

HURRICANE ENGINEERING & TESTING INC.

Computer Controlled Product Testing & Design.

.....Wind Load Analysis

Large Missile Impact & Cyclic Wind Pressure Tests (SBCCI-SSTD 12-99 ASTM E-1886 & ASTM E-1996) (TAS 201/203, PA 201/203)

June 23, 2004

REPORT NUMBER: HETI-04-1907

MANUFACTURER: Wayne-Dalton Corporation.
3395 Addison Dr., Pensacola, FL 32514.

TEST LOCATION: Hurricane Engineering & Testing Inc.
6120 NW 97 AVE, Miami, FL 33178.

LAB. CERT. NUMBER: 02-0415.01 (MIAMI-DADE COUNTY).

PRODUCT: Fabric-Shield™ Storm Panel, with Center Seam

PRODUCT DESCRIPTION: 0.037" thick PVC Coated Woven Polyester fabric.
(Reference Tensile Test Reports: HETI-04-T224).

PRODUCT SIZE: 62 7/8" w x 110 7/8" h

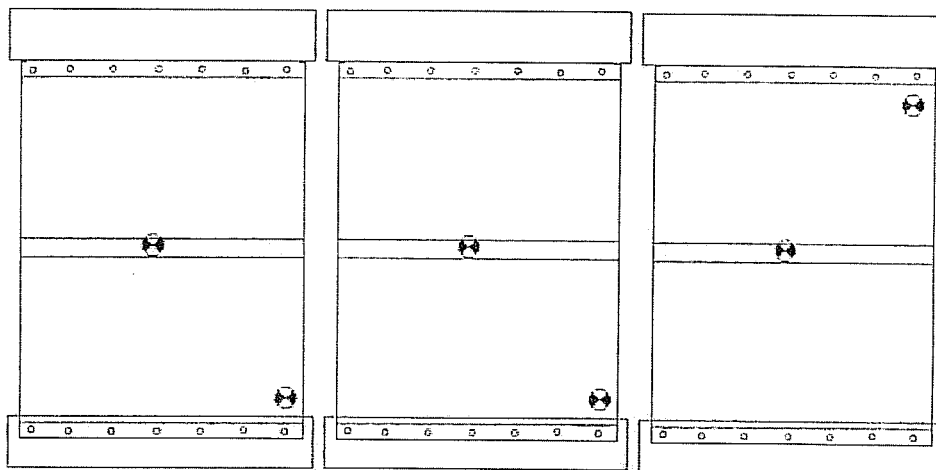
DESIGN LOADS (psf): +62, -60

DRAWING NUMBER: EX-04382, EX-04383, EX-04384, EX-04385 dated 07/14/2003, and EX 04420
dated 08/04/04 by Wayne-Dalton Corporation

NOTE: HETI stamped drawing is an integral part of this report.

TEST WITNESSED BY: Syed Waqar Ali, Ph. D. (HETI)
Dr. Nasreen K. Ali, E.I. (HETI)

WITNESSING ENGINEER: Mr. Rafael E. Droz-Seda, P.E. (HETI)



Impact Locations

6120 NW 97th Avenue, Miami, Florida 33178 • Phone 305-597-5590 • Fax 305-597-7023
www.hurricanetesting.com

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8/11/04

Construction Details

PRODUCT Fabric-Shield™ Storm Panel with Center Seam

PRODUCT SIZE 62 7/8" w x 110 7/8" h

Opening Size (Installed at 90°)

Sample 1: 63" w x 104" h

Sample 2: 63" w x 107" h

Sample 3: 63" w x 110" h

Track Extrusions

Drawing No.	COMPONENT	OVERALL DIMENSION (INCHES)	MAX. WALL THICKNESS (INCHES)	Material
EX-04383	Studless Angle Track	2.006 x 1.675	0.090	6063-T6
EX-04384	Stucco F-Track	1.487 x 0.496	0.090	6063-T6
EX-04385	Studded Angle	2.000 x 2.000	0.090	6063-T6
EX-04382	Studless Flat Track	1.675 x .373	0.090	6063-T6

Fabric Material

A 0.037" PVC coated woven polyester fabric.

