

HAESUNGDS CO., LTD.

(Seongju-dong) 726 Ungnam-ro, Seongsan-gu Changwon-si, Gyeongnam Korea

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

SGS File No. : AYGA21-05317
Product Name : LEAD FRAME

Item No./Part No. : Pd Plating

Received Date : 2021. 12. 31

Test Period ; 2021. 12. 31 to 2022. 01. 07

Test Results: For further details, please refer to following page(s)

Page 1 of 15

SGS Korea Co., Ltd.

Issued Date: 2022. 01. 07

Tommy Oh / Chemical Lab Mgr



Sample No. : AYGA21-05317.001

Sample Description : LEAD FRAME
Item No./Part No. : Pd Plating
Materials : Metal Alloy

Heavy Metals

| Test Items | Unit | Test Method | MDL | Results |
|------------------------------|--------|---|-----|---------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321-5 : 2013, by ICP-OES | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321-5 : 2013, by ICP-OES | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321-4 : 2013+AMD1:2017CVS, by ICP-OES | 2 | N.D. |
| Hexavalent Chromium (Cr VI)* | μg/cm² | With reference to IEC 62321-7-1 : 2015, by UV-Vis | 0.1 | N.D. |

Issued Date: 2022. 01. 07

Page 2 of 15

Total Metals

| Test Items | Unit | Test Method | MDL | Results |
|----------------|-------|---|-----|---------|
| Antimony (Sb) | mg/kg | With reference to EPA 3052 : 1996, EPA 6010D : 2018, by ICP | 10 | N.D. |
| Beryllium (Be) | mg/kg | With reference to EPA 3052 : 1996, EPA 6010D : 2018, by ICP | 0.5 | N.D. |
| Arsenic (As) | mg/kg | With reference to EPA 3052 : 1996, EPA 6010D : 2018, by ICP | 10 | N.D. |

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|--|-----|---------|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |



Sample No. : AYGA21-05317.001

Sample Description : LEAD FRAME
Item No./Part No. : Pd Plating
Materials : Metal Alloy

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|--|-----|---------|
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321-6 : 2015, by GC-MS | 5 | N.D. |

Issued Date: 2022. 01. 07

Page 3 of 15

Phthalates

| THE TAIL CO | | | | |
|---|-------|--|-----|---------|
| Test Items | Unit | Test Method | MDL | Results |
| Di-butyl phthalate (DBP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Benzyl butyl phthalate (BBP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-(2-ethylhexyl) phthalate (DEHP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-isobutyl phthalate (DIBP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| [di(C6-C8 alkyl)phthalate] branched (DIHP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| [di(C7-C11 alkyl)phthalate] linear and branched (DHNUP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Bis(2-methoxyethyl) phthalate (BMP, BMEP, DMEP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-isononyl phthalate (DINP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-isodecyl phthalate (DIDP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-n-octyl phthalate (DNOP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-n-hexyl phthalate (DNHP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |
| Di-n-pentyl phthalate(DPP, DnPP) | mg/kg | With reference to IEC 62321-8 : 2017, by GC-MS | 50 | N.D. |

Chlorinated Paraffin

| Test Items | Unit | Test Method | MDL | Results |
|--|-------|--|-----|---------|
| Alkanes, C10~13, Short Chain Chlorinated Paraffins(SCCP) | mg/kg | With reference to ISO 18219, by CI-GC-MS | 50 | N.D. |

Chlorinated Organic Substances

| Test Items | Unit | Test Method | MDL | Results |
|-----------------------------------|-------|---|-----|---------|
| Polychlorinated Naphthalene (PCN) | mg/kg | With reference to US EPA 8081 A(US EPA 3550C), by GC/MS | 5 | N.D. |



Sample No. : AYGA21-05317.001

Sample Description : LEAD FRAME
Item No./Part No. : Pd Plating
Materials : Metal Alloy

Polymer Identification

| Test Items | Unit | Test Method | MDL | Results |
|------------|------|-------------|-----|----------|
| PVC | ** | FT-IR | - | Negative |

