### **APPENDIX C**

### COMPATIBILITY TEST RESULTS

# ONONDAGA LAKE PRE DESIGN INVESTIGATION SEDIMENT CONSOLIDATION AREA (SCA) COMPATIBILITY TESTING SUMMARY REPORT

Prepared For:



301 Plainfield Road, Suite 330 Syracuse, NY 13212

Prepared By:

#### PARSONS

301 Plainfield Road, Suite 350 Syracuse, NY 13212 Phone: (315) 451-9560 Fax: (315) 451-9570

**JANUARY 2010** 

#### **1.0 INTRODUCTION**

This summary report describes the results of bench-scale laboratory compatibility testing. The objective of the testing was to obtain data to assess the compatibility of the materials to be used in the Sediment Consolidation Area (SCA) construction (i.e., geotextile tubes and potential liner materials) with the materials to be dredged from Onondaga Lake. The sampling and testing activities presented in this report were conducted in accordance with the procedures outlined in the Phase IV PDI Work Plan and associated addendum (Parsons, 2008a and b). The details regarding the testing objectives, methods of sample collection and analysis, and results are described below.

#### 2.0 SAMPLE COLLECTION AND ANALYSIS

A bulk sample of sediment from the in-lake waste deposit (ILWD) was obtained for compatibility testing since a majority of the sediment will be dredged from this area. The ILWD is predominantly comprised of Solvay waste, although some areas have an overlying layer of natural sediments. In addition, sediment in the ILWD has the highest average concentration for all the chemicals of concern, except for mercury, of all the remediation areas. The ILWD also has a high pH (approximately 11) and contains non-aqueous phase liquid (NAPL) in certain areas. The bulk sediment sample was collected at Station 10118 (i.e., Bulk Sample 1B) because previous sampling has shown that this area has the highest concentration of volatile organic compounds (VOCs) in the ILWD.

Sediment for Bulk Sample 1B was collected using the bulk-sample-collection procedures described in the work plan (Parsons, 2008a and b). Approximately 100 gallons of sediment were collected. Samples of geosynthetic materials were obtained from manufacturers as indicated in Table 1.

Compatibility tests were performed to monitor the physical properties of the geotextile tube material and geomembrane materials while immersed in the sediment that will be dredged. The physical condition of the materials was monitored as a function of cumulative exposure time by means of dimensional measurements and physical property tests.

Geotextile tube material was tested in accordance with ASTM D6389, and sewing thread was tested in accordance with ASTM D5446. The geotextile tube material and thread were immersed and tested at durations of 30, 60, 90, and 120 days. Two sets of testing were performed, one maintained at 23 degrees Celsius (C) and one at 50 degrees C. Geotextile tube materials were tested for puncture, trapezoidal tear, grab strength, apparent opening size, and permittivity. Geotextile tube threads were tested for tensile strength.

Geosynthetic Material	Manufacturer	Description
Geotextile Tube	Tencate	GT500, woven, polypropylene, woven, 17.3 oz/yd <sup>2</sup>
Geotextile Tube Thread	Tencate	Polyester
High Density Polyethylene (HDPE)	GSE	40 mil, smooth
Linear Low Density Polyethylene (LLDPE)	GSE	40 mil, smooth
Polypropylene (PP)	Firestone	45 mil, smooth
Ethylene Propylene Diene Monomer (EPDM)	Firestone	45 mil, smooth

Table 1.	Geosynthetic	<b>Materials</b>
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Geomembrane compatibility tests were performed in accordance with ASTM D 5747. Four geomembrane materials (HDPE, LLDPE, EPDM, and PP) were tested. The materials were immersed and tested at durations of 30, 60, 90, and 120 days. Two sets of testing were performed, one maintained at 23 degrees C and one at 50 degrees C. Geomembrane materials were tested for dimensional properties, puncture, density, hardness, 2% secant modulus, tear resistance, volatiles, extractables, and tensile properties.

The average value for each baseline test (pre-immersion) was computed and used as a reference for the subsequent immersion tests. As each test was performed after the 30, 60, 90, and 120 day immersion periods, the average results were computed. This average value was compared to the average baseline value and the percent change computed as shown on the data sheets in the attached report (Attachment 1). The data was plotted as percent change versus immersion period at 23 degrees C and 50 degrees C in the report.

#### 3.0 RESULTS

The geotextile tube material performed well. The results indicate no significant deterioration of the fabric. The data showed an increase in the strength of the geotextile tube thread. This is most likely attributable to the thread being encased in Solvay waste when it was tested.

All four geomembrane types also performed well. The HDPE and LLDPE geomembrane performed the best since all of the properties were relatively consistent. With respect to the PP and EPDM, they both absorbed the most extractables and volatiles with more strength variations than the HDPE and LLDPE due to absorption and softening of the materials. The complete laboratory report is provided in Attachment 1.

#### 4.0 REFERENCES

- Parsons, 2008a. Onondaga Lake Pre-Design Investigation: Phase IV Work Plan. Syracuse, New York.
- Parsons, 2008b. Onondaga Lake Pre-Design Investigation: Phase IV Work Plan Addendum 1 Bulk Sediment Collection, Dewatering Treatability Study, Material Compatibility and Dret Testing. Syracuse, New York.

### **ATTACHMENT 1**

### COMPATIBILITY TEST RESULTS



June 29, 2009 09LR1826.01

JUL 0 6 2009 SYNALUSE

Parsons 290 Elwood Davis Road Suite 312 Liverpool, NY 13088

Attn: David Steele

#### RE: COMPATIBILITY TEST RESULTS GEOMEMBRANE SAMPLES WITH SOLVAY WASTE HONEYWELL PROJECT PO NO. 444853.00001.00

Dear Mr. Steele:

Submitted herein is our report of 120 day compatibility testing performed on four (4) types of geomembrane identified as follows:

40 mil Smooth HDPE 40 mil Smooth LLDPE 40 mil Polypropylene 40 mil EPDM

Supplier: GSE Supplier: GSE Supplier: Not Provided Supplier: Not Provided

Coupons of the materials were cut and tested for baseline properties as described herein. The remaining coupons were submerged in separate tanks containing Solvay waste. One set of sealed tanks were encased in a Styrofoam housing and maintained at  $23 \pm 1^{\circ}$ C. The other set of tanks were placed on steel shelving, encased in Styrofoam walls and maintained at  $50 \pm 1^{\circ}$ C.

After 30, 60, 90 and 120 days of continuous submergence in the Solvay waste, coupons were removed and tested for the following properties:

#### **Dimensional Properties**

The Width, Length, Thickness and Weight of the coupons were tested before exposure for baseline testing. They were then submerged in the tanks at 23°C and 50°C. At 30, 60, 90 and 120 days the coupons were removed, cleaned and retested for the same properties.

#### Puncture (ASTM D-4833)

Virgin material of each geomembrane type were tested for Puncture to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Puncture.

#### Density (ASTM D-1505)

Virgin material of each geomembrane type were tested for Density to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Density.

#### Hardness (ASTM D-2240)

Virgin material of each geomembrane type were tested for Hardness to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Hardness.

#### 2% Secant Modulus (ASTM D-5323)

Virgin material of each geomembrane type were tested for Modulus to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Modulus.

#### Tear Resistance (ASTM D-1004)

Virgin material of each geomembrane type were tested for Tear Resistance to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Tear Resistance.

#### Volatiles (EPA-SW870)

Virgin material of each geomembrane type were tested for Volatiles to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Volatiles.

#### Extractables (EPA-SW870)

Virgin material of each geomembrane type were tested for Extractables to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Extractables.

#### Tensile Properties (ASTM D-669)

Virgin material of each geomembrane type were tested for Tensile Properties to develop baseline properties. At 30, 60, 90 and 120 days, coupons were removed from each tank and tested for Tensile Properties.

#### Test Results

The average value for each baseline test was computed and used as a reference for the subsequent immersion tests. As each test was performed after the 30, 60, 90 and 120 day immersion periods, the average result was computed. This value was compared to the average baseline value and the percent change computed as shown on the attached data sheets. The data was plotted as percent change vs immersion period at  $23^{\circ}$ C and  $50^{\circ}$ C as shown on the tables.

#### Testing Comments

It is noted the specified tests for this work were based on ASTM D-5747 criteria for HDPE geomembranes. Thus, many of the tests do not apply to LLDPE, Polypropylene and EPDM. However, for comparison purposes, it was decided to run the same tests regardless of the material types as a common baseline.

#### Summary of HDPE Results

#### **HDPE** Dimensional Properties

The values varied only slightly with less then 1% difference over the 120 day period. Thus, Solvay waste had little effect on these properties.

#### **HDPE** Puncture

The results varied with less then 10% decrease in strength over the 120 day period. This is well within the statistical variability of the material itself.

#### **HDPE** Density

The variation in Density was less then 1% over 120 days indicating the Solvay waste has little effect on the density.

#### **HDPE Hardness**

The Hardness decreased by 2.78% at 23°C and 8.33% at 50°C. With immersion, the material tends to soften slightly with greater softening at higher temperatures. However, this softening was quite minimal.

#### HDPE 2% Secant Modulus

At 23°C the Modulus decreased by 22.41% and 11.38% at 50°C. This is as expected. A softening of the material always decreases the Modulus value.

#### **HDPE Tear Resistance**

Tear strength decreased by 10.5% at 23 $^{\circ}$ C and 8.0% at 50 $^{\circ}$ C. These values are well within the statistical variation of the material itself.

#### **HDPE** Volatiles

For these tests, Volatiles varied the most. However, Volatiles evaporate very quickly. Once a sample is removed from the tank, volatiles begin to evaporate. The variation can easily be accounted to the time between the sample was extracted, washed and weighed for the test. These tests are not valid for evaluation unless other tests correlate with these results.

#### **HDPE Extractables**

At 23°C, the Extractables gradually increased over time with a maximum of 19.1% increase. Similarly, at 50°C the Extractables increased through 60 days but decreased at 90 and 120 days. It is difficult to explain this decrease but it does not appear to have an effect on the engineering properties of strength.

#### **HDPE Tensile Properties**

Although the properties varied vs exposure time, the statistical variations were well within the statistical variations of the material's virgin properties. The plots show no significant and consistent decrease with exposure time vs temperature to indicate degradation of the material.

#### Summary of LLDPE Results

#### **LLDPE Dimensional Properties**

The Length, Width, Thickness and Weight all varied by less then 1% indicating that swelling and absorption was very minimal.

#### **LLDPE** Puncture

Puncture strength did decrease by 15.7% at 23°C and 12.81% at 50°C indicating a slight and expected softening of the geomembrane.

#### **LLDPE Density**

The Density change was minimal (<1%) indicating a very slight swelling of the geomembrane.

#### **LLDPE Hardness**

Hardness increased somewhat. However, this test method is not applicable to LLDPE.

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#### LLDPE 2% Secant Modulus

This value decreased by 23.00% at 23 $^{\circ}$ C and 27.18% at 50 $^{\circ}$ C. Although this test is not applicable to a LLDPE membrane, the results suggests a softening of the material.

#### **LLDPE Tear Resistance**

Tear strength varied by +2.94% at 23°C and 12.5% at 50°C. This variation is well within the statistical variation of the material itself.

#### **LLDPE** Volatiles

Volatiles increased significantly indicating the LLDPE absorbed the Volatile components in the Solvay waste. However a relationship between Volatiles and engineering properties is not evident.

#### **LLDPE Extractables**

This value also varied increasing at 23°C and decreasing at 50°C. Again these changes do not correlate well with any engineering properties.

#### **LLDPE Tensile Properties**

Yield stress and yield strain are not applicable to LLDPE. With respect to the Peak Stress and Peak Strain, the change was less then 8% over 120 days and well within the statistical variation of the material itself.

Summary of Polypropylene Results

#### **Polypropylene Dimensional Properties**

Length, Width, Thickness and Weight changes exhibition less then 2% change over the 120 days immersion period. This data does not suggest any significant degradation of the material.

#### **Polypropylene Puncture**

Over 120 days, Puncture strength decreased by 13.97% at 23°C and 21.89% at 50°C.

#### **Polypropylene Density**

The Density change was on the order of 0.5% which was insignificant at both 23°C and 50°C.

#### **Polypropylene Hardness**

Since Hardness does not apply to Polypropylene, no meaningful conclusions can be made.

#### Polypropylene 2% Secant Modulus

This test does not apply to Polypropylene. However, using the graphical procedure of the Standard indicated a 61% decrease after 120 days at  $23^{\circ}$ C and  $50^{\circ}$ C.

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#### **Polypropylene Tear Resistance**

At  $23^{\circ}$ C the Tear strength decreased by 13% after 120 days and 21.95% after 120 days at 50°C. This suggests a softening of the material.

#### **Polypropylene Volatiles**

At both 23°C and 50°C after 120 days, the Polypropylene significantly absorbs Volatiles from the Solvay waste.

#### **Polypropylene Extractables**

Conversely after 120 days, the Polypropylene exhibited a significant decrease in Extractables.

#### **Polypropylene Tensile Properties**

Similar to LLDPE, yield stress and yield strain are not applicable to Polypropylene. Peak values did not change significantly and were well within the statistical variations of the material itself.

#### Summary of EPDM Results

#### **EPDM Dimensional Properties**

Length, Width, Thickness and Weight changes were all less then 2% after 120 days. These values are insignificant.

#### **EPDM** Puncture

After 120 days of exposure, the average values decreased by 18.66% at  $23^{\circ}$ C and 14.71 at  $50^{\circ}$ C. These values are not that significant in that the values can vary by +20% on virgin materials.

#### **EPDM Density**

At both 23°C and 50°C, the Density decreased by less then 1% which is insignificant but does suggest some slight absorption of liquid.

