

## Verification Report

No. HKTEC2304204202

Date : 20 Sep 2023

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RUBADUE WIRE CO., INC.  
5610 BOEING DR. LOVELAND,  
CO. 80538 USA

Sample Name : PFA  
SGS Job No. : 5282608 - HK  
Colour : VARIOUS  
Date of Sample Received : 28 Aug 2023  
Verification Period : 28 Aug 2023 – 18 Sep 2023  
Verification Requested: : With reference to RoHS Directive (EU) 2015/863 amending 2011/65/EU.  
Verification Method : Please refer to next page(s)  
Verification Results : Please refer to next page(s)  
Verification Conclusion : Based on the verification results of the submitted samples, 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.  
Note : The test results are related only to the tested items. The report shall not be reproduced except in full without the written approval of the testing laboratory.

Signed for and on behalf of  
SGS Hong Kong Limited



Lam Ka Yung, Allen  
Senior Chemist

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Laboratory: 1/F, Units 16-29 3/F, 4/F & 5/F, On Wui Centre, 25 Lok Yip Road, Fanling, New Territories, Hong Kong. [www.sgs.com](http://www.sgs.com)

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- Verification Method:
1. With reference to IEC 62321-2:2021, review was performed for the samples disjointed from the submitted articles.
  2. With reference to IEC 62321-1:2013, tests were performed for the samples indicated by the photos in this report
    - (1) With reference to IEC 62321-3-1:2013, screening by EDXRF spectroscopy. (Decision Rule; please refer to appendix 1: Category 5)
    - (2) Wet chemical test method
      - a. With reference to IEC 62321-5:2013, determination of Cadmium by ICP-OES. (Decision Rule: please refer to appendix 1: Category 1)
      - b. With reference to IEC 62321-5:2013, determination of Lead by ICP-OES (Decision Rule: please refer to appendix 1: Category 1)
      - c. With reference to IEC 62321-4:2013, determination of Mercury by ICP-OES. (Decision Rule: please refer to appendix 1: Category 1)
      - d. With reference to IEC 62321-7-2:2017 & ISO 17075-1:2017, determination of Hexavalent chromium by Colorimetric method using UV-Vis. (Decision Rule: please refer to appendix 1: Category 1)  
With reference to IEC 62321-7-1:2015, determination of Hexavalent chromium by Colorimetric method using UV-Vis. (Decision Rule: please refer to appendix 1: Category 4)
      - e. With reference to IEC 62321-6:2015, determination of PBBs and PBDEs by GC-MS. (Decision Rule: please refer to appendix 1: Category 1)
  3. With reference to IEC 62321-8:2017, determination of phthalates by GC-MS. (Decision Rule: please refer to appendix 1: Category 1)

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## Details on Verification

Part No.	Part Description	BOM No.	Restricted Substances	Results of EDXRF <sup>(1)</sup>	Screening Result of PHTH <sup>(2)</sup>	Result of Wet Chemical Testing <sup>(3)</sup> (mg/kg)	Conclusion on EU RoHS	Sample Submitted / Resubmitted Date
17	Blue plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	
18	Grey plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	
19	White plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	
20	Green plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	

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**Details on Verification**

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21	Red plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	
22	Black plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	
23	Translucent plastic - Pellet		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	BL	---	---	Comply	
			PBDEs	BL	---	---	Comply	
			DBP	---	BL	---	Comply	
			BBP	---	BL	---	Comply	
24	Silvery metal plating - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	

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25	Coppery metal - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	
26	Silvery metal plating - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	
27	Coppery metal - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	
28	Coppery metal - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	

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29	Red metal plating - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	
30	Coppery metal - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	
31	Coppery metal - Wire		Cd	BL	---	---	Comply	28 Aug 2023
			Pb	BL	---	---	Comply	
			Hg	BL	---	---	Comply	
			Cr(VI)▼	BL	---	---	Comply	
			PBBs	---	---	---	---	
			PBDEs	---	---	---	---	
			DBP	---	---	---	---	
			BBP	---	---	---	---	

