

Company name:

Product Series:

Product #:

## **ICP Test Report Certification Packet**

CG2, CG3, CG5, AC and PMT Series

Littelfuse, Inc.

GDT

Issue Date:	January 15, 2014		
EU Directive 2002/95/E0 parts, for packing/packa processes.  In addition, it is be used for unit parts, t	C)-restricted substance ging materials, and for nereby reported to your he packing/packaging in	nat there is neither RoHS (201 nor such use, for materials or additives and the like in that the parts and sub-materials materials, and the additives ne following components.	to be used for unit the manufacturing als, the materials to
	Issued :	JORDANUFF H. CABILAN  [Global EHS Engineer]	
(1) Parts, sub-materials This document of Littelfuse, Inc.	•	S-Compliant series products	manufactured by
< Raw Materials U			
(2) The ICP data on all Please see app	measurable substances propriate pages as iden		
Remarks :			
	1	1	



Table 1: List of Raw Materials covered by this report

Total Parts	Raw Material Part Number	Raw Material Description	Page(s)
1	NA	Ceramic	3-8
2	NA	Silver Ring	9-14
3	NA	Fail Safe Clip	15-20
4	NA	Solder Pill (Unleaded)	21-26
5	NA	Cu Electrode	27-32
6	NA	Ni Electrode	33-38
7	NA	Tin Plated Wire	39-44
8	NA	Blue Ink	45-50



No. CTSSA/08643-1(B)/13

CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 1 of 6

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description : Ceramic Sample Receiving Date : 17/04/2013

Testing Period : 17/04/2013 to 13/05/2013

 Date Completed
 :
 13/05/2013

 Reporting Date
 :
 20/05/2013

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).

Analysts : Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

SGS LABORATORY SERVICES (M) SDN. BHD.

CHÓNG KIEN LEN B.Sc.(HONS) AMIC SENIOR LAB MANAGER



No. CTSSA/08643-1(B)/13

Date: 20/05/2013

Page: 2 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

Test results:

**Test Part Description**:

Sample Description : Ceramic

### RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	MDL
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI)	mg/kg	With reference to IEC 62321:2008, and performed by UV-Vis	N.D.	2
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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No. CTSSA/08643-1(B)/13 Date: 20/05/2013

CTS Ref. CTSSA/13/1281/LittelFuse

Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

- (b) N.D. = Not Detected
- (c) MDL = Method Detection Limit
- (d) = Not regulated
- (e) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

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No. CTSSA/08643-1(B)/13

Date: 20/05/2013

Page: 4 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

Test result:

Test Part Description:

Sample Description Ceramic

### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

### Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) = not regulated

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No. CTSSA/08643-1(B)/13

Date: 20/05/2013 CTS Ref. CTSSA/13/1281/LittelFuse

Page: 5 of 6

**Test Part Description**:

Sample Description Ceramic



SGS authenticate the photo on original report only

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No. CTSSA/08643-1(B)/13

Date: 20/05/2013 Page: 6 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

### 1. <u>DETERMINATION OF CADMIUM CONTENT BY</u> <u>IEC 62321 2008</u>

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

## 2. <u>DETERMINATION OF LEAD CONTENT BY</u> <u>IEC 62321 2008</u>

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

↓ Filtration

Analyses by ICP

## 3. <u>DETERMINATION OF MERCURY CONTENT BY</u> <u>IEC 62321 2008</u>

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

# 4. <u>DETERMINATION OF HEXAVALENT CHROMIUM</u> <u>BY IEC 62321 2008</u>

Sample Preparation

Add colour-developing reagent

Acidify with H<sub>2</sub>SO<sub>4</sub>

Let stand for 5-10 min

Analyses by UV- Spectrophotometer (540 nm)

## 5. <u>DETERMINATION OF PBB/PBDE WITH GC-MS</u> BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

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No. CTSSA/08656-1(B)/13

CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 1 of 6

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description Silver Ring Sample Receiving Date 17/04/2013

Testing Period 17/04/2013 to 16/05/2013

Date Completed 16/05/2013 Reporting Date 20/05/2013

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).