#### **EPDM Hardness**

The Hardness values decreased due to softening and corresponds with the decrease in Density.

#### **EPDM 2% Secant Modulus**

Although this test does not apply to EPDM, we used graphical procedure of the Standard. The data indicates a  $40 \pm \%$  loss over 120 days. This suggests a softening of the material similar to Puncture.

#### **EPDM Tear Resistance**

Tear strength varied by +12.5% at  $23^{\circ}$ C and +4.17% at  $50^{\circ}$ C after 120 days of exposure. These values are within the statistical variation of the material itself.

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#### **EPDM Volatiles**

After 120 days of exposure, Volatiles increased by 130% at 23°C and 216% at 50°C. This suggests the EPDM did absorb Volatiles from the Solvay waste.

#### **EPDM Extractables**

Similar to Volatiles, the Extractables also increased by about  $60 \pm \%$  at  $23^{\circ}$ C and  $50^{\circ}$ C. This indicates the EPDM does absorb liquids from the Solvay waste.

#### **EPDM Tensile Properties**

Since yield stress and yield strain does not apply to EPDM, these results were not evaluated. Peak Stress after 120 days of exposure increase by about 15+% with a slight decrease in Peak Strain. This suggests a stiffening of the material which increases Strength but decreases Strain. However, these values are still within the statistical variation of the material itself.

Summary

All four (4) geomembrane types performed well. The HDPE and LLDPE geomembrane performed the best considering all of the properties were relatively consistent. With respect to the Polypropylene and EPDM, they both absorbed the most extractables and volatiles with more strength variations then the HDPE and LLDPE due to the absorption and softening of the materials.

We appreciate the opportunity to provide our services and look forward to working with you again. Should you have any questions, comments or require additional information, please do not hesitate to call. Thank you.

Sincerely,

JET LABORATORIES, INC.

John Boschuk, Jr., P.E. President

cc: Martin A. Switzer

Enclosures JB/mlb \wp10\letter\09121 Inv# 3827

### Summary of Test Results PROPERTY CHANGE (ASTM D-5747)



Project: Material: Sample ID:	Parsons Honeywell GSE 40 mil \$ 101130132 -	Smooth HDPE					Job No.: Date: Tested By: Checked By:	09LR1826.0 <sup>-</sup> 05/15/2009 RL/AM/MLB JB	1
				23° C	elcius				
TEST	Baseline	30-Day	Immersion	60-Day	Immersion	90-Day	Immersion	120-Day	mmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Weight, gr	9.5917	9.5931	0.01	9.61	0.20	9.62	0.25	9.60	0.09
Length, in	5.5443	5.6135	1.25	5.56	0.22	5.54	-0.14	5.54	-0.02
Width, in	2.6255	2.6153	-0.39	2.62	-0.34	2.61	-0.61	2.61	-0.49
Thickness, mils	41	41	0.00	41.33	0.00	41.33	0.00	41.33	0.00
				50° C	elcius				
TEST	Baseline	30-Day	Immersion	60-Day	Immersion	90-Day	Immersion	120-Day	mmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Weight, gr	9.1289	9.1593	0.33	9.18	0.52	9.17	0.49	9.15	0.24
Length, in	5.2642	5.2664	0.04	5.26	-0.05	5.26	-0.01	5.28	0.22
Width, in	2.7485	2.7465	-0.07	2.75	0.00	2.76	0.24	2.75	0.13
Thickness, mils	41	41	0.00 PROPEF	41.00	0.00	41.00	0.00	41.00	0.00
2 1 (%) 1 (%) 0 1 1 1 1 1 1 1 1 1 1 1 1 1	41	41	0.00 PROPER	A1.00	0.00	41.00	0.00	41.00	0.00 ight 23 ngth 23 ith 23 ckness 23 ight 50 ngth 50 ith 50

	ASTM D-57	47, paragrap	7.11.00 1.11.61					
	Client: Project: Material: Sample ID:	Parsons Honeywell GSE 40 mil Sr 101130132 - H 120 Day Testi	nooth HDPE ng			Job No.: Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB	
	PROPERTY	UNIT		REPLICATE		AVERAGE		
	Q		1	2	Э		DEVIATION	
	Weight	grams	9.0441	9.8676	9.8882	9.6000	0.3931	
°.	Length	ü	5.5875	5.5690	5.4725	5.5430	0.0504	
	Width	Ë	2.4030	2.6915	2.7435	2.6127	0.1498	
	Thickness	mils	42	40	42	41.3	0.9428	
							1	1
	PROPERTY	UNIT		REPLICATE		AVERAGE	STANDARD	
	Q		-	2	3		DEVIATION	
	Weight	grams	8.7853	9.4372	9.2310	9.1512	0.2721	
0	Length	.c	5.1890	5.3900	5.2475	5.2755	0.0844	
	Width	Ŀ.	2.6835	2.7645	2.8080	2.7520	0.0516	
	Thickness	mils	41	41	41	41.0	0.0000	

Parsons 9090

101130132 - HDPE

Dimensional Properties.123

### Summary of Test Results HDPE - 23° Celcius

12

49750

40.0

0.6637

0.3410

12

50600

38.2

0.6943

0.3746

0.00

1.71

-4.50

4.61

9.85

Hardness

2% Modulus

Tear

Volatiles

Extractables



-2.78

-22.41

-10.50

-29.04

19.10

oject: aterial: Imple ID:	Parsons Honeywell GSE 40 mil Sn 101130132 - H	nooth IDPE						Job No.: Date: Tested By: Checked By:	09LR1826. 05/15/2009 RL/AM/ML8 JB
TEST	Baseline	30-Day In	nmersion	60-Day Ir	nmersion	90-Day In	nmersion	120-Day Ir	mmersion
TEST READING	Baseline Average	30-Day In Average	nmersion % Change	60-Day Ir Average	nmersion % Change	90-Day In Average	nmersion % Change	120-Day Ir Average	mmersion % Change
TEST READING Puncture	Baseline Average 108.4	30-Day In Average 102.5	nmersion % Change -5.44	60-Day Ir Average 103.8	nmersion % Change -4.28	90-Day In Average 103.1	nmersion % Change -4.89	120-Day Ir Average 98.5	mmersion % Change -9.17

11

36800

35.6

0.6221

0.3803

-5.56

-26.03

-11.00

-6.27

11.52

-8.33

-20.06

-8.50

8.38

16.21

12

38602

35.8

0.4710

0.4061

11

39768

36.6

0.7194

0.3963



DFE - 23						2	:.oN doL	
ent: Parso oject: Hone aterial: GSE mple ID: 10113	ons sywell 40 mil Smooth 30132 - HDPE Jay Testing						Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No.			AVERAGE	STANDARD
		1 .	2	3	4	5		DEVIATION
<sup>o</sup> uncture Resistanc	ie Ibs	102.8	97.0	97.6	97.6	97.3	98.5	2.1814
Density	gr/cucm	0.94	0.94	0.94			0.94	0.0005
Hardness		11	12	12	<b>9</b> ,		12	0.4714
2% Secant Modulu:	s psi	38500	37850	38640	39140	38880	38602	434.5
Tear (MD Only)	lbs	37	35	32	38	37	35.8	2.1354
Volatiles	%	0.4372	0.5048				0.4710	0.0338
Extractables	%	0.3997	0.4125				0.4061	0.0064

Conformance 23.123

JLT Laboratories, Inc.

Parsons 9090

## Summary of Test Results HDPE - 50° Celcius



Onom.	Parsons	Job No.:	09LR1826.01
Project:	Honeywell	Date:	05/15/2009
Material:	GSE 40 mil Smooth	Tested By:	RL/AM/MLB
Sample ID:	101130132 - HDPE	Checked By:	JB
Sample ID:	101130132 - HDPE	Checked By:	

TEST	Baseline	30-Day In	nmersion	60-Day In	nmersion	90-Day In	nmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Puncture	108.4	106.5	-1.73	111.4	2.73	108.1	-0.24	104.1	-4.00
Density	0.931	0.944	1.32	0.945	1.43	0.942	1.11	0.939	0.86
Hardness	12	12	0.00	11	-5.56	11	-5.56	11	-8.33
2% Modulus	49750	51500	3.52	45700	-8.14	44582	-10.39	44088	-11.38
Tear	40.0	36.6	-8.50	38.0	-5.00	37.0	-7.50	36.8	-8.00
Volatiles	0.6637	0.8376	26.20	0.8614	29.78	0.9374	41.23	0.9218	38.88
Extractables	0.3410	0.5713	67.55	0.7804	128.88	0.3568	4.64	0.3466	1.65



Test Results	
Conformance	SI
Geomembrane	HDPE - 50° Celciu

Parsons	Job No.: 09LF
Honeywell	Date: 05/15
SSE 40 mil Smooth	Tested By: RL/A
01130132 - HDPE	Checked By: JB
20 Day Testing	

PARAMETER	UNITS			REPLICATE No.			AVERAGE	STANDARD
		1	2	ю	4	5		DEVIATION
ouncture Resistance	lbs	103.7	104.5	105.3	106.6	100.2	104.1	2.1546
Density	gr/cucm	0.94	0.94	0.94			0.94	0.0005
Hardness		++	12	10			11	0.8165
2% Secant Modulus	psi	43670	43260	44120	45100	44290	44088	620.7
Tear (MD Only)	lbs	39	39	35	35	36	36.8	1.8330
Volatiles	%	0.9321	0.9114				0.9218	0.0103
Extractables	%	0.2355	0.4577				0.3466	0.1111

JLT Laboratories, Inc.

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# Summary of Test Results HDPE - 23° Celcius



Client:	Parsons	Job No.:	09I R1826 01
Project:	Honeywell	Date:	05/15/2009
Material:	GSE 40 mil Smooth	Tested By:	RL/AM/MLB
Sample ID:	101130132 - HDPE	Checked By:	JB

TEST	Baseline	30-Day li	mmersion	60-Day li	mmersion	90-Day II	nmersion	120-Day	mmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Yield Stress	103.2	100.6	-2.52	95.6	-7.36	96.6	-6.40	91.4	-11.43
Yield Strain	18.4	20.4	10.87	20.4	10.87	20.6	11.96	20.0	8.70
Peak Stress	190.4	199.2	4.62	146.4	-23.11	173.6	-8.82	164.8	-13.45
Peak Strain	532.2	592.6	11.35	469.2	-11.84	519.0	-2.48	515.0	-3.23



	09LR1826.01 02/15/2009 RL/AM/MLB JB	CLANDAD	DEVIATION	1.17	0.49	22.86	178.64	
	Job No.: Date: Tested By: Checked By:	AVERAGE		103.2	18.4	190.4	532.2	
			5	104	18	196	624	
			4	103	19	192	613	
		REPLICATE No.	e	105	19	176	557	
			2	102	18	220	683	
			-	102	18	168	184	
Celcius	is well 0 mil Smooth 0132 - HDPE ne Testing	UNITS		lb/in	%	lb/in	%	
DPE - 23° (	int: Parson ject: Honeyv terial: GSE 4( nple ID: 101130 Baselir	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	La Labour

Parsons 9090

Tensile 23.123

	09LR1826.01 02/15/2009 RL/AM/MLB JB	STANDARD	DEVIATION	2.15	1.20	25.51	52.75		
	Job No.: Date: Tested By: Checked By:	AVFRAGE		100.6	20.4	199.2	592.6		
			5	104	22	192	559		
			4	98	19	204	615		
		REPLICATE No.	3	100	21	216	642		
			2	102	19	220	641		
			1	66	21	164	506		
Celcius	s well 0 mil Smooth 0132 - HDPE <b>r Testing</b>	UNITS		lb/in	%	lb/in	%		ories, Inc.
DPE - 23° (	ant: Parson ject: Honeyv terial: GSE 4( nple ID: 101130 30 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		LT Laborat

Parsons 9090

101130132 - HDPE

Tensile 23.123

	09LR1826.01 03/15/2009 RL/AM/MLB JB	CLANDAD	DEVIATION	2.87	1.36	51.33	66.78		
	Job No.: Date: Tested By: Checked By:	AVERAGE		95.6	20.4	146.4	469.2		
			5	91	20	140	450		
			4	98	19	136	403		
		REPLICATE No.	3	96	19	96	450		
			2	94	22	140	445		
			-	66	22	220	598		
elcius	is well 0 mil Smooth 0132 - HDPE 7 Testing	UNITS		lb/in	%	lb/in	%		
IDPE - 23° (	ent: Parson oject: Honey iterial: GSE 4( mple ID: 101130 60 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		

Tensile 23.123

Parsons 9090

11	09LR1826.01 04/15/2009 RL/AM/MLB JB	CONCINCTO	DEVIATION	2.42	0.49	19.69	47.34	
	Job No.: Date: Tested By: Checked By:	AVEDAGE		96.6	20.6	173.6	519.0	
			5	67	20	184	560	
			4	93	21	184	535	
		REPLICATE No	°	98	21	164	491	
			2	95	21	144	441	
S			1	100	20	192	568	
t Result Celcius	ıs well 0 mil Smooth 0132 - HDPE / <b>Testing</b>	UNITS		lb/in	%	lb/in	%	
Tensile Tesi HDPE - 23° (	Client: Parsor Project: Honey Material: GSE 4 Sample ID: 10113( 90 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	

Parsons 9090

Tensile 23.123

	09LR1826.01 05/15/2009 iy: RL/AM/MLB By: JB	AGE STANDAD	DEVIATION	3.93	2.10	3 24.71	77.42	
	Job No.: Date: Tested B Checked	AVED		91.4	20.0	164.8	515.(	
			5	86	22	152	496	
			4	93	23	200	611	
		REPLICATE No	S	88	18	188	596	
			2	97	19	136	410	
10			-	93	18	148	462	
: Result	s vell 1 mil Smooth 132 - HDPE y <b>Testing</b>	UNITS		lb/in	%	lb/in	%	
Tensile Test HDPE - 23° C	Client: Parson Project: Honeyw Material: GSE 40 Sample ID: 101130 120 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	

