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SMART GLASS GROUP
TEST REPORT

SCOPE OF WORK
ASTM E662 - *STANDARD TEST METHOD FOR MEASUREMENT OF SMOKE OBSCURATION USING A CONICAL RADIANT SOURCE IN A SINGLE CLOSED CHAMBER*, ON PRIWATT™ FILM

REPORT NUMBER
104317627MID-002REV2

TEST DATE(S)
04/10/20

ISSUE DATE **[REVISED DATE]**
04/10/20 09/11/20

PAGES
10

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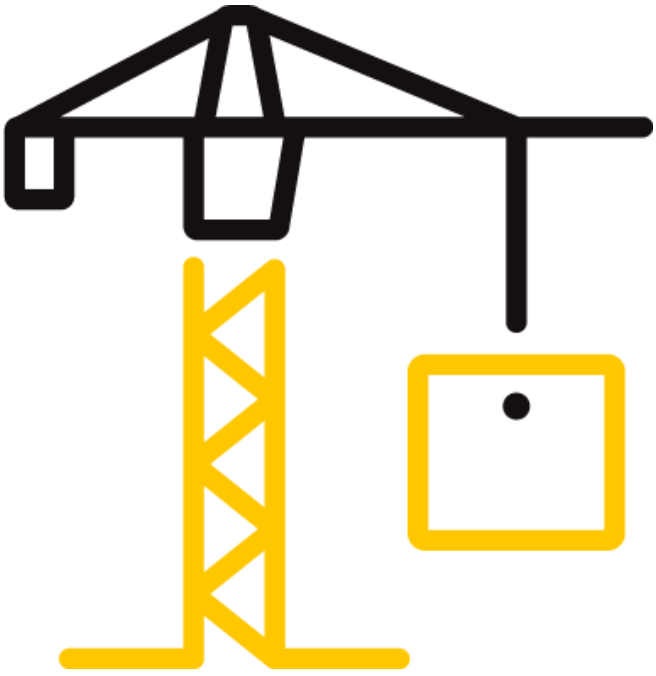

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TEST REPORT FOR SMART GLASS GROUP
Report No.: 104317627MID-002REV2
Date: 09/11/20

REPORT ISSUED TO

SMART GLASS GROUP
7250 Keele Street Unit 93
Concord, ON L4K1Z8
CAN

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Smart Glass Group, 7250 Keele Street Unit 93 Concord, ON L4K1Z8 CAN to perform testing in accordance with ASTM E662 - *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber* and NFPA 130 – 2017 for other vehicle components, on their PriWatt™ Film. Results obtained are tested values and were secured by using the designated test method(s). Testing was conducted at Intertek test facility in Middleton, WI.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. 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, representative samples of test specimens, or other pertinent project documentation, will be retained for the entire test record retention period.

SECTION 2

SUMMARY OF RESULTS

The sample PriWatt™ Film meets the criteria for NFPA 130 – 2017 for other vehicle components.

For INTERTEK B&C:

COMPLETED BY:	Nicholas Hampel	**REVIEWED BY:**	Bryan Bowman
TITLE:	Associate Engineer – B&C	**TITLE:**	Chemist
SIGNATURE:		**SIGNATURE:**	
DATE:	09/11/20	**DATE:**	09/11/20

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SECTION 3

TEST METHOD(S)

The specimen was evaluated in accordance with the following:

> **ASTM E662 – 2017, *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber***

And under the following criteria for other vehicle components:

> **NFPA 130 – 2017, *Standard for Fixed Guideway Transit and Passenger Rail Systems, Section 8.4 Flammability and Smoke Emission***

Per NFPA 130 (2017) Standard for Fixed Guideway Transit and Passenger Rail Systems, Section 8.4 Flammability and Smoke Emission for other vehicle components. Fire Test Procedures and Performance Criteria for Materials and Assemblies state the material must have a specific optical density at 1.5 minutes of less than or equal to 100 (D_s (1.5) ≤ 100) and at 4 minutes of less than or equal to 200 (D_s (4.0) ≤ 200).

