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Report Number: ESP012965P
Report Date: December 16, 2013

STRUCTURAL PERFORMANCE TEST REPORT

Test Requested By: Deceuninck North America, LLC
351 North Garver Road
Monroe, Ohio 45050

Product Type and Series: Series 623.620 PD/ No Impact brackets Standard Vinyl Impact Sliding Glass Door
LC-PG 50-SD 4890 mm x 2413 mm (192.5" x 95")

Tests Conducted: AAMA/WDMA/CSA 101/I.S.2/A440-11 "Standard/Specification for Windows, Door and Unit Skylights".
AAMA 506-11 "Voluntary Specifications for Impact and Cycle Testing of Fenestration Products."
ASTM E-1886-05 "Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials."
ASTM E-1996-09 "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Windborne Debris in Hurricanes."

TEST SPECIMEN

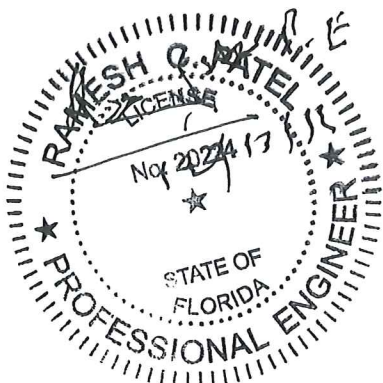
Design Pressure: + 50.0 - 50.0

Overall Size: 4890 mm x 2413 mm (192.5" x 95")

Configuration: O/X/X/O Two (2) operable panels / Two (2) fixed panels

Frame and Sash Material: Extruded vinyl
Frame Construction:

The extruded vinyl main equal leg frame measured 4890 mm wide x 2413 mm high (192.50" wide x .95" high). The frame corners utilized coped and butted corner construction, secured with three (3) # 8 x 76mm (2.5") Phillips PH fasteners. Head and jamb extrusions measured 127.2 mm 5.008" wide x 51mm (2.007") high (refer to drawing # 10001100_SH). The frame sill extrusion measured 127.2 mm (5.088" wide x 51mm(2.007") high (refer to drawing #10001101_SH).The frame sill had vinyl sill insert running full length of fixed panel that measured 46mm (1.800") wide x 26mm (1.020") high and secured to frame utilizing four (4) #8 x 32mm (1.250") Phillips CS self-drilling SMS (refer to drawing # 10001105_SH).



Panel Construction: The operable panels measured 1245 mm (49") wide x 2369mm(93.250") high overall. The fixed panels measured 1238mm (48.750") wide x 2369mm (93.250") high overall. The panels utilized mitered and welded corner construction. The vinyl sash stiles and rails measured 45mm (1.755") wide x 102 mm (4.000") high (*refer to drawing # 10001102_SH*).

The operable and fixed panel interlock stiles had an interlocking vinyl sash adapter measuring 51 mm (2.002") wide x 58 mm (2.279") high (*refer to drawing # 10001117_SH Sash Adapter*) secured through the stile with nine (9) #8 x 16mm (0.625") Phillips PH self-drilling SMS located 102 mm (4") from top and bottom of panel and a maximum of 305 mm (12") on center thereafter.

The fixed panels were secured to frame head/sill with an aluminum (L) shaped bracket measuring 46 mm (1.6") wide x 77 mm (3.031") high overall (*refer to drawing # 011H027*) and was secured to fixed panel interlock stile with two (2) #8 x 25mm (1.00") Phillips CS self-drilling SMS and to frame head/sill utilizing two (2) #8 x 19mm(0.750") Phillips CS self-drilling SMS and two (2) #8 x 64mm(2.500") Phillips CS fasteners per bracket.

