

# **ICP Test Report Certification Packet**

Company Name: Littelfuse, Inc.

Product Type: Surface Mount Varistors

Product Series: CH Series RoHS Compliant Models

Issue Date: May 18, 2012

It is hereby certified by Littelfuse, Inc. that there is neither RoHS (Directive 2011/65/EU)-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≤800ppm, Br≤800ppm, Cl+Br≤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: David Huang

<DGLF Environmental, Health & Safety Engineer >

(1) Parts, sub-materials and unit parts

This document covers CH Series RoHS compliant models 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 7(c)-I of the RoHS Annex.



Table 1: List of Raw Materials covered by this report

Total Parts	P/N	Raw Material Description	Page
1	N/A	BLACK CHIP CH	3-7
2	N/A	SILVER PASTE SP-A6PL	8-19
3	MS208	TERMINATIONS	20-28
4	MS202	BLUE SILICONE	29-37



Date:

May 16, 2012

Result

Pass

Applicant: LITTELFUSE, INC

8755 WEST HIGGINS ROAD SUITE

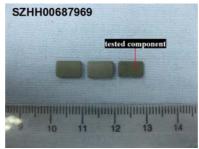
500CHICAGO IL 60631 USA

KRISTEEN BACILA/ARSENIO CESISTA JR. Attn:

Sample Description:

One (1) submitted sample said to be black chip CH.

Tested component: black ceramic.



Tests conducted:

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

Conclusion:

**Tested Samples** 

Submitted sample

Standard

Restriction of the use of certain hazardous substance in

electrical electronic and equipment (RoHS Direction 2002/95/EC and supersedure 2011/65/EU)

Authorized by:

For Intertek Testing Services

Shenzhen Ltd.

Ben N.L. Lin General Manager



**Tests Conducted** 

## **RoHS Chemical Test**

## (A) Test Result Summary:

Testing Item	Result
Cadmium (Cd) Content (mg/kg)	ND(<2)
Lead (Pb) Content (mg/kg)	ND(<2)
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)

Chemist: Wang Haijun/Zeng Guoliang

mg/kg = milligram per kilogram = ppm

< = Less than ND = Not detected



**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 2002/95/EC and supersedure 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 08, 2012 Testing period: May 08, 2012 to May 16, 2012

# (D) Measurement Flowchart:

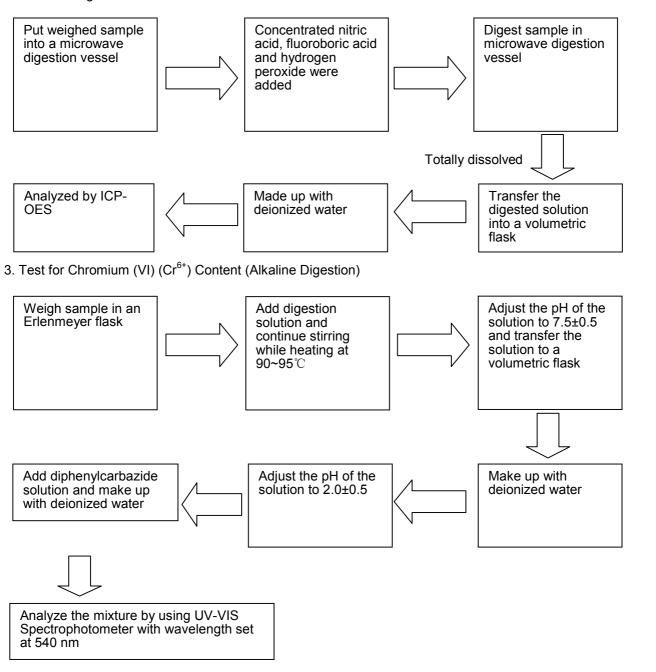
## 1. Test for Cd/Pb Contents

Add suitable acid Put weighed sample Digest sample in into a suitable vessel vessel Totally dissolved Analyzed by ICP-Made up with Transfer the deionized water digested solution OES into a volumetric flask



