83589-40-6 DR[2] 91315-61-6
Dichlorodifluoromethane (CFC-12) and its isomers	75-71-8 DR[2] 185009-39-6 DR[2] 62185-71-1
Trichlorotrifluoroethane (CFC-113) and its isomers	76-13-1 DR[2] 39349-94-5

	DR[2] 56996-61-3 DR[2] 57762-34-2
Dichlorotetrafluoroethane (CFC-114) and its isomers	76-14-2
Monochloropentafluoroethane (CFC-115) and its isomers	76-15-3 DR[2] 12770-91-1
Chlorotrifluoromethane (CFC-13) and its isomers	75-72-9 185009-43-2
Pentachlorofluoroethane (CFC-111) and its isomers	354-56-3 29756-45-4
Tetrachlorodifluoroethane (CFC-112) and its isomers	76-12-0 76-11-9
Heptachlorofluoropropane (CFC-211) and its isomers	422-78-6 135401-87-5
Hexachlorodifluoropropane (CFC-212) and its isomers	3182-26-1
Pentachlorotrifluoropropane (CFC-213) and its isomers	2354-06-5 134237-31-3
Tetrachlorotetrafluoropropane (CFC-214) and its isomers	29255-31-0 2268-46-4
Trichloropentafluoropropane (CFC-215) and its isomers	1599-41-3 4259-43-2 76-17-5
Dichlorohexafluoropropane (CFC-216) and its isomers	661-97-2
Chloroheptafluoropropane (CFC-217) and its isomers	422-86-6 76-18-6
Halons:	
Bromochlorodifluoromethane (Halon-1211) and its isomers	353-59-3 11104-73-7
Bromotrifluoromethane (Halon-1301) and its isomers	75-63-8 62395-25-9
Dibromotetrafluoroethane (Halon-2402) and its isomers	124-73-2 DR[2] 76199-55-8
Carbon tetrachloride	56-23-5
1,1,1-trichloroethane (methyl chloroform) and its isomers except 1,1,2-trichloroethane	71-55-6 DR[2] 74552-83-3
Bromomethane (methyl bromide)	74-83-9
Chlorobromomethane	74-97-5
Hydrobromofluorocarbons (HBFCs) and their isomers:	
Bromodifluoromethane and its isomers	1511-62-2
HBFC-22B1 (FM-100) 1511-62-2	
CHFBr2	1868-53-7
CH2FBr	NA
C2HFBr4	NA
C2HF2Br3	NA
C2HF3Br2	354-04-1 DR[2] 66542-88-9
C2HF4Br	NA
C2H2FBr3	NA
C2H2F2Br2	75-82-1
C2H2F3Br	421-06-7
C2H3FBr2	358-97-4
C2H3F2Br	NA
C2H4FBr	762-49-2
C3HFBr6	NA
C3HF2Br5	NA
C3HF3Br4	NA
C3HF4Br3	NA

C3HF5Br2	NA
C3HF6Br	NA
C3H2FBr5	NA
C3H2F2Br4	NA
C3H2F3Br3	NA
C3H2F4Br2	NA
C3H2F5Br	NA
C3H3FBr4	NA
C3H3F2Br3	NA
C3H3F3Br2	NA
C3H3F4Br	NA
C3H4FBr3	NA
C3H4F2Br2	NA
C3H4F3Br	NA
C3H5FBr2	NA
C3H5F2Br	NA
C3H6FBr	NA
Hydrochlorofluorocarbons (HCFCs) and their isomers:	
Dichlorofluoromethane (HCFC-21)	75-43-4 DR[2] 39289-28-6
Chlorodifluoromethane (HCFC-22)	75-45-6 DR[2] 73666-77-0 DR[2] 134191-96-1
Chlorofluoromethane (HCFC-31)	593-70-4
Tetrachlorofluoroethane (HCFC-121) 1,1,1,2-tetrachloro-2-fluoroethane 1,1,2,2-tetrachloro-1-fluoroethane	130879-71-9 DR[2] 134237-32-4[3] 354-11-0 354-14-3
Trichlorodifluoroethane (HCFC-122) Trichloro-1,1-difluoroethane 1,2,2-trichloro-1,1-difluoroethane 1,2,2-trichloro-1,2-difluoroethane 1,1,1-trichloro-2,2-difluoroethane 1,1,2-trichloro-2,2-difluoroethane	41834-16-6 55949-46-7 354-21-2 DR[2] 134237-33-5[3] DR[2] 62549-18-2 354-15-4 354-12-1 NA
Dichlorotrifluoroethane (HCFC-123) Dichloro-1,1,2-trifluoroethane 2,2-dichloro-1,1,1-trifluoroethane 1,2-dichloro-1,1,2-trifluoroethane (HCFC-123a) 1,1-dichloro-1,2,2-trifluoroethane 2,2-dichloro-1,1,2-trifluoroethane	34077-87-7 90454-18-5 306-83-2 354-23-4 812-04-4 NA
Chlorotetrafluoroethane (HCFC-124) 2-chloro-1,1,1,2-tetrafluoroethane 1-chloro-1,1,2,2-tetrafluoroethane (HCFC-124a)	63938-10-3 2837-89-0 354-25-6
Trichlorofluoroethane (HCFC-131) 1,1,2-trichloro-2-fluoroethane 1,1,2-trichloro-1 (or 2)-fluoroethane 1,1,2-trichloro-1-fluoroethane (HCFC-131a) 1,1,1-trichloro-2-fluoroethane (HCFC-131b)	27154-33-2 134237-34-6[3] 359-28-4 90134-98-8 811-95-0 2366-36-1
Dichlorodifluoroethane (HCFC-132) Dichloro-1,1-difluoroethane 1,1-dichlorodifluoroethane (meso) 1,2-dichloro-1,2-difluoroethane (R,R)-(+-).1,2-dichloro-1,2-difluoroethane 1,2-dichloro-1,1-difluoroethane (HCFC-132b)	25915-78-0 55494-45-6 31153-51-2 33579-37-2 33489-30-4 1649-08-7

1,1-dichloro-1,2-difluoroethane	1842-05-3
1,1-dichloro-2,2-difluoroethane	471-43-2
1,2-dichloro-1,2-difluoroethane	431-06-1
Chlorotrifluoroethane (HCFC-133)	1330-45-6
	DR[2] 38097-47-1
1-chloro-1,2,2-trifluoroethane	431-07-2
1-chloro-1,1,2-trifluoroethane	421-04-5
2chloro-1,1,1-trifluoroethane (HCFC-133a)	75-88-7
Dichlorofluoroethane (HCFC-141)	25167-88-8
1,1-dichloro-1-fluoroethane (HCFC-141b)	1717-00-6
1,2-dichloro-1-fluoroethane	430-57-9
1,1-dichloro-2-fluoroethane	430-53-5
Chlorodifluoroethane (HCFC-142)	25497-29-4
	DR[2] 58561-84-5
	DR[2] 27175-71-9
Chloro-1,1-difluoroethane	55949-44-5
2-chloro-1,1-difluoroethane	338-65-8
1-chloro-1,1-difluoroethane (HCFC-142b)	75-68-3
	DR[2] 65762-25-6
1-chloro-1,2-difluoroethane (HCFC-142a)	338-64-7
Hexachlorofluoropropane (HCFC-221)	29470-94-8
	134237-35-7[3]
1,1,1,2,3,3-hexachloro-3-fluoropropane	431-79-8
1,1,1,2,3,3-hexachloro-2-fluoropropane	422-40-2
1,1,1,2,2,3-hexachloro-1-fluoropropane	422-26-4
1,1,2,2,3,3-hexachloro-1-fluoropropane	422-28-6
1,1,1,3,3,3-hexachloro-2-fluoropropane	NA
Pentachlorodifluoropropane (HCFC-222)	116867-32-4
	134237-36-8[3]
1,1,2,3,3-pentachloro-1,3-difluoropropane	421-82-3
1,1,1,2,3-pentachloro-3,3-difluoropropane	431-80-1
1,1,1,3,3-pentachloro-2,2-difluoropropane	422-49-1
1,2,2,3,3-pentachloro-1,1-difluoropropane	422-30-0
1,1,1,2,2-pentachloro-3,3-difluoropropane	422-27-5
1,1,1,2,3-pentachloro-2,3-difluoropropane	NA
1,1,1,3,3-pentachloro-2,3-difluoropropane	NA
(1,1,3,3,3-pentachloro-1,2-difluoropropane)	
1,1,2,2,3-pentachloro-1,3-difluoropropane	NA
1,1,2,3,3-pentachloro-1,2-difluoropropane	NA
Tetrachlorotrifluoropropane (HCFC-223)	29470-95-9
	134237-37-9[3]
1,1,1,3-tetrachloro-2,3,3-trifluoropropane	54002-59-4
1,1,2,3-tetrachloro-1,3,3-trifluoropropane	431-83-4
1,1,1,2-tetrachloro-3,3,3-trifluoropropane	431-81-2
1,1,3,3-tetrachloro-1,2,2-trifluoropropane	422-52-6
1,1,1,3-tetrachloro-2,2,3-trifluoropropane	422-50-4
1,2,3,3-tetrachloro-1,1,2-trifluoropropane	422-41-3
2,2,3,3-tetrachloro-1,1,1-trifluoropropane	422-35-5
1,1,2,2-tetrachloro-1,3,3-trifluoropropane	422-29-7
1,1,1,2-tetrachloro-2,3,3-trifluoropropane	NA
1,1,3,3-tetrachloro-1,2,3-trifluoropropane	NA
1,2,2,3-tetrachloro-1,1,3-trifluoropropane	NA
1,1,2,3-tetrachloro-1,2,3-trifluoropropane	NA
Trichlorotetrafluoropropane (HCFC-224)	127564-91-4
	134237-38-0[3]
1,1,3-trichloro-1,2,3,3-tetrafluoropropane	53063-53-9
1,1,1-trichloro-2,3,3,3-tetrafluoropropane	53063-52-8
1,1,2-trichloro-1,3,3,3-tetrafluoropropane	431-84-5

