

SHANDONG HAANGLAS CO., LTD

HEAT FLOW METER TEST REPORT

SCOPE OF WORK

VIG SPECIMEN - 5 S1.16+0.15V+5 - ASTM C518

REPORT NUMBER

P0492.03-116-25 R1

TEST DATE

11/3/2022 - 11/11/2022

ISSUE DATE

11/14/22

REVISED DATE

11/29/2022

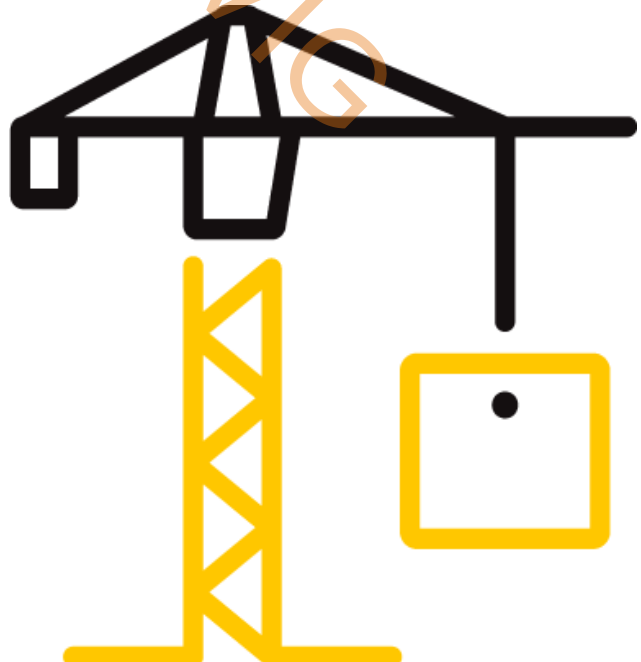
PAGES

12

DOCUMENT CONTROL NUMBER

RT-R-AMER-Test-7906 (01/17/22)

©2017 INTERTEK



TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

REPORT ISSUED TO

SHANDONG HAANGLAS CO., LTD

NO.2 Dongyue Avenue

Tai'an, Shandong, China, 271000

SECTION 1

SUMMARY

SERIES/MODEL: VIG Specimen - 5 S1.16+0.15V+5

Architectural Testing, Inc. (an Intertek Company), dba Intertek Building & Construction (B&C), was contracted by Shandong HaanGlas Co., Ltd to perform heat flow meter testing in accordance with ASTM C518-21 on their, Vacuum Insulated Glass Unit. Results obtained are tested values and were secured by using the designated test method. Testing was conducted at the Intertek B&C test facility in York, Pennsylvania.

Intertek B&C is an accredited testing laboratory and all testing was conducted in full compliance with ASTM approved procedures and specifications.

Intertek B&C will service this report for the entire test record retention period. The test record retention period ends four years after the test date. Test records, such as detailed drawings, datasheets, or other pertinent project documentation, will be retained for the entire test record retention period. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

For INTERTEK B&C:

COMPLETED BY: Jonathan M. Bright

TITLE: Engineer

SIGNATURE:

DATE: 11/29/22

JMB:esl

REVIEWED BY: Eric S. Leitner

TITLE: Manager - Thermal Testing

SIGNATURE:

DATE: 11/29/22

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample(s) tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 2

TEST METHODS

The product were evaluated in accordance with the following:

ASTM C518-21, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

SECTION 3

TEST SPECIMEN DESCRIPTION

SERIES/MODEL	VIG Specimen - 5 S1.16+0.15V+5
PRODUCT TYPE	Vacuum Insulated Glass Unit
SPECIMEN TEST SIZE	13-13/16" x 13-13/16"

**This product is not a compressible sample.*

SPECIMEN CONSTRUCTION	The test specimens were provided by the client as 6 units measuring approximately 0.4" x 13-13/16" x 13-13/16". Samples were placed into a foam surround mask of the same thickness, instrumented with surface thermocouples located on the top and bottom surfaces in the center of each panel. Then the samples were installed into the apparatus with buffer mats between the meter and surfaces of each panel to ensure proper contact with the apparatus. See Appendix B: Photographs.
------------------------------	---

