

TEST REPORT



REPORT NUMBER: 102850330COQ-002C
ORIGINAL ISSUE DATE: April 3, 2017

EVALUATION CENTER

INTERTEK TESTING SERVICES NA LTD.
1500 BRIGANTINE DRIVE
COQUITLAM, BC V3K 7C1

RENDERED TO

MANSONVILLE PLASTICS (BC) LTD.
19402 – 56TH AVENUE
SURREY, BC V3S 6K4
CANADA

PRODUCT EVALUATED: EPS29 Foam
EVALUATION PROPERTY: Physical Properties

**Report of EPS29 Foam for compliance with requirements of
ASTM D6817/D6817M-15, Standard Specification for Rigid
Cellular Polystyrene Geofoam**

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2 Introduction

Intertek Testing Services NA Ltd. (Intertek) has conducted a test program for Mansonville Plastics (BC) Ltd. on a geofoam product. The evaluation was carried out to determine whether the product would comply with the requirements of ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*. This evaluation was completed during the months of February-March 2017.

3 Test Samples

3.1. SAMPLE SELECTION

Intertek representative, Luke Kong, sampled the geofoam product on December 20, 2016. The sample selection process and witnessing was conducted at Mansonville Plastics Ltd., 19402 56 Avenue, Surrey, BC, V3S 6K4, Canada. Products were selected in accordance with recognized independent sampling procedures, and were received at the Evaluation Center on January 10, 2017 (Coquitlam ID# VAN1701300926-001).

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

The sample was identified as EPS29 Foam, a geofoam product with manufacturing date of December 10, 2016 and production lot number 32180.

4 Testing and Evaluation Methods

4.1. CONDITIONING

Before testing, all specimens were held in standard laboratory conditions for at least 88 hours at a temperature of $23 \pm 2^\circ\text{C}$ and relative humidity of $50 \pm 5\%$.

4.2. SPECIMEN PREPARATION

All specimens were cut by the client prior to submitting to the Evaluation Center.

4.3. DENSITY

The density was determined in accordance with ASTM D1622/D1622M-14, *Standard Test Method for Apparent Density of Rigid Cellular Plastics* on a minimum of six (6) specimens measuring 51 mm (2 in.) long x 51 mm (2 in.) wide x 51 mm (2 in.) thick. The specimens were weighed, and then measured for length, width, and thickness at three points for each dimension. The density was calculated as follows:

$$D = W_s / V$$

Where:

D	= Density, kg/m ³ (lbs/ft ³)
W _s	= Weight of specimen, kg (lbs)
V	= Volume of specimen, m ³ (ft ³)

4.4. COMPRESSIVE STRENGTH

Compressive strength was tested in accordance with ASTM D1621-16, *Standard Test Method*

for *Compressive Properties of Rigid Cellular Plastics*. Six (6) specimens, measuring 51 mm (2 in.) long x 51 mm (2 in.) wide x 51 mm (2 in.) thick, were prepared. A plot of load versus deflection was recorded for each specimen and these results were used to calculate values for compressive strength based on 1%, 5%, and 10% deformation.

$$S_c = W / A$$

Where:

- S_c = Compressive Strength, Pa (psi)
- W = Load at 1%, 5% and 10% deformation, N (lbf)
- A = Initial horizontal cross-sectional area, mm² (in².)

4.5. FLEXURAL STRENGTH

The flexural strength was evaluated using ASTM C203-05a (2012), *Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation*, Method 1. Ten (10) samples, each measuring 305 mm (12 in.) long x 102 mm (5 in.) wide x 25 mm (1 in.) thick, were prepared for testing. All specimens were simply supported and loaded at a strain rate of 0.1 in/in-min until failure. The flexural strength was calculated as follows:

$$S = 3PL / 2bd^2$$

Where:

- S = Stress in the outer fibers, kPa (psi)
- P = Ultimate load, N (lbf)
- L = Support span, mm (in.)
- b = Width of specimen, mm (in.)
- d = Width of specimen, mm (in.)

4.6. LIMITING OXYGEN INDEX

Limiting oxygen index was tested in accordance with ASTM D2863-13, *Standard Test Method for Measuring Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)*. Testing was conducted at an external Intertek facility; refer to Intertek Report 102965433MID-001C in Appendix B.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

The test results, together with the applicable requirements of ASTM D6817/D6817M-15 are shown in Table 1 below. A full set of test results are included in the Appendices.


Table 1. Test Results			
Property	Test Result	Requirements	Pass/Fail
Density, kg/m ³	30.8	≥ 28.8	Pass
Compressive Strength, kPa			
• 1%	92	≥ 75	Pass
• 5%	207	≥ 170	Pass
• 10%	230	≥ 200	Pass
Flexural Strength, kPa	380.0	≥ 345	Pass
Oxygen Index, %	32.8	≥ 24.0	Pass

6 Conclusion

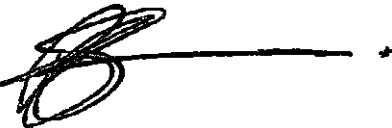
The Mansonville Plastics (BC) Ltd. geofoam product identified and evaluated in this report has met the requirements for an EPS29 product as described in ASTM D6817/D6817M-15. Test results are as outlined in Section 5 of this report.