Materials tested for surface flammability shall not exhibit any flaming running or flaming dripping per Section 8.4.1.1 of the standard.

The maximum test limits for the smoke emissions (Specific Optical Density) shall be for both flaming and non-flaming modes per Section 8.4.1.2 of the standard.

The following table outlines the specific criteria for NFPA 130:

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Date: 09/11/20

Table 8.4.1 Fire Test Procedures and Performance Criteria for Materials and Assemblies

Category	Function of Material	Test Method	Performance Criteria
Cushioning	All individual flexible cushioning materials used in seat cushions, mattresses, mattress pads, armrests, crash pads, and grab rail padding [a–e]	ASTM D3675	$I_s \le 25$
		ASTM E662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 175
Fabrics	Seat upholstery, mattress ticking and covers, curtains, draperies, window shades, and woven seat cushion suspensions [a–c, f–h]	14 CFR 25, Appendix F, Part I (vertical test)	Flame time ≤ 10 sec Burn length ≤ 6 in.
		ASTM E662	D_s (4.0) ≤ 200
Other vehicle components	Seat and mattress frames, wall and ceiling lining and panels, seat and toilet shrouds, toilet seats, trays and other tables, partitions, shelves, opaque windscreens, combustible signage, end caps, roof housings, articulation bellows, exterior shells, nonmetallic skirts, battery case material, and component boxes and covers [a,b,i–k]	ASTM E162	$I_s \le 35$
		ASTM E662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200
	Thermal and acoustical insulation [a,b]	ASTM E162	$I_s \le 25$
		ASTM E662	D_s (4.0) ≤ 100
	HVAC ducting [a,b]	ASTM E162	$I_s \le 25$
		ASTM E662	D_s (4.0) ≤ 100
	Floor covering [b,k,l]	ASTM E648	CRF ≥ 5 kW/m^2
		ASTM E662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200
	Light diffusers, windows, and transparent plastic windscreens [b,i]	ASTM E162	$I_s \le 100$
		ASTM E662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200
	Adhesives and sealants [a,b]	ASTM E162	$I_s \le 35$
		ASTM E662	D_s (1.5) ≤ 100D_s (4.0) ≤ 200
Elastomers [a,b,i,j]	Window gaskets, door nosings, intercar diaphragms, seat cushion suspension diaphragms, and roof mats	ASTM C1166	Flame propagation ≤ 100 mm (4 in.)
		ASTM E662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200
Wire and cable	All	See 8.6.7.1.1.1 through 8.6.7.1.3.	See 8.6.7.1.1.1 through 8.6.7.1.3.
Structural components [m]	Flooring,[n] other[o]	ASTM E119	Pass

[a] See 8.4.1.1.
[b] See 8.4.1.2.
[c] See 8.4.1.3.
[d] See 8.4.1.4.
[e] See 8.4.1.5.
[f] See 8.4.1.6.
[g] See 8.4.1.7.
[h] See 8.4.1.8.
[i] See 8.4.1.9.
[j] See 8.4.1.10.
[k] See 8.4.1.11.
[l] See 8.4.1.12.
[m] See 8.4.1.13.
[n] See 8.4.1.14.
[o] See 8.4.1.15.

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SECTION 4
MATERIAL SOURCE

Test samples were provided by the client. Test specimens were received March 23, 2020 in good condition. Sample ID number is MID2003230650-001

SECTION 5
EQUIPMENT

EQUIPMENT			
ASSET # - DESCRIPTION:	DAQ - 1150	**CALIBRATION DUE:**	1/23/2021
ASSET # - DESCRIPTION:	Calorimeter - 1490	**CALIBRATION DUE:**	N/A
ASSET # - DESCRIPTION:	Radiometer - 1489	**CALIBRATION DUE:**	4/10/2020
ASSET # - DESCRIPTION:	Balance - 1396	**CALIBRATION DUE:**	4/7/2021
ASSET # - DESCRIPTION:	Calipers - 1062	**CALIBRATION DUE:**	7/9/2020
ASSET # - DESCRIPTION:	Stop watch - 1428	**CALIBRATION DUE:**	4/7/2021
ASSET # - DESCRIPTION:	Room Temp/Humidity Monitor - 1451	**CALIBRATION DUE:**	12/12/2020
ASSET # - DESCRIPTION:	Conditioning Temp/Humidity Monitor - 1450	**CALIBRATION DUE:**	12/12/2020

SECTION 6
TEST PROCEDURE

The test procedure was performed following ASTM E662 section 11 - Procedure.

