



ICP Test Report Certification Packet

Company Name: Littelfuse, Inc.

Product Type: Surface Mount Varistors

Product Series: MLN Series

Issue Date: November 23, 2013

It is hereby certified by Littelfuse, Inc. that there is neither RoHS (EU Directive 2002/95/EC)-restricted substance nor such use, for materials to be used for unit parts, for packing/packaging materials, and for additives and the like in the manufacturing processes.

And it is certified by Littelfuse, Inc. that the series products listed above are compliant with LF Halogen Free Standard (Cl  $\leq$  800ppm, Br  $\leq$  800ppm, Cl+Br  $\leq$  1000ppm).

In addition, it is hereby reported to you that the parts and sub-materials, the materials to be used for unit parts, the additives and the like in the manufacturing processes, are all composed of the following components.

Issued by:   
JORDANUFF H. CABILAN

[Global EHS Engineer ]

(1) Parts, sub-materials and unit parts

This document covers the MLN Surface Mount Varistors RoHS-Compliant series products manufactured by Littelfuse, Inc.

Please see Table 1 for raw materials used.

(2) The ICP data on all measurable substances

Please see appropriate pages as identified in Table 1.

Remarks :

Pb (lead) contained in glass of electronic components and is categorized as exempt under section 5 of the RoHS Annex.



Table 1: List of Raw Materials covered by this report

<b>Total Parts</b>	<b>Raw Material P/N</b>	<b>Raw Material Description</b>	<b>Page</b>
<b>1</b>	<b>N/A</b>	<b>BLACK CHIP ARRAY</b>	<b>3-10</b>
<b>2</b>	<b>MS253</b>	<b>TERMINATIONS</b>	<b>11-18</b>



**Test Report**

Number: SZHH00779633

Applicant: LITTELFUSE, INC  
8755 WEST HIGGINS ROAD SUITE  
500CHICAGO IL 60631 USA

Date: May 07, 2013

Attn: KRISTEEN BACILA/ARSENIO CESISTA JR.

Sample Description:  
One (1) submitted sample said to be **black chip**.  
Tested component: black magnet.



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Tests conducted:  
As requested by the applicant, refer to attached page(s) for details.

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Conclusion:

<u>Tested Samples</u>	<u>Standard</u>	<u>Result</u>
Tested component of submitted sample	Restriction of the use of certain hazardous substance in electrical and electronic equipment (RoHS Directive 2011/65/EU)	See test conducted

<u>Submitted sample</u>	<u>Test Item</u>	
Submitted sample	Halogen (F, Cl, Br, I) Content	See test conducted

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Authorized by:  
For Intertek Testing Services  
Shenzhen Ltd.

Ben N.L. Lin  
General Manager





**Test Report**

Number: SZHH00779633

Tests Conducted

1 RoHS Chemical Test

(A) Test Result Summary:

Testing Item	Result
Cadmium (Cd) Content (mg/kg)	ND(<2)
Lead (Pb) Content (mg/kg)	<b>33100*</b>
Mercury (Hg) Content (mg/kg)	ND(<2)
Chromium (VI)(Cr <sup>6+</sup> ) Content (mg/kg)	2
Polybrominated Biphenyls (PBBs)(mg/kg)	
Monobromobiphenyl (MonoBB)	ND(<5)
Dibromobiphenyl (DiBB)	ND(<5)
Tribromobiphenyl (TriBB)	ND(<5)
Tetrabromobiphenyl (TetraBB)	ND(<5)
Pentabromobiphenyl (PentaBB)	ND(<5)
Hexabromobiphenyl (HexaBB)	ND(<5)
Heptabromobiphenyl (HeptaBB)	ND(<5)
Octabromobiphenyl (OctaBB)	ND(<5)
Nonabromobiphenyl (NonaBB)	ND(<5)
Decabromobiphenyl (DecaBB)	ND(<5)
Polybrominated Diphenyl Ethers (PBDEs)(mg/kg)	
Monobromodiphenyl Ether (MonoBDE)	ND(<5)
Dibromodiphenyl Ether (DiBDE)	ND(<5)
Tribromodiphenyl Ether (TriBDE)	ND(<5)
Tetrabromodiphenyl Ether (TetraBDE)	ND(<5)
Pentabromodiphenyl Ether (PentaBDE)	ND(<5)
Hexabromodiphenyl Ether (HexaBDE)	ND(<5)
Heptabromodiphenyl Ether (HeptaBDE)	ND(<5)
Octabromodiphenyl Ether (OctaBDE)	ND(<5)
Nonabromodiphenyl Ether (NonaBDE)	ND(<5)
Decabromodiphenyl Ether (DecaBDE)	ND(<5)

ND = Not detected

\* = Failed item

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**Test Report**

Number: SZHH00779633

Tests Conducted

(B) RoHS Requirement:

Restricted Substances	Limits
Cadmium (Cd)	0.01% (100 mg/kg)
Lead (Pb)	0.1% (1000 mg/kg)
Mercury (Hg)	0.1% (1000 mg/kg)
Chromium (VI) (Cr <sup>6+</sup> )	0.1% (1000 mg/kg)
Polybrominated Biphenyls (PBBs)	0.1% (1000 mg/kg)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000 mg/kg)

The above limits were quoted from 2011/65/EU for homogeneous material.

