

## TEST REPORT

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

PAGE: 1 of 17

REPORT NO. RT23R-S4295-008-E-R2

DATE: Jul. 24, 2023

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

NAME/TYPE OF PRODUCT : SOLDER Sphere SAC105  
SAMPLE ID NO. : RT23R-S4295-008  
MANUFACTURER/VENDOR : Alpha Assembly Solutions Korea Ltd.

SAMPLE RECEIVED : Jul. 05, 2023  
TESTING DATE : Jul. 05, 2023 ~ Jul. 13, 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

PAGE: 2 of 17  
DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008  
SAMPLE DESCRIPTION : SOLDER Sphere SAC105

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	252
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> .

1. 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>)
2. The above results will be carried out by visual comparison only with the standard.



## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008  
SAMPLE DESCRIPTION : SOLDER Sphere SAC105

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

Notes : mg/kg = ppm = parts per million  
< = Less than  
N.D. = Not detected (<MDL)  
MDL = Method detection limit



※ You can verify the forgery and authenticity by the barcode at the end of this document.

## TEST REPORT

PAGE: 4 of 17  
DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

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	27
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	16
Antimony (Sb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	41
Polyvinyl chloride (PVC)	-	With reference to KS K 0210-1, and determined by FT-IR	N.A.	Negative

Tested by : Chano Kim, Jooyeon Lee

Notes : mg/kg = ppm = parts per million  
 < = Less than  
 N.D. = Not detected ( <MDL )  
 MDL = Method detection limit  
 Negative = Undetectable  
 Positive = Detectable



## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

TEST ITEM	UNIT	TEST METHOD	MDL	RESULT
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.
Short-chain chlorinated paraffin (SCCP)	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by LC/MS/MS and/or GC/ECD	100	N.D.
Polychlorinated biphenyls (PCBs)	mg/kg	With reference to US EPA 3540C/8082, by solvent extraction and determined by GC/MS	5	N.D.
Polychlorinated terphenyls (PCTs)	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	5	N.D.
Polychlorinated naphthalenes (PCNs)	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	5	N.D.
Tributyltin (TBT)	mg/kg	With reference to ISO 17353, by solvent extraction and determined by GC/MS	1	N.D.
Triphenyltin (TPHT)	mg/kg	With reference to ISO 17353, by solvent extraction and determined by GC/MS	1	N.D.
Tributyltin-Oxide (TBTO)	mg/kg	With reference to ISO 17353, by solvent extraction and determined by GC/MS	1	N.D.
Dibutyltin (DBT)	mg/kg	With reference to ISO 17353, by solvent extraction and determined by GC/MS	1	N.D.
Dioctyltin (DOT)	mg/kg	With reference to ISO 17353, by solvent extraction and determined by GC/MS	1	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 : Hayan Park

Notes : mg/kg = ppm = parts per million  
 < = Less than  
 N.D. = Not detected ( <MDL )  
 MDL = Method detection limit

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



※ You can verify the forgery and authenticity by the barcode at the end of this document.

## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

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

Notes : mg/kg = ppm = parts per million  
 < = Less than  
 N.D. = Not detected ( <MDL )  
 MDL = Method detection limit

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



※ You can verify the forgery and authenticity by the barcode at the end of this document.

