

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. : AYGA22-04758
Product Name : LEAD FRAME

Item No./Part No. : C194

Received Date : 2022. 12. 20

Test Period : 2022. 12. 20 to 2022. 12. 27

Conclusion : Based on the performed tests on selected part of submitted samples, the results of Cadmium,

Lead, Mercury, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE), Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP), and Diisobutyl phthalate (DIBP) comply with the limits as set by RoHS

Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

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

SGS Korea Co., Ltd.

Page 1 of 16

Issued Date: 2022. 12. 27

Tommy Oh / Chemical Lab Mgr

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Sample No. : AYGA22-04758.001

Sample Description : LEAD FRAME

Item No./Part No. : C194

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	63.9
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.

Total Metals

Test Items	Unit	Test Method	MDL	Results
Antimony (Sb)	mg/kg	With reference to EPA 3052 : 1996, EPA 6010D : 2018, by ICP-OES	10	N.D.
Beryllium (Be)	mg/kg	With reference to EPA 3052 : 1996, EPA 6010D : 2018, by ICP-OES	5	N.D.
Arsenic (As)	mg/kg	With reference to EPA 3052 : 1996, EPA 6010D : 2018, by ICP-OES	10	N.D.

Flame Retardants-PBBs/PBDEs

Tame netaldants 1 BBS/1 BBS				
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.

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Issued Date: 2022. 12. 27

Page 2 of 16



Sample No. : AYGA22-04758.001

Sample Description : LEAD FRAME

Item No./Part No. : C194

Materials : Metal Alloy

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
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.
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

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

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Issued Date: 2022. 12. 27

Page 3 of 16



Sample No. : AYGA22-04758.001

Sample Description : LEAD FRAME

Item No./Part No. : C194

Materials : Metal Alloy

Chlorinated Paraffin

Test Items	Unit	Test Method	MDL	Results
Alkanes, C14~17, Medium Chain Chlorinated Paraffins (MCCP)	mg/kg	With reference to ISO 18219, by CI-GC-MS	50	N.D.
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.

PCBs & PCTs

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.

Polymer Identification

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

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.
Iodine(I)	mg/kg	With reference to BS EN 14582 : 2016, by IC	50	N.D.

Organotin Compounds

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Issued Date: 2022. 12. 27

Page 4 of 16



Sample No. : AYGA22-04758.001

Sample Description : LEAD FRAME

Item No./Part No. : C194

Materials : Metal Alloy

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.

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.
Perfluorooctane sulfonate (PFOS) and its salts ^	μg/kg	CEN/TS 15968, LC/MS/MS	10	N.D.

[^] 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).

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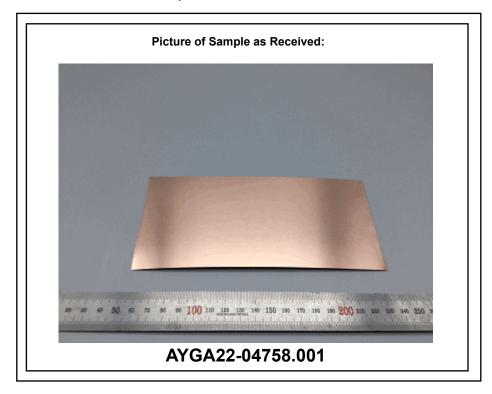
Issued Date: 2022. 12. 27

Page 5 of 16



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.



