Alligo Group Chemical Requirements
Ver. 2022.2– Electronics and other goods

Introduction

This document contains information to suppliers (producers, importers and traders) regarding legal requirements and restricted substances in Electric and Electronic Equipment (EEE), tools, supplies, chemicals and similar products purchased by Alligo Group which will hereon in this document be referred to as Alligo.

The Alligo Chemical Requirements constitutes a part of Alligo Supplier Agreement and is applicable to all orders and products delivered to Alligo. The supplier is obliged to inform all its sub-suppliers and subcontractors of the chemical requirements throughout the supply chain and enforce full implementation of the same.

For further information, comments or questions, please contact Alligo quality department at: info@swedol.se.

Legal Requirements

REACH – European Parliament and Council Regulation (EC) No 1907/2006

REACH is the European Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals. It entered into force in 2007, replacing the former legislative framework for chemicals in the EU. The main aims of REACH are to ensure a high level of protection for human health and the environment, including the promotion of alternative test methods.

REACH affects all EU-actors that professionally manufacture, import, sell, buy, distribute or use chemicals as such and in articles. Thus, Alligo require that all our suppliers comply with REACH and other EU legislation.

Registration

One of the requirements of REACH is that manufactures of chemicals and importers of chemicals and articles have a duty to register, for each legal entity, substances on their own, or in preparations that they produce or import in quantities over 1000 kg per year (per manufacturer/importer), unless the substances is exempt from registration. For importers of articles registration requirements apply to substances

intentionally released from articles under certain conditions, in which case the article producer/importer is responsible for the registration.

Duty to Inform on Substances for Authorization and registration in the SCIP-database

All EU-actors that professionally manufacture, import, sell or distribute articles are legally obliged to inform their customer about the presence of a Candidate List substance of very high concern, SVHC-substance, in articles placed on the market.

Since 5 January 2021 all articles containing SVHC-substances must be registered in the SCIP-database established under the Waste Framework Directive 2008/98/EC.

All suppliers are requested to follow updated information on the website of the European Chemicals Agency (ECHA): http://ECHA.europa.eu.

The Candidate List (SVHC): https://echa.europa.eu/candidate-list-table

The Authorization List (Annex XIV): https://echa.europa.eu/authorisation-list

SCIP-database: https://echa.europa.eu/scip

Information required regarding products

1. Any substances from the Candidate List (SVHC) present above 0.1% in articles (refers to any individual part of an article) delivered to Alligo shall be declared. Please list these substances by name, CAS RN and concentration (% or mg/kg).

2. Articles containing SVHC-substances need to be registered in the SCIP-database. Please, provide us with the registration number, SCIP-number, for all relevant articles.

Information regarding products shall be sent to mikaela.johansson@alligo.com as well as your contact person in purchasing within Alligo.

CLP-Regulation (EC) No 1272/2008

The Regulation on classification, labelling and packaging of substances and mixtures aligns existing EU legislation to the United Nations' Globally Harmonized System (GHS). CLP is legally binding across the Member States and directly applicable to all industrial sectors. It requires manufacturers, importers or downstream users of substances or mixtures to classify, label and package their hazardous chemicals appropriately before placing them on the market.

https://ec.europa.eu/growth/sectors/chemicals/legislation_en
https://echa.europa.eu/regulations/clp/understanding-clp

BPR, Regulation (EU) 528/2012

The Biocidal Products Regulation concerns the placing on the market and use of biocidal products. This regulation aims to improve the functioning of the biocidal products market in the EU, while ensuring a high level of protection for humans and the environment. All biocidal products require an authorization before they can be placed on the market, and the active substances contained in that biocidal product must be previously approved.

https://echa.europa.eu/regulations/biocidal-products-regulation/understanding-bpr

RoHS, Directive 2011/65/EU

This directive restricts the use of certain hazardous substances in electrical and electronic equipment (EEE) and promotes the collection and recycling of such equipment. The requirements have been gradually extended to include all electric and electronic equipment (EEE), it will be fully implemented by 22 July 2019, except for explicit exclusions. The recast (RoHS 2) came into force 2011.

http://ec.europa.eu/environment/waste/rohs_eee/legis_en.htm
http://ec.europa.eu/environment/waste/rohs_eee/events_rohs3_en.htm

Batteries & Accumulators, Directive 2006/66/EC

The batteries directive intends to minimize the negative impact of batteries and accumulators and their waste on the environment. The directive harmonizes the requirements for placing batteries and accumulators on the market. It encompasses all kinds of batteries and accumulators, with some small exceptions. Within the directive is also legislation for waste batteries and accumulators.

http://ec.europa.eu/environment/waste/batteries/index.htm
http://ec.europa.eu/environment/waste/batteries/legislation.htm

PPW, Directive 94/62/EC

Directive 94/62/EC was adopted to harmonize national measures concerning the management of packaging and packaging waste and to prevent or reduce its impact on the environment.

http://ec.europa.eu/environment/waste/packaging/legis.htm

POPs, Regulation (EC) No 2019/1021

Persistent organic pollutants (POPs) are chemical substances that persist in the environment, bioaccumulate through the food web, and pose a risk of causing adverse effects to human health and the environment. This group of priority pollutants consists of pesticides (such as DDT), industrial chemicals (such as polychlorinated biphenyls, PCBs) and unintentional by-products of industrial processes (such as dioxins and furans).

http://ec.europa.eu/environment/chemicals/international_conventions/index_en.htm

Ozon-depletion, Regulation (EC) No 1005/2009

This Regulation lays down rules on the production, import, export, placing on the market, use, recovery, recycling, reclamation and destruction of substances that deplete the ozone layer.

https://eur-lex.europa.eu/legal-ontent/EN/TXT/PDF/?uri=CELEX:32009R1005&from=EN

Implementation

The supplier is fully liable for compliance with the requirements specified in this document. The supplier is advised to carry out their own risk assessments and self-reference tests of products and/or materials for chemicals content and other aspects as necessary, on their own expense.

Alligo will carry out due diligence testing to verify compliance. In case of non-compliance with the Chemical Requirements, appropriate actions need to be discussed with Alligo without delay. The supplier will be liable for all costs occurred related to a non-compliance due to negligence or carelessness.

Please note! Comments on chemical guide.
The chemical guide below is first and foremost constructed for electronic and electric equipment. However, the guide can be used for most other goods, products and supplies that Alligo retail and should be considered for all products, except textiles and leather. For textiles and leather, the chemical guide specifically for textiles and leather should be advised.

Main changes in the EEE Chemical Guidance:

- RoHS exemption list in Annex 1 is updated

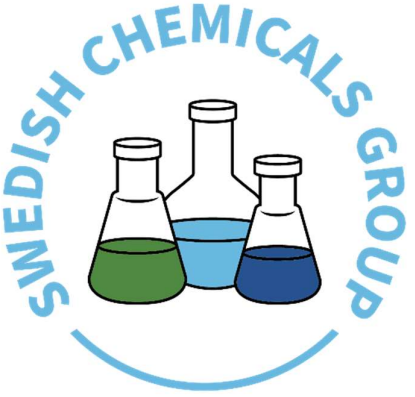
- Minor clarifications and language corrections for various substances to improve the understandability

- The testing standards which have been updated are:

    - IEC standards measuring bromine or bromine compound with different techniques; 62321-9 (HBCDD), IEC 62321-3-3 (screening with pyrolyser/thermal desorption accessory GC-MS), IEC 62321-3-1 (screening total bromine) IEC 62321-3-2 (total bromine), have benna added

Chemicals Guidance; Information on authorization and restrictions of substances used in electrical and electronic processes and products

Ver: August 2022



The Swedish Chemicals Group

Table of contents

PREFACE 5

EXPLANATORY SECTION 6

PROCESS CHEMICALS 9

Alkylphenol ethoxylates (APEO) and derivatives 9

Bisphenols 11

C, C'-azodi(formamide) (ADCA) 12

Ethylenethiourea 13

Ethylenediamine (EDA) 14

Formaldehyde 15

Formamide 16

Fluorinated Greenhouse gases 17

Hexahydromethylphthalic anhydride (MHHPA) 18

Hydrazine 19

Imidazoles 20

4,4'- Diaminodiphenylmethane (MDA) 21

2,2'-dichloro-4,4'-methylenedianiline (MOCA) 22

Michler's ketone 23

Ozone depleting substances 24

PAH - Polycyclic aromatic hydrocarbons 25

PFAS - Highly fluorinated sulphonic acids (PFOS and related substances) 26

PFAS - Highly fluorinated ethers 28

Solvents 29
- Aromatic organic solvents 29
- Aliphatic organic solvents 30
- Aprotic solvents 31
- Chlorinated organic solvents 34

TGIC and β-TGIC 36

Tin organic compounds (Organostannic compounds) 37

Trimellitic anhydride (TMA) 38

PRODUCT-RELATED (PROPERTY-LENDING) CHEMICALS 39

Arsenic compounds 39

Asbestos 40

Benzotriazols UV-320, UV327, UV-328 and UV-350 41

6,6'-di-tert-butyl-2,2'-methylenedi-p-cresol (DBMC) 42

Flame retardants/Biocides - Boric acid, and related boron compounds 43

Cadmium (Cd) and cadmium salts 44

Flame retardants/Plasticizers - Chloroparaffins 46

Chromium VI compounds 47

Cobalt and cobalt (II) compounds 49

EGDME, DEGDME and TEGDME 50

Flame retardants - Dechlorane ™ Plus 51

Gold 52

Halogenated flame retardants (other than those already listed in this guide) 53

Flame retardants - Hexabromocyclododecan (HBCDD) 55

Lead (Pb) and lead salts 56

Nickel (Ni) in skin contact 60

Perchlorates 61

PFAS - Highly fluorinated carboxylic acids (PFOA and related substances) 62

Phthalate esters 64

Flame retardants – Polybrominated biphenyls (PBB) and Polybrominated diphenyl ethers (PBDE) 66

1,3-propanesultone 68

Siloxanes 69

Tantalum 70

Tin 71

Tungsten 72

Flame retardants - Chloroorganic phosphates (TCEP, TCPP, TDCPP/TDCP) 73

Flame retardants - Trisubstituted phosphates 74

BIOCIDAL AGENTS 75

General information 75

Cu-HDO (Bis-(N-cyclohexyldiazeniumdioxy) –copper) 75

Carbendazim 76

Dimethylfumarate (DMFu) 77

Guanidine, N,N'''-1,6-hexanediylbis[N'-cyano-, polymer with 1,6-hexanediamine, hydrochloride (PHMB 1600; 1.8) 78

Pentachlorophenol (PCP) and all isomers of Tetrachlorophenols (TeCP) 79

Permethrin 80

Silver and its compounds 81

Tri-substituted organostannic compounds 82

Triclosan and Triclocarban 83

Zincpyrithion 84

Proposition 65 in California: Other chemicals listed 85

APPENDIX 1 – EXEMPTIONS IN ROHS 86

APPENDIX 2 – NON EXHAUSTIVE LIST OF DBTS (DIBUTYLTIN COMPOUNDS) 90

APPENDIX 3 – CHROMIUM (VI) SVHC COMPOUNDS 91

APPENDIX 4 – SVHC LEAD AND LEAD COMPOUNDS 92

APPENDIX 5 – GREENHOUSE GASES 93

APPENDIX 6 – LIST OF PAHS 94

APPENDIX 7 – HALOGEN FREE/LOW HALOGEN INDUSTRY STANDARDS 95

APPENDIX 8 - PHTHALATE ESTERS 96

PREFACE

This guide is to facilitate for importing and other companies to comply with the chemical legislation and recommendations in force in the fields of electrical and electronic equipment. This guide also includes recommendation regarding packaging material. By requiring that their suppliers follow these guidelines, and thereby avoiding products containing unwanted substances, human health and environment are protected in producing, supplying and importing countries. Import of the mentioned products from, in particular, developing countries to the European Union (EU) and European Economic Area (EEA) is also facilitated and promoted by this guide.

The distinguishing properties of the substances and the processes in which they are used are described in the guide.

The stipulated analysis standards and test equipment is commonly occurring, and the limits of quantification (LOQ) are generally accepted. Please note that when limit values are given, possible contamination by the external environment and inaccuracy in the measurement of very low concentration must be taken into consideration.

Required substitutes are less harmful while providing the desired effect or property.

The guide exists also in Chinese. To facilitate communication, the contents on each page are identical in each linguistic version. The English version of this guide is preferential for interpretation.

EXPLANATORY SECTION

Word list

Required limit value:	Limit value as agreed in business sector and or by legal requirements. Note that limit value is measured in product. Weight percent shall be calculated from the weight of the material if nothing else is stated.
CAS RN:	Chemical abstract services registration number. CAS RNs are given for specific defined substances.
Properties:	Human toxicological and eco toxicological properties.
Use:	Identified uses on the market.
Comments:	Information on known alternatives and recommendations on how to avoid unwanted chemicals.
Legal background:	Current legal international and national framework and requirements. Substances listed on Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 (REACH) leads to information duty if the concentration is above 0.1 weight-% (1000 mg/kg).
Test method:	Standardized test method if such exists. ISO/EN standards are prioritized over national or commercial standards. Test equipment if no standardized test method exists. Abbreviations of recommended test equipment are explained below. All substances in a chemical group may not be legally regulated, but still included as a chemical group in this guide. As it can distinguish between different laboratories which substances besides the legal restricted, they offer test for, this should be confirmed before ordering
Detection limit:	Limit of detection (LOD). Lowest concentration the test equipment is able to detect. This can vary between different test laboratories. Note that detection limit is not relevant as required limit values for all substances as the background concentrations can be notably higher
MADL	Maximum Allowable Dose Levels. Safe harbor levels for chemicals causing reproductive toxicity in Proposition 65, in California.
NSRL:	No Significant Risk Levels. Safe harbor levels for cancer-causing chemicals in Proposition 65, in California.
Quantification limit:	Limit of quantification (LOQ). The smallest concentration of an analyte that can be reliably measured by an analytical procedure.
Packaging material:	According to Directive (EC) No 94/62/EC of 20 December 1994 on packaging and packaging waste. The directive regulates substances in packaging material; meaning all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer.

Test equipment abbreviations

ANALYSES OF ORGANIC COMPOUNDS

- **Gas chromatography: GC**

Detectors used together with GC:

- MS: Mass selective detector: GC-MS
- DAD: Diode array detector: GC-DAD
- ECD: Electron capture detector: GC-ECD

- **Liquid chromatography: LC**

Note: Sometimes the abbreviation HPLC is used. It stands for High Performance Liquid Chromatography.

Detectors used together with LC:

- MS: Mass selective detector: LC.MS
- DAD: Diode array detector: LC-DAD
- ECD: Electron capture detector: LC-ECD
- UV/VIS: Ultraviolet/visible spectrophotometric detector: LC-UV/VIS

ANALYSES OF METALS

- **Inductively Coupled Plasma Spectrometry: ICP**

Detectors together with ICP:

- OES: Optical emission spectrometer: ICP-OES
- MS: Mass selective detector: ICP-MS

- **Atomic absorption spectrophotometer: AAS**

SCREENING ANALYSES OF ELEMENTS

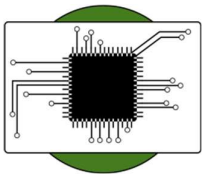
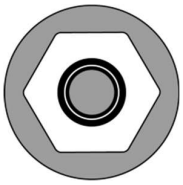
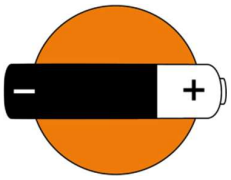
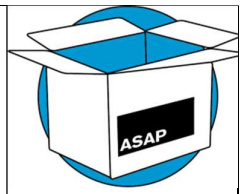
- **X-ray fluorescence, XRF**

Relationship between units used in the guide

1000	mg/kg	equals	1000	ppm	(parts per million)
			1 000 000	ppb	(parts per billion)
			1 000 000	µg/kg	(microgram per kilogram)
			0.1	% (by weight)	
			x	µg/cm2/week	x is a measure of the release of a substance from a surface, and is only partially dependent on the concentration of the substance

Product and material categories concerned

All chemicals are not used in all materials. A general division into the categories listed below has therefore been made that may be applicable to several kinds of articles due to their material composition

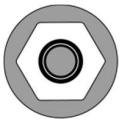
				
Printed wiring board Materials used in components, epoxy boards (PCBs) etc	**Metal** Metals and metal alloys	**Plastics** Material made of polymers, like plastics and rubber	**Batteries**	**Packaging** Paper cardboard, plastic bags, tags, labels, etc.