(C) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) Content	With reference to IEC 62321 Edition 1.0:2008, by acid digestion and determined by ICP - OES	2 mg/kg
Lead (Pb) Content	With reference to IEC 62321 Edition 1.0:2008, by acid digestion and determined by ICP - OES	2 mg/kg
Mercury (Hg) Content	With reference to IEC 62321 Edition 1.0:2008, by acid digestion and determined by ICP - OES	2 mg/kg
Chromium (VI)(Cr <sup>6+</sup> ) Content	With reference to IEC 62321 Edition 1.0:2008, by alkaline digestion and determined by UV-VIS Spectrophotometer	1 mg/kg
Polybrominated Biphenyls (PBBs)& Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 Edition 1.0:2008, by solvent extraction and determined by GC/MS and further HPLC confirmation when necessary	5 mg/kg

Date sample received : Apr 26, 2013  
Testing period : Apr 26, 2013 to May 06, 2013

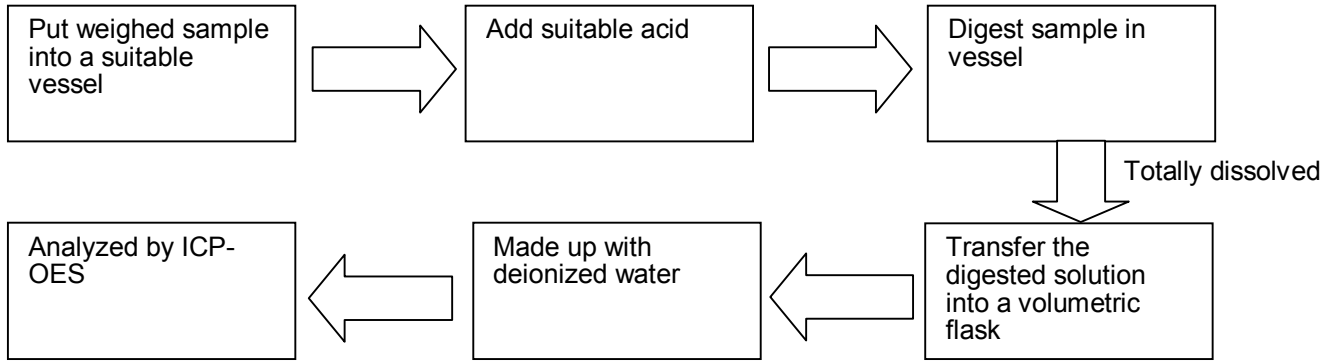
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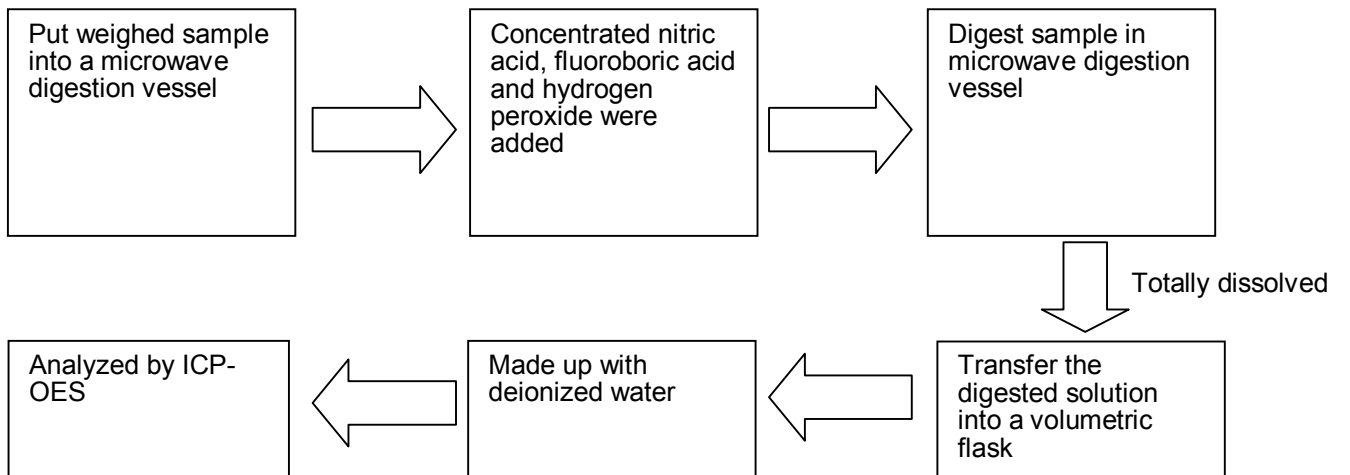
Tests Conducted