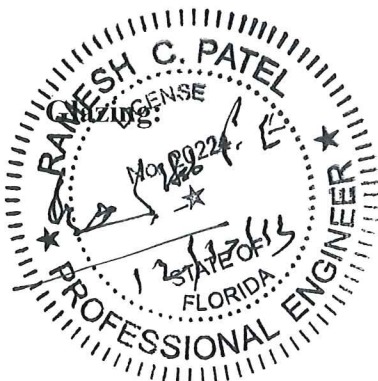
The fixed panels each had three (3) aluminum snubbers each measuring 45mm (1.780") wide x 32mm (1.242") high x 762 mm (30") long. Two (2) were secured equal distance on the frame jamb at each fixed panel location with nine (9) #8 x 32 mm (1.250") Phillips F.H. self-tapping S.M.S. The third aluminum snubber was centered at the frame head fixed panel. This Frame head/Fixed panel snubber utilized no fasteners and was inserted between the frame head pocket and fixed panel sash top rail (*refer to drawing # 10300148*).

Two (2) aluminum T-Brackets were located at frame head of the operable panel track pocket c/l of the operable panel. The tracks/guides measured 47mm (1.845") wide x 29mm (1.145") high x 305mm (12.00") long. Each track/guide was secured to the frame head with eight (8) #8 x 64mm (2.500") Phillips F.H self-tapping S.M.S.

The four (4) lite vinyl astragal measured 58mm (2.275") wide x 60mm (2.354") high (*refer to drawing # 10001116*). The four (4) lite vinyl astragal was secured to the panel with eight (8) #8 x 52mm (2.00") Phillips P.H.S.M.S. The fasteners were located at 127mm (5.00") from the each end of the vertical astragal and 305mm (12.000") on center thereafter.

Day lite opening:

Daylight opening for all panels measured 1038 mm (40.875") wide x 2162 mm (85.125") high.



1.000" overall insulated laminated glass consisting of the following: One (1) exterior piece of .1875" tempered glass / one (1) .375" Duraseal/Quanex spacer system / one (1) piece of .1875" annealed glass / 0.090" PVB interlayer (By Solutia/Saflex as stated by mfg.) / one (1) piece of .1875" annealed glass. Exterior glazed with silicone back bedding compound, .625" glass bite (*refer to drawing # 1*) The glazing utilized an extruded vinyl snap-in glazing bead measuring .283" wide x .977" high overall with (*refer to drawing # 1001111_SH Glazing Bead*)

Reinforcement:

One (1) H shaped aluminum reinforcement measuring 50mm (1.971") wide x 39mm (1.555") high x full length was located in each fixed panel interlock stile, operable panel interlock stile and operable panel astragal stile (*refer to drawing # 10300151*).

The fixed panel interlock reinforcement and the operable interlock reinforcement were secured through the interlock into stile with nine (9) #8 x 16mm (0.625") Phillips PH self-drilling SMS located 102 mm (4") from top and bottom of panel and a maximum of 305 mm (12") on center thereafter.

The operable panel astragal reinforcement was secured to the panel thru the astragal with eight (8) #8 x 52mm (2.00") Phillips P.H.S.M.S. The fasteners were located at 127mm (5.00") from the each end of the vertical astragal and 305mm (12.000") on center thereafter.

One (1) free floating aluminum reinforcement measuring 50 mm (1.965") wide x 39 mm (1.555") high x full length was located in each fixed panel jamb stile and operable panel lockstile (*refer to drawing # 10300150*).

One (1) aluminum reinforcement in each operable panel bottom rail. Secured with two (2) #8 x .750" TEK screws (*refer to drawing # 10300152*)

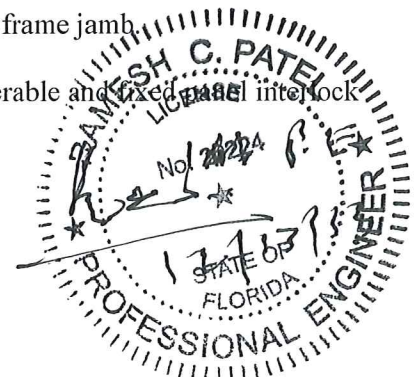
One (1) 1.5" x 1.5" x 8' x .125" aluminum angle. Located at frame sill interior, center mid-span. Secured to rough opening butted against interior frame sill attached to rough opening with eight (8) #10 x 2" SMS

Weep System:

Four (4) weep notches that measured 25 mm (1.00") wide x 6 mm (.250") high were located as follows. One (1) at the corner of the exterior face of the frame sill and one (1) at the corner of the interior track leg of the frame sill. Each weep notch measured 76 mm (3.00") c/l from the frame jamb/sill corner connection.

