



Test Report

No. 4178941-CH02

Date: August 2, 2017

Page 1 of 11

NeoGraf Solutions, LLC
11709 Madison Ave.
Lakewood, OH 44107
United States

“This report supersedes all previous documents bearing the test report number 4178941-CH02-PRE.”

The following sample(s) was/were submitted **GrafGuard**
and identified by/on behalf of the client as:

Sample Received Date: **7/24/2017**

Testing Period: **7/26/2017 – 7/31/2017, 08/01/2017 – 08/02/2017**

Test Requested : Please refer to the result summary.

Test Method & Results : Please refer to next page(s).

Result Summary :

Test Requested	Comment
1) RoHS Directive 2011/65/EU Annex II [amended by Directive (EU) 2015/863]	PASS
2) Phthalate content as requested by client	See test results
3) Antimony content	See test results
4) Beryllium content	See test results
5) Halogen (Cl, Br, I, F) Content of the submitted sample(s) with reference to BS EN 14582:2016	See test results
6) Annex XVII of REACH Regulation (EC) No. 1907/2006 and its amendments – Perfluorooctane sulfonates (PFOS) content (Formerly Directive 2006/122/EC)	PASS
7) Perfluorooctanoic Acid (PFOA) content	See test results

Signed for and on behalf of SGS North America, Inc.

Prepared By:

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1. RoHS Directive 2011/65/EU Annex II [amended by Directive (EU) 2015/863]

Test Item(s):	Unit	Test Method	Results	MDL	Limit
			1		
Cadmium(Cd)	mg/kg	With reference to IEC 62321-5:2013 (Determination of Cd and Pb by ICP-OES and /or ICP-MS)	ND	2	100
Lead (Pb)	mg/kg		ND	2	1000
Mercury (Hg)	mg/kg	With reference to IEC 62321-4:2013 (Determination of Hg by ICP-OES and/ or ICP-MS)	ND	2	1000
Hexavalent Chromium (CrVI)	mg/kg	With reference to IEC 62321:2008 (Determination of CrVI by UV-VIS)	ND	2	1000
Sum of PBBs	mg/kg	With reference to IEC 62321-6:2015 (Determination of PBB and PBDE by GC-MS)	ND	-	1000
Monobromobiphenyl	mg/kg		ND	5	-
Dibromobiphenyl	mg/kg		ND	5	-
Tribromobiphenyl	mg/kg		ND	5	-
Tetrabromobiphenyl	mg/kg		ND	5	-
Hexabromobiphenyl	mg/kg		ND	5	-
Pentabromobiphenyl	mg/kg		ND	5	-
Heptabromobiphenyl	mg/kg		ND	5	-
Octabromobiphenyl	mg/kg		ND	5	-
Nonabromobiphenyl	mg/kg		ND	5	-
Decabromobiphenyl	mg/kg		ND	5	-
Sum of PBDEs	mg/kg		ND	-	1000
Monobromodiphenyl ether	mg/kg		ND	5	-
Dibromodiphenyl ether	mg/kg		ND	5	-
Tribromodiphenyl ether	mg/kg		ND	5	-
Tetrabromodiphenyl ether	mg/kg		ND	5	-
Pentabromodiphenyl ether	mg/kg		ND	5	-
Hexabromodiphenyl ether	mg/kg		ND	5	-
Heptabromodiphenyl ether	mg/kg		ND	5	-
Octabromodiphenyl ether	mg/kg		ND	5	-
Nonabromodiphenyl ether	mg/kg	ND	5	-	
Decabromodiphenyl ether	mg/kg	ND	5	-	
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	IEC 62321-8:2017 (Determination of DEHP, BBP, DBP and DIBP by GC-MS)	ND	50	1000
Butyl benzyl phthalate (BBP)	mg/kg		ND	50	1000
Dibutyl phthalate (DBP)	mg/kg		ND	50	1000
Diisobutyl phthalate (DIBP)	mg/kg		ND	50	1000

Sample Description:

1. GrafGuard

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Note :

- (a) mg/kg = ppm ; 0.1wt% = 1000ppm
- (b) ND= not detected
- (c) MDL = Method Detection Limit
- (d) - = not regulated
- (e) * = Total Chromium analysis by ICP-MS and/or ICP-OES was not detected in submitted sample. Therefore, Hexavalent Chromium determination using UV-Visible Spectroscopy was not performed.
- (f) 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

2. Phthalate content as requested by client

Method : With reference to IEC 62321-8:2017. Analysis was performed by Gas Chromatography / Mass Spectrometry.