Analysts Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

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No. CTSSA/08656-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 2 of 6

Test results:

**Test Part Description**:

Sample Description : Silver Ring

### RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	<u>MDL</u>
Cadmium(Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI) by Spot test / boiling water extraction (optional) #		With reference to IEC 62321:2008	Negative	-
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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No. CTSSA/08656-1(B)/13 Date: 20/05/2013 CTS Ref. CTSSA/13/1281/LittelFuse

Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008,	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

- (b) N.D. = Not Detected
- (c) MDL = Method Detection Limit
- (d) # = Spot-Test:
  - a. Negative means the absence of Cr(VI) on the tested areas
  - b. Positive means the presence of Cr(VI) on the tested areas

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is negative or cannot be confirmed)

### **Boiling water extraction:**

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas;
   The detected concentration in 50 mL boiling water extraction solution is equal or greater than 0.02 mg/kg with 50 cm<sup>2</sup> sample surface area.

For corrosion protection coatings on metals: Information on storage conditions and production date of the tested sample is unavailable and thus results of Cr(VI) represent status of the sample at the time of testing.

- (e) = Not regulated
- (f) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

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No. CTSSA/08656-1(B)/13

Date: 20/05/2013

Page: 4 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

Test result:

Test Part Description:

Sample Description : Silver Ring

### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

### Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) = not regulated

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No. CTSSA/08656-1(B)/13

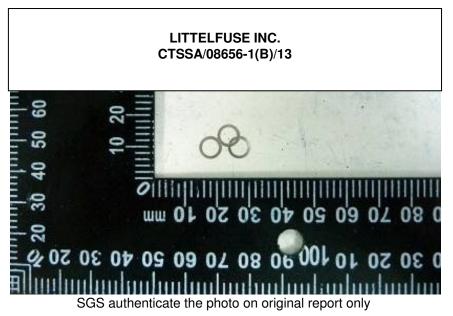
Date: 20/05/2013

Page: 5 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

**Test Part Description**:

Sample Description : Silver Ring



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SGS Laboratory Services (M) Sdn. Bhd. (Company No. 63972-M)

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No. CTSSA/08656-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

# 1. DETERMINATION OF CADMIUM CONTENT BY IEC 62321 2008 Sample Receiving and Registration Cut sample in small pieces Weight sample (0.2-0.5g) into digestion vessel Acid digestion (Microwave) "Totally Dissolved" Filtration

# 2. DETERMINATION OF LEAD CONTENT BY IEC 62321 2008 Sample Receiving and Registration Cut sample in small pieces Weight sample (0.2-0.5g) into digestion vessel Acid digestion (Microwave) "Totally Dissolved" Filtration Analyses by ICP

## 3. <u>DETERMINATION OF MERCURY CONTENT BY</u> <u>IEC 62321 2008</u>

Analyses by ICP

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

### 4. <u>DETERMINATION OF HEXAVALENT CHROMIUM</u> BY IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Spot-test (Qualitative)

Boiling-water-extraction

Analyses by UV- Spectrophotometer

Test Report

### 5. <u>DETERMINATION OF PBB/PBDE WITH GC-MS</u> BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

SGS LABORATORY SERVICES (M) SDN. BHD.

CHONG KIEN LEN B.Sc.(HONS) AMIC SENIOR LAB MANAGER



No. CTSSA/08646-1(B)/13

Date: 20/05/2013

Page: 1 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description Sample Receiving Date Failsafe Clip 17/04/2013

Testing Period

17/04/2013 to 13/05/2013

Date Completed Reporting Date

13/05/2013 20/05/2013

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).

Analysts

Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

SGS LABORATORY SERVICES (M) SDN. BHD.