PROCESS CHEMICALS

Process chemicals are used in the manufacturing process but have no function in the finished product. Remains of the process chemicals may however be found in the finished product and cause health or environmental problems.

Alkylphenol ethoxylates (APEO) and derivatives

The most common APEOs are Nonylphenol ethoxylates (NPEO) and Octylphenol ethoxylates (OPEO).



Required limit value:	Should not be used in processes. Occurrence in products below 100 mg/kg (0.01%) for total APEO is regarded as unintended residues (contaminants) which cannot be controlled.
CAS RN:	Various
Properties:	Irritating to skin. The metabolites affect the respiratory system, have endocrine disruptive effect (hormones) and are dangerous for the environment. Nonylphenol ethoxylates are rapidly degraded to 4-nonylphenol, which is even more dangerous for the environment. A similar environmental danger is the degradation of octylphenol ethoxylate into 4-octylphenol.
Use:	APEO is present in corrosion protective agents, scouring and lubricating agents, cooling and lubricating agents for metal tooling. May be used in paints, lacquers and varnishes in concentrations up to 10% w/w of the mixture. Commercial nonylphenol is used in the production of phenol/formaldehyde resins, plastics, stabilisers, as a catalyst in the curing of epoxy resins (4-Nonylphenol, branched and linear). Octylphenol may still be used (as an antioxidant) in some older formulations of stabilizers for PVC cable jacketing. 4-tert-Octylphenol 140-66-9 may be used as rubber additives.
Comments:	The main alternatives for NPEOs include aliphatic alcohol ethoxylates, both linear and branched, and glucose-based carbohydrate derivatives such as alkylpolyglucoside, glucamides, and glucamine oxides. Note that in this group of alternatives, there might be substances having human and environmental aspects (some branched aliphatic alcohols may be toxic and amine containing substances (like glucamine oxides) may form nitrosamines under certain process conditions).
Legal background:	Legal limit: 0.1% by weight for nonylphenol ethoxylate (NPEO) as a substance or constituent of preparations (closed systems exempted). Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 46.

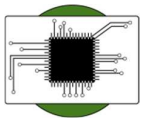
Norway restricts manufacture, import, export, sale and use of octylphenol and octylphenol ethoxylates, and mixtures containing these substances, FOR 2004-06- 01-922.

4-Nonylphenol, branched and linear (4-NP, various CAS RN), 4-Nonylphenol, branched and linear, ethoxylated, ethoxylated (4-NPnEO, various CAS RN), 4-(1,1,3,3-tetramethylbutyl)phenol, (4-tert-octylphenol CAS 140-66-9), 4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated (4-tert-OPnEO, UVCB substance, no CAS RN), 4-tert-butylphenol (CAS RN 98-54-4) and tris(4-nonylphenyl, branched and linear) phosphite (TNPP) with = 0.1% w/w of 4-nonylphenol, branched and linear (4-NP) (no CAS RN)) are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Several AP and APEO are also included in Annex XIV to REACH.

Test method: No standardised test method available.

Test equipment: LC-MS, LC-DAD
LOQ: 10 mg/kg

Bisphenols




Required limit value: Should not present in products.

CAS RN: Bisphenol A; BPA (4,4'-isopropylidenediphenol): 80-05-7
2,2-bis(4'-hydroxyphenyl)-4-methylpentane: 6807-17-6
Bisphenol B; (4,4'-(1-methylpropylidene)bisphenol): 77-40-7

Properties: Toxic for reproduction. Endocrine disrupting properties

Use: Mainly used in manufacture of polycarbonate epoxy resins and chemicals. Also as; hardener in epoxy resins and thermal prints. May be used as catalyst and anti-oxidant for processing PVC.

Comments: Left as residues in polycarbonate and epoxy. Bisphenols can be found in products with material based on plastic and paper.

Legal background: BPA, Bisphenol B and 2,2-bis(4'-hydroxyphenyl)-4-methylpentane are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Bisphenol A (BPA) content in thermal paper (0.02w%), is restricted according to Annex XVII of Regulation (EC) No 1907/2006 (REACH), entry 66.

Canadian medical equipment legislation; Declare if manufactured from raw materials using BPA or derived of BPA and if used in medical devices and part that comes into contact with patient or patient fluids (e.g., via intravenous, inhalation, oral exposure, contact with skin, or as an implant).

In California: BPA is listed in Proposition 65. Safe Harbor Limit: MADL 3 µg/day (dermal exposure from solid materials). Settlements agreed at 3 ppm for cell phone cases. 20 ppm or zero limit for various products. Note that the settlements apply only for the specific article in that settlement.

Test method: No standardised test method available.

Test equipment LC-MS, GC-MS.
LOQ: 10 mg/kg

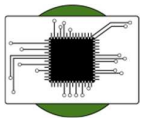
C, C'-azodi(formamide) (ADCA)

Required limit value:	Should not be used in processes or present in products.
CAS RN:	123-77-3
Properties:	Respiratory sensitizer
Use:	Azodicarbonamide, or azodiformamide is mainly as blowing agent in the rubber and plastics industry. Blowing agent in especially EVA and PVC.
Comments:	Can leave residues of formamide in the material. ADCA may decompose into semicarbazide a suspected carcinogen. Use physical blowing agents such as carbondioxide, hydrocarbons or nitrogen as alternative to chemical blowing agents when possible.
Legal background:	ADCA is listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS. LOQ: 200 mg/kg

Ethylenethiourea

Required limit value:	Should not be present in products.
CAS RN:	Imidazolidine-2-thione (2-imidazoline-2-thiol) also called ethylenethiourea: 96-45-7
Properties:	Toxic for reproduction.
Use:	Used primarily as an accelerator for vulcanizing rubber
Legal background:	Ethylenethiourea is listed on the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: Ethylenethiourea is listed in Proposition 65. Safe Harbor Limit: NSRL 20 µg/day.
Test method:	No standardised test method available. Test equipment: LC-MS LOQ: 20 mg/kg

Ethylenediamine (EDA)



Required limit value:	Should not be present in products.
CAS RN:	107-15-3
Properties:	Respiratory and skin sensitizer
Use:	Used in the production of many industrial chemicals. Used as a catalyst in epoxy resins (in glues, adhesives, paints). Used in the production of polyurethane fibers.
Legal background:	Ethylenediamine is listed on the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH).
Test method:	No standardised test method available. Test equipment: LC-MS, GC-MS LOQ: 100 mg/kg

Formaldehyde

Required limit value:	1000 mg/kg
CAS RN:	50-00-0
Properties:	Formaldehyde is a volatile colourless gas that is CMR classified. Occurs naturally in small quantities in the atmosphere and in nature. Formaldehyde is a human carcinogen that can also cause skin irritation and allergy.
Use:	Transformation product from formaldehyde releasers such as carbamide- and melamine binders (glues). Preservative.
Comments:	Use products without formaldehyde or with very low concentrations of formaldehyde. Due to its volatility, formaldehyde is “contagious”.
Legal background:	Restrictions for use of substances, harmonised classified as carcinogens, mutagenic, reproductive toxic according to CLP including class 2 (only 1A and 1B are CMR), as substances, as constituents of other substances or in mixtures. These are found in REACH annex XVII, entry 28-30. Releases of formaldehyde from construction products are restricted. German law (Bedarfsgegenständeverordnung and Chemikalien-Verbotsverordnung); Products with formaldehyde content shall be labeled. Wooden products shall not release formaldehyde. Cleaning and finishing agents shall not contain formaldehyde above 0.2%. California; Limits on Formaldehyde Emissions from Composite Wood Panels. Proposed EU restriction on formaldehyde in articles related to testing in air chamber. In California: Formaldehyde (gas) is listed in Proposition 65. Safe Harbor Limit: NSRL 40 µg/day.
Test method:	EN 717-1, -2, -3 (emissions) EN 120 (content) ISO/DIS 12460-2, -3, 4 (emissions) EN ISO 141 84-1(textiles), LOQ: 16 mg/kg ISO 17226 (leather), LOQ: 16 mg/kg

Formamide

Required limit value: Should not be present in products.

CAS RN: 75-12-7

Properties: Toxic for reproduction.

Use: Formamide is used as solvent for example in the production of synthetic leather and inks. Furthermore, formamide is used as a solvent and plasticizer in consumer products. It can be an ingredient as softener for paper, water soluble glues and wood stains. During processing of foam, formamide is formed as a by-product at higher temperatures. Especially tosylsemicarbazide and azodicarbonamide (see headline ADCA above) are responsible for the presence of formamide in EVA-consumer products.

Comments: For the application as solvent, formamide might be replaced by other solvents like dipropylene glycol.
Potential alternatives as N,N-dimethylformamide, N-methylformamide or low molecular weight ethylene glycol ethers are not considered to be adequate substitutes due their similar toxicity to reproduction.

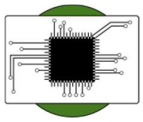
Legal background: Formamide is listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Formamide is restricted in puzzle mats in Belgium and France and included in the Toy Safety Directive (limit value 200 mg/kg).

Test method: No standardised test method available.

Solvent extraction. Test equipment: GC-MS or LC-MS
LOQ: 50 mg/kg

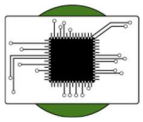
Fluorinated Greenhouse gases

(Perfluorocarbons (PFCs), Sulfur hexafluoride (SF6) and Hydrofluorocarbons (HFCs)



Required limit value:	Should not be used in processes or present in products.
CAS RN:	Several, see appendix 5
Properties:	Dangerous for the environment.
Use:	Semiconductor manufacturing processes use high GWP fluorinated compounds including perfluorocarbons (e.g., CF_4, C_2F_6 and C_3F_8), hydrofluorocarbons (CHF_3, CH_3F and CH_2F_2), nitrogen trifluoride (NF_3) and sulfur hexafluoride (SF_6). Refrigerant, foaming agent, extinguishing agents, cleaning agents, insulating media, caustic gas. SF 6 plasma is used in the semiconductor industry as an etchant and for flat panel display units manufacturing.
Alternative:	Ammonia, hydrocarbons, carbondioxide, depending on specific use/application.
Legal limit:	Intentionally added. Regulation (EC) No 517/2014 of the European parliament and of the council of 16 April 2014 on fluorinated greenhouse gases Products that are not listed in Annex III in regulation (EC) 517/2014 may be sold under certain conditions. Products and equipment that contain fluorinated greenhouse gases must be labelled before being placed on the market.
Test method:	No suited method for dissolved gases in products

Hexahydromethylphthalic anhydride (MHHPA)



Required limit value:	Should not be present in products.
CAS RN:	Hexahydromethylphthalic anhydride; 25550-51-0 Hexahydro-4-methylphthalic anhydride; 19438-60-9 Hexahydro-1-methylphthalic anhydride; 48122-14-1 Hexahydro-3-methylphthalic anhydride; 57110-29-9 Cyclohexane-1,2-dicarboxylic anhydride; 85-42-7, 14166-21-3, 13149-00-3
Properties:	Allergenic, causing respiratory health effects. Impacts caused by MHHPA on the health of the affected individuals and on society as a whole, are comparable to those elicited by category 1 carcinogens, mutagens and reproductive toxicants (CMRs), and the substance is considered of very high concern.
Use:	MHHPA is a curing agent for epoxy resin mainly used in electric and electronics field. MHHPA is commonly used in a specific mixture with HHPA (hexahydrophthalic anhydride). Found in diode (LED), transmitter and capacitator in electronic manufacturing industry.
Legal background:	0.1% by weight Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH).
Test method:	No standardised test method available. Test equipment: GC-MS

Hydrazine

Required limit value:	Should not be used in processes or present in products.
CAS RN:	Hydrazine: 302-01-2, 7803-57-8
Properties:	Carcinogenic, allergenic, toxic.
Use:	Mainly used as a chemical foaming agent in preparing polymer foams. Corrosion inhibitor.
Comments:	Use physical blowing agents such as carbondioxide, hydrocarbons or nitrogen as alternative to chemical blowing agents when possible
Legal background:	0.1% by weight Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: Hydrazine is listed in Proposition 65. Safe Harbor Limit: NSRL 0.04 µg/day.
Test method:	No standardised test method available. Test equipment: UV-VIS Spectrometer, GC-MS LOQ: 200 mg/kg

Imidazoles

Required limit value:	Should not be used in processes or present in products.
CAS RN:	1-vinylimidazole CAS 1072-63-5 2-methylimidazole CAS 693-98-1
Properties:	Toxic for reproduction
Use:	Mainly used in formulations and as a monomer in the production of polymers As a catalyst in the production of coating products. It can be used as the curing agent of adhesives, epoxy resin and as additives for the preparation of foam plastics
Legal background:	Duty to inform your customer on substances for authorisation (EU/EEA) Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: 2-methylimidazole is listed in Proposition 65.
Test method:	No standardised test method available. Test equipment: GC-MS. LOQ: 200 mg/kg

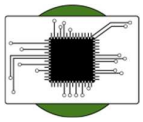
4,4'- Diaminodiphenylmethane (MDA)

Required limit value:	Should not be used in processes or present in products.
CAS RN:	101-77-9
Properties:	Carcinogenic, persistent.
Use:	Hardener for epoxy resins, intermediate in the manufacture of high performance polymers e.g. building block for polyether ether ketone (PEEK). Mainly used in epoxy coatings and composites and PEEK. MDA is reacted in the polymerisation process and likely not found free in the material.
Legal background:	0.1% by weight MDA is included both in Annex XIV and in the candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: MDA is listed in Proposition 65. Safe Harbor Limit: NSRL 0.4 µg/day.
Test method:	No standardised test method available. Test equipment: LC-MS, GC-MS.

2,2'-dichloro-4,4'-methylenedianiline (MOCA)

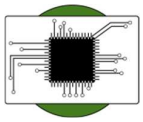
Required limit value:	Should not be used in processes or present in products.
CAS RN:	101-14-4
Properties:	Carcinogenic, persistent.
Use:	Curing agent (for polyurethane resins, epoxy resins and epoxy urethane reins, polystyrene and poly(methylmethacrylate) (PMMA), cross-linker (for polyurethane), chain extender (for polyurethane) or prepolymer, MOCA may be used as a curing agent in cast polyurethane elastomer production. Polyurethanes with crosslinking agent can be used in the production of machines, buildings, automobiles, airplanes, mining and sport equipment The amount of un-reacted MOCA is estimated to be in the range of 0.01% and 4%
Legal background:	0.1% by weight MOCA is included both in Annex XIV and in the candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: MOCA is listed in Proposition 65. Safe Harbor Limit: NSRL 0.5 µg/day.
Test method:	No standardised test method available. Test equipment: LC-MS, GC-MS.

