QAI LABORATORIES
CERTIFICATION TESTING INSPECTION

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CLIENT: **Colorado Roofing Products LLC**
3590 Himalaya Rd.
Aurora, CO 80011

Test Report No: RJ4095-3	Date: August 25, 2015

SUBJECT: Fire Classification Testing on Polyurethane Shake Roof Covering.

SAMPLE ID: CeDUR™ Shakes, Color: Live Oak.

SAMPLING DETAIL: The samples were randomly selected by a QAI representative at the client's manufacturing facility located at 3590 Himalaya Rd. Aurora, CO 80011 on July 1, 2015. QAI documented the materials and manufacturing procedures in accordance with ICC-ES AC85, Section 3.1.

DATE OF RECEIPT: Samples were received at QAI Laboratories on July 6, 2015.

TESTING PERIOD: July 8 – August 24, 2015.

AUTHORIZATION: Testing authorized by Paul Mallory under QAI Test Proposal # MB-2015-060103 dated June 8, 2015.

TEST REQUESTED: Conduct a full Class A series of Intermittent Flame, Spread of Flame, and Burning Brand roof fire tests on the sampled material in accordance with the methods and procedures outlined in ASTM Test Method E108-11*, "Standard Test Methods for Fire Tests of Roof Coverings"(E108).*

TEST RESULTS: Detailed test results are provided on subsequent pages of this report.

CONCLUSION: The Sampled CeDUR roof shakes **met** the requirements, in accordance with the Engineering Evaluation on page 5, for an ASTM E108-11 for Class A roof covering.

Prepared By

David Royer
Laboratory Technician
Fire Technology Dept.

Signed for and on behalf of QAI Laboratories

Brian Ortega
Fire Analyst
Fire Technology Dept.

FIRE CLASSIFICATION TEST PER ASTM E 108-11

Storage of Assembled Test Decks

All test deck assemblies were stored indoors at temperatures not lower than 60ºF (16ºC) nor higher than 90ºF (32ºC) for the period of time necessary to cure the assembly components prior to testing. The test decks were stored in such a manner to assure that each deck was surrounded by free circulating air.

Roof System and Test Deck Assembly Construction Details

The test decks were constructed by QAI personnel following the construction details outlined in ASTM E108-11 specification standard for deck construction.

Lumber: Nominal 2” x 4” Douglas Fir lumber having a moisture content between 8 and 12%.

Solid Deck: $^{15}/_{32}$” AC Exterior grade plywood, having a moisture content not greater than 8%.

Underlayment: One layer of ASTM D226 30# felt asphalt roof underlayment was fastened to the substrate using T50 flat head staples at 18” intervals and incorporated a 2” overlap.

Felt Interlayment: A single 18” strip of 30 # ASTM D226 Type 2 roofing underlayment fastened to the substrate using T50 flat head staples at 18” intervals.
Beginning with the first full course, the 18” felt was applied over the top 3” of the course, followed by the next course of shakes. The felt interweave was continued up the deck, laying felt over the top 3” of each consecutive row of shakes.

Roof Covering: CeDUR™ Shakes synthetic roofing shakes fastened to the deck with 1 ¾” long roofing nails allowing a minimum ¾” penetration through the sheathing. The fasteners were placed two per shake, with the exception where 3 fasteners were used to attach the 12” wide shakes. Each course was overlapped to leave 10” exposure and fastened at 12” above the leading edge of the shake. The shakes were cut along the edge of the deck when necessary to create a finished edge, no treatment was done with the exposed edge. The specimens also contained shakes with cut edges at random locations within the field of the deck in such a manner as to be exposed to flame and brand placement locations. The Spread of Flame decks were constructed using the manufacturer’s minimum allowable exposure of 8”.

FIRE CLASSIFICATION TEST PER ASTM E 108-11 (CONT.)