SECTION 7
TEST CALCULATIONS

The smoke density calculations were performed as written in ASTM E662 section 12 - Calculations.

SECTION 8
TEST SPECIMEN DESCRIPTION

The PDLC (polymer dispersed liquid crystals) film material was provided by the client as squares measuring approximately 75mm x 75mm. Thickness was about 0.5mm. Prior to the test samples were conditioned at 140° F for 24 hours and then equilibrated to 75° F and 50% relative humidity.

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TEST REPORT FOR SMART GLASS GROUP
Report No.: 104317627MID-002REV2
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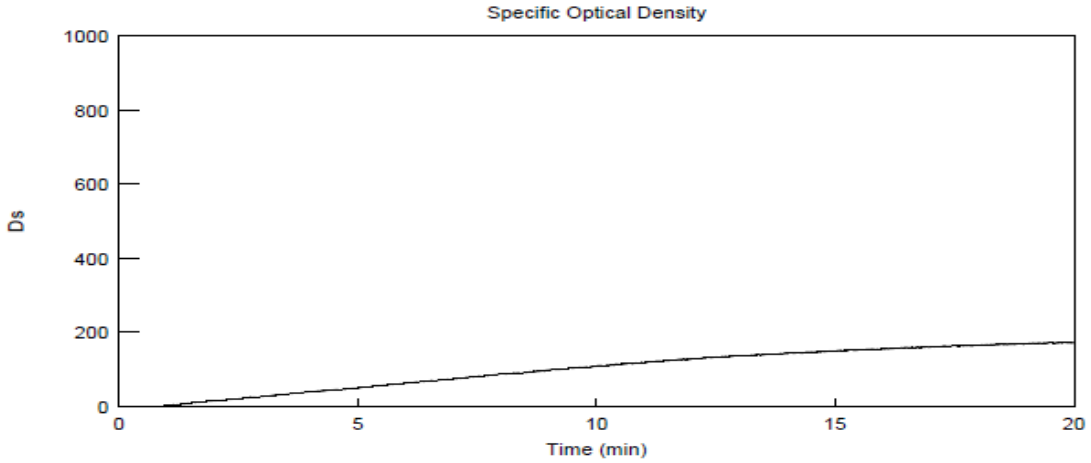
SECTION 9
TEST RESULTS

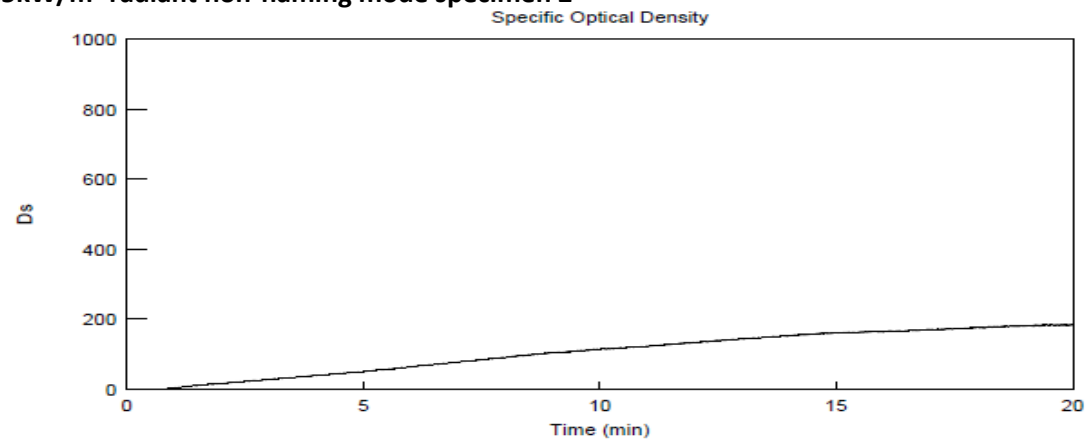
25kW/m² radiant non-flaming mode specimen 1



