

# TEST REPORT



**Intertek**

**REPORT NUMBER: 3175418COQ-002**  
ORIGINAL ISSUE DATE: May 21, 2009

## EVALUATION CENTER

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

## RENDERED TO

HW MANUFACTURING LTD.  
244-2855 PEMBINA HWY  
WINNIPEG R3T 2H5

PRODUCT EVALUATED: Type 3 Expanded Polystyrene (EPS)  
EVALUATION PROPERTY: Physical Properties

**Report of Type 3 EPS for compliance with selected requirements  
of the following criteria: CAN/ULC S701-05 *Standard for Thermal  
Insulation, Polystyrene, Boards and Pipe Covering***

*This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.*

# 1 Table of Contents

---

1	Table of Contents.....	2
2	Introduction.....	3
3	Test Samples.....	3
3.1.	Sample Selection.....	3
3.2.	Sample And Assembly Description.....	3
4	Testing And Evaluation Methods.....	3
4.1.	Conditioning.....	3
4.2.	Specimen Preparation.....	3
4.3.	Flexural Strength.....	3
4.4.	Compressive Strength.....	4
4.5.	Density.....	4
5	Testing And Evaluation Results.....	4
5.1.	Results And Observations.....	4
6	Conclusion.....	5
Appendix A	Thermal Resistance Test Data.....	7 pages
Appendix B	Test Data.....	6 pages

## 2 Introduction

---

Intertek Testing Services NA Ltd. (Intertek) has conducted a test program for HW Manufacturing Inc. on a polystyrene bead product. The evaluation was carried out to determine whether the product would comply with selected requirements of the National Standard of Canada CAN/ULC S701-05 *Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering*. This evaluation was completed in the month of May 2009.

## 3 Test Samples

---

### 3.1. SAMPLE SELECTION

Intertek representative, Cliff Ainsworth, witnessed the production and randomly selected a series of EPS Block Type 3 Insulation on April 28, 2009. The EPS Block was manufactured at HW Manufacturing Inc., located in Mile 10 Road Starbuck, Winnipeg. Samples were received at the Evaluation Center on May 12, 2009. The product was selected in accordance with recognized independent sampling procedures.

### 3.2. SAMPLE AND ASSEMBLY DESCRIPTION

The sample was identified as Type 3 EPS HW.EPS. Comfort R. The raw material, identified as Styrochem MB590E Type III, was manufactured at Styrochem, 19250 Clark Graham, Baie D'orfe, Quebec.

## 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  $50 \pm 5\%$  in accordance with ASTM D618-08, Procedure A, *Standard Practice for Conditioning Plastics for Testing*.

### 4.2. SPECIMEN PREPARATION

All specimens were cut to the required dimensions using a hot wire cutter and a band saw.

### 4.3. THERMAL RESISTANCE

Specimens were prepared for thermal resistance and sent to an external facility for testing (refer to Appendix A). Testing was conducted at a material thickness of approximately 25 mm in accordance with ASTM C518-04 *Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*. The long term thermal resistance was not determined as this product was not intended to retain a blowing agent other than air.

### 4.4. FLEXURAL STRENGTH

The flexural strength was evaluated using ASTM C203-05, Method 1 *Test Method for Flexural Properties of Thermal Insulation*. To comply with the CAN/ULC-S701-05 test requirements, Procedure B (section 10.3) was adopted, which stipulates an outer fiber strain rate of 0.1

mm/mm·min.

Nine samples measuring 300 mm (12 in.) long x 100 mm (4 in.) wide x 25.4 mm (1 in.) thick were prepared. All specimens were simply supported and loaded to 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.)

#### 4.5. COMPRESSIVE STRENGTH

The compressive strength was evaluated using ASTM D1621-04a *Method for Compressive Properties of Rigid Cellular Plastics*. Six specimens measuring 100 mm (4 in.) long x 100 mm (4 in.) wide x 25.4 mm (1 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 a 10 % core deformation as follows:

$$S_c = W / A$$

Where:

- S<sub>c</sub> = Compressive Strength, Pa (psi)
- W = Load at 10% deformation, N (lbf)
- A = Initial horizontal cross-sectional area, mm<sup>2</sup> (in<sup>2</sup>.)

#### 4.6. DENSITY

The density was determined in accordance with ASTM D1622-08 *Test Method for Apparent Density of Rigid Cellular Plastics* on a minimum of six specimens measuring 100 mm (4 in.) long x 100 mm (4 in.) wide x 25.4 mm (1 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<sup>3</sup> (lbs/ft<sup>3</sup>)
- W<sub>s</sub> = weight of specimen, kg (lbs)
- V = volume of specimen, m<sup>3</sup> (ft<sup>3</sup>)

## 5 Testing and Evaluation Results

### 5.1. RESULTS AND OBSERVATIONS

The EPS test results, together with the performance requirements of CAN/ULC S701-05 for a Type 3 EPS product are shown in Table 1 below. A full set of test results is included in Appendix B.

