SUPPLIER MANUAL AND ENVIRONMENTAL PROCUREMENT GUIDELINES

ABOUT FLEX

Flex is a leading sketch-to-scale™ solutions company that designs and builds intelligent products for a connected world. With more than 200,000 professionals across 30 countries and a promise to help make the world Live smarter™, the company provides innovative design, engineering, manufacturing, real-time supply chain insight and logistics services to companies of all sizes in various industries and end-markets. For more information, visit www.flex.com or follow us on Twitter @flexintl.

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1.0 BACKGROUND/INTRODUCTION

In 2006, the world was introduced to new environmental directives enacted in Europe, RoHS (Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment) and WEEE (Waste Electrical and Electronic Equipment), that defined a new era of environmental awareness and compliance.

Since 2006, the enactment of environmental laws in other countries and the establishment of environmental requirements in major brand companies have escalated at an exponential rate. Now the world has REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) and it's growing list of SVHCs (Substances of Very High Concern), RoHS Recast (update to original RoHS directive that now eliminates certain excluded industries and removes originally defined exemptions), as well as many other laws from China, Korea, Japan, South America and others.

Part/ Product environmental compliance requirements have been continually evolving over the last numbers of years including the type of products flex is producing. This means that both flex and suppliers are no longer relying on the basic suite of the EU RoHS/REACH/WEEE requirements but a whole range of other requirements.

Flex has participated fully in the compliancy efforts since before 2006 but has realized that simple environmental declaration solutions cannot effectively keep pace with the legal change velocity. As a result, Flex has introduced a new environmental data management process based on the IPC1752A declaration protocol that allows us to keep pace with the regulations and provide due diligence to our customers. Flex provides manufacturing services for our many customers who have varying environmental requirements and this new process allows us to meet all such requirements. Materials that Flex adds to customer products will all be evaluated with Full Material Content declarations with the goal to ensure compliance to regulations in all products our materials are built in to.

2.0 PURPOSE

This supplier manual is intended to provide you, our valued suppliers, with the knowledge and guidelines to determine the homogeneity of materials and to correctly provide the information to Flex in determining and maintaining the environmental compliance status of the identified materials and or products to identified environmental legal, regulatory, industry or customer requirements. Flex appreciates your participation in this initiative and we look forward to working with you to ensure environmental sustainability in our world.

3.0 SCOPE

This supplier manual applies to all materials, components, parts, assemblies and/or products supplied to Flex. The procedures described herein comprise a mandatory process for all suppliers and Parts provided to Flex.

4.0 DEFINITIONS and ABBREVIATIONS

4.1.	**Product**	A product is a conglomeration of assembled parts as finished goods and a whole entity ready for end-user application & usage.
4.2.	**Assembly**	An assembly is a collection of components and materials that are not intended to be disassembled or cannot reasonably be disassembled without the use of a specialized tool, by the end user.
4.3.	**Part**	A part is any item or assembly that a supplier sells to Flex that is incorporated into Flex products.
4.4.	**Component**	A component is a combination of homogeneous materials that have been formed into a single manufactured part.

4.5. **Material** Materials are items used to construct parts. Material is always made up of one or more substances.

4.6. **Substance** A substance is a chemical element, compound, or polymer (if it has a CAS number). All substances are materials, but all materials are not necessarily substances. For example: brass is a material that is made up of copper and zinc substances. Zinc metal is a material and a substance. Polycarbonate is a material and a substance because there is a CAS number (25037-45-0) for it. Lexan is the brand name for a material. Lexan is not a substance because it can include other constituents besides the polycarbonate substance and because it does not have a CAS number.

4.7. **Full Material Declaration (FMD)**
A full material declaration discloses 100% of the homogenous materials that are found in the supplied materials/parts and 100% of all the substances that are contained in those materials. Materials or substances (whether “Intentionally Added” or not) contained in materials/parts purchased (and in turn incorporated into supplier’s products) must be disclosed. It is recognized that in certain situations, 100% disclosure by CAS Registry Number may not be feasible due to the confidentiality or proprietary nature of the information.

4.8. **Homogenous material** A unit that cannot be mechanically disjointed in single materials or any material that is not mechanically divisible (disassembled, cut or ground) into separate material constituents. The term “homogeneous” is understood as "of uniform composition throughout". Examples of homogeneous materials are individual types of: plastics, ceramics, glass, metals, alloys, paper, board, resins, and coatings. The term “mechanically disjointed” means that the materials can be, in principle, separated by mechanical actions such as for example: unscrewing, cutting, crushing, grinding and abrasive processes.

4.9. **RoHS** Acronym for European Union Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

4.10. **RoHS Compliant** Material, part, component, assembly or product that complies with the European Union Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment including any applicable exemptions.

4.11. **REACH** Acronym for European Union regulation on the Restriction, Evaluation, Authorization and Reduction of Chemicals. This regulation requires all substances, chemicals and materials to be registered to appropriate authorities and communicated, including all uses, bi-directionally along the supply chain.

