

TOPSEAL CO. LTD

TEST REPORT

SCOPE OF WORK

ASTM C1184 STRUCTURAL SILICONE SEALANT, AND ASTM C920 ELASTOMERIC JOINT SEALANT PROPERTY EVALUATION OF TOPSEAL® 793 STRUCTURAL GLAZING SEALANT

REPORT NUMBER

R9177.01-106-31 R0

TEST DATES

01/06/25 - 01/27/26

ISSUE DATE

01/30/26

RECORD RETENTION END DATE

01/27/30

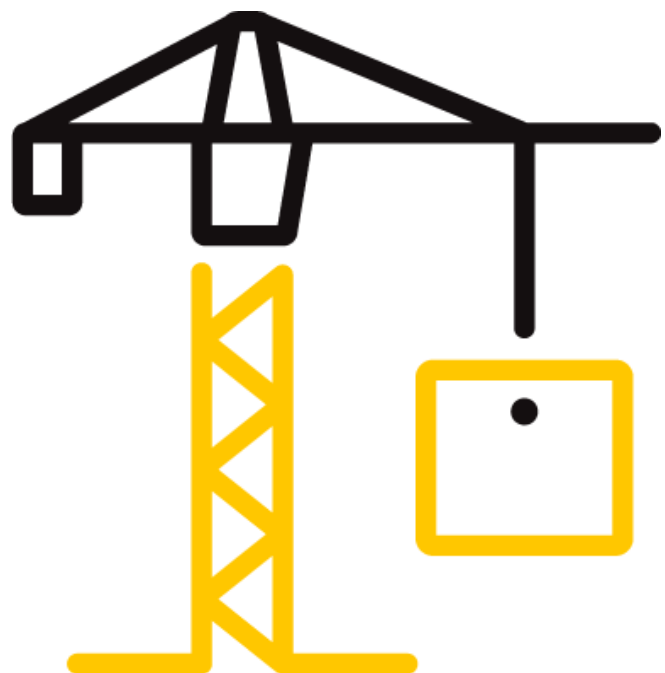
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31

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Report No.: R9177.01-106-31 R0

Date: 01/30/26

REPORT ISSUED TO

TOPSEAL CO., LTD

37-20, Maengdonsandan-ro, Maengdon-myeon,
Eumseong-gun, Chungcheongbuk-do. South Korea 27733

SECTION 1

SCOPE

Product: TopSeal® 793 Structural Glazing Sealant

Architectural Testing, Inc. (an Intertek company) dba Intertek Building & Construction (B&C) was contracted by TopSeal Co. LTD to evaluate TopSeal® 793 Structural Glazing Sealant in accordance with ASTM C1184 for Structural Silicone Sealant Properties, and ASTM C920 for Elastomeric Joint Sealant Properties. Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at the Intertek B&C test facility in York, Pennsylvania.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

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For INTERTEK B&C:

COMPLETED BY:	Steven Marmolejos	REVIEWED BY:	Joseph M. Brickner
TITLE:	Technician I Materials Laboratory	TITLE:	Technical Manager Materials Laboratory
SIGNATURE:		SIGNATURE:	
DATE:	01/30/26	DATE:	01/30/26

SM:jmb/kae

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SECTION 2

TEST METHODS

The specimens were evaluated in accordance with the following:

ASTM C1184-23, *Standard Specification for Structural Silicone Sealants*

ASTM C639-24, *Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants* (Modified in accordance with ASTM C1184 and ASTM C920)

ASTM C603-19, *Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants* (Modified in accordance with ASTM C1184)

ASTM C661-22, *Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer* (Modified in accordance with ASTM C1184 and ASTM C920)

ASTM C792-23, *Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants* (Modified in accordance with ASTM C1184)

ASTM C679-22, *Standard Test Method for Tack-Free Time of Elastomeric Sealants* (Modified in accordance with ASTM C1184 and ASTM C920)

ASTM C1135-24, *Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants* (Modified in accordance with ASTM C1184)

ASTM C1442-14(2021), *Standard Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus*

ASTM G155-21, *Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*

ASTM C920-18, *Standard Specification for Elastomeric Joint Sealants*

ASTM C1183-13(2024), *Standard Test Method for Extrusion Rate of Elastomeric Sealants* (Modified in accordance with ASTM C920)

ASTM D1475-13(2020), *Standard Test Method for Density of Liquid Coatings, Inks, and Related Products* (Modified in accordance with ASTM C920)

ASTM C1246-17(2022), *Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure* (Modified in accordance with ASTM C920)

ASTM C510-22, *Standard Test Method for Staining and Color Change of Single or Multicomponent Joint Sealants* (Modified in accordance with ASTM C920)

ASTM C794-22, *Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants* (Modified in accordance with ASTM C920)

ASTM C793-23, *Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants* (Modified in accordance with ASTM C920)

