

***Accelerated Weathering of 2000 Hours, and Tensile Properties
Testing of Class A and Class C Inspire Slate Shingles***

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Applicant:
Inspire Roofing Products
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2 Preface

All services undertaken are subject to the following general policy:

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3 Introduction

Intertek Testing Services NA Ltd. (Intertek) has conducted accelerated weathering and tensile properties testing for Inspired Roofing Products on a discontinuous roofing product. The evaluation was conducted from March 2006 to October 2006 in accordance with the following criteria:

- ICC-ES AC 07 *"Acceptance Criteria for Special Roofing Systems"*, approved June 2006
- ASTM D638-03 *"Test Method for Tensile Properties of Plastics"*
- ASTM G155-05a *"Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials"*

4 Materials and Methods

4.1. SAMPLE SELECTION

Intertek representative, Dave Carter, selected a series of Class C shingles on April 3, 2006 and Class A shingles on July 19, 2006. The product was manufactured at Inspire Roofing Products LLC, 1101 Industrial Drive, Albion, MI, 49224. The product was identified as Inspire Slate Shingles Class A & C and composed of a polymer composite base material compression molded to emulate a natural slate tile roof. The raw material mix consists of 20 melt polyethylene polymer, magnesium hydroxide, inorganic pigment, UV protectant, calcium stearate, polyolefin plastomer additive.

The sample selection process was carried out in accordance with independent approved sampling procedures.

4.2. SPECIMEN PREPARATION

Specimens for the weatherometer were cut to the required dimensions using a straight edge and a sharp blade. Tensile samples were cut with a machined die conforming to ASTM D638-03.

4.3. TEST PROCEDURES

4.3.1. Conditioning

Before testing, the test specimens were conditioned for at least 24 hours at a temperature of $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and relative humidity of $50 \pm 5\%$.

4.3.2. Accelerated Weathering

Representative sections of the product were subjected to 2,000 hours of xenon arc light as per ASTM G155-05a.

4.3.3. Tensile Properties

Tensile strength and elongation tests were carried out as described in ASTM D638-03. Five specimens for each sample series were prepared to Type II coupon specifications with the following exceptions:

L = 1.25 in.
WO = 1.0 in.
LO = 4.5 in.
G = 1.0 in.
D = 3.0 in.

The test series are defined as control and after 2000 hours accelerated weathering. Each specimen was placed in a tensile testing machine equipped with self-aligning grips, and then loaded at a constant rate of 2.0 in/min. The tensile strength was calculated based on the cross-sectional area of the specimen and the maximum load attained. The elongation of the material was based on the extension that occurred at the point of the first significant break of the specimen.

5 Test Results

Visual examination of the product after 2000 hours of accelerated weathering revealed no evidence of cracking, crazing, pitting, chalking, discoloration, or any other surface changes. The product tensile properties test results are shown in Tables 1 and 2 below. A full set of test results is included in Appendix A.

Table 1. Tensile Properties for Class A Shingles

Product Condition	Tensile Strength (psi)			Elongation (%)		
	Mean	Standard Deviation	Change from Control (%)	Mean	Standard Deviation	Change from Control (%)
Control						
▪ Tile Direction	2293	29	---	52.9	8.0	---
▪ Cross Direction	2132	72		48.3	10.6	
After Weathering						
▪ Tile Direction	2108	100	-8.1	48.3	5.2	-8.7
▪ Cross Direction	2051	29	-3.8	38.3	8.3	-20.6

Table 2. Tensile Properties for Class C Shingles

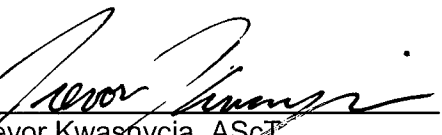
Product Condition	Tensile Strength (psi)			Elongation (%)		
	Mean	Standard Deviation	Change from Control (%)	Mean	Standard Deviation	Change from Control (%)
Control						
▪ Tile Direction	2282	85	---	54.7	6.0	---
▪ Cross Direction	2191	25		48.9	12.0	
After Weathering						
▪ Tile Direction	2398	78	-5.1	53.6	10.8	-1.9
▪ Cross Direction	2208	88	0.8	42.5	8.3	-13.0

6 Conclusion

The Inspire Slate Shingles Class A & C products identified and evaluated in this report have been tested in accordance with Section 3.2.1 of ICC-ES AC 07 *"Acceptance Criteria for Special Roofing Systems"*, approved June 2006. The product has shown properties and visual changes as presented in Section 5 of this test report.