CHÓNG KIEN LEN B.Sc.(HONS) AMIC

SENIOR LAB MANAGER

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No. CTSSA/08646-1(B)/13

Date: 20/05/2013

Page: 2 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

Test results:

Test Part Description:

Sample Description

Failsafe Clip

### RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	MDL
Cadmium(Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI) by Spot test / boiling water extraction (optional) #		With reference to IEC 62321:2008	Negative	*
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

(b) N.D. = Not Detected

(c) MDL = Method Detection Limit

(d) # = Spot-Test:

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is negative or cannot be confirmed)

### **Boiling water extraction:**

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas; The detected concentration in 50 mL boiling water extraction solution is equal or greater than 0.02 mg/kg with 50 cm<sup>2</sup> sample surface area.

For corrosion protection coatings on metals: Information on storage conditions and production date of the tested sample is unavailable and thus results of Cr(VI) represent status of the sample at the time of testing.

(e) - = Not regulated

(f) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

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CTS Ref. CTSSA/13/1281/LittelFuse

Test result:

Test Part Description:

Sample Description

Failsafe Clip

### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

### Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) -= not regulated

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Test Part Description:

Sample Description

Failsafe Clip



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No. CTSSA/08646-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

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1. DETERMINATION OF CADMIUM CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

3. DETERMINATION OF MERCURY CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

2. DETERMINATION OF LEAD CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

4. <u>DETERMINATION OF HEXAVALENT CHROMIUM</u>
BY IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Spot-test (Qualitative)

Boiling-water-extraction

Analyses by UV- Spectrophotometer

Test Report

5. DETERMINATION OF PBB/PBDE WITH GC-MS

BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

int sample (0.5-4.0g) into extraction inimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

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CTS Ref. CTSSA/13/1281/LittelFuse

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description : Solder Pill (Unleaded)

Sample Receiving Date : 17/04/2013

Testing Period : 17/04/2013 to 16/05/2013

Date Completed : 16/05/2013 Reporting Date : 20/05/2013

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).

Analysts : Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

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Test results:

Test Part Description:

Sample Description : Solder Pill (Unleaded)

### RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	<u>MDL</u>
Cadmium(Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	14	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI) by Spot test / boiling water extraction (optional) #		With reference to IEC 62321:2008	Negative	-
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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No. CTSSA/08658-1(B)/13 Date: 20/05/2013 CTS Ref. CTSSA/13/1281/LittelFuse

Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

- (b) N.D. = Not Detected
- (c) MDL = Method Detection Limit
- (d) # = Spot-Test:
  - a. Negative means the absence of Cr(VI) on the tested areas
  - b. Positive means the presence of Cr(VI) on the tested areas

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is negative or cannot be confirmed)

### **Boiling water extraction:**

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas;
   The detected concentration in 50 mL boiling water extraction solution is equal or greater than 0.02 mg/kg with 50 cm<sup>2</sup> sample surface area.

For corrosion protection coatings on metals: Information on storage conditions and production date of the tested sample is unavailable and thus results of Cr(VI) represent status of the sample at the time of testing.

- (e) = Not regulated
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CTS Ref. CTSSA/13/1281/LittelFuse

Test result:

Test Part Description:

Sample Description : Solder Pill (Unleaded)

### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

### Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) = not regulated

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**Test Part Description**:

Sample Description : Solder Pill (Unleaded)



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CTS Ref. CTSSA/13/1281/LittelFuse

# 1. DETERMINATION OF CADMIUM CONTENT BY IEC 62321 2008 Sample Receiving and Registration Cut sample in small pieces Weight sample (0.2-0.5g) into digestion vessel Acid digestion (Microwave) "Totally Dissolved" Filtration Analyses by ICP

# 2. DETERMINATION OF LEAD CONTENT BY IEC 62321 2008 Sample Receiving and Registration Cut sample in small pieces Weight sample (0.2-0.5g) into digestion vessel Acid digestion (Microwave) "Totally Dissolved" Filtration Analyses by ICP

# 3. DETERMINATION OF MERCURY CONTENT BY IEC 62321 2008 Sample Receiving and Registration Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

### 4. <u>DETERMINATION OF HEXAVALENT CHROMIUM</u> BY IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Spot-test (Qualitative)

Boiling-water-extraction

Analyses by UV- Spectrophotometer

Test Report

### 5. <u>DETERMINATION OF PBB/PBDE WITH GC-MS</u> BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

SGS LABORATORY SERVICES (M) SDN. BHD.