INTERTEK TESTING SERVICES NA LTD.

Reported by: _____




Chris Chang, P.Eng.
Engineer, Building Products

Reviewed by: _____


Baldeep Sandhu
Manager, Building Products

APPENDIX A: Test Data (7 pages)



Company	Mansonville Plastics (BC) Ltd.	Technician(s)	Chris Chang 
Project No.	G102850330	Reviewer	Baldeep Sandhu 
Models	EPS29	Start/End Date	February 28-March 20, 2017
Product Name	Same as above	Sample ID	VAN1701300926-001
Standard	ASTM D6817/D6817M-15, <i>Standard Specification for Rigid Cellular Polystyrene Geofoam</i>		

Test Data Package

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Density	2
Compression #1	3
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Compression #4	6
Flexural Strength	7



Test: **Density**
 Date: 28-Feb-17
 Client: Mansonville Plastics (BC) Ltd.
 Product: **EPS29**
 Method:

Project: G102850330
 Eng/Tech: Chris Chang
 Reviewer: Baldeep Sandhu

Method: ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*
 ASTM D1622/D1622M-14, *Standard Test Method for Apparent Density of Rigid Cellular Plastics*

Specimen Size: 51 mm x 51 mm x 51 mm (2 in. x 2 in. x 2 in. thick)
 Conditioning: Minimum 88 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%
 Equipment: Mitutoyo Digital Caliper (Intertek ID# P60005, cal due May 11, 2017)
 T&D Thermorecorder TR72Ui (Intertek ID# P60554, cal due August 18, 2017)
 Time/Temp/RH: 11:10AM / 23.6°C / 49.0%

Specimen	Length (in)				Width (in)				Depth (in)					Weight	Density	
	L1	L2	L3	Avg.	W1	W2	W3	Avg.	D1	D2	D3	D4	Avg.	(g)	(kg/m ³)	(lbs/ft ³)
1	12.09	12.09	12.10	12.10	3.99	4.01	4.00	4.00	1.03	1.02	1.02	1.02	1.02	24.52	30.9	1.93
2	12.09	12.09	12.08	12.09	4.00	4.01	4.00	4.00	1.02	1.03	1.02	1.03	1.03	24.45	30.8	1.92
3	12.09	12.11	12.07	12.09	4.00	4.01	4.01	4.01	1.02	1.03	1.02	1.03	1.03	24.52	30.8	1.92
4	12.09	12.09	12.09	12.09	4.02	4.02	4.02	4.02	1.02	1.03	1.02	1.03	1.03	24.42	30.6	1.91
5	12.08	12.10	12.10	12.09	4.01	4.02	4.03	4.02	1.02	1.03	1.02	1.03	1.03	24.44	30.6	1.91
6	12.10	12.10	12.10	12.10	4.02	4.02	4.02	4.02	1.02	1.03	1.02	1.02	1.02	24.64	31.0	1.93
														Mean:	30.8	1.92
														StdDev:	0.2	0.0
														COV:	0%	0%



Test: **Compressive Strength**
 Date: 21-Mar-17
 Client: Mansonville Plastics (BC) Ltd.
 Product: **EPS29**
 Method: ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*
 ASTM D1621-16, *Standard Test Method for Compressive Properties of Rigid Cellular Plastics*
 ASTM D618-13, *Standard Practice for Conditioning Plastics of Testing*

Project: G102850330
 Eng/Tech: Chris Chang
 Reviewer: Baldeep Sandhu

Conditioning: Minimum 88 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%

Specimen Size: 51 mm x 51 mm x 51 mm (2 in. x 2 in. x 2 in.)
 Sp. Thickness: 50.8 mm 2.00 in
 Rate of Straining: 5 mm/mm.min 0.20 in/in.min
 Crosshead Speed: 5.0 mm/min 0.20 in/min
 Equipment: Mitutoyo Digital Caliper (Intertek ID# P60005, cal due May 11, 2017)
 Instron 3382 (Intertek ID# P60553, cal due June 30, 2017)
 T&D Thermorecorder TR72Ui (Intertek ID# P60554, cal due August 18, 2017)
 Time/Temp/RH: 12:45PM / 23.1°C / 47.0%