Property	Test Result	Requirement	Pass/Fail
Thermal Resistance, m <sup>2</sup> .°C/W (for 25 mm thickness)	0.75	0.74 min.	Pass
Flexural Strength, kPa	376	300 min.	Pass
Compressive Strength, kPa	184	140 min.	Pass
Density, kg/m <sup>3</sup>	28.6	Note 1	Note 1

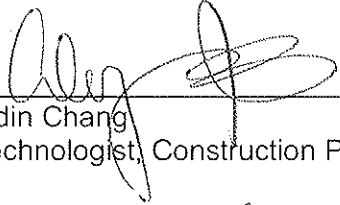
Note 1: Not a testing requirement, for information purposes only.

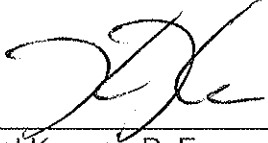
## 6 Conclusion

---

The Type 3 EPS identified and evaluated in this report has met thermal resistance, flexural strength and compressive strength requirements of National Standard of Canada CAN/ULC S701-05 *Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering* for use as a Type 3 classified product.

### INTERTEK TESTING SERVICES NA LTD.

Reported by:   
Aldin Chang  
Technologist, Construction Products

Reviewed by:   
Kal Kooner, P. Eng.  
Manager, Engineering Services CDN

## **APPENDIX A: Thermal Resistance Test Data (7 pages)**

# TEST REPORT

**Intertek**

**REPORT NUMBER: 3175418TOR-003**  
ORIGINAL ISSUE DATE: May 19, 2009

**EVALUATION CENTER**  
Intertek  
6225 Kenway Drive  
Mississauga, ON L5T 2L3

## **RENDERED TO**

HW Manufacturing Ltd.  
244-2855 Pembina Hwy  
Winnipeg, MB R3T 2H5  
Attn: Mr. Glen Gross

PRODUCT EVALUATED: EPS FOAM  
EVALUATION PROPERTY: STEADY-STATE THERMAL TRANSMISSION  
PROPERTIES

**Report of Testing EPS Foam Insulation for Steady-State Thermal  
Transmission Properties in accordance with ASTM C518-04,  
Standard Test Method for Steady-State Thermal Transmission  
Properties by Means of the Heat Flow Meter Apparatus**

*This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.*

# 1 Table of Contents

---

1	Table of Contents.....	2
2	Introduction .....	3
3	Test Samples .....	3
	3.1. SAMPLE SELECTION .....	3
	3.2. SAMPLE AND ASSEMBLY DESCRIPTION .....	3
4	Testing and Evaluation Methods.....	4
	4.1.1 TEST STANDARD 1.....	4
5	Testing and Evaluation Results.....	4
	5.1. RESULTS AND OBSERVATIONS.....	4
6	Conclusion.....	5

APPENDIX A – Test Data (Page 6 - 7)

---



## **2 Introduction**

---

Intertek Testing Services NA Ltd. (Intertek) has conducted testing for HW Manufacturing on Expandable Polystyrene (EPS) Foam insulation to evaluate Steady-State Thermal Transmission Properties. Testing was conducted in accordance with ASTM C518-04, "Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus" as per CAN/ULC S701-05 "Thermal Insulation, Polystyrene, Boards and Pipe Covering". The evaluation of the insulation was performed May 19, 2009.

## **3 Test Samples**

---

### **3.1. SAMPLE SELECTION**

Samples were randomly selected on March 11, 2009 by Intertek representative Cliff Ainsworth at the HW Manufacturing Ltd. facility in Starbuck, Manitoba. The bead type was identified as Styrochem MB590E Type III. Samples were received at the Mississauga Evaluation Center on May 14, 2009.

### **3.2. SAMPLE AND ASSEMBLY DESCRIPTION**

Samples consisted of three panels approximately 12" x 12" x 1". All specimens were conditioned at ambient laboratory environment for 96 hours prior to being tested.

---

## 4 Testing and Evaluation Methods

---

- 4.1. Three (3) specimens were tested. Specimens were conditioned for 96 hours at ambient laboratory environment. The test specimens were weighed using an Ohaus Model GT4100 scale (Inv. No. 280 01 0075), and then measured for length, width, and thickness at four points for each dimension using Mitutoyo digital calipers (Inv. No. 280 01 0909). The apparent densities for the specimens were calculated. The specimens were then evaluated in accordance with ASTM C518-04 "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus" as per CAN/ULC S701-05 "Thermal Insulation, Polystyrene, Boards and Pipe Covering" using a Netzsch Lambda 2000 Heat Flow Meter Model 436/3/1, Serial No. 183A-1204-606000390 (Inv. No. 280-01-0725).

### 4.1.1 TEST STANDARD 1

**Thermal Resistance:** ASTM C518-04 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

## 5 Testing and Evaluation Results

---

### 5.1. RESULTS AND OBSERVATIONS

The following are the average results from the set of specimens. Complete results for each individual specimen are shown in Appendix A, Test Data.