CHONG KIEN LEN B.Sc.(HONS) AMIC SENIOR LAB MANAGER



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CTS Ref. CTSSA/13/1281/LittelFuse

LITTELFUSE INC. **800E. NORTHWEST HIGHWAY** DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description

Copper Electrode

Sample Receiving Date

17/04/2013

**Testing Period** 

17/04/2013 to 13/05/2013

**Date Completed** 

13/05/2013

Reporting Date

20/05/2013

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).

Analysts

Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

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CTS Ref. CTSSA/13/1281/LittelFuse

Test results:

Test Part Description:

Sample Description

Copper Electrode

### RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	MDL
Cadmium(Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI) by Spot test / boiling water extraction (optional) #	***	With reference to IEC 62321:2008	Negative	
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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Date: 20/05/2013

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Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

(a) mg/kg = ppm; (0.1wt% = 1000ppm)

(b) N.D. = Not Detected (c) MDL = Method Detection Limit

(d) # = Spot-Test:

a. Negative means the absence of Cr(VI) on the tested areas

b. Positive means the presence of Cr(VI) on the tested areas

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is negative or cannot be confirmed)

### **Boiling water extraction:**

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas;

The detected concentration in 50 mL boiling water extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

For corrosion protection coatings on metals: Information on storage conditions and production date of the tested sample is unavailable and thus results of Cr(VI) represent status of the sample at the time of testing.

(e) - = Not regulated

(f) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

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SENIOR LAB MANAGER

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No.26 Jalan Anggerik Vanilla 31/93 Kota Kemuning 40460 Shah Atam, Selangor Darul Ehsan, Malaysia t +6(03) 5121 2320 f +6 (03) 5121 9082 www.sgs.com



No. CTSSA/08644-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

Test result:

Test Part Description:

Sample Description

Copper Electrode

### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

### Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) -= not regulated

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Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

Test Part Description:

Sample Description

Copper Electrode



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No. CTSSA/08644-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

# 1. DETERMINATION OF CADMIUM CONTENT BY IEC 62321 2008 Sample Receiving and Registration Cut sample in small pieces Weight sample (0.2-0.5g) into digestion vessel Acid digestion (Microwave) "Totally Dissolved" Filtration Analyses by ICP

### 3. DETERMINATION OF MERCURY CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

### 2. DETERMINATION OF LEAD CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

### 4. DETERMINATION OF HEXAVALENT CHROMIUM BY IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Spot-test (Qualitative)

+

Boiling-water-extraction

Analyses by UV- Spectrophotometer

Test Report

### 5. DETERMINATION OF PBB/PBDE WITH GC-MS BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

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No. CTSSA/08651-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description Sample Receiving Date Nickel Electrode 17/04/2013

Testing Period

17/04/2013 to 14/05/2013

Date Completed Reporting Date 14/05/2013 20/05/2013

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).

Analysts

Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

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No. CTSSA/08651-1(B)/13 Da CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 2 of 6

Test results:

Test Part Description:

Sample Description

Nickel Electrode

### RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	MDL
Cadmium(Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI) by Spot test / boiling water extraction (optional) #		With reference to IEC 62321:2008	Negative	
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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No. CTSSA/08651-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 3 of 6

	0,0,,,,,	TOOK TO TEOTIE LICE USE
of PBDEs	mg/kg	With reference to IEC 6

Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	-
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

(b) N.D. = Not Detected

(c) MDL = Method Detection Limit

(d) # = Spot-Test:

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is negative or cannot be confirmed)

### **Boiling water extraction:**

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas;

The detected concentration in 50 mL boiling water extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

For corrosion protection coatings on metals: Information on storage conditions and production date of the tested sample is unavailable and thus results of Cr(VI) represent status of the sample at the time of testing.

