

## Test Report

No. : CE/2020/94512

Date : 2020/10/06

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HAESUNGDS CO., LTD.

(SEONGJU-DONG) 726, UNGNAM-RO, SEONGSAN-GU, CHANG-WON-SI, GYEONGSANGNAM-DO, KOREA

The following sample(s) was/were submitted and identified by/on behalf of the applicant as :

Sample Submitted By : HAESUNGDS CO., LTD.  
Sample Description : LEAD FRAME  
SGS Korea File No. : AYGA20-05058  
Style/Item No. : C194-AG  
Sample Material : METAL ALLOY  
Sample Receiving Date : 2020/09/26  
Testing Period : 2020/09/26 to 2020/10/06

### Test Requested :

- (1) As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample(s).
- (2) Please refer to next pages for the other item(s).

Test Result(s) : Please refer to following pages.

Conclusion : (1) Based on the performed tests on selected part of submitted sample(s), the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

  
Troy Chang / Manager  
Signed for and behalf of  
SGS TAIWAN LTD.  
Chemical Laboratory - Taipei



PIN CODE: E4A34778

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## Test Result(s)

PART NAME No.1 : SILVER/COPPER COLORED METAL SHEET (EXCLUDING THE FRAME)

| Test Item(s)                   | Unit               | Method  | MDL  | Result | Limit |
|--------------------------------|--------------------|---|------|--------|-------|
|                                |                    |   |      | No.1   |       |
| Cadmium (Cd)                   | mg/kg              | With reference to IEC 62321-5: 2013 and performed by ICP-OES.           | 2    | n.d.   | 100   |
| Lead (Pb)                      | mg/kg              | With reference to IEC 62321-5: 2013 and performed by ICP-OES.           | 2    | n.d.   | 1000  |
| Mercury (Hg)                   | mg/kg              | With reference to IEC 62321-4:2013+ AMD1:2017 and performed by ICP-OES. | 2    | n.d.   | 1000  |
| Hexavalent Chromium Cr(VI)(#2) | µg/cm <sup>2</sup> | With reference to IEC 62321-7-1: 2015 and performed by UV-VIS.          | 0.10 | n.d.   | -     |
| <b>Sum of PBBs</b>             | mg/kg              | With reference to IEC 62321-6: 2015 and performed by GC/MS.             | -    | n.d.   | 1000  |
| Monobromobiphenyl              | mg/kg              |   | 5    | n.d.   | -     |
| Dibromobiphenyl                | mg/kg              |   | 5    | n.d.   | -     |
| Tribromobiphenyl               | mg/kg              |   | 5    | n.d.   | -     |
| Tetrabromobiphenyl             | mg/kg              |   | 5    | n.d.   | -     |
| Pentabromobiphenyl             | mg/kg              |   | 5    | n.d.   | -     |
| Hexabromobiphenyl              | mg/kg              |   | 5    | n.d.   | -     |
| Heptabromobiphenyl             | mg/kg              |   | 5    | n.d.   | -     |
| Octabromobiphenyl              | mg/kg              |   | 5    | n.d.   | -     |
| Nonabromobiphenyl              | mg/kg              |   | 5    | n.d.   | -     |
| Decabromobiphenyl              | mg/kg              |   | 5    | n.d.   | -     |
| <b>Sum of PBDEs</b>            | mg/kg              |   | -    | n.d.   | 1000  |
| Monobromodiphenyl ether        | mg/kg              |   | 5    | n.d.   | -     |
| Dibromodiphenyl ether          | mg/kg              |   | 5    | n.d.   | -     |
| Tribromodiphenyl ether         | mg/kg              |   | 5    | n.d.   | -     |
| Tetrabromodiphenyl ether       | mg/kg              |   | 5    | n.d.   | -     |
| Pentabromodiphenyl ether       | mg/kg              |   | 5    | n.d.   | -     |
| Hexabromodiphenyl ether        | mg/kg              | 5   | n.d. | -      |       |
| Heptabromodiphenyl ether       | mg/kg              | 5   | n.d. | -      |       |
| Octabromodiphenyl ether        | mg/kg              | 5   | n.d. | -      |       |
| Nonabromodiphenyl ether        | mg/kg              | 5   | n.d. | -      |       |
| Decabromodiphenyl ether        | mg/kg              | 5   | n.d. | -      |       |