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### Remark

- (1) (a) There are the results on total Br while test items on restricted substances are PBBs and PBDEs. There is the result on total Cr while test item on restricted substances is Cr(VI).
- (b) Results are obtained by EDXRF for primary screening, and further chemical testing by ICP-OES (for Cd, Pb, Hg), UV-Vis (for Cr(VI)) and GC-MS (for PBBs, PBDEs) is recommended to be performed if the concentration exceeds the below warning value according to IEC62321-3-1:2013 (unit: mg/kg).

Element	Polymer	Metal	Composite Materials
Cd	$BL \leq (70-3\sigma) < X < (130+3\sigma) \leq OL$	$BL \leq (70-3\sigma) < X < (130+3\sigma) \leq OL$	$LOD < X < (150+3\sigma) \leq OL$
Pb	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (500-3\sigma) < X < (1500+3\sigma) \leq OL$
Hg	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (500-3\sigma) < X < (1500+3\sigma) \leq OL$
Br	$BL \leq (300-3\sigma) < X$	--	$BL \leq (250-3\sigma) < X$
Cr	$BL \leq (700-3\sigma) < X$	$BL \leq (700-3\sigma) < X$	$BL \leq (500-3\sigma) < X$

(c) BL = Below Limit, OL = Over Limit, IN = Inconclusive, LOD = Limit of Detection, -- = Not regulated.

(d) The XRF screening test for RoHS elements – The reading may be different to the actual content in the sample be of non-uniformity composition.

- (2) Screening results of PHTH are for primary screening, and further chemical testing by GC-MS (for DBP, BBP, DEHP and DIBP) are recommended to be performed if the concentration exceeds the below warning value (unit: mg/kg).

Compound	Polymer
DBP	$BL \leq 600 < X$
BBP	$BL \leq 600 < X$
DEHP	$BL \leq 600 < X$
DIBP	$BL \leq 600 < X$

- (3) (a) mg/kg = 0.0001%, MDL=Method detection Limit, ND = Not Detected (<MDL), --- = Not conducted, - = Without BOM.

(b) Unit and MDL in wet chemical test

Test Item	Pb	Cd	Hg	DBP	BBP	DEHP	DIBP
Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MDL	10	10	10	100	100	100	100

The MDL for single compound of PBBs and PBDEs is 100 mg/kg,  
 MDL of Cr(VI) for polymer, composite and leather sample is 10 mg/kg.  
 MDL of Cr(VI) for metal sample is 0.10µg/cm<sup>2</sup>.

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(c) ▼ =Metal sample

- a. The sample is positive for CrVI if the CrVI concentration is greater than 0.13 µg/cm<sup>2</sup>.  
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/cm<sup>2</sup>).  
The coating is considered a non-CrVI based coating
- c. The result between 0.10 µg/cm<sup>2</sup> and 0.13 µg/cm<sup>2</sup> 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?p=104:30:1742232870351101:::FSP\\_ORG\\_ID,FSP\\_LANG\\_ID:1258637,25](http://www.cenelec.eu/dyn/www/f?p=104:30:1742232870351101:::FSP_ORG_ID,FSP_LANG_ID:1258637,25)

(4) \* = Considering insufficient sample amount, the Method Detection Limit (MDL) is raised appropriately.