(e) - = Not regulated

(f) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

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No. CTSSA/08651-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 4 of 6

Test result:

Test Part Description:

Sample Description

Nickel Electrode

### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

### Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) = not regulated

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Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

Test Part Description:

Sample Description

Nickel Electrode



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No. CTSSA/08651-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

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.....

1. DETERMINATION OF CADMIUM CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

3. DETERMINATION OF MERCURY CONTENT BY

IEC 62321 2008 Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

2. DETERMINATION OF LEAD CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

4. DETERMINATION OF HEXAVALENT CHROMIUM BY IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Spot-test (Qualitative)

Boiling-water-extraction

Analyses by UV- Spectrophotometer

Test Report

5. DETERMINATION OF PBB/PBDE WITH GC-MS BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

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No. CTSSA/08659-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description : Tin Plated Wire Sample Receiving Date : 17/04/2013

Testing Period : 17/04/2013 to 16/05/2013

Date Completed : 16/05/2013 Reporting Date : 20/05/2013

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).

Analysts : Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

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No. CTSSA/08659-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

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Test results:

Test Part Description :

Sample Description

Tin Plated Wire

## RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	MDL
Cadmium(Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI) by Spot test / boiling water extraction (optional) #		With reference to IEC 62321:2008	Negative	+
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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B.Sc.(HONS) AMIC SENIOR LAB MANAGER



Test Report No. CTSSA/08659-1(B)/13 Date : 20/05/2013 Page: 3 of 6 CTS Ref. CTSSA/13/1281/LittelFuse

Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321;2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

- (b) N.D. = Not Detected
- (c) MDL = Method Detection Limit
- (d) # = Spot-Test:
  - a. Negative means the absence of Cr(VI) on the tested areas
  - b. Positive means the presence of Cr(VI) on the tested areas

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is negative or cannot be confirmed)

## **Boiling water extraction:**

- a. Negative means the absence of Cr(VI) on the tested areas
- b. Positive means the presence of Cr(VI) on the tested areas; The detected concentration in 50 mL boiling water extraction solution is equal or greater than 0.02 mg/kg with 50 cm<sup>2</sup> sample surface area.

For corrosion protection coatings on metals: Information on storage conditions and production date of the tested sample is unavailable and thus results of Cr(VI) represent status of the sample at the time of testing.

- (e) = Not regulated
- (f) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

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No. CTSSA/08659-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

Test result:

Test Part Description:

Sample Description

Tin Plated Wire

#### Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

## Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) -= not regulated

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No. CTSSA/08659-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

Test Part Description:

Sample Description

Tin Plated Wire



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No. CTSSA/08659-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

2. DETERMINATION OF LEAD CONTENT BY

IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Page: 6 of 6

1. DETERMINATION OF CADMIUM CONTENT BY

IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

1

Analyses by ICP

Filtration

Analyses by ICP

4. DETERMINATION OF HEXAVALENT CHROMIUM

BY IEC 62321 2008
Sample Receiving and Registration

Sample Preparation

Sample Preparation

Spot-test (Qualitative)

Boiling-water-extraction

Analyses by UV- Spectrophotometer

Test Report

3. DETERMINATION OF MERCURY CONTENT BY

IEC 62321 2008

Sample Receiving and Registration

Cut sample in small pieces

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

+

Analyses by ICP

5. DETERMINATION OF PBB/PBDE WITH GC-MS BY IEC 62321 2008

Cut sample in small pieces

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

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No. CTSSA/08640-1(B)/13

Date: 20/05/2013

Page: 1 of 6

CTS Ref. CTSSA/13/1281/LittelFuse

LITTELFUSE INC. 800E. NORTHWEST HIGHWAY DES PLAINES, IL 60016, USA

The following merchandise was (were) submitted and identified by the client as:

Sample Description Sample Receiving Date Blue Ink 17/04/2013

Testing Period

17/04/2013 to 10/05/2013

Date Completed Reporting Date

10/05/2013 20/05/2013

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).