(D) Measurement Flowchart:

1. Test for Cd/Pb Contents



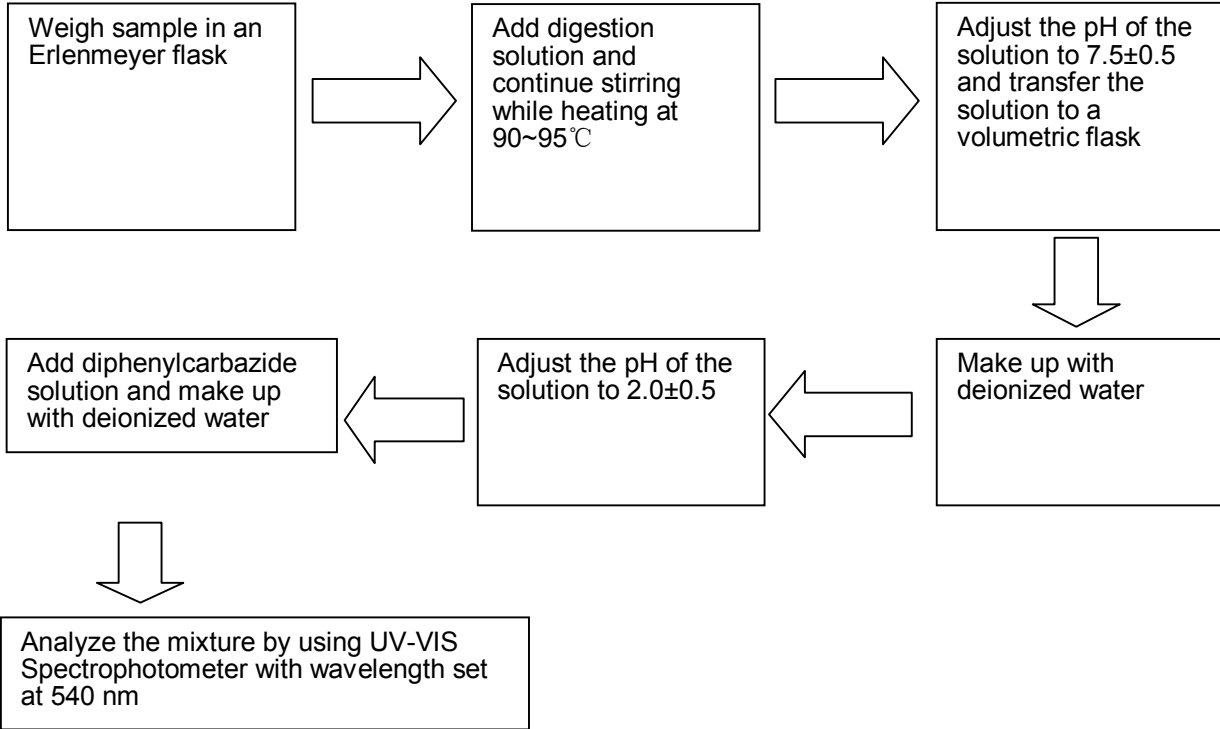
2. Test for Hg Content



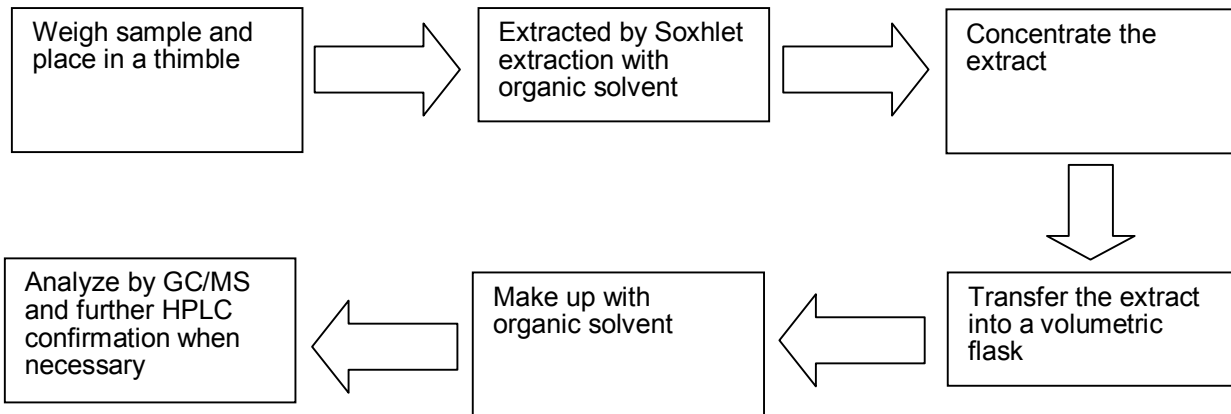
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Tests Conducted