Michler's ketone



Required limit value:	Should not be used in processes or present in products.
CAS RN:	Michler's ketone (4,4'-bis(dimethylamino)benzophenone): 90-94-8.
Properties:	Carcinogenic.
Use:	Process chemical in the production of electronic circuit boards
Legal background:	0.1w% Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: Michler's ketone is listed in Proposition 65. Safe Harbor Limit: NRSL 0.8 µg/day.
Test method:	No standardised test method available. Test equipment: LC-MS

Ozone depleting substances

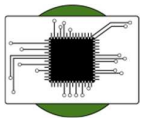
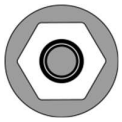


Required limit value:	Should not be used in processes or present in products.
Properties:	Liquid or gas. Dangerous for the environment.
Use:	Refrigerant, foaming agent, extinguish ant, solvent cleaner.
Comments:	Alternatives: water-based cleaning in processes, carbon dioxide/water blowing as foaming agent. Several alternatives are greenhouse gases (HFC).
Legal limit:	Intentionally added Montreal protocol, EC Regulation 1005/2009, Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases
Test method:	No suited method for dissolved gases in products

PAH - Polycyclic aromatic hydrocarbons

Required limit value:	Should not be used in processes or present in products.
CAS RN:	Various, regulated PAHs are listed in appendix 6.
Properties:	Carcinogenic, allergenic, toxic. Several are persistent, bioaccumulative and toxic in the environment
Use:	PAHs are not synthesized chemically for industrial purposes. The major source of PAHs is the incomplete combustion of organic material such as coal, oil and wood. They are used as intermediaries in pharmaceuticals, agricultural products, photographic products, thermosetting plastics, lubricating materials, and other chemical industries. May be found as impurities in rubber materials, soft plastics, colored plastics containing carbon black and leather
Comments:	Avoid critical sources for PAH such as Carbon Black and contaminated mineral oil-based lubricants (extender oil) in rubber.
Legal background:	Eight PAHs are listed in annex XVII, entry 50 of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Materials in toys or childcare articles that come into direct contact with the human skin shall not include of any of the listed PAHs in amounts more than 0.5 mg/kg For rubber or plastic materials with skin contact in other product categories the limit value is 1 mg/kg The voluntary German GS standard has requirements for the sum of 15 PAH and also specifically benzo [a] pyrene that most products in the German market follow. See appendix 6. U.S. EPA priority list include 16 PAH compounds for regulation in air, soil and water. Ten PAHs are included in the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: Several PAH are listed in Proposition 65. Safe Harbor Limit: NSRL 0.033-0.35 µg/day.
Test method:	ISO 21461 (NMR) AfPS GS 2019-01 PAK IEC 62321-10:2020 LOQ: 0.2 mg/kg

PFAS - Highly fluorinated sulphonic acids (PFOS and related substances)

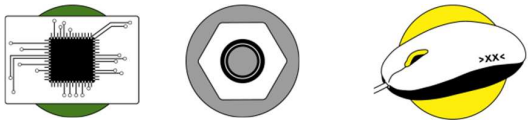




Required limit value:	Should not be present in products.
CAS RN:	Several, including 1763-23-1, 355-46-4
Properties:	Highly fluorinated carboxylic acids (PFSAs) such as PFOS are persistent, bioaccumulative and toxic (PBT) substances. PFOS can cause cancer (testicular and kidney cancer), liver damage and changes in immune- and endocrine system (e.g. cholesterol levels).
Use:	Antistatic agent for films and plastics. Surface treatment surfactant in semiconductor industry. Protective surfactant layer for metal plating with Cr (VI) compounds. PFOS other PFSAs are used as an emulsifier in the production of fluoropolymers such as polytetrafluoroethylene (PTFE) etc. They can be as present as pure substances in products or as precursor chemicals (e.g. polymers) that form PFOS and other PFSAs due to transformation processes. Salts of PFBS are used as additives in plastics for anti-static properties, as flame retardants (in PC) and in manufacturing processes of plastics (e.g. for compounding).
Legal limit:	Legal limit: Shall not occur PFOS and its derivatives are listed as POPs[1] in the Stockholm Convention on Persistent Organic Pollutants (POPs) and banned in EU by the POPs Regulation (EU) No 2019/1021. Residues below 0.1% by weight in articles or part of articles are allowed to be placed on the market and used, as these are the amounts that may be present as impurity[2]. Perfluorohexane-1-sulphonic acid and its salts (PFHxS), and Perfluorobutane sulphonic acid (PFBS) and its salts are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Declaration duty in Sweden from 1 January 2019 to the Swedish Chemicals Agency for PFAS in chemical products that are deliberately added. Composition needs not to be specified but the information duty applies without any concentration limit.

[1] Persistent Organic Pollutants (POPs) are organic chemical substances, which remain intact for exceptionally long periods of time, become widely distributed in the environment, accumulate in the fatty tissue of living organisms and toxic to both humans and wildlife
[2] The total amount of PFOS and PFOS related substances counted as PFOS, see test method EN/TS 15968:2009

	In California: Perfluorooctane Sulfonic Acid (PFOS) and its salts and transformation and degradation precursors are listed in Proposition 65.
Test method:	CEN/TS 15968:2010 Test equipment: LC-MS

PFAS - Highly fluorinated ethers



Required limit value:	Should not be present in products.
CAS RN:	13252-13-6
Properties:	Highly fluorinated ethers (PFPEs) such as HFPO-DA (2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propionic acid) were developed as replacements for PFAO and PFOS. They are water-soluble and mobile surfactants that are under suspicion to be equally persistent as other PFASs. While the bioaccumulation potential of HFPO-DA is still uncertain, this substance has showed adverse effects on kidney, immune- and haematological system, as well as effects on foetus development in animal studies. Other PFPEs are likely to be equally stable and mobile.
Use:	PFPEs are used as emulsifiers in the production of fluoropolymers such as polytetrafluoroethylene (PTFE) etc.
Comments:	Non-fluorinated emulsifiers such as hydrocarbons should be preferred to produce fluoro polymers. Fluorinated emulsifiers may only be applied for essential uses.
Legal background:	HFPO-DA, its salts and its acyl halides (CAS 13252-13-6, 67118-55-2, 2062-98-8 and 62037-80-3) are listed in the Candidate List of Substances of Very High Concern for authorization of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Declaration duty in Sweden from 1 January 2019 to the Swedish Chemicals Agency for PFAS in chemical products that are deliberately added. Composition needs not to be specified but the information duty applies without any concentration limit.
Test method:	Test equipment: LC-MS LOQ: -

Solvents

Aromatic organic solvents

Required limit value:	Should not be present in products.
CAS RN:	Various
Properties:	Liquids or gases. Inhalation can affect the nervous system and cause headache, fatigue and nausea. Cause irritation on skin, eyes and mucous membranes. Kerosene and diesel odour in finished products. Some aromatic organic compounds are carcinogenic.
Use:	Solvents.
Comments:	Aromatic organic solvents are volatile organic compounds (VOC). There are statutory hygienic limit values for employees in many countries Alternatives are solvents of higher quality with lower levels of aromatic hydrocarbons or synthetic thickeners based on polycarboxylic acids. Replace simple aromatic hydrocarbons (petrol) with low-molecular-weight aliphatic hydrocarbons. To avoid problems with organic solvents, switching to water-based dyeing and printing processes is recommended.
Legal background:	Manufacturers in the EU are required to follow the Industry Emissions Directive (IED), 2010/75/EU. In California: Benzene is listed in Proposition 65. Safe Harbor Limit: NSRL 6.4 µg/day (oral), 13 µg/day (inhalation). MADL: 24 µg/day (oral), 49 µg/day (inhalation).
Test method:	SNV 195 651, screening method. Panel odour test. Detection limit: No odour. No standardised quantitative test method for materials available.

Aliphatic organic solvents

Required limit value: Should not be present in products.

CAS RN: Various

Properties: Liquids or gases. Inhalation can affect the nervous system and cause headache, fatigue and nausea, as well as chronic effects. Cause irritation on skin, eyes and mucous membranes.

Use: Solvents. The limit for humans to sense a smell lies around 100 mg/kg for most substances.

Comments: Some aliphatic organic solvents are volatile organic compounds (VOC). If possible, chose water-based systems based on easily degradable surfactants. If not possible to switch over to water- based systems, there are statutory hygienic limit values for employees in many countries for strict compliance to maintain workers safety.

Legal background: Manufacturers in EU are required to follow the “IED”, 2010/75/EU.
2-methoxyethyl acetate, CAS RN 110-49-6, and formamide, CAS RN 75-12-7, are two aliphatic solvents listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).

Test method: SNV 195 651, screening method. Panel odour test.
Detection limit: No odour.

Aprotic solvents

DMFa (N, N-dimethylformamide)

Required limit value:	Should not be present in products in concentrations above 500 mg/kg (sum of DMFa, DMAC and NMP)..
CAS RN:	N,N-dimethylformamide (DMFa): 68-12-2
Properties:	Toxic to reproduction. It may have a faint amine odour in finished products.
Use:	Used as solvent and in high voltage capacitors. Used in production of elastomers, leather imitation, as PU, acrylic and aramide. An intermediate for paper finishing
Comments:	If possible, chose water-based systems based on easily degradable surfactants. If not possible to switch over to water-based systems, there are statutory hygienic limit values for employees in many countries for strict compliance to maintain workers safety
Legal background:	Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: DMFa is listed in Proposition 65.
Test method:	Test equipment: GC-MS EN 16778 (protective gloves) CEN ISO/TS 16189 (footwear and footwear components) EN 17131 (textile) LOQ: 10 mg/kg

DMAC

Required limit value:	Should not be present in products in concentrations above 500 mg/kg (sum of DMFa, DMAC and NMP)..
CAS RN:	N, N-dimethylacetamide (DMAC): 127-19-5
Properties:	Toxic to reproduction, irritating.
Use:	Used in electrolytic capacitors, as solvent and in industrial coatings, elastomers, polyimide films, paint strippers and ink removers. Residues may remain in products as unreacted process chemical
Comments:	If not possible to switch over to water-based systems, there are statutory hygienic limit values for employees in many countries for strict compliance to maintain workers safety
Legal background:	Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). In California: DMAC is listed in Proposition 65.
Test method:	No standardised quantitative test method available. Test equipment: GC-MS, LC-MS (EN 17131 can be used as reference for in-house methods though it applies to DMFa) LOQ: 10 mg/kg.

NMP (N-methyl-2-pyrrolidone)

Required limit value: Should not be present in products in concentrations above 500 mg/kg (sum of DMFa, DMAC and NMP).

CAS RN: N-methyl-2-pyrrolidone (NMP): 872-50-4

Properties: Toxic to reproduction, irritating.

Use: Good solvency properties for polymers. Surface treatment of resins and metal coated plastics or as a paint stripper. Intermediates for plasticizers, stabilizers and specialty inks. It is also used in lithium ion battery fabrication, as a solvent for electrode preparation. Used as solvent in textile coating processes and in production of leather imitation (PU).

Polyamide precursor. SBR (styrene-butadiene) latex production.

Comments: Note that NEP (1-ethylpyrrolidin-2-one), CAS 2687-91-4 is not a suitable alternative to NMP since it is Reproduction Toxic 1B (a CMR substance), and on-going regulation of a limit value for working environment.
If not possible to switch over to water-based systems, there are statutory hygienic limit values for employees in many countries for strict compliance to maintain workers safety.

Legal background: Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH).
NMP has a limit value for working environment under Annex XVII of Regulation (EC) No 1907/2006 (REACH), entry 71

In California: NMP is listed in Proposition 65. Safe Harbor Limit: MADL 3200 µg/day (inhalation), 17000 µg/day (dermal).

Test method: No standardised test method available.

Test equipment: GC-MS, LC-MS
EN ISO 19070 (leather)
(EN 17131 can be used as reference for in-house methods though it only applies to DMFa)
LOQ: 25 mg/kg.

Chlorinated organic solvents

Required limit value: Should not be used in processes or present in products.
CAS RN: Various

Properties: Liquid or gas. Affect the nervous system. Irritating to skin and mucous membranes. Many chlorinated organic solvents are dangerous for the environment.

Use: Solvent used in the manufacture of rubber, metal paint and several industries used for grease and oil, e.g. in stain removers. Also used in cleaning agents and detergents.
See also under heading "Flame retardants".

Comments: Where possible, apply water-based emulsions based on easily degradable surfactants. Alternative products are available or under development for all uses.

Legal background:

Solvent	CAS-RN	Legal framework	Legal requirement
Chloroform	67-66-3	Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).	Shall not be placed on the market, or used as substances, as constituents of other substances or in mixtures in concentrations equal to or greater than 0.1% by weight
1,1,2 Trichloroethane	79-00-5		
1,1,2,2 Tetrachloroethane	79-34-5		
1,1,1,2 Tetrachloroethane	630-20-6		
Pentachloroethane	76-01-7		
1,1 Dichloroethylene	75-35-4		
1,4-dichlorobenzene	106-46-7		
Carbon tetrachloride	56-23-5	Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer	Shall not be produced, placed on the market, or used
1,1,1 Trichloroethane	71-55-6		
α,α,α,4-tetrachlorotoluene; p-chlorobenzotrichloride	5216-25-1	Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).	1 mg/kg in textiles
α,α,α-trichlorotoluene; benzotrichloride	98-07-7		
α-chlorotoluene; benzyl chloride	100-44-7		

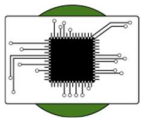
Trichloroethylene	79-01-6	Included in Authorization List and in candidate List of Substances of Very High Concern for authorization and annex XIV in Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH)	Authorisation is needed for use in EU 0.1% by weight in articles for information duty.
1,2,3-trichloropropane	96-18-4	Candidate List of Substances of Very High Concern for authorization in Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH)	0.1% by weight in articles for information duty.

Manufacturers in EU are required to follow the the Industry Emissions Directive (IED), 2010/75/EU.

In California: Several chlorinated solvents are listed in Proposition 65. Safe Harbor Limit: NSRL 3-50 µg/day.

Test method: No standardised test method available.
Test equipment: GC-MS, GC-ECD.
LOQ: 0.5 mg/kg (GC-MS)

TGIC and β-TGIC



Required limit value:	Should not be present in products.
CAS RN:	1,3,5-tris(oxiranylmethyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-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
Properties:	Mutagen toxic
Use:	Mainly used as a hardener in resins and coatings; also used in inks for the printed circuit board industry, electrical insulation material, resin moulding systems, laminated sheeting, silk screen printing coatings, tools, adhesives, lining materials and stabilisers for plastics.
Legal background:	Legal Limit: 0.1% by weight The Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). In California: TGIC is listed in Proposition 65.
Test method:	No standardised test method available. Test equipment: LC-MS

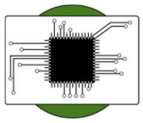
Tin organic compounds (Organostannic compounds)

Required limit value:	Should not be present in products.
CAS RN:	Various
Properties:	Tributyltin, dibutyltin and dioctyltin compounds are different chemical substances that are toxic and dangerous for the environment. Bioaccumulative and persistent.
Use:	Dibutyltin compounds (DBT) and dioctyltin compounds (DOT) are used in consumer products as heat stabilizers (mainly PVC) or catalysts, Lewis acid catalysts (PU and PVC). Organotin catalysts are used in a wide variety of polyurethane applications, aiding formation of the urethane bond and generally functioning as Lewis acid catalysts. Dibutyltin dichloride (DBTC) may be used as additive in the production of rubber tires.
Comments:	Alternative stabilizers are barium/zinc, potassium/zinc, calcium or calcium/zinc organic stabilisers. Alternative catalysts can be organotitanate or zirconate compounds (e.g. titanium 2-ethylhexanoate) or amines such as bis- (dimethylaminoethyl) ether (BDMAEE) and triethylenediamine (TEDA) along with organometallic compounds such as potassium acetate. Dialkyl tin compounds represents a large family of substances that consist of the following common constituents, see list of DBTs in appendix 2. Trialkyltin compounds are biocides, see also the section regarding Biocidal agent.
Legal background:	Legal Limit: 0.1% by weight Dioctyltin (DOT), dibutyltin (DBT) compounds and tri-substituted organostannic compounds such as tributyltin (TBT) shall not be used in articles. Annex XVII of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 20. Several TBT compounds (pesticides) are also included in the Rotterdam convention. Tributyltin oxide (TBTO), 56-35-9, Dibutyltin dichloride (DBTC), 683-18-1, 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE), 15571-58-1 and reaction mass of DOTE and MOTE[3], Dibutylbis(pentane-

[3] 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

	2,4-dionato-O,O')tin, 22673-19-4 and Dioctyltin dilaurate[4], are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Test method:	No standardised test method. Test equipment: GC-MS. LOQ: 0.2 mg/kg

Trimellitic anhydride (TMA)