1,3,3-trichloro-1,1,2,2-tetrafluoropropane	422-54-8
1,1,3-trichloro-1,2,2,3-tetrafluoropropane	422-53-7
1,1,1-trichloro-2,2,3,3-tetrafluoropropane	422-51-5
2,3,3-trichloro-1,1,1,2-tetrafluoropropane	422-47-9
1,2,3-trichloro-1,1,2,3-tetrafluoropropane	422-42-4
1,2,2-trichloro-1,1,3,3-tetrafluoropropane	422-32-2
2,2,3-trichloro-1,1,1,3-tetrafluoropropane	NA
1,1,2-trichloro-1,2,3,3-tetrafluoropropane	NA
Dichloropentafluoropropane (HCFC-225)	127564-92-5
1,3-dichloro-1,1,2,3,3-pentafluoropropane	136013-79-1
3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca)	422-56-0
1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)	507-55-1
2,2-dichloro-1,1,1,3,3-pentafluoropropane (HCFC-225aa)	128903-21-9
1,1-dichloro-1,2,3,3,3-pentafluoropropane	111512-56-2
(R,S)2,3-dichloro-1,1,1,2,3-pentafluoropropane	111512-55-1
(R,R)2,3-dichloro-1,1,1,2,3-pentafluoropropane	111512-51-7
1,1-dichloro-1,2,2,3,3-pentafluoropropane	13474-88-9
1,2-dichloro-1,1,3,3,3-pentafluoropropane (HCFC-225da)	431-86-7
2,3-dichloro-1,1,1,2,3-pentafluoropropane (HCFC-225ba)	422-48-0
1,2-dichloro-1,1,2,3,3-pentafluoropropane	422-44-6
Chlorohexafluoropropane (HCFC-226)	28987-04-4 134308-72-8[3]
2-chloro-1,1,1,2,3,3-hexafluoropropane (HCFC-226ba)	51346-64-6
2-chloro-1,1,1,3,3,3-hexafluoropropane (HCFC-226da)	431-87-8
3-chloro-1,1,1,2,2,3-hexafluoropropane (HCFC-226ca)	422-57-1
1-chloro-1,1,2,2,3,3-hexafluoropropane (HCFC-226cb)	422-55-9
1-chloro-1,1,2,3,3,3-hexafluoropropane (HCFC-226ea)	359-58-0
Pentachlorofluoropropane (HCFC-231)	NA 134190-48-0[3]
1,1,1,2,3-pentachloro-2-fluoropropane	421-94-3
1,1,2,3,3-pentachloro-2-fluoropropane	NA
1,1,1,3,3-pentachloro-3-fluoropropane	NA
1,1,2,2,3-pentachloro-1-fluoropropane	NA
1,1,1,2,2-pentachloro-3-fluoropropane	NA
1,1,1,2,3-pentachloro-3-fluoropropane	NA
1,1,1,3,3-pentachloro-2-fluoropropane	NA
1,1,2,2,3-pentachloro-3-fluoropropane	NA
1,1,2,3,3-pentachloro-1-fluoropropane	NA
Tetrachlorodifluoropropane (HCFC-232)	127564-82-3
1,2,3,3,-tetrachloro-1,1-difluoropropane	67879-59-8
1,1,3,3,-tetrachloro-2,2-difluoropropane	1112-14-7
1,1,1,3,-tetrachloro-2,2-difluoropropane	677-54-3
1,1,1,3,-tetrachloro-3,3-difluoropropane	460-89-9
1,1,1,3,-tetrachloro-2,3-difluoropropane	NA
1,1,1,2,-tetrachloro-2,3-difluoropropane	NA
1,1,1,2,-tetrachloro-3,3-difluoropropane	NA
1,1,2,3,-tetrachloro-1,2-difluoropropane	NA
1,1,2,3,-tetrachloro-1,3-difluoropropane	NA
1,2,3,3,-tetrachloro-1,2-difluoropropane (1,1,2,3,-tetrachloro-2,3-difluoropropane)	NA
1,2,2,3,-tetrachloro-1,1-difluoropropane	NA
1,2,2,3,-tetrachloro-1,3-difluoropropane	NA
1,1,3,3,-tetrachloro-1,3-difluoropropane	NA
1,1,2,2,-tetrachloro-3,3-difluoropropane (2,2,3,3,-tetrachloro-1,1-difluoropropane)	NA
1,1,2,2,-tetrachloro-1,3-difluoropropane	NA
Trichlorotrifluoropropane (HCFC-233)	61623-04-9 134237-40-4[3]

1,1,3-trichloro-2,2,3-trifluoropropane	131221-36-8
1,1,1-trichloro-2,2,3-trifluoropropane	131211-71-7
1,1,3-trichloro-1,2,3-trifluoropropane	54377-32-1
1,1,1-trichloro-2,3,3-trifluoropropane	54306-56-8
1,1,2-trichloro-2,3,3-trifluoropropane	13058-99-6
1,1,1-trichloro-3,3,3-trifluoropropane	7125-84-0
2,2,3-trichloro-1,1,1-trifluoropropane	7125-83-9
2,3,3-trichloro-1,1,1-trifluoropropane	431-51-6
1,1,3-trichloro-1,2,2-trifluoropropane	421-99-8
1,2,3-trichloro-1,1,2-trifluoropropane	421-95-4
1,1,3-trichloro-1,3,3-trifluoropropane	333-26-6
1,1,2-trichloro-1,2,3-trifluoropropane	NA
1,2,3-trichloro-1,2,3-trifluoropropane	NA
1,1,2-trichloro-1,3,3-trifluoropropane	NA
1,3,3-trichloro-1,1,2-trifluoropropane	NA
2,2,3-trichloro-1,1,3-trifluoropropane	NA
1,2,3-trichloro-1,1,3-trifluoropropane	NA
1,2,2-trichloro-1,1,3-trifluoropropane	NA
Dichlorotetrafluoropropane (HCFC-234)	127564-83-4
1,3-dichloro-1,1,3,3-tetrafluoropropane (HCFC-234fa)	76140-39-1
1,3-dichloro-1,2,2,3-tetrafluoropropane	70341-81-0
1,1-dichloro-1,2,2,3-tetrafluoropropane	70192-63-1
1,1-dichloro-1,3,3,3-tetrafluoropropane	64712-27-2
(R,R) 1,3-dichloro-1,1,2,3-tetrafluoropropane	53149-65-8
3,3-dichloro-1,1,1,2-tetrafluoropropane	53063-54-0
2,2-dichloro-1,1,3,3-tetrafluoropropane	17705-30-5
1,1-dichloro-2,2,3,3-tetrafluoropropane	4071-01-6
1,2-dichloro-1,2,3,3-tetrafluoropropane	425-94-5
1,3-dichloro-1,1,2,2-tetrafluoropropane (HCFC-234cc)	422-00-5
2,3-dichloro-1,1,1,3-tetrafluoropropane (HCFC-234da)	NA
1,1-dichloro-1,2,3,3-tetrafluoropropane	NA
1,2-dichloro-1,1,3,3-tetrafluoropropane	NA
2,3-dichloro-1,1,1,2-tetrafluoropropane	NA
2,2-dichloro-1,1,1,3-tetrafluoropropane	NA
1,2-dichloro-1,1,2,3-tetrafluoropropane	NA
1,3-dichloro-1,1,2,3-tetrafluoropropane	NA
Chloropentafluoropropane (HCFC-235)	108662-83-5
	134237-83-5[3]
3-chloro-1,1,1,2,3-pentafluoropropane	134237-41-5
2-chloro-1,1,1,3,3-pentafluoropropane (HCFC-235da)	134251-06-2
1-chloro-1,2,2,3,3-pentafluoropropane (HCFC-235ca)	28103-66-4
1-chloro-1,1,2,2,3-pentafluoropropane (HCFC-235cc)	679-99-2
1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa)	677-55-4
3-chloro-1,1,1,2,2-pentafluoropropane (HCFC-235cb)	460-92-4
2-chloro-1,1,1,2,3-pentafluoropropane	422-02-6
1-chloro-1,1,2,3,3-pentafluoropropane	NA
2-chloro-1,1,2,3,3-pentafluoropropane	NA
Tetrachlorofluoropropane (HCFC-241)	NA
	134190-49-1[3]
1,1,1,2-tetrachloro-3-fluoropropane	84816-05-7
1,1,1,3-tetrachloro-3-fluoropropane	23153-22-2
1,1,2,3-tetrachloro-3-fluoropropane	21981-25-9
1,1,2,2-tetrachloro-1-fluoropropane	7126-06-9
1,1,2,3-tetrachloro-2-fluoropropane	3175-26-6
1,1,1,2-tetrachloro-2-fluoropropane	3175-25-5
1,1,2,3-tetrachloro-1-fluoropropane	666-27-3
1,1,1,3-tetrachloro-2-fluoropropane	NA
1,1,2,2-tetrachloro-3-fluoropropane	NA