3. Test for Chromium (VI) (Cr<sup>6+</sup>) Content (Alkaline Digestion)



4. Test for PBBs/PBDEs Contents



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**Test Report**

Number: SZHH00779633

Tests Conducted

2 Halogen Content

( I ) Test Result Summary:

<u>Testing Item</u>	<u>Result (mg/kg)</u>
Fluorine (F) Content	ND
Chlorine (Cl) Content	ND
Bromine (Br) Content	ND
Iodine (I) Content	ND

mg/kg = milligram per kilogram = ppm  
ND = Not detected

( II ) Test Method:

<u>Testing Item</u>	<u>Testing Method</u>	<u>Reporting Limit</u>
Halogen (F, Cl, Br, I) Content	With reference to BS EN 14582:2007, by calorimetric bomb and determined by Ion Chromatography	50 mg/kg

Reporting limit = Quantitation limit of analyte in sample

Date sample received : Apr 26, 2013  
Testing period : Apr 26, 2013 to May 03, 2013

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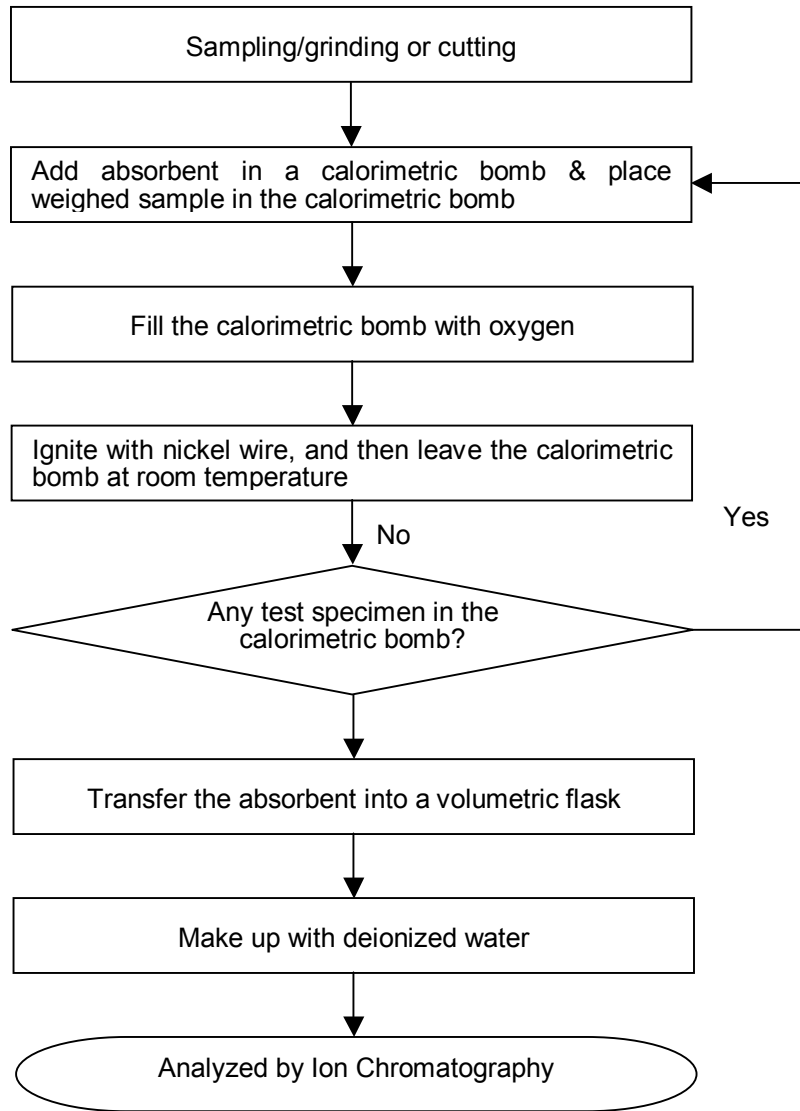




Tests Conducted

(III) Measurement Flowchart:

Test for Halogen Content (Reference Method: BS EN 14582:2007)



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End of report

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**Test Report**

Number: SZHH00781393

Applicant: LITTELFUSE, INC  
8755 WEST HIGGINS ROAD SUITE  
500CHICAGO IL 60631 USA

Date: May 13, 2013

Attn: KRISTEEN BACILA/ARSENIO CESISTA JR.