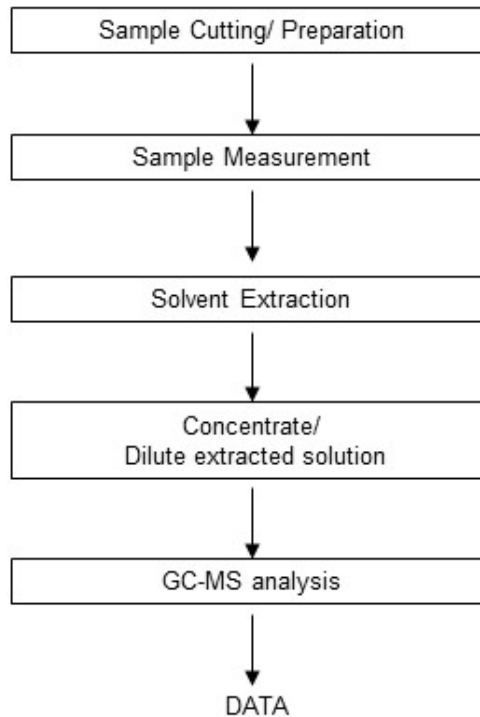


**Appendix 1**

Category	Decision Rule Statement
1	<p>The decision rule for conformity reporting is based on the non-binary statement with guard band (is equal to the expanded measurement uncertainty with a 95% coverage probability, <math>w = U95</math>) in ILAC-G8:09/2019 Clause 4.2.3.</p> <p>A. "Pass - the measured value is within (or below / above) the acceptance limit, where the acceptance limit is below / above to the guard band." or "Pass - The measured values were observed in tolerance at the points tested. The specific false accept risk is up to 2.5%."</p> <p>B. "Conditional Pass - The measured values were observed in tolerance at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values exceeded / out of tolerance. When the measured result is close to the tolerance, the specific false accept risk is up to 50%."</p> <p>C. "Conditional Fail - One or more measured values were observed out of tolerance at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values were in tolerance. When the measured result is close to the tolerance, the specific false reject risk is up to 50%."</p> <p>D. "Fail - the measured value is out of (or below / above) the tolerance limit added / subtracted to the guard band." or "Fail - One or more measured values were observed out of tolerance at the points tested". The specific false reject risk is up to 2.5%.</p>
2	<p>The decision rule for conformity reporting is based on EN 1811:2023: Reference test method for release of nickel from all post assemblies which are inserted into pierced parts of the human body and articles intended to come into direct and prolonged contact with the skin in Section 9.2 interpretation of results.</p>
3	<p>The decision rule for conformity reporting is based on the general consideration of simple acceptance as stated in ISO/IEC Guide 98-3: "Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM 1995)", and more specifically for analytical measurements to the EURACHEM/CITAC Guide 2012 "Quantifying Uncertainty in Analytical Measurement".</p>
4	<p>The decision rule for conformity reporting is according to the IEC 62321-7-1 Edition 1.0 2015-09 Section 7: Table 1-(comparison to standard and interpretation of result)</p>
5	<p>The decision rule for conformity reporting is according to the IEC 62321-3-1 Edition 1.0 2013-06 Annex A.3 interpretation of result.</p>
6	<p>The decision rule for conformity reporting is according to the GB/T 26125-2011 Annex A to H</p>
7	<p>The decision rule for conformity reporting is according to the requested specification or standard (ASTM F963-17 section 4.3.5)</p>
8	<p>The decision rule for conformity reporting is according to the requested specification or standard (AS/NZS ISO 8124 Part 3 section 4.2)</p>
Remark	<p>If the decision rule is not feasible to be used and the uncertainty of the result is able to be provided, the uncertainty range of the result will be shown in the report. Otherwise, only result will be shown in the report.</p>