Analysts

Ng Jing Wei, Cho Kar Yen, Tan Li Wei, Choong Lap Kit &

Tay Siam Pine

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No. CTSSA/08640-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

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Test results:

Test Part Description:

Sample Description

Blue Ink

# RoHS Directive 2011/65/EU Annex II

Test Item(s):	Unit	Test Method	Results	MDL
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, and performed by ICP-OES	N.D.	2
Hexavalent Chromium (CrVI)	mg/kg	With reference to IEC 62321:2008, and performed by UV-Vis	N.D.	2
Sum of PBBs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	4
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5

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No. CTSSA/08640-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

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Sum of PBDEs	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and performed by GC-MS	N.D.	5
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, and	N.D.	5

Note: (a) mg/kg = ppm; (0.1wt% = 1000ppm)

(b) N.D. = Not Detected (c) MDL = Method Detection Limit

(d) - = Not regulated

(e) Testing based on original basis

(f) Upon Customer's request, this report has been issued in more than one original. Only the first original is a legally binding document and may be used for any legal purpose, including payment. (Original 2-2)

performed by GC-MS

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No. CTSSA/08640-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 4 of 6

Test result:

Test Part Description :

Sample Description

Blue Ink

## Optional: RoHS Directive 2011/65/EU, priority substances

Test Item(s):	Unit	Test Method	Results	MDL
Hexabromocyclododecane (HBCDD)	mg/kg	Based on IEC 62321:2008, and performed by GC-MS	N.D.	10
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Butyl benzyl phthalate (BBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30
Dibutyl phthalate (DBP)	mg/kg	Based on EN 14372: 2004, and performed by GC-MS	N.D.	30

## Note:

- (a) Reference Information: Directive 2011/65/EU recasting RoHS directive 2002/95/EC: Hexabromocyclododecane (HBCDD), Bis (2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP) and Dibutyl phthalate (DBP) are considered as a priority for risk evaluation and substance restriction.
- (b) mg/kg = ppm; 0.1wt% = 1000ppm
- (c) N.D. = Not detected
- (d) MDL = Method Detection Limit
- (e) -= not regulated
- (f) Testing based on original basis

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No. CTSSA/08640-1(B)/13

Date: 20/05/2013

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CTS Ref. CTSSA/13/1281/LittelFuse

Test Part Description:

Sample Description

Blue Ink

LITTELFUSE INC.
CTSSA/08640-1(B)/13

But 01 02 02 07 05 09 02 08 06 001 01 02 02 07 05 09 02 08 06 002 01 02 02 02 07 05 09 02 08 06 002 01 02 02 02 07 05 09 02 08 06 002 01 02 02 02 03 06 002 01 02 02 03 06 002 01 02 02 03 06 002 01 02 03 06 002 01 02 03 06 002 01 02 03 06 002 01 02 03 06 002 01 03 002 01 03

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No. CTSSA/08640-1(B)/13 CTS Ref. CTSSA/13/1281/LittelFuse

Date: 20/05/2013

Page: 6 of 6

1. DETERMINATION OF CADMIUM CONTENT BY

IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

2. DETERMINATION OF LEAD CONTENT BY

IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

3. DETERMINATION OF MERCURY CONTENT BY IEC 62321 2008

Sample Receiving and Registration

Sample Preparation

Weight sample (0.2-0.5g) into digestion vessel

Acid digestion (Microwave)

"Totally Dissolved"

Filtration

Analyses by ICP

4. DETERMINATION OF HEXAVALENT CHROMIUM BY IEC 62321 2008

Sample Preparation

Add colour-developing reagent

Acidity with H2SO4

Let stand for 5-10 min

Analyses by UV- Spectrophotometer (540 nm)

5. DETERMINATION OF PBB/PBDE WITH GC-MS
BY IEC 62321 2008

Sample Preparation

Weight sample (0.5-4.0g) into extraction thimble

Soxhlet Extraction with Toluene

Filter through 0.45 um membrane filter

Analyses by GC-MS (with appropriate dilution)

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

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