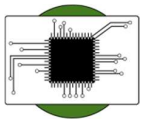


Required limit value:	Should not be present in products.
CAS RN	552-30-7
Properties:	May cause allergy or asthma symptoms. May cause an allergic skin reaction.
Use:	Trimellitic anhydride is used mainly in the synthesis of trimellitate esters. These esters are used as plasticizers for polyvinyl chloride, especially when temperature stability is required. TMA is also used for producing epoxy and alkyd resins as well as a variety of other products including dyes, insecticides, polyester resins and pharmaceuticals. It is also widely used in the formulation of paints and plastics.
Comments:	Alternative plasticizers may be epoxidized soybean oil (ESBO)
Legal background:	TMA is listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Test method:	No standardised test method

[4] Dioctyltin dilaurate, stannane, dioctyl-, bis(coco acyloxy) derivs., and any other stannane, dioctyl-, bis(fatty acyloxy) derivs. wherein C12 is the predominant carbon number of the fatty acyloxy moiety

PRODUCT-RELATED (PROPERTY-LENDING) CHEMICALS

Arsenic compounds



Required limit value:	Should not be present in products.
CAS RN:	Various
Properties:	May cause cancer. Toxic by inhalation and toxic if swallowed. Persistent, bioaccumulative and toxic.
Use:	Fining agent in glass, in semiconductors, pigment in metal alloy, preservative in wood.
Comments:	Triethyl arsenate may potentially be used in the fabrication of integrated circuits. Arsenic acid is used in the fabrication of printed circuit boards. Arsenic may be used in glass.
Legal limit:	0.1% by weight Diarsenic Pentoxide; 1303-28-2 Diarsenic Trioxide; 1327-53-3 Triethyl arsenate; 15606-95-8 Arsenic acid; 7778-39-4 Calcium arsenate; 7778-44-1 are listed both on the Candidate List of Substances of Very High Concern and in the authorization list (annex XIV) of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH) As wood preservatives regulated in Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 19 (limit level; no intentionally added content) In California: Inorganic arsenic compounds are listed in Proposition 65. Safe Harbor Limit: NSRL 0.06 µg/day (inhalation), 10 µg/day (except inhalation). Inorganic arsenic oxides are listed in Proposition 65.
Test method:	No standardised test method available. Test equipment: AAS, ICP-MS and ICP-OES LOQ: 100 µg/kg

Asbestos

Required limit value:	Should not be present in products
CAS RN:	Asbestos;1332-21-4
Properties:	May cause cancer.
Use:	Brake lining pad, insulator, filler, abrasive, pigment, paint, talc, adiabatic material. Chrysotile and tremolite are common contaminants in talc.
Comments:	Asbestos is the generic name for a group of six naturally occurring fibrous silicate minerals: Actinolite; 77536-66-4 Amosite ; 12172-73-5 Anthopyhyllite ; 77536-67-5 Chrysolite ; 12001-29-5 Crocidolite ; 12001-28-4 Tremolite ; 77536-68-6
Legal limit:	Intentionally added Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 6. Legal exposure limit 0,1 fibre/cc (cubic centimetre) The six fibrous silicate minerals Asbestos are listed in the Rotterdam convention In California: Asbestos is listed in Proposition 65. Safe Harbor Limit: NSRL 100 fibers/day (inhalation).
Test method:	No standardised test method available. Test equipment: Microscopic examination (industry practice; ratio of fibre length to diameter is at polarized light filter least 3:1).

Benzotriazols UV-320, UV327, UV-328 and UV-350

Required limit value:	Should not be present in products.
CAS RN:	2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320); 3846-71-7 2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol (UV-327); 3864-99-1 2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328); 25973-55-1 2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV-350); 36437-37-3
Properties:	Persistent, Bioaccumulative and Toxic Very Persistent and very Bioaccumulative
Use:	UV-stabilizer for plastics, polyurethanes and rubber and constituent in formulations used for coating of surfaces, e.g. cars or special industrial wood coatings. Also used in dishwasher detergents, dry cleaning equipment, and de-icing/anti-icing fluids.
Legal background:	UV-320, UV-327, UV-328 and UV-350 are listed both in the Candidate List of Substances of Very High Concern and in the authorization list of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Japan (Law Concerning the Examination and Regulation of Manufacture): no intentionally added benzotriazols.
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS, GC-ECD LOQ: 50 mg/kg

6,6'-di-tert-butyl-2,2'-methylenedi-p-cresol (DBMC)


Required limit value:	Should not be present in products.
CAS RN:	119-47-1
Properties:	Toxic to Reproduction
Use:	Antioxidant and/or stabilizers used in plastic and rubber.
Legal background:	6,6'-di-tert-butyl-2,2'-methylenedi-p-cresol is listed on the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 of the European Parliament of the Council (REACH).
Test method:	No standardised test method available. Test equipment LC and GC-MS. LOQ: 100 mg/kg

Flame retardants/Biocides - Boric acid, and related boron compounds

Required limit value:	Should not be present in products.
CAS RN:	Boric acid; 10043-35-3 and 11113-50-1 Disodium tetraborate anhydrous; 1303-96-4, 12179-04-3 and 1330-43-4 Tetraboron disodium heptaoxid, hydrate; 12267-73-1 Diboron trioxide; 1303-86-2 Lead bis(tetrafluoroborate) 13814-96-5 Sodium perborate; perboric acid, sodium salt, 234-390-0 Sodium peroxometaborate, 7632-04-04 Disodium octaborate, 12008-41-2 Orthoboric acid, sodium salt, e.g. 13840-56-77
Properties:	Toxic to reproduction
Use:	Wood veneers/pressed wooden panels. Boric acid and other boron compounds may be used as flame retardant in wood, for polystyrene beads and biocidal agent in boards etc. Diboron trioxide, and Boron sodium oxide (B3NaO5) may be found in electrical components (resistors, condensers, diodes).
Legal limit:	Boric acid, disodium tetraborate anhydrous, disodium octaborate, tetraboron disodium heptaoxid, hydrate, diboron trioxide, lead bis(tetrafluoroborate), sodium perborate; perboric acid, sodium salt, Sodium peroxometaborate and Orthoboric acid, sodium salt are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Sodium peroxometaborate is also listed in annex XIV to REACH.
Test method:	No standardised test method available. Test equipment: AAS, ICP-MS and ICP-OES LOQ: 25 mg/kg for individual compounds (10 mg/kg for total Boron content)

Cadmium (Cd) and cadmium salts

Required limit value:	Should not be present in products.
CAS RN:	Cadmium (metal): 7440-43-9
Properties:	Heavy metal that occurs naturally in small quantities in nature. Toxic to aquatic organisms. Non-biodegradable. Dangerous for the environment. Can cause kidney damage.
Use:	Surface treatment of products-electroplating, relay contact, photodiode voltic cell. Pigment in colouring agent. Also in plastics (PVC) as stabilizers and pigment. Cadmium based stabilizers to increase the service of life of the material. In Ni/Cd batteries. For recycled packaging cadmium may have had a different original use.
Comments:	Calcium-zinc based stabilizers. Order cadmium-free processes and materials. Battery alternatives are available, such as nickel-zinc (NiZn), nickel metal hydride (NiMH) and lithium-ion (Li-ion) batteries. Occurrence in materials below 0.5 mg/kg is generally regarded as contaminations which cannot be controlled.
Legal limit:	100 ppm in homogenous material[5] Directive 2011/65/ECof the European Parliament and of the Council (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment Legal limit in batteries: 20 ppm Directive 2006/66/EC of the European Parliament and of the Council on batteries and accumulators and waste batteries and accumulators. 0.01 % by weight (100 ppm) in articles produced from plastic material and in the paint of painted articles. Cadmium shall not be used in brazing fillers or in jewellery. Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 23 Cadmium, Cadmium oxide (1306-19-0), Cadmium sulphide (1306-23-6), Cadmium chloride (10108-64-2), Cadmium fluoride (7790-79-6) Cadmium sulphate (10124-36-4, 31119-53-6) , Cadmium nitrate (10325-94-7), Cadmium carbonate (513-78-0) and Cadmium hydroxide (21041-95-2) are listed on

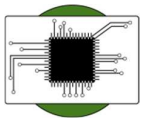
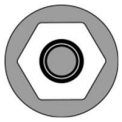
[5] The RoHS substance restrictions apply to every individual homogenous material in the part. Exemptions for product category 1-7 and 10 are given in Appendix 1

	the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). The sum of concentration levels of lead, cadmium, mercury and hexavalent chromium present in packaging or packaging components shall not exceed 100 ppm by weight Directive (EC) No 94/62/EC of 20 December 1994 on packaging and packaging waste. Korean Quality Management and Safety Control of Industrial Products Act. Legal limit in batteries; 10 ppm In California: Cadmium and cadmium compounds are listed in Proposition 65. Safe Harbor Limit: MADL cadmium 4.1 µg/day (oral). A number of settlements involving heavy metal, including cadmium, have been reached in a wide variety of products. Example max 90 ppm of cadmium in exterior designs, 100 ppm in necklaces otherwise warning. Note that the settlements apply only for the specific article in that settlement. Cadmium is restricted in Denmark. Danish legal limits: 75 mg/kg. (*Bekendgørelse nr. 858 af 5. September 2009 om forbud mod import salg og fremstilling af cadmiumholdige varer*)
Test method:	IEC 62321-3-1 (screening Cd) IEC 62321-5 Test equipment: 1) XRF. 2) AAS, ICP-MS and ICP-OES LOQ: 1) 50 mg/kg. 2) 100 µg/kg.

Flame retardants/Plasticizers - Chloroparaffins

Required limit value:	Should not be present in products.
CAS RN:	Short-chain chloroparaffins(SCCP; C10-C13): e.g. 85535-84-8 Medium-chain chloroparaffins (MCCP; C14-C17): e.g. 85535-85-9, 198840-65-2, 1372804-76-6 Long-chain chloroparaffins (LCCP; C18-): 85535-86-0
Properties:	Persistent, bioaccumulative and toxic. Carcinogenic. Allergenic.
Use:	Plasticizers and flame retardant in plastic material and rubber. Fat liquoring agent in leather production.
Comments:	Alternative plasticizers and flame retardants are available but must be evaluated. Halogen-free alternatives include phosphorus- and nitrogen-based flame retardants and non-chemical barrier technologies.
Legal background:	Legal limit: Shall not occur. Short-chain chloroparaffins are listed as POP in the Stockholm Convention on Persistent Organic Pollutants (POPs) and banned in EU by Regulation (EU) No 2019/1021. Residues below 0.15% SCCP by weight in articles are allowed to be placed on the market and used, as this is the amount of SCCP that may be present as an impurity in an article produced with MCCP. Short-chain chloroparaffins (C10-C13) and Medium-chain chloroparaffins (C14-C17) are listed on the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH). Canada: Chlorinated alkanes with (C10-C13) are prohibited In California: Chloroparaffins are listed in Proposition 65. Safe Harbor Limit: NSRL 8 µg/day.
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS

Chromium VI compounds

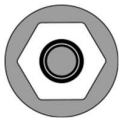



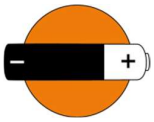

Required limit value:	Should not be present in products.
CAS RN:	Several Chromium VI substances. Chromium VI (Cr+6, hexavalent chromium): 18540-29-9 Chromium (VI) oxide: 1333-82-0
Properties:	Dangerous for the environment. Carcinogenic. Allergenic. Toxic.
Use:	Chromium trioxide (1333-82-0) is used for the passivation of copper foils in the manufacture of printed circuit board. Surface treatment (anti corrosive) in steel manufacturing Chromic acid is used as wood preservative. Some dyes and pigments may contain chromium.
Comments:	Chromium (III), silane-based coating and organic resins may be alternatives for PWB copper passivation, but must be evaluated. Chrome (III) is an alternative in surface treatment of metal but only for decorative metal plating and not hard metal plating. Other metals such as tin and zinc may be used for metal plating instead of chromium (VI).
Legal limit:	1000 ppm in homogenous material[6] Directive 2011/65/ECof the European Parliament and of the Council (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment 0,0003% by weight (3 mg/kg) for leather in direct skin contact 0.1 % by weight for other applications Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 47. Chromium (VI) compounds listed on the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH) are listed in Appendix 3. Several Chromium compounds are also included in REACH Annex XIV. The sum of concentration levels of Lead, cadmium, mercury and hexavalent chromium present in packaging or packaging components shall not exceed 100 ppm by weight Directive (EC) No 94/62/EC of 20 December 1994 on packaging and packaging waste.

[6] The RoHS substance restrictions apply to every individual homogenous material in the part. Exemptions are given in Appendix 1

	In California: Hexavalent chromium is listed in Proposition 65. Safe Harbor Limit: NSRL 0.001 µg/day (inhalation), MADL 8.2 µg/day (oral).
Test method:	IEC 62321-3-1 (screening total Cr) IEC 62321-5 (Cr) IEC 62321-7-1, -2 (CrVI)

Cobalt and cobalt (II) compounds





Required limit value: Cobalt (II) should not be present in products.

CAS RN: Various

Properties: Carcinogenic and toxic for reproduction.
Conflict mineral. A large part of the world's cobalt production derives from mines in the Democratic Republic of the Congo (DRC).

Use: Cobalt (II) compounds are used as surface treatment (anti corrosive) in steel manufacturing. Cobalt dichloride is used in drying agent, desiccant (silica gel), as humidity indicator. Cobalt is a key component of lithium batteries.

Comments: There are alternative systems based on Cerium, Chrome (III), Titan, Zirconium, Silica etc. depending on metal surface treated.
Assure and promote ethical and responsible sourcing of cobalt.

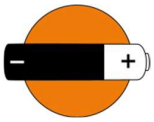
Legal limit: 0.1% by weight

Cobalt dichloride: 7646-79-9
Cobalt(II) carbonate: 513-79-1
Cobalt(II) diacetate: 71-48-7
Cobalt(II) dinitrate: 10141-05-6
Cobalt(II) sulphate: 10124-43-3
are listed on the Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH).

In California: Cobalt(II) sulphate, Cobalt(II) oxide, Cobalt Sulfate Heptahydrate and Cobalt Metal powder are listed in Proposition 65.

Test method: IEC 62321
Test equipment: 1) XRF. 2) AAS. 3) ICP-MS and ICP-OES
LOQ: 1) 50 mg/kg as Cobalt. 2) 100 µg/kg as Cobalt.

EGDME, DEGDME and TEGDME

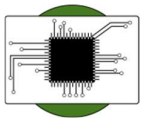


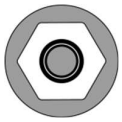
Required limit value:	Should not be used in processes or present in products.
CAS RN:	1,2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME); 110-71-41,2-Diethoxyethane; 629-14-1 Bis(2-methoxyethyl) ether (diglyme,); 111-96-6 1,2-bis(2-methoxyethoxy)ethane (triglyme, TEGDME); 112-49-2 Bis(2-(2-methoxyethoxy)ethyl)ether (tetraglyme, TEGDME); 143-24-8
Properties:	Toxic for reproduction
Use:	Use as an electrolyte solvent in lithium batteries. As a solvent or as a processing aid in the manufacture and formulation of industrial chemicals. May be in found in printing inks.
Legal limit:	0.1% by weight The Candidate list of Substances of Very High Concern (SVHC) for the authorization of the Regulation (EC) No 1907/2006 (REACH) DEGDME is also included in REACH authorization list (Annex XIV)
Test method:	No standardised test method available. Test equipment: LC-MS

Flame retardants - Dechlorane ™ Plus

Required limit value:	Should not be present in products
CAS RN:	13560-89-9; 135821-74-8; 135821-03-3 (Dodecachloropentacyclo octadeca diene)
Properties:	Persistent and bioaccumulative.
Use:	Flame retardant for plastics, electronic wiring and cables, automobiles, hard plastic connectors and plastic roofing material. Use in adhesives and sealants. Use in binding agents.
Legal background:	Dechlorane™ Plus is listed in the Candidate List of Substances of Very High Concern for authorization of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Canada: Dechlorane is prohibited from 2023
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS, GC-ECD, (XRF to detect chlorine). LOQ: 100 mg/kg

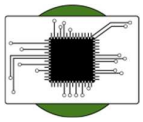
Gold





Required limit value:	Gold originated from conflict areas should not be present in products.
CAS RN:	7440-57-5
Properties:	Good chemical resistance and conductivity properties. Conflict mineral
Use:	Corrosion-free electrical connectors in electrical devices.
Comments:	Assure and promote ethical and responsible sourcing of gold.
Legal background:	Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas. Section 1502 of the Dodd–Frank Wall Street Reform and Consumer Protection Act (USA)
Test method:	No standardised test method available. Test equipment: XRF, AAS, ICP.