Specimen	Length (mm)			Width (mm)			Depth (mm)				Load at 1% Deformation		Compressive Strength			
	L1	L2	L3	W1	W2	W3	D1	D2	D3	D4	(lbf)	(N)	(kPa)	(psi)		
1	51.85	51.90	51.75	51.24	51.19	51.17	51.13	51.10	51.14	51.14	54.6	243	91.5	13.3		
2	51.24	51.21	51.27	51.18	51.16	51.21	51.45	51.27	51.31	51.41	52.0	232	88.3	12.8		
3	51.49	51.60	51.54	50.93	50.97	50.98	51.33	51.50	51.59	51.36	57.9	258	98.1	14.2		
4	51.16	51.30	51.23	51.21	51.28	51.19	51.49	51.31	51.27	51.41	49.2	219	83.5	12.1		
5	51.69	51.87	51.90	51.21	51.32	51.33	51.17	51.21	51.27	51.19	55.0	245	92.2	13.4		
6	51.17	51.18	51.17	51.63	51.49	51.33	51.19	51.21	51.27	51.35	59.9	266	101.1	14.7		
												Mean:	92.4	13.4		
												StdDev:	6.4	0.9		
												COV:	6.9%	6.9%		

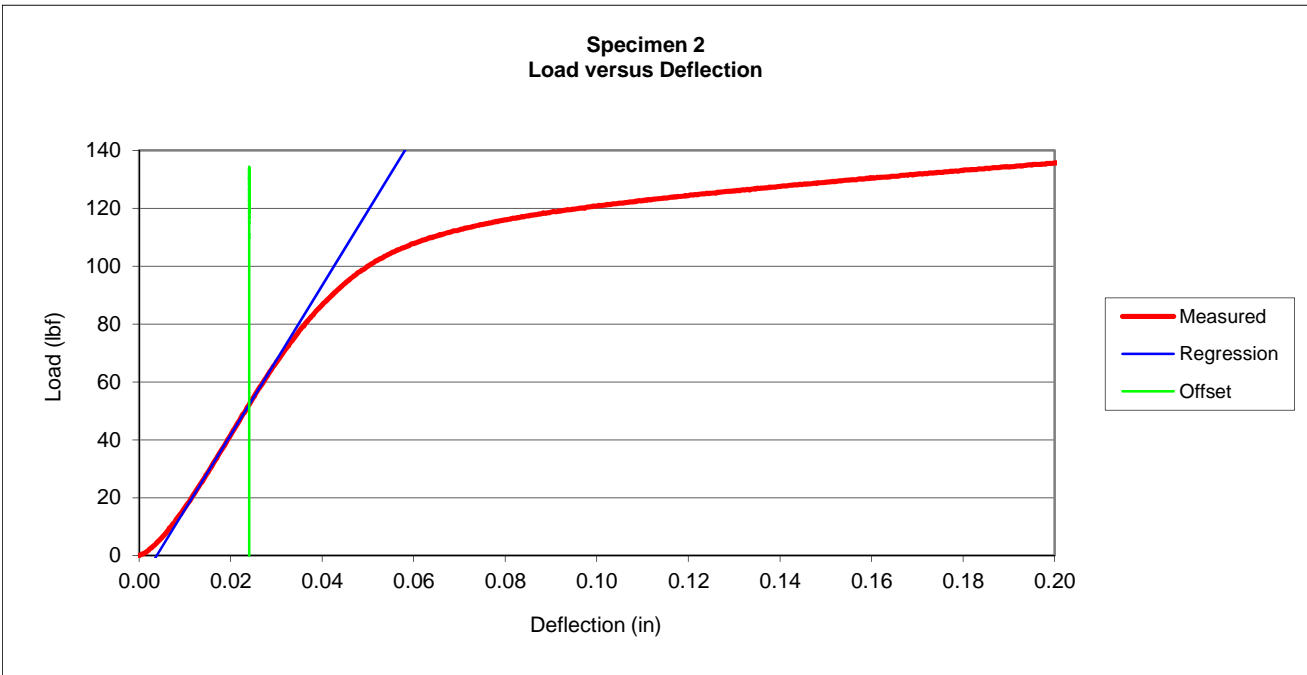
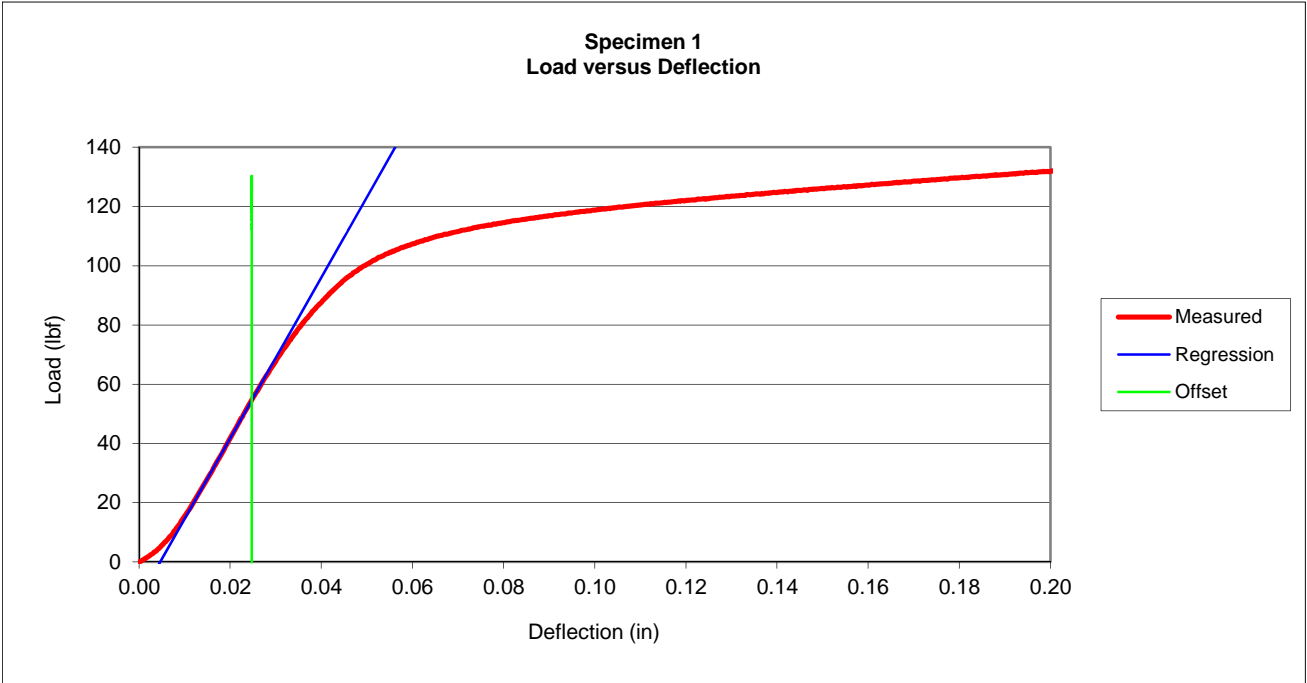
Specimen	Length (mm)			Width (mm)			Depth (mm)				Load at 5% Deformation		Compressive Strength			
	L1	L2	L3	W1	W2	W3	D1	D2	D3	D4	(lbf)	(N)	(kPa)	(psi)		
1	51.85	51.90	51.75	51.24	51.19	51.17	51.13	51.10	51.14	51.14	119.8	533	200.8	29.1		
2	51.24	51.21	51.27	51.18	51.16	51.21	51.45	51.27	51.31	51.41	121.7	542	206.5	29.9		
3	51.49	51.60	51.54	50.93	50.97	50.98	51.33	51.50	51.59	51.36	130.8	582	221.6	32.1		
4	51.16	51.30	51.23	51.21	51.28	51.19	51.49	51.31	51.27	51.41	119.5	532	202.7	29.4		
5	51.69	51.87	51.90	51.21	51.32	51.33	51.17	51.21	51.27	51.19	121.9	542	204.0	29.6		
6	51.17	51.18	51.17	51.63	51.49	51.33	51.19	51.21	51.27	51.35	122.3	544	206.6	30.0		
												Mean:	207.0	30.0		
												StdDev:	7.5	1.1		
												COV:	3.6%	3.6%		