**Flowchart for Phthalates measurement**

Method: IEC 62321-8:2017

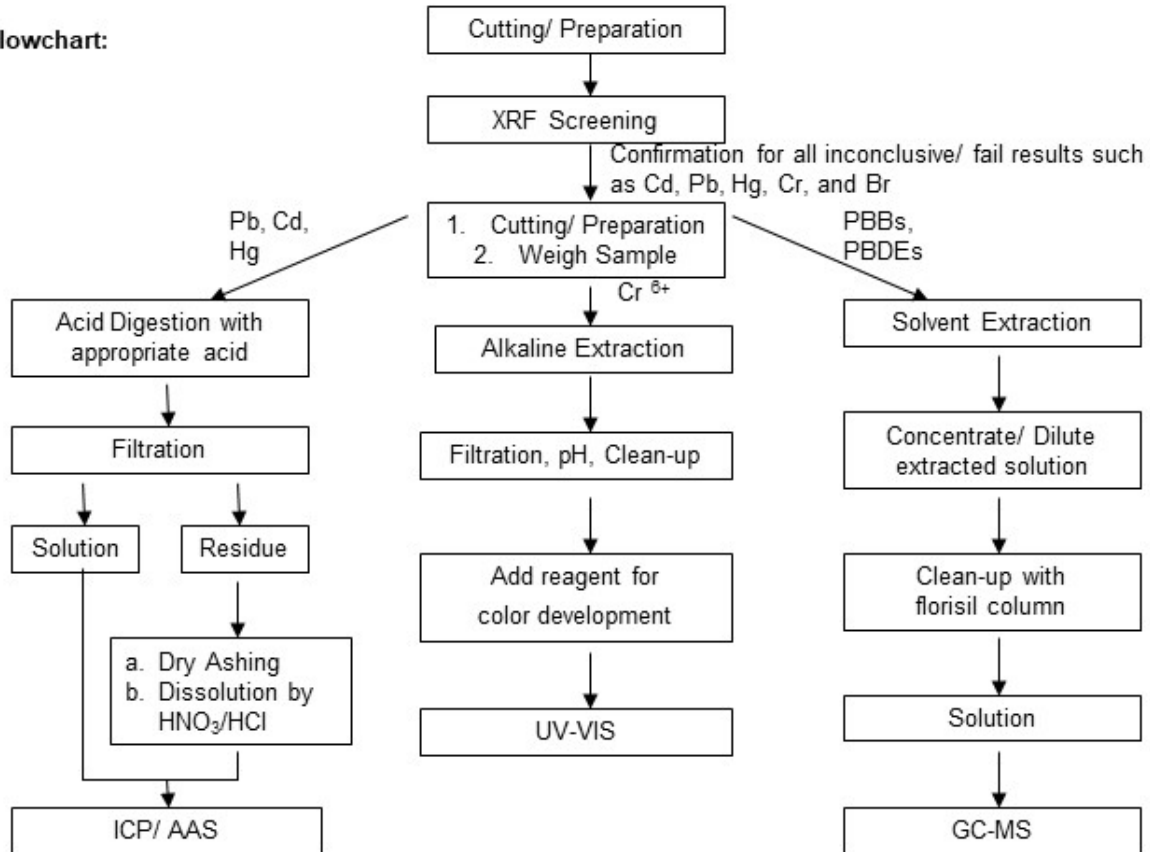


Tested by : Lumpy Lee  
 Checked by : Edmund Kwan

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Flowchart:

