

**Western Digital Product Environmental Compliance Engineering Specification  
& Requirements for Materials, Parts, Products & Product Protective Packaging**

**AW**

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Parts, Products and Product Protective Packaging**

**Doc # 2096-001669 Rev AW**

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## 1 INTRODUCTION

- 1.1. Western Digital must guarantee environmental compliance for all materials, parts, products and Product Protective Packaging and materials used during the manufacture of the parts, products and Product Protective Packaging for Western Digital.
- 1.2. Information on environmental compliance allows Western Digital to:
  - 1.2.1. Satisfy legal and regulatory requirements;
  - 1.2.2. Drive improvements in product design; and
  - 1.2.3. Respond to inquiries from customers, product recyclers and other stakeholders.
- 1.3. This document describes Western Digital's specifications for prohibiting, restricting, and reporting certain chemical compounds/materials/substances in Western Digital's products or manufacturing processes.
- 1.4. This document describes Western Digital supplier's requirements for compliance to Western Digital's Product Environmental Compliance Engineering Specification.
- 1.5. This revision of the specification applies to all parts and materials that are purchased by Western Digital & its subsidiaries and used in Western Digital products, effective July 01, 2020. For parts that are already compliant to the previous revision, no action is required (with the exceptions of specific customer requirements on certain products)

This specification is divided into two product categories:

### **Product Category 1 [refer to Section 5]:**

- Removable cards [Secure Digital, Memory Stick, Compact Flash, USB flash drives, EYE-FI, etc...]
- Embedded products [iNAND, MCP, iSSD, PPN, ULGA, eMLC, etc...]
- Component IC product for removable cards [TSOP, QFN, BGA, LGA, Controller IC etc...]
- Solid State Drive products [ESS, CSS and other SSD product lines] and all included components
- Hard Disk Drive products [ESS, CSS and other HDD product lines] and all included components
- 
- Card product accessories [lanyards for card products, plastic caps etc...]
- Card product packaging materials [jewel cases, shipping trays, shipping labels, insert, clamshells, boxes...]
- Card adapters that are sold together with removable cards [microSD adapters etc...]
- Purchased cards
- SSD & HDD products packaging materials [shipping trays, shipping labels, insert, boxes etc...]

### **Product Category 2 [refer to Section 6]:**

- MP3 products [Clip Jam, Clip Sport, Clip Sport Go, Clip Sport Plus etc...]
- MP3 products accessories [Ear phones, lanyards for MP3, USB cables, skins etc...]
- MP3 packaging materials [jewel cases, shipping trays, shipping labels, insert, clamshells, boxes etc...]
- Card readers
- Card adapters that are sold separately [Express CF adapter etc...]
- Batteries
- Content Solutions for all branded products [DAS, NAS, SanDisk professional, commercial products]
- Data Center Systems [DCS] & External Storage Products
- Other retails and ODM product lines

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## 2 OBJECTIVES and SCOPE

### 2.1 OBJECTIVES

- This document describes Western Digital's environmental policy objectives and, worldwide legal & regulatory and also customer requirements.
- This document describes the restrictions on Materials, certain chemicals used in manufacturing.
- This document describes compliance requirements for the European Union (EU) Directive 2011/65/EU on the Restriction on the use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS).
- This document also describes Halogenated Flame Retardants BFR/CFR/PVC-Free and also Low Halogen (Halogen Free) requirements for materials, parts, products and Product Protective Packaging supplied for Western Digital applications which are designed to meet "BFR/CFR/PVC-Free" requirements and Low Halogen or Halogen Free requirements.

### 2.2 SCOPE

- Western Digital Environmental Compliance Specification establishes baseline environmental requirements for :
- All materials, parts, products and Product Protective Packaging used in Western Digital -designed applications, products and/or those referencing this specification in a Statement of Work, print, contract or other procurement documents.
- Products designed, manufactured and sold by Western Digital.
- Products contracted to a third party by Western Digital for design and manufacturing, and sold by Western Digital with its trademark/logo (including Branded Products).
- Repair or service parts.
- Instruction manuals and CD's
- Suppliers must ensure all material, parts, products and Product Protective Packaging comply with the requirements provided in this document.
- The supplier is responsible for compliance with this specification, including compliance of any subcontracted operations and procured materials used in the manufacture of parts, products and Product Protective Packaging for Western Digital applications.
- Suppliers are responsible to comply with all applicable legal and worldwide local, state, national, or international "Environmental Laws including laws, rules and regulations relating to environmental matters such as material restrictions, material bans, labeling, availability of product environmental information, and other similar requirements.
- Suppliers are required to disclose information about all the substances contained in the materials, parts, products and Product Protective Packaging shipped to Western Digital.
- All conflicts and deviations must be notified to Western Digital procurement and Product Environmental Compliance Team
- The approved drawings take precedence over this specification.

## 3 TERMS & DEFINITIONS

- **Article:** an object which during production is given a special shape, surface, or design which determines its function to a greater degree than does its chemical composition. [Source: EU Regulation 1907/2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH)]. In reference to EU REACH Substances of Very High Concern (SVHC), when a product is made up of more than one constituent Article, the SVHC concentration above 0.1% weight by weight applies to each constituent Article making up the product. [Source: Judgement of the European Court for EU Regulation 1907/2006 (REACH) Articles 7(2) and 33, 10 September 2015]
- **Banned:** The substances are banned to use in WD products at any level of threshold limit concentration. Not to be added intentionally.
- **BFRS & CFRs:** Brominated/chlorinated flame retardants. These substances contain or are treated with bromine and/or chlorine. They are typically added to reduce the flammability of substances such as epoxy resins and

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thermoplastics. Examples include, but are not limited to, Tetrabromo-bisphenol-A (TBBP-A), brominated epoxy resins and Polybrominated diphenyl ethers (PBDEs).