INTERTEK TESTING SERVICES NA LTD.

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Appendix A: Test Data (4 pages)



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Test: **Tensile Strength** As Received
Date: 23-Oct-06 Project: 3096431 Eng/Tech: Geri Nishio
Client: Inspire Roofing Products
Product: Inspire Slate Shingles: Class "A"
Method: ASTM D 638-03 Tensile Properties of Plastics
Conditioning: Cured for at least 24 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%
Exposure: None
Crosshead speed: 2.0 ins/min 50.8 mm/min
Gauge length: 1.0 ins. 25.4 mm/min
Equipment: *Loading:* Instron 8516 Universal Testing Machine (Intertek ID D000568) calibration due July 07
Load Cell: Instron 8516 Internal 25kN Load cell (Intertek ID D000567) calibration due July 07
Measurments: Mitutoyo Digital Calipers (Intertek ID P52652) calibration due July 07

Pull direction in length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.27	0.20	1.64	121.60	454.6	2272.9	64.0%
2	0.26	0.21	1.59	123.10	473.5	2254.6	58.6%
3	0.27	0.19	1.47	117.00	440.7	2319.4	47.2%
4	0.25	0.21	1.45	120.10	482.3	2296.8	45.1%
5	0.24	0.21	1.50	118.10	487.0	2319.1	49.7%
Mean					467.6	2292.5	52.9%
Sdev					19.5	28.6	8.0%
COV					4.2%	1.2%	15.2%

Pull direction across length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.26	0.18	1.65	103.70	404.3	2246.0	65.0%
2	0.25	0.27	1.36	140.80	573.5	2124.2	36.3%
3	0.26	0.22	1.43	120.30	459.2	2087.1	43.3%
4	0.26	0.20	1.50	108.70	411.7	2058.7	49.8%
5	0.26	0.22	1.47	120.50	471.6	2143.7	47.0%
Mean					464.1	2132.0	48.3%
Sdev					67.8	71.8	10.6%
COV					14.6%	3.4%	22.0%



ETL SEMKO

Test: **Tensile Strength** After 2,000 hours UV
Date: 23-Oct-06 Project: 3096431 Eng/Tech: Geri Nishio
Client: Inspire Roofing Products
Product: Inspire Slate Shingles: Class "A"
Method: ASTM D 638-03 Tensile Properties of Plastics
Conditioning: Cured for at least 24 hours at a temperature of $23 \pm 2^{\circ}\text{C}$ and relative humidity of $50 \pm 5\%$
Exposure: 2,000 hours Xenon Arc Ultraviolet Light
Crosshead speed: 2.0 ins/min 50.8 mm/min
Gauge length: 1.0 ins. 25.4 mm/min
Equipment: *Loading:* Instron 8516 Universal Testing Machine (Intertek ID D000568) calibration due July 07
Load Cell: Instron 8516 Internal 25kN Load cell (Intertek ID D000567) calibration due July 07
Measurements: Mitutoyo Digital Calipers (Intertek ID P52652) calibration due July 07
UV Exposure: Atlas 25/18WT Xenon Arc Ultraviolet Weatherometer (Intertek ID xx) calibration due Sept 07

Pull direction in length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.27	0.18	1.43	94.47	356.5	1980.5	43.0%
2	0.26	0.17	1.44	96.58	365.1	2147.9	44.3%
3	0.27	0.17	1.51	94.41	345.8	2034.3	51.1%
4	0.26	0.17	1.56	99.75	379.3	2231.0	55.8%
5	0.28	0.18	1.47	106.60	386.2	2145.7	47.5%
Mean					366.6	2107.9	48.3%
Sdev					16.4	99.8	5.2%
COV					4.5%	4.7%	10.8%
% Change					-21.6%	-8.1%	-8.7%

Pull direction across length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.28	0.19	1.43	108.1	393.1	2068.9	43.5%
2	0.27	0.18	1.32	97.79	362.2	2012.1	32.0%
3	0.28	0.15	1.28	86.58	313.1	2087.5	28.5%
4	0.27	0.16	1.39	87.78	326.3	2039.5	39.1%
5	0.26	0.16	1.49	86.61	327.4	2046.6	48.8%
Mean					344.4	2050.9	38.3%
Sdev					32.7	28.8	8.29%
COV					9.5%	1.4%	21.6%
% Change					-25.8%	-3.8%	-20.6%



