



**Force Engineering & Testing, Inc.**

19530 Ramblewood Drive  
Humble, Texas 77338  
Phone: (281) 540-6603  
Fax: (281) 540-9966  
www.forceengineeringtesting.com

Project Number : 432-0016T-11

Test Report Date : May 11, 2011

Test Material: 16 mm Polycarbonate Hurricane Storm Panels with K5HY  
Aluminum Union

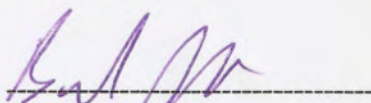
Test Protocol : ASTM E 330, E 1886 & E 1996

Test Location : Force Engineering & Testing, Inc.  
19530 Ramblewood Drive  
Humble, TX 77338

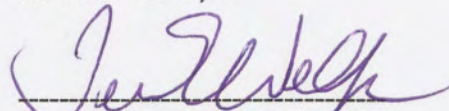
Miami Dade County Lab Certification No: 05-1122.13

## **16mm Polycarbonate Hurricane Storm Panels Covering a 7'x7' Opening**

Report by:

  
Brandon Jasek, P.E.

Reviewed by:

  
Terrence E. Wolfe, P.E.



ACCREDITED  
LABORATORY

ACCREDITED TL-417



ACCREDITED  
LABORATORY



ACCREDITED  
LABORATORY



TEXAS DEPARTMENT  
OF INSURANCE  
ACCREDITED LABORATORY

Project Number: 432-0016T-11

**TEST DATES:**

April 7-May 6, 2011

**TEST SPECIMEN:**

***Installer and Material Provider:***

Hurripanel Fasteners  
15502 Hwy 3, Suite 401  
Webster, TX 77598

***Polycarbonate Hurricane Storm Panels:***

Manufacturer: Polygal, Inc.  
9405 D. Ducks Lane  
Charlotte, NC 28273  
Model: 16 mm Polycarbonate Structural Sheet (PCSS) triple wall.  
Dimension: 40 ¾" wide x 92" long x 16 mm thick.

***Panel Anchors:***

Manufacturer: Elco Construction Products  
1301 Kerr Drive  
Decorah, Iowa 52101  
Model: PANELMate Pro TVAS #ENT737 (Hurripanel Fastener #K21CBY): Carbon Steel, 7 3/8" overall length w/ 14-10 thread 3" long on penetration end and ¼-20 threaded stud 1-1/8" long on exposed end. Anchors attached to 2x4 wood studs.  
PANELMate Female TVAS #ENW737 (Hurripanel Fastener #K29CBY): Carbon Steel, 7 3/8" overall length w/ 14-10 thread 3" long on penetration end and ¼-20 internal threads ½" deep on exposed end. Anchors attached to 2x4 wood studs.

***Aluminum Union:***

Manufacturer: Non-Ferrous Extrusions  
8410 Hempstead Road  
Houston, TX 77008  
Model: K5HY: 6063-T5 Aluminum, 3.08" wide x 0.89" deep x 0.125" thick x 92" long. Union attached to anchor w/ ¼"-20 x 1-1/2" stainless steel bolt with 1-1/8" OD stainless steel washer bonded washer.  
The aluminum unions were attached to the panels w/ ¼-20 x 1-1/2" with 1-1/8" OD stainless steel bonded washer at 12" O.C. Max.

Project Number: 432-0016T-11

**Tested Substrate:**

Structural: 2x4 SYP #2 wood framing. Double studs at jambs  
7/16" OSB sheeting attached to studs

Brick Veneer: Brick: King size brick, 2 5/8"x2 5/8"x9 1/2"  
Mortar: 1 part Holcim Masonry Cement Type N to 3 parts  
masonry sand.  
Brick ties: S-22 wall tie 22 Ga., (2) ties per brick row at every  
other brick row attached to wood framing with (1) 6d x 2"  
galvanized nail.

**Substrate Assembly:**

A 7'x 7' opening was creating using 2x4 SYP #2 wood framing. The wood framing was nailed together w/ (2) 10d galvanized nails per connection. The jambs of the opening had double studs. The framing was then sheeted with 7/16" OSB using 6d nails at 12" O.C. int./ext. The brick was then layed leaving a 2" gap between brick and OSB. The brick was tied to the OSB with (2) brick ties per brick row at every other brick row.