Halogenated flame retardants (other than those already listed in this guide)




Required limit value: Should not be present in products

Properties: Hazardous halogenated substances are difficult to break down and accumulate in humans, animals and plants - with cancerous risks and harmful effects on hormonal functions. Brominated and chlorinated flame retardants are restricted in several companies RSL and in environmental labeling systems, due to their hazardous environmental and health properties

Use: As flame retardant and/or as plasticizers.

Comments: There are several non-halogenated flame retardants with low effects on human and nature that may be used as alternatives. Different flame retardant systems fit different plastic material and must be evaluated from case to case. Some examples of alternatives and use are listed in table below:

Alternative substance	**Used in plastics**
Aluminium trihydroxide (ATH)	Polyolefins, EVA, PVC etc
Magnesium hydroxide	Polyolefins, EVA, PVC etc
Red phosphorus	fibreglass-reinforced polyamides
Ammonium polyphosphate (APP)	polyamides and polyolefins if combined with suitable synergists
Antimony trioxide (ATO)	flame retardant properties in combination with halogen containing polymers (e.g PVC)
Zinc borates	Zinc borates (used mainly in PVC) cannot be used alone to achieve desired flame retardant properties in polymers, since it is used as synergist together with other flame retardants
Zinc hydroxystannate (ZHS) and Zinc stannate (ZS)	ZHS and ZS have primarily found use as alternative non-toxic synergists to antimony trioxide in PVC and other halogen-containing polymer systems.
Aryl phosphates	PVC, HIPS and styrenics. Note some of the aryl phosphates are restricted (included in this guide, see 'Trisubstituted phosphates')
Di hydro-oxaphosphaphenanthrene oxide (DOPO)	used to make phosphorus containing epoxy resins for printed circuit boards
Metal-phosphinates	glass fibre reinforced polyamides and polyesters

Nitrogen based organic flame-retardants	Melamine

Legal background: Halogenated flame retardants are restricted in plastic enclosures and stands of electronic displays, regulation (EU) 2019/2021, the ecodesign requirements for electronic displays (100cm2 Display).

Several halogenated flame retardants have been restricted globally; see specific substances in this guide.

Some halogenated flame retardants, including 2,2-bis(bromomethyl)propane1,3-diol (BMP, CAS RN 3296-90-0), 2,2-dimethylpropan-1-ol, tribromo derivative/3-bromo-2,2-bis(bromomethyl)-1-propanol (TBNP, CAR RN 36483-57-5, 1522-92-5), 2,3-dibromo-1-propanol (2,3-DBPA, CAS RN 96-13-9) are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 REACH).

In addition to these, there is a huge number of other halogenated substances that are not legally restricted. However there are industry standards defining “halogen free” “low halogen electronics” etc, see appendix 7.

In California: Vinyl bromide (CAS RN: 593-60-2) and Tris(2,3-dibromopropyl)phosphate, TBPP (CAS RN: 126-72-7) are listed in Proposition 65. Safe Harbor Limit: NRSL 0.3 µg/day for Tris(2,3-dibromopropyl)phosphate.

TBPP was last being sold in late 1970s and is probably phased-out except for in recycled materials.

Test method: No standardised test method available.
Bromine and chloride containing substances can be detected by for instance XRF, combustion ion chromatography, AAS and ICP.

Flame retardants - Hexabromocyclododecan (HBCDD)

Required limit value:	Should not be present in products.
CAS RN:	Hexabromocyclododecane (HBCDD): 25637-99-4, 3194-55-6, 134237-50-6,134237-51-7 and 134237-52-8
Properties:	Persistent, bioaccumulative and toxic. Halogenated organic additives in polymers may leach out and have a negative impact on health and environment. Halogen containing polymers may form highly corrosive substances and an undefined range of halogenated substances that may be PBT or CMR when incinerated.
Use:	Flame-retardant treatment of products, where fire protection is required. Mainly used in HIPS (range 5% to 7%). Also used in packaging flakes made of polystyrene (PS).
Comments:	Alternative plasticizers and flame retardants are available but must be evaluated. Halogen-free alternatives include phosphorus- and nitrogen-based flame retardants and non-chemical barrier technologies.
Legal background:	Legal limit: Shall not occur. Hexabromocyclododecane is listed as POP in the Stockholm Convention on Persistent Organic Pollutants (POPs) and is banned in EU by Regulation (EU) No 2019/1021. Residues below 100 mg/kg are allowed to be placed on the market and used, as this amount may be present as an impurity.
Test method:	IEC 62321-9 (HBCDD) IEC 62321-6 (PBB, PBDE) IEC 62321-3-1 (screening total bromine) IEC 62321-3-2 (total bromine) IEC 62321-3-3 (screening with pyrolyser/thermal desorption accessory GC-MS) Test equipment: GC-MS, LC-MS, GC-ECD LOQ: 20 mg/kg.

Lead (Pb) and lead salts

Required limit value: Should not be present in products.

CAS RN: Lead (metal): 7439-92-1

Properties: Lead exposure can give rise to a number of negative health effects, including damage to liver, nervous system and foetuses. Lead is mainly accumulated in bone tissue. It has a very long half-life in the human body. Use of lead in plastics has not been deemed to cause any significant environmental or health effects in the short term, but in the long term such use increases lead concentrations in the environment.

Use: Solder. Lead salts are additives in plastics (pigments/colourants). Lead based stabilizers increase the service of life of the material (cables/cords). Rubber hardener, pigment, materials for battery, (zinc carbon batteries, alkaline button cells), optical materials, X-ray shielding in CRT glass, ferroelectrics. Metallic surface coating. For recycled packaging material lead may have had a different original use. Lead metal can also be used to increase ductility of other metals. Piezoelectronic PZT components (i.e buzzers) consist mainly of lead (P), zirconium (Z), titanium (T) (Lead zirconium titanium oxide is an SVHC). These components are exempted in RoHS directive however lead titanium zirconium oxide and lead titanium trioxide are listed in Candidate list.

Comments: Alternatives are available, such as lead-free solder. Alternative stabilizers are barium/zinc, potassium/zinc or calcium, calcium/zinc organic stabilisers.
Alternative catalysts can be organotitanate or zirconate compounds (e.g. titanium 2-ethylhexanoate) or amines such as bis- (dimethylaminoethyl) ether (BDMAEE) and triethylenediamine (TEDA) along with organometallic compounds such as potassium acetate.

Legal limit: 1000 ppm in homogenous material[7]
Directive 2011/65/EC of the European Parliament and of the Council (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Lead and lead salts are listed both on the Candidate List of Substances of Very High Concern and in the authorization list

[7] The RoHS substance restrictions apply to every individual homogenous material in the part. Exemptions for product category 1-7 and 10 are given in Appendix 1

of the Regulation (EC) No 1907/2006 REACH). SVHC lead compounds are listed in Appendix 4.
Legal limit in batteries: 40 ppm
Directive 2006/66/EC of the European Parliament and of the Council on batteries and accumulators and waste batteries and accumulators.

Chinese Standard GB 24427-2009 (Alkaline zinc manganese dioxide batteries); 40 ppm

Brazil Legislation (CONAMA Resolution 401/2008) and Swiss legislation: 1000 ppm of lead and lead compounds in non-alkaline zinc-manganese dioxide batteries

Lead salts are restricted in paint products (no restriction on painted articles) within the EU, entry 16 (lead carbonates) and 17 (lead sulphates). Lead and its compounds are restricted in jewellery articles within EU with a legal limit: 500 mg/kg (0.05%). Lead and its compounds are restricted in articles that may be placed in the mouth by children with the legal limit 500 mg/kg (0.05%)[8], entry 63. Annex XVII of Regulation (EC) No 1907/2006 of the European Commission.

Danish legal limits: 100 mg/kg. (*Bekendgørelse nr. 856 af 5. September 2009 om forbud mod import og salg af produkter, der indeholder bly*).

In California: Lead and lead compounds are listed in Proposition 65. Safe Harbor Limit: NRSL lead acetate 23 µg/day (oral), lead 15 µg/day (oral), lead phosphate 58 µg/day (oral), lead subacetate 41 µg/day (oral), MADL lead 0.5 µg/day. Settlements agreed at 50, 90 or 100 ppm for various products. Note that the settlements apply only for the specific article in that settlement.

US Consumer Product Safety Improvement Act regarding toys and childcare articles: 90 ppm in paint and similar coatings 100 ppm in accessible parts in toys and childcare articles.

The sum of concentration levels of lead, cadmium, mercury and hexavalent chromium present in packaging or packaging components shall not exceed 100 ppm by weight
Directive (EC) No 94/62/EC of 20 December 1994 on packaging and packaging waste.

[8] That limit shall not apply where it can be demonstrated that the rate of lead release from such an article or any such accessible part of an article, whether coated or uncoated, does not exceed 0,05 µg/cm$_2$ per hour (equivalent to 0,05 µg/g/h), and, for coated articles, that the coating is sufficient to ensure that this release rate is not exceeded for a period of at least two years of normal or reasonably foreseeable conditions of use of the article

Test method:	IEC 62321-3-1 (screening lead) IEC 62321-5 Test equipment: 1) XRF. 2) AAS, ICP-MS and ICP-OES LOQ: 1) 50 mg/kg as lead. 2) 10 mg/kg as lead

Mercury

Required limit value:	Should not be present in products.
CAS RN:	Mercury (metal): 7439-97-6 Phenylmercury neodecanoat:26545-49-3 Phenylmercury octanoate: 13864-38-5 Phenylmercury 2-ethylhexanoate: 13302-00-6 Phenylmercury propionate : 103-27-5 Phenylmercury acetate: 62-38-4
Properties:	Heavy metal that occurs naturally in small quantities in nature. Toxic to aquatic organisms. Non-biodegradable. Dangerous for the environment. Can cause kidney damage.
Use:	In lamps. Metal construction parts. Relays and switches. In batteries; silver-oxide button cells, alkaline batteries, zinc carbon batteries. Phenylmercury compound are used as catalysts in the production of polyurethane coatings, adhesives, sealants and elastomers.
Comments:	LED lamps contain no mercury. Order mercury-free processes and materials. Battery alternatives are available, such as nickel-zinc (NiZn), nickel metal hydride (NiMH) and lithium-ion (Li-ion) batteries.
Legal limit:	1000 ppm in homogenous material[9] Directive 2011/65/EC, (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment Legal limit in batteries: 5 ppm Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators. Canadian Products Containing Mercury Regulations (SOR/2014-254); 5 ppm in homogenous material of batteries Chinese Standard GB 24427-2009: 1 ppm in batteries

[9] The RoHS substance restrictions apply to every individual homogenous material in the part..Exemptions for product category 1-7 and 10 are given in Appendix 1

Phenylmercury compound are restricted in articles (0.01 %) in Annex XVII, Regulation (EC) No 1907/2006, REACH, entry 62.

Products containing mercury may not be placed on the Swedish market.
Norway prohibits the manufacture, import, export and sale of articles that contain mercury or mercury compounds (0.001% (10 ppm).
Denmark prohibits the import, export and sale of articles and part of articles that contain mercury or mercury compounds (0.01% (100 ppm).
Article 1 of the European Parliament and Council Regulation (EC) No 1102/2008 of 22 October 2008 ban the exports of metallic mercury and certain mercury compounds and mixtures.

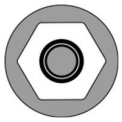
Mercury is under restriction globally through the Minamata Convention.
The sum of concentration levels of lead, cadmium, mercury and hexavalent chromium present in packaging or packaging components shall not exceed 100 ppm by weight
Directive (EC) No 94/62/EC of 20 December 1994 on packaging and packaging waste

Mercury and its compounds are listed in the Rotterdam convention.

In California: Mercury is listed in Proposition 65.

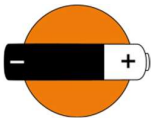
Test method: IEC 62321-4
Test equipment: 1) XRF. 2) AAS, ICP-MS and ICP-OES
LOQ: 1) 50 mg/kg. 2) 10 mg/kg

Nickel (Ni) in skin contact



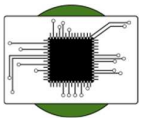
Required limit value:	0.5 µg per cm^2 and week for products intended to come into direct and prolonged contact with the skin.
CAS RN:	Nickel (metal): 7440-02-0
Properties:	Nickel is one of the most common substances that cause contact dermatitis. Highly allergenic (strong sensitizer).
Use:	Example application for prolonged skin contact is an ear bud (headphone), mobile phone.
Comments:	Refrain from using nickel-treated metals or nickel-containing metal coatings.
Legal limit:	0.5 µg per cm^2 and week for products intended to come into direct and prolonged contact with the skin. Annex XVII of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH), entry 27. In California: Metallic nickel is listed in Proposition 65.
Test method:	Test method I: EN 12472:2020+A1:2009 and EN 1811:2011+A1:2015 (for coated items) 1811:2011+A1:2015 (for non-coated item). Detection limit I: 0.01 µg/cm^2/week Test method II: Screening test for nickel emission. Swedish pharmacies sell a test kit. Detection limit II: Qualitative indication only = no occurrence. (This screening method can also give a reading for other metals than Ni.)

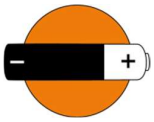
Perchlorates



Required limit value:	60 ppm in batteries.
CAS RN:	Perchlorate; 14797-73-0
Properties:	Perchlorate is a strong oxidiser and explosive
Use:	Lithium batteries; coin cell batteries
Legal limit:	60 ppm in batteries. California Assembly Bill No. 826 - Perchlorate Contamination Prevention Act (Labelling requirement). Several regions have restrictions regarding transports of lithium batteries.
Test method:	No standardised test method available. Test equipment: LC-MS

PFAS - Highly fluorinated carboxylic acids (PFOA and related substances)





Required limit value: Should not be present in products.

CAS RN: Several, including: 335-67-1

Properties: Highly fluorinated carboxylic acids (PFCAs) such as PFOA are persistent, bioaccumulative and toxic (PBT) substances. PFOA is a carcinogen.

Uses (examples): Per and polyfluorinated chemicals (PFAS) are surfactants, stable, temperature-resistant and water- and grease-repellent substances.

- Fluoropolymers (PVDF) for Li ion batteries
- Superconductors
- Antireflection layers for displays
- Nonfoaming surfactants for metal electrowinning
- Liquid crystal display retardation films
- Anti-bleed agents for adhesives in semiconductor devices
- Surfactants in ink for printers / photocopy machines
- Cationic surfactant for electro deposition of tin.

Degradation products from additives in cleaning agents, fire extinguishing agents, metal plating and impregnation agents in leather and textiles. PFOA is used as an emulsifier in the production of fluoropolymers such as polytetrafluoroethylene (PTFE) fluoroethylene propylene (FEP), polyvinylidene fluoride (PVDF) etc.

Legal background: Legal limit: Shall not occur
PFOA, its salts and related compounds are listed in the Stockholm Convention on Persistent Organic Pollutants (POPs) and banned in EU by the POPs Regulation (EU) No 2019/1021. Residues below 0.025 mg/kg of each substance, and 1 mg/kg of a combination of PFOA-related substances in substances, mixtures, and articles are allowed to be placed on the market and used, as these are amounts that may be present as impurities.

