

3M™ SCOTCHSHIELD™ ULTRA
SAFETY AND SECURITY
WINDOW FILMS

SMALL MISSILE IMPACT , WIND CYCLING,
AND UNIFORM STRUCTURAL LOAD
TEST REPORTS



Window Film Depot

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SUMMARY

The 3M™ Scotchshield™ Ultra Safety and Security Window Film System was tested against the following test criteria outlined in the Dade County Building Code Compliance Protocols:

PA 201 Small Missile Impact

PA 202-94 Uniform Structural Loads

PA 203-94 Wind Cycle Loading

This tested system successfully passed all three requirements. It consisted of a 3/16" thermally tempered glass mounted in an aluminum commercial grade fixed frame using 3M Scotchshield Ultra Safety and Security '400' Series Window Film applied to the glass and sealed at the perimeter where the glass and film meet the frame.

Note: This is not a Dade County Building Code Approval. These test results provide evidence of performance against the same test criteria. All tests were conducted by National Certified Testing Laboratories, an independent laboratory certified by Dade County to perform these standards.

Dade County Building Code Compliance, and where does it apply?

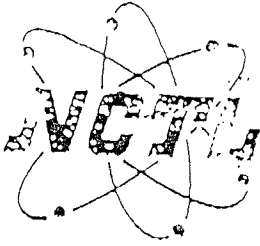
Dade County, Florida is located in South Florida which includes the cities of Miami and Homestead. The latter of which was hit hard by Hurricane Andrew and suffered catastrophic property damage. This Category 4 Hurricane also provided evidence that there was a need to improve the existing building codes in Dade County.

Dade County Building Code Compliance Office responded with some tougher structural requirements relative to roofing, wall cladding, and glazing systems for new construction, renovation, replacement or repair of commercial and residential properties within Dade County.

These code changes do not apply to existing commercial and residential properties unless they are going through renovation, replacement, or repair. 'Retrofit' applications, as in the case of applying security window film to existing glazing are not required to meet these new code requirements.

Dade County does not give approvals to window films, glazing, or frames alone; they give approvals to properly tested complete window or glazing systems. Each system requires its own approval. If the window frame is different (than tested), or the glass is different (size, thickness, type), or the film thickness is different, it will require its own testing for the 'new' system approval. (The exception: a smaller opening than tested, or thicker glass (same type) than tested, or stronger frame than tested is generally accepted).

We provide this test report to demonstrate the performance of the 3M™ Scotchshield™ Ultra Safety and Security Film Window System using one particular commercial grade glazing system tested to the same protocol standards called for by the Dade County Building Code Compliance Office. It is not an approval, nor is it a guarantee. Your windows may be different from what was tested, therefore we cannot make claims as to the actual performance of your window system. Regardless, this system when installed properly will provide an increased measure of impact and wind resistant protection against the forces associated with strong wind storms.



NATIONAL CERTIFIED TESTING LABORATORIES

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STRUCTURAL IMPACT & CYCLIC PERFORMANCE TEST REPORT

REPORT NO.: NCTL-210-1920-1,2,3 (S)(I)(C)
TEST DATE: 03-21-97
REPORT DATE: 04-13-97
EXPIRATION DATE: 04-31-97 (NCTL)

LAB CERTIFICATION NO.: 94-0323.47

CLIENT: 3M Specified Construction Products Department
3M Center Building 225-1S-08
St. Paul, MN 55144-1000

TEST SPECIMEN: Three (3) 3M's Fixed Commercial Window Systems employing 3M™ Scotchshield™ Ultra Safety and Security "400" Series Window Film.

TEST SPECIFICATION: Dade County Building Code Compliance Office Protocol PA 201, Impact Test Procedures and PA 203-94, "Criteria for Testing Products Subjected to Cyclic Wind Pressure Loading", and PA 202-94, "Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure.