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MATERIAL SOURCE

The materials were provided by TopSeal Co. LTD. The following were received in good condition on 12/9/24:

- One (1), box of twenty-six 300ml tubes of TopSeal® 793 Structural Glazing Sealant (Lot #: 241111, Exp. Date: Nov. 2025)
- Two (2), cans of Dowsil Primer-C OS, (Batch #: YY0001J005, Exp. Date: 07/12/25)
- Five (5), 3 in. by 6 in. by 1/16 in. stainless steel plates (SUS)
- One (1), box of plastic nozzles

Refer to the product description photos in Section 9. The materials were tested as received, except for preparing test specimens from the original materials. Representative materials/test specimens will be retained by Intertek B&C for a minimum of four years from the test completion date.

SECTION 4

LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Steven Marmolejos	Intertek B&C
Joseph M. Brickner	Intertek B&C

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SECTION 5

TEST PROCEDURES

All conditioning of test specimens and test conditions were at standard laboratory conditions, unless otherwise reported. Refer to the test related photos in Section 9. Calibration certificates are available on request.

ASTM C639 - Rheological Flow (per ASTM C1184 and ASTM C920)

Two stainless steel channels having open ends (vertical testing) and two stainless steel channels having closed ends (horizontal testing) were filled with a sealant. One channel was placed vertically, and one channel was placed horizontally into a freezer (ICN: INT000206) maintained at $4.4 \pm 2^{\circ}\text{C}$ ($40 \pm 3.6^{\circ}\text{F}$) for a period of 4 hours. One channel was placed vertically, and one channel was placed horizontally into an oven (ICN: 005980) maintained at $50 \pm 2^{\circ}\text{C}$ ($122 \pm 3.6^{\circ}\text{F}$) for a period of 4 hours. At the end of the 4-hour period, the specimens were removed from their conditioning chambers and observed for any flow on the lower edge.

ASTM C603 - Extrudability (per ASTM C1184)

A 177 mL (6 fl oz) cartridge was filled with sealant and then placed into an EFD Ultra 2400 Series dispenser which expelled the sealant from the cartridge under 50 psi of pressure with no attached nozzle. The rate of extrusion was determined.

ASTM C661 - Hardness (per ASTM C1184 and ASTM C920)

Two specimens were prepared by filling a brass frame of internal dimensions measuring 5 in. x 1-1/2 in. x 1/4 in. on top of anodized aluminum panels. The frame was removed, and the sealant was allowed to cure for 21 days at the following: 7 days at standard laboratory conditions, 7 days in a humidity chamber (ICN: 005987) maintained at $38 \pm 2^{\circ}\text{C}$ ($100 \pm 3.5^{\circ}\text{F}$) and 95% RH, and then 7 days at standard laboratory conditions. A Shore "A" durometer (ICN: INT000287) was applied to the surface of each sealant pad with a force of three pounds. The instantaneous hardness reading was measured and recorded. Two additional readings were taken on each sealant pad for a total of six measurements.

ASTM C792 - Heat Aging (per ASTM C1184)

Three specimens were prepared by filling a brass frame of internal dimensions measuring 5 in. x 1-1/2 in. x 1/4 in. on top of anodized aluminum plates. Before preparing a specimen, the aluminum plate was weighed on a digital balance (ICN: 65216). The aluminum plate and the sealant were weighed using the same balance immediately after removing the brass frame. Specimens were allowed to cure for 7 days at standard laboratory conditions. Following the cure period, two specimens were placed into a forced-draft oven (ICN: INT03225) maintained at $88 \pm 5^{\circ}\text{C}$ ($190 \pm 10^{\circ}\text{F}$) for 21 days, while a third specimen was maintained at laboratory conditions. Specimens were allowed to cool to standard conditions, then re-weighed to determine a percentage of mass loss.

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ASTM C679 - Tack-Free Time (per ASTM C1184)

Pads of sealant were prepared by filling a brass frame of internal dimensions measuring 5 in. x 1-1/2 in. x 1/4 in. on top of anodized aluminum plates. Upon completion of the first sealant pad, a timer was started. The tack-free time was tested using polyethylene strips and a 30g weight with dimensions 1-5/8 in. X 3/4 in. every twenty minutes for the duration of the test. A polyethylene strip was placed on the sealant pad and the 30g weight placed on top for 30 seconds. After 30 seconds the weight was removed, and the polyethylene strip was peeled away from the sealant at a 90° angle. The test continued until no sealant adhered to the polyethylene strip when peeled away from the sealant.