Storm Panel Construction

Two pieces of PVC coated woven polyester fabric were cut to 62 7/8" w x 60 1/2" h. A 1 5/8" overlap at center was welded, the top and bottom edge was folded twice creating a 3X fold and welded to create 62 7/8" x 110 7/8" panel. The finished edge on top and bottom was 2" wide.

Grommets

(6) 1/2" hole size x 1.05" flange DIA X 0.017" thick brass, trade size#4 grommet and grommet washer installed @12" O.C and at 1 7/16" from vertical edge along the top and (6) along the bottom of the fabric. The center of the grommets was 1 3/8" from edge of the fabric.

Attachment of Fabric to Track

Sample 1-2: The fabric was attached to the tracks using 1/4"-20 x 3/4" long square head fastener slid into the track, which were passing through the grommet holes and secured with a 1/4"-20 washer wing nut.

Sample 3: The fabric was attached to the tracks using 1/4"-20 x 3/4" long square head fastener slid into the track on one side and 1/4"-20 x 3/4" stud press fit into the studded angle on the other side. The fasteners were passing through the grommet holes and secured with a 1/4"-20 washer wing nut.

INSTALLATION

Sample 1

SUBSTRATUM 2000 psi Hollow Masonry Blocks.

Left Track: Studless Flat Track

Right Track: Stucco F-Track

Location & Type	Fastener Type	Spacing	Quantity
Left End, Wall Mount (<i>Face Mount</i>)	1/4" x 1 3/4" Elco Tapcon	1 7/16" from end and (8 1/2"±1/8") O.C. & 2 1/2" from edge of substrate	8
Right End, Wall Mount (<i>Face Mount</i>)	1/4" x 1 3/4" Elco Tapcon	1 7/16" from end and (8 1/2"±1/8") O.C. & 2 1/2" from edge of substrate	8

Sample 2

SUBSTRATUM 2732 psi Concrete on both sides

Left Track: Stucco F-Track

Right Track: Studless Angle Track

Location & Type	Fastener Type	Spacing	Quantity
Right End, Inside Mount	1/4" x 1" SS Sidewalk bolt (All-Point Solid Set 1/4-20 Anchor)	1 7/16" from end and (8 1/2"±1/8") O.C. & 2 1/2" from edge of substrate	8
Left End, Wall Mount (<i>Face Mount</i>)	1/4" x 1 3/4" Elco Tapcon	1 7/16" from end and 12" O.C. & 2 1/2" from edge of substrate	6

Sample 3

SUBSTRATUM 2732 psi Concrete on both sides

Left Track: Studless Angle Track

Right Track: Studded Angle

Location & Type	Fastener Type	Spacing	Quantity
Left End, Inside Mount	1/4"-20 Female Panelmate Anchor	1 7/16" from end and (12"±1/8") O.C. & 2 1/2" from edge of substrate	6
Right End, Inside Mount	1/4" x 1" SS Sidewalk bolt (All-Point Solid Set 1/4-20 Anchor)	1 7/16" from end and (8 1/2"±1/8") O.C. & 2 1/2" from edge of substrate	8

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Test Results

Large Missile Impact Test

Impact Location	Speed (fps)	Maximum Deflection (in)	Observations
Sample 1			
Center	50	13 1/2	No penetration or rupture.
Corner	50	6 7/8	No penetration or rupture.
Sample 2			
Center	50	13 1/4	No penetration or rupture.
Corner	50	8	No penetration or rupture.
Sample 3			
Center	50	14	No penetration or rupture.
Corner	50	8 1/2	No penetration or rupture.

The samples were impacted with a #2 Southern Yellow Pine S4S, 2 x 4 missile, 9 lbs 96" long. The deflections were rounded to nearest 1/8". Installed fabric was not in tension prior to testing.