5.0 TABLE OF REFERENCES

Document Title	Document Number	Link to Document
General Specification on Environmental Compliance for Suppliers	CES-MAT-2-001-00	https://flex.com/other/supplier-information-supplier-quality
Flex Specification for Procurement of Lead (Pb)-Free Electronic and Electromechanical Components and Assemblies	CES-MAT-2-003-00	https://flex.com/other/supplier-information-supplier-quality
Specification of banned and restricted substances for use	CES-REG-1-001-00	https://flex.com/other/supplier-information-supplier-quality
Supplier Quality General Requirements	FMS-QMS-3-005-00	https://flex.com/other/supplier-information-supplier-quality
Anthesis IPC1-752A material declaration user guide	Anthesis IPC 1752A Guide	https://flex.com/other/supplier-information-supplier-quality
Anthesis IPC1-752A material declaration template	Anthesis IPC 1752A Template	https://flex.com/other/supplier-information-supplier-quality

6.0 PROCEDURE STATEMENT

6.1 Flex Environmental Procedure and T&C Expectations

6.1.1 As an industry leader in the area of social responsibility, which includes green compliance, Flex has developed a customer focused environmental strategy with several key policy elements.

6.1.1.1 Flex is committed to working with our customers to provide complete, end-to-end, vertically integrated solutions.

6.1.1.2. Flex is focused on providing products and services in compliance with our customer's environmental requirements

6.1.1.3 Flex is focused on providing products and services in compliance with our customer's environmental requirements

6.1.1.4 Adopt a progressive position that meets customer and legal obligations.

6.1.1.5 Ensure appropriate support for customers in their desire to be/become compliant and ensure that responsibilities and liabilities are appropriately assigned.

6.1.1.6 Continually improve our competitive positioning through the provision of market-leading ROHS, REACH and WEEE compliant capabilities and services

6.1.1.7 Create win-win business agreements with our valued business partners.

6.1.2 Supplier warrants and represents that, unless otherwise specifically agreed by a duly authorized representative of Buyer, all Product supplied and work performed under this Agreement shall comply with all applicable laws governing the environmental compliance of the products similar but not exclusive to the RoHS Directive 2011/65/EU and (EU) 2015/863 and/or (EC) No 1907/2006 on Registration, Evaluation, Authorization and Restriction of Chemicals ("REACH"). Suppliers who provide components and/or assemblies to Buyer agree that such components and/or assemblies shall meet the requirements of Buyer's document "General Specifications on Environmental Compliance for Suppliers" and Buyer's document "Specification for Procurement of Lead (Pb) Free Electronic and Electromechanical Components and Assemblies".

7.0 PROCEDURE

7.1 Background and Policy Information

7.1.1 The RoHS directive is designed to restrict the use of certain materials deemed hazardous to humans and the environment. The WEEE directive is designed to facilitate environmentally conscious recycling by electronics sellers. Both directives apply to most electronic devices and their component parts.

In January 2003, the European Union adopted the RoHS and WEEE Directives. Later, in June 2011 the RoHS Directive was revised.

The original RoHS Directive, Directive 2002/95/EC, has undergone two revisions since its inception in 2002:

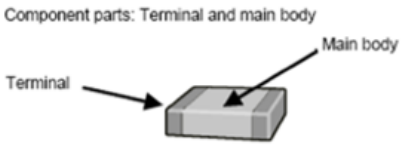
- Directive 2011/65/ EU, "RoHS-Recast" or "RoHS 2", which replaced Directive 2002/95/EC
- Directive 2015/863, "RoHS 3", which amended Annex II of RoHS 2

The banned substances and their limits proposed under the RoHS legislation are shown in Figure 1:

Status	Substances and Limits
Current Restrictions	Cadmium(Cd): 0.01%
	Mercury: 0.1%
	Lead(Pb) : 0.1%
	Hexavalent chromium (Cr6+) : 0.1%
	Polybrominated biphenyls (PBB): 0.1 %;
	Polybrominated diphenyl ethers (PBDE): 0.1 %
	Bis(2-Ethylhexyl) phthalate (DEHP): 0.1%
	Benzyl butyl phthalate (BBP): 0.1%
	Dibutyl phthalate (DBP): 0.1%
	Diisobutyl phthalate (DIBP): 0.1%

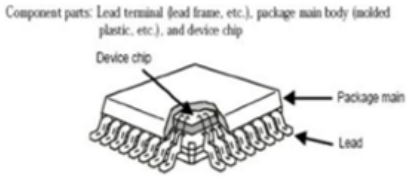
7.1.2 The RoHS acceptance limits are defined using Homogeneous Materials (see definition of Homogeneous Material in Section 4).

7.1.3 Some examples of Homogeneous Materials in some common electrical components are shown in Figure 2, Figure 3 and Figure 4:



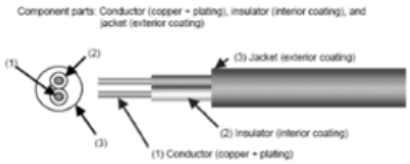
Homogeneous Materials:
- Terminal
- Main Body
- Core (within main body)

Figure 2. SMT Chip Device Homogenous Materials



Homogeneous Materials:
- Molded Encapsulate
- Chip
- Die Attach material
- Bond Wire
- Lead Frame
- Lead Frame plating

Figure 3. Semiconductor Device Homogeneous Materials



Homogeneous Materials:
- Conductor Wire
- Conductor Wire Plating
- Insulator Jacket

Figure 4. Cable Homogeneous Materials.