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| Test Item(s)  | Unit  | Method   | MDL      | Result | Limit |
|---|-------|--|----------|--------|-------|
|   |       |  |          | No.1   |       |
| Polychlorinated Biphenyls (PCBs)<br>(CAS No.: 1336-36-3)                                | mg/kg | With reference to US EPA 3550C: 2007.<br>Analysis was performed by GC/MS.  | 0.5      | n.d.   | -     |
| Polychlorinated Naphthalene<br>(PCNs)   | mg/kg | With reference to US EPA 3550C: 2007.<br>Analysis was performed by GC/MS.  | 5        | n.d.   | -     |
| Polychlorinated Terphenyls<br>(PCTs)  | mg/kg | With reference to US EPA 3550C: 2007.<br>Analysis was performed by GC/MS.  | 0.5      | n.d.   | -     |
| Alkanes, C10-13, chloro (Short<br>Chain Chlorinated Paraffins)<br>(CAS No.: 85535-84-8) | mg/kg | With reference to US EPA 3550C: 2007.<br>Analysis was performed by GC/MS.  | 100      | n.d.   | -     |
| Medium-Chain Chlorinated<br>Paraffins (C14-C17) (MCCP)<br>(CAS No.: 85535-85-9)         | mg/kg | With reference to US EPA 3550C: 2007.<br>Analysis was performed by GC/MS.  | 100      | n.d.   | -     |
| Tributyl Tin (TBT)  | mg/kg | With reference to ISO 17353: 2004. Analysis<br>was performed by GC/FPD.  | 0.03     | n.d.   | -     |
| Bis(tributyltin)oxide (TBTO) (CAS<br>No.: 56-35-9)                                      | mg/kg | With reference to ISO 17353: 2004. Analysis<br>was performed by GC/FPD. Calculated from<br>the result of Tributyl Tin (TBT). | 0.03 (▲) | n.d.   | -     |
| Triphenyl Tin (TphT)  | mg/kg | With reference to ISO 17353: 2004. Analysis<br>was performed by GC/FPD.  | 0.03     | n.d.   | -     |
| Dibutyl Tin (DBT)   | mg/kg | With reference to ISO 17353: 2004. Analysis<br>was performed by GC/FPD.  | 0.03     | n.d.   | -     |
| Diocetyl Tin (DOT)  | mg/kg | With reference to ISO 17353: 2004. Analysis<br>was performed by GC/FPD.  | 0.03     | n.d.   | -     |
| <b>Halogen</b>  |       |  |          |        |       |
| Halogen-Fluorine (F)<br>(CAS No.: 14762-94-8)   | mg/kg | With reference to BS EN 14582: 2016.<br>Analysis was performed by IC.  | 50       | n.d.   | -     |
| Halogen-Chlorine (Cl)<br>(CAS No.: 22537-15-1)  | mg/kg | With reference to BS EN 14582: 2016.<br>Analysis was performed by IC.  | 50       | n.d.   | -     |
| Halogen-Bromine (Br)<br>(CAS No.: 10097-32-2)   | mg/kg | With reference to BS EN 14582: 2016.<br>Analysis was performed by IC.  | 50       | n.d.   | -     |
| Halogen-Iodine (I)<br>(CAS No.: 14362-44-8)   | mg/kg | With reference to BS EN 14582: 2016.<br>Analysis was performed by IC.  | 50       | n.d.   | -     |
| Antimony (Sb)   | mg/kg | With reference to US EPA 3052: 1996.<br>Analysis was performed by ICP-OES.   | 2        | n.d.   | -     |