SECTION 4

TEST CONDITIONS

COLD PLATE TEMPERATURE	10°F nominal
WARM PLATE TEMPERATURE	60°F nominal
MEAN SPECIMEN TEMPERATURE	35°F nominal
AVERAGE TEMPERATURE GRADIENT	50°F/inch nominal
HEAT FLOW ORIENTATION	Vertical Heat Flow, The specimen was prepared and installed into the test apparatus horizontally so that the measured heat flow was from the hot plate to the cold plate, as intended for use.
SPECIMEN CONFIGURATION	Single horizontal specimen
METERING AREA	4" x 4" heat flux transducer on warm side plate

TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 5
EQUIPMENT

DESCRIPTION	SERIAL #	ASSET #	CALIBRATION DATE
Dial Calipers (0-12")	52-008-012-0	INT01848	01/18/23
Adams Scale (CBK 70A)	17960300	65197	12/15/22
Digital Indicators (0-1")	17960305	65196	01/14/23
Temp/Humidity Transmitter	12961265	63736	02/24/23
Intertek 24" HFM	-	Y003323	*

**Device calibrated prior to use.*
SECTION 6
CALIBRATION INFORMATION

Calibration Material	NIST Standard Reference Material 1450d, 1" Thickness Fibrous Glass Board, Serial Number 357, dated January 20, 2012, no expiration.	
Material Thermal Conductance	0.211	(C) (Btu/hr·ft ² ·°F)

SECTION 7
TEST RESULTS (IP Units)

Test Specimen ID	Sample Name	Avg. Heat Flux (Btu/hr·ft ²)	Avg. Thermal Conductance (C) (Btu/hr·ft ² ·°F)	Avg. Thermal Resistance (R) (hr·ft ² ·°F/Btu)	Avg. Thermal Resistivity (r) (hr·ft ² ·°F/Btu-in)	Apparent Thermal Conductivity (k) (Btu-in/hr·ft ² ·°F)	Specimen Avg. Thickness (inches)	†Specimen Avg. Density (Lbs./Ft ³)
1	Sample 1	4.45	0.089	11.26	28.58	0.035	0.394	149.27
2	Sample 2	4.36	0.087	11.47	29.34	0.034	0.391	151.72
3	Sample 3	4.36	0.087	11.47	30.51	0.033	0.376	155.48
4	Sample 4	4.30	0.086	11.64	32.88	0.030	0.354	166.26
5	Sample 5	4.48	0.090	11.16	27.76	0.036	0.402	148.91
6	Sample 6	4.36	0.087	11.47	28.25	0.035	0.406	145.07

TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 7 (continued)
TEST RESULTS (SI Units)

Test Specimen ID	Sample Name	Avg. Heat Flux (W/m ²)	Avg. Thermal Conductance (C) (W/m ² ·K)	Avg. Thermal Resistance (Rsi) (m ² ·K/W)	Avg. Thermal Resistivity (r) (m·K/W)	Apparent Thermal Conductivity (k) (W/m·K)	Specimen Avg. Thickness (mm)	† Specimen Avg. Density (kg/m ³)
1	Sample 1	14.02	0.504	1.98	198.16	0.005	10.01	2391.12
2	Sample 2	13.75	0.495	2.02	203.43	0.005	9.93	2430.34
3	Sample 3	13.75	0.495	2.02	211.54	0.005	9.55	2490.49
4	Sample 4	13.56	0.488	2.05	227.97	0.004	8.99	2663.17
5	Sample 5	14.14	0.509	1.97	192.47	0.005	10.21	2385.29
6	Sample 6	13.76	0.495	2.02	195.87	0.005	10.31	2323.75

†The density of the sample was determined by dividing the average weight of the sample by its volume. The weight was measured using a calibrated scale and the volume was determined by measuring the length, width, and height of the sample.