Sample Description:

One (1) submitted sample said to be **dark grey paste (terminations)**.  
Part No. : MS253.



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Tests conducted:

As requested by the applicant, refer to attached page(s) for details.

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To be continued

Authorized by:  
For Intertek Testing Services  
Shenzhen Ltd.



Ben N.L. Lin  
General Manager





**Test Report**

Number: SZHH00781393

Conclusion:

Tested Samples  
Submitted sample

Standard  
Restriction of the use of certain hazardous substance  
in electrical and electronic equipment (RoHS  
Directive 2011/65/EU)

Result  
See Test Conducted

Phthalates content requirement in Annex XVII  
Items 51 & 52 of the REACH Regulation (EC) No.  
1907/2006 & Amendment No. 552/2009 (formerly  
known as Directive 2005/84/EC) (DEHP, DBP &  
BBP)

Pass

Test Item  
Halogen (F, Cl, Br, I) Content

See Test Conducted

Hexabromocyclododecane Content

See Test Conducted

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Authorized by:  
For Intertek Testing Services  
Shenzhen Ltd.

Ben N.L. Lin  
General Manager





**Test Report**

Number: SZHH00781393

Tests Conducted

1 RoHS Chemical Test

(A) Test Result Summary:

Testing Item	Result
Cadmium (Cd) Content (mg/kg)	ND(<2)
Lead (Pb) Content (mg/kg)	<b>2530*</b>
Mercury (Hg) Content (mg/kg)	ND(<2)
Chromium (VI)(Cr <sup>6+</sup> ) Content (mg/kg)	ND(<1)
Polybrominated Biphenyls (PBBs)(mg/kg)	
Monobromobiphenyl (MonoBB)	ND(<5)
Dibromobiphenyl (DiBB)	ND(<5)
Tribromobiphenyl (TriBB)	ND(<5)
Tetrabromobiphenyl (TetraBB)	ND(<5)
Pentabromobiphenyl (PentaBB)	ND(<5)
Hexabromobiphenyl (HexaBB)	ND(<5)
Heptabromobiphenyl (HeptaBB)	ND(<5)
Octabromobiphenyl (OctaBB)	ND(<5)
Nonabromobiphenyl (NonaBB)	ND(<5)
Decabromobiphenyl (DecaBB)	ND(<5)
Polybrominated Diphenyl Ethers (PBDEs)(mg/kg)	
Monobromodiphenyl Ether (MonoBDE)	ND(<5)
Dibromodiphenyl Ether (DiBDE)	ND(<5)
Tribromodiphenyl Ether (TriBDE)	ND(<5)
Tetrabromodiphenyl Ether (TetraBDE)	ND(<5)
Pentabromodiphenyl Ether (PentaBDE)	ND(<5)
Hexabromodiphenyl Ether (HexaBDE)	ND(<5)
Heptabromodiphenyl Ether (HeptaBDE)	ND(<5)
Octabromodiphenyl Ether (OctaBDE)	ND(<5)
Nonabromodiphenyl Ether (NonaBDE)	ND(<5)
Decabromodiphenyl Ether (DecaBDE)	ND(<5)

ND = Not detected

\* = Failed item

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**Test Report**

Number: SZHH00781393

Tests Conducted

(B) RoHS Requirement:

Restricted Substances	Limits
Cadmium (Cd)	0.01% (100 mg/kg)
Lead (Pb)	0.1% (1000 mg/kg)
Mercury (Hg)	0.1% (1000 mg/kg)
Chromium (VI) (Cr <sup>6+</sup> )	0.1% (1000 mg/kg)
Polybrominated Biphenyls (PBBs)	0.1% (1000 mg/kg)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000 mg/kg)

The above limits were quoted from 2011/65/EU for homogeneous material.