Issued Date: 2022. 01. 07

Page 4 of 15

Halogen Content

| Test Items | Unit | Test Method | MDL | Results |
|--------------|-------|---|-----|---------|
| Bromine(Br) | mg/kg | With reference to BS EN 14582 : 2016, by IC | 30 | N.D. |
| Chlorine(Cl) | mg/kg | With reference to BS EN 14582 : 2016, by IC | 30 | N.D. |
| Fluorine(F) | mg/kg | With reference to BS EN 14582 : 2016, by IC | 30 | N.D. |
| lodine(I) | mg/kg | With reference to BS EN 14582 : 2016, by IC | 50 | N.D. |

Organotin Compounds

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|------------------------------------|------|---------|
| Tributyltin (TBT) | mg/kg | With reference to ISO 17353, GC/MS | 0.02 | N.D. |
| Triphenyltin (TPhT) | mg/kg | With reference to ISO 17353, GC/MS | 0.02 | N.D. |
| Dibutyltin (DBT) | mg/kg | With reference to ISO 17353, GC/MS | 0.02 | N.D. |
| Dioctyltin (DOT) | mg/kg | With reference to ISO 17353, GC/MS | 0.02 | N.D. |
| Tributyltin oxide (TBTO) | mg/kg | With reference to ISO 17353, GC/MS | 0.02 | N.D. |

Flame Retardants

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------------|-------|--|-----|---------|
| Hexabromocyclododecane (HBCDD) | mg/kg | With reference to USEPA 3540 C, by LC/MS | 5 | N.D. |

Other(s)

| Test Items | Unit | Test Method | MDL | Results |
|-----------------------------------|-------|---|-----|---------|
| Polychlorinated Biphenyls (PCBs) | mg/kg | With reference to US EPA 8082,(US EPA 3550C), by GC/MS | 3 | N.D. |
| Polychlorinated terphenyls (PCTs) | mg/kg | With reference to US EPA 8082,(US EPA 3550C), by GC/MS | 3 | N.D. |

Perfluorinated Compounds (PFC)

| Test Items | Unit | Test Method | MDL | Results |
|--|-------|------------------------|-----|---------|
| Perfluorootanoic acid (PFOA) and its salts + | μg/kg | CEN/TS 15968, LC/MS/MS | 10 | N.D. |



Sample No. : AYGA21-05317.001

Sample Description : LEAD FRAME

Item No./Part No. : Pd Plating

Materials : Metal Alloy

Perfluorinated Compounds (PFC)

| Test Items | Unit | Test Method | MDL | Results |
|--|-------|------------------------|-----|---------|
| Perfluorooctane sulfonate (PFOS) and its salts ^ | μg/kg | CEN/TS 15968, LC/MS/MS | 10 | N.D. |

Issued Date: 2022. 01. 07

Page 5 of 15

^ PFOS refer to its salts / derivative including PFOS-K (CAS No.: 2795-39-3) , PFOS-Li (CAS No.: 29457-72-5), PFOS-NH4 (CAS No.: 29081-56-9), PFOS-NH(OH)2 (CAS No.: 70225-14-8), PFOS-N(C2H5)4 (CAS No.: 56773-42-3), PFOS-N(C10H21)2(CH3)2 (CAS No. 251099-16-8) and POSF (CAS No.: 307-35-7).

+ PFOA refer to its salts including PFOA-Na (CAS No.: 335-95-5), PFOA-K (CAS No.: 2395-00-8), PFOA-Ag (CAS No.: 335-93-3), PFOA-F (CAS No.: 335-66-0) and APFO (CAS No.: 3825-26-1).

NOTE: (1) N.D. = Not detected. (<MDL)

- (2) mg/kg = ppm, ug/kg = ppb, mg/L = ppm
- (3) MDL = Method Detection Limit
- (4) = No regulation
- (5) ** = Qualitative analysis (No Unit)
- (6) Negative = Undetectable / Positive = Detectable
- (7) * = a. The sample is positive for Cr VI if the Cr VI concentration is greater than 0.13 ug/cm2.

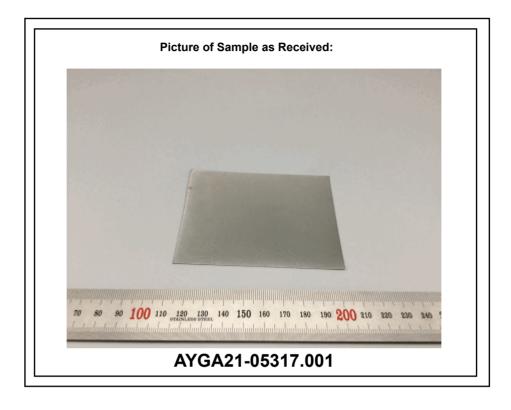
The sample coating is considered to contain Cr VI.