ETL SEMKO

Test: **Tensile Strength** As Received
Date: 23-Oct-06 Project: 3096431 Eng/Tech: Geri Nishio
Client: Inspire Roofing Products
Product: Inspire Slate Shingles: Class "C"
Method: ASTM D 638-03 Tensile Properties of Plastics
Conditioning: Cured for at least 24 hours at a temperature of $23 \pm 2^{\circ}\text{C}$ and relative humidity of $50 \pm 5\%$
Exposure: None
Crosshead speed: 2.0 ins/min 50.8 mm/min
Gauge length: 1.0 ins. 25.4 mm/min
Equipment: *Loading:* Instron 8516 Universal Testing Machine (Intertek ID D000568) calibration due July 07
Load Cell: Instron 8516 Internal 25kN Load cell (Intertek ID D000567) calibration due July 07
Measurments: Mitutoyo Digital Calipers (Intertek ID P52652) calibration due July 07

Pull direction in length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.27	0.23	1.48	138.70	509.9	2217.1	47.8%
2	0.26	0.22	1.59	126.90	482.5	2193.2	59.2%
3	0.27	0.19	1.62	115.50	435.8	2293.9	61.7%
4	0.26	0.21	1.55	124.20	482.3	2296.8	55.0%
5	0.26	0.19	1.50	118.10	457.8	2409.2	49.7%
Mean					473.7	2282.1	54.7%
Sdev					28.1	84.6	6.0%
COV					5.9%	3.7%	10.9%

Pull direction across length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.27	0.19	1.41	109.70	411.6	2166.5	41.0%
2	0.27	0.20	1.64	115.70	433.3	2166.7	63.5%
3	0.27	0.20	1.50	118.80	440.0	2200.0	50.4%
4	0.26	0.20	1.56	115.00	444.9	2224.4	56.4%
5	0.25	0.22	1.33	123.00	483.3	2196.8	33.3%
Mean					442.6	2190.9	48.9%
Sdev					26.0	24.6	12.0%
COV					5.9%	1.1%	24.6%



ETL SEMKO

Test: **Tensile Strength** After 2,000 hours UV
 Date: 23-Oct-06 Project: 3096431 Eng/Tech: Geri Nishio
 Client: Inspire Roofing Products
 Product: Inspire Slate Shingles: Class "C"
 Method: ASTM D 638-03 Tensile Properties of Plastics
 Conditioning: Cured for at least 24 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 5%
 Exposure: 2,000 hours Xenon Arc Ultraviolet Light
 Crosshead speed: 2.0 ins/min 50.8 mm/min
 Gauge length: 1.0 ins. 25.4 mm/min
 Equipment: *Loading:* Instron 8516 Universal Testing Machine (Intertek ID D000568) calibration due July 07
Load Cell: Instron 8516 Internal 25kN Load cell (Intertek ID D000567) calibration due July 07
Measurments: Mitutoyo Digital Calipers (Intertek ID P52652) calibration due July 07
UV Exposure: Atlas 25/18WT Xenon Arc Ultraviolet Weatherometer (Intertek ID xx) calibration due Sept 07

Pull direction in length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.26	0.20	1.44	128.00	492.3	2461.5	44.4%
2	0.27	0.20	1.49	132.70	496.1	2480.4	48.6%
3	0.26	0.20	1.55	121.80	468.5	2342.3	55.5%
4	0.26	0.18	1.72	114.50	433.7	2409.5	71.6%
5	0.26	0.19	1.48	114.70	436.1	2295.4	48.2%
Mean					465.3	2397.8	53.6%
Sdev					29.7	78.4	10.8%
COV					6.4%	3.3%	20.1%
% Change					-1.8%	5.1%	-1.9%

Pull direction across length of tile

Sample #	Width (inches)	Thickness (inches)	Lgth @ brk (inches)	Break load (lbs)	Brk. Str (lbs/inch)	Tensile (psi)	Elong. (%)
1	0.27	0.23	1.34	131.70	482.4	2097.5	34.3%
2	0.26	0.21	1.40	127.10	488.8	2327.8	40.3%
3	0.25	0.22	1.38	124.20	495.8	2253.7	37.6%
4	0.26	0.20	1.45	114.10	432.2	2161.0	45.1%
5	0.26	0.20	1.56	114.40	440.0	2200.0	55.5%
Mean					467.9	2208.0	42.5%
Sdev					29.5	87.9	8.3%
COV					6.3%	4.0%	19.4%
% Change					5.7%	0.8%	-13.0%