September 23, 2019

Tara Wentz
AP Thermoforming, LLC
1035 Little Gap Rd
Parlmerton, PA 18071
Phone: (610) 826-4579

Via Email: twentz@apformliner.com

**Terra Cotta Testing for PCI Standard**
**CTLGroup Project No. 052133**

Dear Ms. Wentz:

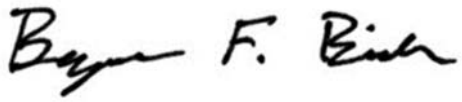
Attached are test results for the terra cotta samples that you submitted to CTLGroup. The samples arrived at CTLGorup in a dry condition on January 23, 2019. As requested, testing was performed in accordance with the PCI Standard for Architectural Terra Cotta embedded in precast concrete. During conditioning of the Tensile Bond Strength test samples per ASTM C666, Procedure B, we observed a failure of the concrete substrate. Per your request, we repeated the Tensile Bond Strength test on new samples submitted on May 17, 2019.

Results indicate that the terra cotta meets the requirements of the PCI Standard.

We appreciate this opportunity to conduct specialized testing services for you. Should you have any questions, please contact me.

Sincerely,

**CONSTRUCTION TECHNOLOGY LABORATORIES, INC., d/b/a CTLGroup**



Ben Birch, PE (IL, CO, VT, TX)
Concrete and Cement-Based Materials
(847) 972-3246
BBirch@CTLGroup.com

**Client: AP Thermoforming, LLC**
**Project: PCI Testing**
**Contact: Tara Wentz**
**Submitted by: Tara Wentz**
**Date Received: January 23, 2019**

**CTL Project No: 052133**
**CTL Project Mgr.: B. Birch**
**Analyst: G. Neiweem**
**Date Analyzed: January 25, 2019**
**Approved: C. Arboleda**
Revised: Sept **Report Date: February 6, 2019**

## PCI Standard for Architectural Terra Cotta
## Section 1. Size-Dimensional Tolerances

| Sample No. | *Width,* (L), inches | *Avg. Width,* Avg. (L), inches | *Height,* (W), inches | *Avg. Height,* Avg. (W), inches | *Thickness,* (H), inches | *Avg. Thickness,* Avg. (H), inches | pass/fail |
|---|---|---|---|---|---|---|---|
| Sample 1 | 16.025 | 16.030 | 11.640 | 11.638 | 0.808 | 0.795 | pass |
| | 16.030 | | 11.633 | | 0.799 | | |
| | 16.029 | | 11.641 | | 0.791 | | |
| | 16.035 | | 11.637 | | 0.782 | | |
| Sample 2 | 15.967 | 15.968 | 11.630 | 11.636 | 0.808 | 0.797 | pass |
| | 15.972 | | 11.640 | | 0.811 | | |
| | 15.967 | | 11.639 | | 0.787 | | |
| | 15.968 | | 11.634 | | 0.781 | | |
| Sample 3 | 15.966 | 15.970 | 11.633 | 11.637 | 0.804 | 0.797 | pass |
| | 15.967 | | 11.637 | | 0.805 | | |
| | 15.972 | | 11.643 | | 0.795 | | |
| | 15.974 | | 11.636 | | 0.785 | | |
| Sample 4 | 15.963 | 15.967 | 11.635 | 11.635 | 0.804 | 0.790 | pass |
| | 15.968 | | 11.635 | | 0.801 | | |
| | 15.967 | | 11.636 | | 0.778 | | |
| | 15.971 | | 11.635 | | 0.780 | | |
| Sample 5 | 15.965 | 15.970 | 11.638 | 11.635 | 0.800 | 0.791 | pass |
| | 15.969 | | 11.635 | | 0.798 | | |
| | 15.972 | | 11.631 | | 0.783 | | |
| | 15.973 | | 11.636 | | 0.782 | | |
| Sample 6 | 15.966 | 15.969 | 11.635 | 11.639 | 0.808 | 0.798 | pass |
| | 15.970 | | 11.646 | | 0.806 | | |
| | 15.969 | | 11.652 | | 0.789 | | |
| | 15.971 | | 11.622 | | 0.788 | | |
| Sample 7 | 15.967 | 15.967 | 11.615 | 11.629 | 0.802 | 0.793 | pass |
| | 15.973 | | 11.620 | | 0.800 | | |
| | 15.963 | | 11.661 | | 0.779 | | |
| | 15.964 | | 11.621 | | 0.791 | | |
| Sample 8 | 15.963 | 15.968 | 11.639 | 11.631 | 0.791 | 0.791 | pass |
| | 15.970 | | 11.639 | | 0.794 | | |
| | 15.972 | | 11.622 | | 0.789 | | |
| | 15.968 | | 11.623 | | 0.792 | | |
| Sample 9 | 15.966 | 15.967 | 11.643 | 11.645 | 0.802 | 0.795 | pass |
| | 15.966 | | 11.641 | | 0.805 | | |
| | 15.965 | | 11.647 | | 0.790 | | |
| | 15.972 | | 11.652 | | 0.784 | | |
| Sample 10 | 15.963 | 15.967 | 11.647 | 11.647 | 0.794 | 0.794 | pass |
| | 15.974 | | 11.652 | | 0.809 | | |
| | 15.963 | | 11.646 | | 0.792 | | |
| | 15.968 | | 11.644 | | 0.780 | | |