1,2,2,3-tetrachloro-1-fluoropropane	NA
1,1,3,3-tetrachloro-1-fluoropropane	NA
1,1,3,3-tetrachloro-2-fluoropropane	NA
Trichlorodifluoropropane (HCFC-242)	127564-90-3 134237-42-6[3]
1,3,3-trichloro-1,1-difluoropropane	460-63-9
1,2,3-trichloro-1,2-difluoropropane	7164-14-9
1,1,3-trichloro-2,2-difluoropropane	1112-13-6
1,2,3-trichloro-1,1-difluoropropane	431-24-3
1,1,1-trichloro-2,2-difluoropropane	1112-05-6
1,2,2-trichloro-1,1-difluoropropane	7126-05-8
1,1,2-trichloro-1,2-difluoropropane	7126-04-7
1,1,1-trichloro-2,3-difluoropropane	NA
1,1,2-trichloro-1,3-difluoropropane	NA
1,1,3-trichloro-1,2-difluoropropane	NA
1,1,2-trichloro-2,3-difluoropropane	NA
1,2,2-trichloro-1,3-difluoropropane	NA
2,2,3-trichloro-1,1-difluoropropane	NA
1,1,1-trichloro-3,3-difluoropropane	NA
1,1,3-trichloro-1,3-difluoropropane	NA
1,1,2-trichloro-3,3-difluoropropane	NA
1,1,3-trichloro-2,3-difluoropropane	NA
1,2,3-trichloro-1,3-difluoropropane	NA
Dichlorotrifluoropropane (HCFC-243)	116890-51-8 134237-43-7[3]
2,2-dichloro-1,1,1-trifluoropropane	7126-01-4
1,1-dichloro-1,2,2-trifluoropropane	7125-99-7
1,2-dichloro-1,1,2-trifluoropropane	7126-00-3
2,3-dichloro-1,1,1-trifluoropropane (HCFC-243da)	338-75-0
1,3-dichloro-1,2,2-trifluoropropane	67406-68-2
1,1-dichloro-2,2,3-trifluoropropane	70192-70-0
3,3-dichloro-1,1,1-trifluoropropane	460-69-5
1,3-dichloro-1,1,2-trifluoropropane	NA
1,2-dichloro-1,1,3-trifluoropropane	NA
1,1-dichloro-1,2,3-trifluoropropane	NA
2,3-dichloro-1,1,2-trifluoropropane	NA
2,2-dichloro-1,1,3-trifluoropropane	NA
1,2-dichloro-1,2,3-trifluoropropane	NA
1,3-dichloro-1,1,3-trifluoropropane	NA
1,1-dichloro-1,3,3-trifluoropropane	NA
3,3-dichloro-1,1,2-trifluoropropane	NA
2,3-dichloro-1,1,3-trifluoropropane	NA
1,3-dichloro-1,2,3-trifluoropropane	NA
Chlorotetrafluoropropane (HCFC-244)	NA 134190-50-4[3]
2-chloro-1,1,1,3-tetrafluoropropane (HCFC-244db)	117970-90-8
3-chloro-1,1,2,2-tetrafluoropropane	679-85-6
1-chloro-1,2,2,3-tetrafluoropropane	67406-66-0
1-chloro-1,1,3,3-tetrafluoropropane (HCFC-244fb)	2730-64-5
2-chloro-1,1,3,3-tetrafluoropropane (HCFC-244da)	19041-02-2
2-chloro-1,1,1,2-tetrafluoropropane (HCFC-244ba)	421-73-8
1-chloro-1,1,2,2-tetrafluoropropane	421-75-0
1-chloro-1,1,2,3-tetrafluoropropane	NA
3-chloro-1,1,1,2-tetrafluoropropane	NA
2-chloro-1,1,2,3-tetrafluoropropane	NA
3-chloro-1,1,1,3-tetrafluoropropane	NA
3-chloro-1,1,2,3-tetrafluoropropane	NA
Trichlorofluoropropane (HCFC-251)	NA

	134190-51-5[3]
(R,S)-(.+-.) 1,2,3-trichloro-1-fluoropropane	84847-80-3
(R,R)-(.+-.)	84847-79-0
[R(R,S)]	76985-34-7
[R(R,R)]	76985-33-6
(R,S)	67832-50-2
(R,R)	67832-44-4
1,2,3-trichloro-2-fluoropropane	7126-16-1
1,2,2-trichloro-3-fluoropropane	70192-89-1
1,1,3-trichloro-1-fluoropropane	818-99-5
1,1,3-trichloro-2-fluoropropane	76937-36-5
1,1,2-trichloro-1-fluoropropane	421-41-0
1,1,2-trichloro-2-fluoropropane	3175-24-4
1,1,1-trichloro-2-fluoropropane	NA
1,1,1-trichloro-3-fluoropropane	NA
1,1,2-trichloro-3-fluoropropane	NA
1,1,3-trichloro-3-fluoropropane	NA
1,2,2-trichloro-1-fluoropropane	NA
1,2,3-trichloro-1-fluoropropane	NA
Dichlorodifluoropropane (HCFC-252)	NA
	134190-52-6[3]
1,1-dichloro-2,2-difluoropropane	1112-01-2
1,1-dichloro-3,3-difluoropropane	131404-17-6
1,1-dichloro-1,3-difluoropropane	121612-64-4
1,2-dichloro-1,1-difluoropropane	7126-15-0
1,2-dichloro-2,3-difluoropropane	70192-74-4
2,3-dichloro-1,1-difluoropropane	82578-00-5
1,3-dichloro-1,1-difluoropropane	819-00-1
1,3-dichloro-1,2-difluoropropane	111483-26-2
1,3-dichloro-2,2-difluoropropane	1112-36-3
1,1-dichloro-1,2-difluoropropane	NA
1,1-dichloro-2,3-difluoropropane	NA
1,2-dichloro-1,2-difluoropropane	NA
1,2-dichloro-1,3-difluoropropane	NA
1,3-dichloro-1,3-difluoropropane	NA
2,2-dichloro-1,1-difluoropropane	NA
2,2-dichloro-1,3-difluoropropane	NA
Chlorotrifluoropropane (HCFC-253)	26588-23-8
	134237-44-8[3]
2-chloro-1,1,1-trifluoropropane	421-47-6
3-chloro-1,1,1-trifluoropropane	460-35-5
1-chloro-1,1,2-trifluoropropane	134251-05-1
2-chloro-1,1,2-trifluoropropane	69202-10-4
3-chloro-1,1,2-trifluoropropane	121612-65-5
1-chloro-1,1,3-trifluoropropane	83124-56-5
1-chloro-1,2,2-trifluoropropane	70192-76-6
1-chloro-2,2,3-trifluoropropane	56758-54-4
2-chloro-1,1,3-trifluoropropane	NA
3-chloro-1,1,3-trifluoropropane (1-chloro-1,3,3-trifluoropropane)	NA
1-chloro-1,2,3-trifluoropropane	NA
2-chloro-1,2,3-trifluoropropane	NA
Dichlorofluoropropane (HCFC-261)	127404-11-9
	134237-45-9[3]
1,1-dichloro-1-fluoropropane	7779-56-6
1,1-dichloro-2-fluoropropane	53074-31-0
1,1-dichloro-3-fluoropropane	53074-30-9
1,2-dichloro-1-fluoropropane	7799-55-5

1,2-dichloro-2-fluoropropane	420-97-3
1,2-dichloro-3-fluoropropane	453-01-0
1,3-dichloro-1-fluoropropane	83124-60-1
1,3-dichloro-2-fluoropropane	816-38-6
2,2-dichloro-1-fluoropropane	NA
Chlorodifluoropropane (HCFC-262)	NA 134190-53-7[3]
1-chloro-1,1-difluoropropane	421-02-3
2-chloro-1,1-difluoropropane	430-93-3 DR[2] 5268567-3
3-chloro-1,1-difluoropropane	83124-57-6
1-chloro-1,2-difluoropropane	430-96-6
1-chloro-2,3-difluoropropane	37161-81-2
2-chloro-1,3-difluoropropane	102738-79-4
1-chloro-2,2-difluoropropane	420-99-5
2-chloro-1,2-difluoropropane	NA
1-chloro-1,3-difluoropropane	NA
Chlorofluoropropane (HCFC-271)	NA 134190-54-8[3]
1-chloro-1-fluoropropane	430-55-7
1-chloro-2-fluoropropane	430-46-6
1-chloro-3-fluoropropane	462-38-4
2-chloro-1-fluoropropane	20372-78-5
2-chloro-2-fluoropropane	420-44-0

Notes:
[1] Manufacturing processes do not include facilities equipment or systems such as chillers and fire suppression systems.
[2] DR denotes a deleted registry number that was replaced with another registry number.
[3] Chemical to which Chemical Abstract Service (CAS) assigned registry number based on premise that it was a trade name, although chemical may be the same as another one already listed.