Ds at 1.5 min: 9.0
Ds at 4 min: 40.0
Max. Ds (first 4 min): 40.0
Max. Ds Time (first 4 min): 3:57.4
Max. Ds: 174.0
Max. Ds Time: 19:59.8
Clear Beam Ds: 5.0
Corrected Max. Ds: 169.0

Average Backwall Temp: 88.8 °Fahrenheit
Minimum Backwall Temp: 85.1 °Fahrenheit
Maximum Backwall Temp: 91.8 °Fahrenheit

25kW/m² radiant non-flaming mode specimen 2



Ds at 1.5 min: 11.0
Ds at 4 min: 39.0
Max. Ds (first 4 min): 39.0
Max. Ds Time (first 4 min): 3:54.3
Max. Ds: 185.0
Max. Ds Time: 19:34.1
Clear Beam Ds: 5.0
Corrected Max. Ds: 180.0

Average Backwall Temp: 86.4 °Fahrenheit
Minimum Backwall Temp: 85.3 °Fahrenheit
Maximum Backwall Temp: 86.9 °Fahrenheit

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TEST REPORT FOR SMART GLASS GROUP
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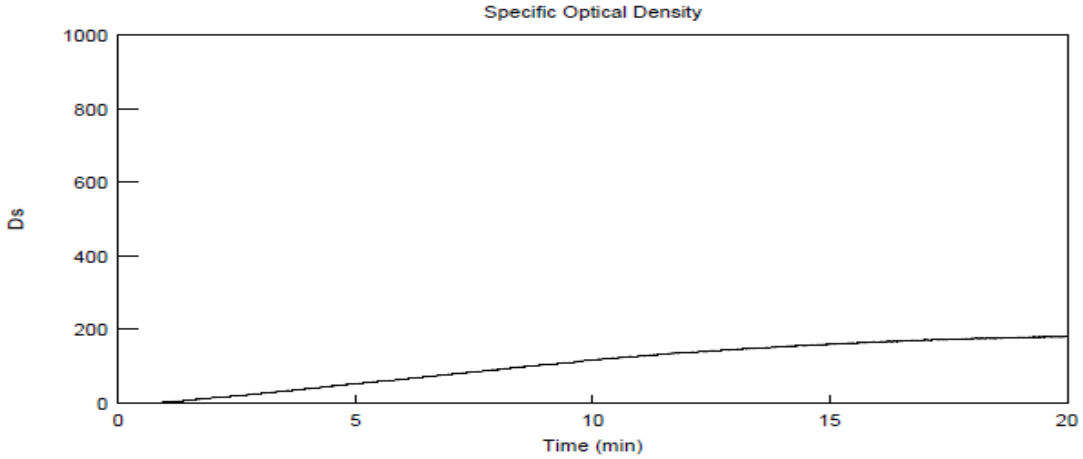
Date: 09/11/20

