

## TEST REPORT

APPLICANT : Alpha Assembly Solutions Korea Ltd.  
ADDRESS : 40, Okgucheonseo-ro 131beon-gil,  
Siheung-si, Gyeonggi-do, Korea

PAGE: 1 of 12

REPORT NO. RT23R-S4295-003-E-R2

DATE: Jul. 24, 2023

SAMPLE DESCRIPTION : The following submitted sample(s) said to be:-

NAME/TYPE OF PRODUCT : SOLDER Sphere SAC387  
SAMPLE ID NO. : RT23R-S4295-003  
MANUFACTURER/VENDOR : Alpha Assembly Solutions Korea Ltd.

SAMPLE RECEIVED : Jul. 05, 2023  
TESTING DATE : Jul. 05, 2023 ~ Jul. 12, 2023

TEST METHOD(S) : Please see the following page(s).  
TEST RESULT(S) : Please see the following page(s).

\* Note 1 : The test results presented in this report refer only to the object tested.

\* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

Approved by,



Jade Jang / Lab. Technical Manager

Authorized by,



Bo Park / Lab. General Manager



Authenticity check



## TEST REPORT

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DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-003-E-R2

SAMPLE ID NO. : RT23R-S4295-003  
SAMPLE DESCRIPTION : SOLDER Sphere SAC387

TEST ITEM	UNIT	TEST METHOD	MDL	RESULT
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5 Edition 1.0 : 2013, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg		5	236
Mercury (Hg)	mg/kg	With reference to IEC 62321-4 : 2013/AMD1 : 2017, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr <sup>6+</sup> ) (For metal)	μg/cm <sup>2</sup>	With reference to IEC 62321-7-1 Edition 1.0 : 2015, by boiling water extraction and determined by UV-VIS Spectrophotometer	0.10	Negative

Tested by : Jooyeon Lee, Chano Kim

Notes : mg/kg = ppm = parts per million  
μg/cm<sup>2</sup> = microgram per square centimeter  
< = Less than  
N.D. = Not detected (<MDL)  
MDL = Method detection limit

Remarks : Interpretation of Cr<sup>6+</sup> results

Qualitative result	Concentration of Cr <sup>6+</sup> (μg/cm <sup>2</sup> )	Meaning
Negative	< 0.10	The sample coating is considered a non-Cr <sup>6+</sup> based coating.
Inconclusive	0.10 ≤ and ≤ 0.13	Unavoidable coating variation may influence the determination.
Positive	> 0.13	The sample coating is considered to contain Cr <sup>6+</sup> .

- The qualitative results should be determination by the average result of three test results.  
(If concentration of Cr<sup>6+</sup> is over 0.10μg/cm<sup>2</sup>)
- The above results will be carried out by visual comparison only with the standard.



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SAMPLE ID NO. : RT23R-S4295-003

SAMPLE DESCRIPTION : SOLDER Sphere SAC387

TEST ITEM	UNIT	TEST METHOD	MDL	RESULT
<b>Polybrominated Biphenyl (PBBs)</b>				
Monobromobiphenyl	mg/kg	With reference to IEC 62321-6 Edition 1.0 : 2015, by solvent extraction and determined by GC/MS	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>Polybrominated Diphenyl Ether (PBDEs)</b>				
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321-6 Edition 1.0 : 2015, by solvent extraction and determined by GC/MS	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.

Tested by : Hayan Park

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REPORT NO. RT23R-S4295-003-E-R2

SAMPLE ID NO. : RT23R-S4295-003

SAMPLE DESCRIPTION : SOLDER Sphere SAC387

TEST ITEM	UNIT	TEST METHOD	MDL	RESULT
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Fluorine (F)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Iodine (I)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Arsenic (As)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	19
Beryllium (Be)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Nickel (Ni)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	19
Antimony (Sb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	50
Hexabromocyclododecane (HBCDD)	mg/kg	With reference to IEC 62321-9 : 2021, by solvent extraction and determined by LC/MS and GC/MS	10	N.D.
Perfluorooctanoic acid (PFOA)	mg/kg	With reference to DIN CEN/TS 15968, by ultrasonic extraction and determined by LC/MS or LC/MS/MS	0.025	N.D.
Perfluorooctane sulfonate (PFOS)	mg/kg	With reference to DIN CEN/TS 15968, by ultrasonic extraction and determined by LC/MS or LC/MS/MS	0.025	N.D.