**Tests Conducted** 

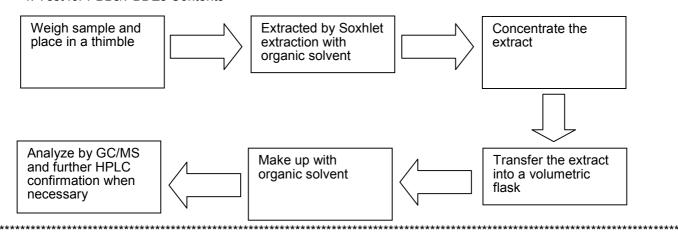
## 2. Test for Hg Content





**Tests Conducted** 

## 4. Test for PBBs/PBDEs Contents



End of report



No. SHAEC1201680106

Date: 21 Feb 2012

Page 1 of 6

SHIN-NIHON KAKIN CO.,LTD 1-6,MIYAMOTO,ITABASHI,TOKYO.JAPAN

The following sample(s) was/were submitted and identified on behalf of the clients as: SILVER PASTE

SGS Job No. :

SP12-003156 - SH

Model No.:

SP-A6PL

Date of Sample Received :

17 Feb 2012

Testing Period:

17 Feb 2012 - 21 Feb 2012

Test Requested:

Selected test(s) as requested by client.

Test Method:

Please refer to next page(s).

Test Results:

Please refer to next page(s).

Conclusion:

Based on the performed tests on submitted samples, the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) comply with the limits as set by RoHS

Directive 2011/65/EU Annex II; recasting 2002/95/EC.

Signed for and on behalf of SGS-CSTC Ltd.

Fan Jingjie, JJ Approved Signatory

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="https://www.sgs.com/terms\_e-document.htm">www.sgs.com/terms\_e-document.htm</a>. Attention is drawn to the limitation of liability information contained hereon reflects the Company's findings at the time of its observation only act within the limits of Client's instructions. If any, The Company's sole responsibility is to its Client and this document does not exponent experties to a transaction for prevencioning all the bylogists and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company, as a unauthorized alters un, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

[9]



No. SHAEC1201680106

Date: 21 Feb 2012

Page 2 of 6

Test Results:

## Test Part Description:

Specimen No. SGS Sample ID Description

SHA12-016801.006 Green paste

### Remarks:

(1) 1 mg/kg = 1 ppm = 0.0001%

(2) MDL = Method Detection Limit

(3) ND = Not Detected ( < MDL)

(4) "-" = Not Regulated

### RoHS Directive 2011/65/EU

Test Method: With reference to IEC 62321:2008

(1) Determination of Cadmium by ICP-OES.

(2) Determination of Lead by ICP-OES.

(3) Determination of Mercury by ICP-OES.

(4) Determination of Hexavalent Chromium by Colorimetric Method using UV-Vis.

(5) Determination of PBBs / PBDEs content by GC-MS.

Test Item(s)	Limit	<u>Unit</u>	MDL	006
Cadmium (Cd)	100	mg/kg	2	ND
Lead (Pb)	1,000	mg/kg	2	ND
Mercury (Hg)	1,000	mg/kg	2	ND
Hexavalent Chromium (Cr(VI))	1,000	mg/kg	2	ND
Sum of PBBs	1,000	mg/kg		ND
Monobromobiphenyl		mg/kg	5	ND
Dibromobiphenyl	9,1	mg/kg	5	ND
Tribromobiphenyl	1.4	mg/kg	5	ND
Tetrabromobiphenyl	(-)	mg/kg	5	ND
Pentabromobiphenyl		mg/kg	5	ND
Hexabromobiphenyl	-	mg/kg	5	ND
Heptabromobiphenyl	12	mg/kg	5	ND
Octabromobiphenyl	4.4	mg/kg	5	ND
Nonabromobiphenyl	-	mg/kg	5	ND
Decabromobiphenyl	÷	mg/kg	5	ND
Sum of PBDEs	1,000	mg/kg	-	ND
Monobromodiphenyl ether	-	mg/kg	5	ND

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="https://www.sgs.com/terms\_e-document.htm">www.sgs.com/terms\_e-document.htm</a>. Attention is drawn to the limitation of liability of any fit such a subject to Terms and Conditions of the Company is findings at the time of its intersection of wards within the limits of Client's instructions. If any. The Company's sole responsibility is to its Client and this document does not exponent parties to a transaction for exercising all this limits of client's instructions. If any. The Company's sole responsibility is to its Client and this document does not exponent to a transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company, unauthorized alternation, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