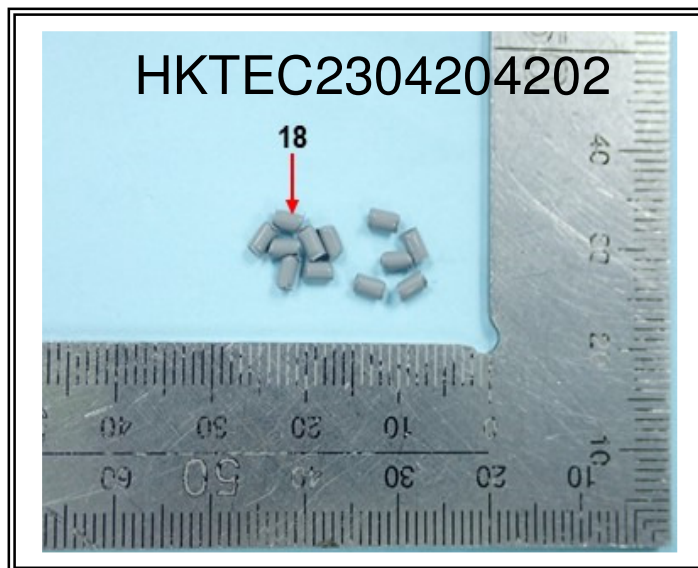
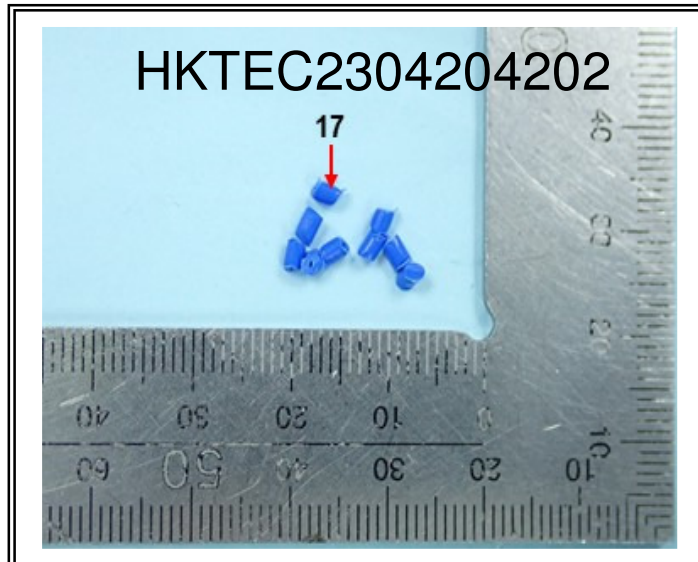


- Note : 1) Boiling water test method was also performed for Cr (VI) analysis in metal sample.  
 2) The polymeric samples were dissolved totally by pre-conditioning method according to above flow chat for Cd, Pb and Hg contents analysis.

Operator : Keith Fung (XRF)  
Chiu Kan Yuen/ Tang Koon Pang (Acid digestion)  
Chiu Kan Yuen (Dry Ashing)  
Nick Liu (Hexavalent Chromium)  
Kent Wan (PBBs and PBDEs)

Section Chief : Chan Chun Kit, Dickson

Sample photo:



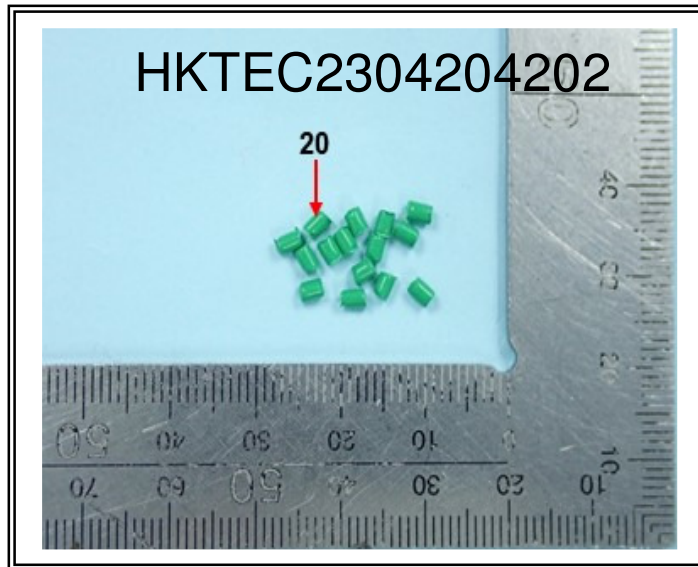
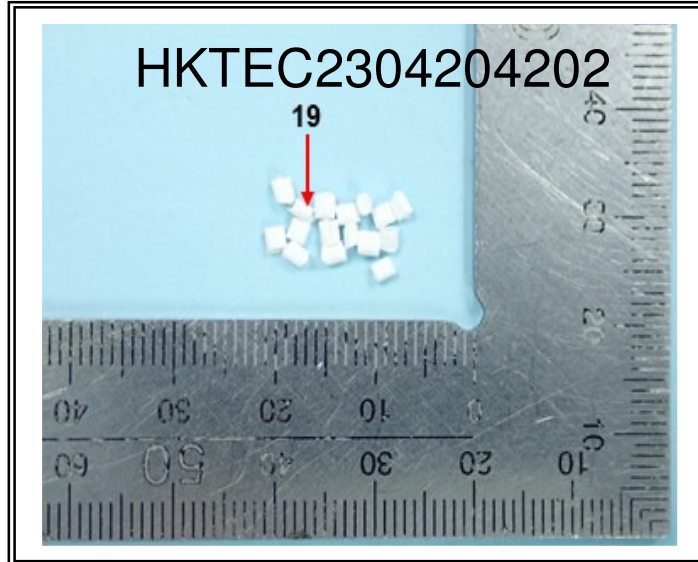
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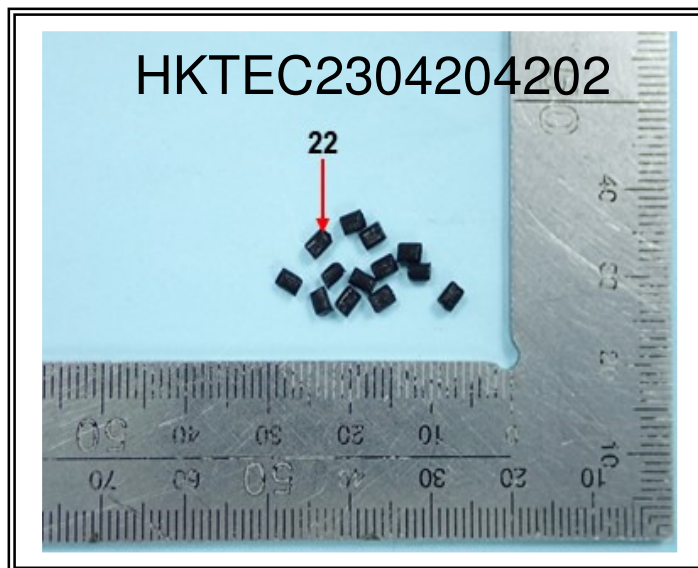
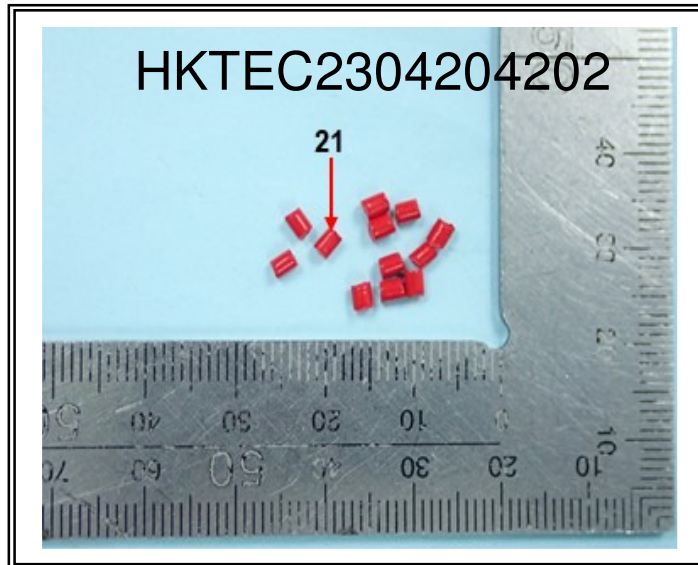