**Storm Panel Installation:**

Two 16mm thick panels were used to cover the opening running horizontal. The panels were 40 3/4" wide x 92" long with 4" on each side of the opening to overlap the brick. The K5HY union was used on the bottom of the lower panel, between the two panels and on the top of the upper panel. The panel must sit in the union 1.477". The unions were attached to panels w/ 1/4"-20 x 1-1/2" with 1-1/8" OD stainless steel bonded washer at 12" O.C. max. The PANELMate Female TVAS anchors were used at every union attachment. The unions were attached to the anchors w/ 1/4"-20 x 1-1/2" stainless steel bolt with 1-1/8" OD stainless steel bonded washer.

Force Engineering &  
Testing, Inc.  
State of Texas  
Reg. # F-4611

On the left side of the opening, PANELMate Female TVAS anchors were installed thru the brick into the 2x4 wood studs w/ min. 2" penetration. A 1/4" hole was drilled through the brick then a 1/2" x 3/4" hole drilled to countersink the anchors. The holes were drilled 2" from the edge of the brick, (1) hole for each union, (4) holes between the unions maximum 12" O.C. The panel was attached to anchor w/ 1/4"-20 x 1-1/2" stainless steel screw with a 1/4"-20 washer base wing nut and 1-1/8" OD stainless steel bonded washer.



5/19/11

Project Number: 432-0016T-11

On the right side of the opening, PANELMate Pro TVAS anchors were installed thru the brick into the 2x4 wood studs w/ min. 2" penetration. A ¼" hole was drilled through the brick. The holes were drilled 2" from the edge of the brick, (1) hole for each union, (4) holes between the unions maximum 12" O.C. The panel was attached to anchor w/ ¼-20 washer base wing nut and 1-1/8" OD stainless steel bonded washer.

**Large Missile Impact Test (ASTM E 1996-04):**

Missile: Level D, #2 Southern Yellow pine 2x4, length 93", weight 9.25 lbs

**Specimen A**

<b>Impact Location</b>	<b>Missile Velocity (ft/sec)</b>	<b>Deflection At Impact Location During Testing</b>	<b>Permanent Deflection After Testing</b>
Center	50.1	3.790"	0.100"

**Specimen B**

<b>Impact Location</b>	<b>Missile Velocity (ft/sec)</b>	<b>Deflection At Impact Location During Testing</b>	<b>Permanent Deflection After Testing</b>
6" from bottom left corner	49.8	3.125"	0.500"

**Specimen C**

<b>Impact Location</b>	<b>Missile Velocity (ft/sec)</b>	<b>Deflection At Impact Location During Testing</b>	<b>Permanent Deflection After Testing</b>
6" from upper right corner	50.0	2.875"	0.375"

No failures occurred.



Project Number: 432-0016T-11

**Cyclic Wind Pressure Test (ASTM E 1886-04):**

Deflection at center of the bottom panel

Specimen A: Design Load + / - 45.0 psf

**Inward Acting Pressure**

Pressure Range		Number of Cycles	Deflection	Results
Low	High			
12	30	3500	XX	Passed
0	36	300	XX	Passed
30	48	600	XX	Passed
18	60	100	3.9375"	Passed

**Outward Acting Pressure**

Pressure Range		Number of Cycles	Deflection	Results
Low	High			
18	60	50	4.5000"	Passed
30	48	1050	XX	Passed
0	36	50	XX	Passed
12	30	3350	XX	Passed

The specimen showed no failures after 9000 cycles.

Specimen B: Design Load + / - 45.0 psf

**Inward Acting Pressure**

Pressure Range		Number of Cycles	Deflection	Results
Low	High			
12	30	3500	XX	Passed
0	36	300	XX	Passed
30	48	600	XX	Passed
18	60	100	4.7500"	Passed

**Outward Acting Pressure**

Pressure Range		Number of Cycles	Deflection	Results
Low	High			
18	60	50	4.9375"	Passed
30	48	1050	XX	Passed
0	36	50	XX	Passed
12	30	3350	XX	Passed

The specimen showed no failures after 9000 cycles.