ASTM C1135 - Tensile Adhesion (per ASTM C1184)

Specimens were prepared by filling a 2 in. long x 3/8 in. wide x 1/2 in. deep cavity with sealant between two pieces of float glass. The specimens were cured for 21 days at standard laboratory conditions before groups of five specimens were subjected to one of the following conditions immediately prior to testing:

- Standard Laboratory Conditions
- 1 hour at 88 ±5°C (190 ±10°F) in an oven (ICN: INT03225) and tested at the same temperature
- 1 hour at -29 ±2°C (-20 ±4°F) in a freezer (ICN: INT000206) and tested at the same temperature
- 7 days of immersion in deionized water and tested within 10 minutes of removal from water
- 7,286 hours of light exposure in a Xenon accelerated weathering chamber (ICN: INT01427) in accordance with ASTM C1442: 0.35 irr @ 340nm

The conditioned specimens were mounted to an Instron UTM (ICN: 005740) equipped with a 2kN load cell (ICN: 005742) and pulled in tension at a crosshead movement speed of 0.5 in/min until failure occurred.

ASTM C1183 - Extrusion Rate (per ASTM C920)

A 177 mL (6 fl-oz) cartridge was filled with sealant and then placed into an EFD Ultra 2400 Series dispenser which expelled the sealant under 40 psi of pressure through a plastic nozzle having a 0.125-in. opening. A stopwatch was used to measure the time to empty the cartridge. Specific gravity was calculated using the method described in ASTM D1475, by filling and weighing a weight-per-gallon cup.

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ASTM C792 - Heat Aging (per ASTM C920)

Three specimens were prepared by filling a brass frame of internal dimensions measuring 5 in. x 1-1/2 in. x 1/4 in. on top of nominally 2 in. wide x 6 in. long aluminum plates. Before preparing specimens, the aluminum plate was weighed on a digital balance (ICN: 65216). The plate and the sealant were weighed using the same balance after removing the brass frame. Specimens were allowed to cure for 28 days at standard laboratory conditions. Following the cure period Specimens 1 and 2 were placed into a forced-draft oven (ICN: INT03225) at $70 \pm 2^{\circ}\text{C}$ ($158 \pm 3.6^{\circ}\text{F}$) for 21 days while the control specimen was maintained at laboratory conditions. Specimens were allowed to cool to standard conditions, then re-weighed again to determine a percentage of mass loss. Specimens were also evaluated for cracking and chalking compared to the control specimen

ASTM C510 - Stain and Color Change (per ASTM C920)

Four sets of specimens were made. A set consisted of one mortar only specimen and one mortar specimen with a sealant pad applied. The mortar mix was made using 4-parts Ottawa white sand, 1-part Portland white cement, and 0.25-part hydrated lime. The ingredients were mixed with water to form a smooth paste, and spread onto aluminum plates with approximate dimensions of 6-in. x 2.75-in. x 0.25-in. The mortar was allowed to cure for 4 hours, then a sealant layer with the dimensions 5-in. x 1.5-in. x 0.25-in. was applied to the mortar substrates. The sealant was allowed to cure for 24 hours.

After the initial cure time, two sets were subjected to 100 hours of UV light exposure in a QUV (ICN: INT00387) in accordance with ASTM C1442. One set was exposed to laboratory conditions for 14 days, and during this exposure period, the specimens were immersed in distilled water for 1 minute each day, 5 days per week. The last set was exposed to laboratory conditions for 14 days. At the end of the exposure periods, all the specimens containing the sealant were compared to the similarly exposed specimens without sealant for change in color or stains on the mortar

ASTM C794 - Adhesion-in-Peel (per ASTM C920)

Specimens were prepared on anodized aluminum and glass panels primed with Dowsil Construction Primer C and, and stainless-steel panels (SUS). Wire mesh strips consisting of 30/30 mesh, 0.012 in. wire diameter stainless steel screen cloth were cleaned with Xylene and primed with a Dowsil Construction Primer C. The specimens were allowed to cure for 21 days at $73 \pm 3.6^{\circ}\text{F}$. Testing was conducted on an Instron UTM (ICN: 005740) equipped with a 2kN load cell (ICN: 005740). Specimens were peeled at an 180° angle at a separation rate of 2 in/min.

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ASTM C793 - Effects of Accelerated Weathering (per ASTM C920)

The accelerated weathering tests consisted of evaluating the sealants when applied to aluminum panels measuring 6 in. long x 3 in. wide using a brass frame having internal dimensions measuring 5 in. x 1.5 in. x 0.125 in. Three specimens were prepared and cured for 21 days at standard lab conditions. At the end of the curing period, two specimens were subjected to 291 hours of exposure in a Xenon-Arc accelerated weathering chamber (ICN: INT01427) in accordance with ASTM C1442: 0.35 irr @ 340nm. At the completion of the exposure, the specimens were evaluated for any changes in appearance, when compared to the unexposed specimen. All three specimens were placed in a freezer controlled at -26°C for 24 hours with a mandrel having 0.5 in. diameter. At the end of the 24-hour period, each specimen was bent over the mandrel within 1 second and evaluated for cracks in the bend area.