3"Building,No.889 Yishan Road Xuhui District,Shanghai China 200233中國·上海·徐江区宜山路889号3号楼 邮编: 200233

www.cn.sgs.com e sgs.china@sgs.com



Test Report	No. SHAEC12016801	06	Date: 21	Feb 2012	Page 3 of 6
Test Item(s)	<u>Limit</u>	<u>Unit</u>	MDL	<u>006</u>	
Dibromodiphenyl ether	-	mg/kg	5	ND	
Tribromodiphenyl ether	-	mg/kg	5	ND	
Tetrabromodiphenyl ether	5	mg/kg	5	ND	
Pentabromodiphenyl ether	<del>-</del>	mg/kg	5	ND	
Hexabromodiphenyl ether	-	mg/kg	5	ND	
Heptabromodiphenyl ether	-	mg/kg	5	ND	
Octabromodiphenyl ether	(C <del>2</del> )	mg/kg	5	ND	
Nonabromodiphenyl ether	-	mg/kg	5	ND	
Decabromodiphenyl ether	7°4	mg/kg	5	ND	

## Notes:

- (1) The maximum permissible limit is quoted from directive 2011/65/EU, Annex II
- (2) Result shown is of the total weight of wet sample.

## Halogen

Test Method: With reference to EN 14582: 2007, analysis was performed by Ion Chromatograph (IC).

Test Item(s)	<u>Unit</u>	MDL	006
Fluorine (F)	mg/kg	50	ND
Chlorine (CI)	mg/kg	50	ND
Bromine (Br)	mg/kg	50	ND
lodine (I)	mg/kg	50	ND

## Notes:

(1) Result shown is of the total weight of wet sample.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="https://www.sgs.com/terms-e-document.htm">www.sgs.com/terms-e-document.htm</a>. Attention is drawn to the limitation of isability in growing too and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its possention only any within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not accommand a transaction for processoric sing all the big hights and obligations under the transaction documents. This document cannot be responded except in full, without prior written approval of the Company, with unauthorized alternation, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

In the company of the company of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

3"Bullding,No.869 Yishan Road Xuhui District,Shanghai China 200233 中国·上海·徐汇区宜山路889号3号楼 邮编: 200233 

No. SHAEC1201680106

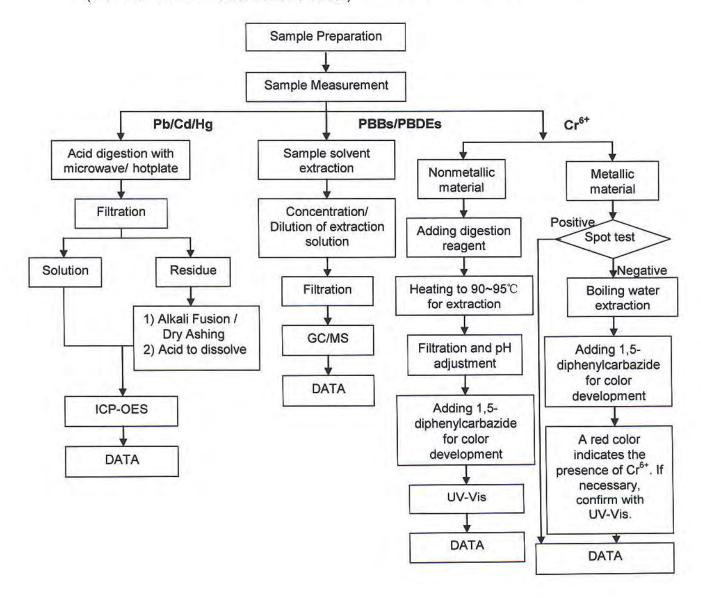
Date: 21 Feb 2012

Page 4 of 6

## **ATTACHMENTS**

# **RoHS Testing Flow Chart**

- 1) Name of the person who made testing: Jan Shi/Yoyo Wang/Allen Xiao/Gary Xu
- 2) Name of the person in charge of testing: Jeff Zhang/George Xu/ Elim Lin
- These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr6+ and PBBs/PBDEs test method excluded)



This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="https://www.sgs.com/terms\_e-document.itm">www.sgs.com/terms\_e-document.itm</a>. Attention is drawn to the limitation of liability information contained hereon reflects the Company's findings at the time of its information only above within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exponent experted experted at transaction for previous recising all this highlights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company of unauthorized attending to the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law the content or provided to the sample(s) tested.