Weather-stripping:

<u>Quantity</u>	<u>Description</u>	<u>Location</u>
Two (2) strips	Fin seal 9mm (.270") wide x 6 mm (.250") high	one (1) operable panel track and one (1) fixed panel track frame head
One (1) strip	Fin seal 9mm (.270") wide x 6 mm (.250") high	one (1) operable panel track frame sill
Two (2) strips	Fin seal 9mm (.270") wide x 6 mm (.250") high	One (1) each frame jamb
Four (4) strip	Fin seal 9mm (.270") wide x 6mm (.250") high	One each operable and fixed panel interlock
Two (2) strips	Fin seal 9mm (.270") wide x 6mm (.250") high	Astragal



Hardware:

<u>Quantity</u>	<u>Description</u>	<u>Location</u>
Four (4)	Steel front adjustable tandem roller, 42mm (1.66") OD wheels, each secured with two (2) # 8 x 25mm(1.00") Phillips PH SMS	Each operable panel bottom rail corner
Two (2)	Inside/Outside Pull Handle	Located at lock stile of the operable panel
One (1)	Gemini II Lock with 2450 Trimplate, secured with four (4) # 10 x 32mm (1.250") Phillips flat head screws.	Lock stile of the operable panel located 972mm (38.250") c/l measuring from bottom of panel.
One (1)	Steel keeper (Gemini 1") secured with four (4) #8 x 76mm (3.00") Phillips P.H. screws.	Latch stile of the operable panel located 972mm (38.250") c/l measuring from bottom of panel.

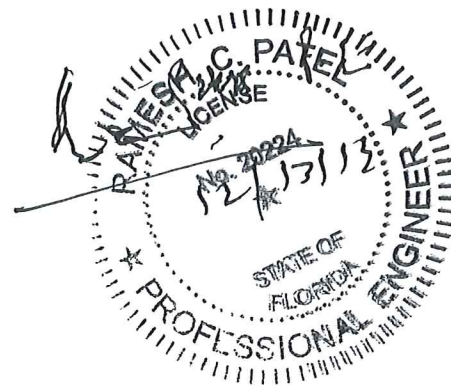
Installation:

The specimen was secured to the 50 mm x 305 mm (2" x 12") wood test buck utilizing forty-six (46) #8 x 38 mm (1.500") Phillips PH SMS. Seven (7) in each frame jamb located at 152mm (6.00"), 508 mm (20.00"), 864 mm (34.00"), 1219 mm (48.00"), 1575mm (62.00"), 1930 mm (76.00") and 2134mm (84.00") measuring from frame sill to frame head.

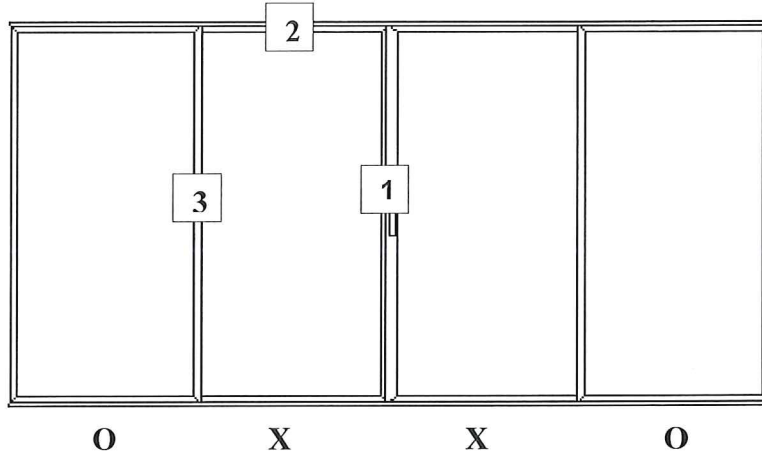
Sixteen (16) in the frame head and frame sill located at 152 mm (6.00"), 457 mm (18.00"), 762 mm (30.00"), 1067mm (42.00"), 1372mm (54.00") 1676 mm (66.00"), 1981mm (78.00"), 2286 mm (90.00"), 2591mm (102.00"), 2896 mm (114.00"), 3212 mm (124.00"), 3454 mm (136.00"), 3759 mm (148.00"), 4064 mm (160.00"), 4369 mm (172.00"), 4674 mm (184.00") and 4978 mm (196.00") measuring from left frame jamb to right frame jamb.