7.1.4 The RoHS and WEEE directives have been broken into various categories of electrical devices. The RoHS directive applies only to categories 1-7 and 10, 11. The WEEE directive applies to all the categories of EEE, as shown in Figure 5:

Category	Example
Category 1: Large household appliances	refrigerators, washers, stoves, air conditioners
Category 2: Small household appliances	vacuum cleaners, hair dryers, coffee makers, irons
Category 3: Computing & communications equipment	computers, printers, copiers, phones, satellite TV, cell tower equipment, antennas
Category 4: Consumer electronics	TVs, DVD players, stereos, video cameras
Category 5: Lighting	Lamps, lighting fixtures, light bulbs (some fluorescents are exempt)
Category 6: Power tools	drills, saws, nail guns, sprayers, lathes, trimmers, blowers
Category 7: Toys, leisure and sports equipment	videogames, treadmills, talking dolls, Fitbits
Category 8: Medical devices and equipment	includes in-vitro diagnostic medical devices (IVDs)
Category 9: Monitoring and control equipment	thermostats, smoke detectors, fire alarms, including industrial applications
Category 10: Automatic dispensers	vending machines, ATM machines
Category 11: Catch-all	all other electronic and electrical equipment not covered under the other categories. Included are 2-wheeled electric vehicles; electronic nicotine delivery systems (ENDS) such as e-cigarettes, cannabis vaporizers and vape pens; electrical cables that are less than 250V working voltage.

7.2 Packaging Requirements

7.2.1 The heavy metals contained in the package materials are regulated as shown in Figure 6 based on Europe Packaging components Disposal Instruction (94/62/EC). Packaging materials includes cartons to package products, cartons for returnable boxes, and packaging for part transportation which includes handles, reels, sticks, magazines, bags, staples, sheets, wraps, paints, inks, tapes, labels, cushions, wooden frames, corrugated

cardboard, vinyl ties, cushioning materials, foil and trays. Some US states and other countries have similar restrictions.

Substance or Category	PPM Threshold	Comments
Cadmium Mercury Lead Chromium VI	<0.01% (100ppm)	The combined concentration limit of Cadmium, Murcury, Lead and Chromium VI in packaging is limit to maxium of 100ppm.
Chlorofluorocarbons (CFCs)	Banned	
Hydrochlorofluorocarbons (HCFCs)	Banned	
Hydrofluorocarbons (HFCs)	Banned	
Expanded Polystyrene (EPS)	Banned	

Figure 6: Banned Materials for Packaging

7.3 Battery Requirements

7.3.1 The heavy metals contained in batteries are regulated as shown in Figure 7 based on Europe Council Directives on batteries and accumulators containing certain dangerous substances (91/157/EEC 98/101/EC):

Substance or Category	PPM Threshold	Comments
Mercury and compounds	5	Batteries, accumulators and button cells. All button cells have to comply since Oct 2015. This includes those used for hearing aids and those under the 2% by weight category.
Cadmium and compounds	20	Batteries, accumulators and button cells Exemption of Cadmium in portable batteries, and those used in cordless power tools until 1/Jan/2017. Exemptions under Article 4.
Lead and compounds	40	Batteries, accumulators and button cells

Figure 7: Banned Materials for Batteries

7.4 Halogen Free and Green Requirements

7.4.1 A number of customers are interested in Halogen Free products. This can be a stand-alone requirement or part of a corporate Green Policy. Various industry groups have looked at this issue and IEC 61249-2-21 has provided a standard definition of Halogen Free. Generally most customers follow the IEC definition, although some individual requirements may exist. According to IEC 61249-2-21, a product is Halogen Free if it contains no more than:

- 900 PPM Chlorine
- 900 PPM Bromine
- 1500 PPM Total Halogens (Chlorine & Bromine)

Additionally, some customers have implemented Green Policies. These vary greatly from customer to customer and there is no standard industry definition of Green

requirements. The requirements can vary from limiting the use of Chlorine (Cl), Bromine (Br), Lead (Pb), and Antimony (Sb) to full Green procurement policies with detailed tables of various banned and restricted substances. Where a declaration request is designed to verify Green Status a request for full materials disclosure may be made.

7.5 Flex Environmental Requirements

7.5.1 See Specification of banned and restricted substances for use, available at the Flex' Supplier Quality External Webpage:

https://flex.com/other/supplier-information-supplier-quality

7.6 Material Analysis for Environmental Compliance

7.6.1 Suppliers are expected to:

- Understand the composition and compliance of any products supplied to Flex.
- Ensure compliant components are compatible with Pb-free surface mount processes and, where possible, with existing Pb processes.
- Ensure that components are marked according to IPC/JEDEC J-STD-609B-2016 (Marking and Labeling of Components, PCBs and PCBAs to Identify Lead (Pb), Lead-Free (PB-Free) and Other Attributes) guidelines, where appropriate.
- Ensure that supplier MPNs are distinct and that NO device is available in a compliant and non-compliant state with the same MPN.
- Retain all relevant data and lab analysis for no less than 10 years.