Annex G. Perfluorocarbons (PFC)

Carbon tetrafluoride	75-73-0
Perfluoroethane	76-16-4

Annex H. Polychlorinated biphenyls (PCBs)

Polychlorinated Biphenyls	1336-36-3
Aroclor	12767-79-2
Chlorodiphenyl (Aroclor 1260)	11096-82-5
Kanechlor 500	27323-18-8
Aroclor 1254	11097-69-1
Terphenyls	26140-60-3

Annex I. Polychlorinated naphthalenes

Polychlorinated Naphthalenes	70776-03-3

Annex J. Shortchain Chlorinated Paraffins

Only short-chain chlorinated paraffins with carbon length of 10-13 atoms are covered.

Chlorinated paraffins (C10-13)	85535-84-8
Other Short Chain Chlorinated Paraffins	-

Annex K. Tributyl tin oxide (TBTO)

Bis(tri-n-butyltin) oxide	56-35-9

Annex L. Cadmium/Cadmium Compounds

Cadmium	7440-43-9
Cadmium oxide	1306-19-0
Cadmium sulfide	1306-23-6
Cadmium chloride	10108-64-2
Cadmium sulfate	10124-36-4
Other cadmium compounds	-

Annex M. Chromium VI Compounds

Chromium (VI) oxide	1333-82-0
Barium chromate	10294-40-3
Calcium chromate	13765-19-0
Chromic acetate	1066-30-4
Chromium trioxide	1333-82-0
Lead (II) chromate	7758-97-6
Sodium chromate	7775-11-3
Sodium dichromate	10588-01-9
Strontium chromate	7789-06-2
Potassium dichromate	7778-50-9
Potassium chromate	7789-00-6
Zinc chromate	13530-65-9

Annex N. Lead/Lead Compounds

Lead	7439-92-1
Lead (II) sulfate	7446-14-2
Lead (II) carbonate	598-63-0
Lead hydrocarbonate	1319-46-6
Lead acetate	301-04-2
Lead (II) acetate, trihydrate	6080-56-4
Lead phosphate	7446-27-7
Lead selenide	12069-00-0
Lead (IV) oxide	1309-60-0
Lead (II,IV) oxide	1314-41-6
Lead (II) sulfide	1314-87-0
Lead (II) oxide	1317-36-8
Lead (II) carbonate basic	1319-46-6
Lead hydroxidcarbonate	1344-36-1
Lead (II) phosphate	7446-27-2
Lead (II) chromate	7758-97-6
Lead (II) titanate	12060-00-3
Lead sulfate, sulphuric acid, lead salt	15739-80-7
Lead sulphate, tribasic	12202-17-4
Lead stearate	1072-35-1
Other lead compounds	-

Annex O. Mercury /Mercury Compounds

Mercury	7439-97-6
Mercuric chloride	33631-63-9
Mercury (II) chloride	7487-94-7
Mercuric sulfate	7783-35-9
Mercuric nitrate	10045-94-0
Mercuric (II) oxide	21908-53-2
Mercuric sulfide	1344-48-5
Other mercury compounds	-

Annex P. Polybrominated biphenyls (PBBs) including all congeners and isomers

2-Bromobiphenyl	2052-07-05
3-Bromobiphenyl	211-57-7
4-Bromobiphenyl	92-66-0
Decabromobiphenyl	13654-09-06
Dibromobiphenyl	92-86-4
Heptabromobiphenyl	35194-78-6
Hexabromobiphenyl	59080-40-9, 36355-01-8, 67774-32-7
Nonabromobiphenyl	27753-52-2
Octabromobiphenyl	61288-13-9
Pentabromobiphenyl	56307-79-0
Polybrominated Biphenyl	59536-65-1
Tetrabromobiphenyl	40088-45-7
Tribromobiphenyl	59080-34-1
Firemaster FF-1	67774-32-7

Annex Q. Polybrominated diphenyl ethers (PBDEs) including all congeners and isomers

Bromodiphenyl Ether	101-55-3
Decabromodiphenyl Ether	1163-19-5
Dibromodiphenyl Ether	2050-47-7
Heptabromodiphenyl Ether	68928-80-3
Hexabromodiphenyl Ether	36483-60-0
Nonabromodiphenyl Ether	63936-56-1
Octabromodiphenyl Ether	32536-52-0
Pentabromodiphenyl Ether	32534-81-9
Tetrabromodiphenyl Ether	40088-47-9
Tribromodiphenyl Ether	49690-94-0

Annex R. Antimony/Antimony Compounds

Antimony (metallic)	7440-36-0
Antimony trioxide	1309-64-4
Antimony pentoxide	1314-60-9
Antimony trichloride	10025-91-9
Sodium antimonate	15432-85-6
Other antimony compounds	-

Annex S. Arsenic/Arsenic Compounds

Arsenic	7440-38-2

Gallium arsenide	1303-00-0
Calcium arsenate	7778-44-1
Calcium arsenite	27152-57-4
Arsenic pentoxide	1303-28-2
Arsenic trioxide	1327-53-3
Potassium arsenite	10124-50-2
Potassium arsenate	7784-41-0
Lead arsenate	3687-31-8
Other arsenic compounds	-

Annex T. Beryllium/Beryllium Compounds

Beryllium	7440-41-7
Beryllium-aluminum alloy	12770-50-2
Beryllium chloride	7787-47-5
Beryllium fluoride	7787-49-7
Beryllium hydroxide	13327-32-7
Beryllium oxide	1304-56-9
Beryllium phosphate	13598-15-7
Beryllium sulfate	13510-49-1
Beryllium sulfate tetrahydrate	7787-56-6
Beryl ore	1302-52-9
Other beryllium compounds	-

Annex U. Bismuth/Bismuth Compounds and Alloys

Bismuth	7440-69-9
Bismuth trioxide	1304-76-3
Bismuth nitrate	10361-44-1
Other bismuth compounds	-

Annex V. Brominated Flame Retardants (other than PBB or PBDE)

Poly(2,6-dibromo-phenylene oxide)	69882-11-7
Tetra-decabromo-diphenoxy-benzene	58965-66-5
1,2-Bis(2,4,6-tribromo-phenoxy) ethane	37853-59-1
3,5,3’,5’-Tetrabromo-bisphenol A (TBBA)	79-94-7
TBBA carbonate oligomer, 2,4,6-tribromo-phenol terminated	71342-77-3
TBBA carbonate oligomer, phenoxy end capped	94334-64-2
TBBA carbonate oligomer	28906-13-0
TBBA-TBBA-diglycidyl-ether oligomer	70682-74-5
TBBA-epichlorhydrin oligomer	40039-93-8
TBBA, unspecified	30496-13-0
Brominated epoxy resin end-capped with tribromophenol	139638-58-7
Brominated epoxy resin end-capped with tribromophenol TBBA-(2,3-dibromo-propyl-ether)	135229-48-0 21850-44-2
TBBA bis-(2-hydroxy-ethyl-ether)	4162-45-2
TBBA-bis-(allyl-ether) TBBA-dimethyl-ether	25327-89-3 37853-61-5
Tetrabromo-bisphenol S	39635-79-5
TBBS-bis-(2,3-dibromo-propyl-ether) 2,4-Dibromo-phenol 2,4,6-tribromo-phenol	42757-55-1 615-58-7 118-79-6

Pentabromo-pheno 2,4,6-Tribromo-phenyl-allyl-ether	l 608-71-9 3278-89-5
Tribromo-phenyl-allyl-ether, unspecified	26762-91-4
Bis(2-ethylhexyl)tetrabromo-phthalate 2-Hydroxy-propyl-2-(2-hydroxy-ethoxy)-ethyl-TBP TBPA, glycol-and propylene-oxide esters	26040-51-7 20566-35-2 75790-69-1
N,N'-Ethylene –bis-(tetrabromo-phthalimide) Ethylene-bis(5,6-dibromo-norbornane-2,3-dicarboximide)	32588-76-4 52907-07-0
2,3-Dibromo-2-butene-1,4-diol	3234-02-4
Dibromo-neopentyl-glycol Dibromo-propanol Tribromo-neopentyl-alcohol	3296-90-0 96-13-9 36483-57-5
Poly tribromo-styrene Tribromo-styrene Dibromo-styrene grafted PP	57137-10-7 61368-34-1 171091-06-8
Poly-dibromo-styrene Bromo-/Chloro-paraffins Bromo-/Chloro-alpha-olefin	31780-26-4 68955-41-9 82600-56-4
Vinylbromide Tris-(2,3-dibromo-propyl)-isocyanurate Tris(2,4-Dibromo-phenyl) phosphate	593-60-2 52434-90-9 49690-63-3
Tris(tribromo-neopentyl) phosphate	19186-97-1
Chlorinated and brominated phosphate ether	125997-20-8
Pentabromo-toluene	87-83-2
Pentabromo-benzyl bromide	38521-51-6
1,3-Butadiene homopolymer,brominated	68441-46-3
Pentabromo-benzyl-acrylate, monomer	59447-55-1
Pentabromo-benzyl-acrylate, polymer	59447-57-3
Decabromo-diphenyl-ethane Tribromo-bisphenyl-maleinimide Brominated trimethylphenyl-lindane	84852-53-9 59789-51-4 59789-51-4
Other Brominated Flame Retardants	-
Hexabromo-cyclo-dodecane (HBCD), unspecified Tetrabromo-cyclo-octane 1,2-Dibromo-4-(1,2 dibromo-methyl)-cyclo-hexane	3194-55-6 31454-48-5 3322-93-8
TBPA Na salt Tetrabromo phthalic anhydride	25357-79-3 632-79-1