Specimen	Length (mm)			Width (mm)			Depth (mm)				Load at 10% Deformation		Compressive Strength			
	L1	L2	L3	W1	W2	W3	D1	D2	D3	D4	(lbf)	(N)	(kPa)	(psi)		
1	51.85	51.90	51.75	51.24	51.19	51.17	51.13	51.10	51.14	51.14	132.6	590	222.3	32.2		
2	51.24	51.21	51.27	51.18	51.16	51.21	51.45	51.27	51.31	51.41	136.3	607	231.3	33.5		
3	51.49	51.60	51.54	50.93	50.97	50.98	51.33	51.50	51.59	51.36	143.3	637	242.7	35.2		
4	51.16	51.30	51.23	51.21	51.28	51.19	51.49	51.31	51.27	51.41	134.3	598	227.8	33.0		
5	51.69	51.87	51.90	51.21	51.32	51.33	51.17	51.21	51.27	51.19	135.1	601	226.2	32.8		
6	51.17	51.18	51.17	51.63	51.49	51.33	51.19	51.21	51.27	51.35	136.0	605	229.7	33.3		
												Mean:	230.0	33.4		
												StdDev:	7.0	1.0		
												COV:	3.0%	3.0%		




Test: **Compressive Strength**
Date: 21-Mar-17
Client: Mansonville Plastics (BC) Ltd.
Product: **EPS29**
Method: ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*

