

Test Report

No. SHAEC1621611803

Date: 19 Oct 2016

Page 1 of 14

CHANGZHOU STARSEA ELECTRONICS CO.,LTD
1 TIANMUHU ROAD,CHANGZHOU JIANGSU CHINA

The following sample(s) was/were submitted and identified on behalf of the clients as : SOD PACKAGING DIODE (HALOGEN & Sb2O3 FREE)

SGS Job No. : SP16-035482 - SH
Client Ref. Information : SOD-123,SOD-323 ,SOT-23 PACKAGE
Date of Sample Received : 29 Sep 2016
Testing Period : 29 Sep 2016 - 19 Oct 2016
Test Requested : Selected test(s) as requested by client.
Test Method : Please refer to next page(s).
Test Results : Please refer to next page(s).
Conclusion : Based on the performed tests on submitted sample(s), the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBBs), Polybrominated diphenyl ethers (PBDEs) and Phthalates such as 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.

Signed for and on behalf of
SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.

Marry Ma

Marry Ma
Approved Signatory



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Test Results :

Test Part Description :

Specimen No.	SGS Sample ID	Description
SN1	SHA16-216118.010	Silvery/gray solid sheet
SN2	SHA16-216118.011	Silvery metal
SN3	SHA16-216118.012	Black solid
SN4	SHA16-216118.013	Copper metal wire

Remarks :

- (1) 1 mg/kg = 0.0001%
- (2) MDL = Method Detection Limit
- (3) ND = Not Detected (< MDL)
- (4) "-" = Not Regulated

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

- Test Method :
- (1) With reference to IEC 62321-5:2013, determination of Cadmium by ICP-OES.
 - (2) With reference to IEC 62321-5:2013, determination of Lead by ICP-OES.
 - (3) With reference to IEC 62321-4:2013, determination of Mercury by ICP-OES.
 - (4) With reference to IEC 62321:2008, determination of Hexavalent Chromium by Colorimetric Method using UV-Vis.
 - (5) With reference to IEC 62321-6:2015, determination of PBBs and PBDEs by GC-MS.
 - (6) With reference to IEC 62321-8 Ed.1.0 (111/321/CD), determination of phthalates by GC-MS.

Test Item(s)	Limit	Unit	MDL	010	012
Cadmium (Cd)	100	mg/kg	2	ND	ND
Lead (Pb)	1000	mg/kg	2	ND	ND
Mercury (Hg)	1000	mg/kg	2	ND	ND
Hexavalent Chromium (Cr(VI))	1000	mg/kg	2	ND	ND
Sum of PBBs	1000	mg/kg	-	ND	ND
Monobromobiphenyl	-	mg/kg	5	ND	ND
Dibromobiphenyl	-	mg/kg	5	ND	ND
Tribromobiphenyl	-	mg/kg	5	ND	ND
Tetrabromobiphenyl	-	mg/kg	5	ND	ND
Pentabromobiphenyl	-	mg/kg	5	ND	ND
Hexabromobiphenyl	-	mg/kg	5	ND	ND
Heptabromobiphenyl	-	mg/kg	5	ND	ND
Octabromobiphenyl	-	mg/kg	5	ND	ND



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Test Item(s)	Limit	Unit	MDL	010	012
Nonabromobiphenyl	-	mg/kg	5	ND	ND
Decabromobiphenyl	-	mg/kg	5	ND	ND
Sum of PBDEs	1000	mg/kg	-	ND	ND
Monobromodiphenyl ether	-	mg/kg	5	ND	ND
Dibromodiphenyl ether	-	mg/kg	5	ND	ND
Tribromodiphenyl ether	-	mg/kg	5	ND	ND
Tetrabromodiphenyl ether	-	mg/kg	5	ND	ND
Pentabromodiphenyl ether	-	mg/kg	5	ND	ND
Hexabromodiphenyl ether	-	mg/kg	5	ND	ND
Heptabromodiphenyl ether	-	mg/kg	5	ND	ND
Octabromodiphenyl ether	-	mg/kg	5	ND	ND
Nonabromodiphenyl ether	-	mg/kg	5	ND	ND
Decabromodiphenyl ether	-	mg/kg	5	ND	ND
Di-butyl Phthalate (DBP)	1000	mg/kg	50	ND	ND
Benzyl Butyl Phthalate (BBP)	1000	mg/kg	50	ND	ND
Di-2-Ethyl Hexyl Phthalate (DEHP)	1000	mg/kg	50	ND	ND
Diisobutyl Phthalates (DIBP)	1000	mg/kg	50	ND	ND