Project Number: 432-0016T-11

Specimen C: Design Load + / - 45.0 psf

**Inward Acting Pressure**

Pressure Range				
Low	High	Number of Cycles	Deflection	Results
12	30	3500	XX	Passed
0	36	300	XX	Passed
30	48	600	XX	Passed
18	60	100	4.8750"	Passed

**Outward Acting Pressure**

Pressure Range				
Low	High	Number of Cycles	Deflection	Results
18	60	50	5.0625"	Passed
30	48	1050	XX	Passed
0	36	50	XX	Passed
12	30	3350	XX	Passed

The specimen showed no failures after 9000 cycles.

Project Number: 432-0016T-11

**STATIC AIR PRESSURE TEST (ASTM E 330-02):**

Specimen D: Design Load = + / - 45.0 psf

**Positive Loading:**

	Pressure (psf)	Hold Time (sec)	Deflection #1	Deflection #2	Deflection #3
Pre-Load (.5xDP)	22.5	10	2.470	2.113	2.479
	0	60	0.000	0.000	0.000
Design Pressure	45	10	3.969	3.824	3.769
	0	0	0.170	0.086	0.042

	Pressure (psf)	Hold Time (sec)	Deflection #1	Deflection #2	Deflection #3
.5 x Test Load	33.75	10	3.320	3.224	3.311
	0	60	0.000	0.000	0.000
Test Load	67.5	10	5.422	5.433	4.939
	0	0	0.197	0.211	0.115

**Negative Loading:**

	Pressure (psf)	Hold Time (sec)	Deflection #1	Deflection #2	Deflection #3
Pre-Load ( .5xDP)	22.5	10	3.118	2.649	2.833
	0	60	0.000	0.000	0.000
Design Pressure	45	10	3.972	3.637	3.647
	0	0	0.060	0.054	0.062

	Pressure (psf)	Hold Time (sec)	Deflection #1	Deflection #2	Deflection #3
.5 x Test Load	33.75	10	3.715	3.353	3.382
	0	60	0.000	0.000	0.000
Test Load	67.5	10	4.898	4.821	4.654
	0	0	0.095	0.097	0.081

The specimen showed no failures.

Deflection #1: Center of bottom panel

Deflection #2: Center of middle aluminum union

Deflection #3: Center of top panel

Project Number: 432-0016T-11

Note: During this test, tape and plastic were used to seal against air leakage. The tape and plastic had no restrictive influence on the test.

**STATEMENT OF INDEPENDENCE:**

Force Engineering & Testing, Inc. or any persons employed by them do not have any financial interest in Polygal, Inc., Elco Construction Products, Non-Ferrous Extrusions or Hurripanel fasteners.

Force Engineering & Testing, Inc. is not owned, operated or controlled by Polygal, Inc., Elco Construction Products, Non-Ferrous Extrusions or Hurripanel fasteners.



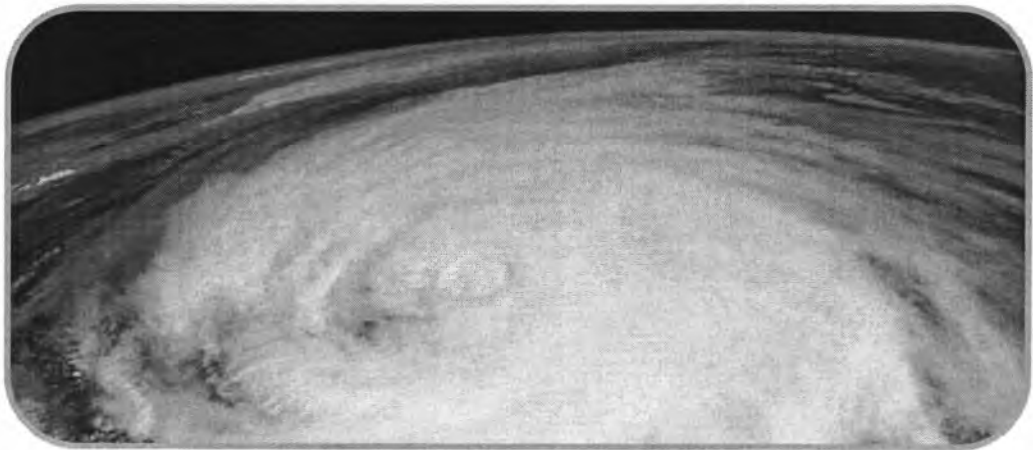
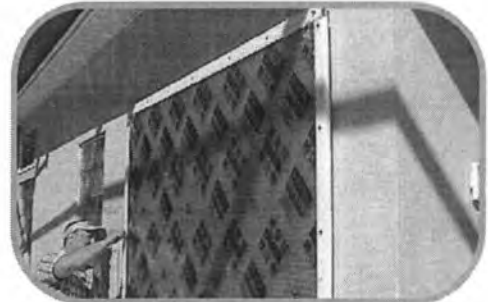
## Appendix