Annex W. Magnesium/Magnesium Alloys

Magnesium	7439-95-4
Other magnesium alloys	-

Annex X. Phthalates

Bis (2-ethylhexyl) phthalate (DEHP)	117-81-7
Dibutylphthalate (DBP)	84-74-2
Bis(2-methoxyethyl) phthalate (DBP)	117-82-8

Annex Y. Polyvinyl Chloride

Polyvinyl chloride (PVC)	9002-86-2

Annex Z. Radioactive Substances

Uranium	7440-61-6
Plutonium	7440-07-5
Radon	10043-92-2
Americium	7440-35-9
Thorium	7440-29-1
Cesium	7440-46-2
Strontium	7440-24-6
Other radioactive substances	-

Annex AA. Selenium/Selenium Compounds

Selenium	7782-49-2
Hydrogen selenide	7783-07-5
Sodium selenide	1313-85-5
Selenium dioxide	7446-08-4
Sodium selenate	10112-94-4
Dimethyl selenide	593-79-3
Selenium oxide	12640-89-0
Other selenium compounds	-

Annex BB. Tributyl Tin, Triphenyl Tin

Tributyltin	688-73-3
Tributyltin oxide	56-35-9
Tributyltin benzoate	4342-36-3
Tributyl tin bromide	1461-23-0
Tributyltin linoleate	24124-25-2
Tributyltin methacrylate	2155-70-6
Triphenyl tin	668-34-8
Triphenyltin N,N'-dimethyldithiocarbamate	1803-12-9
Triphenyltin fluoride	379-52-2
Triphenyltin acetate	900-95-8
Triphenyltin chloride	639-58-7
Triphenyltin hydroxide	76-87-9
Triphenyltin fatty acid salts (C=9-11)	47672-31-1
Triphenyltin chloroacetate	7094-94-2
Tributyltin methacrylate	2155-70-6
Bis(tributyltin) fumarate	6454-35-9
Tributyltin fluoride	1983-10-4
Bis(tributyltin) 2,3-dibromosuccinate	31732-71-5
Tributyltin acetate	56-36-0
Tributyltin laurate	3090-36-6
Bis(tributyltin) phthalate	4782-29-0
Copolymer of alkyl acrylate, methyl methacrylate and tributyltin	
methacrylate(alkyl, C=8)	67772-01-4
Tributyltin sulfamate	6517-25-5
Bis(tributyltin) maleate	14275-57-1
Tributyltin chloride	1461-22-9,7342-38-3
Mixture of tributyltin cyclopentanecarboxylate and its analogs (Tributyltin	
naphthenate)	-
Tributyltin cyclopentane carbonate=mixture	5409-17-2

Triphenyltin fatty acid ((9-11) salt)	18380-71-7,18380-72-8,47672-31-1,94850-90-5
Mixture of tributyltin 1,2,3,4,4a,4b,5,6,10,10a-decahydro -7-isopropyl- 1,4a- dimethyl-1-phenanthrenecarboxylate and its analogs (Tributyltin rosin salt)	26239-64-5
Tributyltin naphthenate	85409-17-2
Other Tributyl Tins & Triphenyl Tins	-

Annex CC. Polycyclic Aromatic Hydrocarbons

Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(e)pyren	192-97-2
Benzo(g,h,i)perylene	191-24-2
Benzo(j)fluoranthene	205-82-3
Benzo(k)fluoranthene	207-08-9
Chrysene	218-01-9
Dibenzo(a,h)anthracene	53-70-3
Fluoranthene	206-44-0
Fluorene	86-73-7
Indeno(1,2,3-c,d)pyrene	193-39-5
Naphthalene	91-20-3
Phenanthrene	81-5-8
Pyrene	129-00-0

Annex DD. SVHC Candidate List (current as of the date of this specification, current list maintained by ECHA at http://echa.europa.eu/web/guest/candidate-list-table)

Substance Name	CAS Number
Benzene-1,2,4-tricarboxylic acid 1,2 anhydride (trimellitic anhydride; TMA)	552-30-7
Benzo[ghi]perylene	191-24-2
Decamethylcyclopentasiloxane (D5)	541-02-6
Dicyclohexyl phthalate (DCHP)	84-61-7
Disodium octaborate	12008-41-2
Dodecamethylcyclohexasiloxane (D6)	540-97-6
Ethylenediamine (EDA)	107-15-3
Lead	7439-92-1
Octamethylcyclotetrasiloxane (D4)	556-67-2
Terphenyl, hydrogenated	61788-32-7

1,6,7,8,9,14,15,16,17,17,18,18-Dodecachloropentacyclo[12.2.1.16,9.02,13.05,10]octadeca-7,15-diene ("Dechlorane Plus"™) covering any of its individual anti- and syn-isomers or any combination thereof rel-(1R,4S,4aS,6aR,7R,10S,10aS,12aR)-1,2,3,4,7,8,9,10,13,13,14,14-dodecachloro-1,4,4a,5,6,6a,7,10,10a,11,12,12a-dodecahydro-1,4:7,10-dimethanodibenzo[a,e]cyclooctene 1,6,7,8,9,14,15,16,17,17,18,18-dodecachloropentacyclo[12.2.1.16,9.02,13.05,10]octadeca-7,15-diene (EC No.: 236-948-9 | CAS No.: 13560-89-9) rel-(1R,4S,4aS,6aS,7S,10R,10aR,12aR)-1,2,3,4,7,8,9,10,13,13,14,14-dodecachloro-1,4,4a,5,6,6a,7,10,10a,11,12,12a-dodecahydro-1,4:7,10-dimethanodibenzo[a,e]cyclooctene	
Benz[a]anthracene	56-55-3; 1718-53-2
Cadmium carbonate	513-78-0
Cadmium hydroxide	21041-95-2
Cadmium nitrate	10325-94-7; 10022-68-1
Chrysene	218-01-9; 1719-03-5
Reaction products of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and 4-heptylphenol, branched and linear (RP-HP) with ≥0.1% w/w 4-heptylphenol, branched and linear (4-HPbl)	
Perfluorohexane-1-sulphonic acid and its salts (PHFxS)	
4,4'-isopropylidenediphenol (Bisphenol A; BPA)	80-05-7
4-heptylphenol, branched and linear substances with a linear and/or branched alkyl chain with a carbon number of 7 covalently bound predominantly in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof	
Nonadecafluorodecanoic acid (PFDA) and its sodium and ammonium salts Decanoic acid, nonadecafluoro-, sodium salt EC No.: - | CAS No.: 3830-45-3 Ammonium nonadecafluorodecanoate EC No.: 221-470-5 | CAS No.: 3108-42-7 Nonadecafluorodecanoic acid EC No.: 206-400-3 | CAS No.: 335-76-2	
p-(1,1-dimethylpropyl)phenol	80-46-6

Benzo[def]chrysene (Benzo[a]pyrene)	50-32-8
1,3-propanesultone	1120-71-4
2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol (UV-327)	3864-99-1
2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV-350)	36437-37-3
Nitrobenzene	98-95-3
Perfluorononan-1-oic-acid and its sodium and ammonium salts Ammonium salts of perfluorononan-1-oic-acid EC No.: - | CAS No.: -, 4149-60-4 Perfluorononan-1-oic-acid EC No.: 206-801-3 | CAS No.: 375-95-1 Sodium salts of perfluorononan-1-oic-acid EC No.: - | CAS No.: -, 21049-39-8	
1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters with ≥ 0.3% of dihexyl phthalate (EC No. 201-559-5) 1,2-Benzenedicarboxylic acid, mixed decyl and hexyl and octyl diesters EC No.: 272-013-1 | CAS No.: 68648-93-1 1,2-Benzenedicarboxylic acid, di-C6-10-alkyl esters EC No.: 271-094-0 | CAS No.: 68515-51-5	
5-sec-butyl-2-(2,4-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [1], 5-sec-butyl-2-(4,6-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [2] covering any of the individual stereoisomers of [1] and [2] or any combination thereof 5-sec-butyl-2-(4,6-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane 5-sec-butyl-2-(2,4-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane	
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	25973-55-1
2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	3846-71-7
2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE)	15571-58-1
Cadmium fluoride	7790-79-6
Cadmium sulphate	10124-36-4, 31119-53-6
Reaction mass of 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate and 2-ethylhexyl 10-ethyl-4-[[2-[(2-ethylhexyl)oxy]-2-oxoethyl]thio]-4-octyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (reaction mass of DOTE and MOTE)	
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	68515-50-4
Cadmium chloride	10108-64-2
Sodium perborate, perboric acid, sodium salt Perboric acid, sodium salt EC No.: 234-390-0 | CAS No.: 11138-47-9 Sodium perborate EC No.: 239-172-9 | CAS No.: 15120-21-5	
Sodium peroxometaborate	7632-04-4
Cadmium sulphide	1306-23-6