Specimen	Thermal Resistance at 25 mm (0.984 in.) $m^2 \cdot K / W^{**}$ ( $^{\circ}F ft^2 h / Btu$ )	Thermal Resistance at 25.4 mm (1 in.) $m^2 \cdot K / W$ ( $^{\circ}F ft^2 h / Btu$ )
EPS Foam	0.752 (4.267)	0.764 (4.335)

\*\*  $K \cdot m^2 / W = m^2 \cdot ^{\circ}C / W$

#### 5.1.1. Statement of Measurement Uncertainty

It was estimated that these results have an overall measurement uncertainty of 0.66% at the 95% confidence level.

---

## 6 Conclusion

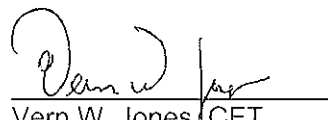
---

Intertek has performed testing of EPS foam insulation specimens for HW Manufacturing in accordance with ASTM C518-04 "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus" as per CAN/ULC S701-05 "Thermal Insulation, Polystyrene, Boards and Pipe Covering". Complete test data is shown in Appendix A.

Tested by: Dave Carter

### INTERTEK TESTING SERVICES NA LTD

Reported by:   
D. J. Carter, P. Eng.  
Building Products Engineer  
Physical Testing Services

Reviewed by:   
Vern W. Jones, CET  
Manager  
Physical Testing Services

---

**APPENDIX A**  
**Test Data**

---

## Test Data

### Test: Steady-State Thermal Transmission

Date: May 19, 2009

Test Method(s): ASTM C518-04 "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus".

Conditioning: 96 hours at ambient laboratory environment

Equipment: Scale (inventory number 280 01 0075), Calipers (inventory number 280 01 0909), Netzsch Heat Flow Meter (inventory number 280 01 0725).

Eng/Tech: Dave Carter

### Thermal Transmission

Property	# 1	# 2	# 3
Density	28.63 kg/m <sup>3</sup> (1.79 lb/ft <sup>3</sup> )	28.51 kg/m <sup>3</sup> (1.78 lb/ft <sup>3</sup> )	28.74 kg/m <sup>3</sup> (1.79 lb/ft <sup>3</sup> )
Thickness	27.21 mm (1.0712 in.)	27.13 mm (1.0682 in.)	27.21 mm (1.0711 in.)
Upper Surface Temperature	34.96° C (94.93° F)	34.96° C (94.92° F)	34.92° C (94.85° F)
Lower Surface Temperature	12.61° C (54.70° F)	12.63° C (54.74° F)	12.59° C (54.67° F)
Temperature Differential	22.36° C (40.24° F)	22.32° C (40.18° F)	22.32° C (40.18° F)
Mean Temperature	23.78° C (74.81° F)	23.79° C (74.83° F)	23.76° C (74.76° F)
Rate of Heat Flux	27.324 W/m <sup>2</sup> (8.658 Btu/h-ft <sup>2</sup> )	27.364 W/m <sup>2</sup> (8.675 Btu/h-ft <sup>2</sup> )	27.320 W/m <sup>2</sup> (8.660 Btu/h-ft <sup>2</sup> )
Thermal Conductance	1.222 W/m <sup>2</sup> ·K (0.215 Btu/h-ft <sup>2</sup> ·°F)	1.226 W/m <sup>2</sup> ·K (0.216 Btu/h-ft <sup>2</sup> ·°F)	1.224 W/m <sup>2</sup> ·K (0.216 Btu/h-ft <sup>2</sup> ·°F)
Thermal Resistance	0.819 K·m <sup>2</sup> /W (4.648 °F·ft <sup>2</sup> ·h/Btu)	0.816 K·m <sup>2</sup> /W (4.632 °F·ft <sup>2</sup> ·h/Btu)	0.817 K·m <sup>2</sup> /W (4.640 °F·ft <sup>2</sup> ·h/Btu)
Thermal Conductivity	0.033 W/m·K (0.230 Btu·in/h-ft <sup>2</sup> ·°F)	0.033 W/m·K (0.231 Btu·in/h-ft <sup>2</sup> ·°F)	0.033 W/m·K (0.231 Btu·in/h-ft <sup>2</sup> ·°F)
Thermal Resistivity	30.085 K·m/W (4.339 °F·ft <sup>2</sup> ·h/Btu·in)	30.063 K·m/W (4.336 °F·ft <sup>2</sup> ·h/Btu·in)	30.037 K·m/W (4.333 °F·ft <sup>2</sup> ·h/Btu·in)
Thermal Resistance @ 25 mm (0.984 in)	0.752 K·m <sup>2</sup> /W ** (4.270 °F·ft <sup>2</sup> ·h/Btu)	0.752 K·m <sup>2</sup> /W (4.268 °F·ft <sup>2</sup> ·h/Btu)	0.751 K·m <sup>2</sup> /W (4.264 °F·ft <sup>2</sup> ·h/Btu)
Thermal Resistance @ 25.4 mm (1.00 in)	0.764 K·m <sup>2</sup> /W (4.338 °F·ft <sup>2</sup> ·h/Btu)	0.764 K·m <sup>2</sup> /W (4.336 °F·ft <sup>2</sup> ·h/Btu)	0.763 K·m <sup>2</sup> /W (4.332 °F·ft <sup>2</sup> ·h/Btu)