Burning Brand Test – Class A (Four Test Decks)

Test Parameters

Wind Velocity: 1056 ft/min ± 44 ft/min
Test Deck Slope: 5" per Horizontal Foot
Class A Brands: Size: 12" x 12" x 2 $^{11}/_{32}$" (1 per test deck)

The brands were placed on the decks following the flame application schedule as outlined in Section 10.4.1 of ASTM E 108-11. Brands were placed at the locations considered most vulnerable which was determined to be centered over panel joints in the test deck

Test Results

Burning Brand Details				
Test Deck Assembly	**Ignition** *(MM:SS)*	**Brand Extinguished** *(MM:SS)*	**Test Terminated** *(MM:SS)*	**Pass/Fail**
1	00:30	21:30	44:20	Pass
2	00:15	29:00	33:00	Pass
3	00:20	25:30	31:15	Pass
4	00:25	25:25	36:50	Pass

Observations

All test decks performed in a similar manner. At no time during the test was there any evidence of flaming on the underside of the test decks, neither did any glowing embers fall from the deck assembly.

FIRE CLASSIFICATION TEST PER ASTM E 108-11 (CONT.)

Intermittent Flame Test – Class A (Two Test Decks)

Test Parameters

Wind Velocity: 1056 ft/min ± 44 ft/min
Flame Temperature: 1400 ± 50º F
Test Deck Slope: 5" per Horizontal Foot
Cycling Periods: 15 cycles: 2-minute Flame-On, 2-minute Flame-Off

Test Results

Test Deck Assembly #1: The deck assembly ignited at 50 seconds then self-extinguished during the following flame-off cycle. The test deck continued to ignite and self-extinguish during the first 3 cycles. No ignition was noted during the next 7 cycles. The deck began to ignite and sustain flaming during the last 3 cycles. The test was terminated at 1 hour 58 minutes with no evidence of flaming on the underside of the deck, neither was there any glowing embers or displacement of any portion of the deck.

Test Deck Assembly #2: The deck assembly ignited at 47 seconds then self-extinguished during the following flame-off cycle. The test deck continued to ignite and self-extinguish during the following 3 cycles. No ignition was noted during the next 7 cycles. The deck began to ignite and sustain flaming during the last 4 cycles. The test was terminated at 1 hour 22 minutes with no evidence of flaming on the underside of the deck, neither was there any glowing embers or displacement of any portion of the deck.

FIRE CLASSIFICATION TEST PER ASTM E 108-11 (CONT.)

Spread of Flame Test – Class A (Two Test Decks)

Test Parameters

Wind Velocity: 1056 ft/min ± 44 ft/min
Flame Temperature: 1400 ± 50º F
Test Deck Slope: 5" per Horizontal Foot
Flame Application: 10 Minutes

Test Results

Spread of Flame Details					
Test Deck Assembly	**Ignition Time** *(MM/SS)*	**Maximum Spread of Flame** *(ft)*	**Lateral Spread of Flame** *(ft)*	**Flame Front Recession** *(ft)*	**Pass/Fail**
1	00:55	2	None	1	Pass
2	01:25	2	None	1	Pass

Observations

Both decks performed in a similar manner. After the ignition of the test sample surface the flame front progressed steadily to the maximum spread distance and then receded back to 1 foot until the test was terminated at 10 minutes.

CONDITIONS OF ACCEPTANCE FOR CLASSIFICATION BY ASTM E108

At no time during or after the intermittent flame, spread of flame or burning brand tests shall:

1. Any portion of the roof covering material be blown or fall off the test deck in the form of flaming or glowing brands that continue to glow after reaching the floor, or
2. The roof deck be exposed, or
3. Portions of the roof deck fall away in the form of particles that continue to glow after reaching the floor.
4. At no time during the Class A intermittent flame or burning brand tests shall there be sustained flaming of the underside of the deck.
5. At the conclusion of the spread of flame tests, the flaming shall not have spread beyond 6 feet for Class A, and there shall have been no significant lateral spread of flame from the path directly exposed to the test flame.