3 "Building,No.889 Yishan Road Xuhui District,Shanghai China 200233 中国 - 上海 · 徐汇区宜山路889号3号楼 邮编: 200233 www.cn.sgs.com e sgs.china@sgs.com



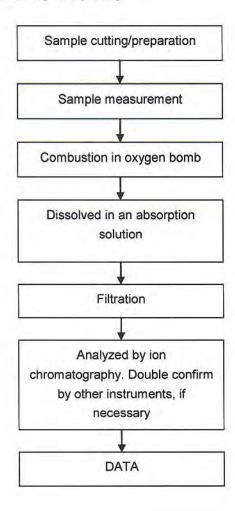
No. SHAEC1201680106

Date: 21 Feb 2012

Page 5 of 6

# **Halogen Testing Flow Chart**

- 1) Name of the person who made testing: Sisily Yin
- 2) Name of the person in charge of testing: Daisy Gong



This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm. and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="https://www.sgs.com/terms\_e-document.htm">www.sgs.com/terms\_e-document.htm</a>. Attention is drawn to the limitation of liability together the control in the limitation of liability together the company is findings at the time of its possention only only within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exponerate parties to at transaction frost exercising all this hights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company are unlawful and offenders may be prosecuted to the fullest extent of the law.



No. SHAEC1201680106

Date: 21 Feb 2012

Page 6 of 6

Sample photo:



SGS authenticate the photo on original report only

\*\*\* End of Report \*\*\*

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="https://www.sgs.com/terms-e-document.htm">www.sgs.com/terms-e-document.htm</a>. Attention is drawn to the limitation of liability of entire the company of the compa



No. SHAEC1203840702

Date: 09 Apr 2012

Page 1 of 6

SHIN-NIHON KAKIN CO.,LTD. 1-6,MIYAMOTO, ITABASHI,TOKYO,JAPAN

The following sample(s) was/were submitted and identified on behalf of the clients as: SILVER PASTE.

SGS Job No. :

SP12-007978 - SH

Model No.:

SP-A6PL

Date of Sample Received:

05 Apr 2012

Testing Period:

05 Apr 2012 - 09 Apr 2012

Test Requested:

Selected test(s) as requested by client.

Test Method:

Please refer to next page(s).

Test Results:

Please refer to next page(s).

Signed for and on behalf of SGS-CSTC Ltd.

Fan Jingjie, JJ

Approved Signatory

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request at accessible at http://www.sgs.commerns.and\_conditions him and for disctonic format documents subject to Terms and Conditions for Electronic Documents at www.sgs.com/lefns\_e-document.htm, Attention is drawn to the limitation of its presentation of least an arrangement of the company is not a subject that information contained hereon reflects the Company is lindings, at the time of its presentation of least information the limits of Clienta in structions. If any, The Company is plus responsibility is to its Client and this document does not accommend outlies to a transaction for receiving all they higher and obligations profer the transaction documents. This document cannot be responsible developed in this whole prior written approval of the Company way impuritorized attention, forgery or trisification of the content or appearance of this document is unrawful and affected any be prosecuted to the fullest extent of the law.



No. SHAEC1203840702

Date: 09 Apr 2012

Page 2 of 6

Test Results:

## Test Part Description:

Specimen No.

SGS Sample ID

Description

1

SHA12-038407.002

Ink green mud

## Remarks:

- (1) 1 mg/kg = 1 ppm = 0.0001%
- (2) MDL = Method Detection Limit
- (3) ND = Not Detected ( < MDL )
- (4) "-" = Not Regulated

## **Phthalates**

Test Method: With reference to EN14372: 2004, analysis was performed by GC-MS.

Test Item(s)	Unit	MDL	002
Bis-(2-ethylhexyl) Phthalate (DEHP)	%	0.003	ND
Benzylbutyl Phthalate (BBP)	%	0.003	ND
Dibutyl Phthalate (DBP)	%.	0.003	ND

### Notes:

- (1) DBP,BBP,DEHP Reference information: Entry 51 of Regulation (EC) No 552/2009 amending Annex XVII of REACH Regulation (EC) No 1907/2006 (previously restricted under Directive 2005/84/EC);
  - Shall not be used as substances or in mixtures, in concentrations greater than 0,1 % by weight of the plasticised material, in toys and childcare articles.
  - ii) Toys and childcare articles containing these phthalates in a concentration greater than 0.1 % by weight of the plasticised material shall not be placed on the market.

Please refer to Regulation (EC) No 552/2009 to get more detail information

## Hexabromocyclododecane (HBCDD)

Test Method: With reference to US EPA 3550C: 2007, analysis was performed by GC-MS.

Test Item(s)
Hexabromocyclododecane (HBCDD)

Unit.