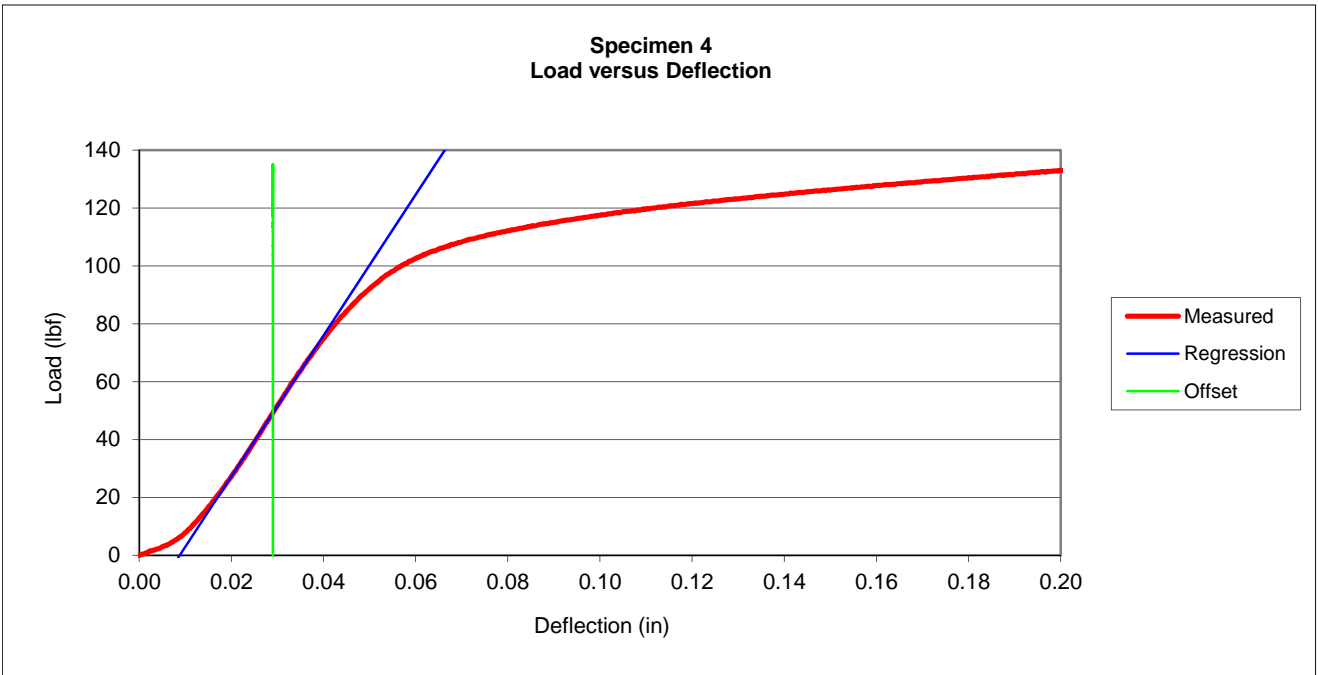
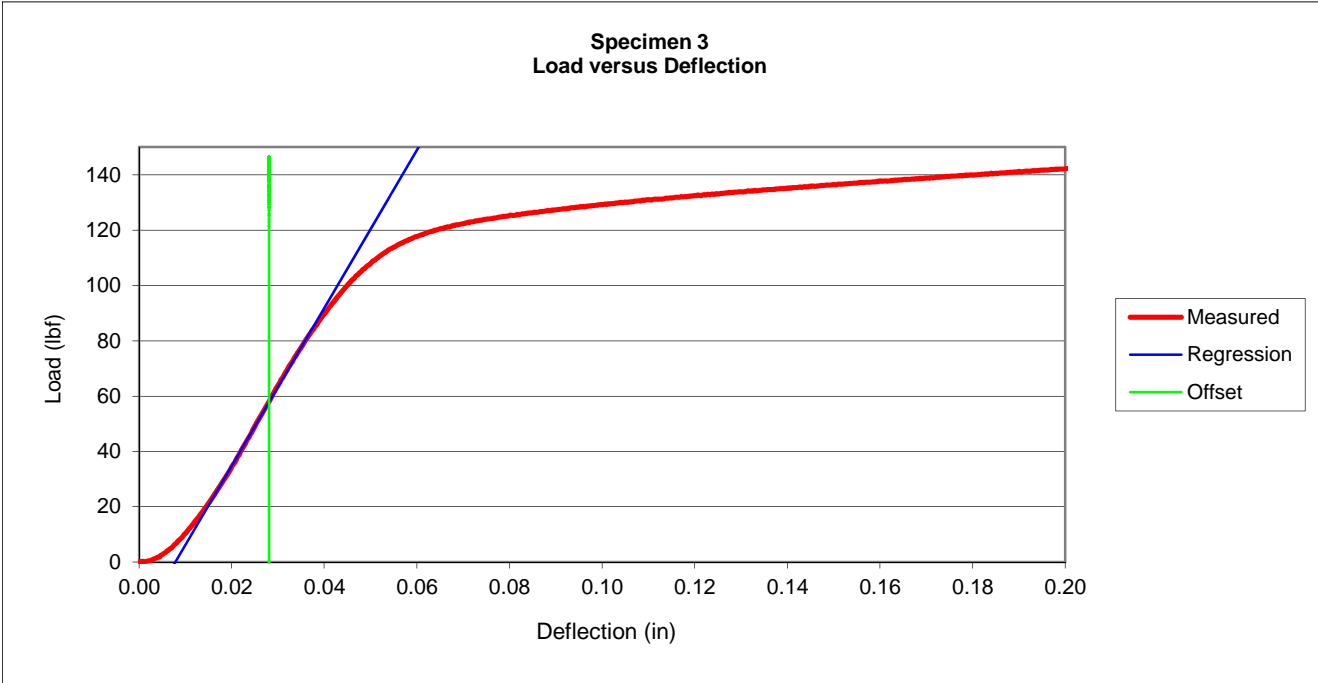
Project: G102850330
Eng/Tech: Chris Chang
Reviewer: Baldeep Sandhu 