ANSI/NCSL Z540-2-1997 Type B uncertainty for this test was: 6%

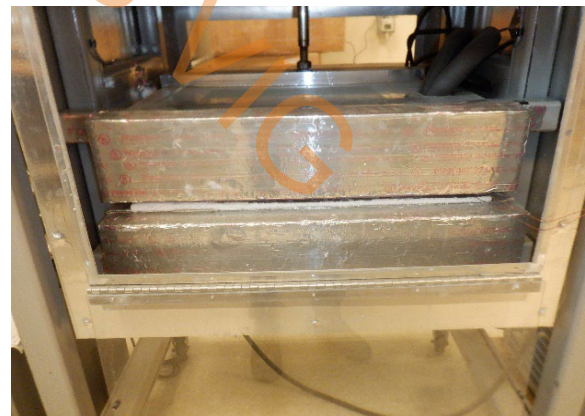
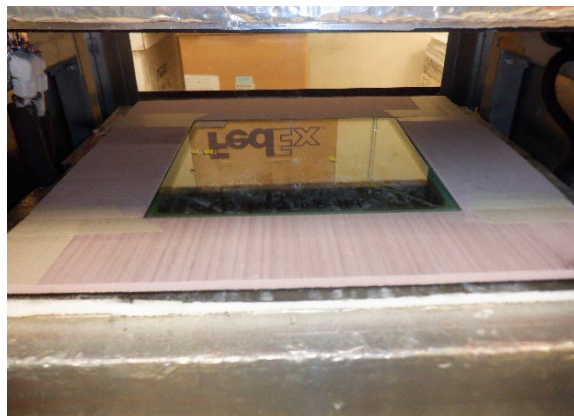
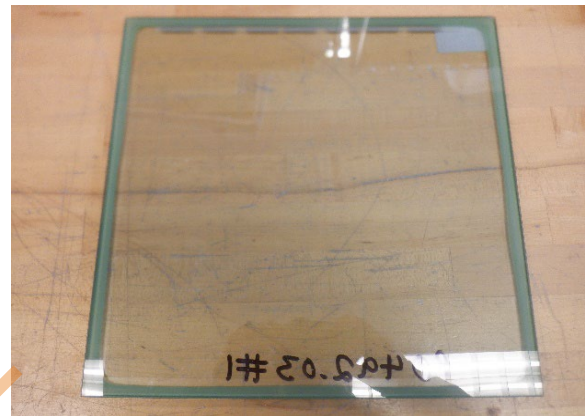
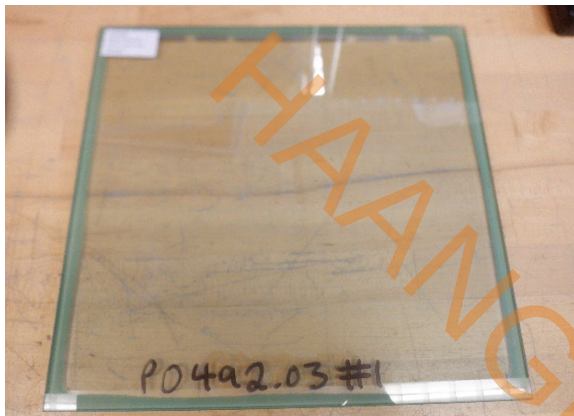
TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 8
PICTURES

VIG Specimen - 5S1.16+0.15V+5, (Sample 1)



TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

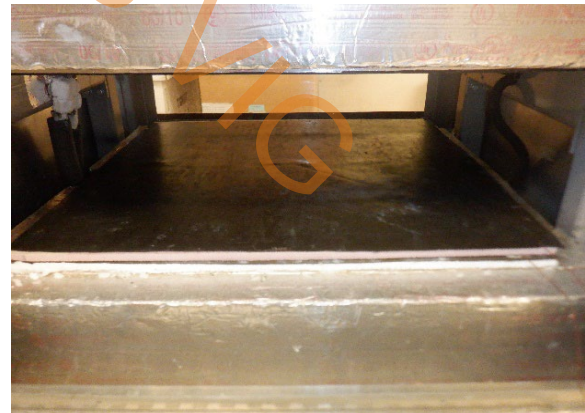
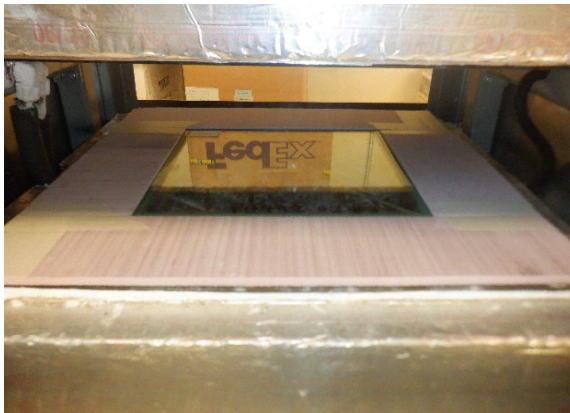
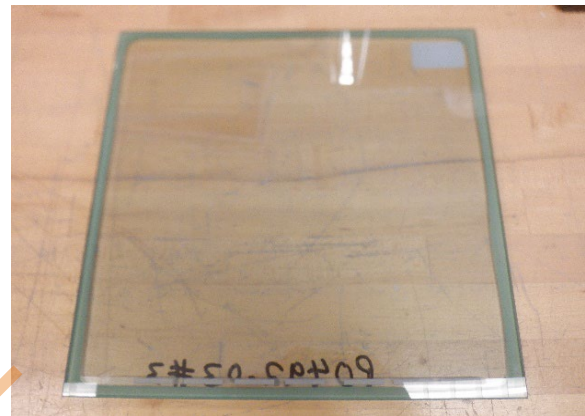
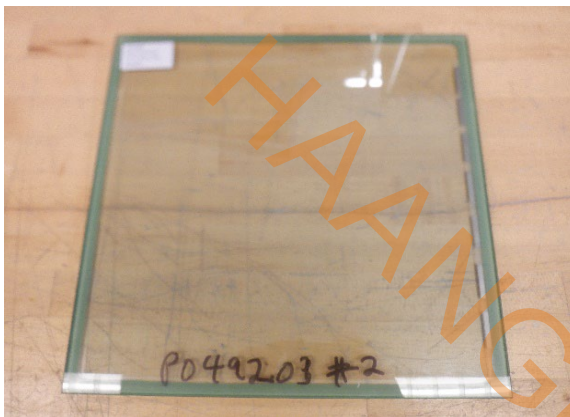
Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 8 (continued)

PICTURES

VIG Specimen - 5S1.16+0.15V+5, (Sample 2)



TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

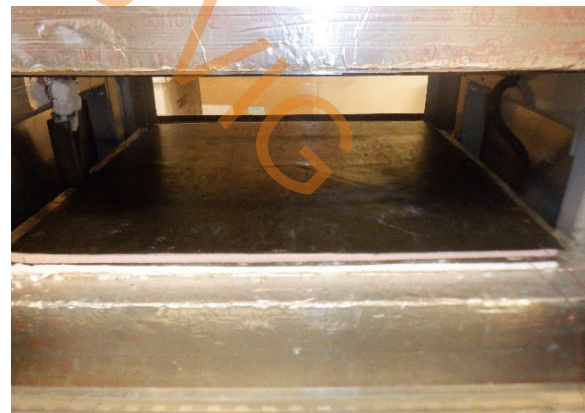
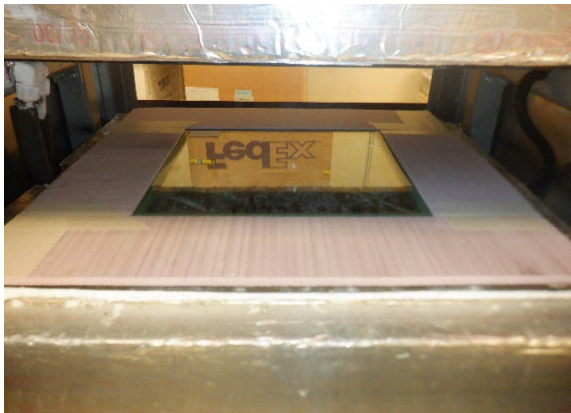
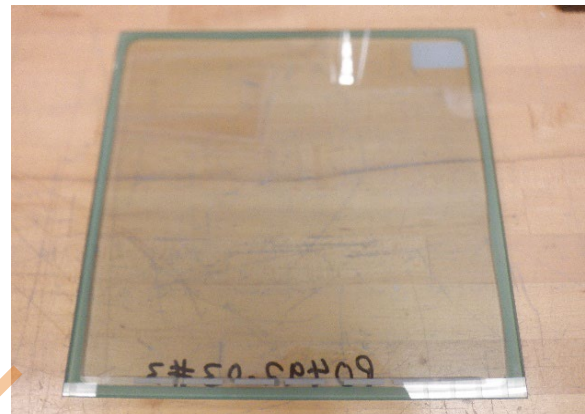
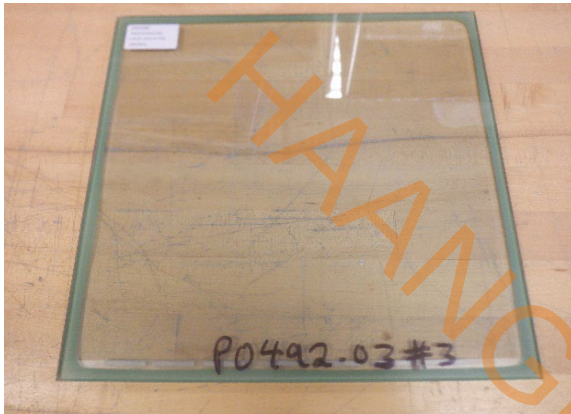
Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 8 (continued)

PICTURES

VIG Specimen - 5S1.16+0.15V+5, (Sample 3)



TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

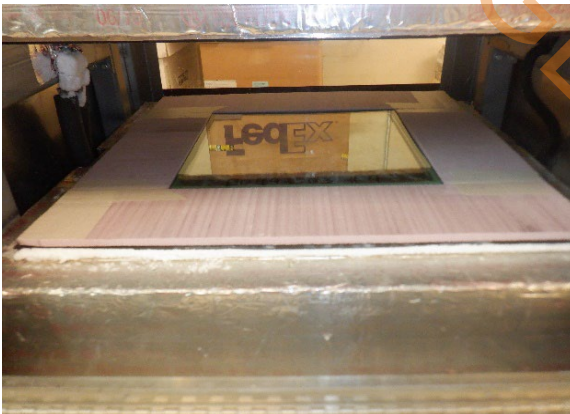
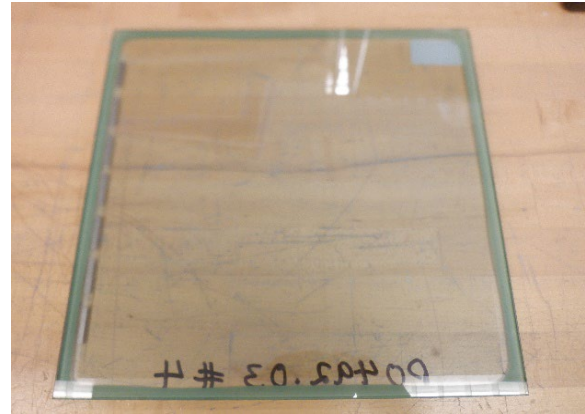
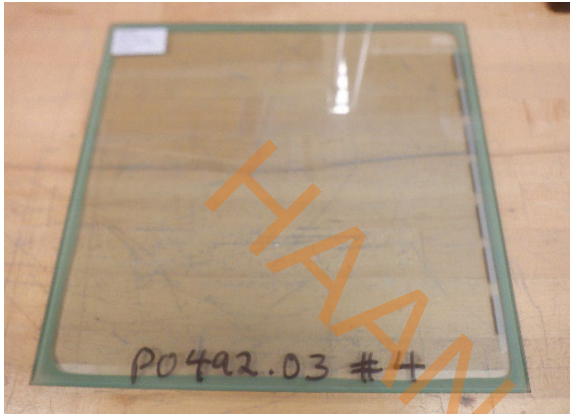
Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 8 (continued)