Tested by : Chano Kim, Jooyeon Lee, Hayan Park

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Intertek Testing Services Korea Ltd.  
Seoul Office: Tel : 02-6090-9500 Fax : 02-3409-0025 Web Site : [intertek.co.kr](http://intertek.co.kr)  
Seoul Lab. Address : 7, Ahasan-ro 5-gil, Seongdong-gu, Seoul, 04793 Korea



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## TEST REPORT

REPORT NO. RT23R-S4295-003-E-R2

SAMPLE ID NO. : RT23R-S4295-003

SAMPLE DESCRIPTION : SOLDER Sphere SAC387

TEST ITEM	CAS NO.	UNIT	TEST METHOD	MDL	RESULT
Phthalates					
Dibutyl phthalate (DBP)	84-74-2	mg/kg	With reference to IEC 62321-8 Edition 1.0 : 2017, by solvent extraction and determined by GC/MS	50	N.D.
Di(2-ethylhexyl) phthalate (DEHP)	117-81-7	mg/kg		50	N.D.
Diisononyl phthalate (DINP)	28553-12-0 68515-48-0	mg/kg		100	N.D.
Diisodecyl phthalate (DIDP)	26761-40-0 68515-49-1	mg/kg		100	N.D.
Benzyl butyl phthalate (BBP)	85-68-7	mg/kg		50	N.D.
Diisobutyl phthalate (DIBP)	84-69-5	mg/kg		50	N.D.
Dimethyl phthalate (DMP)	131-11-3	mg/kg		50	N.D.
Diethyl phthalate (DEP)	84-66-2	mg/kg		50	N.D.
Di-n-pentyl phthalate (DPP)	131-18-0	mg/kg		50	N.D.
Di-n-hexyl phthalate (DNHP)	84-75-3	mg/kg		50	N.D.
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich (DIHP)	71888-89-6	mg/kg		50	N.D.
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (DHNUP)	68515-42-4	mg/kg		50	N.D.

Tested by : Hayan Park

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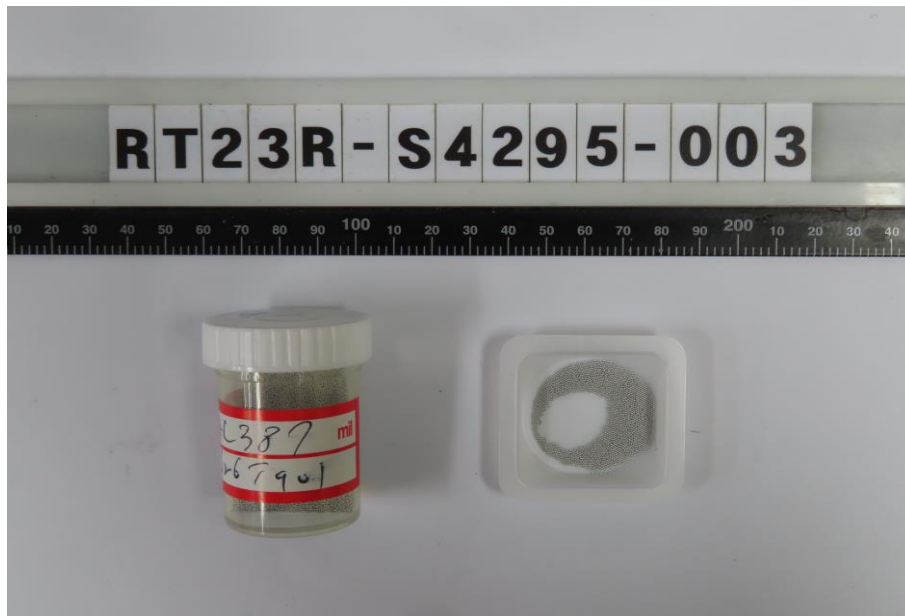
SAMPLE ID NO. : RT23R-S4295-003  
SAMPLE DESCRIPTION : SOLDER Sphere SAC387

TEST ITEM	CAS NO.	UNIT	TEST METHOD	MDL	RESULT
Di(2-methoxyethyl) phthalate (DMEP)	117-82-8	mg/kg	With reference to IEC 62321-8 Edition 1.0 : 2017, by solvent extraction and determined by GC/MS	50	N.D.
Diisopentyl phthalate (DIPP)	605-50-5	mg/kg		50	N.D.