Sealant: Silicone caulking as needed to seal the test units to the wood bucks.

Screen: Roll formed aluminum screen with fiberglass mesh, and vinyl spline.



Surface Finish: White vinyl



- Location (1) - Center mid-span astragal
- Location (2) - Between installation anchors, frame head
- Location (3) - Center mid-span of the interlock



Specimen 1

Performance Test Results

<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
Operating Force Operable sash	ASTM E2068		
	Max. Force to maintain motion	18 lbs.	20.23/lbs
	Max. Force to initiate motion	27 lbs	30.35/lbs
Air Infiltration @ 1.57psf	ASTM E283	0.23 cfm/ft ²	0.34 cfm/ft ²
The tested specimen meets the performance levels specified in AAMA/WDMA/CSA 101/I.S.2/A440-11. Measured air recorded in two (2) decimals at client's request			
Water Resistance 5.0 gph/ft ² WTP= 7.5 psf	ASTM E547		
	Four (4) 5 min. cycles	No Entry	No Entry
	The specimen was tested with and without an insect screen installed.		

Performance Test Results: Cont.

<u>Title of Test</u>		<u>Method</u>		<u>Measured</u>	<u>Allowed</u>
Uniform Structural Load		ASTM E330			
Design Pressure of +50.0psf					
Range of test	time	load	<u>Deflection</u>	<u>Perm. Set</u>	<u>Allowable</u>
Positive loads	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 38.13 mm (1.501") Gross		Record only
Test load	10	75.0	Loc. 1	3.74 mm (0.147")	9.5mm (.373")
Design Load	10	50.0	Loc. 2 .534 mm (.021") Gross		Record only
Test load	10	75.0	Loc. 2	.101mm (0.004")	1.2mm (.048")
Design Load	10	50.0	Loc. 3 28.68 mm (1.129") Gross		Record only
Test load	10	75.0	Loc. 3	2.08 mm (0.082")	9.5mm (.373")
Design Pressure of -50.0psf					
Negative loads	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 42.16 mm (1.660") Gross		Record only
Test load	10	75.0	Loc. 1	1.90 mm (0.075")	9.5mm (.373")
Design Load	10	50.0	Loc. 2 .330 mm (.013") Gross		Record only
Test load	10	75.0	Loc. 2	2.03 mm (0.008")	1.2mm (.048")
Design Load	10	50.0	Loc. 3 33.33 mm (1.320") Gross		Record only
Test load	10	75.0	Loc. 3	3.302 mm (0.130")	9.5mm (.373")

Location (1) -Center mid-span astragal .004 of 93.25" span = .373" (9.5 mm) allowable permanent set

Location (2) -Between installation anchors, frame head .004 of 12" span = .048" (1.2mm) allowable permanent set

Location (3) -Center mid-span of the interlock .004 of 93.25" span = .373" (9.5mm) allowable permanent set

Forced Entry Resistance **ASTM F842** Passed No Entry
 Type "C" Window Assembly
 The test specimen meets the performance Grade 20.

Welded Corner Test **ASTM D 618** Passed
Note: When loaded to failure @ 47 lbs., the break did not extend along the entire weld

	ASTM E 987	<u>Measured</u>	<u>Allowed</u>	<u>Result</u>
Welding				
Top Rail	51.94 lbs.	0.28mm (.011") = 18%	< 90%	Passed
Bottom Rail	51.94 lbs.	0.46mm (.018") = 29%	< 90%	Passed
Left Stile	71.94 lbs.	0.23 mm (.009") = 15%	< 90%	Passed
Right Stile	71.94 lbs.	0.25 mm (.010") = 16%	< 90%	Passed