Parsons 9090

Tensile 23.123

# Summary of Test Results HDPE - 50° Celcius



Client:	Parsons	Job No.:	09I B1826 01
Project:	Honeywell	Date:	05/15/2009
Material:	GSE 40 mil Smooth	Tested By:	RI /AM/MI B
Sample ID:	101130132 - HDPE	Checked By:	JB

TEST	Baseline	30-Day I	mmersion	60-Day I	mmersion	90-Day Ir	nmersion	120-Day	mmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Yield Stress	103.2	92.8	-10.08	100.8	-2.33	98.0	-5.04	94.2	-8.72
Yield Strain	18.4	20.4	10.87	19.6	6.52	20.0	8.70	20.8	13.04
Peak Stress	188.8	168.0	-11.02	165.6	-12.29	181.6	-3.81	157.6	-16.53
Peak Strain	532.2	474.2	-10.90	491.4	-7.67	552.8	3.87	481.4	-9.55



Job No.: 09LR1826 Date: 02/15/200 Tested By: RL/AM/ML Checked By: JB	AVERAGE STANDA	5 DEVIAT	104 103.2 1.17	18 18.4 0.49	196 188.8 25.37	624 532.2 178.64
		4	103	19	192	613
	REPLICATE No.	ю	105	19	176	557
		2	102	18	220	683
		4	102	18	160	184
s well 0 mil Smooth 0132 - HDPE te Testing	UNITS	1	lb/in	%	lb/in	%
Client: Parsor Project: Honey Material: GSE 4 Sample ID: 10113( Baselir	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain

Parsons 9090

711	09LR1826.01 02/15/2009 RL/AM/MLB JB		DEVIATION	2.71	1.20	12.36	82.61		
	Job No.: Date: Tested By: Checked By:		AVENAGE	92.8	20.4	168.0	474.2		
			5	89	22	148	446		
			4	91	19	168	505		
		REPLICATE NO	3	93	21	168	513		
			2	94	19	192	576		
10			1	97	21	164	331		
t Result Celcius	s vell 0 mil Smooth 1132 - HDPE • <b>Testing</b>	UNITS		lb/in	%	lb/in	%		
Tensile Test HDPE - 50° (	Client: Parson Project: Honey/ Material: GSE 4( Sample ID: 101130 30 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		

Parsons 9090

ent: Parson: bject: Honeyv terial: GSE 40								
mple ID: 101130 60 Day	s ell mil Smooth 132 - HDPE Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 03/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No	0.		AVERAGE	STANDARD
		1 201	2	ę	4	5		DEVIATION
Yield Stress	lb/in	98	101	,101	101	103	100.8	1.60
Yield Strain	%	21	20	18	19	20	19.6	1.02
Peak Stress	lb/in	140	120	176	196	196	165.6	23.17
Peak Strain	%	443	351	528	574	561	491.4	83.74

Parsons 9090

	09LR1826.01 04/15/2009 r: RL/AM/MLB By: JB	GF STANDARD	DEVIATION	1.10	1.10	21.75	58.47		
	Job No.: Date: Tested By Checked I	AVERA		98.0	20.0	181.6	552.8		
			5	98	20	188	561		
			4	98	21	164	502		
		REPLICATE No	3	97	21	168	516		
			2	100	18	172	522		
				97	20	216	663		
Celcius	s well 0 mil Smooth 1132 - HDPE • Testing	UNITS		lb/in	%	lb/in	%		
IDPE - 50° (	ient: Parson oject: Honeyv aterial: GSE 4( mple ID: 101130 90 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		-

Parsons 9090

	09LR1826.01 05/15/2009 RL/AM/MLB JB	STANDARD	DEVIATION	2.79	0.75	16.33	52.04	
	Job No.: Date: Tested By: Checked By:	AVERAGE		94.2	20.8	157.6	481.4	
			5	94	20	140	422	
			4	89	21	144	464	
		REPLICATE No.	3	97	21	148	448	
			2	96	20	168	501	
			1	95	22	188		
Celcius	s well 0 mil Smooth 0132 - HDPE ty Testing	UNITS		lb/in	%	lb/in	%	
IDPE - 50° (	ient: Parson oject: Honeyv iterial: GSE 44 mple ID: 101130 120 Da	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	

Parsons 9090

101130132 - HDPE

### Summary of Test Results PROPERTY CHANGE (ASTM D-5747)



TEST       Baseline       30-Day immersion       60-Day immersion       90-Day immersion       120-Day immersion         Weight, gr       8.5775       8.6102       0.38       8.63       0.56       8.63       0.60       8.62       0         Length, in       4.5652       4.8577       0.03       4.86       -0.01       4.88       0.50       4.85       0.0         Widh, in       2.8260       2.822       0.04       2.82       -0.02       2.81       -0.65       2.83       0.0         Thickness, mils       41       41       0.00       40.67       0.00       40.67       0.00       40.67       0.00         Weight, gr       READING       Merage       Merag	Sample ID:	Honeywell GSE 40 mil 8 104143221 -	Smooth · LLDPE		96 			Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLB JB	1	
TEST READING         Baseline         30-Day Immersion         60-Day Immersion         90-Day Immersion         120-Day Immersion           Weight, gr         8.5775         8.6102         0.38         8.63         0.56         8.63         0.60         8.62         0           Length, in         4.8562         4.8577         0.03         4.86         -0.01         4.88         0.50         4.85         -0           Width, in         2.8250         2.8262         0.04         2.82         -0.02         2.81         -0.65         2.83         0           Thickness, mils         41         41         0.00         40.67         0.00         40.67         0.00         40.67         0           TEST         Baseline         30-Day Immersion         60-Day Immersion         90-Day Immersion         120-Day Immersion         120-Day Immersion         120-Day Immersion         0           READING         Average         Average         % Change         Average <th></th> <th></th> <th></th> <th></th> <th>23° C</th> <th>celcius</th> <th>2 J</th> <th></th> <th></th> <th></th>					23° C	celcius	2 J				
READING         Average         Average         % Change         Average         % Change </th <th>TEST</th> <th>Baseline</th> <th>30-Day</th> <th>Immersion</th> <th>60-Day</th> <th>Immersion</th> <th>90-Day</th> <th>Immersion</th> <th>120-Day</th> <th>Immersion</th>	TEST	Baseline	30-Day	Immersion	60-Day	Immersion	90-Day	Immersion	120-Day	Immersion	
Weight, gr         8.5775         8.6102         0.38         8.63         0.56         8.63         0.60         8.62         0           Length, in         4.8562         4.8577         0.03         4.86         -0.01         4.88         0.50         4.85         -0.00           Width, in         2.8250         2.8262         0.04         2.82         -0.02         2.81         -0.65         2.83         0           Thickness, mills         41         41         0.00         40.67         0.00         40.67         0.00         40.67         0           So° Celcius	READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change	
Length, in       4.8562       4.8577       0.03       4.86       -0.01       4.88       0.50       4.85       -c.         Width, in       2.8250       2.8262       0.04       2.82       -0.02       2.81       -0.65       2.83       0         Thickness, mils       41       41       0.00       40.67       0.00       40.67       0.00       40.67       0         So° Celcius         TEST       Baseline       30-Day Immersion       60-Day Immersion       90-Day Immersion       120-Day Immersion       120-Day Immersion       120-Day Immersion       % Change       Average	Weight, gr	8.5775	8.6102	0.38	8.63	0.56	8.63	0.60	8.62	0.46	
Width, in         2.8250         2.8262         0.04         2.82         -0.02         2.81         -0.65         2.83         0           Thickness, milts         41         41         0.00         40.67         0.00         40.67         0.00         40.67         0           S0° Celcius           TEST         Baseline         30-Day Immersion         60-Day Immersion         30-Day Immersion         120-Day Immersion	Length, in	4.8562	4.8577	0.03	4.86	-0.01	4.88	0.50	4.85	-0.16	
Thickness, mills       41       41       0.00       40.67       0.00       40.67       0.00       40.67       0         50° Celcius         TEST       Baseline       30-Day Immersion       60-Day Immersion       90-Day Immersion       120-Day Immersion       120-Day Immersion         READING       Average       % Change       Average <th co<="" td=""><td>Width, in</td><td>2.8250</td><td>2.8262</td><td>0.04</td><td>2.82</td><td>-0.02</td><td>2.81</td><td>-0.65</td><td>2.83</td><td>0.21</td></th>	<td>Width, in</td> <td>2.8250</td> <td>2.8262</td> <td>0.04</td> <td>2.82</td> <td>-0.02</td> <td>2.81</td> <td>-0.65</td> <td>2.83</td> <td>0.21</td>	Width, in	2.8250	2.8262	0.04	2.82	-0.02	2.81	-0.65	2.83	0.21
50° Celcius         TEST       Baseline       30-Day Immersion       60-Day Immersion       90-Day Immersion       120-Day Immersion         READING       Average       Average       % Change       Average       % Change       Average       % Change         Weight, gr       7.6216       7.6620       0.53       7.68       0.75       7.67       0.69       7.68       0.0         Length, in       4.8562       4.8587       0.05       4.87       0.24       4.86       -0.00       4.87       0.0         Width, in       2.5017       2.5027       0.04       2.50       -0.21       2.50       0.07       2.51       0.0         Thickness, mills       40       40       0.00       40.67       0.83       40.67       0.83       40.67       0.83         PROPERTY CHANGE	Thickness, mils	41	41	0.00	40.67	0.00	40.67	0.00	40.67	0.00	
TEST         Baseline         30-Day Immersion         90-Day Immersion         120-Day Immersion           READING         Average         Average         % Change         Average		1	1		50° C	elcius					
READING         Average         Average         % Change         % Change         Average         % Change         % Change         Average         % Change	TEST	Baseline	30-Day	Immersion	60-Day	mmersion	90-Day	Immersion	120-Day	Immersion	
Weight, gr         7.6216         7.6620         0.53         7.68         0.75         7.67         0.69         7.68         0.0           Length, in         4.8562         4.8587         0.05         4.87         0.24         4.86         -0.00         4.87         0.           Width, in         2.5017         2.5027         0.04         2.50         -0.21         2.50         0.07         2.51         0.           Thickness, mils         40         40         0.00         40.67         0.83         40.67         40.67         40.67         40.67         40.67         40.67         40.67	READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change	
Length, in       4.8562       4.8587       0.05       4.87       0.24       4.86       -0.00       4.87       0.         Width, in       2.5017       2.5027       0.04       2.50       -0.21       2.50       0.07       2.51       0.         Thickness, mils       40       40       0.00       40.67       0.83       40.67       0.83       40.67       0.         PROPERTY CHANGE	Weight, gr	7.6216	7.6620	0.53	7.68	0.75	7.67	0.69	7.68	0.79	
Width, in         2.5017         2.5027         0.04         2.50         -0.21         2.50         0.07         2.51         0.           Thickness, mils         40         40         0.00         40.67         0.83         40.67         0.83         40.67         0.           PROPERTY CHANGE           Image: state	Length, in	4.8562	4.8587	0.05	4.87	0.24	4.86	-0.00	4.87	0.22	
Thickness, mils         40         40         0.00         40.67         0.83         40.67         0.83         40.67         0.           PROPERTY CHANGE           1         Image: Colspan="6">Image: Colspan="6" Colspa="6" Colspan="6" Colspan="6" Colspan="6" Colspa="6	Width, in	2.5017	2.5027	0.04	2.50	-0.21	2.50	0.07	2.51	0.23	
PROPERTY CHANGE	Thickness, mils	40	40	0.00	40.67	0.83	40.67	0.83	40.67	0.83	
C 0					TY CHA						



Client:						
Project: Material: Sample ID:	Parsons Honeywell GSE 40 mil Sr 104143221 - L 120 Day Test	mooth LLDPE ing			Job No.: Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB
PROPERTY	TINU		REPLICATE	1	AVERAGE	STANDARD
0		1	2	e		DEVIATION
Weight	grams	7.7665	9.0903	8.9948	8.6172	0.6028
Length	,Ľ	4.6190	4.9805	4.9460	4.8485	0.1629
Width	Ŀ	2.6690	2.9130	2.9110	2.8310	0.1146
Thickness	mils	40	41	41	40.7	0.4714
PROPERTY	VNIT		REPLICATE		AVERAGE	STANDARD
Q		~	2	3		DEVIATION
Weight	grams	8.4800	7.5752	6.9893	7.6815	0.6132
Length	.Ľ	5.2615	4.8345	4.5040	4.8667	0.3101
Width	'n	2.5355	2.4930	2.4935	2.5073	0.0199
Thickness	mils	41	41	40	40.7	0.4714
Laboratorie	s, Inc.					