Missile Data: Ten (10) # 6 Aggregate Rock fired simultaneously.
Weight: 2 grams each
Velocity: 50 mph / 80 ft. per second

1. Description of unit

1.1 Series 3M™ Scotchshield™ Ultra Film SCLARL 400.

1.2 Overall Size: 48-7/8" wide by 78-7/8" high overall.

1.4 Configuration: Commercial Fixed Window.

1.5 Number and size of lites

A. Three (3) Total
Viewing area: 45" wide by 75" high.

2. Material Characteristics

2.1: Frame and active panel material: Main frame members were of extruded aluminum
Not thermally broken.

2.2.1 Glazing Material:

Glass Surface I.D.
Fixed

Glass Material

3/16" fully tempered glass w/3M Scotchshield Ultra Film.

2.2.2 Glazing Method: All lites were interior pocket glazed using EPDM flexible glazing gaskets and a snap-fitted aluminum glazing bead. Each interior glazing perimeter was silicone cap beaded with a structural silicone sealant.

2.2.3 Daylight Openings: See Paragraph No. 1.5

2.3 Frame Construction: All main frame corners were of double screw butt-type corner construction.

2.4 Weatherstripping: None applicable.

2.6 Hardware: None applicable.

2.7 Washholes: None applicable.

2.8 Muntins: None applicable.

2.9 Reinforcement: None applicable.

3. Installation: Each specimen was mounted into a pressure treated wood test buck as follows:

SCREWS AND METHOD OF ATTACHMENT

SILL MEMBER:	=	Two (2) (# 12 x 3") PPHSMS TYPE AB
HEAD MEMBER:	=	Two (2) (# 12 x 3") PPHSMS TYPE AB
JAMB MEMBER	=	Three (3) (# 12 x 3") PPHSMS TYPE AB Three (3) per jamb. Six (6) total.

Note: See fastener diagram

STRUCTURAL TEST RESULTS

<u>Paragraph No.:</u>	<u>Title of Test</u>	<u>Measured</u>	<u>Allowed</u>
2.1.2/5.2.7	Air Infiltration 6.24 psf (50 mph)	0.00"	0.15 CM/FT ²
2.1.4/5.2.4	Uniform Static Load (30 seconds) Design Load 65 psf Positive 65 psf Negative	0.009" 0.006"	0.316" 0.316"
3.3/5.2.6	Water Penetration - (50 GPH/FT ²) WTP = 15.00 psf	No Entry	No Entry

3.4/5.2.6

Uniform Structural Load
Full Load (30 seconds)

97.5 psf	0.029"	0.316"
97.5 psf	0.021"	0.316"

Specimen No. 1 Impact Test Results - Small Missile

Impact No. 1	-	Center of glass	Meets as stated (no glass breakage)
Impact No. 2	-	Lower corner of glass	Meets as stated (no glass breakage)
Impact No. 3	-	Midspan 6" from glass edge	Meets as stated (no glass breakage)

Specimen No. 2 Impact Test Results - Small Missile

Impact No. 1	-	Center of glass	Meets as stated (no glass breakage)
Impact No. 2	-	Lower corner of glass	Meets as stated (no glass breakage)
Impact No. 3	-	Midspan 6" from left edge	Meets as stated (no glass breakage)

Specimen No. 3 Impact Test Results - Small Missile

Impact No. 1	-	Center of glass	Meets as stated (no glass breakage)
Impact No. 2	-	Lower corner of glass	Meets as stated (no glass breakage)
Impact No. 3	-	Midspan 6" from right edge	Meets as stated (no glass breakage)

Cyclic Test Results - (Table No. 1)

Positive Design Pressure	-	65 psf
Negative Design Pressure	-	65 psf

Inward Acting Pressure Tabulations (65 psf D.P. Positive)

<u>RANGE</u>	<u>CYCLES</u>	<u>DURATION</u>
13.6 psf to 32.5 psf	3,500	Two (2) seconds
0.0 psf to 39.0 psf	300	Two (2) seconds
32.5 psf to 52.0 psf	600	One (1) second
19.5 psf to 65.0 psf	100	Two (2) seconds