\*\* K·m<sup>2</sup>/W = m<sup>2</sup>·°C/W

**APPENDIX B: Test Data (6 pages)**

---



Test: **Flexural Strength**  
 Date: 15-May-09 Project: 3175418 Eng/Tech: A. Chang  
 Client: HW Manufacturing Inc.  
 Product: **HW.EPS.COMFORT R**  
 Method: CAN/ULC-S701-05 Thermal Insulation, Polystyrene, Boards and Pipe Covering  
 ASTM C 203-05 Test Method for Flexural Properties of Thermal Insulation  
 ASTM D 618-00 Test Method for Conditioning of Plastics  
 Method I, Procedure B (Centre-Point)  
 Conditioning: 88 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%  
 Specimen Size: 300 x 100 x 25 mm  
 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: 42.3 mm/min 1.67 in/min  
 Equipment: Instron (Intertek ID 000568; Calibration due 26 Aug,09)  
 Mitutoyo Digital Calipers (ID P1019; Calibration due May 1, 2010)

Specimen	Width (mm)			Depth (mm)			Max Load		Flexural Strength	
	W1	W2	W3	D1	D2	D3	(lbf)	(N)	(kPa)	(psi)
1	102.78	102.96	102.96	27.41	27.41	27.30	15.71	69.9	345.3	50.1
2	102.94	102.88	102.83	26.80	26.83	26.81	16.09	71.6	368.7	53.5
3	102.83	102.91	102.80	26.94	27.39	27.53	16.33	72.6	361.4	52.4
4	102.61	102.88	102.74	26.77	27.03	27.50	18.50	82.3	415.5	60.3
5	102.85	102.83	102.80	27.12	27.10	26.89	15.71	69.9	354.3	51.4
6	102.92	102.78	102.74	27.54	27.61	27.46	17.47	77.7	379.8	55.1
7	102.93	102.90	103.15	26.80	27.24	27.71	16.59	73.8	367.7	53.3
8	102.67	102.74	102.67	26.90	27.32	27.21	18.06	80.3	404.5	58.7
9	102.82	102.76	102.99	27.19	27.32	27.14	16.59	73.8	369.1	53.5
10	102.77	102.80	102.71	27.49	27.56	27.44	17.82	79.3	388.8	56.4
								Mean:	375.5	54.5
								StdDev:	22.0	3.2
								COV:	5.8%	5.8%



**Test:** Compressive Strength  
**Date:** 14-May-09 Project: 3175418 Eng/Tech: A.Chang  
**Client:** HW. Manufacturing Inc.  
**Product:** **HW.EPS.COMFORT R**  
**Method:** CAN/ULC-S701-05 Thermal Insulation, Polystyrene, Boards and Pipe Covering  
 ASTM D1621-04a Method for Compressive Properties of Rigid Cellular Plastics  
 ASTM D618-08, Procedure A *Standard Practice for Conditioning Plastics for Testing*  
**Conditioning:** 88 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%  
**Specimen Size:** 100 x 100 x 25 mm  
**Sp. Thickness:** 25.4 mm  
**Rate of Straining:** 2.5 mm/mm.min  
**Crosshead Speed:** 2.5 mm/min  
**Equipment:** Instron (Intertek ID 000568; Cal. Due Aug 2009)  
 Instron 25 kN load cell (Intertek ID 000567; Cal. Due Aug 2009)  
 Mitutoyo Digital Calipers (ID 1019 ; Calibration due May 1, 2010)

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	102.55	102.83	102.97	102.75	102.99	102.69	27.69	27.69	27.76	27.72	468.8	2086	197.4	28.6
2	102.81	103.02	102.92	102.61	102.63	102.80	27.60	27.60	27.49	27.65	440.4	1960	185.5	26.9
3	103.03	102.84	102.77	102.95	102.88	103.20	27.17	27.17	26.80	27.20	438.0	1949	183.9	26.7
4	102.89	102.95	102.91	103.05	103.00	102.77	27.17	27.17	26.82	26.99	422.9	1882	177.6	25.8
5	102.41	102.63	102.63	102.54	102.60	102.99	27.44	27.44	27.55	27.59	425.1	1891	179.6	26.0
6	102.82	102.86	103.05	102.53	102.72	102.66	27.40	27.40	27.44	27.60	433.1	1927	182.4	26.5
											Mean:		<b>184.4</b>	<b>26.7</b>
											StdDev:		7.0	1.0
											COV:		3.8%	3.8%