- **CAS Number:** CAS numbers are unique numerical identifiers for chemical substances assigned by the Chemical Abstracts Service (CAS) for its chemical substance registry system.
- **Chemical:** a substance, whether by itself or in a mixture, or a mixture, whether manufactured or obtained from nature, but does not include living organisms, which belongs to either of the following categories:
  - (a) Pesticides, including severely hazardous pesticide formulations;
  - (b) Industrial chemicals.
- [Source: EU Regulation 649/2012 of the European Parliament and of the Council of 4 July 2012 concerning the export and import of hazardous chemicals.
- **Conflict Minerals:** In 2010, the U.S. Dodd-Frank Act was passed concerning "Conflict Minerals" originating from the Democratic Republic of the Congo (DRC) or adjoining countries. The SEC has published final rules associated with the disclosure of the source of Conflict Minerals by U.S. publicly traded companies (see the rules at <http://www.sec.gov/rules/final/2012/34-67715.pdf>). The rules reference the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas, which guides suppliers to establish policies, due diligence frameworks, and management systems.
- **Contained:** Contained refers to a substance which is added to or blended with a part or material.
- **Controlled:** Restricts the use of these controlled substances with the homogeneous concentration [unless otherwise stated] above the threshold level stated
- **EDoC:** Environmental Declaration of Conformity Sheet is the form used by Western Digital to collect supplier environmental information as attached in MDDS documents
- **Full Material Disclosure:** Disclosure of all chemical substances, by Chemical Abstract System (CAS) number, present in each homogenous material in a part or assembly
- **Halogen Free (HF):** 900ppm maximum chloride (Cl), 900ppm maximum bromine (Br), and 1500ppm maximum total chlorine and bromine (Cl+Br). Refer to IEC 64249-2-21: (<http://www.iec.ch/>).
- **Homogeneous material:** means one material of uniform composition throughout or a material, consisting of a combination of materials that cannot be disjointed or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes. [Source: EU Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment]
- **ICP:** Inductively Coupled Plasma: chemical analysis method
- **Impurity:** An impurity is a substance with is present in a natural material or generated in a synthetic process, neither of which can be removed by technical means.
- **Indirect Material:** Material that is used during fab, assembly, test process, but it won't be incorporated into finished goods or which will not be shipped or seen by customers
- **Intentionally Added:** Intentionally introduced or intentionally added shall mean deliberately utilized in the formulation of a material or part where its continued presence is desired in the final product to provide a specific characteristic, appearance or quality.
- **Materials:** Includes chemicals or substances that are assembled into a product, such as structural plastics, metals, materials for printed circuit boards and wafers, etc.; materials that are used on a product, such as coatings, paints, pastes, etc.
- **Mechanically Disjointed:** Mechanically disjointed means mechanically separated by cutting, unscrewing, grinding, crushing, etc.
- **MDDS:** Material Declaration Data Sheet: form to disclose the full chemical content of a part or material at homogeneous level (AIS date form is able to use when it is accepted by Western Digital PEC Engineer.)
- **Mixture:** a mixture or solution composed of two or more substances. [Source: EU Regulation No 1272/2008 on classification, labeling and Product Protective Packaging of substances and mixtures]
- **Nanoparticles:** A natural, incidental or manufactured material that contains particles in an unbound state or as an aggregate or as an agglomerate and where, for 50% or more of the particles in the number size distribution, one or more external dimensions are in the range 1nm-100nm

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- **Not Detected:** below the detection limit of established test standards or appropriate industry wide test methods. In general, these test standards/ methods should achieve trace level detection or at the lowest detection capabilities of the specific sample matrix.
- **Not Detectable:** Not detectable means that the substance is not detected t is using the specified analytical technique.
- **Non-Ferrous Metals:** Any metal, including alloys, that does not contain iron in appreciable amounts.
- **Packaging:** 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. 'Non-returnable' items used for the same purposes shall also be considered to constitute packaging. 'Packaging' consists only of: (a) sales packaging or primary packaging (b) grouped packaging or secondary packaging (c) transport packaging or tertiary packaging
- **Particulate:** A minute piece of matter with defined physical boundaries. [Source: EU Commission Recommendation 2011/696/EU on the definition of nanomaterial]
- **Parts:** Any components and assemblies that are supplied to Western Digital/ HGST for use in Western Digital applications.
- **Plastic:** Material that contains, as an essential ingredient, one or more organic polymeric substances of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or processing into finished articles, can be shaped by flow. [Source: National Sanitation Foundation International Draft Standard NSF/ANSI 426]
- **PPM:** Parts per million, unit of measurement for weight percentage. 1 ppm = 1mg/kg = 0.0001% by weight. The parts per million thresholds listed in this specification refer to the weight of the material in a specific part, not the weight of the material in an entire system.
- **Preparation:** a mixture or solution composed of two or more substances, for example: paint, lubricant or ink. [Source: EU Regulation 1907/2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)]
- **Products:** All original equipment manufacturer (OEM) manufactured products supplied to Western Digital for sale with the Western Digital logo.
- **Prohibited:** Banned or Use not allowed.
- **RoHS:** European Union Directive 2002/95/EC and the recast RoHS Directive 2011/65/EU, "Restriction on the use of Certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment". The RoHS substances regulated at this time at this time include lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated biphenyl ethers and 4 phthalate substances (DEHP, BBP, DBP and DIBP).
- **Reportable:** Western Digital requires disclosure of the presence of reportable substances at the homogeneous level in the form of MDDS if over the threshold level stated
- **REACH:** An acronym for European Commission Regulation Number 1907/2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals and amendments. (Current as of the date of this specification, current list maintained in the latest REACH regulation and its amendments)
- **Substance:** A chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition. [Source: EU Regulation 1907/2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH)] Substance includes such examples as ethanol and metals.
- Note: metals are included here not in the form of a part or product such as a heat sink or sheet metal cover but as a metal such as aluminum or aluminum alloy. Substance goes beyond a pure chemical compound defined by a single molecular structure. The definition of substance includes different constituents such as impurities. Also note the word "substance" is used throughout this specification, only the "Substance" with a capital letter refers to this specific definition.
- Substance(s) of Very High Concern (SVHC):
  1. Substances meeting the criteria for classification in accordance with EU Directive 67/548/EEC:
    - Carcinogenic category 1 or 2

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Mutagenic category 1 or 2

Toxic for reproduction category 1 or 2;

2. Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) in accordance with the criteria set out in Annex XIII of the EU REACH Regulation;

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

- **Threshold:** The level of a reportable material above which its presence must be measured and reported to Western Digital. Threshold levels are based on their presence in each individual homogeneous layer.
- **WEEE:** European Union Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment.