## TEST REPORT

PAGE: 7 of 17  
DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-008-E-R2

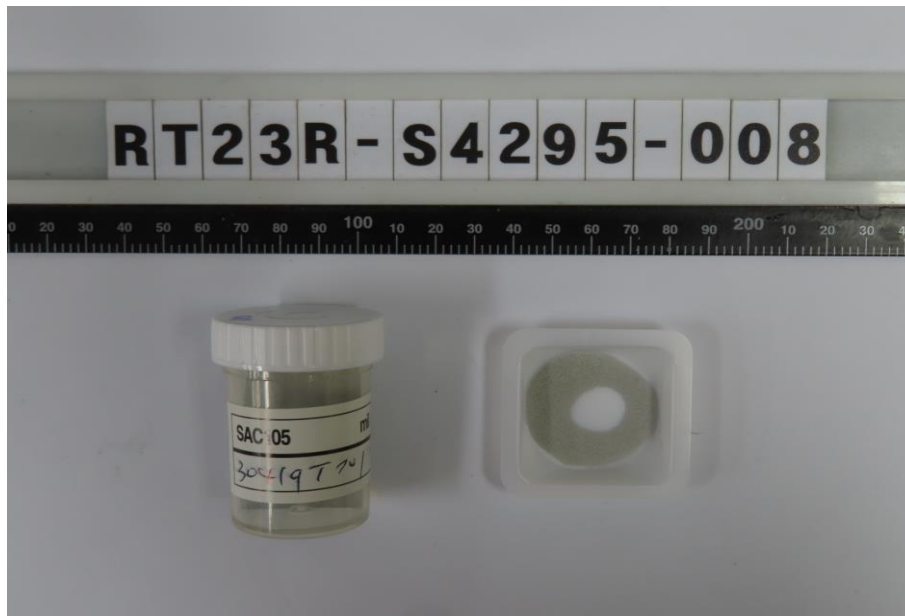
SAMPLE ID NO. : RT23R-S4295-008  
SAMPLE DESCRIPTION : SOLDER Sphere SAC105

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

Notes : mg/kg = ppm = parts per million  
< = Less than  
N.D. = Not detected (<MDL)  
MDL = Method detection limit

\* View of sample as received;-



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



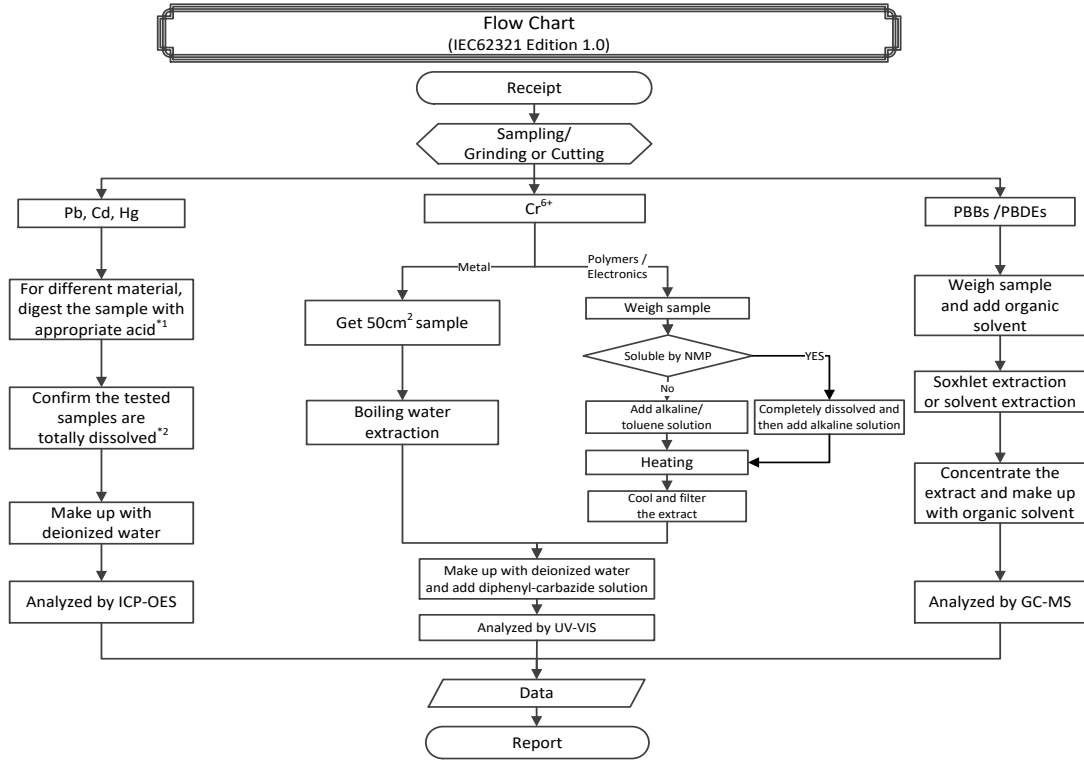
※ You can verify the forgery and authenticity by the barcode at the end of this document.