PCI Requirements:
*Width:* ± 0.039 inches
*Height:* ± 0.09375 inches (up to 15 in.)
*Thickness:* ± 0.0625 inches

Notes:
1. Measurements were performed in general accordance with Section 13.2 and 13.3 of ASTM C67.
2. This report may not be reproduced except in its entirety.

| | |
|---|---|
| **Client: AP Thermoforming, LLC** | **CTL Project No: 052133** |
| **Project: PCI Testing** | **CTL Project Mgr.: B. Birch** |
| **Contact: Tara Wentz** | **Analyst:** |
| **Submitted by: Tara Wentz** | **Date Analyzed:** |
| **Date Received:** | **Approved:** |
| **Report Date:** | **Revised: September 23, 2019** |

**PCI Standard for Architectural Terra Cotta**
**Section 4. Cold Water Absoprtion at 24 Hours**

| Sample No. | 1 | 2 | 3 | 4 | 5 | Average | pass/fail |
|---|---|---|---|---|---|---|---|
| Oven dry weight, g | 4926.3 | 4902.3 | 4895.8 | 4889.5 | 4897.3 | 4902.2 | pass |
| Saturated wt. at 24 hrs, g | 5024.8 | 5014.8 | 5003.4 | 4998.6 | 5002.5 | 5008.8 | |
| 24-hr Cold Water Absorption, % | 2.0 | 2.3 | 2.2 | 2.2 | 2.1 | 2.2 | |

PCI Requirement:
7.5 % Maximum absorption

**Notes:**
1. Testing was performed in general accordance with Section 8 of ASTM C67.
2. This report may not be reproduced except in its entirety.

**Client: AP Thermoforming, LLC**
**Project: PCI Testing**
**Contact: Tara Wentz**
**Submitted by: Tara Wentz**
**Date Received: January 23, 2019**
**Report Date: February 7, 2019**

**CTL Project No: 052133**
**CTL Project Mgr.: B. Birch**
**Analyst: G. Neiweem**
**Date Analyzed: January 29, 2019**
**Approved: B. Birch**
**Revised: September 23, 2019**

## PCI Standard for Architectural Terra Cotta
## Section 6. Out of Square and Section 7. Warpage Tolerances

| Sample No. | Out of Square, in. | | Straightness, in. | Diagonal Flatness, in. | Vertical Flatness, in. | pass/fail |
|---|---|---|---|---|---|---|
| Sample 1 | 0 | 0 | 0 | 1/32 | 1/32 | pass |
| | 0 | 0 | 0 | 1/32 | 1/32 | |
| Sample 2 | 0 | 1/32 | 0 | 0 | 0 | pass |
| | 1/32 | 0 | 0 | 0 | 0 | |
| Sample 3 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 1/32 | 0 | 0 | 0 | |
| Sample 4 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 0 | 0 | 0 | 0 | |
| Sample 5 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 0 | 0 | 0 | 0 | |
| Sample 6 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 0 | 0 | 0 | 0 | |
| Sample 7 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 0 | 0 | 0 | 0 | |
| Sample 8 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 0 | 0 | 0 | 0 | |
| Sample 9 | 1/32 | 0 | 0 | 0 | 0 | pass |
| | 0 | 1/32 | 0 | 0 | 0 | |
| Sample 10 | 0 | 0 | 0 | 0 | 0 | pass |
| | 0 | 0 | 0 | 0 | 0 | |

PCI Requirements:
Out of Square: ± 1/16 inch

Straightness (sweep): ± 0.025% of length
Diagonal Flatness: ± 0.25% of diagonal
Vertical Flatness: ± 1.0% of height

Notes:
1. Out of square measurements were performed in general accordance with Section 19 of ASTM C67.
2. Warpage measurements were performed in general accordance with Section 14 of ASTM C67.
3. This report may not be reproduced except in its entirety.