Notes :

- (1) The maximum permissible limit is quoted from RoHS Directive (EU) 2015/863.
- (2) On 4 June 2015, Commission Directive (EU) 2015/863 was published in the Official Journal of the European Union (OJEU) to include the phthalates BBP, DBP, DEHP and DIBP into ANNEX II of the Rohs Recast Directive. The new law restricts each phthalate to no more than 0.1% in each homogeneous material of an electrical product.
- (3) The restriction of DEHP, BBP, DBP and DIBP shall apply to medical devices, including in vitro medical devices, and monitoring and control instruments, including industrial monitoring and control instruments, from 22 July 2021.
- (4) The restriction of DEHP, BBP, DBP and DIBP shall not apply to cables or spare parts for the repair, the reuse, the updating of functionalities or upgrading of capacity of EEE placed on the market before 22 July 2019, and of medical devices, including in vitro medical devices, and monitoring and control instruments, including industrial monitoring and control instruments, placed on the market before 22 July 2021.
- (5) The restriction of DEHP, BBP and DBP shall not apply to toys which are already subject to the restriction of DEHP, BBP and DBP through entry 51 of Annex XVII to Regulation (EC) No 1907/2006.

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



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Test Method : (1) With reference to IEC 62321-5:2013, determination of Cadmium by ICP-OES.
 (2) With reference to IEC 62321-5:2013, determination of Lead by AAS.
 (3) With reference to IEC 62321-4:2013, determination of Mercury by ICP-OES.
 (4) With reference to IEC 62321-7-1:2015, determination of Hexavalent Chromium by Colorimetric Method using UV-Vis.

Test Item(s)	Limit	Unit	MDL	011	013
Cadmium (Cd)	100	mg/kg	2	ND	ND
Lead (Pb)	1000	mg/kg	2	ND	ND
Mercury (Hg)	1000	mg/kg	2	ND	ND
Hexavalent Chromium (Cr(VI))▼	-	µg/cm ²	0.10	ND	ND

Notes :

- (1) The maximum permissible limit is quoted from RoHS Directive (EU) 2015/863.
- (2) ▼= a. The sample is positive for CrVI if the CrVI concentration is greater than 0.13 µg/cm². The sample coating is considered to contain CrVI
 b. The sample is negative for CrVI if CrVI is ND (concentration less than 0.10 µg/cm²). The coating is considered a non-CrVI based coating
 c. The result between 0.10 µg/cm² and 0.13 µg/cm² is considered to be inconclusive - unavoidable coating variations may influence the determination

Information on storage conditions and production date of the tested sample is unavailable and thus Cr(VI) results represent status of the sample at the time of testing.

IEC 62321 series is equivalent to EN 62321 series

<http://www.cenelec.eu/dyn/www/f?>

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Halogen

Test Method : With reference to EN 14582: 2007, analysis was performed by Ion Chromatograph (IC).

Test Item(s)	Unit	MDL	012
Fluorine (F)	mg/kg	50	ND
Chlorine (Cl)	mg/kg	50	ND
Bromine (Br)	mg/kg	50	61
Iodine (I)	mg/kg	50	ND

Element(s)

Test Method : With reference to US EPA Method 3050B:1996, analysis was performed by ICP-OES.