#### 4. Document Administration

This document is maintained and controlled by Western Digital Product Environmental Compliance group. Supplier questions regarding the requirements in this specification must be referred to Western Digital procurement and Product Environmental Compliance group.

#### 5. PEC Requirements on Product Category 1

##### 5.1 Controlled Substances

Table 5.1a Controlled Substances in Parts/Materials and/or Production Process Parts/Materials

Item #	Controlled Substance	Maximum Threshold limit (ppm)
5.1	Alkylphenols	Banned
5.2	Antimony/Antimony Compounds	700ppm
5.3	Arsenic/Arsenic Compounds	Banned in wood products, paints and all surface usage. 50ppm for others. Exemption for parts of semiconductor(substrates and chips), metal alloy, glass, magnetic filter, copper foil for PCB & Substrate and battery
5.4	Asbestos	Banned
5.5	Azo Colorants, Azo Dyes and Azo Compounds	Banned (The substances which are used in parts or articles that may come into direct and prolonged contact with the human skin) 30ppm for others
5.6	Barium or its compounds	100ppm in surface preparations of products and parts intended to come into direct and prolonged contact with the skin.
5.7	Benzene(CAS# 71-43-2)	Banned
5.8	Benzidine and its Salts	Banned
5.9	Benzotriazole	Banned
5.10	Beryllium and Its compounds (Except Beryllium oxide)	Banned Impurities 200ppm
5.11	Beryllium oxide	Banned
5.12	Bis(chlorometyl) ether (CAS# 542-88-1)	Banned

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5.13	Bisphenol-A (CAS # 80-05-7)	300 ppm for plastics 1000ppm for others
5.14	Bromine and Chlorine (found in same homogeneous material)	1500ppm
5.15	Bromine and its compounds (including in BFRs)	900ppm
5.16	Cadmium/Cadmium Compounds	Banned in plating, surface coating and wood based materials 5ppm for rubber, plastic, paints, inks, and plastic surface treatment, adhesives, tape, label, paper 20ppm in solder 50ppm in other application
5.17	Chlorine and its Compounds (including in CFRs)	900ppm
5.18	Chromium III and chromium compounds	100ppm Controlled in surface preparations of products and parts intended to come into direct and prolonged contact with the skin
5.19	Creosote, coal tar, tar oils and anthracene substances	Prohibited for the treatment of wood
5.20	Dibutyltin (DBT) compounds and Dioctyltin (DOT) compounds	Banned
5.21	Dimethylfumarate (DMF)	Banned
5.22	Di- $\mu$ -oxo-di-n-butylstanniohydroxyborane (DBB) [also known as dibutyltin hydrogen borat]	1000ppm
5.23	Ethylene Glycol Monoethyl Ether and its acetate Ethylene Glycol Monomethyl Ether and its acetate	5ppm
5.24	Fluorinated greenhouse gases (PFC, SF6, HFC)	Banned
5.25	Formaldehyde	Banned for wood products 5ppm in textiles and leather
5.26	Halogenated Aromatic Substances	Banned from use in capacitors and transformers above 500ppm for monohalogenated in materials of the component. Banned from use in capacitors and transformers 50ppm for polyhalogenated aromatic substances in material of the component
5.27	Halogenated dioxins and furans polychlorinated dibenzo-p-dioxins/furans (PCDD/Fs) and polybrominated dibenzo-p-dioxins/furans (PBDD/Fs)	Banned
5.28	Halogenated Diphenyl Methanes (Ugilec141, Ugilec 121/Ugilec 21 and DBBT)	Banned

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5.29	Hexabromocyclododecane(HBCDD) and all major diastereoisomers	Banned
5.30	Hexachlorobenzene (CAS# 118-74-1)	Banned
5.31	Hexachlorobutadiene	Banned
5.32	Hexachlorocyclohexane isomers (HCH)	Banned
5.33	Hexachloroethane	Banned in manufacturing or processing of nonferrous metals
5.34	Hexavalent Chromium/Hexavalent Chromium Compounds	Banned in plating, paints, inks and plastic resins 500ppm for others
5.35	Latex and latex compound	100ppm Banned in surface
5.36	Lead/Lead Compounds	50ppm in polymeric materials, paints, inks, non-metallic, non-ceramic coatings, stabilizer, pigment, drying agent, and visual display units, cable jacket 100ppm in Polyvinyl Chloride (PVC) coating of external cables, wires and cords 90 ppm in wood based materials 800ppm in Solder (bar/wire/cream solder, solder ball) 1000ppm in other applications
5.37	Mercury and its Compounds	Banned
5.38	Medium chained Chlorinated Paraffins (MCCP)	1000ppm
5.39	musk xylene and musk ketone	Banned
5.40	N,N'-ditolyl-p-phenylenediamin, N-tolyl-N'-xylyl-p-phenylenediamine or N,N'-dixylyl-p-phenylene diamine	Banned
5.41	Nickel and its Compounds	Banned on surfaces that are designed to be in prolonged contact with skin
5.42	Nonylphenol/ethoxylates(NP/NPEs) and related substances	Intentionally added
5.43	Ozone Depleting Substances- Class I (CFCx, HBFCs, etc)	Banned
5.44	Ozone Depleting Substances- Class II (HCFCs)	Banned
5.45	PAH	1 ppm individually: Acenaphthene 83-32-9 Acenaphthylene 208-96-8 Anthracene 120-12-7 Benzo(a)anthracene 56-55-3 Benzo(a)phenanthrene (chrysene) 218-01-9 Benzo(a)pyrene 50-32-8 Benzo(b)fluoranthene 205-99-2 Benzo(e)pyrene 192-97-2 Benzo(g,h,i)perylene 191-24-2 Benzo(j)fluoranthene 205-82-3