Test Item	Result (%)		Detection Limit (%)
	1		
Di-n-hexyl phthalate (DnHP)	ND		0.005
Diisononyl Phthalate (DINP)	ND		0.005
Di-n-octyl Phthalate (DNOP)	ND		0.005

Sample Description:

1. GrafGuard

- Note : 1. % = percentage by weight
 2. ND = Not Detected

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3. Antimony Content

Analyzed by Inductively Coupled Argon Plasma Spectrometry.

Test Item	Result (mg/kg)		Detection Limit (mg/kg)
	1		
Antimony (Sb)	ND		10

Sample Description:

1. GrafGuard

Note :

1. ND = Not Detected = denoted less than reporting limit
2. 1 mg/kg = 1 ppm

4. Beryllium Content

Method: With reference to US EPA Method 3050B followed by analysis using ICP-OES and/or ICP-MS.

Test Item	Result (mg/kg)		Detection Limit (mg/kg)
	1		
Beryllium (Be)	ND		10

Sample Description:

1. GrafGuard

Note :

1. ND = Not Detected = denoted less than reporting limit

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5. Halogen (Cl, Br, I, F) content of the submitted sample(s) with reference to BS EN 14582:2016

With reference to **BS EN 14582:2016** "Characterization of waste – Halogen and sulfur content – Oxygen Combustion in closed systems and determination methods". Analysis was performed by Ion Chromatography.

Test Item	Result (mg/kg)	Detection Limit (mg/kg)
	1	
Chlorine (Cl)	68.8	50
Bromine (Br)	ND	50
Fluorine (F)	201	50
Iodine (I)	ND	50

Sample Description:

- GrafGuard

- Note:
1. mg/kg = ppm
 2. ND = Not Detected, reported when the reading is less than the detection limit value.

Remark: ** = testing in progress

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6. Annex XVII of REACH Regulation (EC) No. 1907/2006 and its amendments – Perfluorooctane sulfonates (PFOS) content (Formerly Directive 2006/122/EC)

Method : Solvent extraction followed by analysis using High-performance Liquid Chromatography-Mass Spectrophotometer (HPLC-MS).

Substances or in mixtures :

Test Item	Result (%)	Detection Limit (%)	Permissible Limit (%)
	1		
Perfluorooctane sulfonates (PFOS) [#]	ND	0.001	0.005
Comment	PASS	--	--

Sample Description:

- GrafGuard

Note : 1. % = percentage by weight
 2. ND = Not Detected
 3. # = Perfluorooctane sulfonates (PFOS) are represented by sum of PFOS – Acid, PFOS – Metal Salt and PFOS – Amide.

7. Perfluorooctanoic Acid (PFOA) content

Method : With reference to SGS in-house method, solvent extraction followed by analysis using High-performance Liquid Chromatography-Mass Spectrophotometer (HPLC-MS).

Test Item	Result (%)	Detection Limit (%)
	1	
Perfluorooctanoic Acid (PFOA)	ND	0.001
Comment	--	--