Long chain PFCAs (C8-C14) including their salts (sodium and ammonium) and precursors are listed as a group in the Candidate List of Substances of Very High Concern for authorization of Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Listed below:
(C8) Pentadecafluorooctanoic acid (PFOA), 335-67-1 and its Ammonium salt (APFO), 3825-26-1,

(C9) Perfluorononan-1-oic-acid (PFNA) and its sodium and ammonium salts, 375-95-1, 21049-39-8, 4149-60-4, 4 and (C10) Nonadecafluorodecanoic acid (PFDA) and its sodium and ammonium salts, 335-76-2, 3108-42-7, 3830-45-3, (C11) Henicosafluoroundecanoic acid (PFUnA), 2058-94-8 (C12) Tricosafluorododecanoic acid (PFDoA), 307-55-1, (C13) Pentacosafluorotridecanoic acid (PFTrDA), 72629-94-8, (14) Heptacosafluorotetradecanoic acid (PFTA), 376-06-7,

C9-C14 linear and/or branched perfluorocarboxylic acids (C9-C14 PFCAs), their salts and C9-C14 PFCAs-related substances, are restricted in articles (25 ppb) annex XVII Regulation (EC) No 1907/2006 (REACH), entry 68.
(3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluorooctyl) silanetriol is restricted in spray products (2 ppb) annex XVII Regulation (EC) No 1907/2006 (REACH), entry 73.

Declaration duty in Sweden from 1 January 2019 to the Swedish Chemicals Agency for PFAS in chemical products that are deliberately added. Composition needs not to be specified but the information duty applies without any concentration limit.

In California: PFOA and Perfluorononanoic Acid (PFNA) and its salts are listed in Proposition 65.

Test method: No standardised test method available.
Test equipment: LC-MS
LOQ: 10 µg/kg.

Phthalate esters

Required limit value: 0.1% by weight (1000 mg/kg) in the material of interest.

CAS RN: Various, se appendix 8

Properties: Many phthalates are classified as toxic for reproduction DIDP is of concern in connection with hepatic toxicity. Many phthalates are suspected endocrine disrupters.

Use: Phthalates may be used as plasticizers in polymers. Additives in adhesives, paints, lacquers, varnishes and solvents.

Comments: Alternative plasticizers include citrates, sebacates, adipates, and phosphates etc. The terephthalate, DEHT and the cyclohexane DINCH are example of commercially available alternatives with low human and environmental toxicity. There are also plastics that do not require phthalates.

Legal background: 1000 ppm in homogenous material for DEHP, DBP, BBP and DIBP, Directive 2011/65/EC of the European Parliament and of the Council (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Phthalate ester substances listed in both Annex XIV and/ or the Candidate List of Substances of Very High Concern for authorization and restricted in Annex XVII of Regulation (EC) No 1907/2006 (REACH) is found in Appendix 8

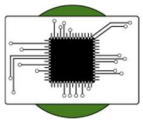
All phthalates in toys and childcare articles for children aged 0-3 years are restricted (0.05%) in Denmark (BEK nr 855).

In California: DEHP, BBP, DBP, DnHP, DIDP and DINP are listed in Proposition 65. Safe Harbor Limit: NSRL BBP 1200 µg/day (oral), DINP 146 µg/day. Safe Harbor Limit: DEHP, NSRL 310 µg/day (oral).. Safe Harbor Limit: MADL DBP 8.7 µg/day, DnHP 2200 µg/day (oral), DIDP 2200 µg/day. Settlements agreed at 1000 ppm for various products for DBP, DEHP, DIDP, DINP and DnHP. Note that the settlements apply only for the specific article in that settlement.

Several phthalates uses are declarable according to EU Medical Device Directive 93/42/EEC (amendment 2007/47/EC), if parts of a device (or a device itself) is intended to administer and/or remove medicines, body liquids or other substances to or from the body, or devices intended for transport and storage of such body fluids or substances)

Test method:	IEC 62321-8 IEC 62321-3-3 (screening with pyrolyser/thermal desorption accessory GC-MS) EN-ISO 14389 Test equipment: GC-MS, LC-MS LOQ: 100 mg/kg

Flame retardants – Polybrominated biphenyls (PBB) and Polybrominated diphenyl ethers (PBDE)




Required limit value:	Should not be present in products.
CAS RN:	Several Polybromerade biphenyl 59536-65-1(mix) Hexabromobiphenyl: 36355-01-8 Tetrabromodiphenyl ether (TetraBDE): 5436-43-1 Penta bromo biphenyl ether (pentaBDE): 32534-81-9, 60348-60-9 Hexa bromo biphenyl ether (HexaBDE): 68631-49-2, 207122-15-4, Heptabromodiphenyl ether (HeptaBDE): 207122-16-5, 446255-22-7 Octa bromo biphenyl ether (OctaBDE): 32536-52-0 Deca bromo biphenyl ether (DecaBDE): 1163-19-5
Properties:	Persistent, bioaccumulative and toxic
Use:	Flame-retardant treatment of products where fire protection is required.
Comments:	Alternative plasticizers and flame retardants are available but must be evaluated. Halogen-free alternatives include phosphorus- and nitrogen-based flame retardants and non-chemical barrier technologies
Legal limit:	1000 ppm in homogenous material[10] Directive 2011/65/EC of the European Parliament and of the Council (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment. TetraBDE, PentaBDE, HexaBDE, HeptaBDE, DecaBDE and Hexabromobiphenyl are listed as POP in the Stockholm Convention on Persistent Organic Pollutants (POPs) and are banned in EU by the POPs regulation (EU) No 2019/1021. Hexabromobiphenyl is banned in detectable content. TetraBDE, PentaBDE, HexaBDE, HeptaBDE, DecaBDE are banned, but only in substances, mixtures and articles that are not covered by the RoHS-directive (above). Residues of TetraBDE, PentaBDE, HexaBDE, HeptaBDE, DecaBDE in mixtures and articles are considered as impurities if the sum of them is below 500 mg/kg.

[10] The RoHS substance restrictions apply to every individual homogenous material in the part. Exemptions for product category 1-7 and 10 are given in Appendix 1

In substances, residues below 10 mg/kg of each brominated diphenylether is considered as impurities.

OctaBDE is restricted in Entry 45 of Annex XVII to Regulation (EC) No 1907/2006 (REACH). The legal limit for OctaBDE in substances and mixtures is 0.1 % by weight. The legal limit for OctaBDE in articles or in flame-retardant parts of articles that are not covered by the RoHS-directive is 0.1 % by weight.

DecaBDE is listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).

PBBs are listed in the Rotterdam Convention

In California: Pentabromodiphenyl ether mixture [DE-71] (technical grade), Polybrominated and polychlorinated biphenyls are listed in Proposition 65. Safe Harbor Limit: NSRL PBB 0.02 µg/day, PCB 0.09 µg/day.

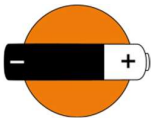
Test method:

IEC 62321-6
IEC 62321-3-1 (screening total bromine)
IEC 62321-3-2 (total bromine)
IEC 62321-3-3 (screening with pyrolyser/thermal desorption accessory GC-MS)
EN 16377 for PBB (plastics)
Test equipment: 1) XRF. 2) GC-MS, LC-MS, GC-ECD LOQ: 1) 50 mg/kg as Br. 2) 10 mg/kg.

IEC 62321-9 (HBCDD)

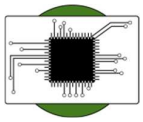
IEC 62321-3-1 (screening total bromine)
IEC 62321-3-2 (total bromine)
IEC 62321-3-3 (screening with pyrolyser/thermal desorption accessory GC-MS)

1,3-propanesultone



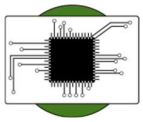
Required limit value:	Should not be present in products.
CAS RN:	1120-71-4
Properties:	Carcinogenic.
Use:	Electrolyte fluid of lithium ion batteries.
Comments:	When heated to decomposition, it emits toxic fumes of sulphur oxides.
Legal background:	Legal limit: 0.1% by weight 1,3-propanesultone is listed in the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). In California: 1,3-propanesultone is listed in Proposition 65. Safe Harbor Limit: NSRL 0.3 µ/day.
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS, GC-ECD

Siloxanes



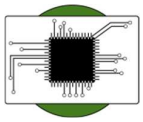
Required limit value:	1000 mg/kg (0.1% by weight)
CAS RN:	556-67-2 Octamethylcyclotetrasiloxane (D4) 541-02-6 Decamethylcyclopentasiloxane (D5) 540-97-6 Dodecamethylcyclohexasiloxane (D6)
Properties:	Reproduction toxic. Toxic to aquatic life with long lasting effects.
Use:	Paper and cardboard products, electronic equipment e.g. semiconductors. Precursors in the production of polymers, such as silicone rubbers. Sealants for construction.
Legal limit:	D4, D5 and D6 are listed in the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Test method:	No standardised test methods Test equipment: GC-MS LOQ: 100 mg/kg

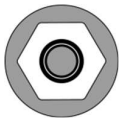
Tantalum



Required limit value:	Tantalum originated from conflict areas should not be present in products.
CAS RN:	7440-25-7
Properties:	Highly corrosion-resistant and chemical inert. Conflict mineral
Use:	Ta-capacitors.
Comments:	Assure and promote ethical and responsible sourcing of Tantalum. In some application Platinum can be a substitute.
Legal background:	Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas. Section 1502 of the Dodd–Frank Wall Street Reform and Consumer Protection Act (USA)
Test method:	No standardised test method available. Test equipment: XRF, AAS, ICP

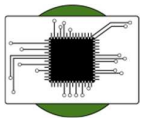
Tin

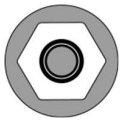




Required limit value:	Tin originated from conflict areas should not be present in products.
CAS RN:	7440-31-5
Properties:	Alloy metal. Corrosion resistant. Conflict mineral.
Use:	Solder. Metal plating.
Comments:	Assure and promote ethical and responsible sourcing of Tin.
Legal background:	Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict affected and high-risk areas. Section 1502 of the Dodd–Frank Wall Street Reform and Consumer Protection Act (USA)
Test method:	No standardised test method available. Test equipment: XRF, AAS, ICP.

Tungsten





Required limit value:	Tungsten originated from conflict areas should not be present in products.
CAS RN:	7440-33-7
Properties:	Robust and hard mineral with high melting point. Conflict mineral.
Use:	Used in light bulb filaments, X-ray tubes (as both the filament and target), electrodes in TIG welding, superalloys, and radiation shielding.
Comments:	Tungsten is also known as wolfram. Assure and promote ethical and responsible sourcing of Tungsten.
Legal background:	Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas. Section 1502 of the Dodd–Frank Wall Street Reform and Consumer Protection Act (USA)
Test method:	No standardised test method available. Test equipment: XRF, AAS, ICP.

Flame retardants - Chloroorganic phosphates (TCEP, TCPP, TDCPP/TDCP)

Required limit value:	Should not be present in products.
CAS RN:	Tris(2-chlorethyl)phosphate (TCEP): 115-96-8 Tris(2-chloro-1-methylethyl) phosphate (TCPP; CAS 13674-84-5) Tris(1,3-dichloro-2-propyl)phosphate (TDCPP/TDCP; CAS 13674-87-8)
Properties:	Persistent, bioaccumulative and toxic. Halogenated organic additives in polymers may leach out and have a negative impact on health and environment. Halogen containing polymers may form highly corrosive substances and undefined range of halogenated substances that may be PBT or CMR when incinerated.
Use:	Flame-retardant treatment of products. Plasticizers.
Comments:	Replace chloroorganic chemical flame retardants with phosphorus- and/or nitrogen-based organic chemical flame retardants or non chemical barrier technologies.
Legal background:	Legal limit: 0.1% by weight Tris(2-chlorethyl) phosphate (TCEP) is listed in the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Toy Safety directive; TCEP, TCPP, TDCPP/TDCP shall not be used (2009/48/EC) TCPP and TDCPP/TDCP are regulated for childcare articles and children´s products in Canada and by US states New York In California: TCEP and TDCPP are listed in Proposition 65. Safe Harbor Limit: RSRL 5.4 µg/day (TDCPP).
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS, GC-ECD LOQ: 5 mg/kg.

Flame retardants - Trisubstituted phosphates

Required limit value:	Should not be present in products.
CAS RN:	Trixylyl phosphate: 25155-23-1, Isopropylated, phenyl phosphate (3:1): 68937-41-7
Properties:	Toxic for reproduction
Use:	Plasticizer and flame retardant of PVC and PU. Mainly used as functional fluid. Plasticizer of vinylite (a copolymer of vinyl chloride and vinyl acetate), cellulosic resins and natural and synthetic rubber. Plasticizer and flame retardant of PVC and PU.
Legal background:	Legal limit: 0.1% by weight Trixylyl phosphate: 25155-23-1 is listed both in the Candidate List of Substances of Very High Concern and in the authorization list of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). Phenol, Isopropylated, phosphate (3:1): 68937-41-7 is listed in the Candidate List of Substances of Very High Concern of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS, GC-ECD LOQ: 5 mg/kg

BIOCIDAL AGENTS

General information

Biocidal agents are both used as ***process chemicals*** to prohibit growth of microbes during production and as ***product related chemicals*** to render biocidal property to the article.
The use of biocidal products in articles should be kept limited, for instance to avoid the increase of resistant bacteria. If the use of biocidal agents is essential, there are biocidal agents approved for PT9 (product type 9, that includes textiles, polymers and leather) according to the Biocidal Product Regulation (EU 528/2012).

Cu-HDO (Bis-(N-cyclohexyldiazeniumdioxy) –copper)

Required limit value:	Should not be present in products.
CAS RN:	312600-89-8
Properties:	Fungicide. Cu-HDO is classified as very toxic to aquatic organisms.
Use:	Fungicide mainly as wood preservatives, but may occur in fungicidal coating of textile-polymeric materials.
Comments:	The alternative to biocidal agents during storage and transport is a cool and dry environment. If use of biocidal agents is essential, folpet, chlorocresol, propiconazole, azoxystrobin and fludioxonil are approved for PT9 according to the Biocidal Product Regulation (EU 528/2012).
Legal background:	Cu-HDO is banned within PT9 (product type 9) that includes textiles, polymers and leather, according to the Biocidal Product Regulation (EU 528/2012)
Test method:	No standardised test method available. LOQ: 50 mg/kg

Carbendazim

Required limit value:	Should not be present in products.
CAS RN:	10605-21-7
Properties:	Fungicide. Reproduction toxic, mutagenic and toxic to aquatic life with long lasting effects and processes.
Use:	To counteract fungus growth.
Alternatives:	The alternative to biocidal agents during storage and transport is cool and dry environment. If use of biocidal agents is essential, folpet, chlorocresol, propiconazole, azoxystrobin and fludioxonil are approved for PT9 according to the Biocidal Product Regulation (EU 528/2012).
Legal background:	Carbendazim is banned within PT9 (product type 9) that includes textiles, polymers, and leather, according to the Biocidal Product Regulation (EU 528/2012)
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS. LOQ: -

Dimethylfumarate (DMFu)

Required limit value: Should not be present in products.

CAS RN: 624-49-7

Properties: Fungicide. DMFu is harmful to skin and a strongly allergenic substance.

Use: To counteract fungus growth in clothes, shoes and other leather items. DMFu can e.g. be found in silica gel bags, but is also applied on the product both as a powder and in tablet form.

Comments: The alternative to biocidal agents during storage and transport is cool and dry environment. If use of biocidal agents is essential, folpet, chlorocresol, propiconazole, azoxystrobin and fludioxonil are approved for PT9 according to the Biocidal Product Regulation (EU 528/2012).

Legal background: Legal limit: 0.00001 % by weight (0.1 mg/kg) in articles or any parts thereof. Annex XVII of Regulation (EC) No 1907/2006 (REACH), entry 61.

Test method: ISO/TS 16186
Test equipment: GC-MS, LC-MS.
LOQ: 0.1 mg/kg.