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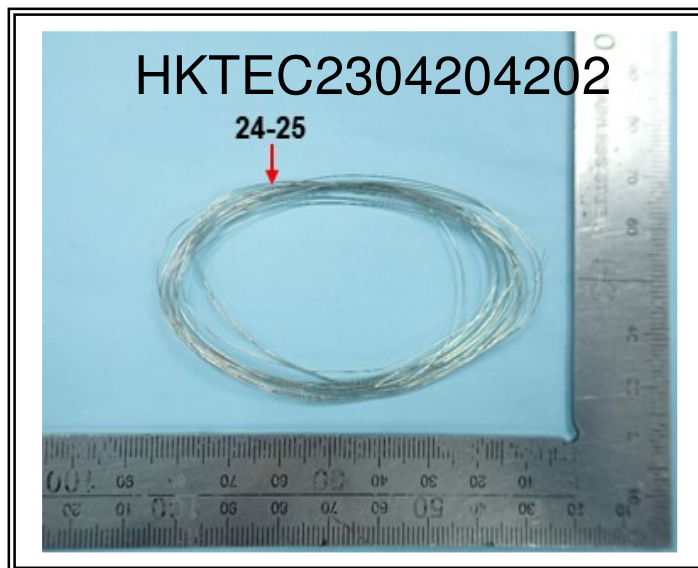
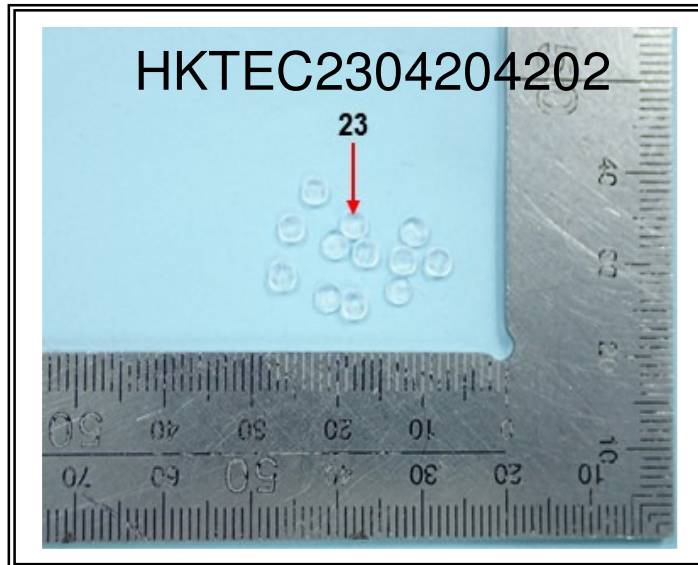
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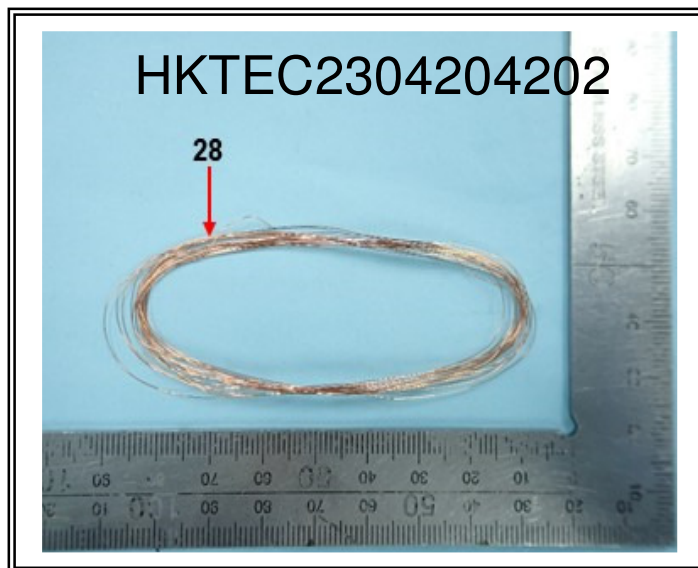