Test: **Compressive Strength**
Date: 21-Mar-17
Client: Mansonville Plastics (BC) Ltd.
Product: **EPS29**
Method: ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*

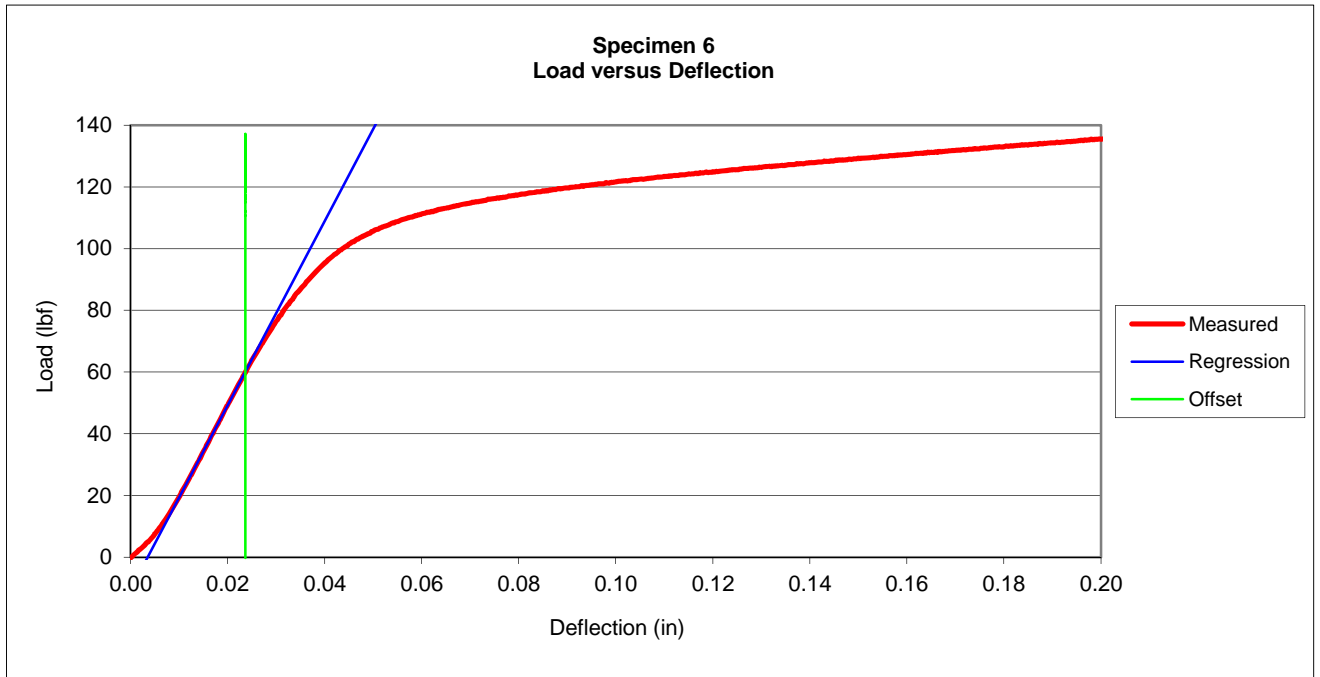
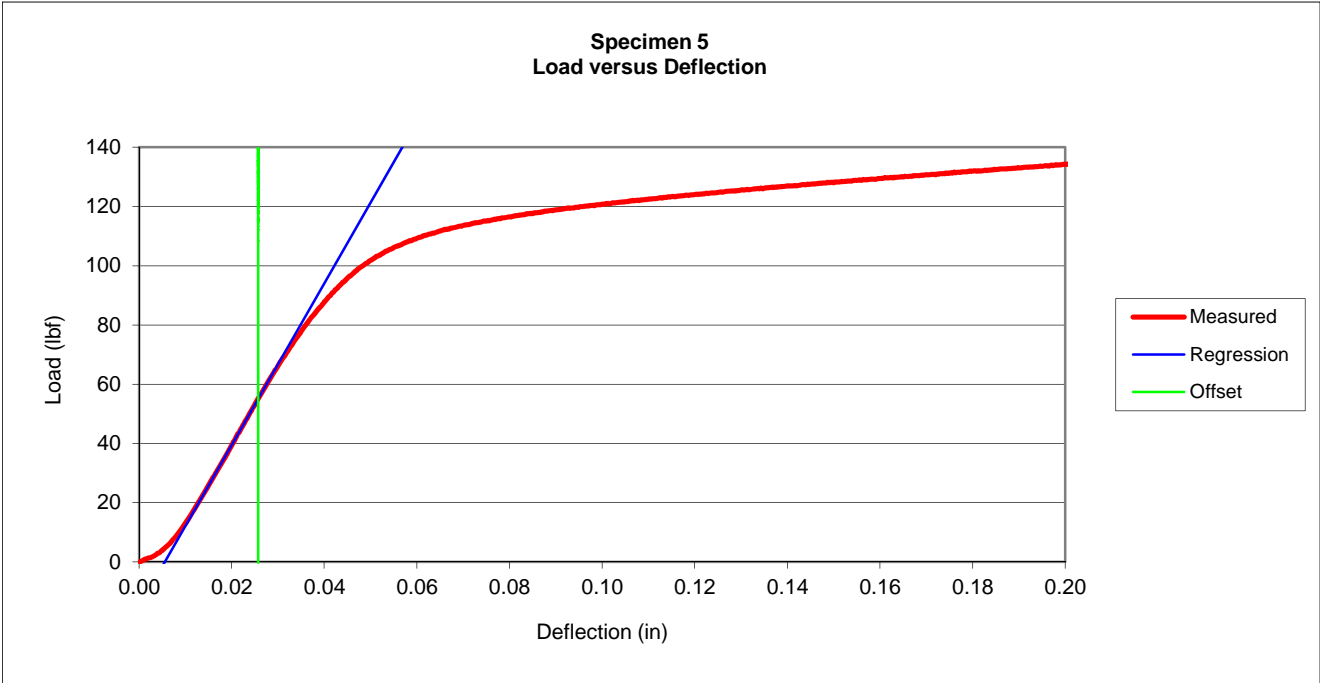
Project: G102850330
Eng/Tech: Chris Chang
Reviewer: Baldeep Sandhu 