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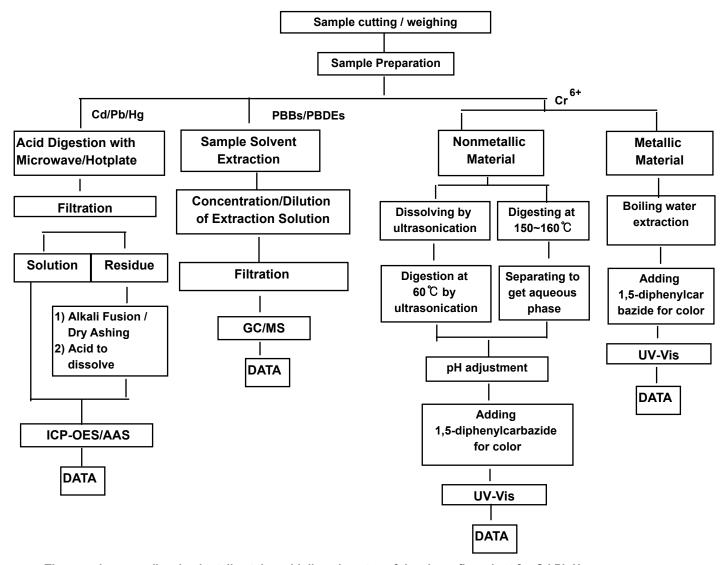
Page 6 of 16



Page 7 of 16

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

Issued Date: 2022. 12. 27



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

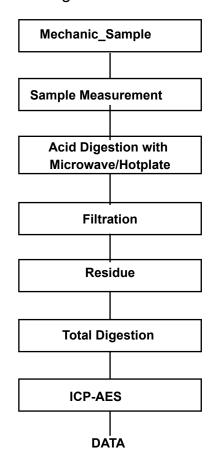


Page 8 of 16

Flow Chart for Inorganic Elements Testing

Issued Date: 2022. 12. 27

Inorganic Elements

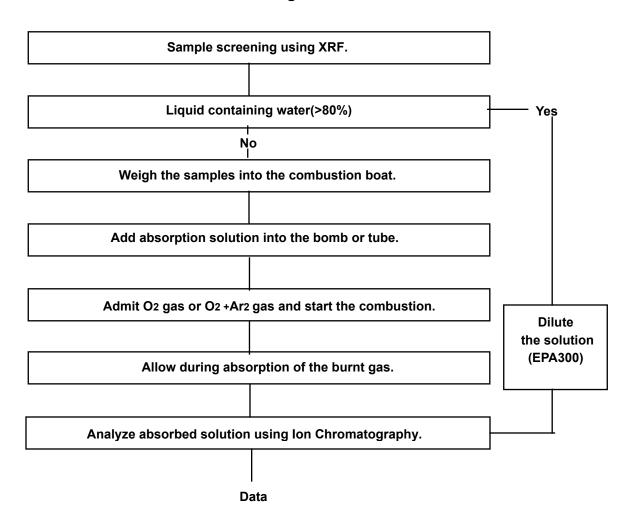


Major Inorganic Antimony(Sb) , Beryllium(Be) , Phosphorus(P) ,
Heavy Metals Arsenic(As) etc.



Page 9 of 16

Flow Chart for Halogen Test



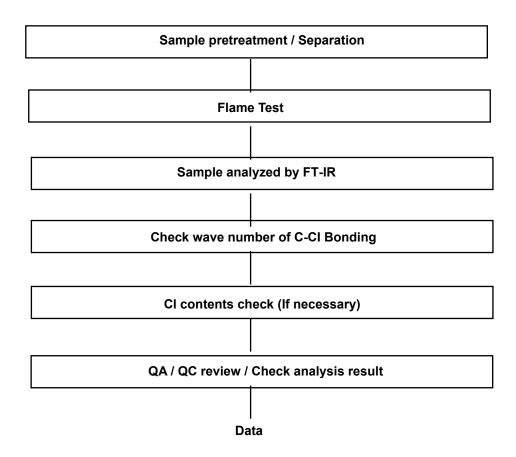
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Page 10 of 16

Flow Chart for PVC Test

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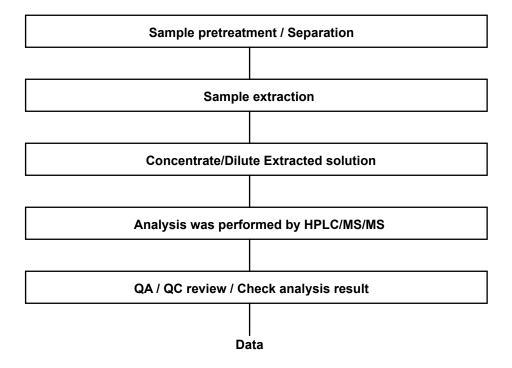