Outward Acting Pressure Tabulations (65 psf D.P. Negative)

<u>RANGE</u>	<u>CYCLES</u>	<u>DURATION</u>
19.5 psf to 65.0 psf	50	Two (2) seconds
32.5 psf to 39.0 psf	1,050	Two (2) seconds
0.00 psf to 52.0 psf	50	One (1) second
19.5 psf to 65.0 psf	3,350	Two (2) seconds

Positive Pressure Results

Specimen No. 1C (Inward) Acting

Maximum deflection = 0.017"
 Maximum Permanent set = 0.006"

Positive Pressure Results

Specimen No. 2C (Inward) Acting

Maximum deflection = 0.009"
 Maximum Permanent set = 0.000"

Positive Pressure Results

Specimen No. 3C (Inward) Acting

Maximum deflection = 0.015"
 Maximum Permanent set = 0.004"

Negative Pressure Results

Specimen No. 1C (Outward) Acting

Maximum deflection = 0.019"
 Maximum Permanent set = 0.005"

Negative Pressure Results

Specimen No. 2C (Outward) Acting

Maximum deflection = 0.008"
 Maximum Permanent set = 0.002"

Negative Pressure Results

Specimen No. 3C (Outward) Acting

Maximum deflection = 0.019"
 Maximum Permanent set = 0.004"

Note: Each specimen showed no resultant failure or distress. Each specimen passed criteria as stated in The South Florida Building Code Chapter 23 and Protocol PA 203-94.

All measurement readings taken using Mitutoyo Dial Indicator Gauges, digital deflection measurer and were taken at midspan of the vertical jamb member.

TESTING COMPLETED 03-21-97

Maximum positive pressure = 65.0 psf
 Maximum negative pressure = 65.0 psf

At the conclusion of all testing, no openings or tears in the glazing film or any damage was observed.

The specimens were tested in accordance with Protocols 202-94, 203-94 and meet the applicable requirements of the South Florida Building Code. Sections 3103.2, 3303.5, 3508, 3514 and 3515, 3603.2 and 3604. The specimens also meet the applicable requirements of Chapter 23, Section 2315 of the South Florida Building Code.

Detailed drawings were available for laboratory records and compared 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 NCTL for a period of four (4) years. The results obtained apply only to the specimen tested.

A. Additional Performance Testing.

Special Note: At this point in testing, due to the point that no broken glass was observed. It was decided to continue on with uniform structural loads and impacts using 5/8" diameter ball bearings at accelerated velocities until glass breakage would occur.

The following results were obtained:

A1.	<u>Uniform Structural Loading (60 second durations)</u>	
	<u>Test Pressure</u>	<u>Results</u>
	140 psf exterior	Pass - no glass breakage
	140 psf interior	Pass - no glass breakage
	160 psf exterior	Pass - no glass breakage
	160 psf interior	Pass - no glass breakage
	180 psf exterior	Pass - no glass breakage
	180 psf interior	Pass - no glass breakage
	200 psf exterior	Pass - no glass breakage
	200 psf interior	Pass - no glass breakage
	210 psf exterior	Pass - no glass breakage
	210 psf interior	Pass - no glass breakage

Note: At this point it was decided to continue on with Impact testing.

A2.1 Research Impact Results - 5/8" Diameter Steel Ball

<u>Test No.</u>	<u>Feet per second</u>	<u>Results</u>
1.	80	Pass - no breakage
2.	100	Pass - no breakage
3.	130	Pass - no breakage

Note: At this point in testing, it was decided to break glass manually, re-impact and re-cycle.

Result: Glass shattered and all glass remained adhered to 3M Scotchshield Ultra Film and remained attached to the main frame system.

Note: At this point in testing, it was decided to continue on with impacts to observe at what point if any that the 5/8" steel ball would penetrate the 3M Scotchshield Ultra Film adhered to the shattered 3/16" tempered glass.

