Architectural Testing

**TEST REPORT**

**Report No.:** C1753.02-301-41

**Rendered to:**

GALLINA USA, LLC
Janesville, WI

TYPE: Multi Celled Panel
SERIES/MODEL: Arco Plus 547-Opal

**Specification**: *NFRC 201-2010, "Interim Standard Test Method for Measuring the Solar Heat Gain Coefficient of Fenestration Systems Using Calorimetry Hot Box Methods".*

| **Summary of Results** | |
|---|---|
| Solar Heat Gain Coefficient (SHGC) | 0.39 |
| **Unit Size**: 39-3/8" x 39-3/8" ( 1000 mm x 1000 mm) (Non-Standard Size) | |
| Testing was performed in the 48" Solar Calorimeter ICN# 62060 | |
| | |

**Test Completion Date**: 08/13/12

Reference must be made to Report No. C1753.02-301-41, dated 09/04/12 for complete test specimen description and data.

**1.0 Report Issued To**: Gallina USA, LLC
4335 Capital Circle
Janesville, WI 53546

**2.0 Test Laboratory**: Architectural Testing, Inc.
2524 E. Jensen Ave
Fresno, California 93706
559-233-8705

**3.0 Project Summary**:

**3.1 Product Type**: Multi Celled Panel

**3.2 Series/Model**: Arco Plus 547-Opal

**3.3 Test Date**: 08/13/12

**3.4 Overall Size**: 39-3/8" x 39-3/8" ( 1000 mm x 1000 mm) (Non-Standard Size)

**3.5 Daylight Opening**: 39-3/8" x 39-3/8" (1000 mm x 1000 mm)

**3.6 Test Sample Submitted by**: Manufacturer

**3.7 Test Sample Submitted for**: Validation for Initial Certification (Prototype Unit)

**4.0 Test Specification**:

NFRC 201-2010, "Interim Standard Test Method for Measuring the Solar Heat Gain Coefficient of Fenestration Systems Using Calorimetry Hot Box Methods".

**5.0 Test Specimen Description**:

**5.1 Construction**:*

The unit consisted of three vertically-oriented multi-cellulor extruded panels, snap fit together.

**See Appendix B for Cross-Sectional Picture*

## 6.0 Test Results:

### 6.1 Heat Flows:

| | | | |
|---|---|---|---|
| 1. | Heat Extracted From System ($Q_{fluid}$) | 1391.0 | Btu/hr |
| 2. | Surround Panel Heat Flow ($Q_{sp}$) | 16.7 | Btu/hr |
| 3. | Surround Panel Conductance | 0.056 | Btu/hr·ft$^2$·F |
| 4. | Heat Across Walls ($Q_{walls}$) | 66.1 | Btu/hr |
| 5. | Flanking Loss Heat Flow ($Q_{fl}$) | 2.970 | Btu/hr |
| 6. | Auxiliary energy ($Q_{aux}$) | 38.4 | Btu/hr |
| 7. | Maximum thermal transmittance ($Q_{u\text{-}factor}$) | 48.6 | Btu/hr |
| 8. | Net Specimen Heat Flow ($Q_s$) | 1218.2 | Btu/hr |

### 6.2 Test Conditions:

| | | | |
|---|---|---|---|
| 1. | Average Interior Air Temperature | 77.8 | F |
| 2. | Average Exterior Air Temperature | 93.9 | F |
| 3. | Surround panel inside temperature ($t_{sp1}$) | 74.5 | F |
| 4. | Surround panel outside temperature ($t_{sp2}$) | 110.8 | F |
| 5. | Maximum Solar Irradiation Es | 297.8 | Btu/hr·ft² |
| 6. | Minimum Solar Irradiation Es | 287.9 | Btu/hr·ft² |
| 7. | Average Solar Irradiation Es | 293.1 | Btu/hr·ft² |
| 8. | Inlet Fluid Temperature | 69.0 | F |
| 9. | Outlet Fluid Temperature | 71.2 | F |
| 10. | Standardized Thermal Transmittance ($U_{st}$)* | 0.28 | Btu/hr·ft²·F |
| 11. | Maximum Exterior Surface Coefficient ($H_{h\text{-}sun}$) | 9.1 | Btu/hr·ft²·F |
| 12. | Minimum Exterior Surface Coefficient ($H_{h\text{-}sun}$) | 7.8 | Btu/hr·ft²·F |
| 13. | Average Exterior Surface Coefficient ($H_{h\text{-}sun}$) | 8.4 | Btu/hr·ft²·F |
| 14. | Standardized Weather Conductance ($h_{stII}$) | 5.1 | Btu/hr·ft²·F |
| 15. | Maximum Wind Velocity | 2.9 | MPH |
| 16. | Minimum Wind Velocity | 0.3 | MPH |
| 17. | Average Wind Velocity | 1.5 | MPH |
| 18. | Average Wind Direction (North equals 360 degrees) | 331 | Degrees |
| 19. | Starting Azimuth | 111 | Degrees |
| 20. | Ending Azimuth | 123 | Degrees |
| 21. | Minimum Altitude | 48 | Degrees |
| 22. | Maximum Altitude | 52 | Degrees |

*Determined using ASTM 1199. For details see ATI report C1826.01-301-46-R0.