APPENDIX

Photograph No.1
CeDUR Shake

********End of Report********

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August 25, 2015
Addendum to QAI Laboratories Test Reports RJ4095-3 and RJ4095-4

Colorado Roofing Products LLC
3590 Himalaya Road
Aurora, Colorado 80011

RE: Evaluation to determine the recognition of a Class A ASTM E108 CeDUR Shake system, color: Walden.

Background and Product Description

QAI Laboratories, Ltd. (QAI) is an International Accreditation Service (IAS) accredited certification body (PCA-119) for the certification of products used as roof covering systems.

QAI is currently in the process of listing Colorado Roofing Products LLC for CeDUR Shake polyurethane roofing product for Class A requirements of ASTM E108-Standard Test Methods for Fire Tests of Roof Coverings. This product is manufactured at Colorado Roofing Products facility:

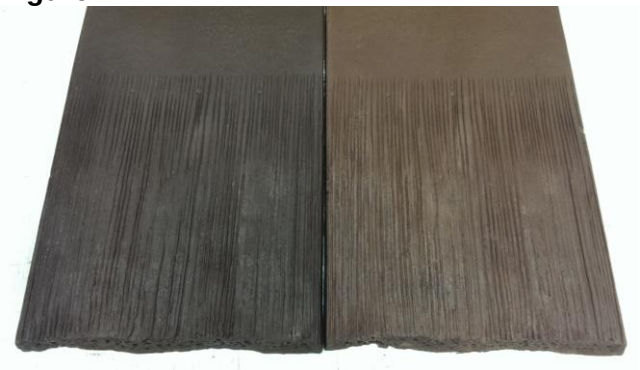
> Colorado Roofing Products LLC
> 3590 Himalaya Road
> Aurora, Colorado 80011

The testing to ASTM E108 has been completed on both solid sheathing (QAI Laboratories Test Report: RJ4095-3) and spaced sheathing (QAI Laboratories Test Report: RJ4095-4). This test series was performed using the Live Oak color on all decks.

Engineering Evaluation

The purpose of this evaluation is to extend the Class A recognition of the Live Oak color CeDUR shake to the Walden color CeDUR shake. The Live Oak color is a light brown and the Walden is a dark brown. Both colors use the same pigmentation coloring process to achieve their colors. See Figure 1 below for a comparison of the two colors.

Figure 1



Walden Live Oak

QAI has evaluated both colors for flame propagation properties of the material and the ignition temperature of the material. This is to demonstrate that both products perform equivalently under these conditions and the color does not show any variation in results.

ASTM D635-Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

This test compares the rate of burning which may be affected by such factors as density, pigments, any anisotropy of the material and thickness of the specimen. In this case both colors are a consistent density and thickness, the only variable is the color.

Color	Elapsed Time (s)	Burned Length (mm)	Notes
Live Oak	0	0	Material self extinguishes after removal of flame.
Walden	0	0	Material self extinguishes after removal of flame.

ASTM D1929-Standard Test Method for Determining Ignition Temperature of Plastics

This test determines the lowest ambient air temperature that will cause ignition of the material. The tested size of sample for both colors is equivalent and the only variable is the color. The results will show that the darker color does not absorb radiant heat faster or ignite at a lower temperature.

Color	Spontaneous Ignition Temperature (F)
Live Oak	850°
Walden	850°

Conclusion

The above results demonstrate that the Walden color performs equivalently to the Live Oak color under the conditions of these small scale flame and ignition property tests. These two tests on their own are not representative of a products ability to achieve an ASTM E108 Class A recognition but comparing the performance of the Walden to the Live Oak which has passed the ASTM 108 series and achieved a Class A QAI Laboratories believes that the Walden CeDUR shake product will also pass the ASTM E108 requirements.

QAI Laboratories is currently in the process of creating the certification documents for final publication to QAI's directory of listed products. Under QAI certification, we will be recognizing both Walden and Live Oak as appropriate for use in a certified ASTM E108, Class A listing. These products will be under follow up inspections, performed at Colorado Roofing Products manufacturing location noted above.

If you require further information please feel free to contact the undersigned.

Sincerely,
QAI Laboratories

Jason Friedrich, EIT
Senior Building Products Engineer