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		Benzo(k)fluoranthene 207-08-9 Benzo(j,k)fluorene (Fluoranthene) 206-44-0 Benzo(r,s,t)pentaphene 189-55-9 Dibenz(a,h)acridine 226-36-8 Dibenz(a,j)acridine 224-42-0 Dibenzo(a,h)anthracene 53-70-3 Dibenzo(a,e)fluoranthene 5385-75-1 Dibenzo(a,e)pyrene 192-65-4 Dibenzo(a,h)pyrene 189-64-0 Dibenzo(a,l)pyrene 191-30-0 7H-Dibenzo(c,g)carbazole 194-59-2 Fluorene 86-73-7 Indeno(1,2,3-cd)pyrene 193-39-5 5-Methylchrysene 3697-24-3 Naphthalene 91-20-3 Phenanthrene 85-01-8 10ppm for sum of total PAH
5.46	Pentachlorobenzene (PeCB, CAS# 608-93-5)	Banned
5.47	Pentachlorophenol (PCP) and its salts and esters	Banned
	Pentachlorothiophenol (PCTP)	Banned
5.48	Perchlorates	Banned
5.49	Perfluorooctane sulfonate (PFOS) and its salts C8F17SO2X (X=OH, metal salt, halide, amide, and other derivatives including polymers)	Banned
5.50	Perfluorooctanoic acids (PFOAs) and its salts	Banned
5.51	Phenol, 2- (2H - benzotriazol -2-yl)-4,6 bis (1,1-dimethylethyl) CAS# 3846-71-7	Banned
5.52	Phenol, isopropylated phosphate (PIP) (3:1) (68937-41-7)	Banned
5.53	Phthalates (DEHP, DBP, BBP, DINP, DIDP, DNOP, DNHP, DIHP, DIBP, DHNUP, DEP, DMP)	1000 ppm each
5.54	Polybrominated Biphenyls (PBBs)	Banned
5.55	Polybrominated Diphenylethers (PBDEs)	Banned
5.56	Polychlorinated Biphenyls (PCBs)	Banned
5.57	Polychlorinated Naphthalenes (PCNs >3 chlorine atoms)	Banned
5.58	Polychlorinated Terphenyl (PCT)	Banned
5.59	Polyvinyl Chloride (PVC)	Banned Exempt CAS#9003-22-9
5.60	Radioactive Substances	Banned
5.61	Red Phosphoreous (Red-P) flame retardants	Banned
5.62	Shortchain Chlorinated Paraffins	Banned

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5.63	Tetrabromo bisphenol-A (TBBPA)	900 ppm
5.64	Toluene	1000ppm for Adhesive, paint
5.65	Tributyl Tin (TBT) and Triphenyl Tin (TPT) and compounds	Banned
5.66	Tributyl Tin Oxide (TBTO)	Banned
5.67	Tris (1,3-dichloro-2-propyl) phosphate (CAS# 13674-87-8)	1000ppm
5.68	Tri-substituted organostannic compounds(except where listed separately)	1000ppm
5.69	Yellow phosphorus	Banned
5.70	Chemicals listed in China VOC standards: GB 30981-2020 (for industrial protective coatings), GB 33372-2020 (for adhesives), GB 38507-2020 (for printing inks) and GB 38508-2020 (for cleaning agents)	Banned as per threshold limits mentioned in the listed China VOC standards
5.71	2,4,6-Tris(tert-butyl)phenol (TTBP) (732-26-3)	Banned

**Notes:**

- "Chlorine" includes, but not limited to, Polyvinyl Chloride (PVC), and other chlorinated compounds.
- "Bromine" includes, but not limited to, Brominated Flame Retardants (other than PBBs or PBDEs), Tetrabromobisphenol A (TBBPA), Hexabromocyclododecane (HBCDD), Hexabromobenzene, and other brominated compounds.
- "Antimony" includes Antimony and all its compounds (typically Antimony Trioxide).

Table 5.1b Controlled Substances in Packaging Materials

Item #	Controlled Substance	Maximum Threshold limit (ppm)
5.72	Arsenic Compounds	Banned
5.73	Asbestos	Banned
5.74	Benzo[a]pyrene	0.5 milligrams per kilogram in wood of dry matter
5.75	Brominated flame retardants (BFRs)	All BFRs in external case plastic parts are banned PBBs, PBDEs including DecaBDE are banned Others not intentional use (Br<900ppm)
5.76	Cadmium, Chromium VI, Lead and Mercury compounds	Sum:100ppm
5.77	Certain Azo Colorants	Banned
5.78	Chlorine type bleaching reagent	Banned
5.79	Cobalt dichloride (CoCl <sub>2</sub> )	Banned in humidity indicator cards Cl 900ppm/Co 1000ppm for silica-gel
5.80	Dibutyltin (DBT) compounds	1000ppm
5.81	Dimethylfumarate (DMF)	Banned in Moisture prevention agents, mildew-proofing agents
5.82	Diocetyl tin (DOT) compounds	1000ppm

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**Western Digital Product Environmental Compliance Engineering Specification  
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5.83	Expanded polystyrene (EPS) foam	Banned (applicable to South Korea only)
5.84	Halogen compounds and halogen resins	Banned in Flame retardants, adhesive
5.85	Halogenated Chlorofluorocarbons(CFC's)	Banned
5.86	Halogenated Diphenyl Methanes	Banned
5.87	Halogenated Plastics or Polymers	Banned
5.88	Hydrogenated Chlorofluorocarbons (HCFC's)	Banned
5.89	Isocyanate	Banned
5.90	Methyl bromide for fumigation	Banned
5.91	Nickel on external surfaces	Banned
5.92	Ozone depleting substances except listed separately (Class I &Class II CFCs and HCFCs)	Banned
5.93	Perfluorooctane sulfonate (PFOS) and PFOS-related compounds	Banned
5.94	PFOA	Banned in coating materials for packaging materials
5.95	Phenol, 2-(2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylethyl) CAS# 3846-71-7	Banned
5.96	Polychlorinated biphenyls (PCBs) and specific substitutes	Banned
5.97	Polychlorinated naphthalenes (more than 3 chlorine atoms)	Banned
5.98	Polychlorinated terphenyls (PCTs)	Banned
5.99	Polyurethane	Banned
5.100	Polyvinyl Chloride (PVC)	Banned
5.101	Radioactive Substances	Banned
5.102	Shortchain chlorinated paraffins	1000
5.103	Tributyl tin oxide (TBTO)	Banned
5.104	Tri-substituted organostannic compounds	Tributyl Tin (TBT) and Triphenyl Tin (TPT) are banned, others<1000ppm
5.105	Urea Formaldehyde based resin	0.05
5.106	Zinc/Zinc Compounds	100ppm