Note: Following manufacturer's instructions, substrates used for Tensile Adhesion and Adhesion in Peel tests were cleaned with Isopropyl Alcohol to remove any possible contaminants before a thin, even layer of Dowsil Primer-C OS, was applied on the substrates using a clean, non-linting cloth (KimTec wipes). Once the primer had thoroughly dried, the sealant was applied on the substrates according to their respective test method.

SECTION 6

TEST SPECIMEN DESCRIPTIONS

TEST PROCEDURE	NUMBER OF SPECIMENS	NOMINAL SPECIMEN DIMENSIONS
ASTM C639 - Rheological Properties	1 horizontal and 1 vertical per temperature	0.75" x 6" x 0.5"
ASTM C603 - Extrudability ASTM C1183 - Extrusion Rate	2 (ASTM 1184) 4 (ASTM C920)	Tube of sealant
ASTM C661 - Hardness	2	5" x 1.5" x 0.25"
ASTM C792 - Heat Aging ASTM C1246 - Effects of Heat Aging	2 and 1 control	5" x 1.5" x 0.25"
ASTM C679 - Tack-Free Time	2	5" x 1.5" x 0.25"
ASTM C1135 - Tensile Test	6 per temp. condition	3" L x 0.75" W x 1" H
ASTM C510 - Stain and Color Change	4 with sealant and 4 without sealant	Sealant: 5" x 1.5" x 0.25" Mortar: 6" x 2.75" x 0.25"
ASTM C794 - Adhesion-in-Peel	4 per substrate	5" x 1" x 0.16"
ASTM C793 - Effects of Accelerated Weathering	2 and 1 control	5" x 1" x 0.125"

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SECTION 7

TEST RESULTS

ASTM C639 - Rheological (Sag) Properties (per ASTM C1184)

SPECIMEN NO.	ORIENTATION	TEMP. (°C)	FLOW / SAG OBSERVATION	REQUIREMENT
1	Horizontal	50	No Deformation	Meets Requirement No Vertical sag or Horizontal deformation
2	Vertical	50	less than 1/16 inch	
1	Horizontal	4.4	No Deformation	
2	Vertical	4.4	less than 1/16 inch	

ASTM C603 - Extrudability (per ASTM C1184)

SPECIMEN NO.	DISPENSING TIME FOR 177 mL (seconds)	EXTRUSION RATE (mL/min)	REQUIREMENT (10 seconds Max.)
1	4	2,655	Meets Requirement

ASTM C661 - Hardness (per ASTM C1184)

SPECIMEN NO.	DUROMETER MEASUREMENT			REQUIREMENT (Hardness Value 20-60)
	1	2	3	
1	42	44	45	Meets Requirement
2	45	45	45	
Overall Average	44			

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ASTM C792 - Heat Aging (per ASTM C1184)

SPECIMEN NO.	ALUMINUM PANEL WEIGHT (g)	WET SEALANT and PANEL (g)	POST EXPOSURE WEIGHT (g)	WEIGHT LOSS (%)	OBSERVATION RATING 0-4 (0 = No Cracking) and REQUIREMENT
1	38.837	76.504	76.181	0.858	0 rating - No Cracking and No Chalking Meets Requirement 10% max weight loss
2	38.818	76.573	76.271	0.800	
Average	38.828	76.539	76.226	0.829	
3 Control	39.071	75.597	75.532	0.178	0 rating - No Cracking and No Chalking Meets Requirement 10% max weight loss

ASTM C679 - Tack-Free Time (per ASTM C1184)

SPECIMEN NO.	TACK FREE TIME (hours)	OBSERVATION and REQUIREMENT
1	3	Meets Requirement No transfer of sealant to the polyethylene film when tested at 3 hours
2	3	

ASTM C1135 - Tensile Adhesion (per ASTM C1184)

SPECIMEN NO.	CONDITIONING / TEMPERATURE (°C)	PEAK LOAD (lbf)	TENSILE STRENGTH (psi)
1	23°C	61.6	60.6
2		112	112
3		103	102
4		77.4	76.7
5		109	108
Average		92.6	91.9

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ASTM C1135 - Tensile Adhesion (per ASTM C1184) - Continued

SPECIMEN NO.	CONDITIONING / TEMPERATURE (°C)	PEAK LOAD (lbf)	TENSILE STRENGTH (psi)
1	88°C	130	130
2		151	151
3		135	135
4		72.5	71.5
5		130	130
Average		123.7	124
1	-29°C	160	159
2		128	128
3		79.9	79.9
4		155	155
5		142	142
Average		133.0	133
1	Water Immersion	48.4	47.6
2		122	122
3		83.4	83.4
4		38.6	38.6
5		135	135
Average		85.5	85.3
1	7,286 Hrs. Accelerated Weathering	112	112
2		129	129
3		112	112
4		134	134
5		145	144
Average		126.4	126.2