**TEST REPORT**

REPORT NO. RT23R-S4295-008-E-R2

PAGE: 8 of 17  
DATE: Jul. 24, 2023

SAMPLE ID NO. : RT23R-S4295-008  
SAMPLE DESCRIPTION : SOLDER Sphere SAC105



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.

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



※ You can verify the forgery and authenticity by the barcode at the end of this document.



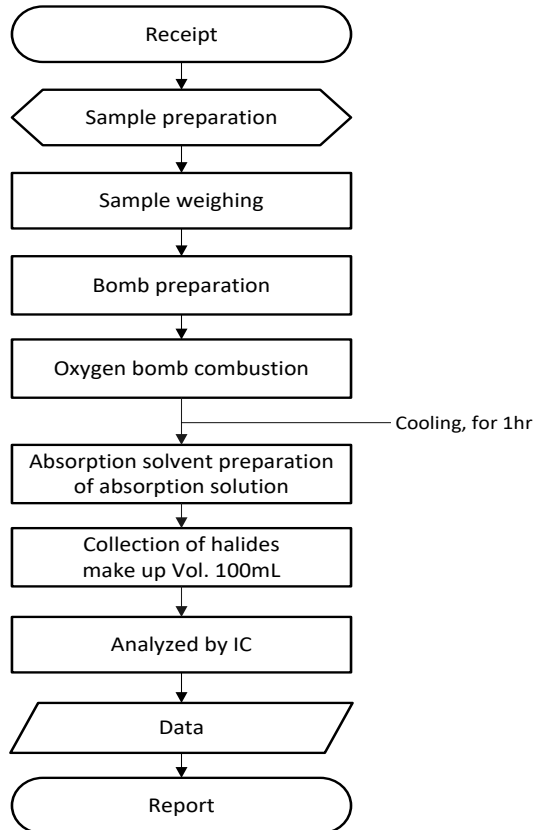
## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (EN14582)