Table 5.1c Controlled Substances in Batteries

Item #	Controlled Substance	Maximum Threshold limit (ppm)
5.107	Mercury	5ppm
5.108	Cadmium	20ppm
5.109	Lead	40ppm

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## 5.2 Reportable Substances

Table 5.2 Reportable Substances in Parts/Materials and/or Production Process Parts/Materials

Item #	Reportable Substance	Maximum Threshold limit (ppm)
5.110	4-[4,4'-bis(dimethylamino) benzhydrylidene] cyclohexa- 2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Violet 3)	1000ppm
5.111	4-aminobiphenyl and its salt	100ppm
5.112	4-nitrobiphenyl and its salt	1000ppm
5.113	Acrylamide	1000ppm
5.114	Aluminum/Aluminum Compounds	Any presence
5.115	Amines, Aliphatic	100ppm
5.116	Aniline Salts	100ppm
5.117	Anthracene(Except for wood treatment)	1000ppm
5.118	Aromatic Amines and Dyes	100ppm
5.119	Aromatic Compounds as monomers (except where listed separately)	100ppm
5.120	2-Butanone oxime(CAS# 96-29-7)	1000ppm
5.121	n-Butyl glycidyl ether(CAS# 2426-08-6)	1000ppm
5.122	Barium Compounds (except barium sulfate)	100ppm
5.123	Benzenamine, N-phenyl-, reaction products with styrene and 2,4,4-trimethylpentene (CAS# 68921-45-9)	1000ppm
5.124	Benzophenone	1000ppm
5.125	Beta-naphthylamine and its salts	1000ppm
5.126	Bis(2-ethylhexyl)tetrabromophthalate (TBPH or BEHTBP) (CAS# 26040-51-7)	1000ppm
5.127	Bismuth/Bismuth Compounds	100ppm
5.128	Boron and its compounds, including alloy	1000ppm
5.129	Cobalt/Cobalt Compounds	Any presence
5.130	Copper/Copper Compounds	Any presence
5.131	Di (2-ethylhexyl) adipate	1000ppm
5.132	Ferrosilicon and Alloys	100ppm
5.133	Gold/Gold Compounds	Any presence
5.134	Indium phosphide (CAS# 22398-80-7)	1000ppm
5.135	Iron/Iron Compounds	Any presence
5.136	Long chained chlorinated paraffins (LCCP; generally C 18-28) (e.g., CAS# 85535-86-0)	1000ppm
5.137	Magnesium/Magnesium Alloys	Any presence
5.138	Medium chained chlorinated paraffins (C 14-17 alkyl chain)	100ppm
5.139	Natural Rubber	1000ppm

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5.140	n-Hexane (CAS# 110-54-3)	1000ppm
5.141	Octachlorostyrene(CAS# 29082-74-4)	1000ppm
5.142	Organic Azo and Azo-oxy Compounds	100ppm
5.143	Organic Halogen Compounds (except where listed separately)	100ppm
5.144	Organic phosphorous compounds	100ppm
5.145	Organic Silicon Compounds	100ppm
5.146	Organochlorine and Organobromine compounds	1000ppm
5.147	Palladium and palladium compounds	Any presence
5.148	Perfluorocarbons	100ppm
5.149	Polybrominated Terphenyls	100ppm
5.150	Rare Earth Elements(Lanthanides, Scandium, Neodymium, Dysprosium, Praseodymium and Yttrium)	Lanthanides, Scandium, Dysprosium and Yttrium: 10ppm Neodymium: Any presence Praseodymium: 1000 ppm
5.151	Rubidium and rubidium compounds	100ppm
5.152	Silver or its compounds	Any presence
5.153	Selenium/Selenium Compounds	1000 ppm
5.154	Surfactants(DTDMAC, DODMAC(DSDMAC) and DHTDMAC)	100ppm
5.154	Tantalum and tantalum compounds	Any presence
5.155	Tellurium or its compounds	100ppm
5.156	Tetramethylthiuram Disulfide (Thiram)	100ppm
5.157	Thallium or its compounds	100ppm
5.158	Tin/Tin Compounds (Except where listed separately)	Any presence
5.159	Tri-n-butyl phosphate (TNBP) (126-73-8)	1000 ppm
5.160	Triclosan	10ppm
5.161	Volatile Organic Compound	100ppm
5.162	White phosphorus	1000ppm
5.163	Zinc/Zinc Compounds	Any presence
5.164	Nanomaterials	Any presence
5.165	Chlorinated Organic Solvents	1000 ppm
5.166	Bisphenol F & Bisphenol S	100 ppm
5.167	Diethyl phthalate	1000 ppm
5.168	Nickel sulfate and nickel sulfamate	1000 ppm
5.169	Toluene Diisocyanate	1000 ppm
5.170	Wood, Paper and other plant-based product	Any presence

**6. PEC**

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**6 Requirements on Product Category 2**

**6.1 Controlled Substances**

Table 6.1a Controlled Substances in Parts/Materials and/or Production Process Parts/Materials