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ASTM C639 - Rheological (Sag) Properties (per ASTM C920)

SPECIMEN NO.	ORIENTATION	TEMP. (°C)	FLOW / SAG OBSERVATION	OBSERVATION and REQUIREMENT
1	Horizontal	50	No Deformation	Meets Requirement No Vertical sag or Horizontal deformation
2	Vertical	50	less than 1/16 inch	
1	Horizontal	4.4	No Deformation	
2	Vertical	4.4	less than 1/16 inch	

ASTM C1183 - Extrusion Rate (per ASTM C920)

SPECIMEN NO.	TIME (s)	MASS (g)	SPECIFIC GRAVITY	EXTRUSION RATE (mL/min)	REQUIREMENT (≥ 10 mL/min)
1	60	149.946	11.502	13.0	Meets Requirement
2	60	156.723	11.502	13.6	
Average				13.3	

ASTM C661 - Hardness (per ASTM C920)

SPECIMEN NO.	DUROMETER MEASUREMENT					
	1	2	3	4	5	6
1	41	41	42	44	44	45
2	41	43	44	44	44	45
Average	43					
Meets requirement for T ₁ and NT use						

ASTM C1246 - Effects of Heat Aging (per ASTM C920)

SPECIMEN NO.	ALUMINUM PANEL WEIGHT (g)	28-DAY CURE WEIGHT (g)	POST 21 DAY HEAT EXPOSURE (g)	WEIGHT LOSS (%)	OBSERVATION RATING 0-4 (0 = no cracking)
1	38.663	56.742	56.657	0.470	No Cracking or Chalking: Rating 0
2	38.519	56.642	56.550	0.508	
Average	38.591	56.692	56.604	0.489	
3 Control	38.837	56.881	56.877	0.022	No Cracking or Chalking: Rating 0

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ASTM C679 - Tack-Free Time (per ASTM C920)

SPECIMEN NO.	TACK FREE TIME (hours)	OBSERVATION and REQUIREMENT
1	72	Meets Requirement for No transfer of sealant to the polyethylene film when tested at 72 hours
2	72	

ASTM C510 - Stain and Color Change (per ASTM C920)

SPECIMEN NO.	CONDITION	SEALANT	OBSERVATION
1	Control	Yes	No observable stain or discoloration on the mortar surface from sealant, No color changes in the sealant
2		No	
1	Water Immersed	Yes	
2		No	
1	100 Hour QUV Exposure	Yes	
2			
3		No	
4			

ASTM C794 - Adhesion-in-Peels (per ASTM C920)

SPECIMEN NO.	SPECIMEN WIDTH (mm)	AVERAGE PEEL STRENGTH (N)	MAXIMUM PEEL STRENGTH (N)	ADHESIVE (%)
Aluminum #1	25.92	125	142	0
Aluminum #2	25.64	97.4	109	0
Aluminum #3	26.63	143	171	0
Aluminum #4	25.81	126	141	0
Average		123	141	
Glass #1	26.62	108	121	0
Glass #2	26.81	111	120	0
Glass #3	26.48	102	116	0
Glass #4	26.79	116	163	0
Average		109	130	
SUS #1	25.99	90.0	96.7	10
Sus #2	25.17	88.2	97.7	20
SUS #3	26.85	106	122	20
SUS #4	26.71	115	129	10
Average		99.8	111	

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ASTM C793 - Accelerated Weathering (per ASTM C920)

SPECIMEN NO.	TEMPERATURE (°C)	WEATHERING OBSERVATION	BEND OBSERVATION
1	-26.0°C	No cracking: Rating 0	No cracking: Rating 0
2	-26.0°C		
3-Control	-26.0°C		

SECTION 8**CONCLUSION**

The TopSeal® 793 Structural Glazing Sealant meets the specified performance requirements listed in the ASTM C1184 and ASTM C920 Specifications for the testing performed in this report.

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SECTION 9 PHOTOGRAPHS



Photo No. 1
Topseal Sealant Material as Received



Photo No. 2
Dowsil Primer C Material as Received

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Photo No. 3
SUS Panel Materials as Received



Photo No. 4
Rheological Properties Test Specimens

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Photo No. 5
Post Exposure Test Specimen Results



