

CLIENT:

ARTISTIC SKYLIGHT DOMES

255 Regina Rd. Woodbridge, ON L4L 8M3

Test Report	No: T1248-4R2	Revision Date: November 9, 2021				
SAMPLE ID:	Artistic Skylight Domes – Fa	all Protection Screen.				
SAMPLING DETAIL:	Client had submitted the samples directly to QAI for testing.					
DATE OF RECEIPT:	Three (3) skylight domes and fall protection screen assemblies were received at QAI on August 4, 2021.					
TESTING PERIOD:	September 10, 2021.					
AUTHORIZATION:	QAI Proposal Number 21M quote and PO 21-205-nf on	A042101 dated April 21, 2021 was accepted by signed May 14, 2021.				
TEST(S) REQUESTED:	Static load testing to CAL CAL-OSHA Section 3212 (-OSHA Section 3212 (b) and Impact load testing to e1) requirements.				

TEST RESULTS:

STATIC LOAD - CAL-OSHA Section 3212 (b)

Test Location	Maximum Load (Ibs)	Deflection Under Load, mm (in)	Comments
1	215	323.9 (12.75)	Screen could not maintain higher applied load.
2	725	277.8 (10.94)	No breakage of outer or inner dome.
3	800	127.0 (5.00)	No breakage of outer or inner dome.

 $\mathsf{IMPACT} = \mathsf{CAL} = \mathsf{CAL}$

	$\frac{1}{100} = \frac{1}{100} = \frac{1}$								
Test Location	Drop Height, mm (in)	Impact Energy, J (lbf)	Comments						
1	1295 (51)	576 (425)	Screen deformed/bent. Outer shell of dome broken. Inner shell intact & unbroken. No passage through to interior.						
2	1295 (51)	576 (425)	Screen deformed/bent. Outer shell of dome broken. Inner shell intact & unbroken. No passage through to interior.						
3	1295 (51)	576 (425)	Screen deformed/bent. Outer shell of dome broken. Inner shell intact & unbroken. No passage through to interior.						

Prepared By

si

Robert Giona Operations Manager

Signed for and on behalf of QAI Laboratories Ltd.

Lawrence Gibson

Executive VP

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Test Assembly

The fall protection screens supplied by Artistic Skylight Domes (Artistic) for testing consisted of 2 lengths of profiled extruded aluminum running the length of the skylight, and were held in place under compression with 2 threaded rods running across the front and back of the skylight. The screen was placed into the groove on one length of profiled aluminum and was retained by aluminum clips. Once one side was secured, the screen was bent over into the other length of profiled aluminum, and again retained by the screen retaining clips.

Component	Description	Quantity				
Screen	ScreenConstructed from 6.3mm (0.250") galvanized steel wire mesh. Welded at joints to create 100mm (4") On-Center (O.C) squares.					
Profiled Aluminum Extrusion	Profiled Aluminum ExtrusionConstructed from 6063 extruded aluminum with T6 temper. 38.5mm (1.5") x 38.5mm (1.5") Angle with 17.5mm (0.686") channel on top leg (Screen channel). Wall thickness was 					
Threaded Rod	Threaded Rod 9.5mm (0.375") diameter threaded rod, 1930mm (76") in length. Thread count of 16 TPI. Zinc plated.					
Lock Washers	Washers 10mm (0.406") Inside Diameter x 22mm (0.875") Outside diameter x 1.2mm (0.050") thick, zinc plated steel.					
Nuts	Nuts 9.5mm (0.375") x 16 TPI zinc plated steel nuts					
Screen Retaining Clips	Screen Retaining ClipsC-Channel extruded aluminum cut to 89mm (3.5") in length. 31.75mm (1.25") wide x 19mm (0.75") deep, with 3.2mm (0.125") wall thickness.					
Screen Clip Screws	Screws #8-5/8" Tek Screw					
Screen Connecting Clips	Butterfly joining clips measured 19mm (0.75") long x 25mm (1") wide x 2mm (0.079") thick stainless steel, connected with a #10 x 19mm (0.75") long stainless steel screw.	20 total (used at each intersection along seam)				

Detailed drawings of the fall screen system can be found in Appendix C of this report.





Test Procedure – Static Load

As there is little detail or requirements noted within CAL-OSHA Section 3212 (b), the test procedure and equipment used were determined via best practices. Static loading was performed at 3 locations deemed worst case (Refer to Photo 1). Load application was made via hydraulic ram/pump with a load cell in line. Load application was distributed over a 305mm x 305mm x 19mm (12" x 12" x 0.75") wooden platen. The screen displacement was measured prior to loading, during loading and post loading application. Each load increment was held for a period of 1 minute, displacement measured, the load was released and after a period of 1 minute the residual displacement was again measured.