Item #	Controlled Substance	Maximum Threshold limit (ppm)
6.1	Arsenic and its Compounds	1000ppm
		For only wood and paint applications
6.2	Asbestos	Banned
6.3	Azo Colorants and Azodyes	30ppm for textile or leather article except 1000ppm for CAS #118685-33-9 and C46H30CrN10O20S2.3Na
6.4	Bisphenol-A (4,4'-isopropylidenediphenol or BPA)	1000ppm
6.5	Cadmium and its Compounds	5ppm for plastics, inks, paints, textiles, rubber, resins/
		100ppm for all other materials
6.6	Certain Chlorine Compounds: Chloroform CAS# 67-66-3 1,1,2-Trichloroethane CAS# 79-00-5 1,1,2,2-Tetrachloroethane CAS# 79-34-5 1,1,1,2-Tetrachloroethane CAS# 630-20-6 Pentachloroethane CAS# 76-01-7 1,1-Dichloroethene CAS# 75-35-4	1000ppm
6.7	Dibutyltin (DBT) compounds and Diocetyl tin (DOT) compounds	1000ppm of Tin
6.8	Dimethylfumarate (DMF)	0.1ppm
6.9	Ethylene Glycol Monoethyl Ether and its acetate	5ppm
6.10	Ethylene Glycol Monomethyl Ether and its acetate	5ppm
6.11	Formaldehyde	Banned for wood products 5ppm in textiles and leather
6.12	Halogenated Dioxins and Furans	900ppm
6.13	Hexavalent Chromium and its Compounds	10ppm for leather and textiles/ 1000ppm for all other materials
6.14	Halogenated Diphenyl Methanes (Ugilec141 CAS# 76253-60-6, Ugilec 121/Ugilec 21 CAS# 81161-70-8, and DBBT CAS# 99688-47-8)	Banned
6.15	Hexabromocyclododecane(HBCDD) and all major diastereoisomers	1000ppm
6.16	Hexachloroethane CAS# 67-72-1	Banned in manufacturing or processing of nonferrous metals
6.17	Lead and its Compounds	100ppm for plastics, inks, paints, textiles, rubber and resins/
		1000ppm for all other materials

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6.18	Mercury and its Compounds	5ppm for plastics, inks, paints, textiles, rubber and resins/ 1000ppm for all other materials
6.19	Nickel	Banned on surfaces of products/parts that are intended to come into direct contact with skin
6.20	Ozone Depleting Substances- Class I (CFCx, HBFCs, etc)	Banned
6.21	Ozone Depleting Substances- Class II (HCFCs)	Banned
6.22	PAH	1 ppm individually: Acenaphthene 83-32-9 Acenaphthylene 208-96-8 Anthracene 120-12-7 Benzo(a)anthracene 56-55-3 Benzo(a)phenanthrene (chrysene) 218-01-9 Benzo(a)pyrene 50-32-8 Benzo(b)fluoranthene 205-99-2 Benzo(e)pyrene 192-97-2 Benzo(g,h,i)perylene 191-24-2 Benzo(j)fluoranthene 205-82-3 Benzo(k)fluoranthene 207-08-9 Benzo(j,k)fluorene (Fluoranthene) 206-44-0 Benzo(r,s,t)pentaphene 189-55-9 Dibenz(a,h)acridine 226-36-8 Dibenz(a,j)acridine 224-42-0 Dibenzo(a,h)anthracene 53-70-3 Dibenzo(a,e)fluoranthene 5385-75-1 Dibenzo(a,e)pyrene 192-65-4 Dibenzo(a,h)pyrene 189-64-0 Dibenzo(a,l)pyrene 191-30-0 7H-Dibenzo(c,g)carbazole 194-59-2 Fluorene 86-73-7 Indeno(1,2,3-cd)pyrene 193-39-5 5-Methylchrysene 3697-24-3 Naphthalene 91-20-3 Phenanthrene 85-01-8 10ppm for sum of total PAH
6.23	Perfluorooctane sulfonate (PFOS) and PFOS-related compounds	1000ppm
6.24	Phthalates (DEHP, DBP, BBP, DINP, DIDP, DNOP, DIBP)	1000ppm for each phthalate
6.25	Polybrominated Biphenyls (PBBs)	1000ppm
6.26	Polybrominated Diphenylethers (PBDEs) including DecaBDE	1000ppm
6.27	Polychlorinated Biphenyls (PCB)	900ppm
6.28	Polychlorinated Naphthalenes (PCNs >3 chlorine atoms)	900ppm

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6.29	Polychlorinated Terphenyls (PCT)	50ppm
6.30	Radioactive Substances	Banned
6.31	Shortchain Chlorinated Paraffins (SCCP)	900ppm
6.32	Tributyl Tin (TBT) and Triphenyl Tin (TPT)	Banned
6.33	Tributyl Tin Oxide (TBTO)	Banned
6.34	Toluene CAS# 108-88-3	1000ppm for adhesive, paint
6.35	Chemicals listed in China VOC standards: GB 30981-2020 (for industrial protective coatings), GB 33372-2020 (for adhesives), GB 38507-2020 (for printing inks) and GB 38508-2020 (for cleaning agents)	Banned as per threshold limits mentioned in the listed China VOC standards

Table 6.1b Controlled Substances in Packaging Materials

Item #	Controlled Substance	Maximum Threshold limit (ppm)
6.36	Cadmium, Mercury, Lead and Hexavalent Chromium	Sum: 100ppm
6.37	Perfluorooctane sulfonate (PFOS) and PFOS-related compounds	1000ppm
6.38	Polyvinyl Chloride (PVC)	900ppm

Table 6.1c Controlled Substances in Batteries

Item #	Controlled Substance	Maximum Threshold limit (ppm)
6.39	Mercury	5ppm
6.40	Cadmium	20ppm
6.41	Lead	40ppm
6.42	Perchlorate	Banned

## 7. Regulatory Requirements

### 7.1 References for Regulatory Requirements

- EU RoHS Directive: <http://ec.europa.eu/environment>
- EU Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS - Recast)
- EU Directive 2015/863 of the European Parliament and of the Council of 31 March 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
- EU Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)
- EU Regulation (EC) No. 1005/2009 on Substances that deplete the ozone layer
- EU Battery Directive [EU Directive 2006/66/EC]
- United States Clean Air Act Section 611 of the 1990 amendments; 40 CFR Part 82
- California Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986