The following results were obtained:

A2.2

Research Impact Results - 5/8" Diameter Steel Ball

<u>Test No.</u>	<u>Feet per second</u>	<u>Results</u>
1.	80	Pass - no penetration
2.	100	Pass - no penetration
3.	130	Pass - no penetration

Note: At this point in testing, it was decided to perform cyclic testing per Table No. 1 of the South Florida Building Code on each specimen having glass shattered but totally in place and adhered glass by 3M Scotchshield Ultra Film the following results were obtained:

A3.

Cyclic Test Results Specimen No.'s 1,2,3

Positive Design pressure = 65.0 psf
Negative Design Pressure = 65.0 psf

Inward Acting Pressure Tabulations (65 psf D.P. Positive)

<u>RANGE</u>	<u>CYCLES</u>	<u>DURATION</u>
13.6 psf to 65.0 psf	3,500	Two (2) seconds
0.0 psf to 39.0 psf	300	Two (2) seconds
32.5 psf to 52.0 psf	600	One (1) second
19.5 psf to 65.0 psf	100	Two (2) seconds

Outward Acting Pressure Tabulations (65 psf D.P. Negative)

<u>RANGE</u>	<u>CYCLES</u>	<u>DURATION</u>
19.5 psf to 65.0 psf	50	Two (2) second
32.5 psf to 39.0 psf	1,050	Two (2) seconds
00.0 psf to 52.0 psf	50	One (1) second
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Positive Pressure Results

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Maximum deflection = 0.017"
Maximum Permanent set = 0.006"

Positive Pressure Results

Specimen No. 2C (Inward) Acting

Maximum deflection = 0.009"
Maximum Permanent set = 0.000"

Positive Pressure Results

Specimen No. 3C (Inward) Acting

Maximum deflection = 0.015"
Maximum Permanent set = 0.004"

Negative Pressure Results
Specimen No. 1C (Outward) Acting
 Maximum deflection = 0.019"
 Maximum Permanent set = 0.005"

Negative Pressure Results
Specimen No. 2C (Outward) Acting
 Maximum deflection = 0.008"
 Maximum Permanent set = 0.002"

Negative Pressure Results
Specimen No. 3C (Outward) Acting
 Maximum deflection = 0.019"
 Maximum Permanent set = 0.004"

Note: Each specimen showed no resultant failure or distress. Each specimen passed criteria as stated in The South Florida Building Code Chapter 23 and Protocol PA 203-94.

TESTING COMPLETED: 03-21-97

Maximum positive pressure = 65.0 psf
 Maximum negative pressure = 65.0 psf

Note: At the conclusion of all testing, no openings or tears in the glazing with 3M Scotchshield Ultra film or any damage was observed in each of the three (3) specimens.

A4. Comparison Impact Results (film -v- no film)

Note: At this point in testing, it was decided to have two (2) specimens tested under the following conditions.

- Specimen No. 1 - Original specimen without 3M Scotchshield Ultra Film.
Specimen No. 2 - Original specimen with 3M Scotchshield Ultra Film.

The following results were obtained using three (3) 5/8" diameter steel balls simultaneously at 130 ft. per second.

- Specimen No. 1 - Glass shattered and fell out, completely leaving envelope open to atmosphere
Specimen No. 2 - Glass shattered, glazing area remained adhered to 3M Scotchshield Ultra Film. Envelope remained totally sealed and intact.

Special Note: At no point in testing did the 3M Scotchshield Ultra Film show any cohesive failure.

Testing witnessed by: Mr. Barry Portnoy, Professional Engineer

Mr. Michael Lane (NCTL)

Mr. John Williams (NCTL)

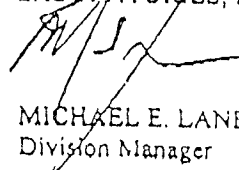
Mr. Paul Loomis (NCTL)

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