Cyclic Wind Pressure Test Results

Sample 1

Cycles	Pressure (psf)	Deflection (in)	Set (in)	Recovery (%)	Duration (sec)
Positive Pressure Cycles					
3500	+31	----	----	----	1
300	+37	----	----	----	1
600	+50	----	----	----	1
100	+62	----	----	----	1
Negative Pressure Cycles					
50	-60	----	----	----	1
1050	-48	----	----	----	1
50	-36	----	----	----	1
3350	-30	----	----	----	1

Sample 2

Cycles	Pressure (psf)	Deflection (in)	Set (in)	Recovery (%)	Duration (sec)
Positive Pressure Cycles					
3500	+31	----	----	----	1
300	+37	----	----	----	1
600	+50	----	----	----	1
100	+62	----	----	----	1
Negative Pressure Cycles					
50	-60	----	----	----	1
1050	-48	----	----	----	1
50	-36	----	----	----	1
3350	-30	----	----	----	1

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Sample 3

Cycles	Pressure (psf)	Deflection (in)	Set (in)	Recovery (%)	Duration (sec)
Positive Pressure Cycles					
3500	+31	----	----	----	1
300	+37	----	----	----	1
600	+50	----	----	----	1
100	+62	----	----	----	1
Negative Pressure Cycles					
50	-60	----	----	----	1
1050	-48	----	----	----	1
50	-36	----	----	----	1
3350	-30	----	----	----	1

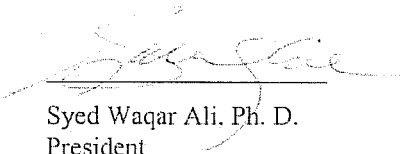
Conclusion

The sample was tested and passed in accordance with Miami-Dade County PA 201, 203, SBCCI SSTD 12-99, and ASTM E 1996 & ASTM E 1886. The samples were intact, operable and all parts were securely in place at the conclusion of each test.

NOTE: The above results were obtained using the designated test methods, which indicates compliance with the performance requirements of the referenced specifications. This report does not constitute certification of the specimens tested.

STATEMENT OF INDEPENDENCE

The Hurricane Engineering & Testing, Inc., does not have, nor does it intend to acquire or will acquire, a financial interest in any company manufacturing or distributing products tested or labeled by the Hurricane Engineering & Testing, Inc. Hurricane Engineering & Testing, Inc., is not owned, operated or controlled by any company manufacturing or distributing products it test or labels.


Syed Waqar Ali, Ph. D.
President


Rafael E. Droz-Seda, P.E.
Resident Engineer

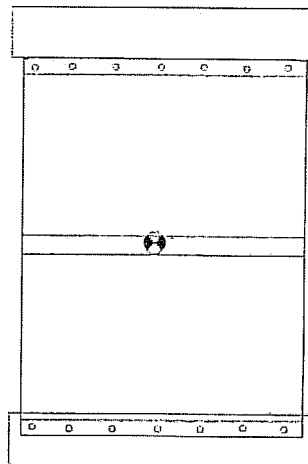
HURRICANE ENGINEERING & TESTING INC.

Computer Controlled Product Testing & Design.
.....Wind Load Analysis

Uniform Static Air Pressure Test (FBC TAS 202) (ASTM E 330-02) (Miami-Dade County Protocol PA 202-94)

June 23, 2004

REPORT NUMBER: HETI-04-1390
MANUFACTURER: Wayne-Dalton Corporation.
3395 Addison Dr., Pensacola, FL 32514.
TEST LOCATION: Hurricane Engineering & Testing Inc.
6120 NW 97 AVE, Miami, FL 33178.
LAB. CERT. NUMBER: 02-0415.01 (MIAMI-DADE COUNTY).
PRODUCT: Fabric-Shield™ Storm Panel, with Center Seam.
PRODUCT DESCRIPTION: 0.037" thick PVC Coated Woven Polyester fabric.
(Reference Tensile Test Reports: HETI-04-T224).
PRODUCT SIZE: 62 7/8" w x 110 7/8" h
DESIGN LOADS (psf): +62, -60
DRAWING NUMBER: EX-04382, EX-04383, EX-04384, EX-04385 dated 07/14/2003, and EX 04420
dated 08/04/04 by Wayne-Dalton Corporation
NOTE: HETI stamped drawing is an integral part of this report.
TEST WITNESSED BY: Syed Waqar Ali, Ph. D. (HETI)
Dr. Nasreen K. Ali, E.I. (HETI)
WITNESSING ENGINEER: Mr. Rafael E. Droz-Seda, P.E. (HETI)



⊗ Gage Location

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Construction Details

PRODUCT Fabric-Shield™ Storm Panel with Center Seam
PRODUCT SIZE 62 7/8" w x 110 7/8" h
Opening Size 63" w x 107" h (Installed at 90°)

Track Extrusions

Drawing No.	COMPONENT	OVERALL DIMENSION (INCHES)	MAX. WALL THICKNESS (INCHES)	Material
EX-04383	Studless Angle Track	2.006 x 1.675	0.090	6063-T6
EX-04384	Stucco F-Track	1.487 x 0.496	0.090	6063-T6

Fabric Material

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Storm Panel Construction

Two pieces of PVC coated woven polyester fabric were cut to 62 7/8" w x 60 1/2" h. A 1 3/4" overlap at center was welded, the top and bottom edge was folded twice creating a 3X fold and welded to create 62 7/8" x 110 7/8" panel. The finished edge on top and bottom was 2" wide.