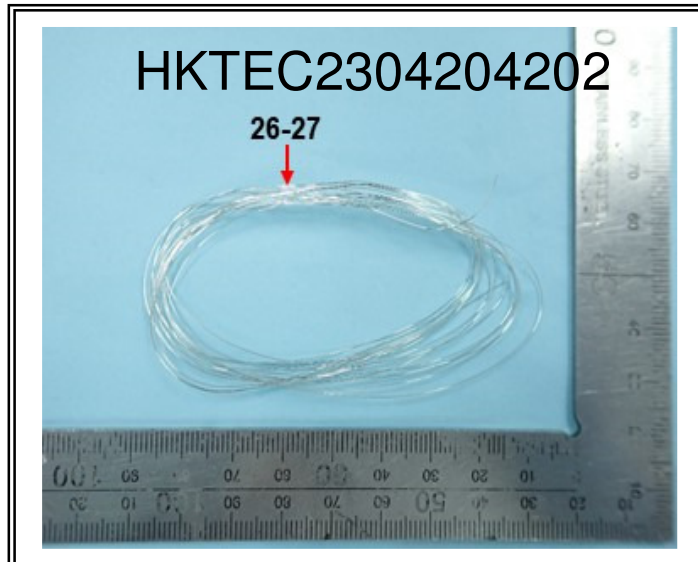
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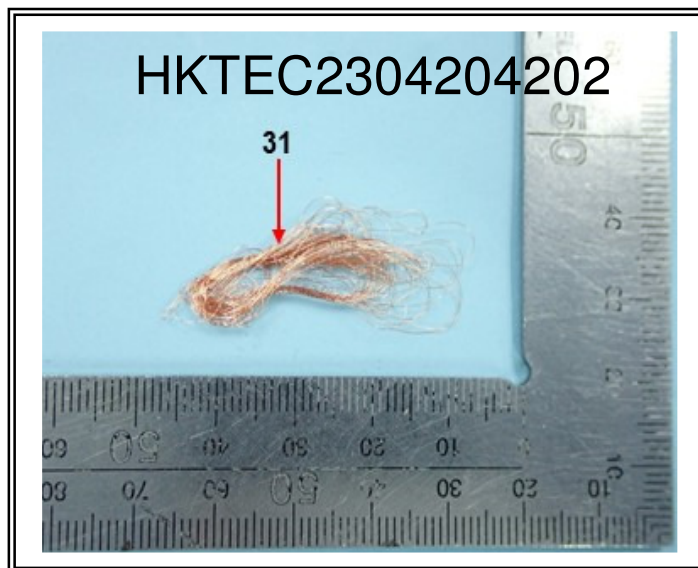
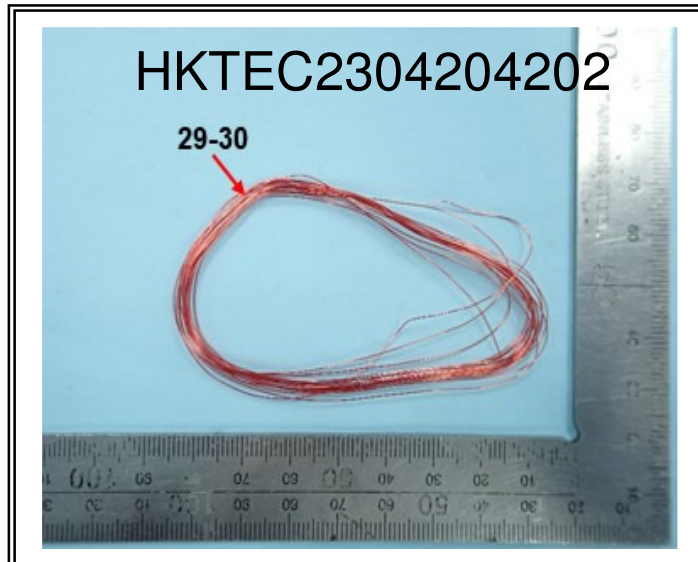
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