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<u>Test Item(s)</u>	<u>Unit</u>	<u>MDL</u>	<u>011</u>	<u>013</u>
Beryllium (Be)	mg/kg	5	ND	ND

Element(s)

Test Method : With reference to US EPA 3052:1996, analysis was performed by ICP-OES.

<u>Test Item(s)</u>	<u>Unit</u>	<u>MDL</u>	<u>010</u>	<u>012</u>
Beryllium (Be)	mg/kg	5	ND	ND
Phosphorus (P)	mg/kg	20		ND
Antimony (Sb)	mg/kg	10		ND

Red Phosphorus

Test Method : SGS in house method(SHTC- CHEM- SOP -342-T), Analysis was performed by ICP-OES and Pyrolysis-GC/MS

<u>Test Item(s)</u>	<u>Unit</u>	<u>MDL</u>	<u>012</u>
Red Phosphorus	mg/kg	500	ND

Hexabromocyclododecane (HBCDD)

Test Method : With reference to IEC 62321:2008, analysis was performed by GC-MS.

<u>Test Item(s)</u>	<u>Unit</u>	<u>MDL</u>	<u>010</u>	<u>012</u>
Hexabromocyclododecane (HBCDD)	mg/kg	10	ND	ND



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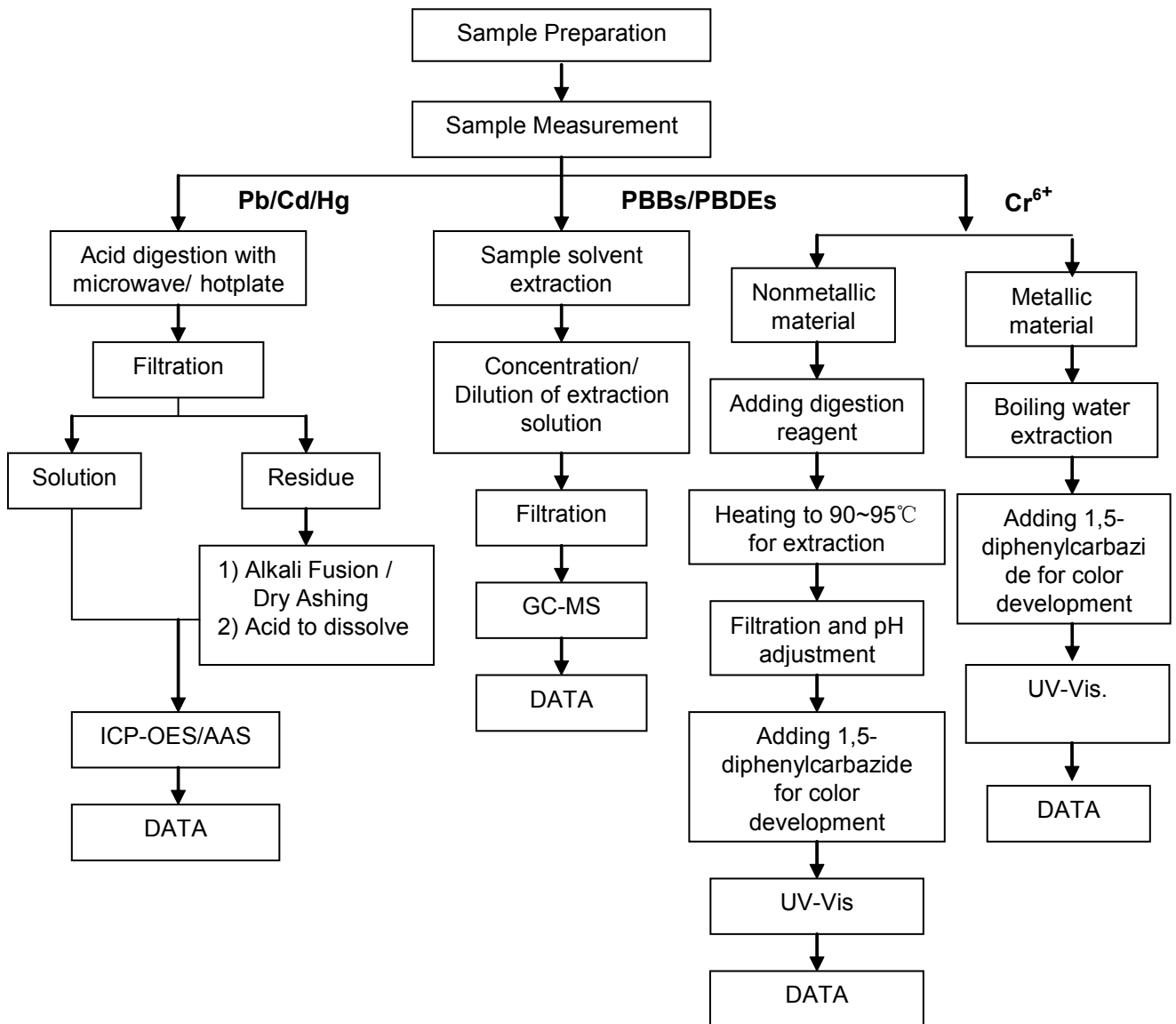
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RoHS Testing Flow Chart