MDL

mg/kg 10

ND

002

The document is issued by the Company subject to its General Conditions of Service printed avariest, excitable on request or accessible at http://www.sqs.com/terms\_and\_documents\_subject to Terms and Conditions for Electronic Decuments at www.sqs.com/terms\_e-occument.htm. Attention as drawn to the limitation of liability adjacent. Subject to Terms and Conditions for Electronic Decuments at www.sqs.com/terms\_e-occument.htm. Attention as drawn to the limitation of liability adjacent. Subject to the Condition is subject to the Condition is drawn to the Company's softeness that information contained before an expension of the Company's softeness to the time of the Company and the Company of the Company and the Company of the Compan

TB/brg/kb89 Yalan Rind Xuliu Dahrd, Sharghal Circa 200233 中国 - 上海 · 徐汇区 宜山路869号3号楼 邮網 200233 www.cn.ags.com e sgs.china@sgs.com



No. SHAEC1203840702

Date: 09 Apr 2012

Page 3 of 6

Remark: Result shown is of the total weight of wet sample.

This opcument is issued by the Company subject to its General Conditions of Service printed overleaf, available on request of accessible at http://www.sgs.com/terms\_and\_conditions that and for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms\_e-document.htm. Attention is drawn to the limitation of tability operations and jurisdiction iscues defined therein. Any holder of this document is possed that information contained hereon reflects the Company's the time of its possed within the familis of Ceprts, instructions, if any. The Company's sole responsibility is to its Client and this document does not expressed by the time of the provided of the transaction for printed of documents. This document cannot be reproduced accept in full, without prior written approved of the Company. They considered except in full, without prior written approved of the Company. They unsufficiently in the content or appearance of this document is unlawful and effected may be presented to the full of extent of the low.

(allows after the standard feature shown in this test report refer only to the sample(s) lested.



No. SHAEC1203840702

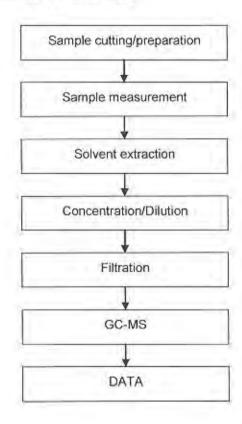
Date: 09 Apr 2012

Page 4 of 6

# **ATTACHMENTS**

# **Phthalates Testing Flow Chart**

- 1) Name of the person who made testing: Elyn Yao
- 2) Name of the person in charge of testing: Rachel Zhang



This document is issued by the Company subject to its General Conditions of Service printed overload, available on request or accessible at http://www.sgs.com/terms\_and\_conditions for Electronic Documents at <a href="https://www.sgs.com/terms\_edocuments.com/terms\_edocuments.com/terms\_edocuments.htm">www.sgs.com/terms\_edocuments.htm</a>. Attention is drawn to the limitation of liability of and jurisdiction issues defined therein. Any holder of this document is not accessible to enterined hereon reflects the Company's findings\_at the time of its description of the Company is findings\_at the time of its description of the company is a service parties to a transaction pay the processing all the binds designations is under the transaction documents, cannot be reproduced except in full, without prior written approval of the Company is unauthorized alternation, forgery or fatsification of the content or appearance of this document is unlawful and effenders may be prosecuted to the fullest extent of the law unauthorized alternation for the content or appearance of this document is unlawful and effenders may be prosecuted to the fullest extent of the law units and the content or appearance of this document is unlawful and effenders may be prosecuted to the fullest extent of the law units and the content or appearance of the company to the company and the content or appearance of the content or appearance of the company and the content or appearance of the content or appearance of the company and the content or appearance of the company and the content or appearance of the content or appearance or appearance of the content or appearance or appearance



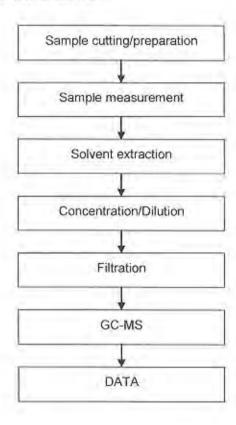
No. SHAEC1203840702

Date: 09 Apr 2012

Page 5 of 6

# **HBCDD Testing Flow Chart**

- 1) Name of the person who made testing: Gary Xu
- 2) Name of the person in charge of testing: Elim Lin



This document is issued by the Company subject to its General Conditions of Service printed overleaf, available or request or accessible at http://www.ags.com/terms\_and\_ponditions\_tite\_a

FBuilding No.RR9 Yahan Road Xuhui District, Shanghai China 200233 中国 - 上海 - 發江区宣山路889号3号楼 麒麟: 200233 I E&E (86-21) 61402553 FE&E (86-21)64953679 HL: (86-21) 61402594 HL: (86-21)54500353 www.cn.ags.com e.ags.chma@egs.com



