

15.08.2013

Dear Sirs,

with this message there are material samples delivered from Talvivaara site and to be tested as specified below.

Following test are to be carried out:: (Test, standard and project requirement/specification if there is one)

- 1) Thickness (ASTMD5199), lowest individual >1,35 mm
- 2) Density (ASTMD1505) >0,94 g/cm³
- 3) Carbon Content (ASTMD4218) 2-3% ,applicable and to be tested from to black layer only
- 4) Carbon Dispersion (ASTMD5596), class 9/10 class 1 or 3, 1/10 class 3 allowed
- 5) Melt Index (ASTMD1238)
- 6) Dimensional Stability (ASTMD1204)
- 7) Tensile (ASTMD6693), 50 mm/min, break 42 N/mm, yield 23 N/mm, el at br >800 %, el. at yield >13%
- 8) Puncture Strength (ASTMD4833), >556 N
- 9) Tear Resistance (ASTMD1004), >187 N
- 10) Low Temperature Brittleness (ASTMD746), tested at -65 celcius degrees (special specification)
- 11) Oxidative Induction Time >160 min (ASTMD3895, 200 degr. celcius, O₂ a 1atm)
- 12) SP-NCTL Stress Crack Resistance (ASTMD5397), >1000 hours (special specification)
- 13) UV Resistance (GRIGM11), HP-OIT retained after 1600 hours >80% (special specification, not standard OIT)
- 14) Oven Aging (ASTMD5721), HP-OIT retained after 90 days >80% (special specification, not standard OIT)

One material sample to be tested:

Material identification	Roll number	Number of pieces
GSE 1,5 mm White Conductive	420043362	10 pieces

Seam samples to be tested (according to ASTM D 6392/GRI GM19):

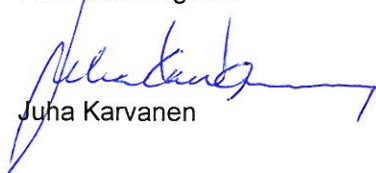
Sample identification	Roll numbers	Material type
KS4-5/S13	410047572/410121240	(1,5 mm black)
KS2-3/S1	410118661/410118661	(1,5 mm black)
URSUS RAF KATE/S21	420043362/420043362	(1,5 mm cond.)
URSUS PLS KATE/S25	420043358/420043358	(1,5 mm cond.)
URSUS-PLS_2/S62	410087205/410087205	(1,5 mm cond.)

Invoice and test results are to be delivered:

email: juha.karvanen@kaitos.fi
cc: perttu.juntunen@kaitos.fi
cc: marja-liisa.leskinen@kaitos.fi

If you have any questions related to testing to be done please send email to all above contact persons.

With Best Regards


Juha Karvanen



Date: 2013-08-20

Mail To:
Attn: Juha Karvanen
Kaitos Oy
Talvivaarantie 66
88120 Tunkakyla
FINLAND

Bill To:
Attn: Accounts Payable
Kaitos Oy
Talvivaarantie 66
88120 Tunkakyla
FINLAND

email: juha.karvanen@kaitos.fi, perttu.juntunen@kaitos.fi, marja-liisa.leskinen@kaitos.com

Dear Mr. Karvanen:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

TRI Job Reference Number: **11513**

Material(s) Tested: 4, Heat Fusion Weld Seam(s)

Test(s) Requested: SAME DAY Peel and Shear
(ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes

AD	Adhesion failure (100% Peel)
BRK	Break in sheeting away from Seam edge
SE	Break in sheeting at edge of seam
AD-BRK	Break in sheeting after some adhesion failure - partial peel
SIP	Separation in the plane of the sheet (leaving the bond intact)
FTB	Film tearing bond (all non "AD" failures)
NON-FTB	100% peel

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Mansukh Patel
Sr. Laboratory Coordinator
Geosynthetic Services Division
www.GeosyntheticTesting.com



DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS

TRI Client: Kaitos Oy

Material: 1.5 mm HDPE

SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

TRI Log #: 11513

TEST REPLICATE NUMBER						
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-KS2-3 Weld: Heat Fusion						
Side: A						Peel A
Peel Strength (kN/m)	20.3	20.8	22.1	21.4	21.4	21.2
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						Peel B
Peel Strength (kN/m)	20.3	19.1	20.1	21.4	20.8	20.4
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						Shear
Shear Strength (kN/m)	22.3	23.3	23.3	24.2	23.8	23.4
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-KS2-4 Weld: Heat Fusion						
Side: A						Peel A
Peel Strength (kN/m)	21.2	22.6	21.4	22.1	22.3	21.9
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						Peel B
Peel Strength (kN/m)	20.7	23.3	21.4	22.6	21.7	21.9
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						Shear
Shear Strength (kN/m)	23.5	24.2	23.7	24.0	23.8	23.8
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS

TRI Client: Kaitos Oy

Material: 1.5 mm HDPE

SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

TRI Log #: 11513

TEST REPLICATE NUMBER						
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-S21 Weld: Heat Fusion						
Side: A						Peel A
Peel Strength (kN/m)	21.2	23.8	23.5	24.2	23.0	23.1
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						Peel B
Peel Strength (kN/m)	20.3	21.0	19.4	20.5	19.4	20.1
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						Shear
Shear Strength (kN/m)	26.1	26.8	27.2	27.9	27.2	27.0
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-S25 Weld: Heat Fusion						
Side: A						Peel A
Peel Strength (kN/m)	22.8	22.8	23.8	22.8	21.9	22.8
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						Peel B
Peel Strength (kN/m)	21.2	23.3	23.5	22.8	23.0	22.7
Peel Incursion (%)	<5%	<5%	<5%	<5%	<5%	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						Shear
Shear Strength (kN/m)	25.2	25.8	25.4	26.3	27.2	26.0
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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