**Client: AP Thermoforming, LLC**
**Project: PCI Testing**
**Contact: Tara Wentz**
**Submitted by: Tara Wentz**
**Date Received: January 23, 2019**
**Report Date: February 14, 2019**

**CTL Project No: 052133**
**CTL Project Mgr.: B. Birch**
**Analyst: G. Neiweem**
**Date Analyzed: February 6, 2019**
**Approved: B. Birch**
**Revised: September 23, 2019**

**PCI Standard for Architectural Terra Cotta**
**Section 11. Modulus of Rupture**

| Sample No. | Max. Load, lbf | Net Width, in. | Depth, in. | Avg. Dist fm Midspan to Plane of Failure, in. | Modulus of Rupture, psi | Average Modulus of Rupture, psi | pass/fail |
|---|---|---|---|---|---|---|---|
| 1 | 980 | 11.64 | 0.80 | 0.19 | 2,922 | 2,912 | pass |
| 2 | 960 | 11.64 | 0.80 | 0.09 | 2,888 | | |
| 3 | 1060 | 11.64 | 0.80 | 0.59 | 2,975 | | |
| 4 | 1020 | 11.64 | 0.79 | 0.21 | 3,069 | | |
| 5 | 890 | 11.64 | 0.79 | 0.12 | 2,707 | | |

PCI Requirement:
Not less than 1,400 psi

Notes:
1. Testing was performed in general accordance with Section 6 of ASTM C67.
2. This report may not be reproduced except in its entirety.

| | |
|---|---|
| **Client: AP Thermoforming, LLC** | **CTL Project No: 052133** |
| **Project: PCI Testing** | **CTL Project Mgr.: B. Birch** |
| **Contact: Tara Wentz** | **Analyst: G. Neiweem** |
| **Submitted by: Tara Wentz** | **Date Analyzed: February 5, 2019** |
| **Date Received: January 23, 2019** | **Approved: B. Birch** |
| **Report Date: February 22, 2019** | **Revised: September 23, 2019** |

**PCI Standard for Architectural Terra Cotta**
**Section 12. Compressive Strength**

| Sample No. | Maximum load, lbf | length, in. | width, in. | Compressive Strength, psi | Avg. Compressive Strength, psi | pass/fail |
|---|---|---|---|---|---|---|
| 6 | 63,600 | 3.99 | 0.82 | 19,520 | 18,810 | pass |
| 7 | 54,200 | 4.04 | 0.81 | 16,630 | | |
| 8 | 59,600 | 4.01 | 0.81 | 18,430 | | |
| 9 | 63,000 | 4.01 | 0.82 | 19,230 | | |
| 10 | 64,400 | 3.94 | 0.81 | 20,220 | | |

PCI Requirement:
Not less than 6,000 psi

Notes:
1. Testing was performed in general accordance with Section 7 of ASTM C67.
2. This report may not be reproduced except in its entirety.