Photo No. 6
Hardness Test 7 Day Humidity Exposure

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Photo No. 7

Specimen Undergoing Hardness Test After Humidity Exposure



Photo No. 8

Heat Aging During Exposure

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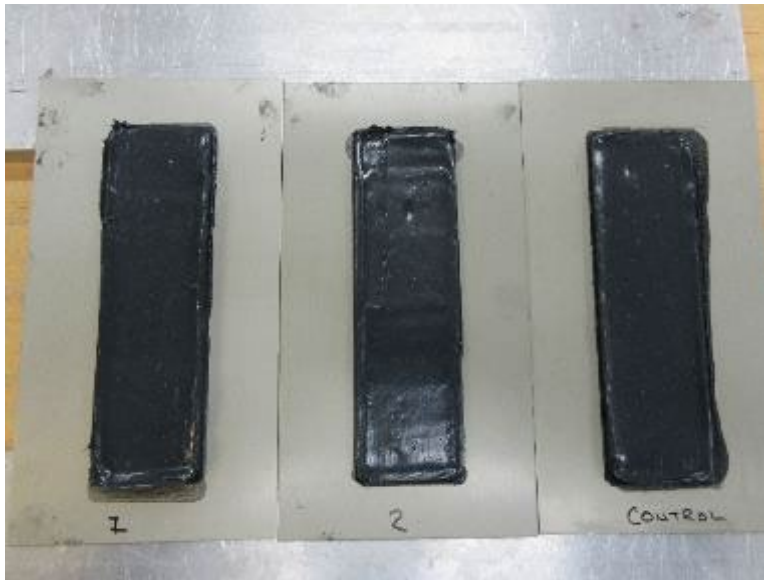


Photo No. 9
Heat Aging Post Exposure



Photo No. 10
Heat Aging Results

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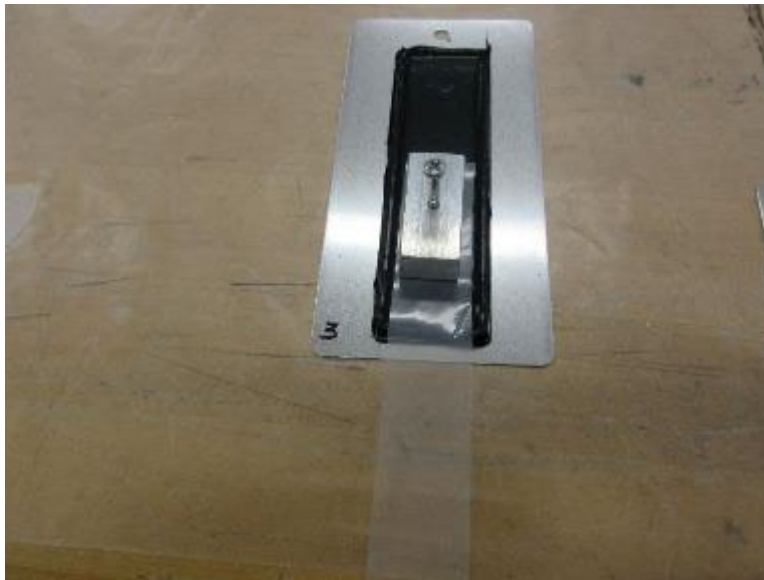


Photo No. 11
Specimen Undergoing Tack Free Time Test

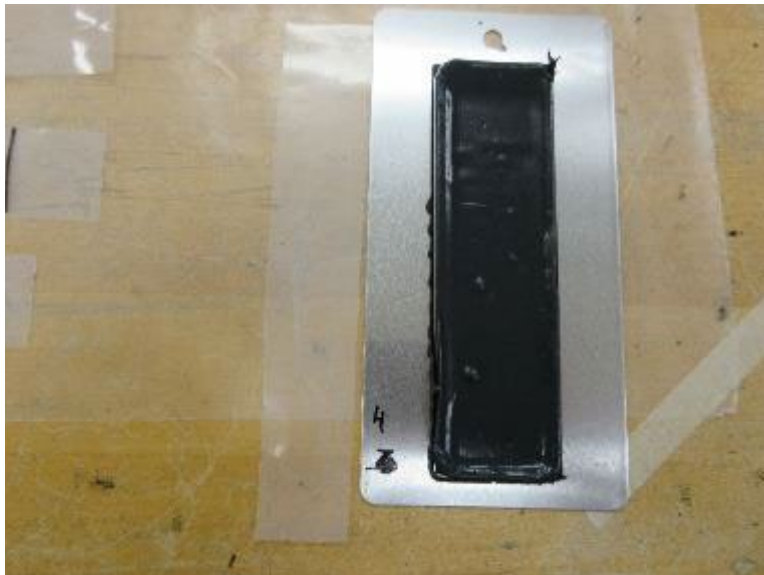


Photo No. 12
Results After 180 Minutes of Tack Free Time

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Photo No. 13
Lab Conditioned Tensile Test Specimen



Photo No. 14
Tensile Test Setup

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Photo No. 15
Specimen Undergoing Tensile Test