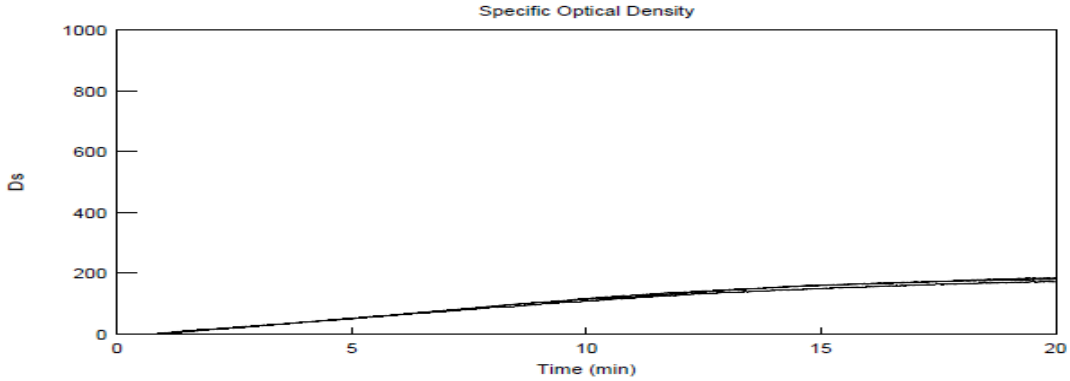
25kW/m² radiant non-flaming mode specimen 3



Ds at 1.5 min: 8.0
Ds at 4 min: 39.0
Max. Ds (first 4 min): 39.0
Max. Ds Time (first 4 min): 3:55.8
Max. Ds: 182.0
Max. Ds Time: 19:54.6
Clear Beam Ds: 4.0
Corrected Max. Ds: 178.0

Average Backwall Temp: 87.6 °Fahrenheit
Minimum Backwall Temp: 83.7 °Fahrenheit
Maximum Backwall Temp: 90.3 °Fahrenheit

25kW/m² radiant non-flaming mode summary



Summary

Run	Specimen #	Ds @ 1.5 min	Ds @ 4 min	Max Ds (first 4 min)	Max Ds Time (first 4 min)	Max Ds	Max Ds Time
1	25kW no flame	9.0	40.0	40.0	3:57.4	174.0	19:59.8
2	25kW no flame	11.0	39.0	39.0	3:54.3	185.0	19:34.1
3	25kW no flame	8.0	39.0	39.0	3:55.8	182.0	19:54.6
Avg.		9.3	39.3	39.3	0:00.0	180.3	19:49.5

Avg Backwall Temp: 87.6 °Fahrenheit Min Backwall Temp: 84.7 °Fahrenheit Max Backwall Temp: 89.7 °Fahrenheit

25kW/m² radiant non-flaming mode observations

At around 20s surface warping, slight expanding, melting, 30s smoking, 1:30 bubbling, 3:00 surface and bubbles mostly blackened.

