



# **GUJARAT BOROSIL LIMITED**

## **HAIL TESTING**

**of the Glass Sheets and PV Modules**

**Report No. 118-11-1301A**

**Proposal No. 22456, Rev. C**

### **Customer Information**

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**Gujarat Borosil Limited**  
**V. Ramaswami**  
44 Khanna Construct House  
RGThadani Marg, worli  
Mumbai, India 400018

### **Purpose of Testing**

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The purpose of this test was to verify that the glass sheets and PV modules were capable of withstanding the impact of hailstones. Three glass sheets and three PV Modules were subjected to the following test input:

<b>Test Input</b>	<b>Standard Referenced</b>
Hail Test	IEC 61646, Edition 2.0, Section 10.17

Acceptance criteria are determined by Stion Corporation.



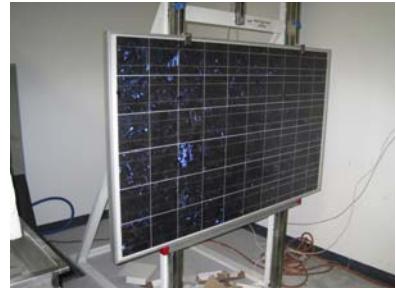
## Product Information

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Product: Glass Sheets and PV Modules  
Quantity: 3 of each



**Glass Sheet**



**PV Module**

## Laboratory Information

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Test engineer: Tyler Garlock, Chris Brookmeyer  
and Grant Lenk; *Westpak, Inc.*  
Test date: 06/22/2011-06/23/2011  
Westpak™ laboratory: San Jose, California

## Test Equipment and Instrumentation

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Please refer to Appendix I

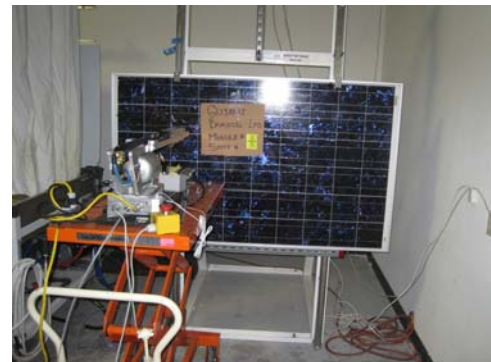


## Test Description

### Hail Test

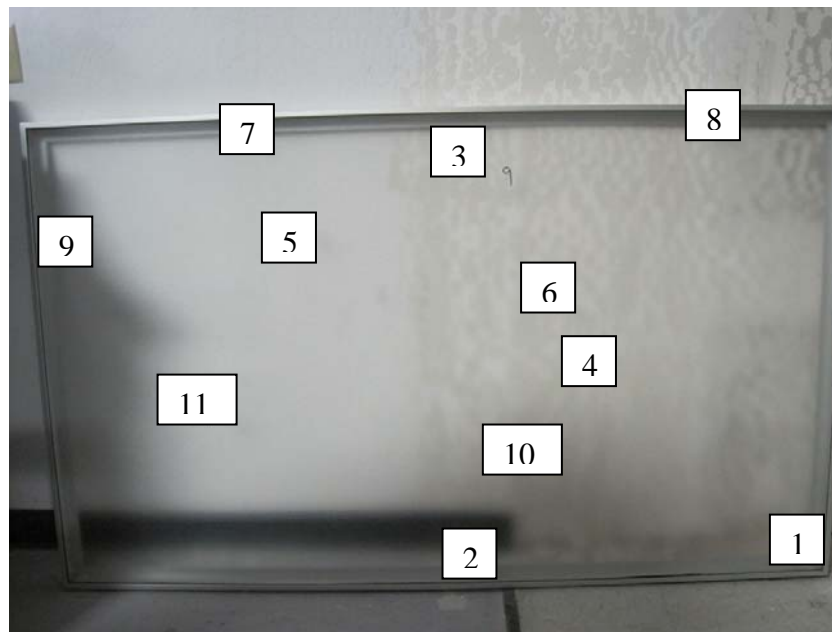
The glass sheets and PV modules were mounted in a rigid support. A launcher propelled 1" O.D. spherical ice balls. If the module was undamaged the test was repeated.

Velocity: 23 m/sec.  
 Distance: Less than 1m  
 Quantity tested: 3 glass sheets  
 3 PV modules  
 Shots Fired: 11 per test sample



**Hail Test Setup**

Notes: The fabricated ice balls were placed in a temperature chamber set at  $-10^{\circ}\text{C}$  ( $\pm 5^{\circ}\text{C}$ ) for a minimum of one hour. Ice balls were taken from the chamber and fired from the launcher (within 60 seconds from removal of the chamber) at the following locations:



**Impact Locations**



## Results and Observations

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Test Input	Observations	Appendix
Hail Test	No damage was observed during the testing of the three glass sheets.  No damage was observed during the testing of the three PV modules.	n/a



## Conclusions

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Three glass sheets and three PV modules were subjected to hail testing outlined in the IEC61646 10.17 test protocol.

At the completion of testing, the units were recycled at the request of Gujarat Borosil Limited.

There were no anomalies throughout the conduct of this test that would detract from the ability of **Gujarat Borosil Limited** from making reasonable judgments concerning the testing as described herein.

**WESTPAK™** is pleased to present this report to **Gujarat Borosil Limited** covering the hail testing of the **Glass Sheets and PV Modules**. The equipment used to conduct this testing has been recently calibrated and is known to be in good operating condition. In addition the test operator uses good laboratory practice at all times. Therefore, the data is considered accurate and reliable. However, there is no warranty expressed or implied with the submission of this report, and **Gujarat Borosil Limited** assumes all liability for use of the data contained herein.

Respectfully submitted,  
**WESTPAK, INCORPORATED**



Tyler Garlock  
June 23, 2011

**Reviewed By**



Phillip A. Cota  
June 23, 2011

# APPENDIX I

## EQUIPMENT and INSTRUMENTATION

<b>Instrumentation &amp; Equipment</b>	<b>Westpak™ ID</b>	<b>Model</b>	<b>Last Calibration</b>
Revco Technologies Freezer	910	ULT 750-5-A31	6/15/2011
Agilent Universal Counter	997	53131A	5/6/2011
Westpak Chronograph	947	WJD 947	Not Required
Hail Impact Tester	946	WP 946	Not Required
Hail Ice Mold	1101	WP 1101	Not Required
Hail Ice Mold	1102	WP 1102	Not Required
Impact Frame	987	GW 987	Not Required

*Note: All calibration conducted annually on instrumentation only*