- b. The sample is negative for Cr VI if Cr VI is ND(concentration less than 0.10 ug/cm2). The coating is considered a non-Cr VI based coating.
- c. The result between 0.10 ug/cm2 and 0.13 ug/cm2 is considered to be inconclusive unavoidable coating variations may influence the determination.
- (8) The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test report is not related to Korea Laboratory Accreditation Scheme.



Page 6 of 15



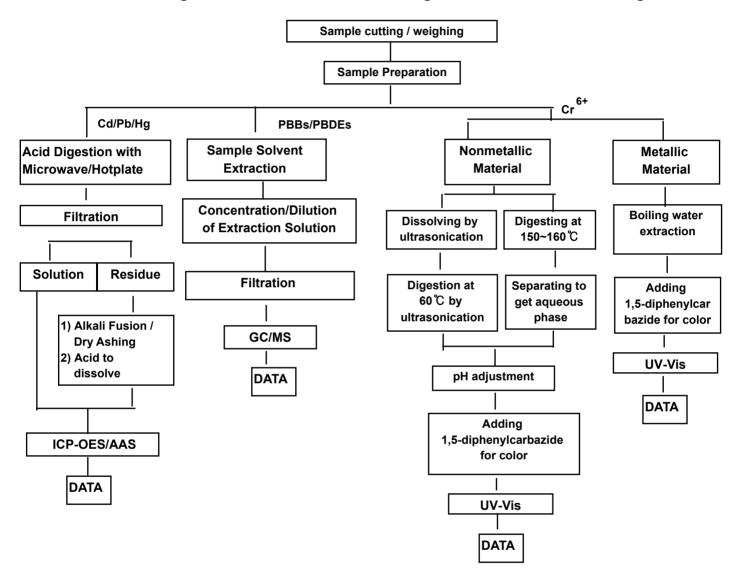
Issued Date: 2022. 01. 07



Page 7 of 15

Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing

Issued Date: 2022. 01. 07



The samples were dissolved totally at the acid digestion step of the above flow chart for Cd,Pb,Hg Section Chief: Timothy Jeon

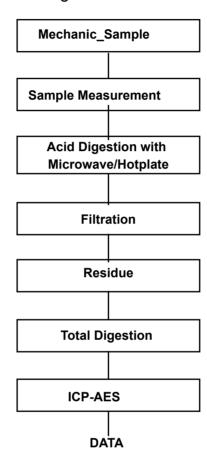


Page 8 of 15

Flow Chart for Inorganic Elements Testing

Issued Date: 2022. 01. 07

Inorganic Elements

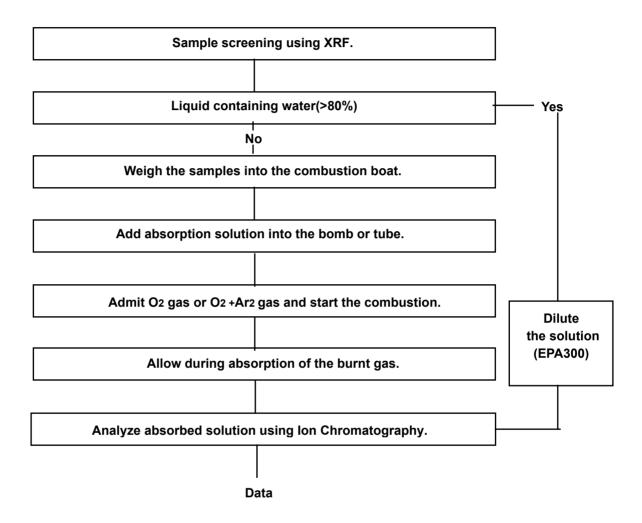


Major Inorganic Antimony(Sb) , Beryllium(Be) , Phosphorus(P) ,
Heavy Metals Arsenic(As) etc.