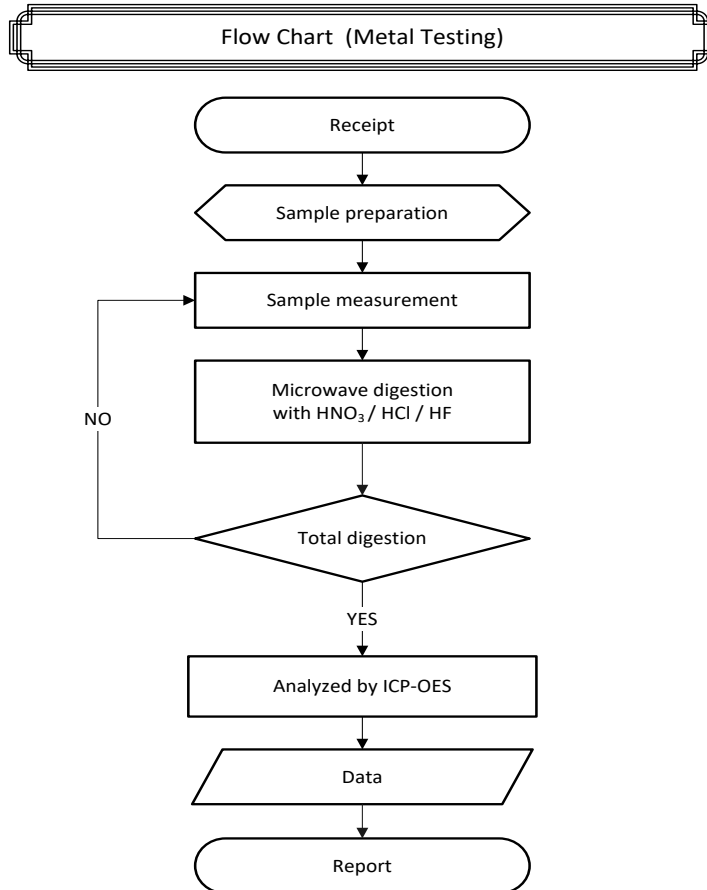


## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105



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



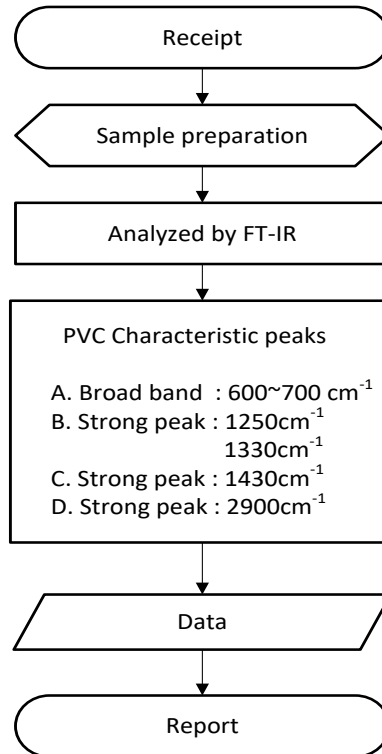
## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (PVC)



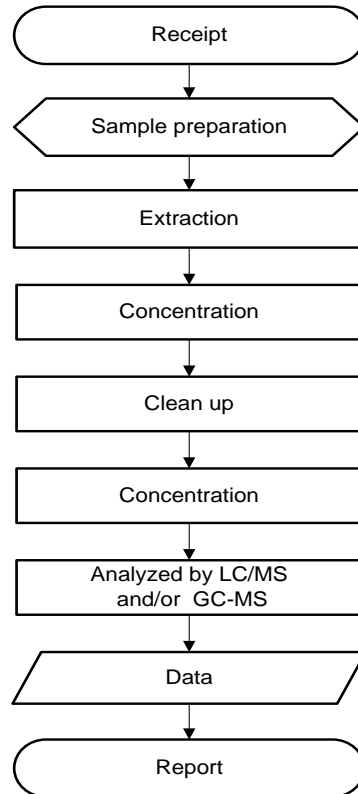
## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (HBCDD)



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



※ You can verify the forgery and authenticity by the barcode at the end of this document.

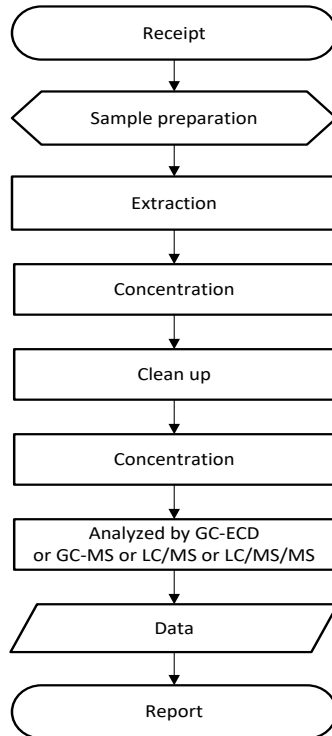
## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (EPA 3540C)



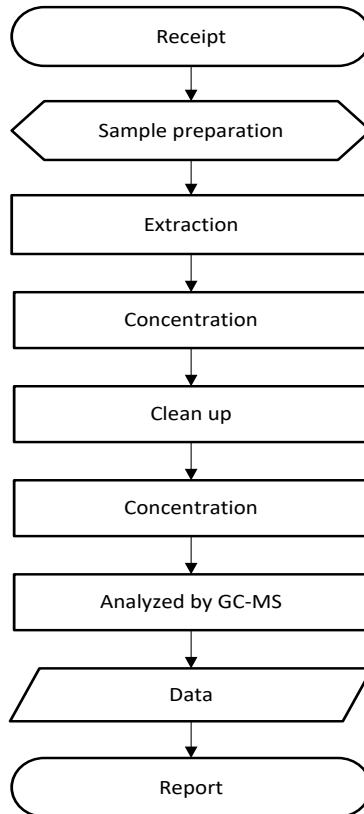
## TEST REPORT

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

Flow Chart (PCB, PCT, PCN)