Tested by : Hayan Park

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\* View of sample as received;-



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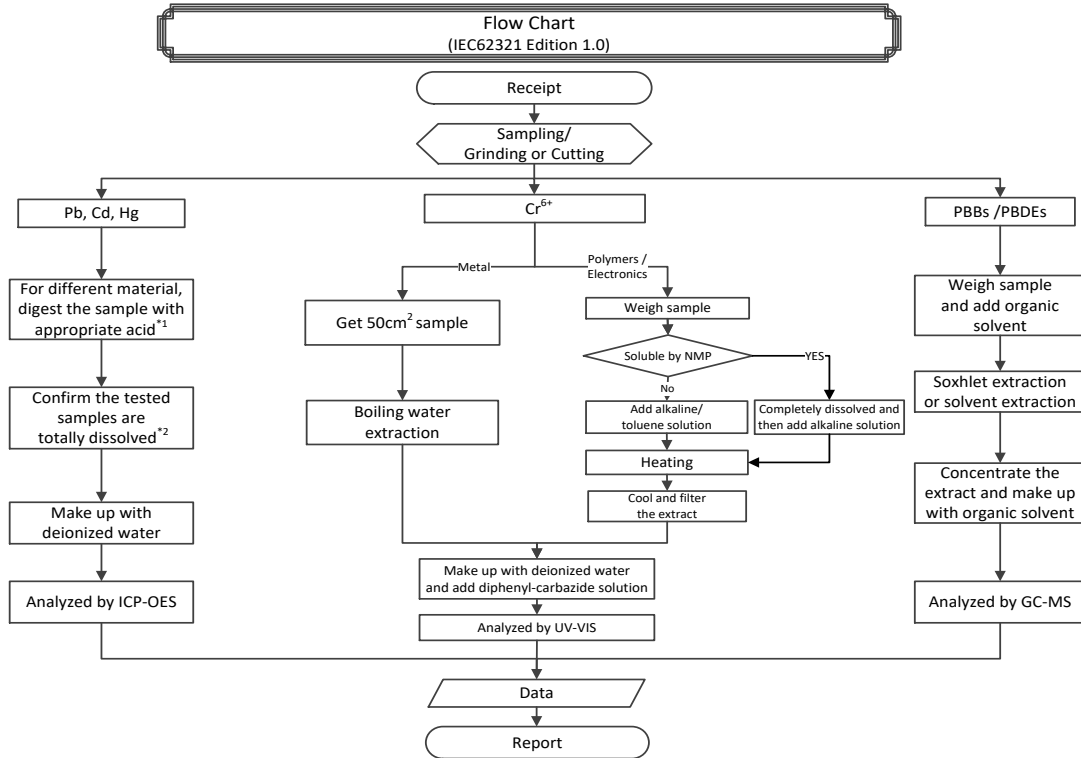
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SAMPLE DESCRIPTION : SOLDER Sphere SAC387



**Remarks :**

\*1 : List of appropriate acid :

Material	Acid added for digestion
Polymers	HNO <sub>3</sub> , HCl, HF, H <sub>2</sub> O <sub>2</sub> , H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3</sub> , HCl, HF
Electronics	HNO <sub>3</sub> , HCl, H <sub>2</sub> O <sub>2</sub> , HBF <sub>4</sub>

\*2 : The samples were dissolved totally by pre-conditioning method according to above flow chart.

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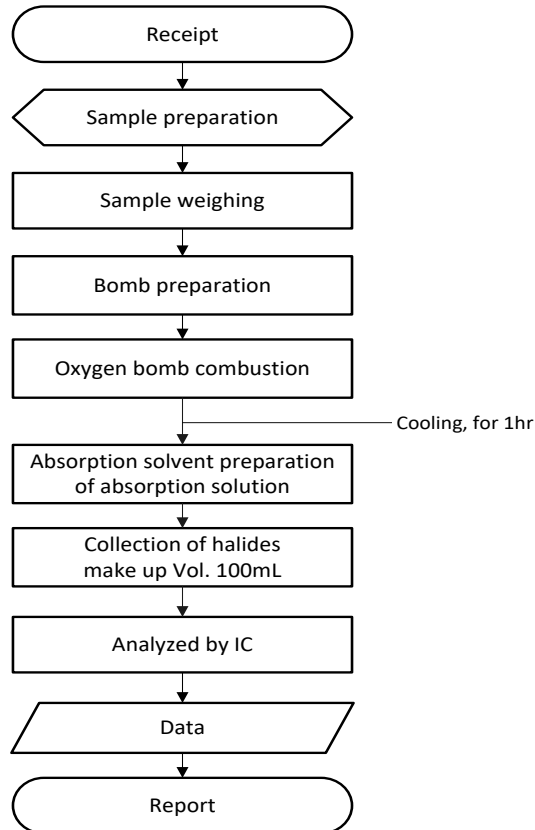
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SAMPLE DESCRIPTION : SOLDER Sphere SAC387