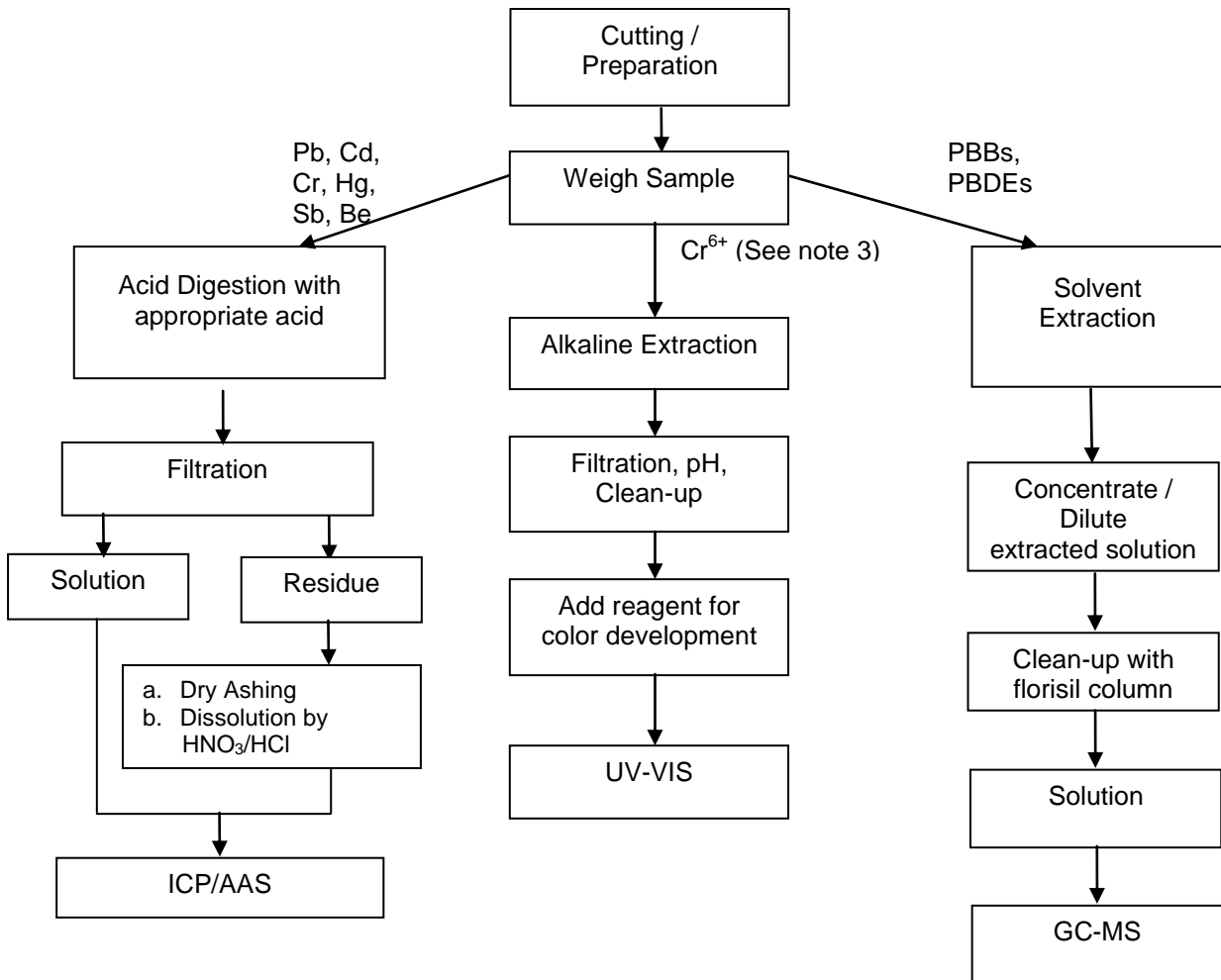
Sample Description:

- GrafGuard

Note : 1. % = percentage by weight
 2. ND = Not Detected

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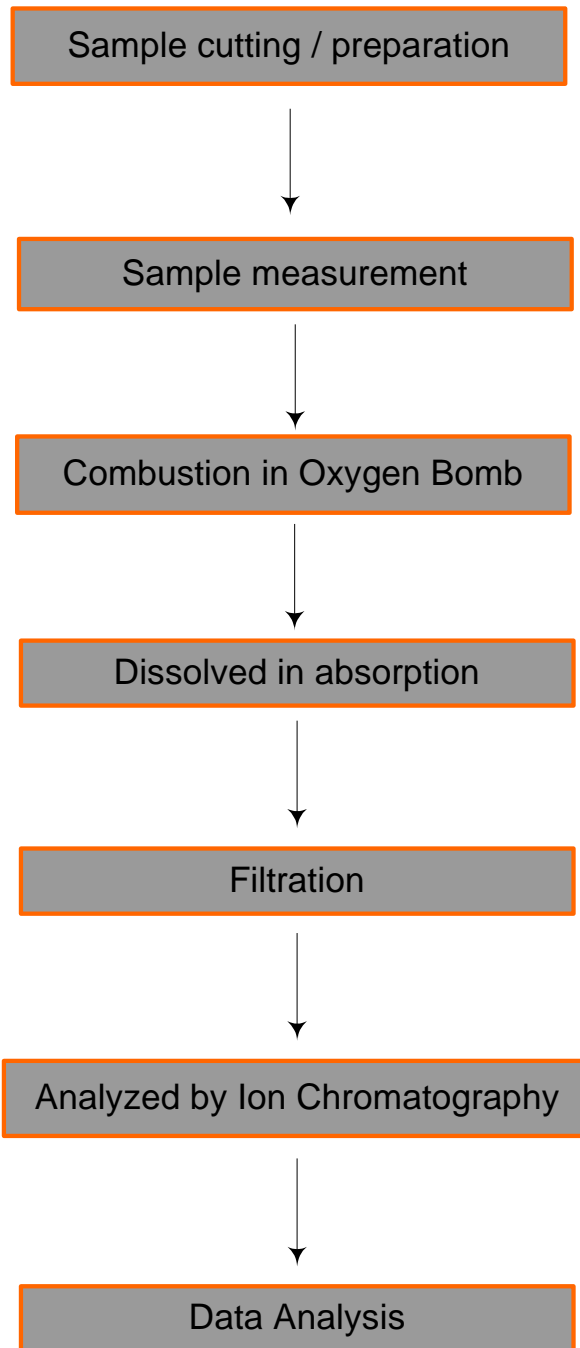
Flowchart for RoHS, Beryllium and Antimony Testing:



- Note : 1. For Cr(VI), spot test is adopted for metal sample.
 2. The Cd, Pb, Hg, Cr and Sb contents test on polymeric samples were dissolved totally by pre-conditioning method according to above flow chart.
 3. Cr⁶⁺ is performed only when total Cr is detected

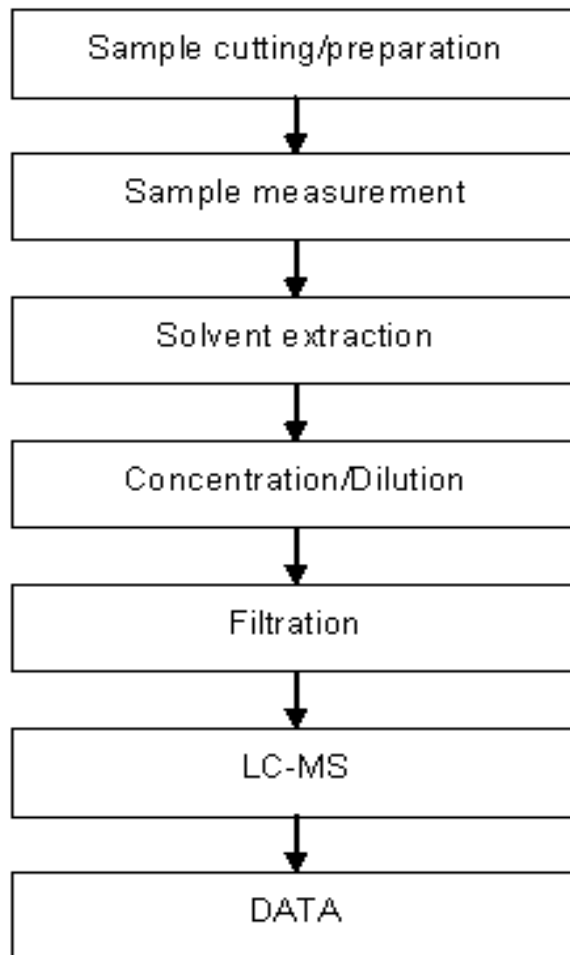
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Halogen Testing Flow Chart



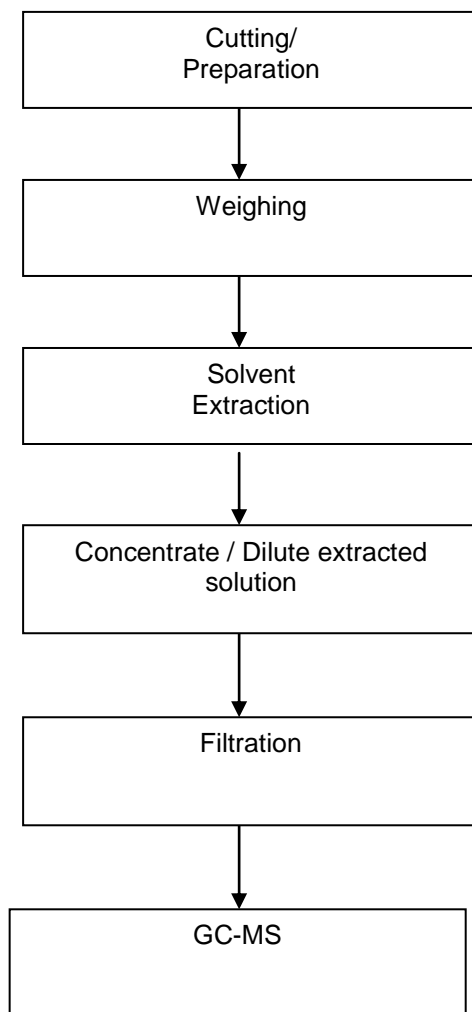
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PFOS/PFOA Testing Flow Chart



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Flowchart for Phthalates



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Sample Photo:



SGS authenticates the photo on the original report only

*** End of Report ***

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