# Polygal Stormguard Hurricane Protection

## Home Hurricane Protection Windows and Doors

Tested and certified to meet the demanding guidelines of the State of Florida Hurricane tests FBC-2004-TAS 201,202,203 2003ICC, IRC, IBC ASTM E 1886-02, E 1996-02, ASTM E 330-02 by an independent testing laboratory when installed according to Polygal instructions. Polygal Stormguard System, Stormguard 3 and Stormguard 3D Hurricane Shutter Systems are a mid-range cost alternative for home/apartment dwellers who want to rely on a certified HVHZ (including Dade & Broward counties) hurricane protection system.

- Tested & Certified
- Allows natural light while protecting windows and doors
- Off the shelf components eliminating long order lead times
- Affordable and easy to install
- Light weight and made from high impact polycarbonate sheet.
- Polygal leading edge technology



The data in this advertisement are provided in good faith and constitute general information without commitment, and no warranty is given or implied. Polycarbonate is a combustible thermoplastic that complies with various international standards, as customary in each country. Avoid exposure to excessive heat or aromatic cleaning solvents. Normal fire precautions should be taken to protect against combustion.

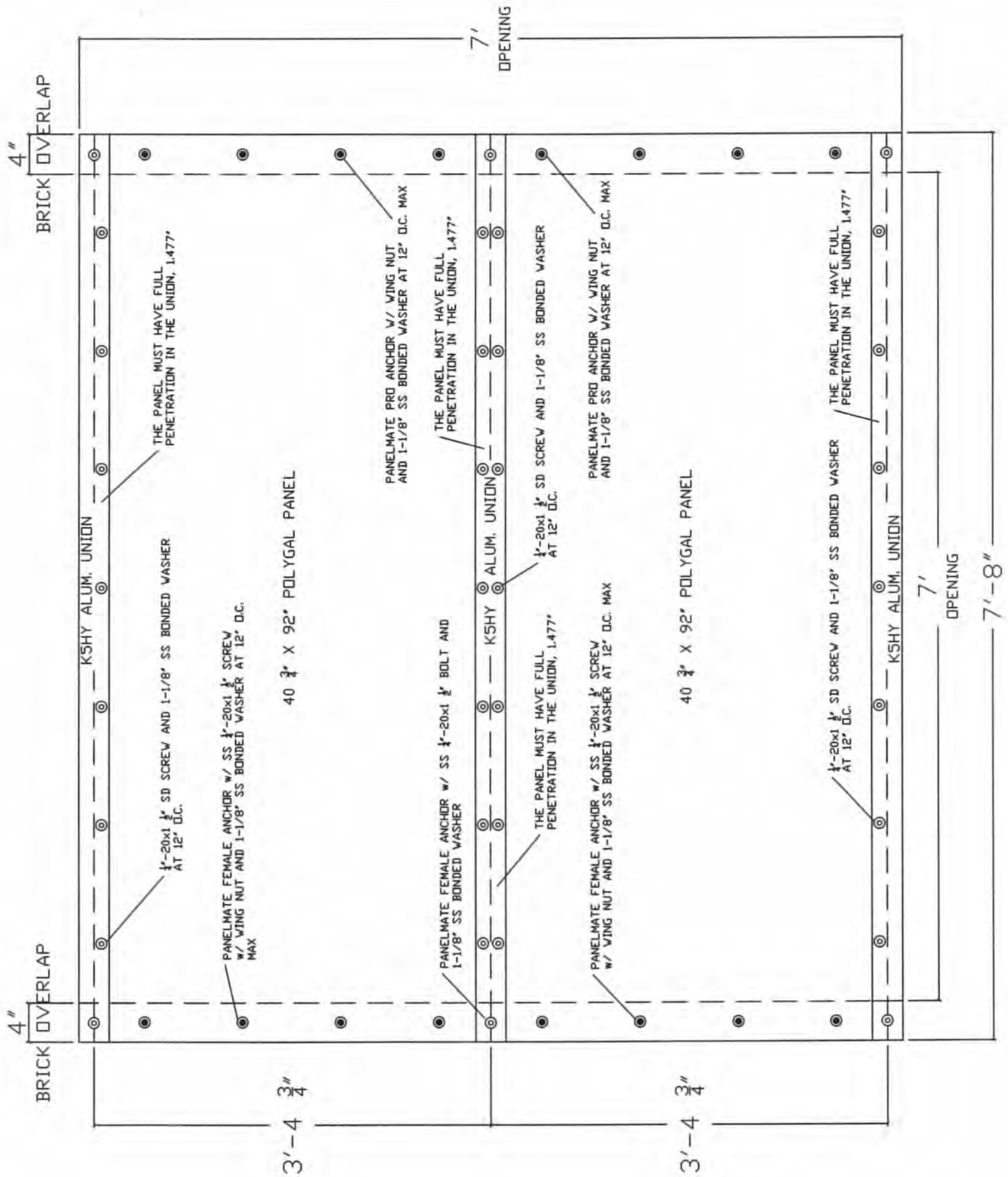
Polygal is the leading manufacturer of structured Polycarbonate panels, and is known throughout the world for the outstanding quality of its products. Polygal was the first manufacturer in the world to create structured Polycarbonate panels, and over the last 30 years, has developed and produced a broad spectrum of these products, which are successfully covering a full array of structures worldwide.

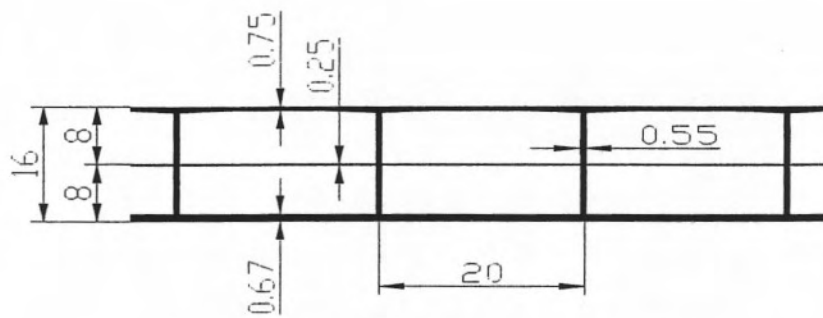
POLYGAL Plastics Industries Ltd. Ramat Hashofet 19238, Israel  
Tel: 972-4-9596222, Fax: 972-4-9596284, E-mail: sales@polygal.co.il  
Web site: www.polygal.com

POLYGAL Inc., P.O. Box 410592, Charlotte, NC 28241 USA  
Tel: 1 704 588 3800, Fax: 1 704 588 7400, E-mail: usasales@polygal.co.il  
Web site: www.polygal.com