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- Canada Prohibition of Certain Toxic Substances Regulations, 2012
- ISO 11469 "Plastics - Generic identification and marking of plastics products"
- IEC 61249-2-21 : <http://www.iec.ch/>
- Directive 94/62/EC of the European Parliament and of the Council of December 1994 on Packaging and Packaging Waste
- Directive 2002/61/EC of the European Parliament and of the Council of 19 July 2002 relating to restrictions on the marketing and use of certain dangerous substances and preparations (azocolourants)
- Directive 122/2006/EC of the European Parliament and of the Council of December 2006 on restrictions on the marketing and use of perfluorooctane sulfonates (PFOS)
- Directive 2009/251/EC of the European Parliament and of the Council of March 2009 on restrictions on the use of biocide dimethylfumarate (DMF)
- IEC 62321 Procedures for the Determination of Regulated Substances in Electro technical Product
- China RoHS
- China VoC standards: GB 30981-2020 (for industrial protective coatings), GB 33372-2020 (for adhesives), GB 38507-2020 (for printing inks) and GB 38508-2020 (for cleaning agents)
- ODC (Ozone Depleting Chemicals) Free manufacturing processes, as per Montreal Protocol
- EU WEEE Directive
- Nanomaterial Compliance as defined by 2011/696/EU
- EPEAT Criteria
- Asbestos Free Products & Workplace as per the Directive 83/477/CEE and Amendment 2007/30/EC
- Radioactive Substances Free Products & Workplace as per the Directive 96/29/Euratom
- Recycle Marking on Plastic Parts weighing > 25g as per ISO 11469 – "Plastics – Generic identification and markings of plastic products".
- California Packaging Recycling CalRecycle
- Directive (EU) 2019/904 of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment (Oxo degradable Plastics)
- Persistent Organic Pollutants (POP) standards: EU Regulation (EU) 2019/1021 and its amendments
- Lacey Act and EU Timber Regulation

## 7.2 Restriction of Hazardous Substances (RoHS)

- All homogeneous material in parts and products must be RoHS compliant as per EU Directive. Note: Phthalates testing required for plastic/rubber materials suspected to contain Phthalates.
- **EU RoHS Exemptions**  
All exemptions under the EU RoHS Recast Directive 2011/65/EU must be clearly disclosed in the reporting documents submitted to Western Digital. EU decision on the status of current exemptions must be diligently monitored. All materials currently under exemptions must be phased out and replaced with alternative RoHS compliant materials based on the feasibility and availability of exemption free materials.

## 7.3 EU REACH Regulation Substances

### REACH Authorization chemicals

Western Digital prohibits REACH authorization chemicals usage in its parts and products in article level at or above 1000 ppm. Western Digital requires suppliers to report the authorized chemical content with MDDS deliverables. The latest list of REACH authorized substances as published by the European Chemicals Agency is located at: <https://echa.europa.eu/authorisation-list>

### Candidate List of substances of very high concern for Authorization

Western Digital requires suppliers to identify if there is any SVHC substances present in an Article. Suppliers are required to report the name, CAS number and the quantity of the SVHC candidate present. The threshold concentration is 1000

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ppm at the article level for all applications, unless otherwise stated. The latest candidate list of REACH SVHC as published by the European Chemicals Agency is located at:  
<https://echa.europa.eu/candidate-list-table>

### Restricted Substances

Western Digital prohibits REACH restricted chemicals usage in its parts and products. Western Digital requires suppliers to report the restricted chemical content with MDDS deliverables. The latest list of REACH restricted substances as published by the European Chemicals Agency is located at:  
<https://echa.europa.eu/substances-restricted-under-reach>

### 8. Requirements for Suppliers

- Procurement and Manufacturing of Materials & Parts
  - Western Digital policy requires all suppliers and contracted manufacturers (CMs) for Western Digital parts and materials to comply with these environmental requirements.
- All suppliers and CMs are required to provide all of the following documents for every item supplied to Western Digital or any Western Digital's contracted manufacturers (including all indirect materials):
  1. Material declaration data sheet (MDDS) in Western Digital format [refer to the format in Section 11];
  2. Environmental Declaration of Conformity (EDoC) in Western Digital Format [Embedded in MDDS template]
  3. Homogeneous material level lab test reports (ICP) are required for all the homogenous materials listed in table below:

Table 8.1: Test parameters required for each homogenous material in the selected category

Test Parameters	Category 1		Category 2		
	All components	Packaging materials	All components except earphones and USB Cables	Earphones and USB cables	Packaging materials
Lead	√	√	√	√	√
Mercury	√	√	√	√	√
Cadmium	√	√	√	√	√
Hexavalent Chromium	√	√	√	√	√
Sum of PBBs (Non-metals only)	√		√	√	
Sum of PBDEs (Non-metals only)	√		√	√	
Chlorine	√				
Bromine	√				

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<p><b>Four Phthalates (DEHP, BBP, DBP and DIBP) in product level for Non-metals only</b></p>	<p>√</p>		<p>√</p>		
<p><b>Seven phthalates (DEHP, DBP, BBP, DINP, DIDP, DNOP, DNHP) in product level for Non-metals only</b></p>				<p>√</p>	

- In addition, we require component and/or homogeneous chemical analysis lab test reports of controlled/reportable substances listed in this document for all parts supplied to Western Digital within fifteen (15) business days, upon request. Western Digital maintains an ongoing green monitoring program and will execute these requests under this program.
- The validity of lab test reports is of 1 year. Suppliers are required to provide the updated lab test reports for expired ones.
- Western Digital only accepts lab test reports from ISO17025 certified 3<sup>rd</sup> party laboratories.
- Supplier are required to comply with China VoC standards GB 30981-2020 (for industrial protective coatings), GB 33372-2020 (for adhesives), GB 38507-2020 (for printing inks) and GB 38508-2020 (for cleaning agents) and provide required documentation along with the completed MDDS. In addition, we require component and/or homogeneous chemical analysis lab test reports of all chemicals in above listed China VoC standards for all parts supplied to Western Digital within fifteen (15) business days, upon request.
- Suppliers are required to comply with EU single use plastics directive that is intended to prevent and reduce the impact of certain plastic products on the environment and the late addition of Oxo-degradable plastics ban to the directive. This prohibits placing on the market of Oxo-degradable plastics from 3rd July 2021. Oxo-degradable plastics are defined as plastic materials that include additives which, through oxidation, lead to the fragmentation of the plastic material into micro-fragments or to chemical decomposition.
- Persistent Organic Pollutants (POP) standards: Suppliers are required to comply with the EU Regulation (EU) 2019/1021 and its amendments. Annex I substances to be prohibited and Annex II substances are to be restricted based on the control measures provided in the directive
- Suppliers must disclose 100% of all the materials used at homogenous level and provide applicable CAS numbers to all substances listed in the MDDS. All fields in the Western Digital MDDS format must be completed. All submitted MDDS will be reviewed and approved by Western Digital Supplier Quality.
- All homogeneous materials lab testing results must be disclosed in the MDDS report with test date and RoHS exemptions.