No. SHAEC1203840702

Date: 09 Apr 2012

Page 6 of 6

Sample photo:



SGS authenticate the photo on original report only

\*\*\* End of Report \*\*\*

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/terms\_and\_conditions. htm. and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms\_e-document.htm. Attention is drawn to the limitation of liability and error produced a printed continuous production issued defined therein. Any holder of this document is advised that information contained hereon reflects the Company is Lindings\_at the time of the person to the contained described the company is sole responsibility is to its Client and this document does not expected a transaction from the contained in the contained and obligations under the transaction documents. This document cannot be reproduced except in full without prior written approval of the Company and unauthorized alteration, largery or fatsification of the content or appearance of this document is unlawful and offenders may be prospected to the fullest extent of the law laters of the content or appearance of this document is unlawful and offenders may be prospected to the fullest extent of the law.

3"Building No.289 Yishan Road Xuhui Distrid, Shanghai China 200233 中国、上海、徐江区宣山路889号3号楼 邮網: 200233 www.ch.sgs.com e sgs.china@sgs.com



Applicant: LITTELFUSE, INC

8755 WEST HIGGINS ROAD SUITE

500CHICAGO IL 60631 USA

Attn: KRISTEEN BACILA/ARSENIO CESISTA JR.

Sample Description:

One (1) submitted sample said to be silver-grey paste (terminations).

Part No. : MS208.



Tests conducted:

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

To be continued

May 15, 2012

Date:

Authorized by:

For Intertek Testing Services

Shenzhen Ltd.

Ben N.L. Lin General Manager



Conclusion:

**Tested Samples** Submitted sample

<u>Standard</u> Restriction of the use of certain hazardous substance in electrical electronic and equipment (RoHS Direction

2002/95/EC and supersedure 2011/65/EU)

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)

Hexabromocyclododecane Content

See Test Conducted

Result

Fail

**Pass** 

Halogen (F, Cl, Br, I) Content

See Test Conducted

Authorized by: For Intertek Testing Services Shenzhen Ltd.

Ben N.L. Lin General Manager



**Test Report** SZHH00687971 Number:

**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)	1940*
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)

Chemist: Wang Haijun/Zeng Guoliang

mg/kg = milligram per kilogram based on dry weight of sample = ppm < = Less than

ND = Not detected

\* = Failed item



**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 2002/95/EC and supersedure 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	

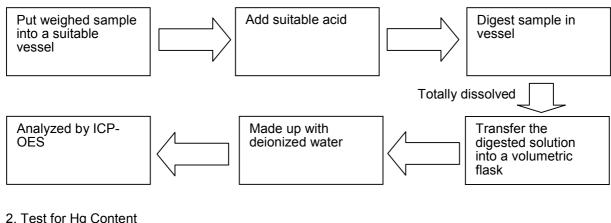
Date sample received: May 09, 2012 Testing period: May 09, 2012 to May 11, 2012