PICTURES

VIG Specimen - 5S1.16+0.15V+5, (Sample 4)



TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

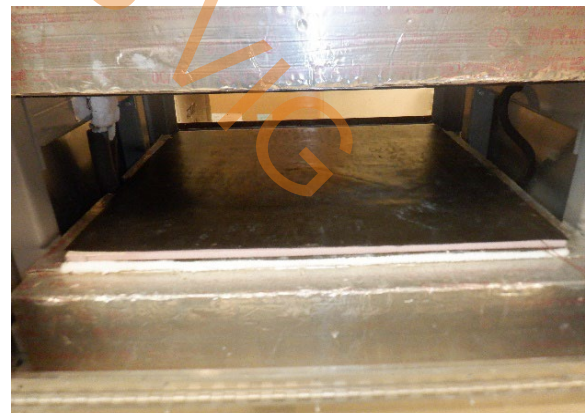
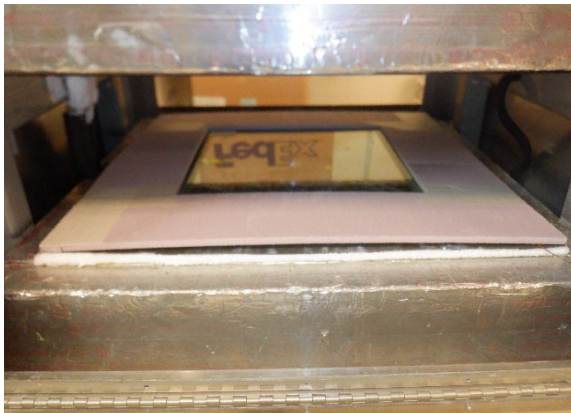
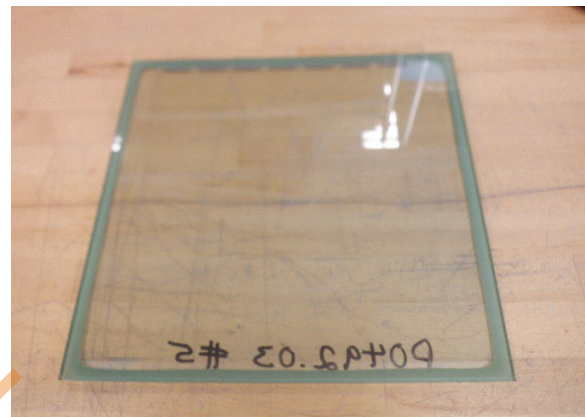
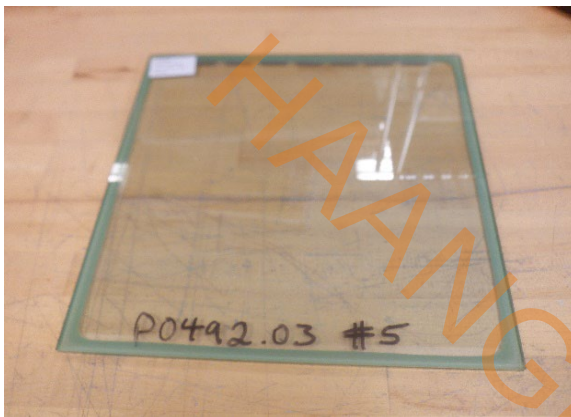
Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 8 (continued)