Technical Support E-mail: techsupport@polygal.com

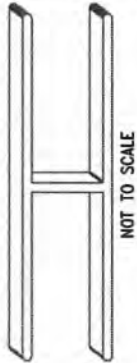




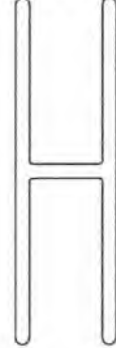
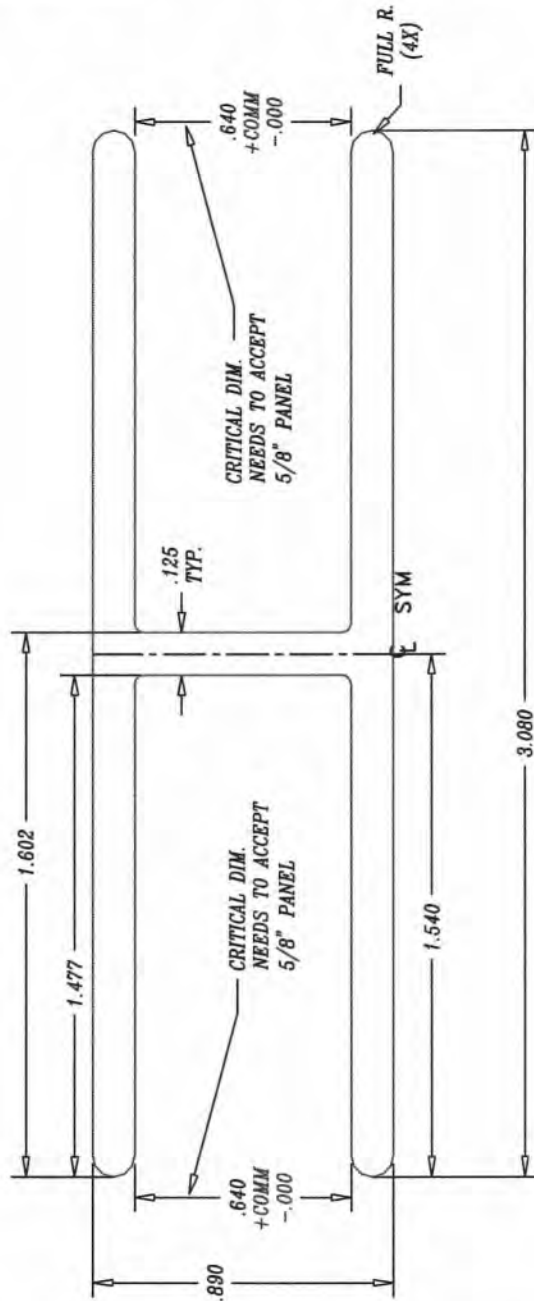


*Polygal SG 16mm*

STANDARD COMMERCIAL TOLERANCES APPLY UNLESS NOTED.  
TYP. WALL THICKNESS .125 UNLESS OTHERWISE NOTED.  
BREAK CORNERS AT R.010 UNLESS OTHERWISE NOTED.



NOT TO SCALE



ACTUAL SIZE

NON-FERROUS EXTRUSION

8410 HEMPSTEAD RD.

HOUSTON, TX 77008

PHONE: (713) 669-5807 FAX: (713) 669-4254

CUSTOMER

HURRIPANEL

DESCRIPTION

CONNECTION CLIP

MATERIAL

6063-T5

EST. AREA

8.44

EST. WT/FT

1.013

EST. PERIMETER

13.593

BREAK SHARP CORNERS AT

.010

UNSP. WALL THK.

.125

SCALE

3X

FEDER

1/2" RECESS

DIE TYPE

9X1 1/2" - 1-HOLE

BACKER TYPE

9X2 3/4" - 1-HOLE

BOLSTER

4603

CIRCLE SIZE

3.185

DRAWN BY:

RLJ.

DATE

01/16/07

DATE

REVISION

NFO # HUPA110606-1

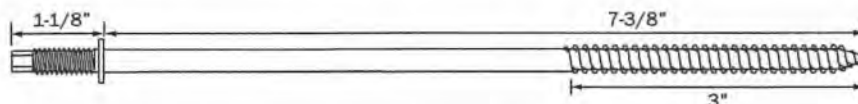
DIE NO. 7173

## PanelMate® Pro TVAS (Through-Veneer Anchoring System)

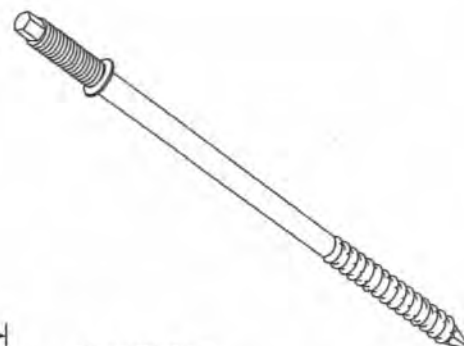
The first anchoring system designed specifically to attach hurricane shutters through brick to a building's structural members.

