

•

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. : AYGA21-05318
Product Name : LEAD FRAME

Item No./Part No. : Au 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)

SGS Korea Co., Ltd.

Page 1 of 15

Issued Date: 2022. 01. 07

Tommy Oh / Chemical Lab Mgr



Sample No. : AYGA21-05318.001

Sample Description : LEAD FRAME
Item No./Part No. : Au 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. : AYGA21-05318.001

Sample Description : LEAD FRAME
Item No./Part No. : Au 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.

Phthalates

Titrialities .						
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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at https://www.sgs.com/en/Terms-and-Conditions.aspx and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at https://www.sgs.com/en/terms-and-conditions/terms-e-document. Attention is drawn to the limitation of liability, indemnification 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 intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, 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. Unless otherwise stated the results shown in this test report refer only to the sample(s).

Issued Date: 2022. 01. 07

Page 3 of 15



Sample No. : AYGA21-05318.001

Sample Description : LEAD FRAME
Item No./Part No. : Au 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. : AYGA21-05318.001

Sample Description : LEAD FRAME

Item No./Part No. : Au 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.

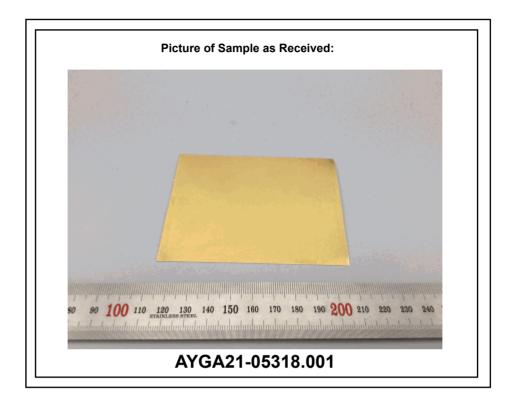
The sample coating is considered to contain Cr VI.

- 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



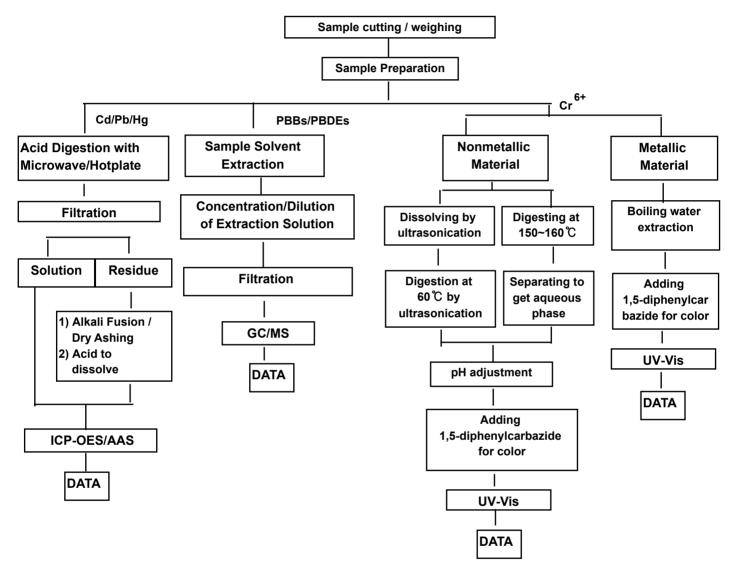
Issued Date: 2022. 01. 07



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

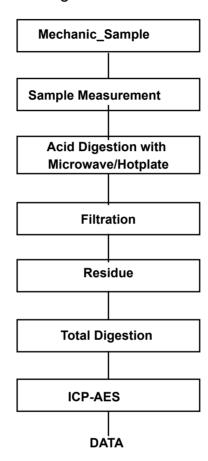


Page 8 of 15

Flow Chart for Inorganic Elements Testing

Issued Date: 2022. 01. 07

Inorganic Elements

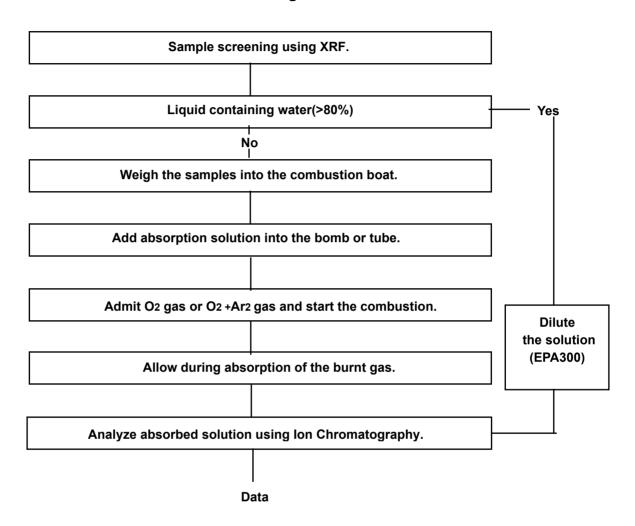


Major Inorganic Antimony(Sb) , Beryllium(Be) , Phosphorus(P) ,
Heavy Metals Arsenic(As) etc.