PICTURES

VIG Specimen - 5S1.16+0.15V+5, (Sample 5)



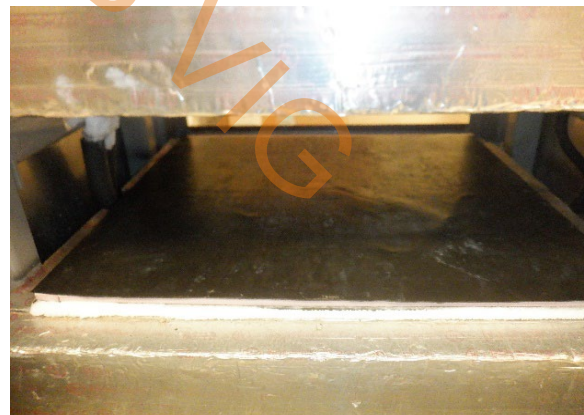
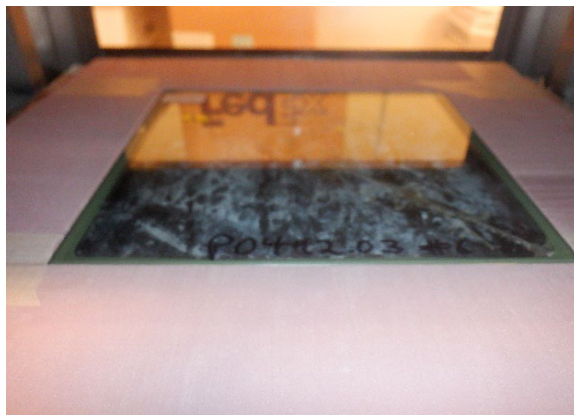
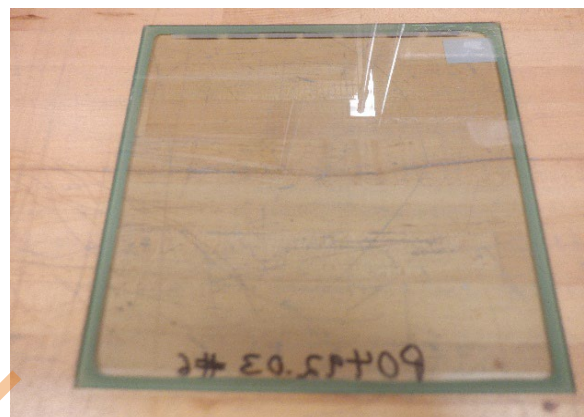
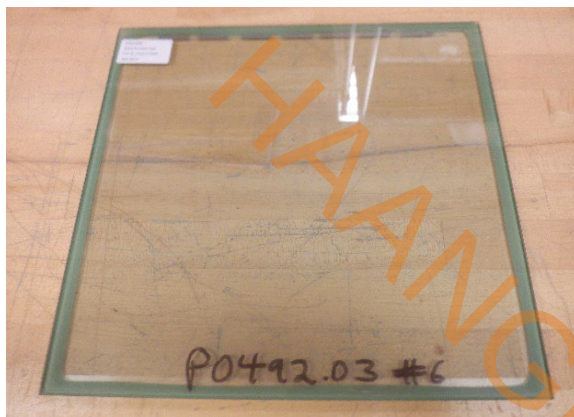
TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 8 (continued)
PICTURES

VIG Specimen - 5S1.16+0.15V+5, (Sample 6)



TEST REPORT FOR SHANDONG HAANGLAS CO., LTD

Report No.: P0492.03-116-25 R1

Date: 11/29/22

SECTION 9

REVISION LOG

REVISION #	DATE	PAGES	REVISION
.01 R0	11/14/22	N/A	Original Report Issued to Customer.
.01 R1	11/29/22	N/A	Corrected Specimen Description & Address Information

HAANGLAS VIG