Large Missile Impact

Specimens 2, 3 & 4: AAMA 506-08/ASTM E-1996-09

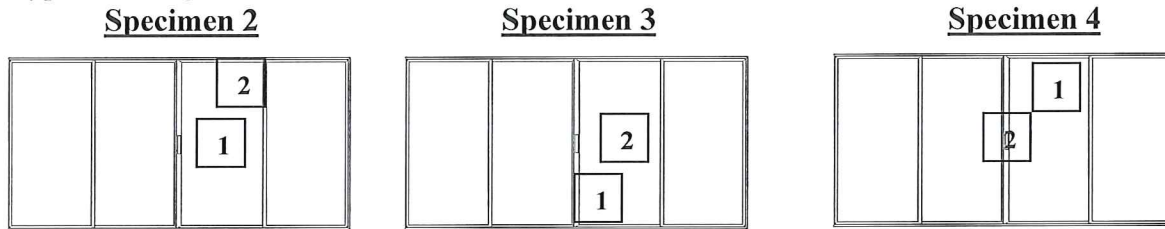
Specimens were tested to ASTM E-1886-05 and 1996-09 with no deviation to the test specifications. All specimens were tested to the Wind Zone 4 requirements stated in section 5 of ASTM E-1996-09. Missile level D. The missile orientation was perpendicular to the glass surface at impact. Each specimen was impacted with an 8 ft., 9 lb. Southern yellow pine 2" x 4" at the following locations:

Note:

X- measurement from left edge of test specimen.

Y- measurement from top edge of test specimen.

Type and weight of missile: #2 Southern yellow pine 2 x 4, length approx. 96" & 9 lb.



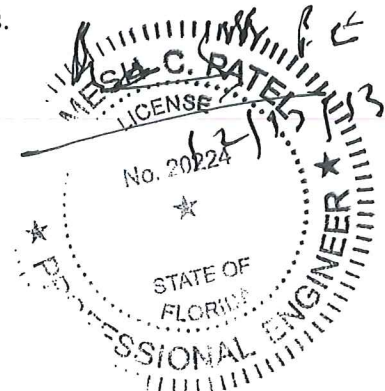
Specimens 2, 3 and 4: ASTM E-1996-06.

<u>Specimen</u>	<u>Impact Loc.</u>	<u>Speed Ft/Sec</u>	<u>X Meas.</u>	<u>Y Meas.</u>
No. 2	Loc: 1.	49.9	122.5"	47.50"
	Loc: 2.	50.1	139.00"	08.50"

<u>Specimen</u>	<u>Impact Loc.</u>	<u>Speed Ft/Sec</u>	<u>X Meas.</u>	<u>Y Meas.</u>
No. 3	Loc: 1.	49.6	105.00"	87.00"
	Loc: 2.	50.2	122.00"	47.00"

<u>Specimen</u>	<u>Impact Loc.</u>	<u>Speed Ft/Sec</u>	<u>X Meas.</u>	<u>Y Meas.</u>
No. 4	Loc: 1.	50.5	137.00"	09.00"
	Loc: 2.	50.2	96.00"	47.50"

Results: All specimens tested resisted the large missile impact, without penetration of the inner plane of the glazing. With no tear forming longer than 5" and wider than 1/16" thru which air can pass, or no opening through which a 3" diameter solid sphere could freely pass.



Air Pressure Cycling

All Specimens: AAMA 506-08/ASTM E-1996-09

Specimens were tested to AAMA 506-08/ASTM E-1996-09 with no deviation to the test specifications.

All specimens were tested to the requirements of section 5.4 table 1 in ASTM E-1996-09.

Specimen 2

Design Load + 50.0 psf, -50.0 psf

+ Positive loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .2 - .5	10.0	25.0	3500	55
+ .0 - .6	0.00	30.0	300	55
+ .5 - .8	25.0	40.0	600	55
+ .3 - 1.0	15.0	50.0	100	55

4500 cycles complete

-Negative Loads

Deflection/ Set
1.250" 0.250"

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .3 - 1.0	15.0	50.0	50	55
+ .5 - .8	25.0	40.0	1050	55
+ .0 - .6	0.00	30.0	50	55
+ .2 - .5	10.0	25.0	3350	55

4500 cycles complete

9000 cycles completed

Deflection/ Set
1.750" 0.375"