Parsons 9090

Dimensional Properties.123

## Summary of Test Results LLDPE - 23° Celcius



Client: Parsons Job No.: 09LR1826.01 Project: Honeywell Date: 05/15/2009 Material: GSE 40 mil Smooth Tested By: RL/AM/MLB Sample ID: 104143221 - LLDPE JB Checked By:

TEST	Baseline	30-Day In	nmersion	60-Day In	nmersion	90-Day Ir	nmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Puncture	94.5	86.5	-8.43	88.6	-6.22	85.6	-9.40	79.6	-15.71
Density	0.931	0.932	0.07	0.931	-0.04	0.931	0.00	0.928	-0.32
Hardness	9	9	0.00	11	22.22	10	11.11	10	11.11
2% Modulus	22000	28600	30.00	16300	-25.91	17138	-22.10	16896	-23.20
Tear	27.2	30.2	11.03	28.6	5.15	28.0	2.94	28.0	2.94
Volatiles	0.1340	0.4315	221.89	0.7014	423.31	0.6719	401.23	0.6885	413.66
Extractables	0.3461	0.4045	16.87	0.7062	104.05	0.4468	29.09	0.5117	47.85



oject: Honeywe aterial: GSE 40 1 ample ID: 1041432 120 Day	il mil Smooth 21 - LLDPE Testing						Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No.			AVERAGE	STANDARD
		1	2	3	4	5		DEVIATION
<sup>D</sup> uncture Resistance	lbs	78.6	80.3	80.1	81.2	78.0	79.6	1.1706
Density	gr/cucm	0.93	0.93	0.93			0.93	0.0005
Hardness		6	10	11			10	0.8165
2% Secant Modulus	psi	16920	16850	17160	16540	17010	16896	206.0
Tear (MD Only)	lbs	29	28	28	30	25	28.0	1.6733
Volatiles	%	0.6311	0.7459				0.6885	0.0574
Extractables	%	0.5355	0.4879				0.5117	0.0238

104143221 - LLDPE

Conformance 23.123

Parsons 9090

### Summary of Test Results LLDPE - 50° Celcius



Client:ParsonsJob No.:09LR1826.01Project:HoneywellDate:05/15/2009Material:GSE 40 mil SmoothTested By:RL/AM/MLBSample ID:104143221 - LLDPEChecked By:JB

TEST	Baseline	30-Day In	nmersion	60-Day Ir	nmersion	90-Day In	nmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Puncture	94.5	85.3	-9.72	86.2	-8.81	87.1	-7.77	82.4	-12.81
Density	0.931	0.932	0.07	0.931	0.00	0.931	-0.07	0.927	-0.47
Hardness	9	9	0.00	11	18.52	10	7.41	11	18.52
2% Modulus	22000	28500	29.55	15800	-28.18	16188	-26.42	16020	-27.18
Tear	27.2	31.2	14.71	27.6	1.47	28.2	3.68	30.6	12.50
Volatiles	0.1340	0.4870	263.29	1.0762	702.87	0.6659	396.76	0.6229	364.68
Extractables	0.3461	0.5112	47.70	0.4840	39.85	0.3527	1.91	0.3077	-11 11


nple ID: 1041432 120 Day	21 - LLDPE Testing						l ested by: Checked By:	JB
PARAMETER	UNITS			REPLICATE No.			AVERAGE	STANDARD
		-	2	S	4	5		DEVIATION
uncture Resistance	lbs	79.5	83.6	85.0	80.5	83.3	82.4	2.0508
Density	gr/cucm	0.93	0.93	0.93			0.93	0.0000
Hardness		11	10	11			11	0.4714
% Secant Modulus	psi	15640	16210	16360	16110	15780	16020	269.0
ear (MD Only)	lbs	31	31	32	32	27	30.6	1.8547
Volatiles	%	0.6609	0.5848				0.6229	0.0381
Extractables	%	0.2754	0.3399				0.3077	0.0323

# Summary of Test Results LLDPE - 23° Celcius



Job No.:	09LR1826.01
Date:	05/15/2009
Tested By:	RL/AM/MLB
Checked By:	JB
	Job No.: Date: Tested By: Checked By:

TEST	Baseline	30-Day Ir	mmersion	60-Day li	mmersion	90-Day li	mmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Yield Stress	61.4	73.0	18.89	68.4	11.40	74.0	20.52	70.4	14.66
Yield Strain	40.8	41.6	1.96	42.2	3.43	41.0	0.49	41.4	1.47
Peak Stress	178.4	212.8	19.28	185.6	4.04	171.2	-4.04	191.2	7.17
Peak Strain	703.6	894.8	27.17	757.6	7.67	614.8	-12.62	725.2	3.07



	b No.: 09LR1826.01 Ite: 02/15/2009 sted By: RL/AM/MLB ecked By: JB	AVERAGE STANDADD	DEVIATION	61.4 1.36	40.8 1.72	178.4 19.69	703.6 142.28		
	C A D		2	59	38	196	789		
			4	62	40	164	567		
		REPLICATE No.	3	61	43	200	899		
			2	63	41	152	516		
			۲	62	42	180	747		
Celcius	ns well 0 mil Smooth 3221 - LLDPE ne Testing	UNITS		lb/in	%	lb/in-	%		Control Turo
LDPE - 23°	lient: Parsor roject: Honey aterial: GSE 4 ample ID: 10414; Baselir	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		LT Tabaud

104143221 - LLDPE

Parsons 9090

Tensile 23.123

	09LR1826.01 02/15/2009 RL/AM/MLB JB	CTANING	DEVIATION	0.89	2.24	36.12	153.38		
	Job No.: Date: Tested By: Checked By:	AVERAGE		73.0	41.6	212.8	894.8		
			5	73	38	220	924		
			4	72	41	212	984		
		REPLICATE No	3	72	41	216	995		
			2	74	44	252	679		
			-	74	44	164	592		
Celcius	is well 0 mil Smooth 3221 - LLDPE / <b>Testing</b>	UNITS		lb/in	%	lb/in	%		
LDPE - 23°	lient: Parson roject: Honey aterial: GSE 4( ample ID: 104145 30 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		

104143221 - LLDPE

Tensile 23.123

Parsons 9090

lient: Parsons roject: Honeywell laterial: GSE 40 mil Smooth ample ID: 104143221 - LLDPE 60 Day Testing PARAMETER UNITS PARAMETER UNITS Yield Stress Ib/in 69 70 66			Job No.: Date: Tested By: Checked By:	09LR1826.01 03/15/2009 RL/AM/MLB JB
PARAMETER UNITS 1 2 REPLIC 1 2 3 Yield Stress Ib/in 69 70 66				
PARAMETERUNITSREPLIC123Yield StressIb/in697068				
1         2         3           Yield Stress         Ib/in         69         70         66	ATE No.		AVERAGE	STANDARL
Yield Stress Ib/in 69 70 68	4	5		DEVIATION
	68	67	68.4	1.02
Yield Strain         %         41         44         41	1 41	44	42.2	1.47
Peak Stress Ib/in 192 196 18	4 176	180	185.6	4.99
Peak Strain         %         795         794         72	4 735	740	757.6	30.57

104143221 - LLDPE

t: Parsons ct: Honeywell ial: GSE 40 mil	Smooth							
90 Day Tes	sting						Job No.: Date: Tested By: Checked By:	09LR1826.01 04/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No			AVERAGE	TANUATZ
		-	2	3	4	5		DEVIATION
Yield Stress	lb/in	75	75	72	75	73	74.0	1.26
Yield Strain	%	41	41	41	41	41	41.0	0.00
Peak Stress	lb/in	192	196	128	172	168	171.2	31.16
Peak Strain	%	685	708	484	601	596	614.8	79.08

104143221 - LLDPE

Tensile 23.123

11	09LR1826.01 05/15/2009 RL/AM/MLB JB	STANDARD	DEVIATION	2.42	2.33	12.50	37.56		
	Job No.: Date: Tested By: Checked By:	AVERAGE		70.4	41.4	191.2	725.2		
			5	68	38	172	672		
			4	70	40	192	733		
		REPLICATE No	3	69	41	200	777		
			2	70	44	208	749		
			1	75	44	184	695		
Celcius	s well 0 mil Smooth 3221 - LLDPE ty Testing	UNITS		lb/in	%	lb/in	%		
LLDPE - 23°	Client: Parson Project: Honey Material: GSE 4( Sample ID: 104143 120 Da	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		

104143221 - LLDPE

Tensile 23.123

Parsons 9090

# Summary of Test Results LLDPE - 50° Celcius



Client:	Parsons	Job No.:	09LR1826.01
Project:	Honeywell	Date:	05/15/2009
Material:	GSE 40 mil Smooth	Tested By:	RL/AM/MLB
Sample ID:	104143221 - LLDPE	Checked By:	JB

TEST	Baseline	30-Day Ir	mmersion	60-Day I	mmersion	90-Day Ir	nmersion	120-Day	mmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Yield Stress	61.4	74.2	20.85	70.8	15.31	72.2	17.59	75.2	22.48
Yield Strain	42.2	44.4	5.21	43.8	3.79	40.0	-5.21	44.4	5.21
Peak Stress	178.4	182.4	2.24	187.2	4.93	188.8	5.83	184.8	3.59
Peak Strain	703.6	676.6	-3.84	779.0	10.72	762.4	8.36	719.0	2.19



	No.:: 09LR1826.01 e: 02/15/2009 ted By: RL/AM/MLB scked By: JB	VERAGE STANDADD	DEVIATION	61.4 1.36	42.2 0.75	178.4 19.69	703.6 142.28		
	Job Tes Che	4	5	59	43	196	789 7		
			4	62	42	164	567		
		REPLICATE No.	3	61	41	200	899		
			2	63	43	152	516		
			+	62	42	180	747		
Celcius	is well 0 mil Smooth 3221 - LLDPE ne Testing	UNITS		lb/in	%	lb/in	%		anion Inc.
LDPE - 50°	ient: Parson oject: Honey aterial: GSE 4( mple ID: 104143 Baselin	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain		LT about

104143221 - LLDPE

Tensile 50.123

Parsons 9090

09LR1826.01 02/15/2009 v: RL/AM/MLB By: JB		DEVIATION	0.40	0.80	37.57	122.58		
Job No.: Date: Tested By Checked	AVEDA		74.2	44.4	182.4	676.6		
		5	74	44	212	799		
		4	74	44	200	732		
3	REPLICATE No	3	74	44	120	467		
		2	75	44	212	772		
		-	74	46	168	613		
s /ell 1 mil Smooth 221 - LLDPE Testing	UNITS		lb/in	%	lb/in	%		ries. Inc
: Parsoni t: Parsoni al: GSE 40 le ID: 104143 30 Day	ARAMETER		<b>/ield Stress</b>	Yield Strain	eak Stress	<sup>5</sup> eak Strain		Laborate

104143221 - LLDPE

Parsons 9090

	09LR1826.01 03/15/2009 RL/AM/MLB v: JB	E STANDARD	DEVIATION	0.75	1.60	13.60	146.87		
	Job No.: Date: Tested By: Checked B	AVERAG	2	70.8	43.8	187.2	779.0		
			5	70	44	184	676		
			4	70	44	168	624		
		REPLICATE No	3	71	41	208	1012		
			2	71	44	200	888		
			-	72	46	176	695		
Celcius	s vell D mil Smooth \$221 - LLDPE Testing	UNITS		lb/in	%	lb/in	%		
LDPE - 50°	ient: Parson oject: Honeyv aterial: GSE 40 ample ID: 104143 60 Day	PARAMETER		<b>Yield Stress</b>	Yield Strain	Peak Stress	Peak Strain		

104143221 - LLDPE

	y Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 04/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No			AVERAGE	STANDAD
		►	2	3	4	5		DEVIATION
Yield Stress	lb/in	73	73	72	72	71	72.2	0.75
Yield Strain	%	39	38	41	41	41	40.0	1.26
Peak Stress	lb/in	188	200	176	200	180	188.8	9.80
Peak Strain	%	729	812	680	816	775	762.4	5176

104143221 - LLDPE

Parsons Honeywe GSE 40 n 10414322 120 Day	ll nil Smooth 21 - LLDPE Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB
2 2 2	UNITS			REPLICATE No		,	AVERAGE	LANUATS
		1 -	2	S	4	5		DEVIATION
SS	lb/in	84	80	72	71	69	75.2	5.78
ain	%	38	46	46	46	46	44.4	3.20
SSS	lb/in	204	192	148	196	184	184.8	19.50
ain	%	863	719	563	757	693	719.0	97.15

104143221 - LLDPE

#### Summary of Test Results PROPERTY CHANGE (ASTM D-5747)



Client: Project: Material: Sample ID:	Parsons Honeywell Polypropyler Polypropyler	ne					Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLE : JB	)1
				23° C	Celcius				
TEST	Baseline	30-Day	Immersion	60-Day	Immersion	90-Day	Immersion	120-Day	Immersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Weight, gr	11.1493	11.2330	0.75	11.27	1.07	11.25	0.89	11.23	0.76
Length, in	5.3462	5.3507	0.08	5.34	-0.08	5.34	-0.09	5.34	-0.13
Width, in	2.8922	2.8895	-0.09	2.88	-0.51	2.88	-0.57	2.87	-0.61
Thickness, mils	44	44	0.00	44.33	0.00	44.33	0.00	44.33	0.00
TEST	Baseline	30-Day	Immersion	60-Day		90-Day	Immersion	120-Day	Immersion
DEADINO	Daseinie	30-Day		60-Day	Immersion	90-Day	Immersion	120-Day	Immersion
Weight, gr	10.4059	10.5256	1.15	10.58	1 70	10.57	1 56	Average	1 QQ
Length in	5 3895	5 3948	0.10	5 38	-0.21	5.26	0.50	5.20	0.47
Width in	2.0427	2.0297	0.10	0.00	-0.21	0.00	-0.59	0.00	-0.17
Thickness mile	40	2.9307	-0.14	2.94	-0.03	2.94	-0.25	2.94	-0.25
nickness, mils	40	40	0.00	40.33	0.00	40.33	0.00	40.33	0.00
0 			PROPER	RTY CHA	NGE				
2								- We	eight 23
IV Change (%		-			P			→ Wi → Th → We → Le	dth 23 ickness 23 eight 50 nath 50

JLT Laboratories, Inc.