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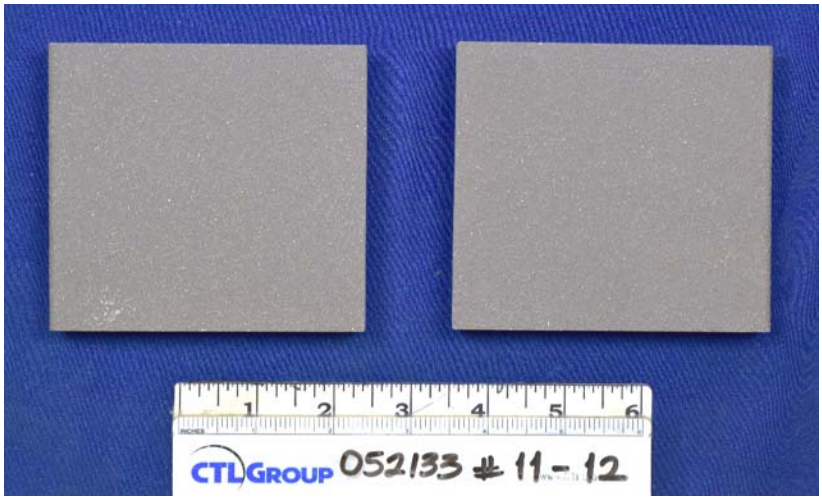
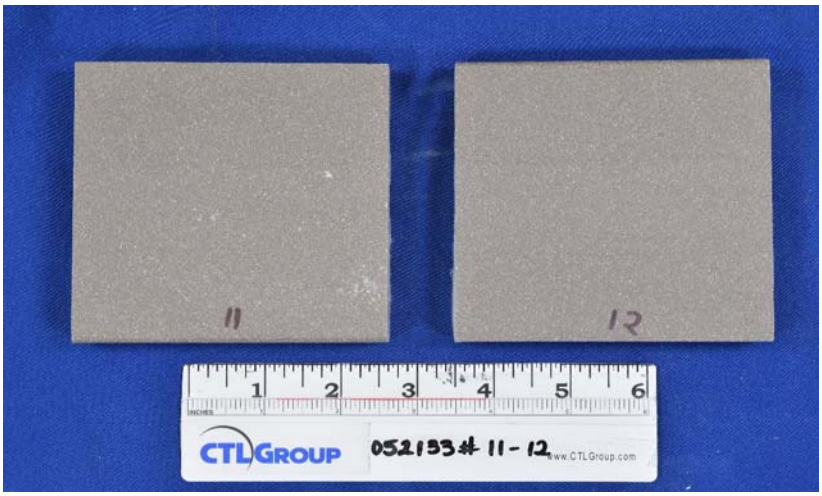
|---|---|
| **Client: AP Thermoforming, LLC** | **CTL Project No: 052133** |
| **Project: PCI Testing** | **CTL Project Mgr.: B. Birch** |
| **Contact: Tara Wentz** | **Analyst: M. Khan** |
| **Submitted by: Tara Wentz** | **Date Analyzed: February 08, 2019** |
| **Date Received: January 23, 2019** | **Approved: S. Vaidya** |
| **Report Date: February 28, 2019** | **Revised: September 23, 2019** |

**PCI Standard for Architectural Terra Cotta**
**Section 13. Chemical Resistance**

**Samples before test:**




**Samples after test:**




**Results:**
Not affected

PCI Requirement:
Not affected

Notes:
1. Testing was performed in general accordance with Section 23 of ASTM C67.
2. This report may not be reproduced except in its entirety.

**Client: AP Thermoforming, LLC**
**Project: PCI Testing**
**Contact: Tara Wentz**
**Submitted by: Tara Wentz**
**Date Received: 17-May-2019**

**CTL Project No: 052133**
**CTL Project Mgr.: Ben Birch**
**Analyst: Spencer Robinson**
**Date Analyzed: 20-May-2019 and 13-Sep-2019**
**Approved: Ben Birch**
**Report Date: September 23, 2019**

**PCI Standard for Architectural Terra Cotta**
**Section 9. Tensile Bond Strength**

*Before Freezing and Thawing:*

| Sample No. | Maximum Pull-Out load, lbf | Nominal length, in. | Nominal width, in. | Tensile Bond Strength Strength, psi | Avg. Tensile Bond Strength, psi | pass/fail |
|---|---|---|---|---|---|---|
| 1 | 20,540 | 16.00 | 8.00 | 160 | 190 | pass |
| 2 | 29,210 | | | 230 | | |
| 3 | 26,120 | | | 200 | | |
| 4 | 25,530 | | | 200 | | |
| 5 | 21,890 | | | 170 | | |

PCI Requirement:
Not less than 150 psi

*After Freezing and Thawing* (Note 2)*:*

| Sample No. | Maximum Pull-Out load, lbf | Nominal length, in. | Nominal width, in. | Tensile Bond Strength Strength, psi | Avg. Tensile Bond Strength, psi | pass/fail |
|---|---|---|---|---|---|---|
| 6 | 28,975 | 16.00 | 8.00 | 230 | 190 | pass |
| 7 | 24,174 | | | 190 | | |
| 8 | 23,618 | | | 180 | | |
| 9 | 22,546 | | | 180 | | |
| 10 | 23,357 | | | 180 | | |

PCI Requirement:
Not less than 150 psi

Notes:
1. Testing was performed in general accordance with modified ASTM E 488
2. Freezing and Thawing Per ASTM C666, Procedure B, was performed elsewhere.
3. This report may not be reproduced except in its entirety.