This procedure was repeated until maximum displacement of the ram was achieved, or when the client was satisfied with the screen performance.

Test Requirements

As per CAL-OSHA Section 3212 (b) – Roof opening covers shall be capable of safely supporting the greater of 400 lbs or twice the weight of the employees, equipment and materials that may be imposed on any one square foot area of the cover at any time.

Test Locations

After review of the screen profile and the relationship to the skylight dome, three (3) locations were picked to be used as test sites, and are shown in the diagram below:

- Location 1 Center of front edge of fall protection screen.
- Location 2 Center of screen connection seam, offset to side (only 1 screen loaded).
- Location 3 Edge of fall protection screen.



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Test Results

	Load VS. Deflection Data										
Location	Load	Initial Displacement		Under Load		Deflection		After Release Displacement		t Commonto	
Location	lbs	mm	in	mm	in	mm	in	in mm in Comments		comments	
	0	446.0875	17 9/16					446.0875	17 9/16	No signs of deformation.	
1	175	446.0875	17 9/16	331.7875	13 1/16	114.30	4 1/2	441.325	17 3/8	Signs of deformation (bending) of screen.	
1	200	441.325	17 3/8	276.225	10 7/8	165.10	6 1/2	436.5625	17 3/16	Signs of deformation (bending) of screen.	
	215	436.5625	17 3/16	112.7125	4 7/16	323.85	12 3/4	400.05	15 3/4	Yield of screen achieved. Cannot sustain further loading.	

Load VS. Deflection Data											
Location	Load	Initial Dis	placement	Unde	Under Load		ction	After Release Displacement		6t-	
Location	lbs	mm	in	mm	in	mm	in	mm	in	comments	
	0	701.675	27 5/8					701.675	27 5/8	No signs of deformation.	
	200	701.675	27 5/8	762	30	60.325	2 3/8	701.675	27 5/8	No signs of deformation.	
	309	701.675	27 5/8	804.8625	31 11/16	103.1875	4 1/16	701.675	27 5/8	Screen in contact with dome.	
	400	701.675	27 5/8	838.2	33	136.525	5 3/8	708.025 27 7/8 Signs of deformation	Signs of deformation (bending) of screen.		
	425	708.025	27 7/8	849.3125	33 7/16	141.2875	5 9/16	709.6125	27 15/16	Signs of deformation (bending) of screen.	
2	440	709.6125	27 15/16	857.25	33 3/4	147.6375	5 13/16	708.025	27 7/8	Screen touching dome.	
	450	708.025	27 7/8	858.8375	33 13/16	150.8125	5 15/16	712.7875	28 1/16	Screen touching dome.	
	500	712.7875	28 1/16	871.5375	34 5/16	158.75	6 1/4	712.7875	28 1/16	Outer shell of dome deforming - no breakage.	
	600	712.7875	28 1/16	900.1125	35 7/16	187.325	7 3/8	717.55	28 1/4	Outer shell of dome deforming - no breakage.	
	700	717.55	28 1/4	942.975	37 1/8	225.425	8 7/8	730.25	28 3/4	Outer shell of dome deforming - no breakage.	
	725	730.25	28 3/4	1008.0625	39 11/16	277.8125	10 15/16	730.25	28 3/4	Outer shell of dome deforming - no breakage.	

Load VS. Deflection Data										
Location	Load	Initial Displacement		Under Load		Defle	Deflection		Displacement	Commonts
Location	lbs	mm	in	mm	in	mm	mm in mm in commen		comments	
	0	806.45	31 3/4					806.45	31 3/4	No signs of deformation.
	200	806.45	31 3/4	836.6125	32 15/16	30.1625	1 3/16	793.75	31 1/4	No signs of deformation.
	300	793.75	31 1/4	852.4875	33 9/16	58.7375	2 5/16	792.1625	31 3/16	No signs of deformation.
	400	792.1625	31 3/16	873.125	34 3/8	80.9625	3 3/16	793.75	31 1/4	No signs of deformation.
2	425	793.75	31 1/4	876.3	34 1/2	82.55	3 1/4	792.1625	31 3/16	No signs of deformation.
5	450	792.1625	31 3/16	884.2375	34 13/16	92.075	3 5/8	793.75	31 1/4	No signs of deformation.
	500	793.75	31 1/4	893.7625	35 3/16	100.0125	3 15/16	794.54375	31 9/32	Screen touching dome.
	600	794.5438	31 9/32	914.4	36	119.85625	4 23/32	801.6875	31 9/16	Screen touching dome.
	700	801.6875	31 9/16	920.75	36 1/4	119.0625	4 11/16	806.45	31 3/4	Screen touching dome.
	800	806.45	31 3/4	933.45	36 3/4	127	5	812.8	32	Screen in full contact with dome.