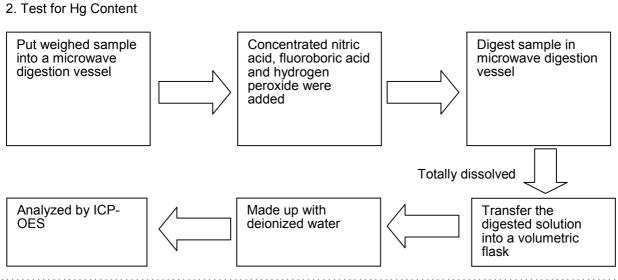


**Tests Conducted** 

## (D) Measurement Flowchart:

## 1. Test for Cd/Pb Contents

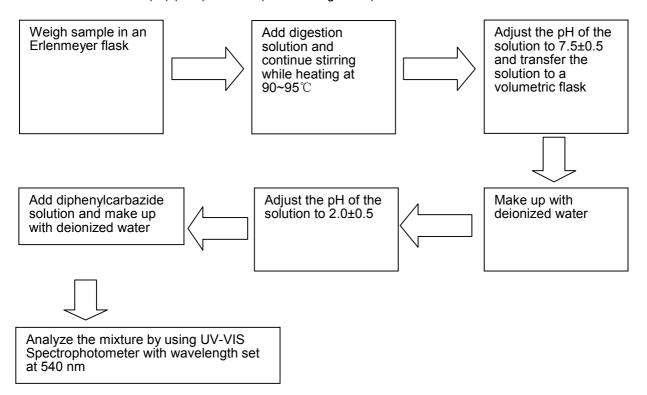




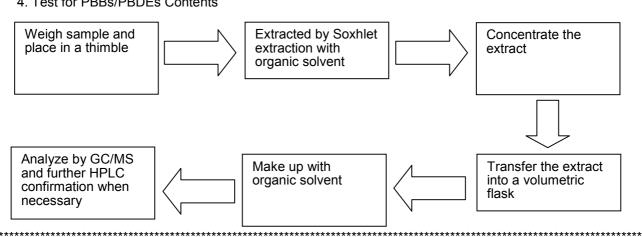


**Tests Conducted** 

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



## 4. Test for PBBs/PBDEs Contents





**Tests Conducted** 

# 2 Phthalate Content

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

Dibutyl phthalate (DBP) Di-(2-ethyl hexyl) phthalate (DEHP) Benzyl butyl phthalate (BBP)	Result (%) <0.01 <0.01 <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.

< = Less than

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

Tested sample: Silver-grey paste (terminations).

Date sample received :May 08, 2012

Testing period :May 08, 2012 to May 12, 2012

## 3 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

Tested Component: Silver-grey paste (terminations).

Date sample received: May 08, 2012

Testing period : May 08, 2012 to May 10, 2012



**Tests Conducted** 

#### 4 **Halogen Content**

## (I) Test Result Summary:

Testing Item	Result (mg/kg)
Fluorine (F) Content	ND
Chlorine (CI) Content	89
Bromine (Br) Content	ND
Iodine (I) Content	ND

mg/kg = milligram per kilogram based on dry weight of sample = ppm ND = Not detected

## (II) Test Method:

Testing Item	Testing Method	Reporting Limit
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

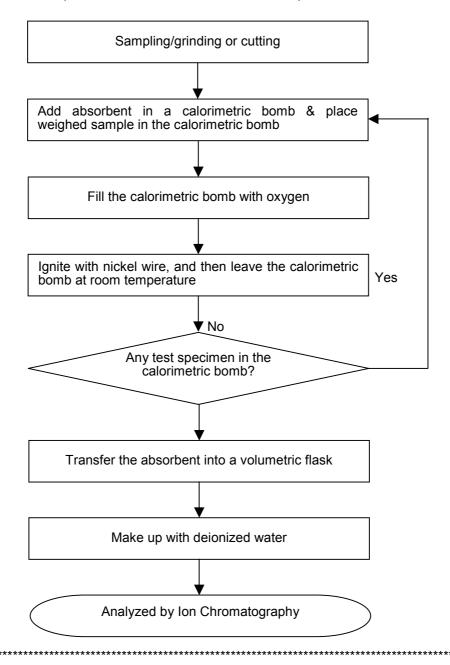
Date sample received: May 08, 2012 Testing period: May 08, 2012 to May 11, 2012



**Tests Conducted** 

## (III) Measurement Flowchart:

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



End of report



Applicant: LITTELFUSE, INC

8755 WEST HIGGINS ROAD SUITE

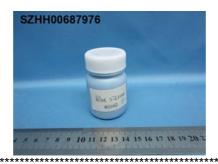
500CHICAGO IL 60631 USA

Attn: KRISTEEN BACILA/ARSENIO CESISTA JR.

Sample Description:

One (1) submitted sample said to be blue paste (blue silicone).

Part No. : MS202.



Tests conducted:

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

To be continued

May 15, 2012

Date:

Authorized by:

For Intertek Testing Services

Shenzhen Ltd.

Ben N.L. Lin General Manager



Conclusion:

**Tested Samples** Submitted sample

Standard
Restriction of the use of certain hazardous substance in electrical electronic and equipment (RoHS Direction

2002/95/EC and supersedure 2011/65/EU)

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

Result

Pass

Test Item

Hexabromocyclododecane Content

See test conducted

Halogen (F, Cl, Br, I) Content

See test conducted

Authorized by: For Intertek Testing Services Shenzhen Ltd.