(C) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) Content	With reference to IEC 62321 Edition 1.0:2008, by acid digestion and determined by ICP - OES	2 mg/kg
Lead (Pb) Content	With reference to IEC 62321 Edition 1.0:2008, by acid digestion and determined by ICP - OES	2 mg/kg
Mercury (Hg) Content	With reference to IEC 62321 Edition 1.0:2008, by acid digestion and determined by ICP - OES	2 mg/kg
Chromium (VI)(Cr <sup>6+</sup> ) Content	With reference to IEC 62321 Edition 1.0:2008, by alkaline digestion and determined by UV-VIS Spectrophotometer	1 mg/kg
Polybrominated Biphenyls (PBBs)& Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 Edition 1.0:2008, by solvent extraction and determined by GC/MS and further HPLC confirmation when necessary	5 mg/kg

Date sample received: May 03, 2013  
Testing period: May 03, 2013 to May 11, 2013

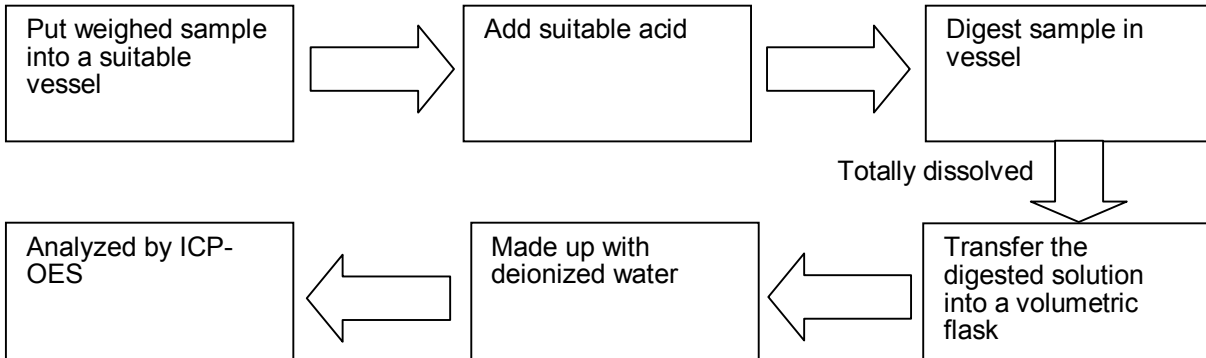
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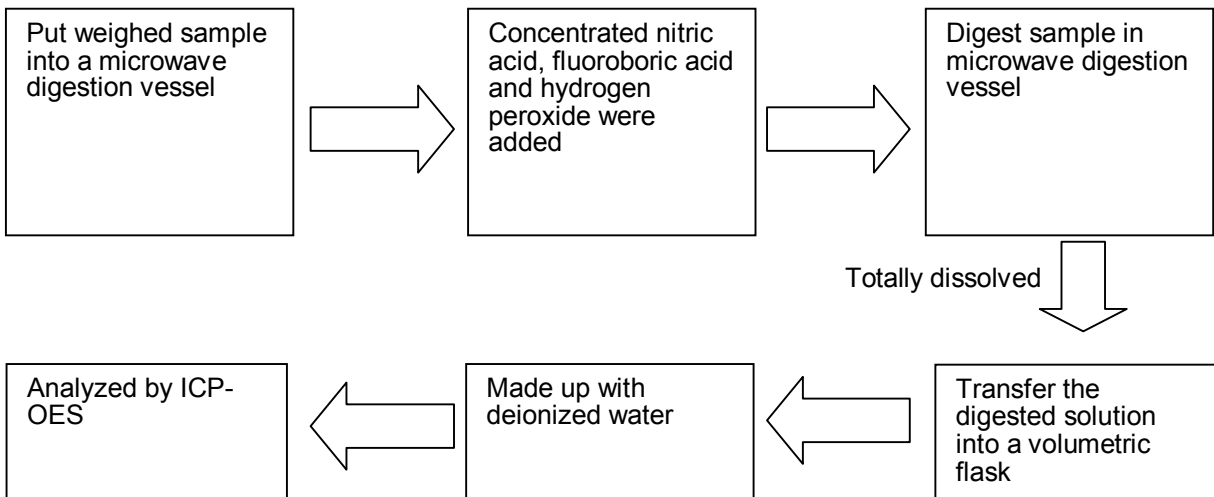
Tests Conducted

(D) Measurement Flowchart:

1. Test for Cd/Pb Contents



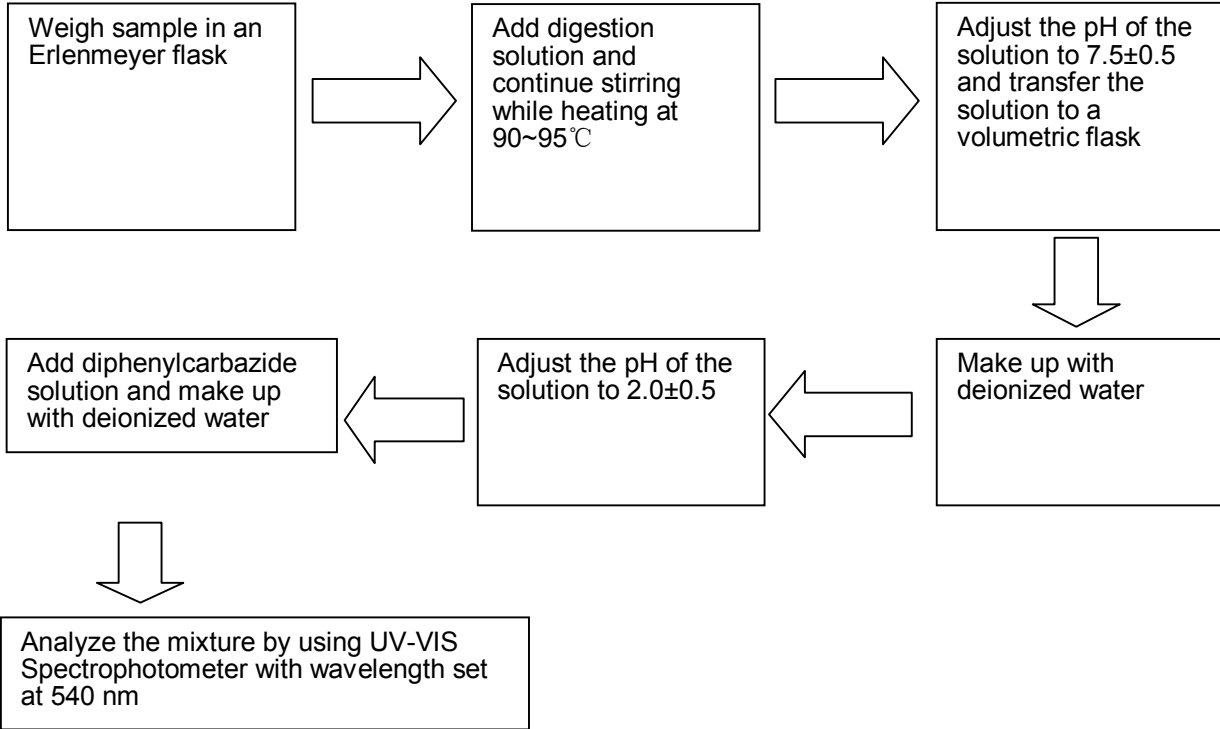
2. Test for Hg Content



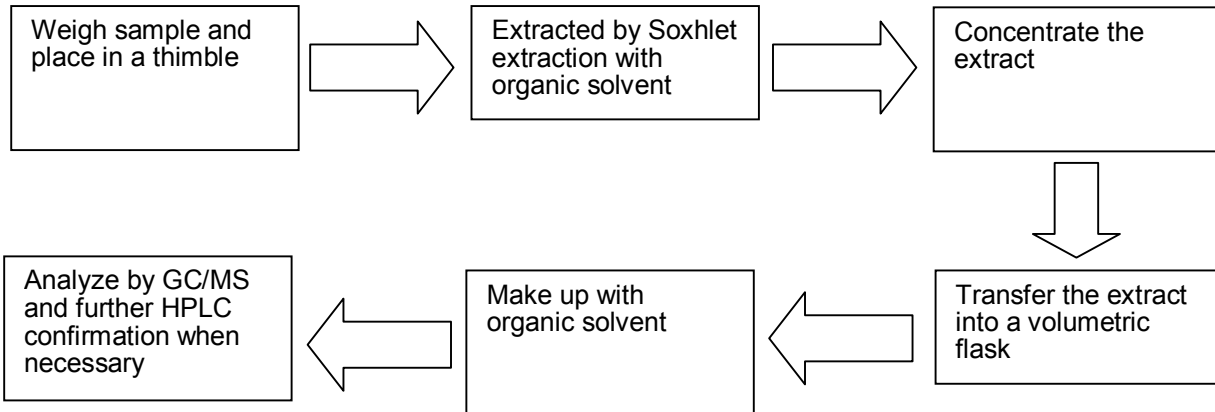
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Tests Conducted

3. Test for Chromium (VI) (Cr<sup>6+</sup>) Content (Alkaline Digestion)



4. Test for PBBs/PBDEs Contents



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Tests Conducted

2 Phthalate Content

With reference to EN14372, by Gas chromatographic-Mass Spectrometric (GC-MS) analysis.

	<u>Result (%)</u>
Dibutyl phthalate (DBP)	<0.01
Di-(2-ethyl hexyl) phthalate (DEHP)	<0.01
Benzyl butyl phthalate (BBP)	<0.01
Sum of three phthalates	<0.01
Limit	0.1 %

The above limit was quoted according to Annex XVII Items 51 & 52 of the REACH Regulation (EC) No. 1907/2006 & Amendment No. 552/2009(formerly known as Directive 2005/84/EC) for phthalate content in toys and children articles.

As per client's request, only DBP, DEHP and BBP were tested for the submitted sample.