Dihexyl phthalate	84-75-3
Disodium 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28)	573-58-0
Disodium 4-amino-3-[[4'-[(2,4-diaminophenyl)azo][1,1'-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38)	1937-37-7
Imidazolidine-2-thione (2-imidazoline-2-thiol)	96-45-7
Lead di(acetate)	301-04-2
Trixylyl phosphate	25155-23-1
4-Nonylphenol, branched and linear, ethoxylated substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, ethoxylated covering UVCB- and well-defined substances, polymers and homologues, which include any of the individual isomers and/or combinations thereof	
Ammonium pentadecafluorooctanoate (APFO)	3825-26-1
Cadmium	7440-43-9
Cadmium oxide	1306-19-0
Dipentyl phthalate (DPP)	131-18-0
Pentadecafluorooctanoic acid (PFOA)	335-67-1
1,2-Benzenedicarboxylic acid, dipentyl ester, branched and linear	84777-06-0
1,2-diethoxyethane	629-14-1
1-bromopropane (n-propyl bromide)	106-94-5
3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	143860-04-2
4,4'-methylenedi-o-toluidine	838-88-0
4,4'-oxydianiline and its salts 4,4'-oxydianiline EC No.: 202-977-0 | CAS No.: 101-80-4	
4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated covering well-defined substances and UVCB substances, polymers and homologues	
4-aminoazobenzene	60-09-3
4-methyl-m-phenylenediamine (toluene-2,4-diamine)	95-80-7
4-Nonylphenol, branched and linear substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof	
6-methoxy-m-toluidine (p-cresidine)	120-71-8
[Phthalato(2-)]dioxotrilead	69011-06-9
Acetic acid, lead salt, basic	51404-69-4
Biphenyl-4-ylamine	92-67-1
Bis(pentabromophenyl) ether (decabromodiphenyl ether) (DecaBDE)	1163-19-5
Cyclohexane-1,2-dicarboxylic anhydride all possible combinations of the cis- and trans-isomers Cyclohexane-1,2-dicarboxylic anhydride EC No.: 201-604-9 | CAS No.: 85-42-7 trans-cyclohexane-1,2-dicarboxylic anhydride EC No.: 238-009-9 | CAS No.: 14166-21-3	

cis-cyclohexane-1,2-dicarboxylic anhydride EC No.: 236-086-3 | CAS No.: 13149-00-3	
Diazene-1,2-dicarboxamide (C,C'-azodi(formamide)) (ADCA)	123-77-3
Dibutyltin dichloride (DBTC)	683-18-1
Diethyl sulphate	64-67-5
Diisopentyl phthalate	605-50-5
Dimethyl sulphate	77-78-1
Dinoseb (6-sec-butyl-2,4-dinitrophenol)	88-85-7
Dioxobis(stearato)trilead	12578-12-0
Fatty acids, C16-18, lead salts	91031-62-8
Furan	110-00-9
Henicosafluoroundecanoic acid	2058-94-8
Heptacosafluorotetradecanoic acid	376-06-7
Hexahydromethylphthalic anhydride including cis- and trans- stereo isomeric forms and all possible combinations of the isomers Hexahydro-4-methylphthalic anhydride EC No.: 243-072-0 | CAS No.: 19438-60-9 Hexahydro-3-methylphthalic anhydride EC No.: 260-566-1 | CAS No.: 57110-29-9 Hexahydro-1-methylphthalic anhydride EC No.: 256-356-4 | CAS No.: 48122-14-1 Hexahydromethylphthalic anhydride EC No.: 247-094-1 | CAS No.: 25550-51-0	
Lead bis(tetrafluoroborate)	13814-96-5
Lead cyanamidate	20837-86-9
Lead dinitrate	10099-74-8
Lead monoxide (lead oxide)	1317-36-8
Lead oxide sulfate	12036-76-9
Lead titanium trioxide	12060-00-3
Lead titanium zirconium oxide	12626-81-2
Methoxyacetic acid	625-45-6
Methyloxirane (Propylene oxide)	75-56-9
N,N-dimethylformamide	68-12-2
N-methylacetamide	79-16-3
N-pentyl-isopentylphthalate	776297-69-9
o-aminoazotoluene	97-56-3
o-toluidine	95-53-4
Orange lead (lead tetroxide)	1314-41-6
Pentacosafluorotridecanoic acid	72629-94-8
Pentalead tetraoxide sulphate	12065-90-6
Pyrochlore, antimony lead yellow	8012-00-8
Silicic acid (H2Si2O5), barium salt (1:1), lead-doped	68784-75-8

with lead (Pb) content above the applicable generic concentration limit for 'toxicity for reproduction' Repr. 1A (CLP) or category 1 (DSD),the substance is a member of the group entry of lead compounds, with index number 082-001-00-6 in Regulation (EC) No 1272/2008	
Silicic acid, lead salt	11120-22-2
Sulfurous acid, lead salt, dibasic	62229-08-7
Tetraethyllead	78-00-2
Tetralead trioxide sulphate	12202-17-4
Tricosafluorododecanoic acid	307-55-1
Trilead bis(carbonate) dihydroxide	1319-46-6
Trilead dioxide phosphonate	12141-20-7
1, 2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME)	110-71-4
1,2-bis(2-methoxyethoxy)ethane (TEGDME; triglyme)	112-49-2
1,3,5-Tris(oxiran-2-ylmethyl)-1,3,5-triazinane-2,4,6-trione (TGIC)	2451-62-9
1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione (β-TGIC)	59653-74-6
4,4'-bis(dimethylamino)-4"-(methylamino)trityl alcohol with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)	561-41-1
4,4'-bis(dimethylamino)benzophenone (Michler's ketone)	90-94-8
[4-[4,4'-bis(dimethylamino) benzhydrylidene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride (C.I. Basic Violet 3) with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)	548-62-9
[4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Blue 26) with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)	2580-56-5
Diboron trioxide	1303-86-2
Formamide	75-12-7
Lead(II) bis(methanesulfonate)	17570-76-2
N,N,N',N'-tetramethyl-4,4'-methylenedianiline (Michler's base)	101-61-1
α,α-Bis[4-(dimethylamino)phenyl]-4 (phenylamino)naphthalene-1-methanol (C.I. Solvent Blue 4) with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)	6786-83-0
1,2-dichloroethane	107-06-2
2,2'-dichloro-4,4'-methylenedianiline	101-14-4
2-Methoxyaniline, o-Anisidine	90-04-0
4-(1,1,3,3-tetramethylbutyl)phenol	140-66-9
Aluminosilicate Refractory Ceramic Fibres are fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.1 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, and fulfil the three following conditions: a) oxides of aluminium and silicon are the main components present (in the fibres) within variable concentration ranges b) fibres have a length weighted geometric mean diameter less two standard geometric errors of 6 or less micrometres (μm) c) alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+MgO+BaO) content less or equal to 18% by weight	

Arsenic acid	7778-39-4
Bis(2-methoxyethyl) ether	111-96-6
Bis(2-methoxyethyl) phthalate	117-82-8
Calcium arsenate	7778-44-1
Dichromium tris(chromate)	24613-89-6
Formaldehyde, oligomeric reaction products with aniline	25214-70-4
Lead diazide, Lead azide	13424-46-9
Lead dipicrate	6477-64-1
Lead styphnate	15245-44-0
N,N-dimethylacetamide	127-19-5
Pentazinc chromate octahydroxide	49663-84-5
Phenolphthalein	77-09-8
Potassium hydroxyoctaoxodizincatedichromate	11103-86-9
Trilead diarsenate	3687-31-8
Zirconia Aluminosilicate Refractory Ceramic Fibres are fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.1 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, and fulfil the three following conditions: a) oxides of aluminium, silicon and zirconium are the main components present (in the fibres) within variable concentration ranges b) fibres have a length weighted geometric mean diameter less two standard geometric errors of 6 or less micrometres (µm). c) alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+MgO+BaO) content less or equal to 18% by weight	
1,2,3-trichloropropane	96-18-4
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	71888-89-6
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4
1-Methyl-2-pyrrolidone (NMP)	872-50-4
2-ethoxyethyl acetate	111-15-9
Hydrazine	302-01-2, 7803-57-8
Strontium chromate	7789-06-2
2-ethoxyethanol	110-80-5
2-methoxyethanol	109-86-4
Acids generated from chromium trioxide and their oligomers Oligomers of chromic acid and dichromic acid Chromic acid EC No.: 231-801-5 | CAS No.: 13530-68-2 Dichromic acid EC No.: 236-881-5 | CAS No.: 7738-94-5	
Chromium trioxide	1333-82-0
Cobalt(II) carbonate	513-79-1
Cobalt(II) diacetate	71-48-7
Cobalt(II) dinitrate	10141-05-6
Cobalt(II) sulphate	10124-43-3
Ammonium dichromate	7789-09-5