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| Test Item(s)  | Unit  | Method  | MDL  | Result | Limit |
|---|-------|---|------|--------|-------|
|   |       |   |      | No.1   |       |
| Arsenic (As)  | mg/kg | With reference to US EPA 3052: 1996. Analysis was performed by ICP-OES. | 2    | n.d.   | -     |
| Beryllium (Be)  | mg/kg | With reference to US EPA 3052: 1996. Analysis was performed by ICP-OES. | 2    | n.d.   | -     |
| PFOS and its salts (CAS No.: 1763-23-1 and its salts)   | mg/kg | With reference to CEN/TS 15968: 2010. Analysis was performed by LC/MS.  | 0.01 | n.d.   | -     |
| PFOA and its salts (CAS No.: 335-67-1 and its salts)  | mg/kg | With reference to CEN/TS 15968: 2010. Analysis was performed by LC/MS.  | 0.01 | n.d.   | -     |
| DBP (Dibutyl phthalate) (CAS No.: 84-74-2)  | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | 1000  |
| BBP (Butyl Benzyl phthalate) (CAS No.: 85-68-7)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | 1000  |
| DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | 1000  |
| DIBP (Di-isobutyl phthalate) (CAS No.: 84-69-5)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | 1000  |
| DIHP (1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich) (CAS No.: 71888-89-6)     | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DHNUP (1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters) (CAS No.: 68515-42-4) | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DMEP (Bis (2-methoxyethyl) phthalate) (CAS No.: 117-82-8)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DINP (Di-isononyl phthalate) (CAS No.: 28553-12-0; 68515-48-0)  | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DIDP (Di-isodecyl phthalate) (CAS No.: 26761-40-0; 68515-49-1)  | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DNOP (Di-n-octyl phthalate) (CAS No.: 117-84-0)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DNHP (Di-n-hexyl phthalate) (CAS No.: 84-75-3)  | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |
| DPP (1,2-Benzenedicarboxylic acid, dipentylester, branched and linear) (CAS No.: 84777-06-0)          | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS.   | 50   | n.d.   | -     |

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| Test Item(s)   | Unit  | Method  | MDL | Result | Limit |
|--|-------|---|-----|--------|-------|
|  |       |   |     | No.1   |       |
| NPIPP (N-pentyl iso-pentyl phthalate) (CAS No.: 776297-69-9)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS. | 50  | n.d.   | -     |
| DNPP (Di-n-pentyl phthalate) (CAS No.: 131-18-0)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS. | 50  | n.d.   | -     |
| DIPP (Di-iso-pentyl phthalate) (CAS No.: 605-50-5)   | mg/kg | With reference to IEC 62321-8: 2017. Analysis was performed by GC/MS. | 50  | n.d.   | -     |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified ( $\alpha$ -HBCDD, $\beta$ -HBCDD, $\gamma$ -HBCDD) (CAS No.: 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)) | mg/kg | With reference to IEC 62321: 2008. Analysis was performed by GC/MS.   | 5   | n.d.   | -     |

**Note :**

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. MDL = Method Detection Limit
3. n.d. = Not Detected = less than MDL
4. " - " = Not Regulated
5. (#2) =
  - a. The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13  $\mu\text{g}/\text{cm}^2$ .  
The sample coating is considered to contain Cr(VI)
  - b. The sample is negative for Cr(VI) if Cr(VI) is n.d. (concentration less than 0.10  $\mu\text{g}/\text{cm}^2$ ).  
The coating is considered a non-Cr(VI) based coating
  - c. The result between 0.10  $\mu\text{g}/\text{cm}^2$  and 0.13  $\mu\text{g}/\text{cm}^2$  is considered to be inconclusive - unavoidable coating variations may influence the determination.
6. PFOS and its salts including CAS No.: 29081-56-9, 2795-39-3, 29457-72-5, 70225-14-8, 56773-42-3, 251099-16-8, 307-35-7.
7. PFOA and its salts including CAS No.: 3825-26-1, 335-95-5, 2395-00-8, 335-93-3, 335-66-0.
8. (▲) : The MDL was evaluated for element / tested substance.