30

-1 0

60

Immersion Period (days)

90

120

		747, paragrap	hs 11.1 & 11.	2			
	Client: Project: Material: Sample ID:	Parsons Honeywell Polypropylene 120 Day Testi	ē.			Job No.: Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB
	PROPERTY	UNIT		REPLICATE		AVERAGE	STANDARD
a second second	0		-	2	3		DEVIATION
	Weight	grams	11.0203	11.6313	11.0494	11.2337	0.2814
	Length	Ľ.	5.2635	5.4075	5.3470	5.3393	0.0590
	Width	ŗ	2.8675	2.8985	2.8580	2.8747	0.0173
loss and	Thickness	mils	44	45	44	44.3	0.4714
	PROPERTY	UNIT		REPLICATE		AVERAGE	STANDARD
	₽		1	2	3		DEVIATION
	Weight	grams	11.0615	10.3916	10.3843	10.6125	0.3175
	Length	. <u>C</u>	5.4455	5.3705	5.3250	5.3803	0.0497
	Width	Ē	2.8975	2.9885	2.9200	2.9353	0.0387
	Thickness	mils	43	39	39	40.3	1.8856

Dimensional Properties.123

Polypropylene

## Summary of Test Results Polypropylene - 23° Celcius



Client: Parsons Job No .: 09LR1826.01 Project: Honeywell Date: 05/15/2009 Material: Polypropylene Tested By: RL/AM/MLB Sample ID: Polypropylene Checked By: JB

TEST	Baseline	30-Day In	nmersion	60-Day Ir	nmersion	90-Day Ir	nmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Puncture	73.7	56.3	-23.66	66.0	-10.50	60.5	-17.91	63.4	-13.97
Density	0.910	0.911	0.11	0.910	0.07	0.908	-0.18	0.906	-0.44
Hardness	9	10	3.57	10	7.14	10	7.14	11	14.29
2% Modulus	27000	10000	-62.96	10600	-60.74	10558	-60.90	10524	-61.02
Tear	24.6	21.0	-14.63	21.8	-11.38	22.0	-10.57	21.4	-13.01
Volatiles	0.3802	0.6838	79.88	0.9197	141.94	0.6089	60.16	0.6806	79.03
Extractables	24.2593	23.5016	-3.12	23.9529	-1.26	1.3578	-94.40	1.9722	-91.87



						Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLB JB
IS			REPLICATE No.			AVFRAGF	STANNAR
	1	2	œ	4	5		DEVIATION
sql	59.6	67.7	61.5	65.1	63.2	63.4	2.8096
cucm	0.91	0.91	0.91			0.91	0.0005
	11	11	10			11	0.4714
osi	10490	10520	10480	10520	10610	10524	45.9
sq	21	22	21	22	21	21.4	0.4899
%	0.6599	0.7013				0.6806	0.0207
%	2.0262	1.9182				1.9722	0.0540

Conformance 23.123

Parsons 9090

## Summary of Test Results Polypropylene - 50° Celcius



Client: Project: Material: Sample ID:	Parsons Honeywell Polypropylene Polypropylene	9						Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLE JB
TEST	Baseline	30-Day In	nmersion	60-Day Ir	nmersion	90-Day In	nmersion	120-Day Ir	nmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Puncture	73.7	59.1	-19.83	62.8	-14.81	59.5	-19.29	57.6	-21.89
Density	0.910	0.910	0.00	0.910	0.00	0.907	-0.29	0.905	-0.51
Hardness	9	9	0.00	10	7.14	10	7.14	10	10.71
2% Modulus	27000	17700	-34.44	9800	-63.70	10068	-62.71	10042	-62.81
Tear	24.6	21.2	-13.82	20.4	-17.07	21.4	-13.01	19.2	-21.95
Volatiles	0.3802	1.0608	179.04	1.8251	380.09	1.2863	238.34	1.9792	420.62
Extractables	24.2593	23.7521	-2.09	23.6336	-2.58	2.1139	-91.29	2.7495	-88.67



	09LR1826.01 05/15/2009 RL/AM/MLB JB	STANDARD	DEVIATION	5.3056	0.0000	0.4714	121.9	0.7483	0.2338	0.2218
	Job No.: Date: Tested By: Checked By:	AVERAGE	9    	57.6	0.91	10	10042	19.2	1.9792	2.7495
			5	57.7			9920	20		
0			4	48.0			0686	19		
ר עכאווו		REPLICATE No.	3	57.3	0.91	10	10210	18		
			2	61.6	0.91	11	10130	19	2.2130	2.9713
Celcius			-	63.3	0.91	10	10060	20	1.7454	2.5277
- 50° (	al ylene Testing	UNITS		lbs	gr/cucm		psi	lbs	%	%
olypropylene	lient: Parsons roject: Honeywe aterial: Polyprop; ample ID: Polyprop; 120 Day	PARAMETER		Puncture Resistance	Density	Hardness	2% Secant Modulus	Tear (MD Only)	Volatiles	Extractables

Polypropylene

Conformance 50.123

## Summary of Test Results Polypropylene - 23° Celcius



	09LK1020.01
Date:	05/15/2009
Tested By:	RL/AM/MLB
Checked By:	JB
	Tested By: Checked By:

TEST	Baseline	30-Day Ir	nmersion	60-Day In	nmersion	90-Day Ir	mmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Yield Stress	53.4	52.0	-2.62	51.8	-3.00	40.4	-24.34	51.0	-4.49
Yield Strain	68.4	67.0	-2.05	72.2	5.56	74.8	9.36	70.4	2.92
Peak Stress	147.2	141.6	-3.80	147.2	0.00	103.2	-29.89	148.0	0.54
Peak Strain	688.6	694.4	0.84	715.2	3.86	591.8	-14.06	709.8	3.08



ient: Parson		elcius						
oject: Honey aterial: Polypro ample ID: Polypro Baselir	s vell ppylene ppylene ie Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 02/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No			AVERAGE	CONCINE
		1	2	e	4	5		DEVIATION
Yield Stress	lb/in	55	56	53	53	50	53.4	2.06
Yield Strain	%	72	72	64	72	62	68.4	4.45
Peak Stress	lb/in	152	144	160	144	136	147.2	6.53
Peak Strain	%	748	644	737	671	643	688.6	45.28

Parsons 9090

Tensile 23.123

11	09LR1826.01 02/15/2009 RL/AM/MLB JB	CONCINETO	DEVIATION	0.63	1.10	3.27	23.24	
	Job No.: Date: Tested By: Checked By:	AVEDACE		52.0	67.0	141.6	694.4	
			5	52	67	144	715	
			4	51	66	132	652	
		REPLICATE No.	e	53	66	144	704	
			2	52	69	148	713	
s elcius			~	52	67	140	688	
t Result e - 23° C	ns well opylene y Testing	UNITS		lb/in	%	lb/in	%	ories, Inc.
Tensile Tes Polypropylene	Client: Parsor Project: Honey Material: Polypr Sample ID: Polypr 30 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	Laborat

Parsons 9090

Tensile 23.123

ent: Parsons ject: Honeywell terial: Polynronylen	a a di						Job No.:	09LR1826.01
mple ID: Polypropylen 60 Day Testi	D						Date: Tested By: Checked By:	03/15/2009 RL/AM/MLB JB
PARAMETER	NITS			REPLICATE NO				
	)	-	2	3	. 4	5	AVERAGE	DEVIATION
Yield Stress	lb/in	52	52	52	52	51	51.8	0.40
Yield Strain	%	77	77	64	74	69	72.2	5.04
Peak Stress	lb/in	148	152	136	144	156	147.2	6.80
			760	659	695	755	715.2	36.97

Parsons 9090

Tensile 23.123

11	09LR1826.01 05/15/2009 RL/AM/MLB JB		STANDARD	1.67	4.50	13.15	59.06
	Job No.: Date: Tested By: Checked By:		AVERAGE	51.0	70.4	148.0	709.8
			5	50	64	152	761
			4	49	77	164	687
		REPLICATE NO	NEFLICATE NU.	54	72	124	604
			2	51	72	152	741
s elcius			-	51	67	148	756
t Result	is well opylene ay Testing	UNITS		lb/in	%	lb/in	%
ensile Test	ent: Parson oject: Honey, iterial: Polypro mple ID: Polypro 120 Da	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain

Parsons 9090

Tensile 23.123

## Summary of Test Results Polypropylene - 50° Celcius



Client:	Parsons	Job No.: 09LR1826.01
Project:	Honeywell	Date: 05/15/2009
Material:	Polypropylene	Tested By: RL/AM/MLB
Sample ID:	Polypropylene	Checked By: JB

TEST	Baseline	30-Day Ir	mmersion	60-Day I	mmersion	90-Day Ir	nmersion	120-Day I	mmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Yield Stress	53.4	50.6	-5.24	49.2	-7.87	51.6	-3.37	48.0	-10.11
Yield Strain	68.4	64.4	-5.85	77.8	13.74	79.0	15.50	79.4	16.08
Peak Stress	147.2	124.8	-15.22	140.0	-4.89	140.8	-4.35	124.0	-15.76
Peak Strain	688.6	675.2	-1.95	707.8	2.79	723.0	5.00	678.0	-1.54



Parsons							
Honeywell Polypropylene Baseline Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 02/15/2009 RL/AM/MLB JB
TER	8						
	-	2	REFLICATE NO	. 4	5	AVERAGE	STANDARD
lb/in	55	56	53	53	50	53.4	2.06
ain %	72	72	64	72	62	68.4	4.45
sss lb/in	152	144	160	144	136	147.2	6.53
	748	644	707	G74	642	688.6	45 2R

711	Job No.: 09LR1826.01 Date: 02/15/2009 Tested By: RL/AM/MLB Checked By: JB		5 DEVIATION	49 50.6 1.02	64 64.4 1.85	120 124.8 4.99	615 675.2 68.07	
			4	52	63	128	781 (	
		REPLICATE No	3	50	62	124	728	
			2	51	66	132	645	
s celcius			1	51	67	120	607	
c kesult 50° C	is well opylene r Testing	UNITS		lb/in	%	lb/in	%	
Polypropylene	Client: Parsor Project: Honey Material: Polypro Sample ID: Polypro 30 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	

Polypropylene

lient: Parsons roject: Honeyw aterial: Polypro ample ID: Polypro 60 Dav	ell oylene							
	Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 03/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No			AVEDACE	CTANING
		1	2	9	4	5		DEVIATION
Yield Stress	lb/in	48	49	51	50	48	49.2	1.17
Yield Strain	%	77	74	78	81	79	77.8	2.32
Peak Stress	lb/in	140	144	136	128	152	140.0	3.27
Peak Strain	%	736	739	671	641	752	707.8	43.68

Parsons 9090

siu	5						
						Job No.: Date: Tested By: Checked By:	09LR1826.01 04/15/2009 RL/AM/MLB JB
-		2	3	4	5	AVERAGE	
	52	52	52	51	51	51.6	0.49
1.2	77	79	72	80	87	79.0	4.86
-	36	152	136	136	144	140.8	7.54
R	22	781	000	CCC	705	723.0	46.72

Tensile 50.123

Parsons 9090

t: Parsons ct: Honeywell ial: Polypropylene le ID: Polypropylene 120 Day Testing 120 Day Testi	Job No.: Date:	09LR1826.01
PARAMETER       UNITS       TREPLICATE No.         1       2       3       4       5         Yield Stress       Ib/in       53       46       47       47       47         Yield Strain       %       90       79       74       85       69	Tested By: Checked By:	RL/AM/MLB JB
1     2     3     4     5       Yield Stress     lb/in     53     46     47     47     47       Yield Strain     %     90     79     74     85     69	AVERAGE	Idvunats
Yield Stress         lb/in         53         46         47         47         47         47           Yield Strain         %         90         79         74         85         69		DEVIATION
Yield Strain         %         90         79         74         85         69	48.0	2.53
	79.4	7.50
reak Stress ID/In 140 112 124 124 120	124.0	9.12
Peak Strain         %         688         643         701         695         663	678.0	21.76

#### Summary of Test Results PROPERTY CHANGE (ASTM D-5747)



Material: Sample ID:	Honeywell EPDM AZ12347 - E	PDM					Date: Tested By: Checked By:	05/15/2009 RL/AM/MLB JB	3
				23° C	elcius				
TEST	Baseline	30-Day	Immersion	60-Day	Immersion	90-Dav	Immersion	120-Day	Immornion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Weight, gr	11.8718	11.9453	0.62	11.97	0.81	11.95	0.63	11.93	0.48
Length, in	5.2212	5.2223	0.02	5.21	-0.14	5.21	-0.18	5.19	-0.60
Width, in	2.5860	2.5800	-0.23	2.57	-0.72	2.58	-0.19	2.58	-0.26
Thickness, mils	43	43	0.00	42.67	0.00	42.67	0.00	42.67	0.00
				50° C	elcius				
TEST	Baseline	30-Day	Immersion	60-Day 1	mmersion	90-Day	Immersion	120-Dav	Immersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Chappen
Weight, gr	14.7763	14.9759	1.35	15.06	1.90	15.05	1.87	15.05	1.87
Length, in	5.5427	5.5385	-0.08	5.53	-0.24	5.49	-0.90	5.50	-0.84
Width, in	3.0300	3.0246	-0.18	2.99	-1.33	3.00	-1.11	3.01	-0.52
hickness, mils	42	42	0.00	42.00	0.00	42.00	0.00	42.00	0.02
					NGE				
2								-	
2								<ul> <li>➡ We</li> <li>→ Ler</li> <li>➡ Wic</li> <li>→ We</li> <li>▲ Ler</li> <li>➡ Wic</li> <li>★ Thic</li> </ul>	ight 23 ngth 23 dth 23 ckness 23 ight 50 ngth 50 dth 50 ckness 50