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- Western Digital requires suppliers to notify and report in case of REACH SVHC substances and Authorization substances present in articles.
- Western Digital requires suppliers to disclose the complete information regarding conflict minerals present in the products supplied to Western Digital.
- Any changes of materials must go through supplier PCN process, in which updated documents must be provided by suppliers.
- Packaging materials must not contain any wood material (including materials used to make paper items), or other wild plant material that was illegally sourced from its country of origin. Examples of illegally sourced materials include, but are not limited to: wood or wild plant materials stolen from parks, reserves, or other protected areas; materials harvested without permission or contrary to applicable harvesting regulations; materials for which the applicable royalties, taxes, or fees were not paid; and materials exported in violation of log or other export bans. This requirement applies to all wood materials and products or packaging made thereof (including wood from planted forests) but does not apply to common food crops.
- Periodic Auditing
  - Western Digital periodically performs chemical analyses on samples taken from product families to ensure that Western Digital environmental compliance is being maintained.
- Verification of New Products
  - Western Digital reviews the compliance of new products to these requirements before release.

## 9. Testing Requirements

### 9.1 RoHS Testing

- All homogeneous materials must be tested for RoHS Substances: Cadmium (Cd), Chromium hexavalent (Cr VI), Lead (Pb), Mercury (Hg). PBB & PBDE and Phthalates (if applicable).
- Metals, Glass & Ceramics are exempted for PBB, PBDE and Phthalates tests.
- RoHS Testing of all homogeneous materials must be performed in accordance with the latest version of IEC 62321 Electrotechnical products

Analysis method acronyms:

- ICP: Inductively coupled plasma
- AA: Atomic Absorption Spectroscopy
- GC-MS: gas chromatography - mass spectrometry
- XRF: X-Ray Fluorescence Spectroscopy
- Spot test or PAK® test: Drip diphenylcarbazide colorimetric solution; then observe color change for several minutes

### 9.2 Phthalates Testing

- Phthalates (DEHP, DBP, BBP, DIBP) testing required for Non Metals materials suspected to contain Phthalates.

### 9.3 Halogen Testing

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- All homogeneous materials except metals/glass/ceramics, must be tested for Bromine and Chlorine wherever applicable.
- Bromine and Chlorine must be tested as per EN 14582, IEC 61189-2, IPC TM-650, and EN 50267-2-1(2).
- Metals, Glass & Ceramic materials are exempted from Halogen testing requirements.
- Testing for PVC is not required, because PVC is difficult to detect using standard test methods. Suppliers must have control measures to ensure compliance with this specification and provide a declaration stating this compliance.

#### **9.4 Red Phosphorus Testing**

- Testing for Red Phosphorus is not required, because red phosphorus is difficult to detect using standard test methods. Suppliers must have control measures to ensure compliance with this specification and provide a declaration stating this compliance.

#### **9.5 All homogeneous materials**

- All homogeneous materials must be tested in finished good condition
- Metal alloys, Glass and Ceramic are to be tested as homogeneous material after high temp processing.
- Plastic and rubber materials must be tested after forming/molding.
- Adhesive, Epoxy, Resin, Solder, Flux, Ink, Paint, Paste, Coating, and Plating etc must be tested to represent the actual manufacturing condition such as after mixing, drying, curing, and baking.

#### **9.6 Recommended Test Report Contents**

Lab Test reports must include following details:

- Lab Test Reports must be in English
- Laboratory Name and location
- Lab Test Report Number
- Operator name,
- Lab Representative name
- Date of sample receipt
- Sample Analysis date (must be the most recent dated)
- Name and description of Sample tested
- Signature of responsible person
- Sample preparation or pre-conditioning methods (e.g. drying, curing, grinding, digestion solution, etc.) for total dissolution.
- Analysis method used (Reference to methods in 62321)
- Analysis Flowchart of test methods with a statement on the degree of dissolution of, with the words of the material or layer being analyzed "sample was completely dissolved" or "no residual precipitates.
- Measurement result.
- Detection limit of each method and for each material analyzed
- Picture of sample tested
- If you are unable to test the part in the finished condition, then the following will apply:
  - If in the raw condition, the RoHS and Halogen Free test data is reported as "Not Detected (ND.)", then the raw sample test data is acceptable. A confirmation statement is required.
  - If in the raw condition, the RoHS and Halogen Free test data is reported as "Detected", the raw sample test data is acceptable. A confirmation statement is required even if the weight of the sample does not change during the manufacturing operation.

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- If in the raw condition, the RoHS and Halogen Free test data is reported as “Detected”, the raw sample test data is acceptable. A confirmation statement is required when the calculated concentration is below Western Digital criteria.
- **Re-Testing Requirements**  
Any changes in design, materials (including material source), manufacturing methods, production locations, etc. must be communicated to Western Digital in writing and revised documents must be provided for review and qualification after retesting.

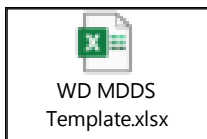
## 10. Homogeneous Material Definition and Examples



Homogeneous  
Materials

## 11. Western Digital MDDS Formats

For direct and indirect material suppliers:



For CMs:



## 12. Document Review

This document will be reviewed by Western Digital on an annual basis.

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