Conversion Formula :  $AX = A \times F$

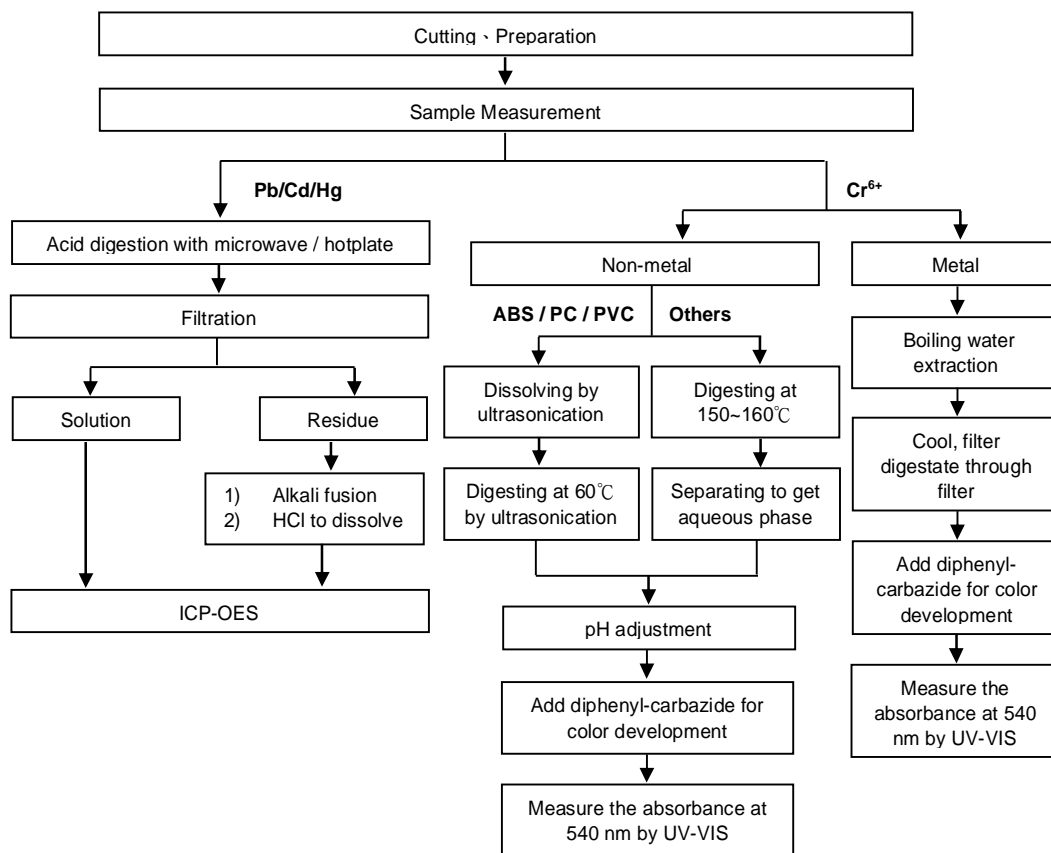
| AX                           | A                  | F     |
|------------------------------|--------------------|-------|
| Bis(tributyltin)oxide (TBTO) | Tributyl Tin (TBT) | 1.024 |

Parameter Conversion Table : [https://twap.sgs.com/sgsrsts/chn/download-REACH\\_tw.asp](https://twap.sgs.com/sgsrsts/chn/download-REACH_tw.asp)

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## Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr<sup>6+</sup> test method excluded)