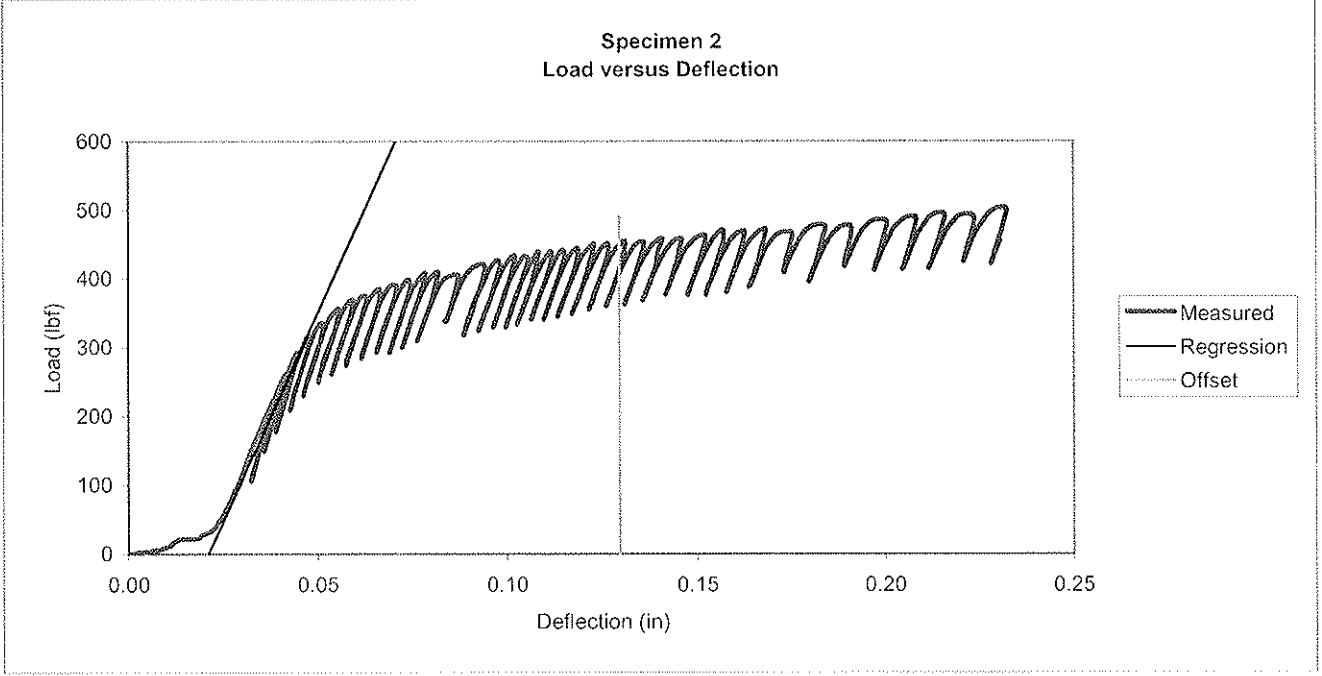
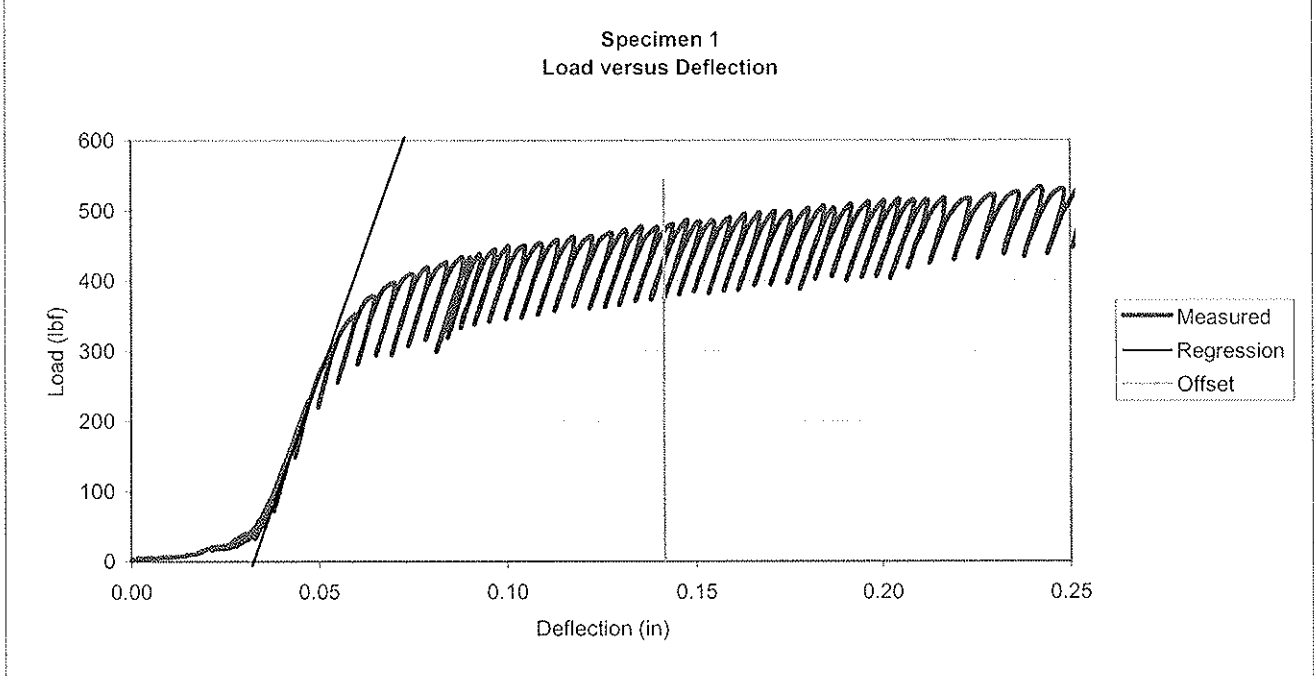