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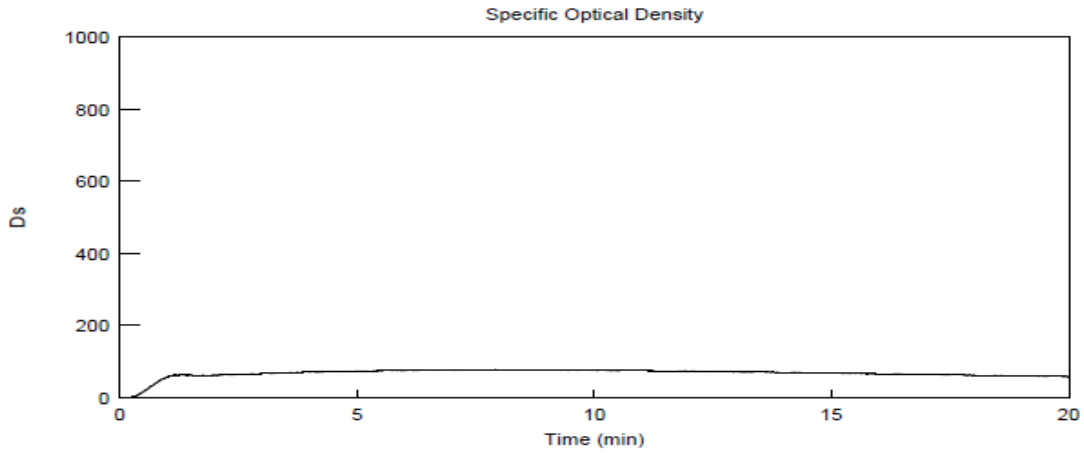
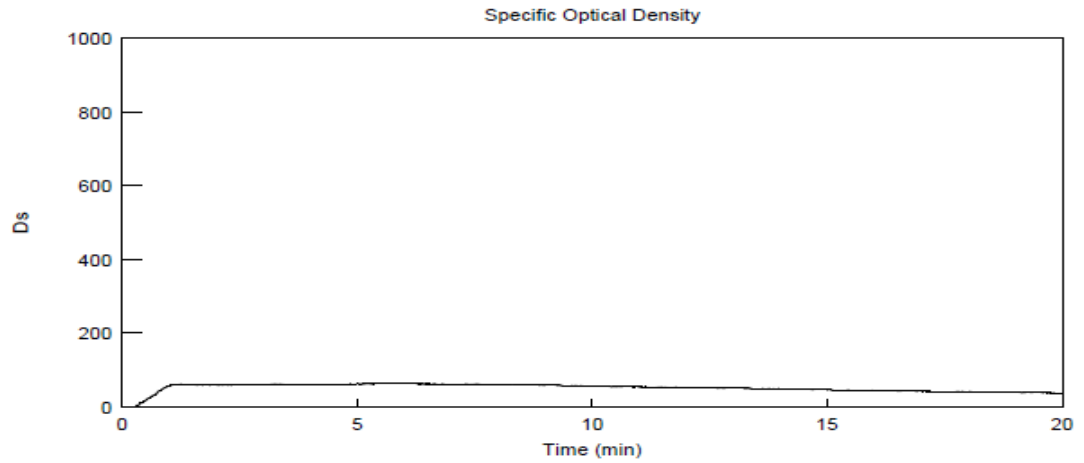
25kW/m^2 radiant flaming mode specimen 1



Ds at 1.5 min: 63.0
Ds at 4 min: 72.0
Max. Ds (first 4 min): 71.0
Max. Ds Time (first 4 min): 3:44.3
Max. Ds: 78.0
Max. Ds Time: 7:55.1
Clear Beam Ds: 12.0
Corrected Max. Ds: 66.0

Average Backwall Temp: 93.9 °Fahrenheit
Minimum Backwall Temp: 86.2 °Fahrenheit
Maximum Backwall Temp: 99.0 °Fahrenheit

25kW/m^2 radiant flaming mode specimen 2



Ds at 1.5 min: 60.0
Ds at 4 min: 62.0
Max. Ds (first 4 min): 62.0
Max. Ds Time (first 4 min): 1:14.8
Max. Ds: 63.0
Max. Ds Time: 4:51.1
Clear Beam Ds: 10.0
Corrected Max. Ds: 53.0

Average Backwall Temp: 94.0 °Fahrenheit
Minimum Backwall Temp: 89.4 °Fahrenheit
Maximum Backwall Temp: 95.7 °Fahrenheit