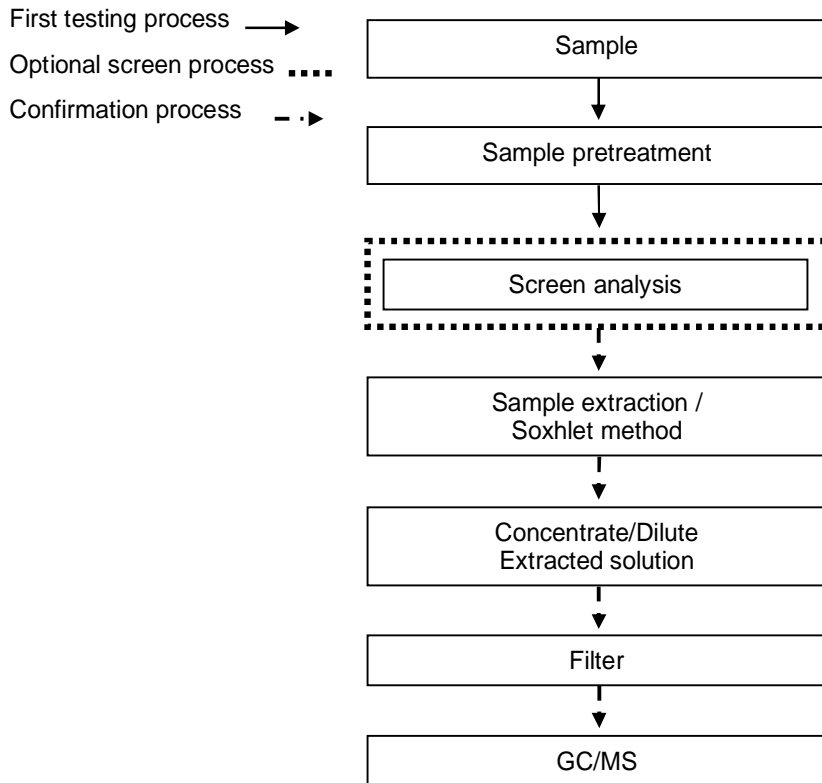


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### Analytical flow chart – PBB / PBDE

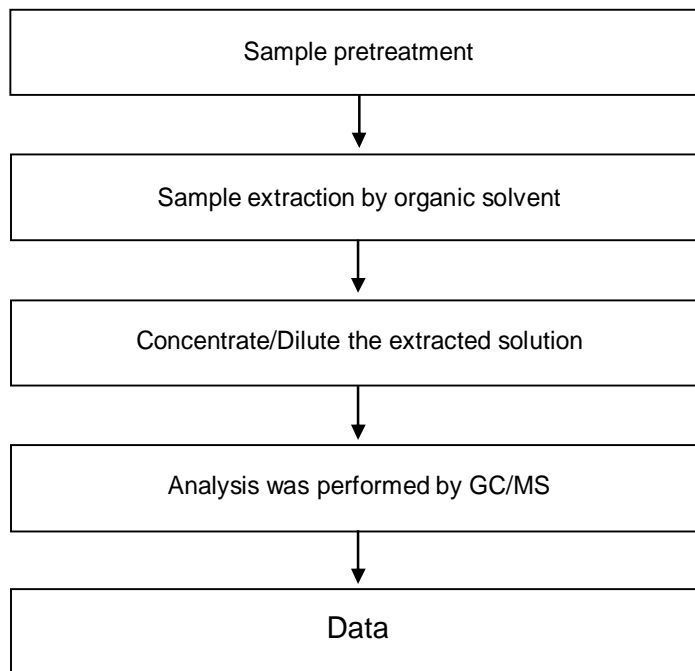


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### Analytical flow chart

\* Apply to: PCBs, PCNs, PCTs, Mirex, Chlorinated Paraffins, DBBT

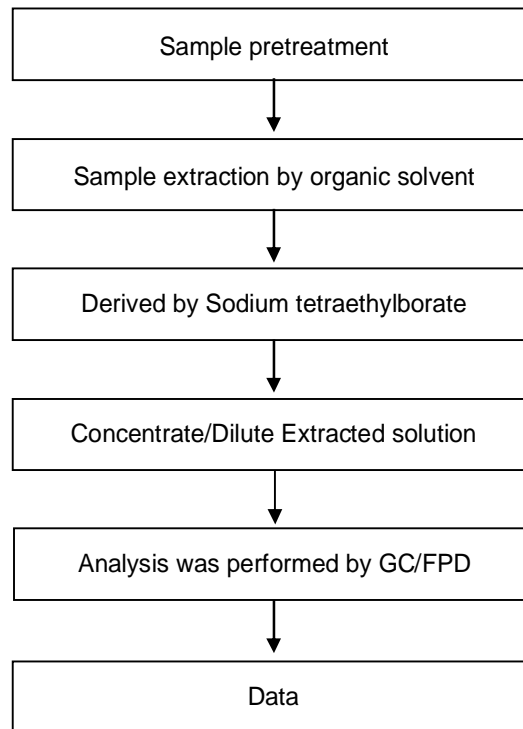




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### Analytical flow chart - Organic-Tin