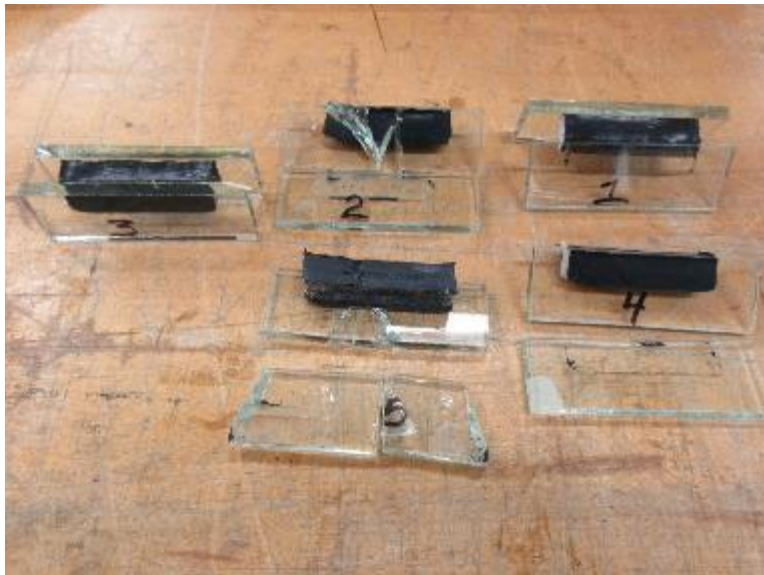


Photo No. 16
Typical Tensile Test Results

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Photo No. 17

Stain and Color Change Specimens Prior to Conditioning

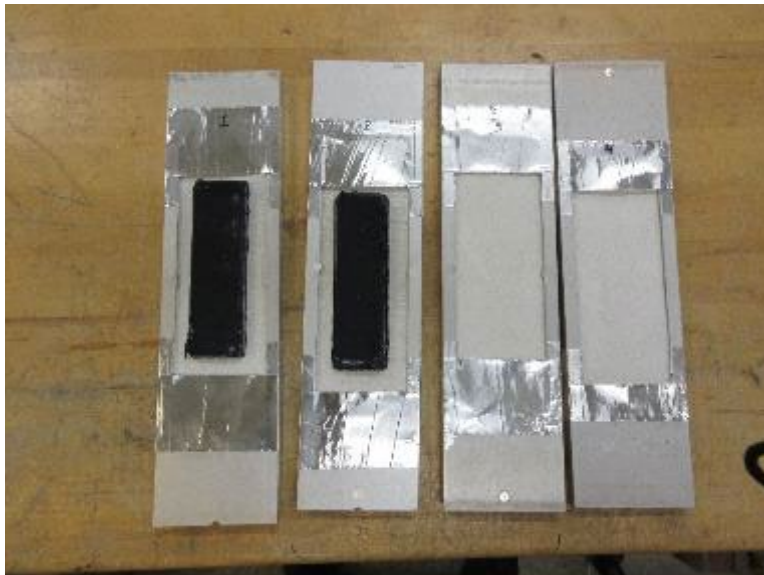


Photo No. 18

Specimens Prepped for 100 Hour QUV Exposure

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Photo No. 19
During 100 QUV Exposure



Photo No. 20
Post Exposure Results

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Photo No. 21

Specimen Prepped for Adhesion-in-Peels Test

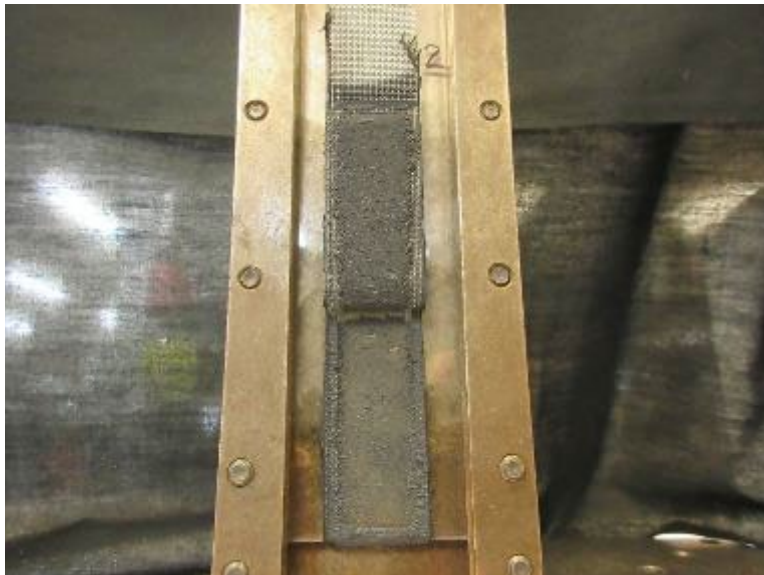


Photo No. 22

Glass Substrate During Peels Test

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Photo No. 23
SUS Panels Undergoing Test