Date sample received :May 04, 2013  
 Testing period :May 04, 2013 to May 09, 2013

3 Halogen Content

( I ) Test Result Summary:

<u>Testing Item</u>	<u>Result (mg/kg)</u>
Fluorine (F) Content	ND
Chlorine (Cl) Content	ND
Bromine (Br) Content	ND
Iodine (I) Content	ND

mg/kg= milligram per kilogram = ppm  
 ND= Not detected

( II ) Test Method:

<u>Testing Item</u>	<u>Testing Method</u>	<u>Reporting Limit</u>
Halogen (F, Cl, Br, I) Content	With reference to BS EN 14582:2007, by calorimetric bomb and determined by Ion Chromatography	50 mg/kg

Reporting limit = Quantitation limit of analyte in sample

Date sample received: May 04, 2013  
 Testing period: May 04, 2013 to May 10, 2013

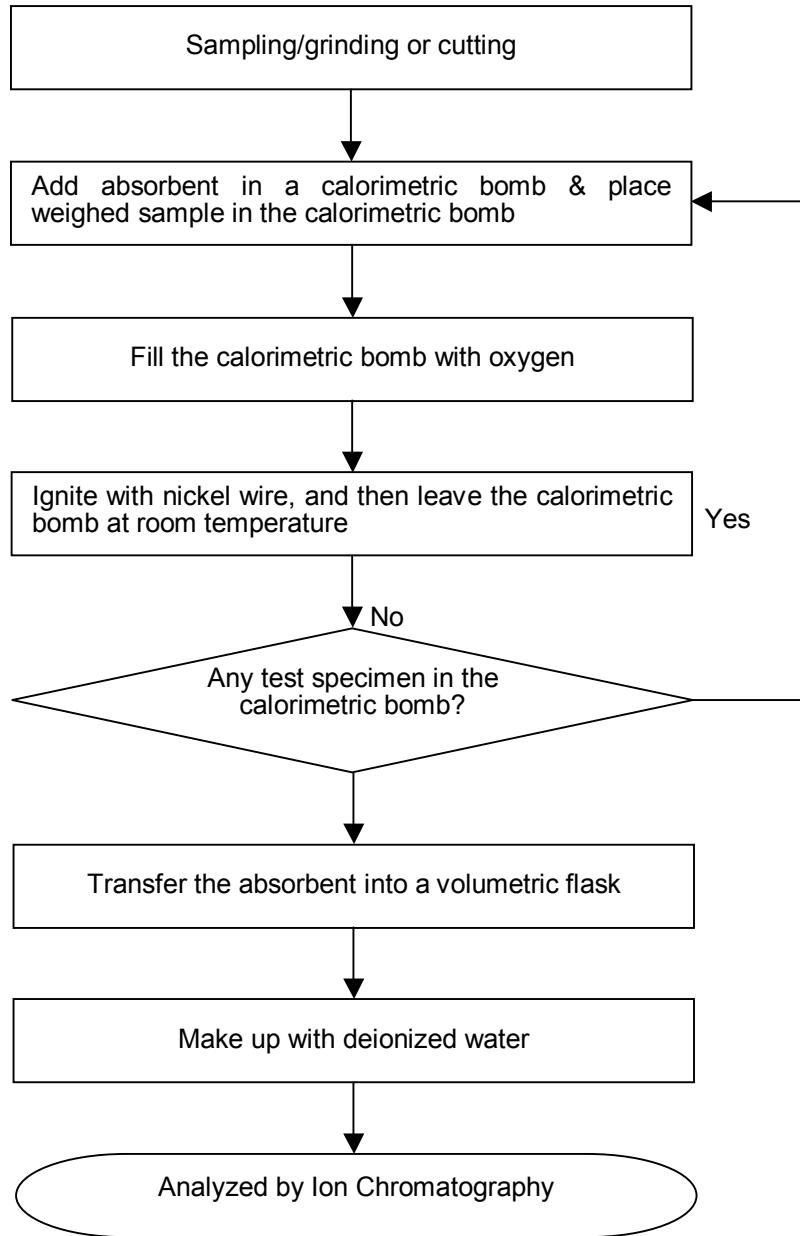
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Tests Conducted

(III) Measurement Flowchart:

Test for Halogen Content (Reference Method: BS EN 14582:2007)



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**Test Report**

Number: SZHH00781393

Tests Conducted

4 Hexabromocyclododecane (HBCDD) Content:

By solvent extraction followed by Gas Chromatographic - Mass Spectrometric (GC-MS) analysis.

Result: Less than 10 mg/kg

mg/kg =milligram per kilogram

Date sample received: May 04, 2013

Testing period: May 04, 2013 to May 09, 2013

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End of report

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