- 1) Name of the person who made testing: Rony Chen/Gary Xu/Sean Li/Selina Song
- 2) Name of the person in charge of testing: Jan Shi/Luna Xu/Jessy Huang/Stone Chen
- 3) These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr⁶⁺ and PBBs/PBDEs test method excluded)



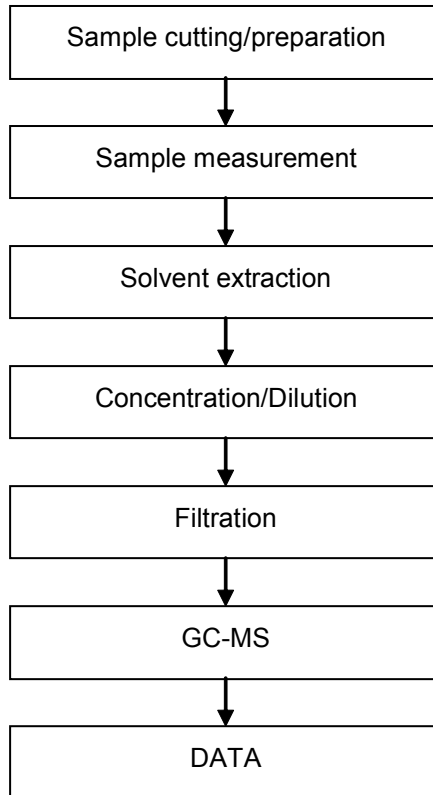
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Phthalates Testing Flow Chart

- 1) Name of the person who made testing: Sherlock Gao
- 2) Name of the person in charge of testing: Jessy Huang



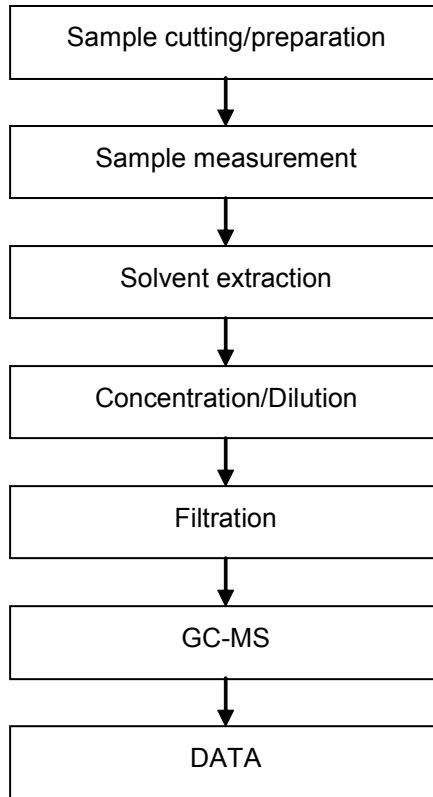
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HBCDD Testing Flow Chart