**6.0 Test Results**: (Continued)

**6.3 Test Duration**:

| | |
|---|---|
| 1. | The test parameters were considered stable for five consecutive time constants (minimum of 10 minutes each) from 09:09 to 09:59 |

**6.4 Calibration Information 48 inch Calorimeter ICN 62060**:

| | | |
|---|---|---|
| 1. | Moving Pyranometer ICN 004059 | 08/26/11 |
| 2. | Flowmeter ICN 004065 | 12/14/11 |
| 3. | Thermocouple | 01/04/12 |
| 4. | Surround Panel Conductivity | 12/02/09 |
| 5. | Power Input | 01/04/12 |
| 6. | Fluid Temperature | 01/05/12 |
| 7. | Miscellaneous Power Input Last Calibration | 01/04/12 |
| 8. | Metering Box Last Calibration | 01/06/12 |
| 9. | Calibration Transfer Standard | 12/15/10 |

The specimen was installed into an extruded polystyrene foam panel with an R-value of 18 using silicone caulking. Tracking system azimuth and altitude are read every minute and the calorimeter is moved to a position normal to the sun from chart stored in computer. The calorimeter is located at 2524 East Jensen in Fresno, California near the northeast corner of the lot elevated approximately 15 feet from ground level. The foreground is desert, the background is industrial buildings.

The estimated uncertainty of this test is 2.50%

This was determined using ANSI/NCSL Z540-2-1997 type B evaluation as described in section 4.3 of this specification. For assumptions used for this calculation or for a description of the procedure contact the "Individual-In-Responsible-Charge" that signed this report.

"This test method does not include separate procedures to determine the heat flows due to either air movement or nighttime U-factor effects. As a consequence, the SHGC results obtained do not reflect the overall performance which may be found in field installations due to temperature differences, wind, shading, air leakage effects, and the thermal bridge effects specific to the design and construction of the fenestration system opening."

"Since there is a wide variety of fenestration system openings in residential, commercial and industrial buildings, it is not feasible to select a "typical" surround panel construction in which to mount the fenestration test specimen. The selection of a relatively high thermal resistance surround panel places the focus of the test on the solar performance of the system. Therefore, it should be recognized that the solar heat gain coefficient results obtained from this test method, for ideal laboratory conditions in a highly insulating surround panel, should only be used for fenestration product comparisons or as input to performance analyses which also include thermal, air leakage and thermal bridge effects due to the surrounding building structure. To determine air leakage effects for windows and doors, refer to Test Method ASTM E 283. For thermal transmittance refer to Test Method ASTM C 1199."

Ratings included in this report are for submittal to an NFRC-licensed IA for certification purposes and are not meant to be used for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) are to be used for labeling purposes.

Detailed drawings, representative samples of the test specimen and a copy of this report will be retained by Architectural Testing for a period of four years. This report is the exclusive property of the client so named herein and relates only to the fenestration product tested. This report may not be reproduced, except in full, without the approval of the laboratory.

For ARCHITECTURAL TESTING, INC.

Digitally Signed by: Jerry Bontilao

Jerry A. Bontilao
Technician

Digitally Signed by: Tyler Westerling

Tyler Westerling, P.E.
Project Engineer
Individual-In-Responsible-Charge

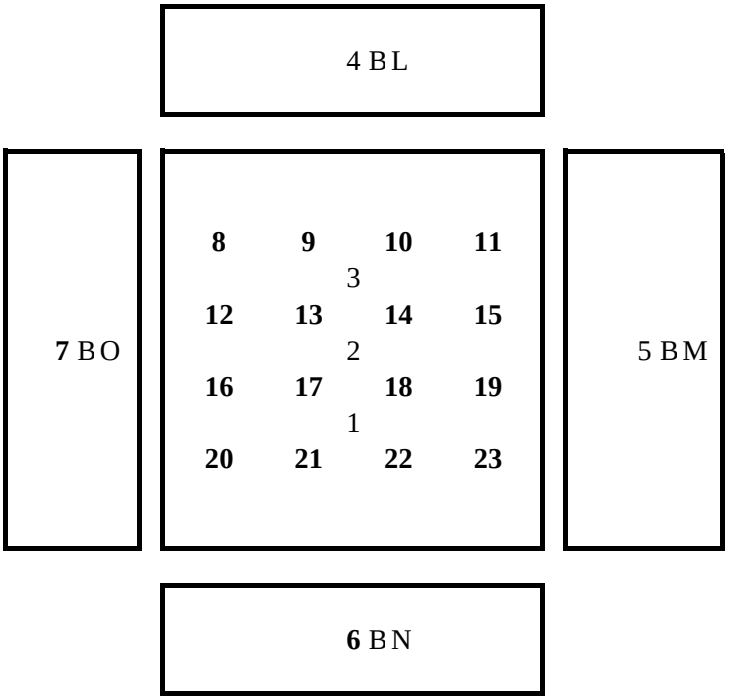
TW:ss

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix-A: Heat Exchanger Thermocouple Location and Temperatures (1)

Appendix-B: Photo (1)

## Appendix A
## Absorber Plate Thermocouple Layout




| | | |
|---|---|---|
| Air Top | 1 | 77.6 F |
| Air Center | 2 | 77.4 F |
| Air Bottom | 3 | 78.4 F |

| | | | | | |
|---|---|---|---|---|---|
| Location | 4 | 71.0 F | Location | 14 | 71.8 F |
| Location | 5 | 73.0 F | Location | 15 | 71.8 F |
| Location | 6 | 72.6 F | Location | 16 | 72.4 F |
| Location | 7 | 73.1 F | Location | 17 | 75.0 F |
| Location | 8 | 72.3 F | Location | 18 | 72.1 F |
| Location | 9 | 72.5 F | Location | 19 | 71.0 F |
| Location | 10 | 72.3 F | Location | 20 | 74.6 F |
| Location | 11 | 72.1 F | Location | 21 | 72.3 F |
| Location | 12 | 71.9 F | Location | 22 | 73.0 F |
| Location | 13 | 72.0 F | Location | 23 | 72.7 F |

**Appendix B**
**Photo**