### Flow Chart (EN14582)





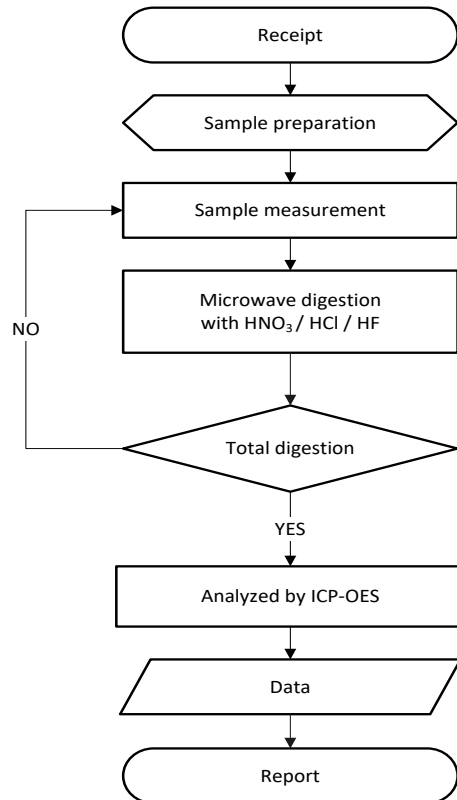
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SAMPLE DESCRIPTION : SOLDER Sphere SAC387

### Flow Chart (Metal Testing)



\*\* Remarks : The samples were dissolved totally by pre-conditioning method according to above flow chart.



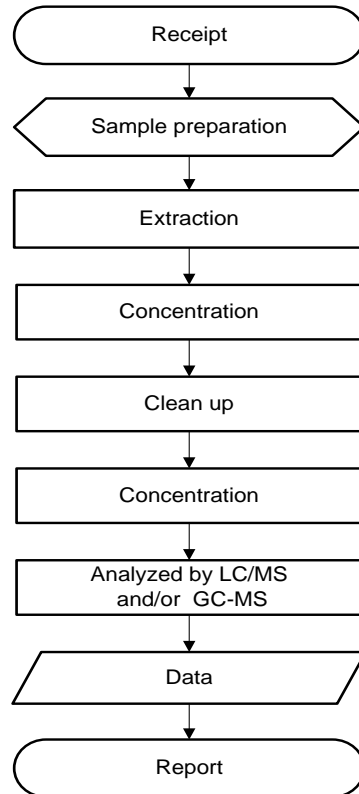
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SAMPLE DESCRIPTION : SOLDER Sphere SAC387

### Flow Chart (HBCDD)



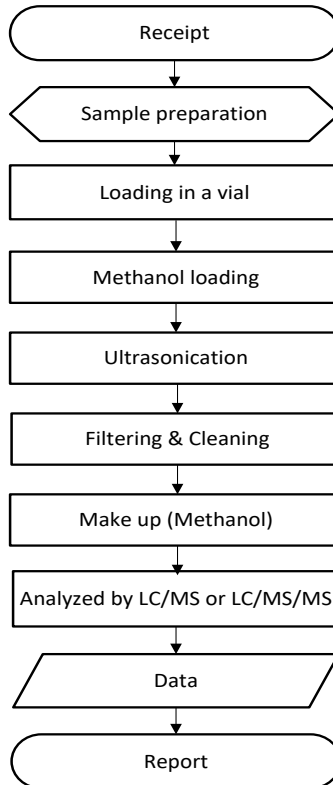
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### Flow Chart (PFOS, PFOA)



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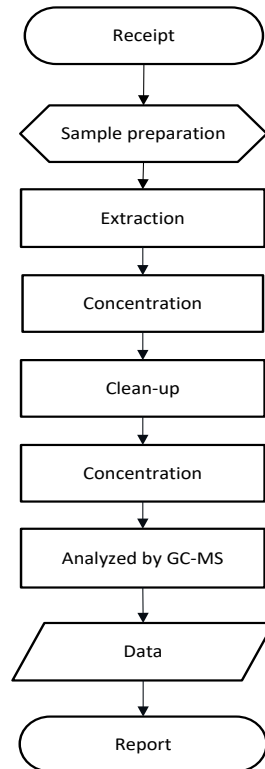
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SAMPLE DESCRIPTION : SOLDER Sphere SAC387

### Flow Chart (Phthalates)



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

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