- 1) Name of the person who made testing: Gary Xu
- 2) Name of the person in charge of testing: Jessy Huang



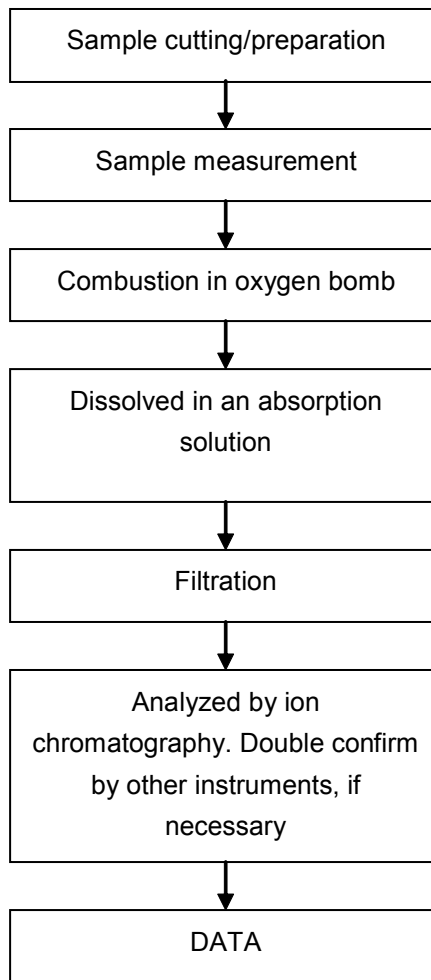
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Halogen Testing (oxygen bomb) Flow Chart

- 1) Name of the person who made testing: Kevin Xu
- 2) Name of the person in charge of testing: Sisily Yin



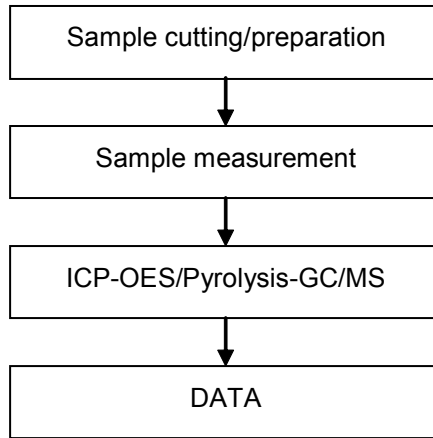
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Red Phosphorus Testing Flow Chart

- 1) Name of the person who made testing: Jessica Qin / Zhengyong Rao
- 2) Name of the person in charge of testing: Linda Li/Summer Jin



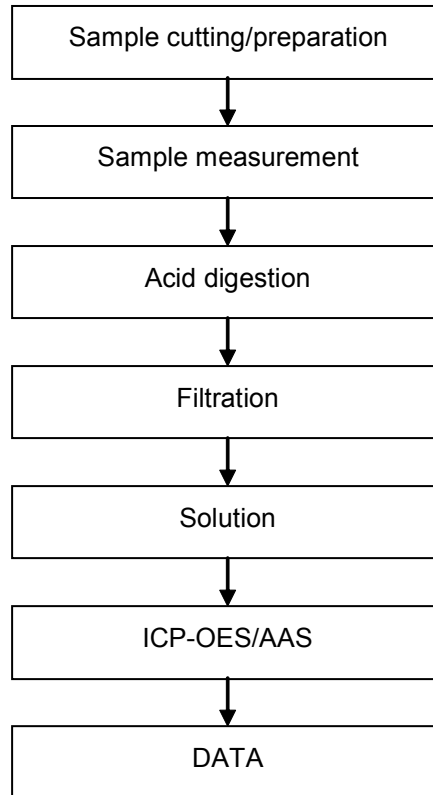
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Elements Testing Flow Chart