### Key Features & Benefits

- Available in both 18-8 stainless steel and carbon steel with silver Stalgard® finish
- 1/4-20 threaded stud has 1-1/8" standardized length
- 14-10 thread is 3" long to provide installation flexibility



Catalog Number		Fastener Length	Overall 1/4-20 Stud Length	Thread Length
Carbon Steel	18-8 Stainless Steel			
ENT737	ENT738	7.375"	1-1/8"	3"



### Installation:

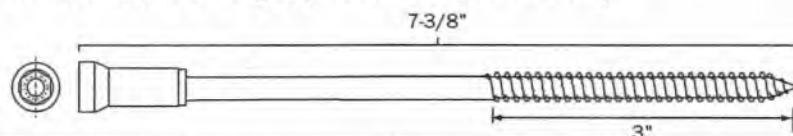
1. Drill a clearance hole through the brick with a 1/4" ANSI masonry drill bit.
2. PanelMate Pro installation tools can be used to seat the fastener.

## PanelMate® Female TVAS

Designed specifically to provide a non-protruding surface to attach hurricane shutters through brick to a building's structural members

### Key Features & Benefits

- Available in both 18-8 stainless steel and carbon steel with silver Stalgard® finish
- Head has 1/4-20 internal threads to a depth of 1/2"
- 14-10 thread is 3" long to provide installation flexibility



Catalog Number		Fastener Length	Thread Length
Carbon Steel	18-8 Stainless Steel		
ENW737	ENW738	7.375"	3"



### Installation

Panelmate® Female TVASanchors can be installed with the same installation components used with Panelmate® Female I.D. anchors.



# Brynof Construction Products

A Division of Brynof Manufacturing, Inc.

5459 Eleventh Street  
Rockford, Illinois 61109

toll free 877-237-4554

p 815.873.8878

f 815.873.8898

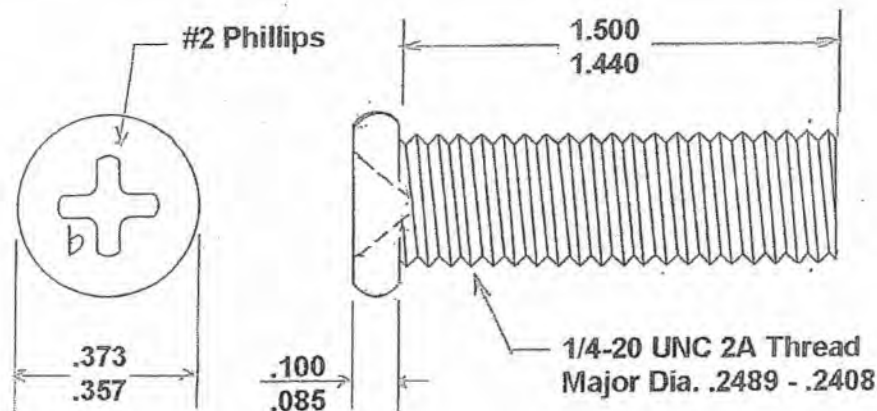
[www.brynofconstructionproducts.com](http://www.brynofconstructionproducts.com)

## Specification Sheet

### Brynof Catalog No. NZ700

<b>Description:</b>	<b>1/4-20 X 1-1/2" Wing Bolt Fastener</b>
<b>Material:</b>	<b>18-8 Stainless Steel</b>
<b>Diameter:</b>	<b>1/4"</b>
<b>Finish:</b>	<b>Plain Finish Passivated</b>
<b>Drive/Head Style:</b>	<b>#2 Phillips Pancake Head</b>
<b>Origin:</b>	<b>Manufactured by Brynof Construction Products in Rockford, Illinois in ISO 9001: 2008 Plant</b>
<b>Head mark:</b>	<b>Brynof registered lower case "b"</b>
<b>Specifications:</b>	<b>Threads: 1/4-20 UNC per ASME B1.1 2002</b>