Specimen 3

Design Load + 50.0 psf, -50.0 psf

+ Positive loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .2 - .5	10.0	25.0	3500	55
+ .0 - .6	0.00	30.0	300	55
+ .5 - .8	25.0	40.0	600	55
+ .3 - 1.0	15.0	50.0	100	55

4500 cycles complete

-Negative Loads

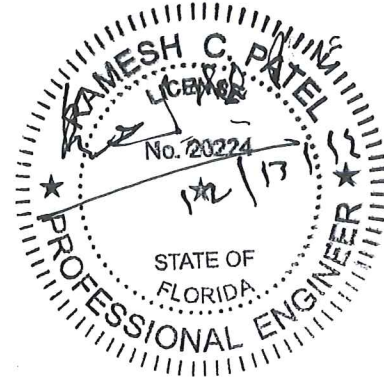
Deflection/ Set
1.250" 0.250"

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .3 - 1.0	15.0	50.0	50	55
+ .5 - .8	25.0	40.0	1050	55
+ .0 - .6	0.00	30.0	50	55
+ .2 - .5	10.0	25.0	3350	55

4500 cycles complete

9000 cycles completed

Deflection/ Set
1.750" 0.375"



Specimen 4
Design Load + 50.0 psf, -50.0 psf
 + Positive loads

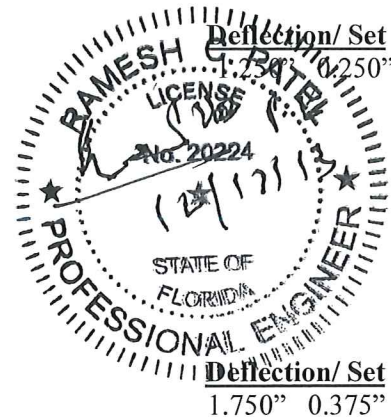
<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .2 - .5	10.0	25.0	3500	55
+ .0 - .6	0.00	30.0	300	55
+ .5 - .8	25.0	40.0	600	55
+ .3 - 1.0	15.0	50.0	100	55

4500 cycles complete

-Negative Loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .3 - 1.0	15.0	50.0	50	55
+ .5 - .8	25.0	40.0	1050	55
+ .0 - .6	0.00	30.0	50	55
+ .2 - .5	10.0	25.0	3350	55

4500 cycles complete


9000 cycles completed
Note: The windows were operable at the end of cycle test.

Results: All specimens tested resisted the large missile impact, without penetration of the inner plane of the glazing and resisted the cycle pressure loading specified in Table 1. With no tear forming longer than 5” and wider than 1/16” thru which air can pass, or no opening through which a 3” diameter solid sphere could freely pass.

Comment:

1. At the conclusion of testing it was determined that the tested specimens passed the criteria of Wind Zone 4 set forth in ASTM E 1886-05 and ASTM E 1996-09.
2. The tested specimens were separated and conditioned for 4 hrs. Between 59 and 95 degrees Fahrenheit.
3. Nominal 2-mil polyethylene film was used to seal against air leakage during structural loads. The film was used in a manner that did not influence the test results.

Test Dates: June 19th 2013 thru November 19th 2013

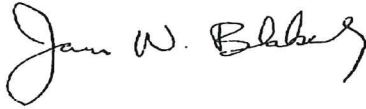
Remarks: Detail drawings were available for laboratory records and comparison to the test specimen at the time of this report. A copy of this report along with representative sections of the test specimen will be retained by Element Materials Technology for a period of four (4) years. The results obtained apply only to the specimen tested. This test report does not constitute certification of this product, but only the above test results were obtained using the designated test methods and they indicate compliance with the performance requirements (paragraphs as listed) of the above referenced specifications. Element Materials Technology assumed that all information provided by the client is accurate and that the physical and chemical properties of the components are as stated by the manufacturer.

Testing Performed By:

Mike Miller Element Materials Technology
Washington Romero Element Materials Technology

Client Present:

Dennis Cox Deceuninck NA



James Blakely
Operations Manager
Element Materials Technology

cc: Deceuninck NA (2)
 Ramesh Patel P.E. (1)
 File (1)