Test: Compressive Strength  
Date: 14-May-09  
Client: HW. Manufacturing Inc.  
Product: HW.EPS.COMFORT R

Project: 3175418

Eng/Tech: A.Chang

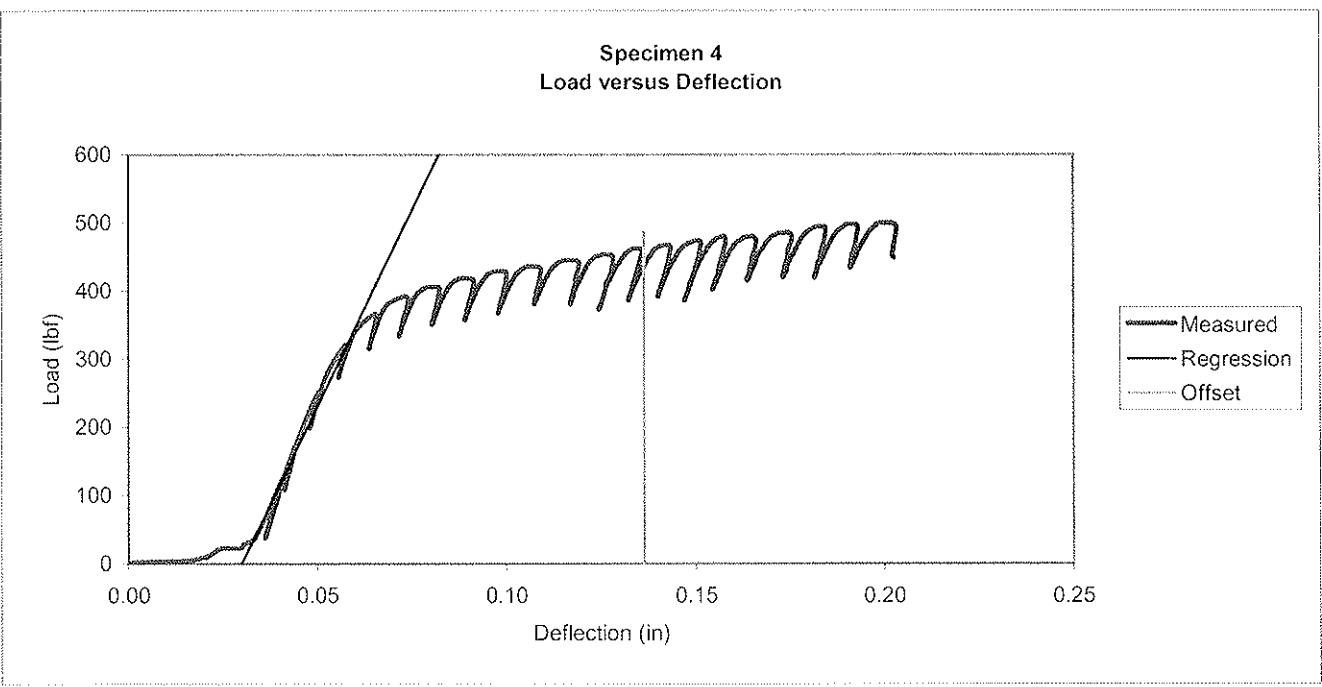
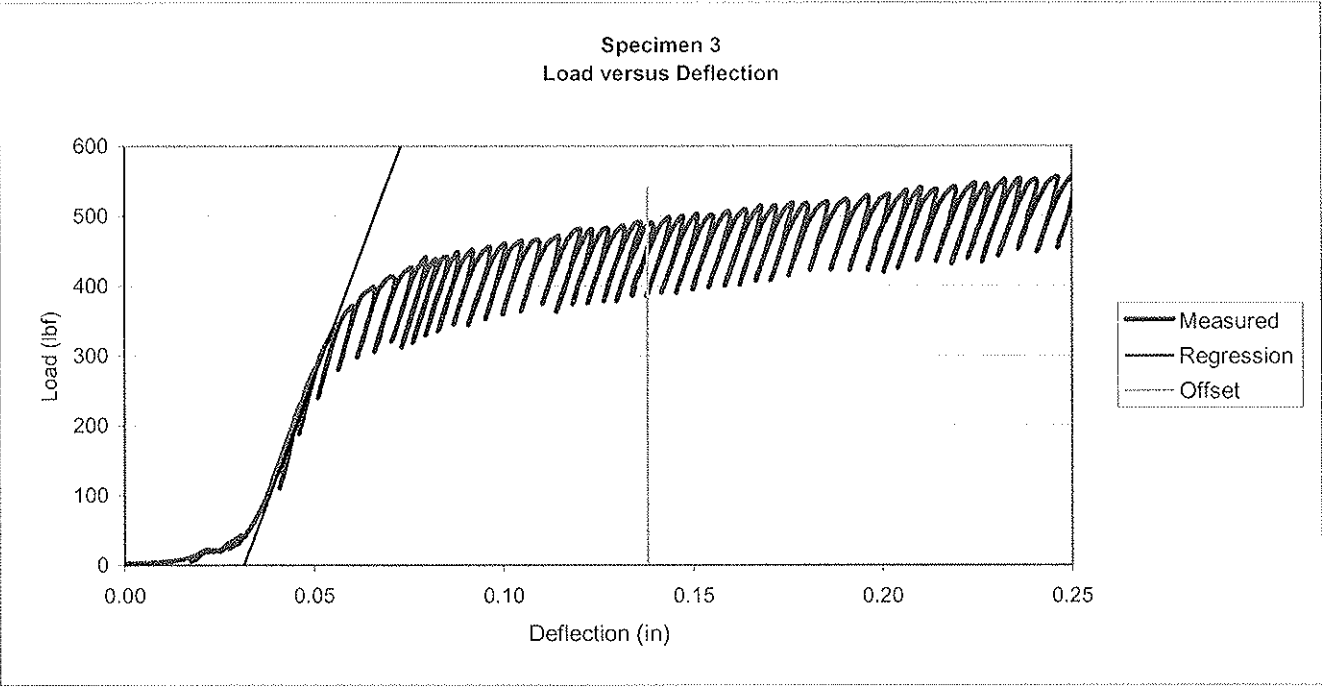