Guanidine, N,N'''-1,6-hexanediylbis[N'-cyano-, polymer with 1,6-hexanediamine, hydrochloride (PHMB 1600; 1.8[11])

Required limit value:	Should not be present in products.
CAS RN:	27083-27-8, 32289-58-0
Properties:	Bactericide. PHMB is very toxic to aquatic life, is suspected of causing cancer and may cause an allergic skin reaction
Use:	Biocide, bactericide.
Comments:	The alternative to biocidal agents during storage and transport is a cool and dry environment.
Legal background:	PHMB is banned within PT9 (product type 9) that includes textiles, polymers and leather, according to the Biocidal Product Regulation (EU 528/2012)
Test method:	No standardised test method available. Test equipment: LC-MS

[11] PHMB (polyhexamethylene biguanide hydrochloride) with CAS no 1802181-67-4 is still under review in the Biocidal Product Regulation (EU528/2012)

Pentachlorophenol (PCP) and all isomers of Tetrachlorophenols (TeCP)

Required limit value:	Should not be present in products.
CAS RN:	87-86-5 (PCP), 131-52-2 (PCP sodium salt), 935-95-5, 4901-51-3, 58-90-2 (isomers of TeCP)
Properties:	Fungicide. Organic compounds. Toxic and dangerous for the environment. On combustion, PCP emits dioxins, which are extremely toxic to humans.
Use:	Fungicide for preservative treatment of goods prior to storage and transport. Preservative in sizing agents and adhesives. Component in printing pastes (thickener).
Comments:	The alternative to biocidal agents during storage and transport is a cool and dry environment. If use of biocidal agents is essential, folpet, chlorocresol, propiconazole, azoxystrobin and fludioxonil are approved for PT9 according to the Biocidal Product Regulation (EU 528/2012).
Legal background:	Legal limit: PCP and its salts and esters shall not occur. Pentachlorophenol and its salts and esters are listed in the Stockholm Convention on Persistent Organic Pollutants (POPs) and banned in EU by the POPs Regulation (EU) No 2019/1021. Residues below 5 mg/kg in substances, mixtures, and articles are allowed to be placed on the market and used, as this is the amount that may be present as an impurity in an article. Pentachlorophenol is listed in the Rotterdam convention. In California: PCP is listed in Proposition 65. Safe Harbor Limit: NRSL 40 µg/day.
Test method:	ISO 17070 (leather)XP G 08-015 (French standard method for PCP in textiles). LOQ: 0.1 mg/kg CEN/TR 14823 (wood). EN ISO 15320 (Pulp, paper and board)

Permethrin

Required limit value:	Should not be present in products.
CAS RN:	52645-53-1
Properties:	Insecticide. Permethrin is like all synthetic pyrethroids a neurotoxin. It is considered more acutely toxic to children than to adults.
Use:	Permethrin is a biocide in textiles and leather. It is also used for home pest control, forestry, and in public health programs, including head lice control.
Comments:	The alternative to biocidal agents during storage and transport is a cool and dry environment.
Legal background:	Permethrin is on the list of temporarily permitted existing biocides within PT9 (product type 9) that includes textiles, polymers and leather, according to the Biocidal Product Regulation (EU 528/2012).
Test method:	No standardised test method available. EN ISO 22517:2021 (pesticide residues in leather). Test equipment: GC-MS, LC-MS. LOQ: 5 mg/kg

Silver and its compounds

Required limit value:	Should not be present in products.
CAS RN:	Silver (metal): 7440-22-4
Properties:	Bactericide. Slight skin and eye irritant. Disturb denitrification processes in nature that is vital for provision of nutrition to plants. Dissolved (free) silver ions are very toxic to aquatic organisms.
Use:	Silver particle complexes in nano size (< 100nm) are antibiotic additives in plastics and fibres.
Comments:	The alternative to antibacterial agents during use is satisfactory washing.
Legal background:	Legal limit: No legal limits for silver compounds exist in textiles and leather. Some silver compounds are on the list of temporarily permitted existing biocides within PT9 (product type 9) that includes textiles, polymers and leather, according to the Biocidal Product Regulation (EU 528/2012). Silver as such is not allowed as a biocidal active substance.
Test method:	No standardised test method available. Test equipment: ICP-MS, ICP-OES or AAS LOQ: 10 mg/kg

Tri-substituted organostannic compounds

Required limit value: Should not be present in products.

CAS RN:
Triphenyltin hydroxide: 76-87-9
Tributyltin oxide (TBTO): 56-35-9
Tributyltin chloride: 1461-22-9
Tributyltin fluoride: 1983-10-4
Tributyltin methacrylate: 2155-70-6
Tributyltin benzoate: 4342-36-3
Tributyltin linoleate: 24124-25-2
Tributyltin naphthenate: 85409-17-2
etc

Properties: Bactericides. Tributyltin compounds are different chemical substances that are toxic and dangerous for the environment. Bioaccumulative and persistent.

Comments: The alternative to antibacterial agents during use is satisfactory washing. If use of biocidal agents is essential, folpet, chlorocresol, propiconazole, azoxystrobin and fludioxonil are approved for PT9 according to the Biocidal Product Regulation (EU 528/2012).

Legal background: Legal Limit: 0.1% by weight
All tri-substituted organostannic compounds such as tributyltin (TBT) are restricted in articles in annex XVII of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH). The seven TBT compounds listed above are also included in the Rotterdam convention.

Tributyltin oxide (TBTO), 56-35-9 and Dibutyltin dichloride (DBTC), 683-18-1 are listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH)

Test method: No standardised test method available.
Test equipment: GC-MS.
LOQ: 0.2 mg/kg
EN ISO17353 (water and sediment)
EN ISO 22744 (textile)

Triclosan and Triclocarban

Required limit value:	Should not be present in products.
CAS RN:	Triclosan: 3380-34-5, Triclocarban: 101-20-2
Properties:	Bactericides. Triclosan is classified as a probable human carcinogen and bio accumulative.
Use:	Anti bacterial agent in clothes and other commodities.
Comments:	The alternative to antibacterial agents during use is satisfactory washing.
Legal background:	Triclosan is banned within PT9 (product type 9) that includes textiles, polymers and leather, according to the Biocidal Product Regulation (528/2012) Triclocarban is not on the active substance list for any product type and thus not allowed to use in EU.
Test method:	No standardised test method available. Test equipment: GC-MS, LC-MS. LOQ: 10 mg/kg

Zincpyrithion

Required limit value: Should not be present in products.

CAS RN: 13463-41-7

Properties: Bactericide, fungicide and algicide. Toxic to Reproduction.

Use: Antibacterial and fungicide agent in articles. Commonly used in shampoo and previously in antifouling paint. May be used in plastic articles.

Comments: The alternative to antibacterial agents during use is satisfactory washing. If use of biocidal agents is essential, folpet, chlorocresol, propiconazole, azoxystrobin and fludioxonil are approved for PT9 according to the Biocidal Product Regulation (EU 528/2012).

Legal background: Zincpyrithion is on the list of temporarily permitted existing biocides within PT9 (product type 9) that includes textiles, polymers and leather, according to the Biocidal Product Regulation (EU 528/2012).

Test method: No standardised test method available.
Test equipment: GC-MS, LC-MS.
LOQ: 1000 mg/kg (100 mg/kg as for Zinc)

Proposition 65 in California: Other chemicals listed

There are chemicals listed in Proposition 65 that are relevant to the materials addressed in this Chemicals guidance, but that are not otherwise included in this document. Those substances are listed in the table below. Please, note that Proposition 65 is a Californian legislation that does not apply in Europe.

Chemicals related to dyestuffs

Substance name	**CAS RN**	**Comment**
Aniline	62-53-3	NSRL: 100 µg/day
Benzyl violet 4B	1694-09-3	NSRL: 30 µg/day
Carbon black (airborne, unbound particles of respirable size)	1333-86-4	No Safe Harbor Limit
C.I. Acid Red 114	6459-94-5	No Safe Harbor Limit
C.I. Direct Blue 15	2429-74-5	No Safe Harbor Limit
Ethylene dichloride (1,2-Dichloroethane)	107-06-2	NSRL: 10 µg/day
Ethylene oxide	75-21-8	NSRL: 2 µg/day MADL: 20 µg/day
Trypan blue (commercial grade)	72-57-1	No Safe Harbor Limit
Hexachlorobenzene	118-74-1	NSRL: 0.4 µg/day

Chemicals related to materials

Substance name	**CAS RN**	**Comment**
Antimony oxide (Antimony trioxide)	1309-64-4	Flame retardant synergist, No Safe Harbor Limit
Dichloromethane (Methylene chloride)	75-09-2	Triacetate, (NSRL): 50 µg/day NSRL- Inhalation: 200 µg/day
N-Nitrosodimethylamine	62-75-9	Rubber, NSRL: 0.04 µg/day
Indium tin oxide (ITO)	50926-11-9	Electronic devices, liquid crystal displays No Safe Harbor Limit

Biocides

Substance name	**CAS RN**	**Comment**
Metham sodium	137-42-8	No Safe Harbor Limit
o-Phenylphenate, sodium	132-27-4	NSRL: 200 µg/day
o-Phenylphenol	90-43-7	No Safe Harbor Limit
2,4,6-Trichlorophenol	88-06-2	NSRL: 10 µg/day
Methyl bromide, as a structural fumigant	74-83-9	MADL - Inhalation: 810 µg/day

Appendix 1 – Exemptions in RoHS

All Current Annex III Exemptions Aug 2021 (regards product category 1-7 and 10 and 11 if no other stated). Exemptions that still appear in the list with passed expire dates, are not yet decided if exempted or restricted.

1 - Mercury in single capped (compact) fluorescent lamps not exceeding (per burner):
1(a) - For general lighting purposes < 30 W: 2,5 mg. Expires on 24 February 2023 2016.
1(b) - For general lighting purposes ≥ 30 W and < 50 W: 3,5 mg. Expires on 24 February 2023.
1(c) - For general lighting purposes ≥ 50 W and < 150 W: 5 mg. Expires on 24 February 2023.
1(d) - For general lighting purposes ≥ 150 W: 15 mg. Expires on 24 February 2023.
1(e) - For general lighting purposes with circular or square structural shape and tube diameter ≤ 17 mm. 7 mg. Expires on 24 February 2023.
1(f) I - For special purposes (UV spectrum): 5 mg. Expires on 24 February 2027 (category 5).
1(f) I - For special purposes: 5 mg. Expires on 24 February 2025 (category 5).
1 (g)- For general lighting purposes < 30 W with a lifetime equal or above 20,000 h: 3.5 mg Expires on 24 August 2023)
2(a) - Mercury in double-capped linear fluorescent lamps for general lighting purposes not exceeding (per lamp):
2(a)(1) - Tri-band phosphor with normal lifetime and a tube diameter < 9 mm (e.g. T2): 4 mg. Expires on 24 February 2023 (category 5).
2(a)(2) - Tri-band phosphor with normal lifetime and a tube diameter ≥ 9 mm and ≤ 17 mm (e.g. T5): 3 mg. Expires on 24 August 2023 (category 5)..
2(a)(3) - Tri-band phosphor with normal lifetime and a tube diameter > 17 mm and ≤ 28 mm (e.g. T8): 3,5 mg. Expires on 24 August 2023 (category 5)..
2(a)(4) - Tri-band phosphor with normal lifetime and a tube diameter > 28 mm (e.g. T12): 3,5 mg. Expires on 24 February 2023 (category 5)..
2(a)(5) - Tri-band phosphor with long lifetime (≥ 25 000 h): 5 mg. Expires on, 21 July 2016, 24 February 2023 (category 5).
2(b) - Mercury in other fluorescent lamps not exceeding (per lamp):
2(b)(3) - Non-linear tri-band phosphor lamps with tube diameter > 17 mm (e.g. T9). 15 mg. Expires on 24 February 2025 (category 5).
2(b)(4) - Lamps for other general lighting and special purposes (e.g. induction lamps).; 15 mg. Expires on, 24 February 2025 (category 5).
3 - Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for special purposes not exceeding (per lamp):
3(a) - Short length (≤ 500 mm). 3,5 mg. Expires on 24 February 2025 (category 5).
3(b) - Medium length (> 500 mm and ≤ 1 500 mm); 5 mg. Expires on 24 February 2025 (category 5).
3(c) - Long length (> 1 500 mm). 13 mg. Expires on 24 February 2025 (category 5).
4(a) - Mercury in other low pressure discharge lamps (per lamp). 15 mg. Expires 24 February 2023, 24 February 2027 (category 5).
4(b) - Mercury in High Pressure Sodium (vapour) lamps for general lighting purposes not exceeding (per burner) in lamps with improved colour rendering index Ra > 60:
4(b)-I P ≤ 155 W.; 30 mg. Expires on 24 February 2023 (2027 category 5).
4(b)-II 155 W < P ≤ 405 W.; 40 mg. Expires on 24 February 2023 (2027 category 5) .
4(b)-III - P > 405 W.; 40 mg. Expires on 24 February 2023 (2027 category 5).
4(c) - Mercury in other High Pressure Sodium (vapour) lamps for general lighting purposes not exceeding (per burner):

4(c)-I P ≤ 155 W; 25 mg. Expires on 24 February 2023 (category 5).
4(c)-II 155 W < P ≤ 405 W; 30 mg. Expires on 24 February 2023 (category 5).
4(c)-III - P > 405 W.; 40 mg. Expires on 24 February 2023 (category 5).
4(e) - Mercury in metal halide lamps (MH). Expires on 21 July 2024, 24 February 2027 (category 5).
4(f) - Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex. Expires on 21 July 2024, 24 February 2025/2027 (specifically cases for category 5).
5(a) Lead in glass of cathode ray tubes. Applies to category 11 and expires 21 July 2024.
5(b) - Lead in glass of fluorescent tubes not exceeding 0,2 % by weight. Expires on 21 July 2024.
6(a) -I Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0,35 % lead by weight, and in batch hot dip galvanised steel components containing up to 0,2 % lead by weight. Expires on 21 July 2024.
6(b) Lead as an alloying element in aluminium containing up to 0,4 % lead by weight. Applies to category 11 and expires 21 July 2024.
6(a)-I Lead as an alloying element in steel for machining purposes containing up to 0,35 % lead by weight and in batch hot dip 87alvanized steel components containing up to 0,2 % lead by weight. Expires 17 January 2020
6(b) - I Lead as an alloying element in aluminium containing up to 0,4 % lead by weight, provided it stems from lead-bearing aluminium scrap recycling. Expires on 21 July 2024.
6(b) – II Lead as an alloying element in aluminium for machining purposes with a lead content up to 0,4 % by weight. Expires on 18 May 2021
6(c) - Copper alloy containing up to 4 % lead by weight. Expires on 21 July 2024.
7(a) - Lead in high melting temperature type solders (i.e. lead- based alloys containing 85 % by weight or more lead), except applications covered by point 24. Expires on 21 July 2024.
7(b) Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission, and network management for telecommunications. Applies to category 11 and expires 21 July 2024
7(c)-I - Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound, (except applications covered under point 34). Expires on 21 July 2024.
7(c)-II - Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher. Does not apply to applications covered by point 7(c)-I and 7(c)-IV of this Annex. Expires on 21 July 2024.
7(c)-III - Lead in dielectric ceramic in capacitors for a rated voltage of less than 125 V AC or 250 V DC. may be used in spare parts for EEE placed on the market before 1 January 2013
7(c)-IV - Lead in PZT based dielectric ceramic materials for capacitors being part of integrated circuits or discrete semiconductors.. Expires on 21 July 2024 for category 11
8(b) Cadmium and its compounds in electrical contacts. Applies to category 11 and expires 21 July 2024
8(b)-I Cadmium and its compounds in electrical contacts used in:
-circuit breakers;
-thermal sensing controls;
-thermal motor protectors (excluding hermetic thermal motor protectors);
-AC switches rated at:
·6 A and more at 250 V AC and more; or
·12 A and more at 125 V AC and more;
-DC switches rated at 20 A and more at 18 V DC and more; and
-switches for use at voltage supply frequency ≥ 200 Hz.
Expires on 21 July 2021
9 - Hexavalent chromium as an anticorrosion agent of the carbon steel cooling system in