**Manufactured exclusively for Hurripanel Fasteners Inc. Webster, TX**



**Made in USA**





FASTENER SERVICES, LLC  
9911 SOUTH 78<sup>TH</sup> AVENUE  
HICKORY HILLS, IL 60457

PHONE: (708) 599-9947

FAX: (708) 599-9943

EMAIL: thehawk1@ameritech.net

Part #

10 x 1/8 Stainless Steel Banded

**STAINLESS STEEL SPECIFICATION**

Washer

TABLE 1: TYPICAL PROPERTIES OF  
STAINLESS STEEL

ASTM A240/AISI TYPE 304  
UNS - S30400  
A2 - 18/8

---

TYPICAL MECHANICAL PROPERTIES

---

TENSILE STRENGTH: 85,000 PSI (586 MPa)  
YIELD STRENGTH: 35,000 PSI (241 MPa)  
ELONGATION: 55%  
ANNEALED

---

CHEMICAL COMPOSITION LIMITS

---

	C	Mn	P	S	Si	Cr	Ni
MINIMUM	0.08	2.00	0.045	0.030	1.00	18.00	8.00
MAXIMUM	Max.	Max.	Max.	Max.	Max.	20.00	10.50

\* SPECIFICATION SUBJECT TO CHANGE WITHOUT NOTICE

*W. J. J. J.*  
5-13-11

PHONE: (708) 599-9947

FAX: (708) 599-9943

EMAIL: thehawk1@ameritech.net

## **BLACK EPDM SPECIFICATION**

**TABLE 1: TYPICAL PHYSICAL PROPERTIES OF  
EPDM KV KL70-587**

ASTM 02000 M3BA710B			B <sub>13</sub>	C <sub>12</sub>	F <sub>19</sub>
PROPERTY	VALUE		TEST METHOD		
BASE MATERIAL	CROSS –LINKED EPDM ETHYLENE PROPYLENE DIENE TERPOLYMER		N/A		
COLOR	BLACK		N/A		
TEST LEVEL	3		GRADE		
TEST TEMPERATURE	B	100°C	TYPE		
VOLUME SWELL	A	NO REQUIREMENT	CLASS		
DUROMETER HARDNESS	70 + OR – 5		ASTM D2240		
TENSILE STRENGTH	10 mpa (1450 PSI MIN)		ASTM D412		
ULTIMATE ELONGATION	250% MINIMUM		ASTM 412A/c		
HEAT RESISTANCE	HEAT AGING 70 hrs @ 100°C CHANGE/HARDNESS MAXIMUM + OR – 10 PTS CHANGE/TENSILE MAXIMUM + OR – 25% CHANGE/ULTIMATE ELONGATION MAXIMUM –25%		ASTM D573		
COMPRESSION SET	MAXIMUM 25%		ASTM 395B		
OZONE RESISTANCE	NO OBSERVED EFFECT (70 hrs @ 50 pphm) 100% QUALITY RETENTION FACING		ASTM D1171		
LOW TEMPERATURE BRITTLINESS	NON-BRITTLE 3 min @ -55°C		ASTM D2137		
UV RESISTANCE	EXCELLENT				
RESISTANCE TO AGING	EXCELLENT				
NON-STAINING	PASS				

\* SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

**Washer Base Wing Nut**

¼-20 washer base wing nut

7/8" diameter washer base

Material: Zamac 3 w/ nickel plating

Manufacturer: Dynacast

**Stainless Steel Bolts**

¼-20 x 1-1/2" Bolt

11/16" Non- threaded, 13/16" threaded with 20 threads per inch

Stainless Steel 316

## Photos



**BRICK WALL WITH 7'x7' OPENING**



**PANELMate FEMALE TVAS ANCHOR INSTALLED**





**PANELMate PRO TVAS ANCHOR INSTALLED**



**PANELS INSTALLED**