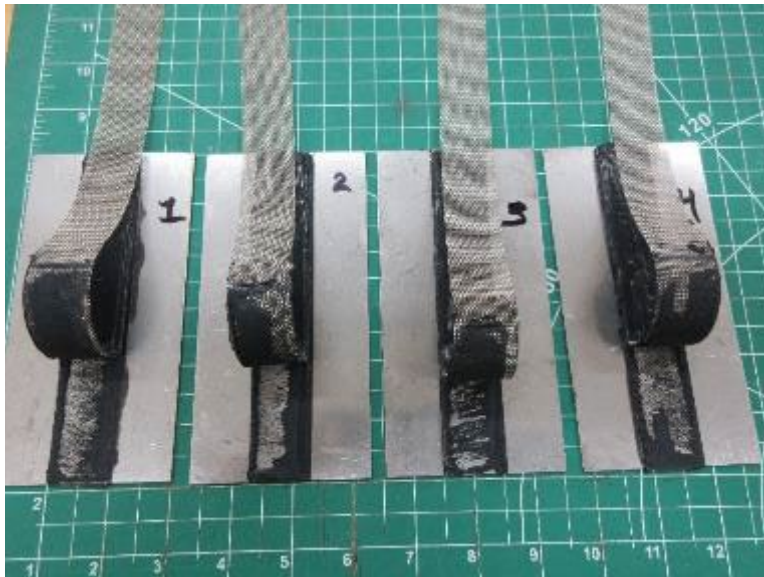


Photo No. 24
SUS Panel Peels Results

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Photo No. 25

Glass Substrate Post Peels Test



Photo No. 26

Aluminum Panel Peels Test Results

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Photo No. 27

Specimens Prior to 250 Hour Weathering Exposure

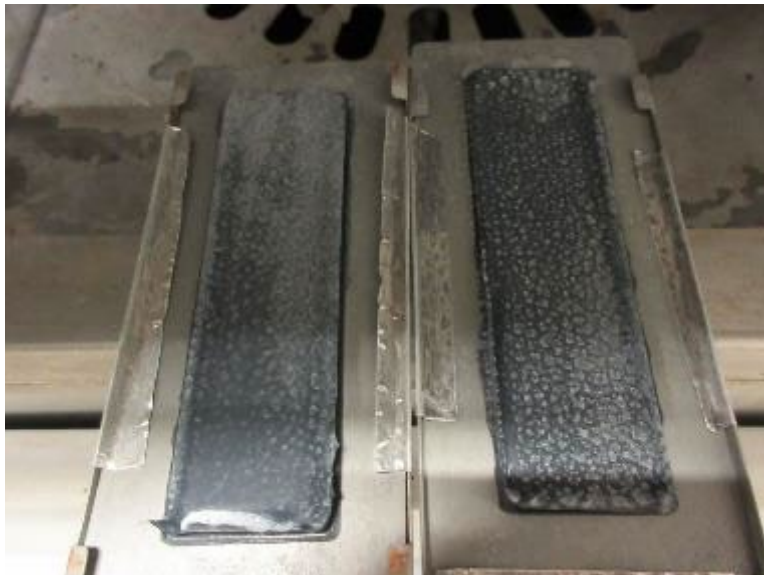


Photo No. 28

Post Weathering Exposure

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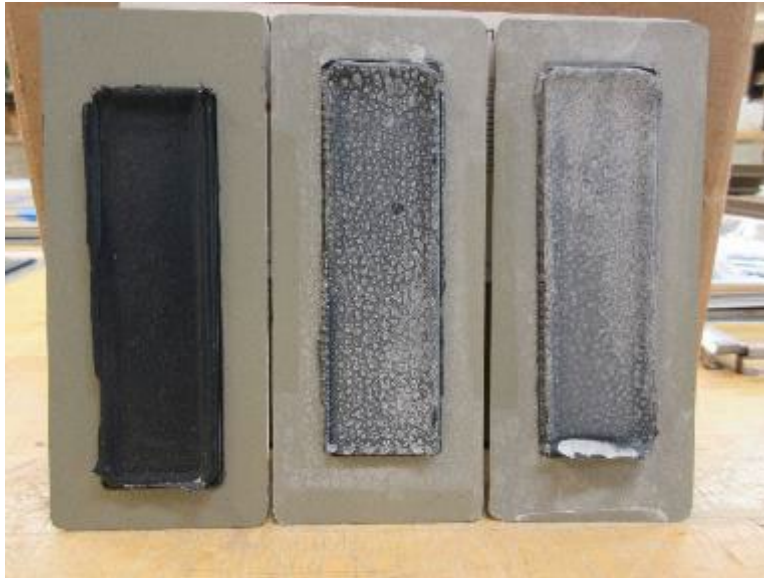


Photo No. 29
Post Exposure Comparison to Control Specimen



Photo No. 30
-26°C Exposure for 24 Hours

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Photo No. 31

Proceed to Bend Specimen Post 24 Hour Exposure



Photo No. 32

Typical Result from Accelerated Weathering



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SECTION 10

REVISION LOG

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