7.7 Component Analysis Basics

7.7.1 Supplier Expectations

There are several key factors to consider when approaching the question of determining material content. The key factors are:

- Analysis of the component for the presence of banned or restricted materials. {This analysis can be empirical (lab analysis) or theoretical, depending on the type of component.}
- The analysis of complex components may require partial or full disassembly to complete the component analysis.
- The presence of banned or restricted substances will require homogeneous material analysis.
- Inclusion of all material sources in the analysis

7.7.2 Two example components are shown in Figure 8 and Figure 9:

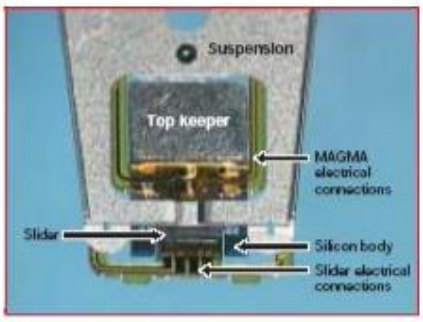


Figure 8. Component Analysis Example 1.

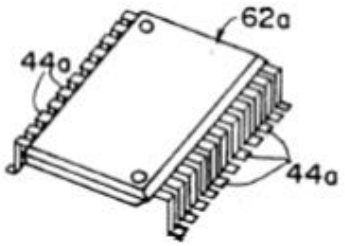


Figure 9. Component Analysis Example 2.

7.7.3 For most banned substances, the banned material levels are based on Homogeneous Materials, not overall component levels. Several points to consider on homogeneous materials and banned substances:

- Where a banned substance is present the level or presence in the homogeneous materials must be identified to determine if the level meets the legislative or directive requirements.
- Verify that levels and homogeneous material configurations meet exemption requirements, if applicable.
- All material sources should be included in the analysis, if possible. Two example components with homogeneous material breakdown are shown in Figure 10 and Figure 11

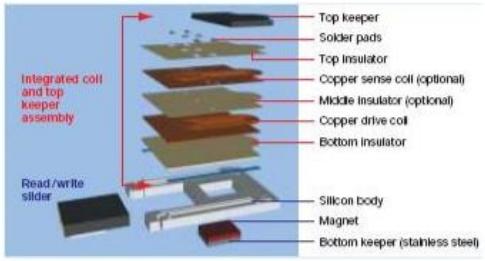


Figure 10. Homogeneous Material Component Example 1.

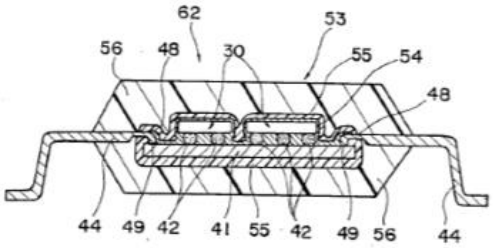


Figure11.Homogeneous Material Component Example 2.

7.7.4 When determining component compliance to legislated requirements it is important to consider all sources of a component or material variation when committing to full compliance. Some points to consider:

- The composition of substances can vary from supplier to supplier.
- Impurity or contamination can vary from supplier to supplier.
- Include materials used in the processing and manufacturing if they are included on the banned or restricted list.
- Note the usage of Halogens, Greenhouse warming compounds/elements, cyanides, and other substances with known, restricted, or proscribed environmental impacts.

An example illustrating these material variation considerations for a sample component is shown in Figure 12.

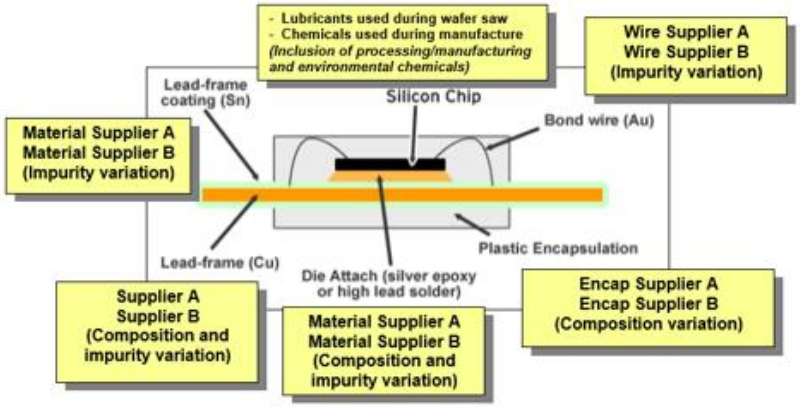


Figure 12 Material Variation Component Example.