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Attachment of Fabric to Track

The fabric was attached to the tracks using 1/4"-20 x 3/4" long square head fastener slid into the track, and were passing through the grommet holes, and 1/4"-20 washer wing nut were installed to secure the fabric.

INSTALLATION

SUBSTRATUM 2732 psi Concrete on both sides

Location & Type	Fastener Type	Spacing	Quantity
Left End, Inside Mount	1/4" x 1" SS Sidewalk bolt (All-Point Solid Set 1/4"-20 Anchor)	1 7/16" from end and (8 1/2"±1/8") O.C. & 2 1/2" from edge of substrate	8
Right End, Wall Mount	1/4" x 1 3/4" Elco Tapcon	1 7/16" from end and 12" O.C. & 2 1/2" from edge of substrate	6

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Test Results

Uniform Static Air Pressure Results

	Pressure (Psf)	Deflection at center (in)	Set (in)	Recovery (%)	Duration (seconds)
Positive Pressure					
Half test load	+47	21.50	0.00	100	30
Design Load	+62	22.19	0.00	100	30
Test Load	+93	22.90	0.00	100	30
Negative Pressure					
Half test load	-45	23.06	0.00	100	30
Design Load	-60	26.46	0.00	100	30
Test Load	-90	28.79	0.00	100	30

Uniform Load Test was performed in accordance with ASTM E330-02. A 1.25% extension in the fabric was observed at the conclusion of the test. Installed fabric was not in tension prior to testing.


Conclusion


The sample was tested and passed for structural wind load only in accordance with Miami-Dade County protocol PA 202, Florida Building Code Test Application Standard TAS 202, and ASTM E 330-02 Test Standards as indicated along with the test results. The sample was structurally intact at the conclusion of the test.

NOTE: The above results were obtained using the designated test methods, which indicates compliance with the performance requirements of the referenced specifications. This report does not constitute certification of the specimens tested.

STATEMENT OF INDEPENDENCE

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 Syed Waqar Ali, Ph. D.
 President


 Rafael E. Droz-Seda, P.E.
 Resident Engineer
 5/11/04

HURRICANE ENGINEERING & TESTING INC.

Computer Controlled Product Testing & Design,

.....Wind Load Analysis

Tensile Test

July 30, 2004

REPORT NUMBER: HETI-04-T224

MANUFACTURER: Wayne-Dalton Corporation,
3395 Addison Dr., Pensacola FL 32514

TEST LOCATION: Hurricane Engineering & Testing Inc.
6120 NW 97 AVE, Miami, FL 33178

PRODUCT: Fabric-Shield Grommet Storm Shutter.

REFERENCE TEST: Report Numbers: HETI-04-1390, HETI-03-1907

SOURCE ID: Welded PVC Coated Woven Polyester Fabric

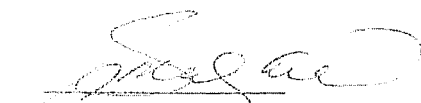
TENSILE TEST EQUIP.: ACCUTEK


COMMENT: Tested as per ASTM E 8-01e1.

Test Results

Sample No.	Width (inch)	Thickness (inch)	Area (in ²)	Ultimate Load (lbs)	Ultimate Stress (psi)	Yield Stress (psi)	Elongation (%)
1	0.4820	0.037	0.0178	289	16205	2635	19
2	0.4820	0.037	0.0178	278	15588	2804	19
3	0.4820	0.037	0.0178	278	15588	2411	21
Average				282	15794	2617	20

Samples collected from test sample in above referenced test reports.


Syed Waqar Ali, Ph. D.
President


Rafael E. Droz-Scda, P.E.
Resident Engineer

8/11/04