Test: **Compressive Strength**  
Date: 14-May-09  
Client: HW Manufacturing Inc.  
Product: HW.EPS.COMFORT R

Project: 3175418

Eng/Tech: A.Chang

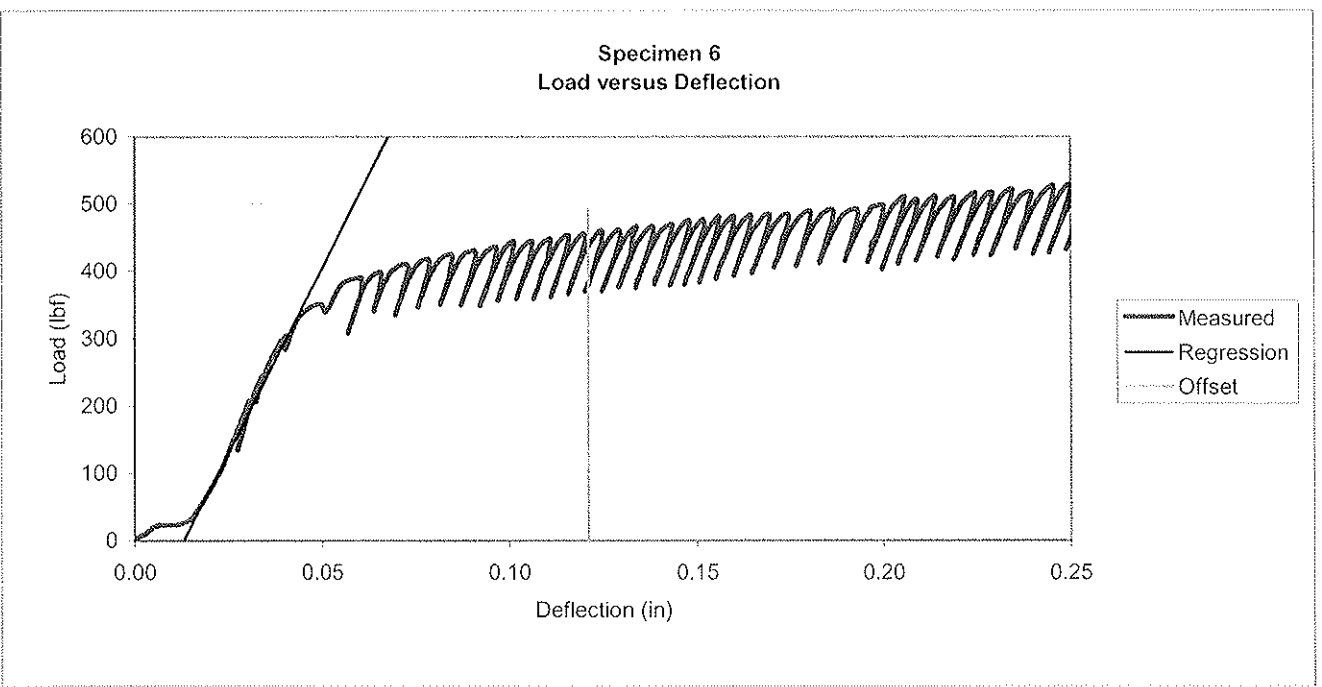
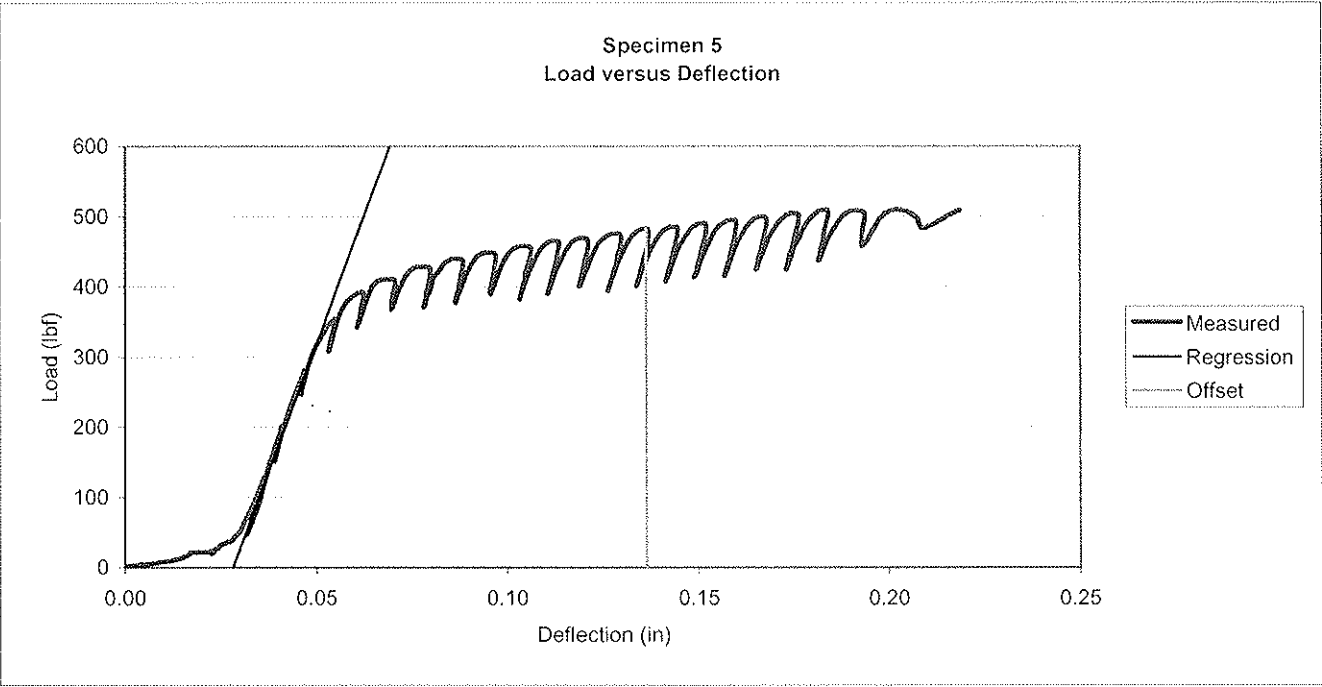