7.7.5 Analytic tools, such as Failure Modes & Effects Analysis (FMEA), shown in Figure 13, and Ishikawa Diagrams (Cause Effect Diagrams), shown in Figure 14, can be used to assess the risk of the various design/material factors and determine whether their inclusion in the first pass analysis is warranted. The benefits of developing an analytic analysis prior to content identification include:

- Saving on Total Product Cost by identifying high-risk suppliers or materials and reducing risk levels prior to introducing a high-risk product to the market.
- Serving as a Guide for Efficient Test Planning since all critical elements can be included in initial content identification tests; reducing the amount of material retest.
- Provides insight for designing In Process Inspection or eliminating inspection/monitoring requirements by eliminating high-risk elements of the design or material supply chain.
- Minimizes Unforeseen Events by identifying high-risk factors prior to a product launch or proliferation.
- Reduces Engineering Changes by allowing for design optimization based on the Environmental FMEA.
- Improves Customer Satisfaction by reducing the risk of high-risk elements of the design impacting the customer's ability to meet market specific environmental requirements (RoHS, Pb-free, etc).
- Minimizes Unnecessary Production Controls by identifying unstable or high-risk elements and allowing their elimination or mitigation.
- Provides Insight to Robust Design by ensuring that all critical elements of the design are identified and their impact on environmental performance considered.
- Identifies Safety Concerns for Validation by considering elements of the design with environmental safety implications.
- Problem Prevention by identifying critical elements prior to their creating environmental or testing issues.
- Knowledge sharing through leveraging analysis on components with shared materials sets allowing for reduced testing or more rapid proliferation of content information through scaling.
- Drive Continuous Environmental Improvements by optimizing the design for the critical environmental requirements.

7.7.6 The Environmental FMEA and Environmental CE Diagram can also be effectively used at all stages of the product lifecycle:

Pathfinding/ Definition - Leverage previous learnings to more rapidly scale new designs; identify key environmental requirements in the design requirements; prioritize changes in materials and the supply chain; identify key technology needs or new material intercept opportunities.

Discovery - Leverage previous learnings to rapidly evaluate new material sources or suppliers; prioritize testing requirements; more rapidly evaluate process interactions on environmental \ compliance.

Development - Leverage previous learnings to optimize production processes and test requirements; prioritize process/material improvements; assist in root cause identification of no discrepant materials; document new learnings for future development opportunities.

Deployment - Ensure new material sources do not add additional risk to the environmental design; assist in the training of local engineers in key process/material details; assist in root cause analysis for any problems occurring during the transfer.

Proliferation/HVM - Ensure new material sources or changes do not impact the environmental risk of the product; assist in root cause

analysis for excursions or environmental issues; prioritize process/material improvements to reduce environmental risk and costs.

7.7.7 Analytic Compositional Analysis

7.7.7.1 In determining the actual material content using analytical tools there are compositional factors to consider:

- Composition identification becomes more difficult and complex the later in the manufacturing process it is conducted. (as shown in Figure 13).
- Detection of banned substances will force the composition determination back to the appropriate level to determine homogeneous material concentrations.
- Frequency and type of composition determination will depend on material types and compositional stability (some materials have high-risk for banned substances as contaminants, like PVC with Lead as a contaminant, so they may require regular monitoring).

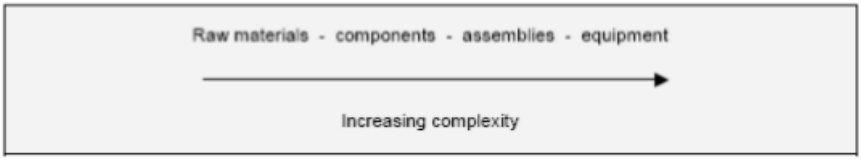


Figure 13 Compositional Analysis Complexity.

7.7.7.2 The types of analysis that can be used depends on several factors:

- Risk of material presence or type of banned substance can determine the analysis options available and their risk
- Composition symmetry/uniformity may permit simpler or lower risk analysis options
- Composition asymmetry/non-uniformity will force higher risk or more complex analysis options

See the below table for a summary of standard material content measurement methods to be used for RoHS against the IEC62321 and BSI 13/30290089 DC. Verify that the lab has the capabilities needed and can show appropriate documentation to verify analytical tool performance and characterization.

Steps	Substances	Polymer Materials	Metal Materials	Electronics (PWBs/Components)
Mechanical sample preparation		Direct measurement Grinding	Direct measurement Grinding	Grinding
Chemical sample preparation		Microwave digestion Acid digestion Dry Ashing Solvent extraction	Acid digestion	Microwave digestion Acid digestion Solvent extraction
Analytical technique definition (incl. typical margins of errors)	PBB/PBDE	GC/MS HPLC/UV	NA	GC/MS HPLC/UV
	Cr VI	Alkaline Digestion/ Colorimetric Method	Spot-test procedure/ boiling-water-extraction procedure	Alkaline Digestion/ Colorimetric Method
	Hg	ICP-AES, ICP-MS, CV AAS, AFS		
	Pb/Cd	ICP-AES, ICP-MS, AAS	ICP-AES, ICP-MS, AAS	ICP-AES, ICP-MS, AAS

Figure 14 Analytical Composition Measurement Tools.