## TEST REPORT

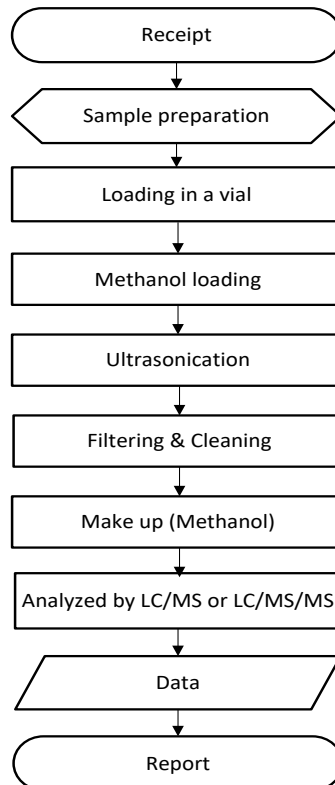
PAGE: 15 of 17  
DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (PFOS, PFOA)



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



※ You can verify the forgery and authenticity by the barcode at the end of this document.

## TEST REPORT

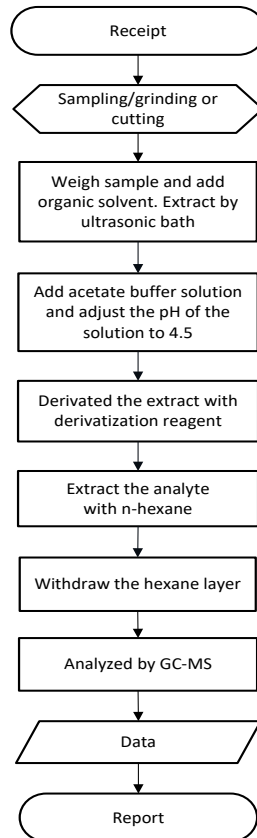
PAGE: 16 of 17  
DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (Organotin Compounds)



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



※ You can verify the forgery and authenticity by the barcode at the end of this document.



## TEST REPORT

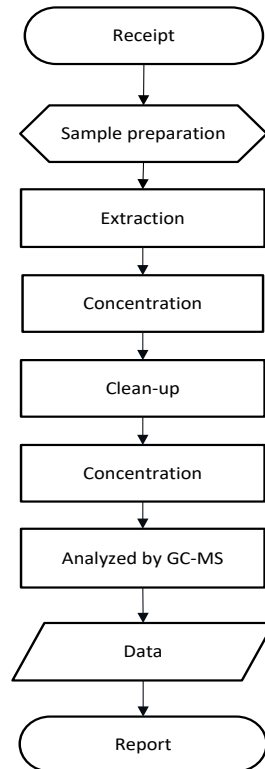
PAGE: 17 of 17  
DATE: Jul. 24, 2023

REPORT NO. RT23R-S4295-008-E-R2

SAMPLE ID NO. : RT23R-S4295-008

SAMPLE DESCRIPTION : SOLDER Sphere SAC105

### Flow Chart (Phthalates)



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

Except where explicitly agreed in writing, all work and services performed by Intertek is subject to our standard Terms and Conditions which can be obtained at our website: <http://www.intertek.com/terms/>. Intertek's responsibility and liability are limited to the terms and conditions of the agreement.

This report is made solely on the basis of your instructions and / or information and materials supplied by you and provide no warranty on the tested sample(s) be truly representative of the sample source. The report is not intended to be a recommendation for any particular course of action, you are responsible for acting as you see fit on the basis of the report results. Intertek is under no obligation to refer to or report upon any facts or circumstances which are outside the specific instructions received and accepts no responsibility to any parties whatsoever, following the issue of the report, for any matters arising outside the agreed scope of the works. This report does not discharge or release you from your legal obligations and duties to any other person. You are the only one authorized to permit copying or distribution of this report (and then only in its entirety). Any such third parties to whom this report may be circulated rely on the content of the report solely at their own risk.

This report shall not be reproduced, except in full.  
This report is not related to the scope of Korea Laboratory Accreditation Scheme.

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



※ You can verify the forgery and authenticity by the barcode at the end of this document.