	ASTM D-57	747, paragrap	hs 11.1 & 11.					
	Client: Project: Material: Sample ID:	Parsons Honeywell EPDM AZ12347 - EF 120 Day Test	Md			Job No.: Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB	
	PROPERTY	UNIT		REPLICATE		AVFRAGE		
	₽		1	2	ę		DEVIATION	
	Weight	grams	11.3564	11.0042	13.4263	11.9290	1.0685	
3° C	Length	Ŀ,	4.9310	5.1425	5.4965	5.1900	0.2333	
	Width	Ŀ.	2.5655	2.4440	2.7280	2.5792	0.1163	
	Thickness	mils	42	43	43	42.7	0.4714	
	PROPERTY	UNIT		REPLICATE		AVFRAGE	STANDARD	
	Q		~	2	3	1 ) ;	DEVIATION	
	Weight	grams	14.7860	15.2103	15.1628	15.0530	0.1898	
0° C	Length	.Ľ	5.4550	5.5380	5.4955	5.4962	0.0339	
	Width	.Ľ	2.9865	3.0230	3.0335	3.0143	0.0201	
	Thickness	mils	42	42	42	42.0	0.0000	

Dimensional Properties.123

### Summary of Test Results EPDM - 23° Celcius



Client:	Parsons	Job No.:	09LR1826.01
Project:	Honeywell	Date:	05/15/2009
Material:	EPDM	Tested By:	RL/AM/MLB
Sample ID:	AZ12347 - EPDM	Checked By:	JB

TEST	Baseline	30-Day Ir	nmersion	60-Day In	nmersion	90-Day Immersion		120-Day Immersion	
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Puncture	39.6	56.3	42.26	35.4	-10.41	32.0	-19.11	32.2	-18.66
Density	1.112	0.911	-18.08	1.110	-0.18	1.107	-0.39	1.105	-0.57
Hardness	2	1	-50.00	2	16.67	2	16.67	1	-33.33
2% Modulus	16000	10000	-37.50	9200	-42.50	9970	-37.69	9994	-37.54
Tear	9.6	21.0	118.75	10.8	12.50	11.2	16.67	10.8	12.50
Volatiles	0.4929	1.1493	133.15	1.2931	162.33	0.6942	40.83	1.1374	130.74
Extractables	1.5058	1.3953	-7.34	2.3699	57.38	2.3017	52.85	2.4331	61.58



nu: raisons ject: Honeywe terial: EPDM nple ID: AZ12347 120 Day	ell - EPDM Testing						Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No.			AVERAGE	TANUATS
		*	2	e	4	5		DEVIATION
uncture Resistance	lbs	32.7	30.7	31.6	32.5	33.4	32.2	0.9368
Density	gr/cucm	1.11	1.11	1.11			1.11	0.0005
Hardness		+	2	-		8	- - -	0.4714
% Secant Modulus	psi	10200	9980	9920	9850	10020	9994	117.9
ear (MD Only)	sql	11	11	10	11	11	10.8	0.4000
Volatiles	%	1.2873	0.9875				1.1374	0.1499
Extractables	%	2.4551	2.4110				2.4331	0.0221

AZ12347 - EPDM

Parsons 9090

Conformance 23.123

## Summary of Test Results EPDM - 50° Celcius



Client:	Parsons	Job No.:	09LR1826.01
Project:	Honeywell	Date:	05/15/2009
Material:	EPDM	Tested By:	RL/AM/MLB
Sample ID:	AZ12347 - EPDM	Checked By:	JB

TEST	Baseline	30-Day Ir	nmersion	60-Day Ir	nmersion	90-Day Immersion		120-Day Immersion	
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Puncture	39.6	31.9	-19.31	36.2	-8.49	33.1	-16.23	33.7	-14.71
Density	1.112	1.110	-0.15	1.110	-0.12	1.107	-0.39	1.104	-0.72
Hardness	2	1	-50.00	1	-33.33	1	-33.33	2	-16.67
2% Modulus	1600	950	-40.63	860	-46.25	898	-43.88	898	-43.88
Tear	9.6	9.8	2.08	10.4	8.33	10.4	8.33	10.0	4.17
Volatiles	0.6279	2.1780	246.85	2.4	282.57	1.8011	186.82	1.9855	216.19
Extractables	1.5058	1.4933	-0.83	2.2334	48.31	2.3321	54.87	2.3891	58.66


	Job No.: 09LR1826.01 Date: 05/15/2009 Tested By: RL/AM/MLB Checked By: JB
1	ell - EPDM Testing
	client: Parsons roject: Honeywe faterial: EPDM ample ID: AZ12347 ample ID: AZ12347

AZ12347 - EPDM

Conformance 50.123

# Summary of Test Results EPDM - 23° Celcius



Client:	Parsons	Job No.: 09LR1826.01
Project:	Honeywell	Date: 05/15/2009
Material:	EPDM	Tested By: RL/AM/MLB
Sample ID:	AZ12347 - EPDM	Checked By: JB

TEST	Baseline	30-Day li	mmersion	60-Day li	mmersion	90-Day li	mmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Yield Stress	30.2	36.6	21.19	41.6	37.75	35.4	17.22	37.8	25.17
Yield Strain	348.8	410.2	17.60	451.6	29.47	362.8	4.01	356.0	2.06
Peak Stress	56.0	60.0	7.14	66.4	18.57	66.4	18.57	64.0	14.29
Peak Strain	433.2	410.4	-5.26	457.6	5.63	432.8	-0.09	426.8	-1.48



	Job No.: 09LR1826 Date: 02/15/200 Tested By: RL/AM/ML Checked By: JB		AVERAGE STAND/	35 30 2 64	408 348.8 30.89	56 56.0 0.00	402 433.2 18.56
			·	5	351	56	456
		REDI ICATE NG	3	27	330	56	447
			6	30	327	56	434
				30	328	56	427
celcius	s vell 47 - EPDM ie Testing	UNITS		lb/in	%	lb/in	%
EPDM - 23°	Client: Parsor Project: Honey Material: EPDM Sample ID: AZ123 Baselir	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain

Parsons 9090

Tensile 23.123

	09LR1826.01 02/15/2009 RL/AM/MLB y: JB	CTANDAR	DEVIATION	1.36	9.28	1.89	52.96		
	Job No.: Date: Tested By: Checked By	AVEDAG		36.6	410.2	60.0	410.4		
			5	35	415	56	439		
			4	35	392	60	465		
		REPLICATE NO	°,	38	413	60	316		
			2	37	413	64	391		
			-	38	418	60	441		
Celcius	s vell 47 - EPDM Testing	UNITS		lb/in	%	lb/in	%		
PDM - 23° (	ent: Parson: ject: Honeyv terial: EPDM mple ID: AZ1234 30 Day	PARAMETER		<b>Yield Stress</b>	Yield Strain	Peak Stress	Peak Strain		

AZ12347 - EPDM

Tensile 23.123

Parsons Honeywell I: EPDM ID: AZ12347 - EPDM 60 Day Testing				Job No.: Date: Tested By: Checked By:	09LR1826.01 03/15/2009 RL/AM/MLB JB
ARAMETER UNITS	REPLICATE No			AVERAGE	UNDARING
1 2	3	4	5		DEVIATION
ield Stress Ib/in 41 44	46	39	38	41.6	3.01
ield Strain % 440 446	420	475	477	451.6	21.71
eak Stress Ib/in 68 64	68	64	68	66.4	1.89
eak Strain % 471 455	444	427	491	457.6	22.01

lient: Parsor roject: Honey								
laterial: EPDM	ns well						Job No.: Date:	09LR1826.01 04/15/2009
ample ID: AZ123 90 Day	47 - EPDM <b>y Testing</b>						l ested By: Checked By:	JB JB
PARAMETER	UNITS			REPLICATE No			AVERAGE	STANDARD
		~	2	e	4	5		DEVIATION
Yield Stress	lb/in	33	38	36	37	33	35.4	2.06
Yield Strain	%	333	387	377	355	362	362.8	18.64
Peak Stress	lb/in	64	64	68	68	68	66.4	1.96
Peak Strain	%	467	341	460	455	441	432.8	46.68

Tensile 23.123

AZ12347 - EPDM

2
49
315
64
399

AZ12347 - EPDM

Tensile 23.123

# Summary of Test Results EPDM - 50° Celcius



Client:	Parsons	Job No.:	09LR1826.01
Project:	Honeywell	Date:	05/15/2009
Material:	EPDM	Tested By:	RL/AM/MLB
Sample ID:	AZ12347 - EPDM	Checked By:	JB

TEST	Baseline	30-Day In	mmersion	60-Day II	nmersion	90-Day Ir	nmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Yield Stress	30.2	43.2	43.05	46.4	53.64	50.2	66.23	49.2	62.91
Yield Strain	348.8	471.0	35.03	502.8	44.15	526.4	50.92	510.4	46.33
Peak Stress	56.0	64.0	14.29	64.0	14.29	64.0	14.29	66.4	18.57
Peak Strain	433.2	448.4	3.51	424.0	-2.12	399.0	-7.89	399.0	-7.89



771	09LR1826.01 02/15/2009 RL/AM/MLB JB	STANDARD	DEVIATION	2.64	30.89	0.00	18.56
	Job No.: Date: Tested By: Checked By:	AVERAGE	1	30.2	348.8	56.0	433.2
			5	35	408	56	402
			4	29	351	56	456
		REPLICATE No	e	27	330	56	447
			2	30	327	56	434
			~	30	328	56	427
Celcius	ns well 47 - EPDM ne Testing	UNITS		lb/in	%	lb/in	%
EPDM - 50°	Client: Parso Project: Honey Material: EPDM Sample ID: AZ123 Baseli	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain

AZ12347 - EPDM

nt: Parson ect: Honeyv erial: EPDM ple ID: AZ1234	is well							
30 Day	47 - EPDM • Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 02/15/2009 RL/AM/MLB JB
PARAMETER	UNITS			REPLICATE No	0.		AVERAGE	STANDARD
		1	2	3	4	5		DEVIATION
Yield Stress	lb/in	42	44	45	45	40	43.2	1.94
Yield Strain	%	477	462	481	480	455	471.0	10.53
Peak Stress	lb/in	64	64	64	64	64	64.0	0.00
Peak Strain	%	441	411	467	463	460	448.4	20.72

Parsons 9090

AVER	5 AVERAGI	5 AVERAGE 5 46.4 515 502.8	AVERAGE       5     AVERAGE       45     46.4       515     502.8       60     64.0
4	4 47	4 47 489	4 47 489 64
REPLICATE No.	REPLICATE No. 3 44	REPLICATE No. 3 44 477	REPLICATE No. 3 44 477 68
2	51	2 51 564	2 51 564 64
~	1 45	1 45 469	1 45 469 64
	lb/in	lb/in %	lb/in %
	Yield Stress	Yield Stress Yield Strain	Yield Stress Yield Strain Peak Stress
	Stress         lb/in         45         51         44         47         45	Stress         Ib/in         45         51         44         47         45         45           Strain         %         469         564         477         489         515	Stress         Ib/in         45         51         44         47         45         45           Strain         %         469         564         477         489         515           Stress         Ib/in         64         64         68         64         60

Parsons 9090

	09LR1826.01 04/15/2009 KL/AM/MLB by: JB	STANDARD	DEVIATION	2.14	33.86	3.58	29.09	
	Job No.: Date: Tested By: Checked B	AVERAC		50.2	526.4	64.0	399.0	
			5	49	488	68	415	
			4	53	577	60	376	
		REPLICATE No.	0	50	515	64	387	
			2	52	554	60	369	
			1	47	498	68	448	
Celcius	s vell 7 - EPDM Testing	UNITS		lb/in	%	lb/in	%	
PDM - 50° (	ient: Parson: oject: Honeyv aterial: EPDM imple ID: AZ1234 90 Day	PARAMETER		Yield Stress	Yield Strain	Peak Stress	Peak Strain	

Parsons 9090

Parsons							
Honeywell EPDM AZ12347 - EPDM 120 Day Testing						Job No.: Date: Tested By: Checked By:	09LR1826.01 05/15/2009 RL/AM/MLB JB
TFR							
	1	2	REPLICATE NO.	. 4	5	AVERAGE	STANDARD
ress Ib/in	44	55	47	46	54	49.2	4.45
rain %	431	579	482	522	538	510.4	50.42
ress Ib/in	72	68	64	68	60	66.4	4.08
					000	300 0	18 8/



GEOTECHNICAL, GEOSYNTHETIC AND MATERIALS TESTING AND RESEARCH

June 29, 2009 09LR1826.01



Parsons 290 Elwood Davis Road Suite 312 Liverpool, NY 13088

Attn: David Steele

### RE: COMPATIBILITY TEST RESULTS GEOTUBE FABRIC & SEWING THREAD WITH SOLVAY WASTE HONEYWELL PROJECT PO NO. 444853.00001.00

Dear Mr. Steele:

Similar to the geomembrane samples, the TenCate Geotube fabric and the sewing thread used to sew the fabric were also subject to immersion testing in the Solvay waste. A virgin sample of each material was taken from the samples and subject to the following baseline tests:

Fabric -	Puncture	ASTM D-4833
	Trap Tear	ASTM D-4533
	Grab Strength	ASTM D-4632
	AOS	ASTM D-4751
	Permittivity	ASTM D-4491
Thread -	Tensile Strength	ASTM D-5446

Samples of the material were then placed in two tanks of Solvay waste at  $23^{\circ}$ C and  $50^{\circ}$ C, respectively. At 30, 60, 90 and 120 days, coupons were removed, cleaned and tested for the same properties as the baseline tests. The average results were compared to the average baseline test results and the percent change computed. The percent change vs immersion time was plotted as shown on the attached data sheets. An evaluation of the results are described herein.