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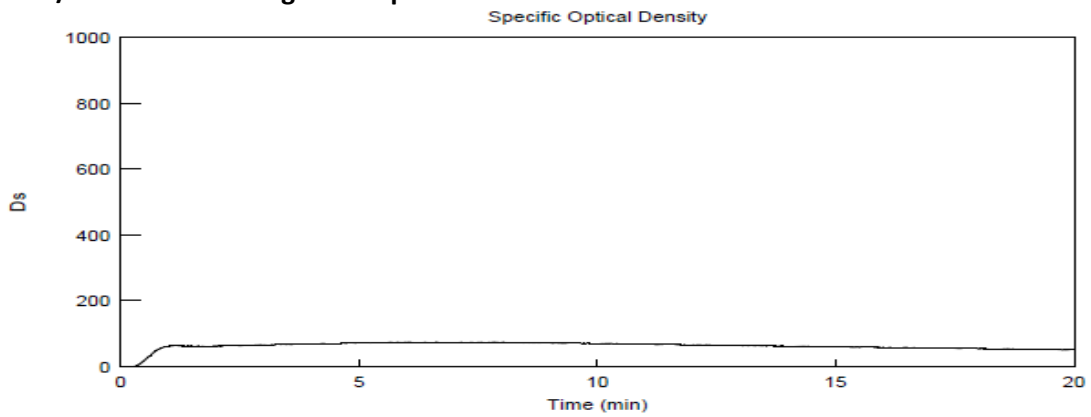
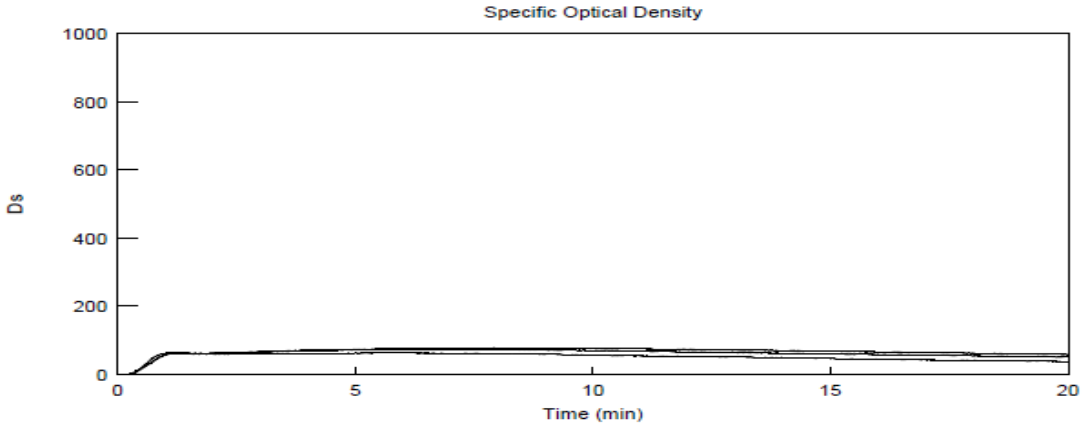
25kW/m² radiant flaming mode specimen 3



Ds at 1.5 min: 63.0
Ds at 4 min: 69.0
Max. Ds (first 4 min): 69.0
Max. Ds Time (first 4 min): 3:47.1
Max. Ds: 75.0
Max. Ds Time: 6:37.5
Clear Beam Ds: 14.0
Corrected Max. Ds: 61.0

Average Backwall Temp: 95.7 °Fahrenheit
Minimum Backwall Temp: 87.8 °Fahrenheit
Maximum Backwall Temp: 99.9 °Fahrenheit

25kW/m² radiant flaming mode summary



Summary

Run	Specimen #	Ds @ 1.5 min	Ds @ 4 min	Max Ds (first 4 min)	Max Ds Time (first 4 min)	Max Ds	Max Ds Time
1	25kW with flame	63.0	72.0	71.0	3:44.3	78.0	7:55.1
2	25kW with flame	60.0	62.0	62.0	1:14.8	63.0	4:51.1
3	25kW with flame	63.0	69.0	69.0	3:47.1	75.0	6:37.5
Avg.		62.0	67.7	67.3	0:00.0	72.0	6:27.9

Avg Backwall Temp: 94.5 °Fahrenheit Min Backwall Temp: 87.8 °Fahrenheit Max Backwall Temp: 98.2 °Fahrenheit

25kW/m² radiant flaming mode observations

Ignition around 7s with orange flames, black smoke, sample blackening, around 30s melting into catch trough, no overflow, sample flame out around 5:00.

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SECTION 10
CONCLUSION

The sample PriWatt™ film meets the specified performance requirements outlined in the NFPA 130 – 17 standard for other vehicle component with the average maximum smoke density at 1.5 minutes (Ds @ 1.5 min) less than 100 for the both test modes and average maximum smoke density at 4.0 minutes (Ds @ 4.0 min) less than 200 for both the flaming and non-flaming modes.

There are no deviations from the test standard.

SECTION 11
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	04/10/20	10	Original Report Issue
1	04/13/20	10	Revised client name
2	09/11/20	10	Revised sample name