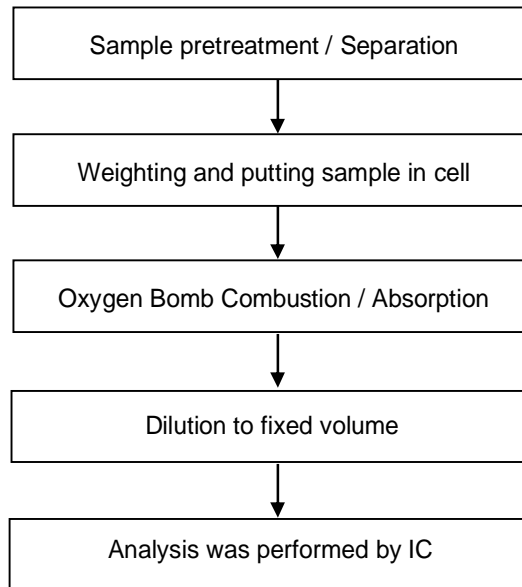


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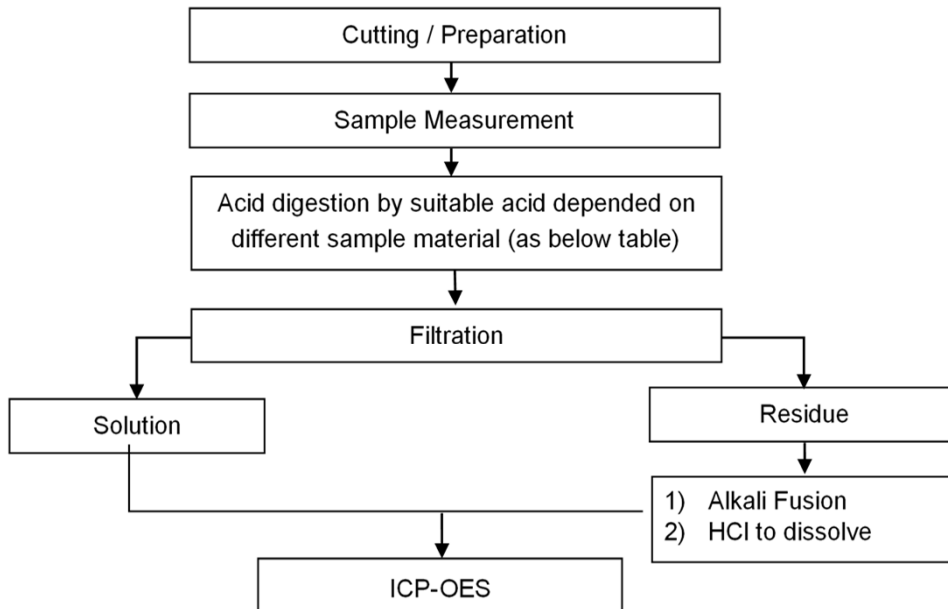
### Analytical flow chart - Halogen



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### Flow Chart of digestion for the elements analysis performed by ICP-OES

These samples were dissolved totally by pre-conditioning method according to below flow chart.

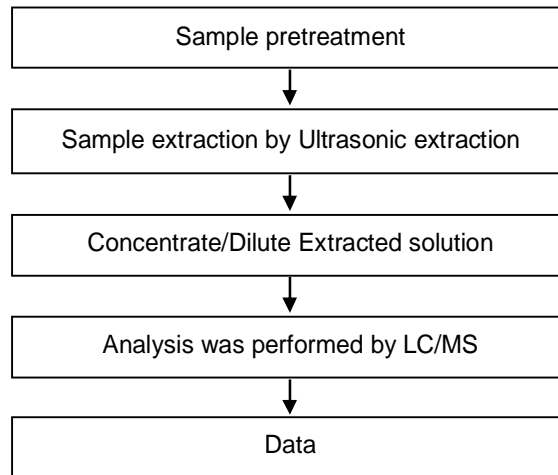


|                                    |   |
|------------------------------------|---|
| Steel, copper, aluminum, solder    | Aqua regia, HNO <sub>3</sub> , HCl, HF, H <sub>2</sub> O <sub>2</sub>                   |
| Glass                              | HNO <sub>3</sub> /HF  |
| Gold, platinum, palladium, ceramic | Aqua regia  |
| Silver                             | HNO <sub>3</sub>  |
| Plastic                            | H <sub>2</sub> SO <sub>4</sub> , H <sub>2</sub> O <sub>2</sub> , HNO <sub>3</sub> , HCl |
| Others                             | Added appropriate reagent to total digestion  |