Test: Compressive Strength  
Date: 14-May-09  
Client: HW Manufacturing Inc.  
Product: HW.EPS.COMFORT R

Project: 3175418

Eng/Tech: A.Chang





Test: **Density**  
 Date: 14-May-09 Project: 3175418 Eng/Tech: A. Chang  
 Client: HW Manufacturing Inc.  
 Product: **HW.EPS.COMFORT R**  
 Method: CAN/ULC-S701-05 Thermal Insulation, Polystyrene, Boards and Pipe Covering  
 ASTM D 1622-08 Test Method for Apparent Density of Rigid Cellular Plastics  
 Specimen Size: 100 x 100 x 25 mm thick  
 Conditioning: 88 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%  
 Equipment: Digital Calipers (ID 1019 ; Calibration due May 1, 2010)  
 Digital Balance (ID P52606 ; Calibration due March 2010 )

Specimen	Length (mm)			Width (mm)			Depth (mm)				Weight	Density	
	L1	L2	L3	W1	W2	W3	D1	D2	D3	D4	(g)	(kg/m <sup>3</sup> )	(lbs/ft <sup>3</sup> )
1	102.55	102.83	102.97	102.75	102.99	102.69	27.69	27.69	27.76	27.72	8.394	28.66	1.79
2	102.81	103.02	102.92	102.61	102.63	102.80	27.60	27.60	27.49	27.65	8.126	27.88	1.74
3	103.03	102.84	102.77	102.95	102.88	103.20	27.17	27.17	26.80	27.20	8.408	29.29	1.83
4	102.89	102.95	102.91	103.05	103.00	102.77	27.17	27.17	26.82	26.99	8.154	28.47	1.78
5	102.41	102.63	102.63	102.54	102.60	102.99	27.44	27.44	27.55	27.59	8.427	29.09	1.82
6	102.82	102.86	103.05	102.53	102.72	102.66	27.40	27.40	27.44	27.60	8.103	27.94	1.75
											Mean:	28.55	1.78
											StdDev:	0.58	0.04
											COV:	2.0%	2.0%