Test: **Compressive Strength**
Date: 21-Mar-17
Client: Mansonville Plastics (BC) Ltd.
Product: **EPS29**
Method: ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*

Project: G102850330
Eng/Tech: Chris Chang
Reviewer: Baldeep Sandhu 





Test: **Flexural Strength**
 Date: 20-Mar-17
 Client: Mansonville Plastics (BC) Ltd.
 Product: **EPS29**
 Method:

Project: G102850330
 Eng/Tech: Chris Chang
 Reviewer: Baldeep Sandhu *BSS*

ASTM D6817/D6817M-15, *Standard Specification for Rigid Cellular Polystyrene Geofoam*
 ASTM C203-05a (2012), *Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Insulation, Method I, Procedure B*

Conditioning: Minimum 88 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%

Specimen Size: 300 mm x 100 mm x 25 mm (12 in. by 4 in. by 1 in.)

Sp. Thickness: 25.4 mm 1.00 in
 Support Span: 254 mm 10.00 in
 Bearing Edges: 32.0 mm 1.26 in
 Rate of Straining: 0.1 mm/mm.min 0.1 in/in.min
 Crosshead Speed: 42.4 mm/min 1.67 in/min

Equipment: Mitutoyo Digital Caliper (Intertek ID# P60005, cal due May 11, 2017)
 Instron 3382 (Intertek ID# P60553, cal due June 30, 2017)
 T&D Thermorecorder TR72Ui (Intertek ID# P60554, cal due August 18, 2017)