Page 11 of 16

Flow Chart for PFOS/PFOA Test

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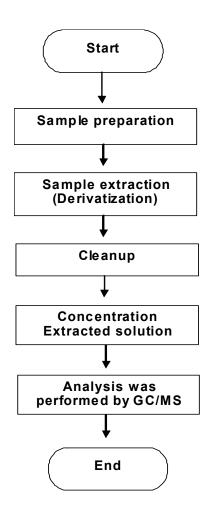




Page 12 of 16

Organotin Flow Chart

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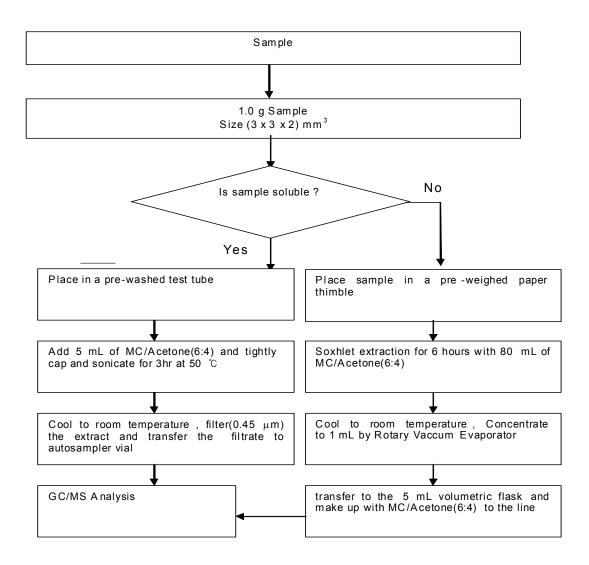




Page 13 of 16

PCBs,PCTs,PCNs Flow Chart

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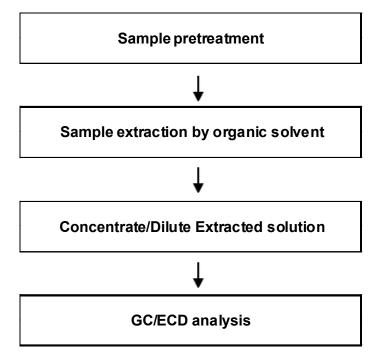




Page 14 of 16

SCCP Analysis Flow Chart

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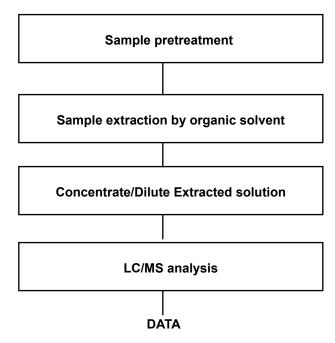




Page 15 of 16

Testing Flow Chart for HBCD

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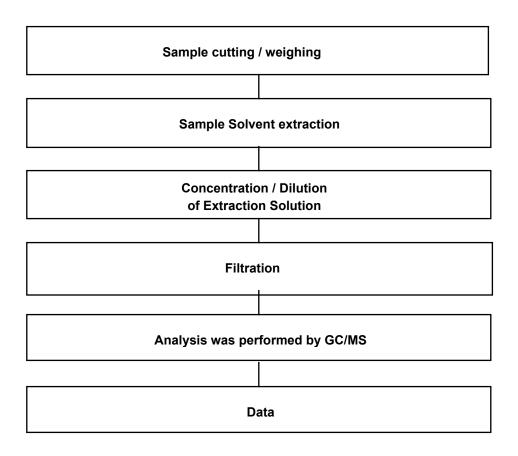




Page 16 of 16

Flow Chart for PhthalateTest

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*** End of Report ***