Boric acid EC No. 233-139-2 and EC No. 234-343-4 Boric acid, crude natural EC No.: 234-343-4 | CAS No.: 11113-50-1 Boric acid EC No.: 233-139-2 | CAS No.: 10043-35-3	
Disodium tetraborate, anhydrous	12179-04-3, 1303-96-4, 1330-43-4
Potassium chromate	7789-00-6
Potassium dichromate	7778-50-9
Sodium chromate	7775-11-3
Tetraboron disodium heptaoxide, hydrate	12267-73-1
Trichloroethylene	79-01-6
Acrylamide	79-06-1
2,4-dinitrotoluene	121-14-2
Anthracene oil	90640-80-5
Anthracene oil, anthracene paste	90640-81-6
Anthracene oil, anthracene paste, anthracene fraction	91995-15-2
Anthracene oil, anthracene paste, distn. lights	91995-17-4
Anthracene oil, anthracene-low	90640-82-7
Diisobutyl phthalate	84-69-5
Lead chromate	7758-97-6
Lead chromate molybdate sulphate red (C.I. Pigment Red 104)	12656-85-8
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	1344-37-2
Pitch, coal tar, high-temp.	65996-93-2
Tris(2-chloroethyl) phosphate	115-96-8
4,4'- Diaminodiphenylmethane (MDA)	101-77-9
5-tert-butyl-2,4,6-trinitro-m-xylene (Musk xylene)	81-15-2
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	85535-84-8
Anthracene	120-12-7
Benzyl butyl phthalate (BBP)	85-68-7
Bis (2-ethylhexyl)phthalate (DEHP)	117-81-7
Bis(tributyltin) oxide (TBTO)	56-35-9
Cobalt dichloride	7646-79-9
Diarsenic pentaoxide	1303-28-2
Diarsenic trioxide	1327-53-3
Dibutyl phthalate (DBP)	84-74-2
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified gamma-hexabromocyclododecane EC No.: - | CAS No.: 134237-52-8 beta-hexabromocyclododecane EC No.: - | CAS No.: 134237-51-7 Hexabromocyclododecane	

EC No.: 247-148-4 | CAS No.: 25637-99-4 1,2,5,6,9,10-hexabromocyclodecane EC No.: 221-695-9 | CAS No.: 3194-55-6 alpha-hexabromocyclododecane EC No.: - | CAS No.: 134237-50-6	
Lead hydrogen arsenate	7784-40-9
Sodium dichromate	10588-01-9, 7789-12-0
Triethyl arsenate	15606-95-8
2,2-bis(4'-hydroxyphenyl)-4-methylpentane	6807-17-6
Benzo[k]fluoranthene	207-08-9
Fluoranthene	206-44-0
Phenanthrene	85-01-8
Pyrene	129-00-0
1,7,7-trimethyl-3-(phenylmethylene)bicyclo[2.2.1]heptan-2-one	15087-24-8
2-methoxyethyl acetate	110-49-6
Tris(4-nonylphenyl, branched and linear) phosphite (TNPP) with ≥ 0.1% w/w of 4-nonylphenol, branched and linear (4-NP)	
2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propionic acid, its salts and its acyl halides (covering any of their individual isomers and combinations thereof)	
4-tert-butylphenol	98-54-4

Annex EE. List of substances subject to REACH Authorisation (current as of the date of this specification, current list maintained in the latest REACH regulation and its amendments) PROHIBITED AT OR ABOVE 0.1% WEIGHT BY WEIGHT OF THE ARTICLE

Substance Name	CAS Number
5-tert-butyl-2,4,6-trinitro-m-xylene (Musk xylene)	81-15-2
4,4'- Diaminodiphenylmethane (MDA)	101-77-9
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified gamma-hexabromocyclododecane EC No.: - | CAS No.: 134237-52-8 beta-hexabromocyclododecane EC No.: - | CAS No.: 134237-51-7 Hexabromocyclododecane EC No.: 247-148-4 | CAS No.: 25637-99-4 1,2,5,6,9,10-hexabromocyclodecane EC No.: 221-695-9 | CAS No.: 3194-55-6 alpha-hexabromocyclododecane EC No.: - | CAS No.: 134237-50-6	
Bis(2-ethylhexyl) phthalate (DEHP)	117-81-7
Benzyl butyl phthalate (BBP)	85-68-7
Dibutyl phthalate (DBP)	84-74-2

Diisobutyl phthalate (DIBP)	84-69-5
Diarsenic trioxide	1327-53-3
Diarsenic pentaoxide	1303-28-2
Lead chromate	7758-97-6
Lead sulfochromate yellow	1344-37-2
Lead chromate molybdate sulfate red	12656-85-8
Tris(2-chloroethyl) phosphate	115-96-8
2,4-dinitrotoluene (2,4-DNT)	121-14-2
Trichloroethylene	79-01-6
Chromium trioxide	1333-82-0
Acids generated from chromium trioxide and their oligomers Oligomers of chromic acid and dichromic acid Chromic acid EC No.: 231-801-5 | CAS No.: 7738-94-5 Dichromic acid EC No.: 236-881-5 | CAS No.: 13530-68-2	
Sodium dichromate	10588-01-9, 7789-12-0
Potassium dichromate	7778-50-9
Ammonium dichromate	7789-09-5
Potassium chromate	7789-00-6
Sodium chromate	7775-11-3
Formaldehyde, oligomeric reaction products with aniline	25214-70-4
Arsenic acid	7778-39-4
Bis(2-methoxyethyl) ether	111-96-6
1,2-dichloroethane (EDC)	107-06-2
2,2'-dichloro-4,4'-methylenedianiline (MOCA)	101-14-4
Dichromium tris(chromate)	24613-89-6
Strontium chromate	7789-06-2
Potassium hydroxyoctaoxodizincatedichromate	11103-86-9
Pentazinc chromate octahydroxide	49663-84-5
1-bromopropane (n-propyl bromide)	106-94-5
Diisopentyl phthalate	605-50-5
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	71888-89-6
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4
1,2-Benzenedicarboxylic acid, dipentyl ester, branched and linear	84777-06-0
Bis(2-methoxyethyl) phthalate	117-82-8
Dipentyl phthalate	131-18-0
N-pentyl-isopentylphthalate	776297-69-9
Anthracene oil A complex combination of polycyclic aromatic hydrocarbons obtained from coal tar having an approximate distillation range of 300°C to 400°C (572°F to 752°F). Composed primarily of phenanthrene, anthracene and carbazole.	90640-80-5
Pitch, coal tar, high-temp. The residue from the distillation of high temperature coal tar. A black solid with an approximate softening point from 30°C to 180°C (86°F to 356°F). Composed	65996-93-2

primarily of a complex mixture of three or more membered condensed ring aromatic hydrocarbons.	
4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated covering well-defined substances and UVCB substances, polymers and homologues	
4-Nonylphenol, branched and linear, ethoxylated substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, ethoxylated covering UVCB- and well-defined substances, polymers and homologues, which include any of the individual isomers and/or combinations thereof	

Annex FF. Hydrofluorocarbons (HFCs)

Trifluoromethane (HFC-23)	75-46-7
Difluoromethane (HFC-32)	75-10-5
Fluoromethane (HFC-41)	593-53-3
1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC-43-10)	138495-42-8
2H, 3H-Decafluoropentane (HFC-43-10mee)	138495-42-8
Pentafluoroethane (HFC–125)	354-33-6
1,1,2,2-tetrafluoroethane (HFC-134)	359-35-3
1,1,1,2-tetrafluoroethane (HFC-134a)	811-97-2
1,1,2-trifluoroethane (HFC-143)	430-66-0
1,1,1-trifluoroethane (HFC-143a)	420-46-2
1,2-Difluoroethane (HFC-152)	624-72-6
1,1-Difluoroethane (HFC-152a)	75-37-6
Monofluoroethane (Ethyl fluoride) (HFC-161)	353-36-6
1,1,1,2,3,3,3-heptafluoropropane (HFC-227ca)	431-89-0
1,1,1,2,2,3,3-heptafluoropropane (HFC-227ca)	2252-84-8
1,1,2,2,3,3-hexafluoropropane (HFC-236ca)	27070-61-7
1,1,1,2,2,3-hexafluoropropane (HFC-236cb)	677-56-5
1,1,1,2,3,3-hexafluoropropane (HFC-236ea)	431-63-0
1,1,1,3,3,3-hexafluoropropane (HFC-236fa)	690-39-1
1,1,2,2,3-pentafluoropropane (HFC-245ce)	679-86-7
1,1,1,3,3-pentafluoropropane (HFC-245fa)	460-73-1
1,1,1,3,3-pentafluorobutane (HFC-365mfc)	406-58-6
Heptafluorocyclopentane (HFC-c-447ef)	15290-77-4