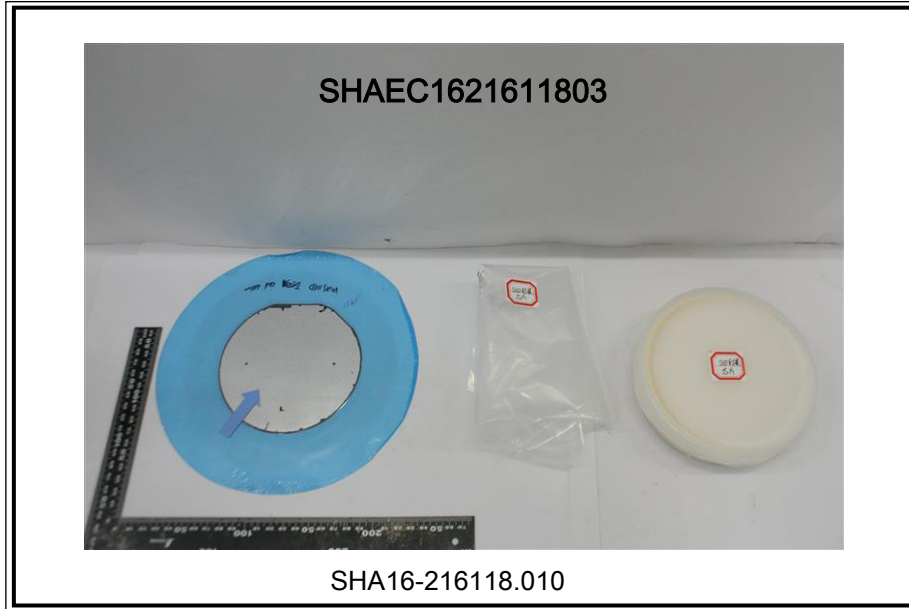
- 1) Name of the person who made testing: Rony Chen/Selina song
- 2) Name of the person in charge of testing: Luna Xu/Jan Shi



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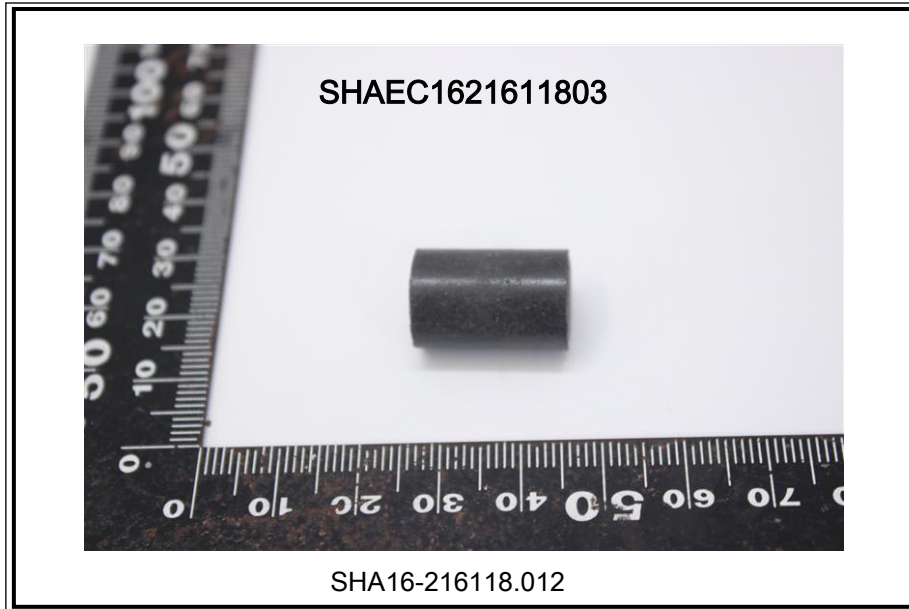
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