David Steele Parsons

### TenCate Geotube

Prior to testing, the immersed coupons were washed to remove the excess Solvay waste and rinsed to clean the holes in the fabric. If there holes were not cleaned, AOS and Permittivity testing would not yield any meaningful results since the holes would be completely blocked. The ends of the thread were simply wiped with a moist towel to fit in the clamps.

### Puncture

Puncture results varied from +34% to -26%. This is typical with a coarse woven fabric because it depends on where the puncture needle is seated on the fabric. If the needle aligns with a strand, the results are higher. If the needle aligns at a woven junction, the results are lower. Per the test procedure, the alignment is random in the test unit.

### **Trap Tear**

Trap Tear values generally decreased by about 25% and remained relatively consistent after 30 days.

### **Grab Strength**

Grab Strength decreased by about 10+% and remained essentially consistent after 30 days.

### AOS

This value ranged from an AOS of 40 to an AOS of 50. Essentially, there was no significant change in AOS over the 120 day period. Prior to testing, the fabric was washed to remove the encrusted Solvay waste that blocked the holes.

#### Permittivity

The baseline values average was  $0.4 \text{ sec}^{-1}$ . Over the 120 day test period, the value varied for  $0.4 \text{ sec}^{-1}$  to  $0.3 \text{ sec}^{-1}$  terminating at about  $0.35 \text{ sec}^{-1}$ . Essentially, there was no meaningful change in Permittivity.

#### TenCate Fabric Summary

The results indicate no significant deterioration of the fabric. In fact, AOS and Permittivity values were essentially the same throughout the test period.

### TenCate Sewing Thread

Since the most important property is the Tensile Strength of the thread used to sew the geotubes, we only performed Tensile Strength per ASTM D-5446. This test was designed to determine the Tensile Strength of thread used for inflatable materials. Since the Geotubes will be filled or inflated with waste, we deemed this an appropriate test.

David Steele Parsons

Page 3 of 3 06/29/2009

Again, a sample of the virgin thread was tested for Strength and the average computed as the baseline value. Samples of the thread were immersed in the Solvay waste in 23°C and 50°C tanks. At 30, 60, 60 and 120 days, samples were removed and tested. The average value was computed and the percent difference plotted vs exposure time.

The data plot shows a general increase in Strength vs Time. This is mostly likely attributed to the fact that the thread was encased in Solvay waste when it was tested.

#### TenCate Sewing Thread Summary

Both the TenCate fabric and sewing thread performed well when exposed to the Solvay waste for 120 days. There is no evidence in these tests to suggest the waste adversely effected the fabric or the thread.

We appreciate the opportunity to provide our services and look forward to working with you again. Should you have any questions, comments or require additional information, please do not hesitate to call. Thank you.

Sincerely,

JLT LABORATORIES, INC.

John Boschuk, Jr., P.E. President

cc:

Martin A. Switzer

Enclosures JB/mlb \wp10\letter\09122 Inv# 3828

# Summary of Test Results TenCate GeoTube



Client: Project: Material: Sample ID:	Parsons Honeywell GT 500 Wove Geotextile - G	n Geotextile eoTube						Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLB JB
	1			(				h	
TEST	Baseline	30-Day In	nmersion	60-Day In	nmersion	90-Day In	nmersion	120-Day Ir	nmersion
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Puncture 23°C	159.8	204.9	28.23	136.6	-14.55	120.4	-24.70	189.0	18.26
Puncture 50°C	159.8	138.4	-13.40	118.2	-26.02	186.1	16.44	214.8	34.40
Trap Tear 23°C	312.1	247.2	-20.79	247.4	-20.73	211.0	-32.38	235.1	-24.66
Trap Tear 50°C	312.1	237.2	-23.99	232.8	-25.40	263.7	-15.51	232.8	-25.40
Grab 23°C	307	292	-4.63	317	3.39	222	-27.70	276	-9.98
Grab 50°C	307	280	-8.55	283	-7.70	267	-13.02	286	-6.88
AOS 23°C	40	40	0.00	43	8.33	47	16.67	43	8.33

43

8.33

47

16.67

47

16.67



AOS 50°C

40

43

8.33

GeoTube Conformance Test Results TenCate GeoTube

09LR1826.01 RL/AM/MLB 03/31/2009 JB Checked By: Tested By: Job No.: Date: GT 500 Woven Geotextile Geotextile - GeoTube **Baseline Testing** Honeywell Parsons Sample ID: Material: Project: Client:

1
158.2 157.8
158.2 157.
308.1 297.
308.1 297.
332 321
332 321
40 40
40 40

Geotube Conformance.123

Laboratories, Inc.

Geotextile - GeoTube

Test Results	
Conformance	oTube
GeoTube	TenCate Ge

Client:	Parsons	Job No.:	09LR1826.01
Project:	Honeywell	Date:	03/31/2009
Material:	GT 500 Woven Geotextile	Tested Bv <sup>-</sup>	RI /AM/MI R
Sample ID:	Geotextile - GeoTube	Checked Bv.	B
	30 Day Testing	.6	1

	UNITS			REPLICATE No.			AVERAGE	STANDARD
		-	2	e	4	5		DEVIATION
0	lbs	146.2	458.5	128.7	154.3	137.0	204.9	127.0715
0	lbs	127.0	132.0	155.0	142.7	135.3	138.4	9.7425
U	lbs	296.8	295.0	213.1	230.6	200.6	247.2	40.8777
U	lbs	203.1	222.5	294.3	230.6	235.6	237.2	30.6119
	lbs	322	300	272	288	280	292	17.4539
	lbs	278	231	295	304	294	280	26.0814
		40	40	40			40	0.0000
		40	50	40			43	4.7140

Geotextile - GeoTube

**ILT** Laboratories, Inc.

5

	09LR1826.01 03/31/2009 RL/AM/MLB y: JB	STANDARD	DEVIATION	9.4971	9.4905	4.8194	5.8002	19.1311	10.9848	4.7140	4.7140
	Job No.: Date: Tested By: Checked By	AVERAGE		136.6	118.2	247.4	232.8	317	283	43	43
			2								
			4								
		REPLICATE No.	e	133.9	131.6	251.2	239.8	290	287	50	40
			2	149.3	110.5	250.4	233.1	329	294	40	50
	xtile		٢	126.5	112.6	240.6	225.6	332	268	40	40
Tube	ell Woven Geote: le - GeoTube Testing	UNITS		sql	lbs	lbs	lbs	sql	sql		
nCate Geo	t: Parsons ct: Parsons vial: GT 500 V ial: Geotextil 60 Day 1	PARAMETER		Puncture 23°C	Puncture 50°C	rap Tear 23°C	rap Tear 50°C	Grab 23°C	Grab 50°C	AOS 23°C	AOS 50°C

Geotextile - GeoTube

Geotube Conformance.123

Parsons 9090

Results	
Test	
GeoTube Conformance	TenCate GeoTube

Client:	Parsons	Job No.:	091 R1826 01
			0.04011100
Project:	Honeyweil	Date:	04/28/2009
			00010100
Material:	G1 500 Woven Geotextile	Tested Rv.	RI /AMA/NI R
		coron nà.	
Sample ID:	Geotextile - GeoTube	Checked Rv.	a
		Circord Dy.	20
	90 Dav Testing		

STANDARD	DEVIATION	1.7500	40.0000	25.1589	62.4117	30.7282	49.7750	4.7140	4.7140
AVERAGE		120.4	186.1	211.0	263.7	222	267	47	47
	5								
	4								
REPLICATE No.	3			217.5	351.8	209	234	50	50
	2	118.6	226.1	238.1	215.0	192	229	50	50
	٢	122.1	146.1	177.5	224.3	264	337	40	40
UNITS		lbs	lbs	lbs	lbs	lbs	lbs		
PARAMETER		Puncture 23°C	Puncture 50°C	Trap Tear 23°C	Trap Tear 50°C	Grab 23°C	Grab 50°C	AOS 23°C	AOS 50°C



Geotube Conformance.123

Parsons 9090

: Parson t: Parson t: Honeyv al: GT 500 le ID: Geotexi 120 Da	s vell ) Woven Geote tile - GeoTube y Testing	extile					Job No.: Date: Tested By: Checked By:	09LR1826.0 05/15/2009 RL/AM/MLB JB
		- k			1			
PARAMETER	UNITS			REPLICATE No.			AVERAGE	STANDARD
		1	2	ę	4	5		DEVIATION
uncture 23°C	sql	160.5	175.8	231.7	188.0		189.0	30.6020
uncture 50°C	229.8	240.1	149.1	255.2			214.8	46.8641
ap Tear 23°C	lbs	244.3	256.8	204.3			235.1	22.3917
ap Tear 50°C	lbs	256.7	213.7	228.1			232.8	17.8709
Grab 23°C	lbs	272	280				276	4.0000
Grab 50°C	lbs	241	330				286	44.5000
AOS 23°C		40	50	40			43	4.7140
AOS 50°C		40	50	50			47	4.7140

Geotextile - GeoTube

Parsons 9090

Geotube Conformance.123

# Summary Permittivity of Test Results TenCate GeoTube



Client:	Parsons	Job No.:	09LR1826.0
Project:	Honeywell	Date:	05/15/2009
Material:	GT 500 Woven Geotextile	Tested By:	RL/AM/MLB
Sample ID:	Geotextile - GeoTube	Checked By:	JB
1			

TEST	Baseline	30-Day Ir	nmersion	60-Day In	nmersion	90-Day Ir	nmersion	120-Day I	mmersion
READING	Average	Average	% Change						
Baseline & 23°C	28.5	25.7	-9.82	21.6	-24.21	28.6	0.35	28.3	-0.70
Baseline & 50°C	28.5	26.8	-5.96	21.8	-23.51	24.6	-13.68	24.4	-14.39

Note: At 60 days, the coupons were only soaked and rinsed but not cleaned with a soft brush, like the other samples.





Client: Project: Material: Sample ID: Manufacturer Spec Value:	Parsons Honeywell Site Geotextile - GT Supplied Samp : TenCate 20 gpm/sq ft	500 le	BASLEINE			Job No.: Report Date : Technician: Machine: Chk'd By :	09LR1826.0 03/30/09 RL JLT-CHPTV JB
HEAD ACROS	S SPECIMEN: ERATURE:	5.08 cm 18.0	Degrees C			SAMP. AREA: TEMP CORR.	44.096 cm^ 1.0510
	COUPON	REPLICATE	FLOW	TIME	FLOW	PERMITTIVITY	
			cm^3	sec	gal/min/ft^2	sec-1	
		1	1305.6	15.31	28.5	0.400	
		2	1324.6	15.50	28.6	0.401	
	Baseline	3	1311.6	15.32	28.6	0.402	
		4	1320.6	15.50	28.5	0.400	
		5	1313.7	15.41	28.5	0.400	
				Average :	28.5	0.400	
11 7 .							



Client: Project: Material: Sample ID: Manufacturer: Spec Value:	Parsons Honeywell Site Geotextile - GTS Supplied Sampl TenCate 20 gpm/sq ft	500 e MARV	30 DAYS			Job No.: Report Date : Technician: Machine: Chk'd By :	09LR1826.01 03/30/09 RL JLT-CHPTV-1 JB
HEAD ACROS	S SPECIMEN: ERATURE:	5.08 cm 18.0	Degrees C			SAMP. AREA: TEMP CORR.	44.096 cm^2 1.0510
	COUPON	REPLICATE	FLOW cm^3	TIME sec	FLOW gal/min/ft^2	PERMITTIVITY sec-1	
		1	1124.2	15.40	24.4	0.343	
	23 Degrees C	2	1127.9	15.47	24.4	0.342	
	Replicate 1	3	1130.7	15.44	24.5	0.344	
		4	1132.1	15.59	24.3	0.341	
		5	1125.0	15.46	24.3	0.341	
		1	1256.6	15.47	27.1	0.381	
	23 Degrees C	2	1272.8	15.72	27.1	0.380	
- 2-1-1-1-1	Replicate 2	3	1244.2	15.37	27.0	0.380	
		4	1250.2	15.43	27.1	0.380	
		4	1252.3	15.50	27.0	0.379	
				Average :	25.7	0.361	
JLT 1	Laboratories	, Inc.	938 S. Central Av	enue, Canonsburg,	. PA 15317 * Tel: (7	'24) 746-4441 / Fax: (1	724) 745-4261





Client: Project: Material: Sample ID: Manufacturer: Spec Value:	Parsons Honeywell Site Geotextile - GTS Supplied Sampl TenCate 20 gpm/sq ft	500 e MARV	30 DAYS			Job No.: Report Date : Technician: Machine: Chk'd By :	09LR1826.01 03/30/09 RL JLT-CHPTV- JB
HEAD ACROS WATER TEMP	S SPECIMEN: ERATURE:	5.08 cm 18.0	Degrees C			SAMP. AREA: TEMP CORR.	44.096 cm^2 1.0510
	COUPON	REPLICATE	FLOW cm^3	TIME Sec	FLOW gal/min/ft^2	PERMITTIVITY sec-1	
		1	1141.5	15.25	25.0	0.351	
	50 Degrees C	2	1150.1	15.35	25.0	0.352	
	Replicate 1	3	1159.0	15.32	25.3	0.355	
		4	1157.8	15.34	25.2	0.354	
		5	1162.0	15.47	25.1	0.352	
		1	1305.6	15.31	28.5	0.400	
	50 Degrees C	2	1324.6	15.50	28.6	0.401	
	Replicate 2	3	1311.6	15.32	28.6	0.402	
		4	1312.2	15.50	28.3	0.397	
	j.	4	1313.4	15.41	28.5	0.400	
				Average :	26.8	0.376	
ILT I	Laboratories	, Inc.	938 S. Central Ave	anue, Canonsburg,	PA 15317 * Tel: (7	724) 746-4441 / Fax: (7	724) 745-4261