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### Analytical flow chart - PFOA/PFOS

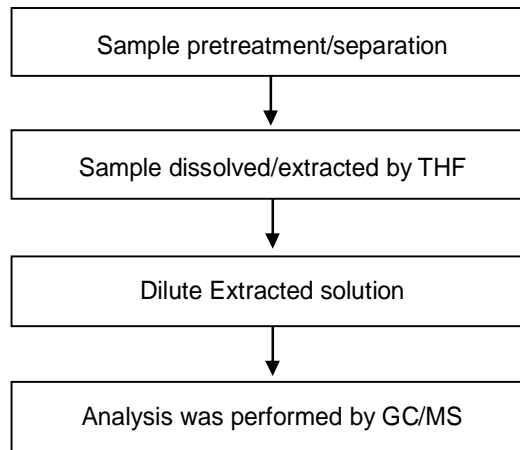


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### Analytical flow chart - Phthalate

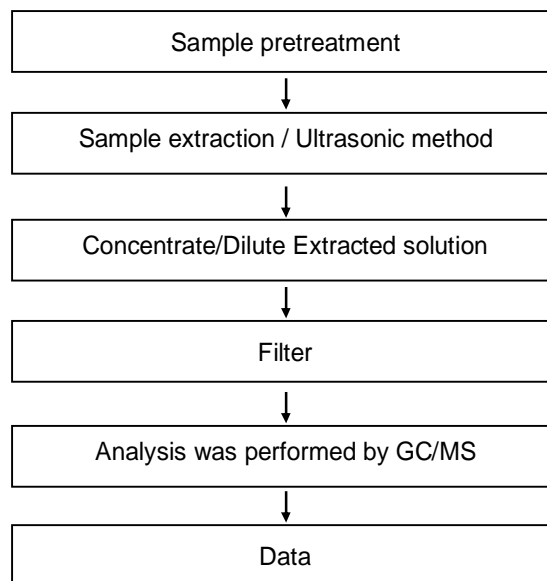
**【Test method: IEC 62321-8】**

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### Analytical flow chart - HBCDD



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## Test Report

No. : CE/2020/94512

Date : 2020/10/06

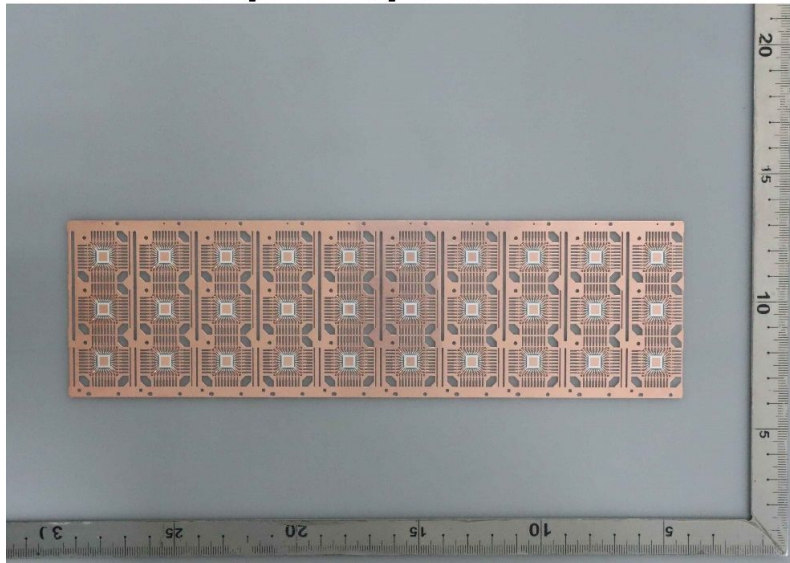
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\* The tested sample / part is marked by an arrow if it's shown on the photo. \*

### CE/2020/94512



\*\* End of Report \*\*

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