7.7.7.3 Where a component is symmetrical (see Figure 15) or the composition is uniform (see Figure 16) the component can be analyzed directly or by analyzing cross-sections. If banned materials are detected, a more detailed analysis of the homogeneous materials might be necessary.

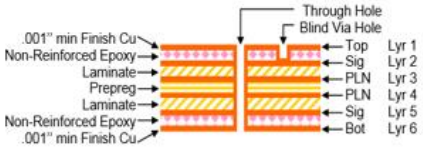


Figure 15 Symetrical Composition

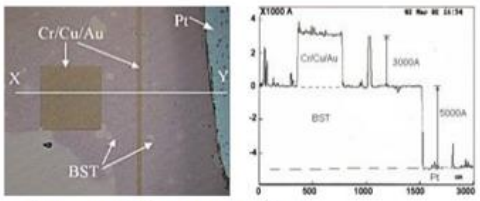


Figure 16 Uniform Composition

The need, type, and frequency of any ongoing inspections can be risk assessed using FMEA or other risk assessment tools. The risk assessment can include factors such as the type of materials used, risk for contamination or material variation, and other necessary risk factors. High-risk components or materials may require special material management systems or ongoing inspections to guarantee continued compliance. When using certified labs, always insure that the lab has adequately characterized their analysis tools for any specialized needs. Where a component is asymmetrical (see Figure 17) or the composition is non-uniform (see Figure 18) the component may need more specialized analysis preparation such as grinding the assembly to a powder form or analyzing subassemblies separately. If banned materials are detected, a more detailed analysis of the homogeneous materials might be necessary.

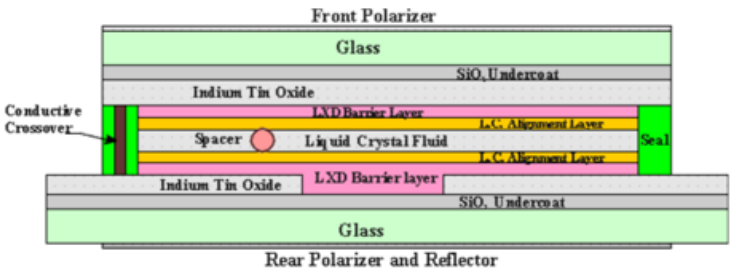


Figure 17 Asymmetric Composition

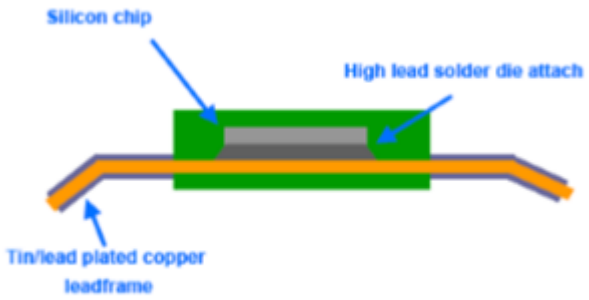


Figure 18 Non-uniform Composition

The need, type, and frequency of any ongoing inspections can be risk assessed using FMEA or other risk assessment tools. The risk assessment can include factors such as the type of materials used, risk for contamination or material variation, and other necessary risk factors. High-risk components or materials may require special material management systems or ongoing inspections to guarantee continued compliance. When using certified labs, always insure that the lab has adequately characterized their analysis tools for any specialized needs

7.7.8 Component Analysis Example

The following is an example of how to breakdown and analyze a sample component using some of the techniques presented in section Error! Reference source not found. This is meant to be a general example and may not be reflective of every material declaration condition, consideration, or customer requirement. The sample component is shown in Figure 19:

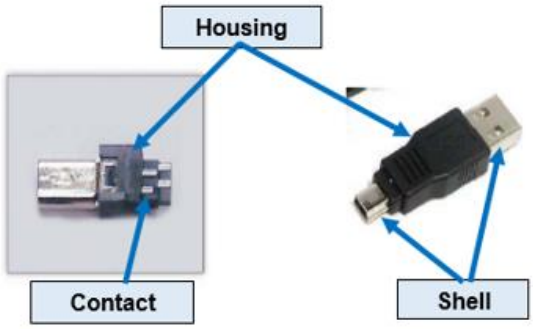


Figure 19 Connector Material Analysis Example (Assemlies)

The component in Figure 19 can be considered using the following breakdown:

Connector – Top level component assembly for declaration and analysis
- **Housing** – subassembly and homogeneous material
- **Contact** – subassembly
  - ➔ Unplated contact – homogeneous material
  - ➔ Contact underplate – homogeneous material
- **Contact overplate** – homogeneous material
- **Shell** – subassembly
  - ➔ Unplated shell – homogeneous material
  - ➔ Shell overplate – homogeneous material

Continuing the analysis of the component in Figure 19 shows the composition of the subassemblies and homogeneous materials to be as follows:

Connector – 200 mg total weight
- **Housing** (100mg): GBK4 Mold Compound (PBT 100%)
- **Contact** (25mg)
  - Unplated Contact (23mg): Brass { Zn (10.5%), Fe (0.3%), Cu (84.1%), Pb (5.1%)}
  - Contact Underplate (1mg): Au (100%)
  - Contact Overplate (1mg): Sn (70%), Pb (30%)