absorption refrigerators up to 0,75 % by weight in the cooling solution. Applies to category 11 and expires 21 July 2024
9(a)-II - Up to 0,75% hexavalent chromium by weight, used as an anticorrosion agent in the cooling solution of carbon steel cooling systems of absorption refrigerators:
-designed to operate fully or partly with electrical heater, having an average utilised power input ≥ 75 W at constant running conditions;
-designed to fully operate with non-electrical heater.
Expires on 21 July 2021 for categories 1-7 and 10.
'9(a)-III - Up to 0,7 % hexavalent chromium by weight, used as an anticorrosion agent in the working fluid of the carbon steel sealed circuit of gas absorption heat pumps for space and water heating.
Applies to category 1 and expires on 31 December 2026.'.
9(b) - Lead in bearing shells and bushes for refrigerant-containing compressors for heating, ventilation, air conditioning and refrigeration (HVACR) applications. Applies to category 11; expires on 21 July 2024.
13(a) - Lead in white glasses used for optical applications. Expires on 21 July 2024.
13(b) - Cadmium and lead in filter glasses and glasses used for reflectance standards. Applies to category 11 and expires 21 July 2024
13(b)-(I) Lead in ion coloured optical filter glass types
Expires on 21 July 2024
13(b)-(II) Cadmium in striking optical filter glass types; excluding applications falling under point 39 of this Annex. Expires on 21 July 2021
13(b)-(III) Cadmium and lead in glazes used for reflectance standards. Expires on 21 July 2021
15 - Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages. Applies to category 11 and expires 21 July 2024
15(a) Lead in solders to complete a viable electrical connection between the semiconductor die and carrier within integrated circuit flip chip packages where at least one of the following criteria applies:
-a semiconductor technology node of 90 nm or larger;
-a single die of 300 mm2 or larger in any semiconductor technology node;
-stacked die packages with die of 300 mm2 or larger, or silicon interposers of 300 mm2 or larger. Expires on 21 July 2021. Expires on 21 July 2024 for category 11
17 Lead halide as radiant agent in high intensity discharge (HID) lamps used for professional reprography applications. Applies to category 11 and expires 21 July 2024
18(b) - Lead as activator in the fluorescent powder (1 % lead by weight or less) of discharge lamps when used as sun tanning lamps containing phosphors such as BSP (BaSi 2 O 5 :Pb). Expires on 21 July 2021. Expires on 21 July 2024 for category 11
21 - Lead and cadmium in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses. Expires on 21 July 2024 for category 11.
24 - Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors. Expires on 21 July 2024.
25 - Lead oxide in surface conduction electron emitter displays (SED) used in structural elements, notably in the seal frit and frit ring. Applies to category 11 and expires 21 July 202429 - Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC. Applies to category 11 and expires on 21 July 2024.
30 - Cadmium alloys as electrical/mechanical solder joints to electrical conductors located directly on the voice coil in transducers used in high-powered loudspeakers with sound pressure levels of 100 dB (A) and more. Applies to category 11 and expires 21 July 2024
31 - Lead in soldering materials in mercury free flat fluorescent lamps (which, e.g. are used

for liquid crystal displays, design or industrial lighting). Applies to category 11 and expires 21 July 2024
32 - Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes. Expires on 21 July 2021. Expires on 21 July 2024 for category 11
33 - Lead in solders for the soldering of thin copper wires of 100 μm diameter and less in power transformers. Applies to category 11 and expires 21 July 2024
34 - Lead in cermet-based trimmer potentiometer elements. Expires on 21 July 2024.
37 - Lead in the plating layer of high voltage diodes on the basis of a zinc borate glass body. Applies to category 11 and expires 21 July 2024
38 - Cadmium and cadmium oxide in thick film pastes used on aluminium bonded beryllium oxide Applies to category 11 and expires 21 July 2024
39(a) Cadmium selenide in downshifting cadmium-based semiconductor nanocrystal quantum dots for use in display lighting applications (< 0,2 μg Cd per mm2 of display screen area) Expires for all categories on 31 October 2019
42 - Lead in bearings and bushes of diesel or gaseous fuel powered internal combustion engines applied in non-road professional use equipment:
-with engine total displacement ≥ 15 litres;
or
-with engine total displacement < 15 litres and the engine is designed to operate in applications where the time between signal to start and full load is required to be less than 10 seconds; or regular maintenance is typically performed in a harsh and dirty outdoor environment, such as mining, construction, and agriculture applications.
Applies to category 11, excluding applications covered by entry 6(c) of this Annex.
Expires on 21 July 2024.
43 - Bis(2-ethylhexyl) phthalate in rubber components in engine systems, designed for use in equipment that is not intended solely for consumer use and provided that no plasticised material comes into contact with human mucous membranes or into prolonged contact with human skin and the concentration value of bis(2-ethylhexyl) phthalate does not exceed:
(a)30 % by weight of the rubber for .
(I)gasket coatings; .
(II)solid-rubber gaskets; or .
(III)rubber components included in assemblies of at least three components using electrical, mechanical or hydraulic energy to do work, and attached to the engine. .
(b)10 % by weight of the rubber for rubber-containing components not referred to in point (a).
Applies to category 11 and expires on 21 July 2024.
For the purposes of this entry, ‘prolonged contact with human skin’ means continuous contact of more than 10 minutes duration or intermittent contact over a period of 30 minutes, per day.
44- Lead in solder of sensors, actuators, and engine control units of combustion engines within the scope of Regulation (EU) 2016/1628 of the European Parliament and of the Council[12], installed in equipment used at fixed positions while in operation which is designed for professionals, but also used by non-professional users.
Applies to category 11 and expires on 21 July 2024.
45 - Lead diazide, lead styphnate, lead dipicramate, orange lead (lead tetroxide), lead dioxide in electric and electronic initiators of explosives for civil (professional) use and barium chromate in long time pyrotechnic delay charges of electric initiators of explosives for civil (professional) use.
Applies to category 11 and expires on 20 April 2026.

[12] Regulation (EU) 2016/1628 on requirements relating to gaseous and particulate pollutant emission limits

Appendix 2 – Non exhaustive list of DBTs (Dibutyltin compounds)

Constituent	CAS RN	No of carbons
R = oxide (DBTO)	818-08-6	0
R = acetate	1067-33-0	2
R = butoxide	3349-36-8	4
R = metylmaleate	15546-11-9	5
R = octanoate	4731-77-5	8
R = isoocanoate	85702-74-5	8
R = (monobutyl)maleate	15546-16-4	8
R = 2-etylhexanoate	2781-10-4	8
R = laurate	77-58-7	12
R = palmitate	13323-63-2	16
R = stearate	5847-55-2	18
R = oleate	13323-62-1	18
R = linoleate	85391-79-3	18
R = linolenate	95873-60-2	18
R = bis(pentane-2,4-dionato-O,O')	22673-19-4	18

Appendix 3 – Chromium (VI) SVHC compounds

Name	CAS RN
Ammonium dichromate	7789-09-05*
Potassium chromate	7789-00-6*
Potassium dichromate	7778-50-9*
Sodium chromate	7775-11-03*
Sodium dichromate dehydrate	7789-12-0, 10588-01-9*
Strontium chromate	7789-06-2*
Chromium trioxide	1333-82-0*
Chromic acid	7738-94-5*
Dichromic acid	13530-68-2*
Lead chromate	7758-97-6*
Lead sulfochromate	1344-37-2*
Lead chromate molybdate sulphate	12656-85-8*
Dichromium tris(chromate)	24613-89-6*
Potassium hydroxyoctaoxodizincatedichromate	11103-86-9*
Pentazinc chromate octahydroxide	49663-84-5*

* SVHC listed in both Annex XIV and in the candidate list

Appendix 4 – SVHC Lead and lead compounds

Name	CAS RN
Lead chromate	7758-97-6
Lead sulfochromate	1344-37-2
Lead chromate molybdate sulphate	12656-85-8
Lead dipicrate	6477-64-1
Lead styphnate	15245-44-0
Lead diazide	13424-46-9
Lead hydrogen arsenate	7784-40-9
Lead monoxide (Lead oxide)	1317-36-8
Orange lead (Lead tetroxide)	1314-41-6
Lead bis(tetrafluoroborate)	13814-96-5
Trilead bis(carbonate)dihydroxide	1319-46-6
Lead titanium trioxide	12060-00-3
Lead titanium zirconium oxide	12626-81-2
Silicic acid, lead salt	11120-22-2
Silicic acid ($H_2Si_2O_5$), barium salt (1:1), lead-doped	68784-75-8
Acetic acid, lead salt, basic	51404-69-4
Lead oxide sulfate	12036-76-9
[Phthalato(2-)]dioxotrilead	69011-06-9
Dioxobis(stearato)trilead	12578-12-0
Fatty acids, C16-18, lead salts	91031-62-8
Lead cynamidate	20837-86-9
Lead dinitrate	10099-74-8
Pentalead tetraoxide sulphate	12065-90-6
Pyrochlore, antimony lead yellow	8012-00-8
Sulfurous acid, lead salt, dibasic	62229-08-7
Tetraethyllead	78-00-2
Tetralead trioxide sulphate	12202-17-4
Trilead dioxide phosphonate	12141-20-7
Lead di(acetate)	301-04-2
Lead	7439-92-1

Appendix 5 – greenhouse gases

Name	CAS RN
Sulfur hexafluoride - SF6	2551-62-4
Hydrofluorocarbons (HFCs)	
HFC-23 - CHF3	75-46-7
HFC-32 - CH2F2	75-10-5
HFC-41 - CH3F	593-53-3
HFC-43-10mee - C5H2F10	138495-42-8
HFC-125 - C2HF5	354-33-6
HFC-134 - C2H2F4	359-35-3
HFC-134a - CH2FCF3	811-97-2
HFC-152a - C2H4F2	75-37-6
HFC-143 - C2H3F3	430-66-0
HFC-143a - C2H3F3	420-46-2
HFC-227ea - C3HF7	431-89-0
HFC-236cb - CH2FCF2CF3	677-56-5
HFC-236ea - CHF2CHFCF3	431-63-0
HFC-236fa - C3H2F6	690-39-1
HFC-245ca - C3H3F5	679-86-7
HFC-245fa - CHF2CH2CF3	460-73-1
HFC-365mfc - CF3CH2CF2CH3	406-58-6
HFC-43-10 mee, CF3CHFCHFCF2CF3	138495-42-8
Perfluorocarbons (PFCs)	
Perfluoromethane - CF4	75-73-0
Perfluoroethane - C2F6	76-16-4
Perfluoropropane - C3F8	76-19-7
Perfluorobutane - C4F10	355-25-9
Perfluoropentane - C5F12	678-26-2
Perfluorohexane - C6F14	355-42-0
Perfluorocyclobutane - c-C4F8	115-25-3

Appendix 6 – list of PAHs

PAH name	CAS RN	REACH Annex XVII (mg/kg)	German GS standard** Materials with foreseeable skin contact more than 30 seconds or short-term repetitive contact with the skin **(mg/kg)**	German GS standard** Materials with foreseeable skin contact less than 30 seconds (short-term skin contact) **(mg/kg)**
Benzo(j)fluoranthene	205-82-3	1	< 0.5	< 1
Benzo(b)fluoranthene	205-99-2	1	< 0.5	< 1
Benzo(k)fluoranthene*	207-08-9	1	< 0.5	< 1
Benzo(a)phenanthrene (chrysene)*	218-01-9	1	< 0.5	< 1
Benzo(a)pyrene*	50-32-8	1	< 0.5	< 1
Dibenzo(a,h)anthracene	53-70-3	1	< 0.5	< 1
Benzo(a)anthracene*	56-55-3	1	< 0.5	< 1
Benzo(e)pyrene	192-97-2	1	< 0.5	< 1
Indeno(1,2,3-cd)pyrene	193-39-5		< 0.5	< 1
Benzo[g,h,i]perylene*	191-24-2		< 0.5	< 1
Naphthalene	91-20-3		< 2	< 10
			< 10	
Phenanthrene*	85-1-8			
Anthracene*	120-12-7			
Benzo(j,k)fluorene (fluoranthene)*	206-44-0			
Pyrene*	129-00-0			< 50 (sum)
			Sum of 15 PAHs < 10	Sum of 15 PAHs < 50

*SVHC listed in candidate list

** Materials in toys, intended for used by children under 14 or can be placed in the mouth have stricter limit values

Appendix 7 – Halogen free/low halogen industry standards

Organisation	Concentration, % (ppm)				
	Br	Cl	Br+Cl	BFR	CFR + PVC polymers
1	<0.09 (900)	<0.09 (900)	<0.15 (1500)	n/a	n/a
2, 3, 4	≤0.09 (900)	≤0.09 (900)	<0.15 (1500)	n/a	n/a
5	n/a	n/a	n/a	<0.1 (1000)	<0.1 (1000)
6	n/a	n/a	n/a	<0.1 (1000)	<0.1 (1000)

Bromine (Br), Chlorine (Cl), Brominated Flame Retardant (BFR), Chlorinated Flame Retardant (CFR), Polyvinylchloride (PVC)

1) Japan Electronics Packaging and Curcuits Association JPCA-ES-01 (boards)
2) European Standard EN 61249-2-21 Identical with IEC 61249-2-21 (boards)
3) IPC-Association Connecting Electronics industries IPC-4101 (boards)
4) International Electronics Manufacturing Initiative (boards and substrates laminates, non-halogenated epoxide)
5) International Electronics Manufacturing Initiative (plastics)
6) IBM Halogenated Flame retardants and Polyvinylchloride material Substrate Specification, EC N28742

Appendix 8 - Phthalate esters

Substances listed in Annex XIV, Annex XVII and/or the Candidate List of Substances of Very High Concern for authorization of Regulation (EC) No 1907/2006 (REACH)

Name	CAS#	RoHS	Candidate list	Annex XIV	Annex XVII
Bis (2-ethylhexyl) phthalate) (DEHP)	117-81-7	x*	x	x	x (entry 51) **
Dibutyl phthalate (DBP)	84-74-2	x*	x	x	x (entry 51) **
Benzyl butyl phthalate (BBP)	85-68-7	x*	x	x	x (entry 51) **
Diisobutyl phthalate (DIBP)	84-69-5	x*	x	x	x (entry 51) **
Di-isononyl phthalate (DINP)	28553-12-0 68515-48-0				x (entry 52)***
Di-isodecyl phthalate (DIDP)	26761-40-0 68515-49-1				x (entry 52) ***
Di-n-octyl phthalate (DNOP)	117-84-0				x (entry 52) ***
1,2-benzenedicarboxylic acid, di-C6-8-branched alkylesters, C7-rich	71888-89-6		x	x	x (entry 72) ****
Di-*n*-pentyl phthalate (DPP)	131-18-0		x	x	x (entry 72) ****
Di-*n*-hexyl phthalate (DnHP)	84-75-3		x	x	x (entry 72) ****
Diisopentyl phthalate	605-50-5		x	x	x (entry 72) ****
Bis (2-methoxyethyl) phthalate	117-82-8		x	x	x (entry 72) ****
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear	84777-06-0		x	x	
n-pentyl-isopentyl phthalate	776297-69-9		x	x	
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4		x	x	
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	68515-50-4		x	x	
1,2-Benzenedicarboxylic acid, mixed decyl and hexyl and octyl diesters, *with ≥ 0.3% of dihexyl phthalate (CAS 84-75-3)*	68648-93-1		x	x	
1,2-Benzenedicarboxylic acid, di-C6-10-alkyl esters, *with ≥ 0.3% of dihexyl phthalate (CAS 84-75-3)*	68515-51-5		x	x	
Dicyclohexyl phthalate (DCHP)	84-61-7		x		
Diisohexyl phthalate	71850-09-4		x		

* restricted in homogenous material 1000 mg/kg

** shall not be used in toys and childcare plasticised articles (not under RoHS), individually or in any combinations in concentration equal to or greater than 0.1% by weight

*** shall not be used in toys and childcare plasticised articles which can be placed in the mouth by children, individually or in any combinations in concentration greater than 0.1% by weight

**** DIHP, DMEP, DIPP, DPP and DnHP have a restriction limit of 1000 mg/kg in clothing, related accessories, textiles other than clothing in skin contact, or footwear (CMR fast track) according to Annex XVII of Regulation (EC) No 1907/2006 (REACH). This limit applies to each substance individually or in combination with other phthalates that are classifies as CMR substances. The CMR fast track restriction does not apply to clothing, related accessories, textiles other than clothing, or footwear within the scope of Regulation (EU) 2016/425 (PPE)