Client: Project: Material: Sample ID: Manufacturer: Spec Value:	Parsons Honeywell Site Geotextile - GT Supplied Samp TenCate 20 gpm/sq ft	500 le MARV	60 DAYS			Job No.: Report Date : Technician: Machine: Chk'd By :	09LR1826.01 03/30/09 RL JLT-CHPTV-1 JB
HEAD ACROS	S SPECIMEN: ERATURE:	5.08 cm 18.0	Degrees C		1	SAMP. AREA: TEMP CORR.	44.096 cm^2 1.0510
	COUPON	REPLICATE	FLOW cm^3	TIME	FLOW gal/min/ft^2	PERMITTIVITY sec-1	
	7	1	1205.5	18.50	21.8	0.306	
	23 Degrees C	2	1208.0	18.46	21.9	0.307	
	Replicate 1	3	1196.7	18.50	21.6	0.303	
		4	1203.3	18.60	21.6	0.304	
		5	1196.4	18.43	21.7	0.305	
		1	1060.2	16.44	21.5	0.303	
	23 Degrees C	2	1181.2	18.32	21.5	0.303	
	Replicate 2	3	1061.2	16.50	21.5	0.302	
ales Million		4	1054.7	16.47	21.4	0.300	
	9	4	1073.4	16.56	21.7	0.304	
				Average :	21.6	0.304	
<b><i>ILT</i></b>	Laboratories	, Inc.	938 S. Central Ave	enue, Canonsburg,	PA 15317 * Tel: (7	'24) 746-4441 / Fax: (	724) 745-4261



Client: Project: Material: Sample ID: Manufacturer: Spec Value:	Parsons Honeywell Site Geotextile - GT Supplied Samp TenCate 20 gpm/sq ft	500 le MARV	60 DAYS			Job No.: Report Date : Technician: Machine: Chk'd By :	09LR1826.01 03/30/09 RL JLT-CHPTV-1 JB
HEAD ACROS	S SPECIMEN: ERATURE:	5.08 cm 18.0	Degrees C			SAMP. AREA: TEMP CORR.	44.096 cm^2 1.0510
	COUPON	REPLICATE	FLOW cm^3	TIME	FLOW gal/min/ft^2	PERMITTIVITY sec-1	
		1	1287.1	19.38	22.2	0.312	
	50 Degrees C	2	1310.2	19.47	22.5	0.316	
	Replicate 1	3	1301.2	19.43	22.4	0.314	
		4	1300.8	19.38	22.4	0.315	
1		5	1306.5	19.34	22.6	0.317	
		1	1230.0	19.34	21.2	0.298	
	50 Degrees C	2	1233.3	19.44	21.2	0.298	
26	Replicate 2	3	1239.3	19.50	21.2	0.298	
		4	1226.8	19.28	21.3	0.299	
	1	4	1230.7	19.28	21.3	0.299	
				Average :	21.8	0.307	
ILT L	aboratories	, Inc.	938 S. Central Ave	nue, Canonsburg.	PA 15317 * Tel: (7	24) 746-4441 / Fax: (7	24) 745-4261



Project: Material: Sample ID: Manufacture Spec Value:	Honeywell Site Geotextile - GT Supplied Sampl er: TenCate 20 gpm/sq ft	500 e MARV	90 DAYS			Report Date : Technician: Machine: Chk'd By :	06/29/09 RL JLT-CHPTV JB
HEAD ACRO WATER TEN	SS SPECIMEN:	5.08 cm 18.0	Degrees C			SAMP. AREA: TEMP CORR.	44.096 cm^ 1.0510
	COUPON	REPLICATE	FLOW cm <sup>^</sup> 3	TIME SEC	FLOW gal/min/ft^2	PERMITTIVITY sec-1	
		1	1314.0	15.26	28.8	0.404	
	23 Degrees C	2	1319.0	15.31	28.8	0.404	
	Replicate 1	3	1318.0	15.29	28.8	0.404	
	1	4	1321.0	15.33	28.8	0.404	
		5	1323.0	15.37	28.8	0.404	
		1	1312.0	15.46	28.4	0.398	
	23 Degrees C	2	1309.0	15.39	28.4	0.399	
	Replicate 2	3	1312.0	15.42	28.4	0.399	
		4	1315.0	15.47	28.4	0.399	
	9	4	1319.0	15.57	28.3	0.397	
				Average :	28.6	0.401	
							-
ILT	Laboratories	Inc					



ECIMEN: TURE: COUPON Degrees C eplicate 1 Degrees C eplicate 2	5.08 cm 18.0 REPLICATE 1 2 3 4 5 1 5 1 2	FLOW           cm^3           1277.0           1275.0           1281.0           1282.0	TIME Sec 17.44 17.45 17.41 17.52	FLOW gal/min/ft^2 24.5 24.5 24.5	SAMP. AREA: TEMP CORR. PERMITTIVITY sec-1 0.344 0.344	44.096 cm*2 1.0510
COUPON Degrees C eplicate 1 Degrees C eplicate 2	REPLICATE 1 2 3 4 5 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	FLOW cm <sup>3</sup> 1277.0 1279.0 1275.0 1281.0 1282.0	TIME Sec 17.44 17.45 17.41 17.52	FLOW gal/min/ft^2 24.5 24.5 24.5	PERMITTIVITY sec-1 0.344 0.344	
Degrees C eplicate 1 Degrees C eplicate 2	1 2 3 4 5 1 2	1277.0 1279.0 1275.0 1281.0 1282.0	17.44 17.45 17.41	24.5 24.5 24.5	0.344 0.344	
Degrees C eplicate 1 Degrees C eplicate 2	2 3 4 5 1 2	1279.0 1275.0 1281.0 1282.0	17.45 17.41	24.5	0.344	
eplicate 1 Degrees C eplicate 2	3 4 5 1 2	1275.0 1281.0 1282.0	17.41	24.5		
Degrees C eplicate 2	4 5 1 2	1281.0 1282.0	17 52	24.0	0.344	
Degrees C eplicate 2	5 1 2	1282.0	11.02	24.4	0.343	
Degrees C eplicate 2	1		17.53	24.4	0.343	
Degrees C eplicate 2	2	1288.0	17.39	24.7	0.348	
eplicate 2	_	1294.0	17.42	24.8	0.349	
	3	1295.0	17.43	24.8	0.349	
	4	1289.0	17.39	24.8	0.348	
	4	1297.0	17.44	24.8	0.349	
			Average :	24.6	0.346	
		pratories, Inc.	pratories, Inc. 938 S. Central Ave	pratories, Inc. 938 S. Central Avenue Canonshura	pratories, Inc. 228 S. Control Avenue Corporations PA 15217 / Tab. 17	pratories. Inc.

#### **PERMITTIVITY OF GEOTEXTILES CONSTANT HEAD METHOD** ASTM D-4491 (Also meets D2434 Criteria for permeability) Client: Parsons Job No.: 09LR1826.01 Project: Honeywell Site Report Date : 06/29/09 Material: Geotextile - GT500 Technician: RL Sample ID: Supplied Sample Machine: JLT-CHPTV-1 Manufacturer: TenCate **120 DAYS** Chk'd By : JB Spec Value: 20 gpm/sq ft MARV HEAD ACROSS SPECIMEN: 5.08 cm SAMP. AREA: 44.096 cm^2 WATER TEMPERATURE: 18.0 **Degrees C** TEMP CORR. 1.0510 COUPON REPLICATE FLOW TIME FLOW PERMITTIVITY cm<sup>^</sup>3 sec gal/min/ft^2 sec-1 1 1314.0 15.45 28.4 0.399 2 1316.0 15.51 28.3 0.398 23 Degrees C 3 1315.0 15.49 28.4 0.398 Replicate 1 4 1315.0 15.47 28.4 0.399 5 1317.0 15.51 28.4 0.398 1 1312.0 15.52 28.2 0.397 2 1312.0 15.51 28.3 0.397 23 Degrees C 3 1309.0 15.44 28.3 0.398 Replicate 2 4 1313.0 15.53 28.2 0.397 4 1312.0 15.49 28.3 0.397 Average : 28.3 0.398 JLT Laboratories, Inc. 938 S. Central Avenue, Canonsburg, PA 15317 \* Tel: (724) 746-4441 / Fax: (724) 745-4261



Client: Project: Material: Sample ID: Manufacturer: Spec Value:	Parsons Honeywell Site Geotextile - GT Supplied Sampl TenCate 20 gpm/sq ft	500 e MARV	120 DAYS			Job No.: Report Date : Technician: Machine: Chk'd By :	09LR1826.01 06/29/09 RL JLT-CHPTV- JB
HEAD ACROS	S SPECIMEN: ERATURE:	5.08 cm 18.0	Degrees C		, *.P	SAMP. AREA: TEMP CORR.	44.096 cm^2 1.0510
	COUPON	REPLICATE	FLOW cm^3	TIME	FLOW gal/min/ft^2	PERMITTIVITY sec-1	
1	1.1.1	1	1246.0	17.54	23.7	0.333	
	50 Degrees C	2	1241.0	17.50	23.7	0.333	
	Replicate 1	3	1235.0	17.49	23.6	0.331	
		4	1251.0	17.56	23.8	0.334	
		5	1250.0	17.55	23.8	0.334	
		1	1301.0	17.39	25.0	0.351	
	50 Degrees C	2	1305.0	17.42	25.0	0.351	
	Replicate 2	3	1318.0	17.46	25.2	0.354	
		4	1311.0	17.53	25.0	0.351	
	1	4	1310.0	17.49	25.0	0.351	
				Average :	24.4	0.342	
							1 1
ILT .	aboratories	Inc					

# Summary of Test Results Sewing Thread



Date:	06/15/2009
Tested By:	RL/AM/MLB
Checked By:	JB
	Tested By: Checked By:

TEST	Baseline	30-Day Immersion		60-Day Immersion		90-Day In	nmersion	120-Day Immersion	
READING	Average	Average	% Change	Average	% Change	Average	% Change	Average	% Change
Baseline & 23°C	59.0	61.4	4.07	61.8	4.75	66.0	11.86	66.4	12.54
Baseline & 50°C	61.4	62.8	2.28	66.2	7.82	68.0	10.75	68.4	11.40



09LR1826.01 06/15/2009 RL/AM/MLB JB	STANDARD	DEVIATION	2.0000	4.8415	5.6710	2.2271	3.4871	1.7889
Job No.: Date: Tested By: Checked By:	AVERAGE		59.0	61.4	62.8	61.8	66.2	66.0
		5	60	55	63	62	69	64
		4	59	64	55	60	66	65
	REPLICATE No.	3	62	61	58	61	66	69
		2	56	69	69	60	60	67
pg		1	58	58	69	66	70	65
ell Thread Sewing Threa	UNITS		sql	sql	lbs	sql	lbs	lbs
it: Parsons sct: Honeyw rial: Sewing ple ID: TenCate	PARAMETER		Baseline	30 Days 23°C	30 Days 50°C	60 Days 23°C	60 Days 50°C	90 Days 23°C
	ent: Parsons ject: Honeywell bete: 09LR1826.01 Date: 06/15/2009 terial: Sewing Thread mple ID: TenCate Sewing Thread Checked By: JB	ent: Parsons ject: Honeywell ject: Honeywell terial: Sewing Thread mple ID: TenCate Sewing Thread mple ID: TenCate Sewing Thread PARMETER UNITS REPLICATE No. 09LR1826.01 Date: 06/15/2009 Tested By: JB Checked By: JB	ent: Parsons ject: Honeywell ietrial: Sewing Thread mple ID: TenCate Sewing Thread mple ID: TenCate Sewing Thread PARMETER UNTS AVERAGE STANDARD PARMETER UNTS A AVERAGE STANDARD PARAMETER UNTS A A 5 AVERAGE STANDARD	Int: Parsons Job No.: 09LR1826.01 Job No.: 06/15/2009 terial: Sewing Thread angle ID: TenCate Sewing Thread Inter Cate Sewing Thread PARAMETER PARAMETER Inter Dis 58 56 62 59 60 59.0 2.0000	Int: Parsons Job No.: 09LR1826.01 Job No.: 09LR1826.01 Date: 06/15/2009 Tested By: RL/AMMLB Tested By: RL/AMM	Int: Parsons Job No.: 09LR1826.01 Job No.: 09LR1826.01 Date: 06/15/2009 Tested By: RL/AM/ILB Checked By: RL/AM/ILB Checked By: JB Checked By: JB Check	mt:     Parsons     Job No::     09LR1826.01       jedt:     Honeywell     0015/2009     06/15/2009       erial:     Sewing Thread     06/15/2009     06/15/2009       parsons     Tencate Sewing Thread     NITS     Tested By:     NILMINLB       parsons     1     2     3     4     5     Devintron       Baseline     Ibs     58     69     61     60     59.0     2.0000       30 Days 23°C     Ibs     69     61     64     56     614     4.8415       30 Days 23°C     Ibs     69     61     60     63     5.271	Int:     Parsons       eict:     Honeywell       leict:     Honeywell       leict:     Honeywell       leict:     Honeywell       leict:     Honeywell       leict:     Sewing Thread       mple ID:     TenCate Sewing Thread       mple ID:     Seging

TenCate Sewing Thread

Laboratories, Inc.

Parsons 9090

1.6733 1.2000 1.3565

68.0

65

69 65

70

68

68 65 66

lbs lbs

90 Days 50°C

120 Days 23°C 120 Days 50°C

67

67

66.4

68 70

68.4

69

69

68

lbs