- **Shell** (75mg)
  - Unplated Shell (71mg): Phosphor Bronze { P (0.1%), Cu (93.3%), Sn (1%), Ni (5.6%)}
  - Shell Overplate (4mg): Ni (86%), Misc (14%)

To roll-up homogeneous material content in the analysis shown above to the component level, use the formula shown in Figure 20.

$$\frac{\sum_{i=1}^{i=n} wt_i * PPM_i}{\sum_{i=1}^{i=n} wt_i}$$

Figure 20 Material Rollup Formula

Where: n = # of homogeneous materials
wt = homogeneous material
weight PPM = homogeneous PPM level

Using the roll-up formula illustrated in Figure 20 provides a component declaration for the sample connector, as shown in Figure 21:

Connector Declaration	
Material	**Content Level**
Pb	7365 PPM
Au	5000 PPM
Fe	345 PPM
Zn	12075 PPM
Ni	37080 PPM
Cu	427930 PPM
P	355 PPM
Sn	7050 PPM
PBT	500000 PPM
Misc	2800 PPM

Figure 21 Sample Connector Declaration.

Since the Lead (Pb) present in the connector is a banned substance, it is necessary to record (and sometimes report) the homogeneous material content level of this substance. The component lead is present in two distinct homogeneous materials as shown in Figure 22.

Homogeneous Material Declaration		
Homogeneous Material	**Banned Material**	**Content Level**
Unplated Contact	Pb	51000
Contact Overplate	Pb	300000

Figure 22 Sample Connector Homogeneous Material Declaration.

It is important to note, as shown in Figure 21 and Figure 22, that the content of material present at the homogeneous level can be substantially different from the component level of that material. Therefore the homogeneous material analysis of banned materials is critical to the determination of whether a component is compliant with RoHS or other legislated requirements.

7.8 Process and Labelling

To manage inventory in the most efficient fashion during the RoHS conversion period Flex seeks to understand the backwards and forwards compatibility of all surface mounted components. Flex has also examined the various industry standards on Pb-Free/RoHS labeling and determined that the IPC standard (IPC/JEDEC J-STD-609B-2016) had the most comprehensive labeling requirements. This is the preferred standard for use with Flex. Finally, in order to facilitate the most efficient management of inventory during the conversion period and beyond, Flex has identified a unique part number strategy to manage all purchased components converting from non-compliance to compliance.

7.8.1 Backwards/Forwards Compatibility

Backwards compatibility for Pb-free and RoHS compliant components is defined by several key aspects:

- Solderability - Where RoHS compliant components have equivalent wettability to a peak temperature of 260°C and standard reflow temperatures of 210ºC they can be considered backward compatible.
- Process - Where RoHS compliant components are compatible with standard reflow temperatures and Sn-Pb solders (or equivalent) they can be considered backward compatible.
- Reliability - Where RoHS compliant components have equivalent field life and performance at high and standard reflow temperatures and at least one standard solder paste (Sn-Pb or equivalent) and at least one Pb-free solder paste (Sn-Ag-Cu or equivalent) they can be considered backward compatible.

Forward compatibility for non-compliant components is defined by:

- Solderability - Where non-RoHS compliant components have equal wettability at a peak temperature of 260°C and standard reflow temperatures of 210ºC they can be considered forward compatible.
- Process - Where non-RoHS compliant components are compatible with high reflow temperatures and Sn-Ag-Cu solder paste (or equivalent) they can be considered forward compatible.
- Reliability - Where non-RoHS compliant components have equivalent field life and performance at high and standard reflow temperatures and at least one standard solder paste (Sn-Pb or equivalent) and at least one Pb-free solder paste (Sn-Ag-Cu or equivalent) they can be considered forward compatible.

7.8.2 IPC Labeling

Flex uses the IPC JEDEC J-STD-609A.01-2011 standard for “Marking, Symbols and Labels for Identification of Lead-Free and Other Reportable Materials in Lead-Free Assemblies, Components and Devices.” Where feasible and applicable, the appropriate labels and markings should be used. Several marking examples are shown in Figure 23, Figure 24, and Figure 25:

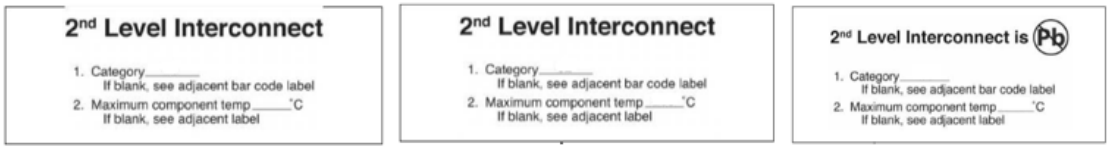


Figure 23 IPC Box/Container Labels

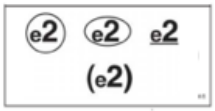


Figure 24 IPC Component Marking

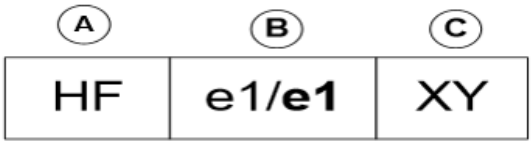


Figure 25 IPC PCB Marking

Key elements shown in Figure 25:
Note: The box is for reference and is not required in the mark.