Annex GG. Nonylphenols

Nonylphenol	25154-52-3
p-nonyl-phenol	104-40-5

4-nonyl-phenol, branched=	84852-15-3
Nonylphenol, branched	90481-04-2
Isononylphenol	11066-49-2
p-Isononylphenol	26543-97-5
p-(Nonan-2-yl))phenol	17404-66-9
p-(2-Methyloctan-2-yl) phenol	30784-30-6
4-(3-Methyloctan-3-yl) phenol	52427-13-1
o-Nonylphenol	136-83-4
o-Isononylphenol	27938-31-4
Phenol, 2-nonyl-, branched	91672-41-2
m-Nonylphenol	139-84-4
Neononylphenol	1196678-78-0
4-(3,5-Dimethylheptan-3-yl) phenol	186825-36-5
4-(3,6-Dimethylheptan-3-yl)phenol	142731-63-3
2-(Nonan-2-yl) phenol	17404-45-4
Phenol, 2-tert-nonyl-	89585-68-2
Phenol, sec-nonyl-	97372-03-7
Phenol, 4-tert-nonyl-	58865-77-3
Phenol, o-sec-nonyl-	27214-48-8
Phenol, p-sec-nonyl-	27072-91-9

Annex HH. Perchlorates

Ammonium perchlorate	7790-98-9
Lithium perchlorate	7791-03-9
Potassium perchlorate	7778-74-7
Sodium perchlorate	7601-89-0
Barium perchlorate	13465-95-7
Lead perchlorate	13637-76-8
Magnesium perchlorate	10034-81-8
Nickel perchlorate	13637-71-3

Annex II. Perfluorooctyl acid (PFOA) and salts (for a more comprehensive list of PFOA CAS numbers see OECD http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=env/jm/mono%282006%2915&doclanguage=en

Pentadecafluorooctanoic acid	335-67-1
2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-penta¬deca¬fluoro-octanoic acid, sodium salt	335-95-5
2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-penta¬deca¬fluoro-octanoic acid, potassium salt	2395-00-8
2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-penta¬deca¬fluoro-octanoic acid, silver salt	335-93-3
Acid Fluoride of PFOA	335-66-0
Methyl ester of PFOA	376-27-2
Ethyl ester of PFOA	3108-24-5
2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-penta¬deca¬fluoro-octanoic acid, ammonium salt	3825-26-1
Octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, chromium(3+)	68141-02-6
Ethanaminium, N,N,N-triethyl-, salt with pentadecafluorooctanoic acid (1:1)	98241-25-9

Annex JJ. Perfluorinated compounds

Perfluoropolymethylisopropyl-ether (PFPMIE)	Not available
Trifluoromethyl sulphur pentafluoride	Not available
Nitrogen trifluoride	7783-54-2
Perfluorocyclopropane	Not available

Annex KK. Toluene Diisocyanate (this list is all inclusive)

Toluene diisocyanate trimer	9019–85–6
Poly(toluene diisocyanate)	9017–01–0
Toluene diisocyanate dimer	26747–90–0
Toluene diisocyanate ‘‘cyclic’’ trimer	26603–40–7
2,6-Toluene diisocyanate Note - reportable except for use in coatings, adhesives, elastomers, binders, and sealants at less than or equal to 0.1% in a Consumer Product (defined as a chemical substance that is directly, or as part of a mixture, sold or made available to consumers for their use in or around a permanent or temporary household or residence, in or around a school, or in recreation. [Source: US Code of Federal Regulations Title 40 Part 721.3 Subpart A])	91–08–7
2,4-Toluene diisocyanate Note - reportable except for use in coatings, adhesives, elastomers, binders, and sealants at less than or equal to 0.1% in a Consumer Product (defined as a chemical substance that is directly, or as part of a mixture, sold or made available to consumers for their use in or around a permanent or temporary household or residence, in or around a school, or in recreation. [Source: US Code of Federal Regulations Title 40 Part 721.3 Subpart A])	584–84–9
Toluene diisocyanate unspecified isomer Note - reportable except for use in coatings, adhesives, elastomers, binders, and sealants at less than or equal to 0.1% in a Consumer Product (defined as a chemical substance that is directly, or as part of a mixture, sold or made available to consumers for their use in or around a permanent or temporary household or residence, in or around a school, or in recreation. [Source: US Code of Federal Regulations Title 40 Part 721.3 Subpart A])	26471–62–5

Annex LL. Nonylphenol Ethoxylates

Ethanol, 2-[2-(4-nonylphenoxy)ethoxy]-	20427-84-3
Poly(oxy-1,2-ethanediyl), α-(4-nonylphenyl)- ω-hydroxy-	26027-38-3
3,6,9,12,15,18,21-Heptaoxatricosan-1-ol, 23- (nonylphenoxy)-	27177-05-5
3,6,9,12,15,18,21,24,27-Nonaoxanonacosan-1- ol, 29-(nonylphenoxy)-	27177-08-8
Ethanol, 2-(nonylphenoxy)-	27986-36-3
Ethanol, 2-[2-[2-[2-(4- nonylphenoxy)ethoxy] ethoxy]ethoxy]-	7311-27-5
Poly(oxy-1,2-ethanediyl), α(nonylphenyl)- ω-hydroxy-	9016-45-9
Ethanol, 2-[2-(nonylphenoxy)ethoxy]-	27176-93-8
Poly(oxy-1,2-ethanediyl), α-(2- nonylphenyl)-ω-hydroxy-	51938-25-1
Poly(oxy-1,2-ethanediyl), α-(isononylphenyl)- ω-hydroxy-	37205-87-1
3,6,9,12,15,18,21,24-Octaoxahexacosan-1-ol, 26-(nonylphenoxy)-	26571-11-9

Annex MM. Creosote, Coal Tar, Anthracene Etc.

Cresote; wash oil	8001-58-9
Creosote Oil; wash oil	61789-28-4

Distillates (coal tar); naphthalene oils; naphthalene oil	84650-04-4
Creosote oil; acenaphthene fraction; wash oil	90640-84-9
Distillates (coal tar); upper; heavy anthracene oil	65996-91-0
Anthracene oil	90640-80-5
Tar acids; coal; crude; crude phenols	65996-85-2
Cresote; wood	8021-39-4
Low temperature tar oil; alkaline; extract residues (coal); low temperature	122384-78-5
coal tar alkaline	
Coal tar	8007-45-2

Annex NN. Dibutyltin Compounds (DBT)

Dibutyltin oxide	818-08-6
Dibutyltin chloride	683-18-1
Dibutyltin diacetate	1067-33-0
Dibutyltin dilaurate	77-58-7
Dibutyltin hydrogen borate	75113-37-0
Dibutyltin maleate	78-04-6
Other dibutyltin compounds	-

Annex OO. Organohalogen Flame Retardants

1,2-bis(2,4,6,-tribromphenoxy)ethane – BTBPE	37853-59-1
2,2',4,4',5,5'-hexabromobiphenyl (Firemaster® BP-6) BB 153	59080-40-9
2,2-bis (bromomethyl) 1,3-propanedioil DBNPG	3296-90-0
2,3,4,5-tetrabromobenzoic acid TBBA	Not available
2-ethylhexyl 2,3,4,5-tetrabromobenzoate TBB	183658-27-7
Bis (2-ethylhexyl) 3,4,5,6-tetrabromophthalate TBPH	26040-51-7
Decabromodiphenyl ethane DBDPE	84852-53-9
Decabromodiphenyl ether decaBDE	1163-19-5
Di(2-ethylhexyl) phthalate DEHP	117-81-7
Hexabromocyclododecane HBCD	25637-99-4, 3194-55-6, 134237-50-6, 134237-51-7, 134237-52-8
Octabromodiphenyl ether octaBDE	32536-52-0
Pentabromodiphenyl ether pentaBDE	32534-81-9
Polybrominated diphenyl ether PBDE	See Annex Q for listing
Tetrabromobisphenol A TBBPA	79-94-7
Tetrabromobisphenol A-bis (2,3-dibromopropylether) TBBPA-BDBPE	Not available
Tetrabromoethylcyclohexane TBECH	Not available
Tributyl phosphate TBP	126-73-8
Tricrecyl phosphate TCP	Not available
Triphenyl phosphate TPhP	115-86-6
Tris (1-chloro-2-propyl) phosphate TCPP	13674-84-5
Tris (1,3-dichloro-2-propyl)phosphate ("chlorinated tris") TDCPP	13674-87-8
Tris (2-butoxyethyl) phosphate TBEP	Not available
Tris (2-chloroethyl) phosphate TCEP	115-96-8
Tris (2-ethylhexyl)phosphate TEHP	Not available
Tris (2,3-dibromopropyl) phosphate TDBPP	126-72-7