Conclusion

The fall protection screen system provided by Artistic Skylight Domes, when tested with static loads, has shown it has the ability to resist breakage and prevent failure of the skylight dome when loaded to the levels and locations noted above.





Test Procedure – Impact Load

As there is little detail or requirements noted within CAL-OSHA Section 3212 (e1), the test procedure and equipment used were determined via best practices. Impact loading was conducted using an impact bag constructed from a polyethylene bag filled with pea gravel. The bag was then wrapped in 2 layers of high strength duct tape, and then wrapped in 2 layers of canvas. The finished bag was measured to have a weight of 45.3 kg (100 lbs) which was attached to a quick release mechanism. The bag was raised to a height of 1295mm (51 inches) before release, which would provide impact energy of 192.8 kg (425 lbs).

Test Requirements

As per CAL-OSHA Section 3212 (e1) – The design, construction, and installation of skylight screens shall meet the strength requirements equivalent to that of covers specified in subsection (b). They shall also be of such design, construction and mounting that under design loads or impacts, they will not deflect downward sufficiently to break the glass below them. The construction shall be of grillwork, with openings not more than 4 inches by 4 inches or of slatwork with openings not more than 2 inches wide with length unrestricted, or of other material of equal strength and similar configuration.

Test Locations

After review of the screen profile and the relationship to the skylight dome, three (3) locations were picked to be used as test sites, and are shown in the diagram below. For each test, a new screen assembly was used.

Location 1 – Center of one section of fall protection screen. Locations 2 & 3 – Center of screen connection seam, both screens loaded.

*** Diagram can be found on next page***







Test Results

Test Location	Impact Bag Mass, kg (lbs)	Drop Height, mm (in)	Impact Energy, J (lbf)	Comments
1	45.3 (100)	1295 (51)	576 (425)	Screen deformed/bent. Outer shell of dome broken. Inner shell intact & unbroken. No passage through to interior.
2	45.3 (100)	1295 (51)	576 (425)	Screen deformed/bent. Outer shell of dome broken. Inner shell intact & unbroken. No passage through to interior.
3	45.3 (100)	1295 (51)	576 (425)	Screen deformed/bent. Outer shell of dome broken. Inner shell intact & unbroken. No passage through to interior.

Conclusion

The fall protection screen system provided by Artistic Skylight Domes, when tested with impact loads of 576 J (425 lbf), has shown it has the ability to resist breakage of both layers of the skylight and prevent passage through to the interior when impacted at the levels and locations noted above.





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APPENDIX A – Static Load Photographs



Photo 1. Static Load Location #1





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Photo 2. Static Load Location #2

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Photo #4. Static Load Location #3 – Under Load

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APPENDIX B – Impact Load Photographs



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Photo #6 – Impact Location #2 – Post Impact

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APPENDIX C – Client Drawings







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SCREEN FRAME DIMENSIONS		SCREEN C	LIP DIMENSIONS				
	NO. REVISION/SUBMISSION	DATE OF REV. 30/07/21			REV		<u></u>
RETURN OF RELEVEND BALANNIGS TO 255 Review D PARAMAGE TO	V REVISED SUBMISSION	20/10/21	MODEL: NEW FALL PROTECTION	SCREEN		1 50	.03/03
Vaughan, Ontario, Canada L4L BM3 E-mail: artisticightine.ca Web: www.arthicisightine.ca	<u>क</u>		FILENAME	DRAWN BY	CHECKED BY	DATE	FILE NO.
				8.1	D.F.	20/10/21	ART21-2010

Decision Rule

Unless specifically stated or identified otherwise, QAI has utilized a simple acceptance rule to make conformity decisions on testing results contained in this report, as applicable.

Revision History

Revision	Date	Comments	Eng/Tech
0	October 29, 2021	Original Issue	R. Giona
1	November 4, 2021	Added CAL-OSHA 3212 (e1) reference to Impact Load statement on cover page. Added CAL-OSHA 3212 (e1) Test requirement into Impact Load section of report.	R. Giona
2	November 9, 2021	Added comment regarding Inner shell of dome unbroken and intact to cover page and impact test result sections.	R. Giona

****End of Report****