Page 9 of 15

Flow Chart for Halogen Test



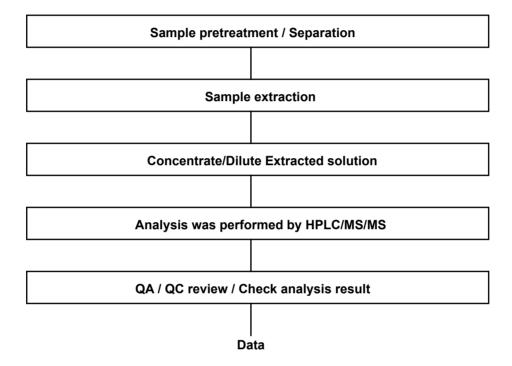
Issued Date: 2022. 01. 07



Page 10 of 15

Flow Chart for PFOS/PFOA Test

Issued Date: 2022. 01. 07

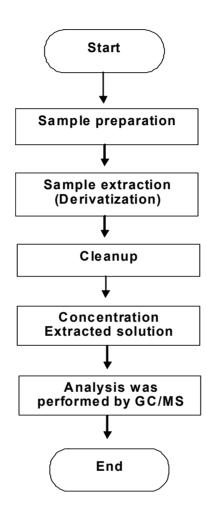




Page 11 of 15

Organotin Flow Chart

Issued Date: 2022. 01. 07

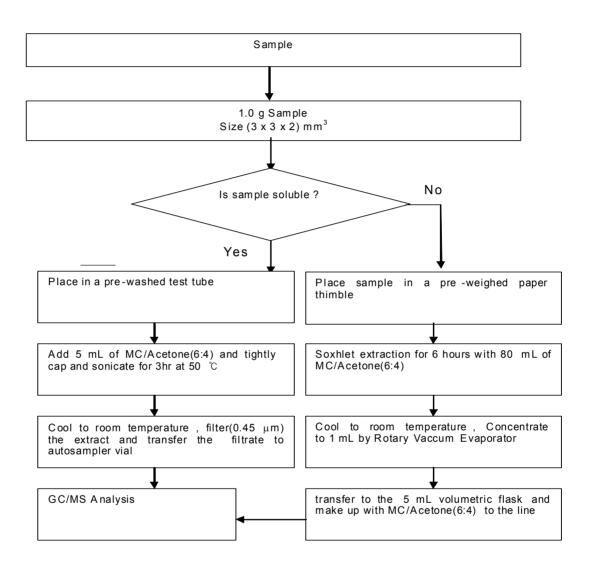




Page 12 of 15

PCBs,PCTs,PCNs Flow Chart

Issued Date: 2022. 01. 07

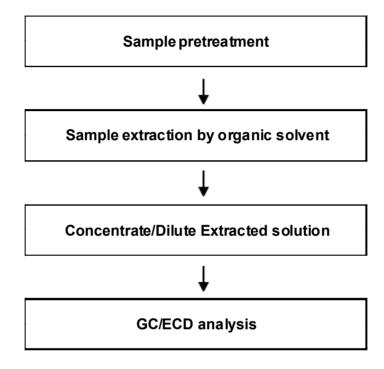




Page 13 of 15

SCCP Analysis Flow Chart

Issued Date: 2022. 01. 07

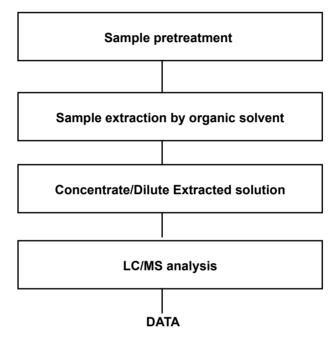




Page 14 of 15

Testing Flow Chart for HBCD

Issued Date: 2022. 01. 07

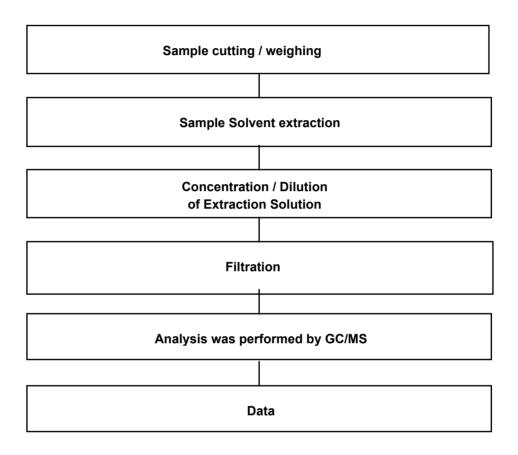




Page 15 of 15

Flow Chart for PhthalateTest

Issued Date: 2022. 01. 07



*** End of Report ***