Strain (E): 0.05 in./in

Time/Temp/RH: 9:00AM / 23.0°C / 49.0%

Specimen	Width (in)			Depth (in)				Deflection (in)	Max Load		Flexural Strength		
	W1	W2	W3	D1	D2	D3	D4		(lbf)	(N)	(kPa)	(psi)	
1	3.99	4.01	4.00	1.03	1.02	1.02	1.02	0.81	15.58	69.3	384.0	55.7	
2	4.00	4.01	4.00	1.02	1.03	1.02	1.03	0.81	15.46	68.8	379.9	55.1	
3	4.00	4.01	4.01	1.02	1.03	1.02	1.03	0.81	14.94	66.5	366.6	53.2	
4	4.02	4.02	4.02	1.02	1.03	1.02	1.03	0.81	15.58	69.3	381.8	55.4	
5	4.01	4.02	4.03	1.02	1.03	1.02	1.03	0.81	14.55	64.7	356.2	51.7	
6	4.02	4.02	4.02	1.02	1.03	1.02	1.02	0.82	15.26	67.9	376.2	54.6	
7	4.00	4.00	4.00	1.03	1.02	1.03	1.02	0.81	15.27	67.9	374.6	54.3	
8	4.01	4.01	3.99	1.02	1.02	1.02	1.02	0.82	15.88	70.6	393.3	57.0	
9	4.01	4.00	3.99	1.02	1.02	1.02	1.02	0.82	15.65	69.6	387.4	56.2	
10	4.01	4.01	4.00	1.02	1.02	1.02	1.01	0.82	16.09	71.6	399.8	58.0	
									Mean:			380.0	55.1
									StdDev:			12.6	1.8
									COV:			3.3%	3.3%

*NOTE: Tests were terminated when the maximum strain in the outer fibers has reached 0.05in./in(mm/mm)
 Max. Load readings were then taken at the deflection at which this strain occurred by letting E=0.05 in./in where D=EL²/6d

APPENDIX B: Oxygen Index Test Report (5 pages)

TEST REPORT

REPORT NUMBER: 102965433MID-001c
ORIGINAL ISSUE DATE: : March 31, 2017
REVISED DATE: NA

EVALUATION CENTER

Intertek
8431 Murphy Drive
Middleton, WI 53562

RENDERED TO
Mansonville Plastics (BC) Ltd.

19402 56 Ave.
Surrey BC V3S 6K4
Canada
Edmund Tiu
Edmund@mansonvilleplastics.com

PRODUCT EVALUATED: EPS29 (T3)
EVALUATION PROPERTY: Oxygen Index

Report of Testing EPS29 (T3) for compliance with the applicable requirements of the following criteria: ASTM D2863- 16 Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle Like Combustion of Plastics (Oxygen Index)

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2 Introduction

Intertek has conducted testing for Mansonville Plastics (BC) Ltd. on EPS29 (T3) to evaluate the oxygen index. Testing was conducted following the standard methods of ASTM D2863- 16, measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics. This evaluation began on March 30, 2017 and was completed on March 31, 2017.

3 Test Samples

3.1. SAMPLE SELECTION

Samples were submitted to Intertek directly from the client. Samples were not independently selected for testing. Samples were received at the Evaluation Center on March 27, 2017 in good condition.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

Sample Name: EPS29 (T3)

Sample Description: Samples were cut to the Type II dimensions of 125mm x 10mm x 10mm per the standard by the client.

4 Testing and Evaluation Methods

4.1. ASTM D2863

Prior to testing, samples were conditioned for a minimum of 40 hours at 23 ± 2 °C and $50 \pm 5\%$ relative humidity. Test specimens were removed from the conditioning chamber just before testing.

The test equipment was verified to be in calibration using the PMMA standard supplied by the equipment manufacture.

Testing was conducted following the testing method set forth in ASTM D2863-09 Procedure A-Top Surface Ignition.

The sample was placed in the oxygen atmosphere and allowed to equilibrate for 30 seconds. Following the 30 seconds, the igniter was used to produce burning across the top of the sample taking care not to maintain the flame against the vertical faces or edges of the specimen. The sample was exposed for 30 seconds with the flame being removed every 5 seconds to observe whether the vertical surface of the specimen was burning steadily. Once the sample ignited the measurement of time, and distance commenced.

Calculations of the oxygen index were performed and recorded according to section 12 of the standard.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

Test Environment: 72°F, 52% R.H.

Equipment Used: Calipers #1248, Stopwatch #1251,

Sample	Oxygen Index (%)	Standard Deviation
EPS29 (T3)	32.79	0.33

5.2. EXAMINATION OF RESULTS

The results of this testing are listed as is as the standard does not have a specific pass/fail criteria.

Test Results relate only to the behavior of the test specimens under the conditions of this test method and that these results must not be used to infer the fire hazards of the material in other forms or under other fire conditions.




6 Conclusion

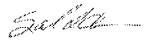
Intertek has conducted testing for Mansonville Plastics (BC) Ltd., on EPS29 (T3), to evaluate the oxygen index. Testing was conducted following the standard methods of ASTM D2863-2012 Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics.

The results of this testing are listed as is; the standard does not have a specific pass/ fail criteria. The test results relate only to the behavior of the test specimens under the conditions of this test method, and these results must not be used to infer the fire hazards of the material in other forms or under other fire conditions.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

INTERTEK

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REVISION SUMMARY

DATE	SUMMARY
March 31, 2017	Original Date of Issue