Ben N.L. Lin General Manager



**Test Report** SZHH00687976 Number:

**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)	ND(<2)
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)

Chemist: Wang Haijun/Zeng Guoliang

mg/kg = milligram per kilogram based on dry weight of sample = ppm < = Less than

ND = Not detected



**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 2002/95/EC and supersedure 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 08, 2012 Testing period: May 08, 2012 to May 11, 2012

# (D) Measurement Flowchart:

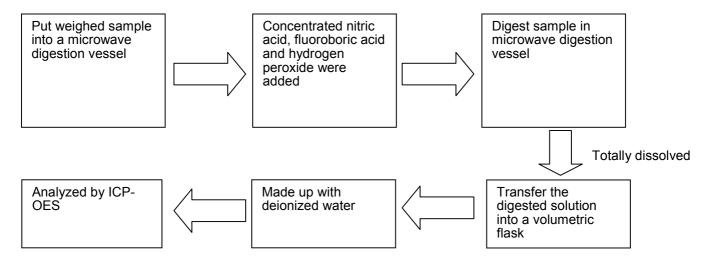
## 1. Test for Cd/Pb Contents

Add suitable acid Put weighed sample Digest sample in vessel into a suitable vessel Totally dissolved Analyzed by ICP-Made up with Transfer the deionized water digested solution OES into a volumetric flask

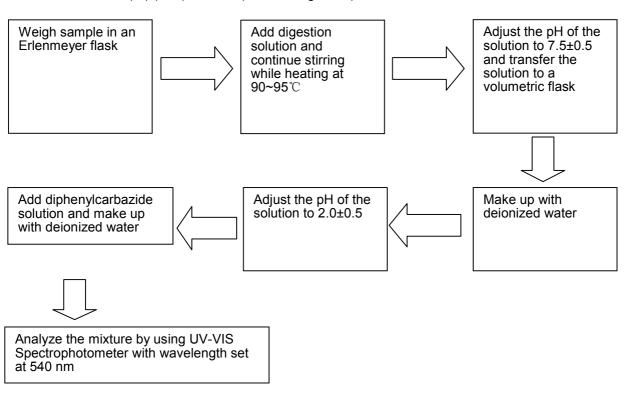


**Tests Conducted** 

## 2. Test for Hg Content



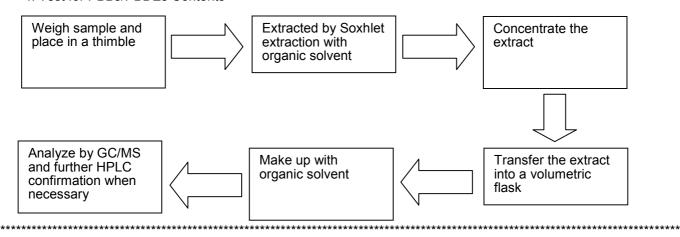
# 3. Test for Chromium (VI) (Cr<sup>6+</sup>) Content (Alkaline Digestion)





**Tests Conducted** 

## 4. Test for PBBs/PBDEs Contents





**Tests Conducted** 

## 2 Phthalate Content

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

	Result (%)
Dibutyl phthalate (DBP) Di-(2-ethyl hexyl) phthalate (DEHP) Benzyl butyl phthalate (BBP)	<0.01 <0.01 <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.

< = Less than

% = Percentage based on dry weight of sample

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

Date sample received :May 08, 2012

Testing period :May 08, 2012 to May 12, 2012

## 3 <u>Hexabromocyclododecane (HBCDD) Content:</u>

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 08, 2012

Testing period: May 08, 2012 to May 12, 2012



**Tests Conducted** 

## Halogen Content

## (I) Test Result Summary:

Testing Item	Result (mg/kg)
Fluorine (F) Content	ND
Chlorine (CI) Content	373
Bromine (Br) Content	ND
Iodine (I) Content	ND

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

## (II) Test Method:

Testing Item	Testing Method	Reporting Limit
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

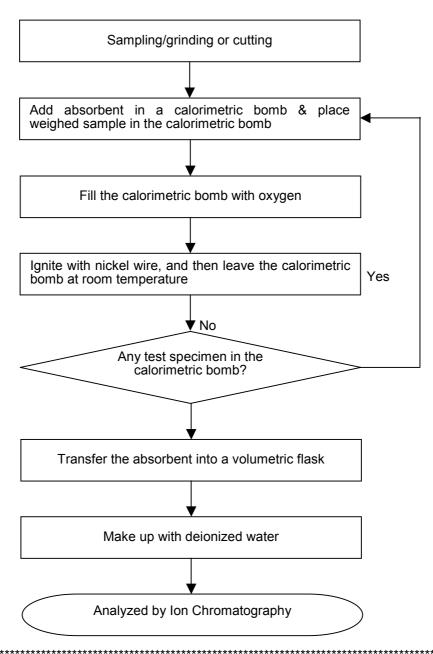
Date sample received : May 08, 2012 Testing period : May 08, 2012 to May 11, 2012



**Tests Conducted** 

## (III) Measurement Flowchart:

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



End of report