- **A** –This mark is used to designate if a PCB contains no Halogens. If this mark is NOT present the PCB is assumed to contain Halogens.

- **B** –This mark is used to indicate the Pb-free plating category used. If this mark is not present the PCB is assumed to have a Sn-Pb plating. Categories: e1 – SnAgCu; e2 – Other Sn alloys (ie. SnCu, SnAg, SnAgCuX, etc) (No Bi or Zn); e3 – Sn; e4 – Precious metals (ie. Ag, Au, NiPd, NiPdAu, but no Sn); e5 – SnZn, SnZnX (no Bi); e6 – Contains Bi; e7 – Low temperature solder (<150 degree C) containing indium but no bismuth.

- **C** – This mark is used to indicate the resin used for the PCB (ER – Epoxy Resin, UR – Urethane Resin, AR – Acrylic Resin, SR – Silicone Resin, XY – Parylene)

7.9 Part number Requirements

To facilitate the most effective inventory management during the RoHS transition, Flex Part Number requirements are:

- Uniqueness: RoHS compliant and non-compliant part numbers MUST BE UNIQUE. It is not permissible to deliver a component in a compliant and non-compliant configuration with identical part numbers.

- Date Codes: Flex has no production system to track components by date code. Using date codes to differentiate compliant and non-compliant components IS NOT PERMISSIBLE.

- Format: Flex has no requirement on the format of compliant part numbers, if they are distinct from non-compliant numbers. Unique numbers, prefixes, extensions, or other methods are all considered acceptable.

8.0 RESPONSIBILITY

8.1 Suppliers are responsible for ensuring the compliance and accuracy of composition information for their components they supply to Flex.

8.2 Failure to provide information or providing inaccurate information MAY result in removal of supplier components from approved Bill of Materials (BoMs) and Approved Vendor Lists (AVLs).

8.3 Documentation is the key to ODM environmental compliance. ODM components WITHOUT some form of documented compliance ARE NOT CONSIDERED COMPLIANT.

9.0 RECORD RETENTION REQUIREMENT

No	Record	Retention Period	Storage Location	Protection	Retrieval	Disposition
1.	Environmental Compliance Records	10 Years	Electronic / Hard Copies As Applicable	As Per Internal Applicable Procedures	As Per Internal Applicable Procedures	As Per Internal Applicable Procedures

(Note: This section is Mandatory if this Policy/Process/or Procedure is related to or leads to the generation of records.)

10.0 APPENDICES

Appendix A – Design for Environment Plastics

Plastics Selection

- Reduce the number / types of plastics used
- Mark/ identify plastic parts to facilitate sorting, reuse and recycling
- Avoid plated plastic parts e.g. use metal can's for EMC (preferred)
- Avoid secondary finished such as paints, coating, plating e.g. painted plastic, use molded in colors and finishes
- Use readily recyclable thermoplastics
- Eliminate or minimize contamination of one material with another
- If contamination unavoidable, ensure dissimilar material are easily separable
- Choose plasticizers and coloring agents in plastics with consideration of environmental impact. Single color preferred for plastics.

Recommended Marking Examples	
Part consists of	Marking
PVC	>PVC< commercial grade name "resin" or material code name
ABS-PC alloy or blend	>ABS+PC< commercial grade name "resin" or material code name
Polyethylene Terephthalate (PET)-Polyphenylene Sulfone (PPSU) blend, 20% glass filled	>(PET+PPSU)-GF20< commercial grade name "resin" or material code name
Preferred Labelling Techniques	
Preferability	Method
Most	Molded-in
	Laser inscribing Compatible label Pad printing
Least	Label of non-compatible material

Blend compound / Impurity

Matrix material

	PE	PVC	PS	PC	PP	PA	POM	SAN	ABS	PBT	PET	PMMA
PE	1	4	4	4	1	4	4	4	4	4	4	4
PVC	4	1	4	4	4	4	4	1	2	4	4	1
PS	4	4	1	4	4	4	4	4	4	4	4	4
PC	4	3	4	1	4	4	4	1	1	1	1	1
PP	4	4	4	4	1	4	4	4	4	4	4	4
PA	3	4	3	4	4	1	4	4	4	3	3	4
POM	4	4	4	4	4	4	1	4	4	3	4	4
SAN	4	1	4	1	4	4	4	1	1	4	4	1
ABS	4	2	4	1	4	4	3	4	1	3	3	1
PBT	4	4	4	1	4	3	4	4	3	1	4	4
PET	4	4	3	1	4	3	4	4	3	4	1	4
PMMA	4	1	3	1	4	4	3	1	1	4	4	1

1=Compatible
2=Restricted compatibility
3=Restricted compatibility, only very small amount of blend compound / impurity allowed
4=Incompatible