Page 9 of 15

Flow Chart for Halogen Test



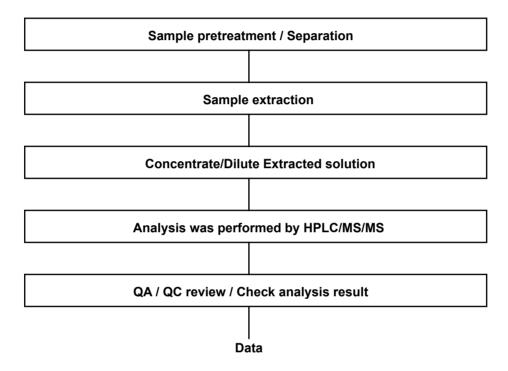
Issued Date: 2022. 01. 07



Page 10 of 15

Flow Chart for PFOS/PFOA Test

Issued Date: 2022. 01. 07

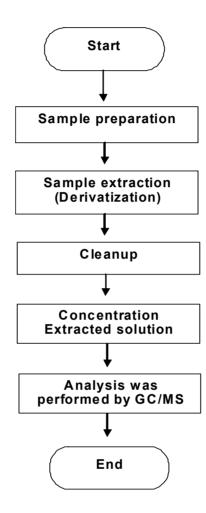




Page 11 of 15

Organotin Flow Chart

Issued Date: 2022. 01. 07

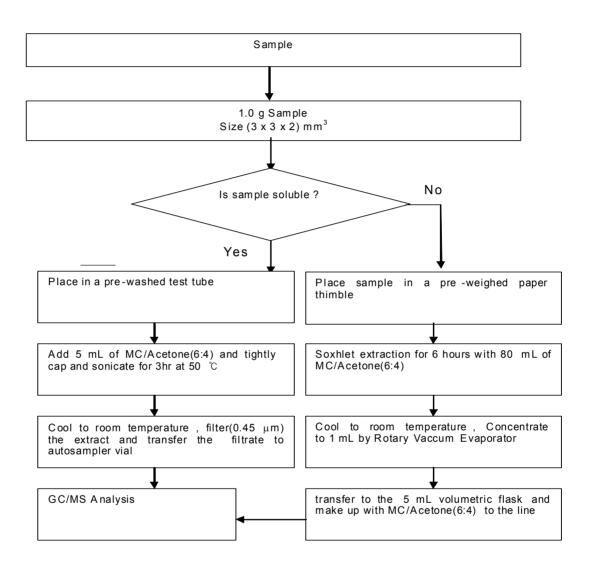




Page 12 of 15

PCBs,PCTs,PCNs Flow Chart

Issued Date: 2022. 01. 07

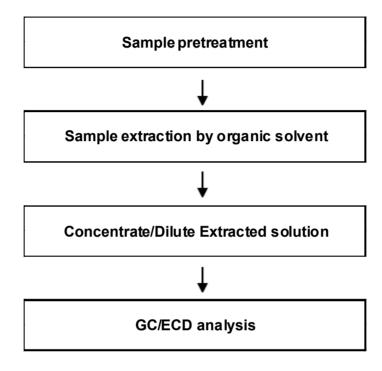




Page 13 of 15

SCCP Analysis Flow Chart

Issued Date: 2022. 01. 07

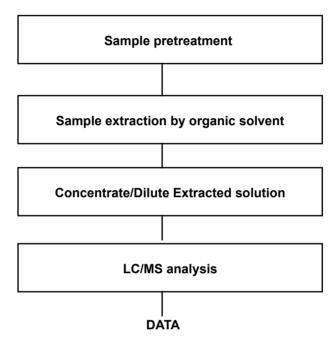




Page 14 of 15

Testing Flow Chart for HBCD

Issued Date: 2022. 01. 07

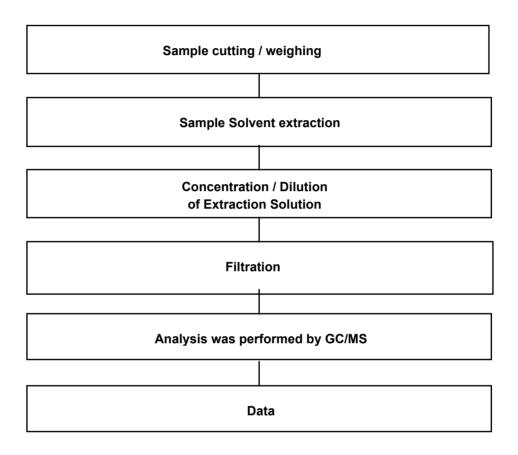




Page 15 of 15

Flow Chart for PhthalateTest

Issued Date: 2022. 01. 07



*** End of Report ***