



**MANUFACTURER INFORMATION**

- 1.0 NAME OF APPLICANT:** Transparent Protection System, Inc.  
6643 42<sup>nd</sup> Terrace North  
West Palm Beach, FL 33407  
888.447.8320
- 2.0 CONTACT PERSON:** Scott Kuntz
- 3.0 HTL TEST NOTIFICATION #:** N/A
- 4.0 HTL LAB CERTIFICATION:** Miami-Dade County (03-0507.09); Florida Building Code (TST1527); AAMA; WDMA; Keystone Certifications
- 5.0 REPORT INFORMATION:**

Specimen #	Test Date
7	1/14-17/05
8	1/25/05
9	1/26/05
10	1/18/05
11	1/18/05
12	1/19/05

**PRODUCT IDENTIFICATION**

- 6.0 Product Type:** Polycarbonate Hurricane Shutter Panels
- 7.0 Model Number:** Clear Guard Polycarbonate Storm Panels
- 8.0 Performance Class and Overall Size:**

Specimen #	Performance Class	Overall Size
7	+/-104 psf	41" x 45"
8		
9		
10	+/-120 psf	
11		
12		

- 9.0 Configuration:** See Transparent Protection System, Inc. Drawing #03-155-1343b, sheet 1 for an elevation of this unit.
- 10.0 Drawing:** This test report is incomplete without the attached Transparent Protection System, Inc. Drawing #03-155-1343b, sheets 1 thru 3 each bearing the raised seal of Hurricane Test Laboratory, LLC.
- 11.0 Source of Sample:** Sample provided by Transparent Protection System, Inc.

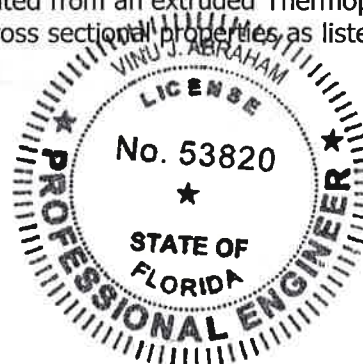
**PRODUCT DESCRIPTION**

- 12.0 DETAILED DESCRIPTION:**
- 12.1 Panel:** Each sample tested as part of this test program consisted of three (3) Storm Panels that were interlocked together. Each panel was fabricated from an extruded Thermoplastic Polycarbonate Resin plastic sheet having overall cross sectional properties as listed in the following table:

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4/29/05

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Description	Item #	Overall Cross Section
Storm Panel	1	2.000" (h) x 15.250" (w) x 0.100" (t)

The following procedures (typical) were utilized when assembling the shutter sample:  
**Storm Panel Attachment:** Each Storm Panel was either direct mounted to the opening as listed in the installation section of this test report or was in-directly mounted to the opening using some or all of the accessories listed in Section 12.2 of this report. Each Storm Panel is mechanically fastened to the mounting accessories using 1/4"-20 x 3/4" studs and a keyhole washer (Item #8) and a washered wingnut (Item #9) located in each valley of the shutter.

**12.2 Storm Panel Mounting Accessories:** Some or all of the following (typical) accessories were utilized in the testing of the Storm Panel samples:

Description	Item #	Overall Cross Section	Aluminum Alloy
"H" Header	10	3.813" x 2.250" x 0.067"	6063-T6
Stud Angle	3	2.000" x 2.000" x 0.125"	6063-T6
Build Out "F" Track	5	1.660" x 3.375" x 0.090"	6063-T6
Build Out Stud Angle	3	2.000" x 2.000" x 0.125"	6063-T6
Assembly	7	2.000" x 5.000" x 0.125"	6063-T6
"F" Track	6	1.675" x 0.380" x 0.095"	6063-T6
Reverse "F" Angle	4	2.000" x 2.000" x 0.092"	6063-T6

**Mounting Accessory Attachment:** See the installation section of this report for details.

## PRODUCT INSTALLATION

**13.0** The following section of this report details how each specimen was installed into the provided openings:

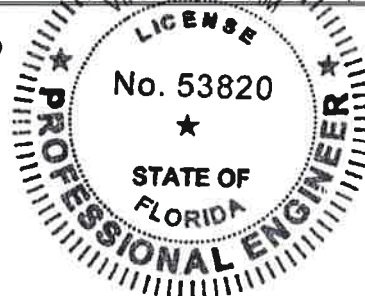
Mounting Style	Substrate	Anchor Type	Anchor Schedule	Specimen #
"H" Header	Wood	1/4" x 2-12" Lag Screw (2-3/32" min. embed.)	2" from each end and 10" on center thereafter - 5 fasteners total.	7
		5/8" x 1/2" wood bushings		8
	CMU	1/4" x 2" ELCO Male Panelmate (1-1/4" min. embed.)		9
Stud Angle	CMU	1/4" x 2" ELCO Tapcon (1-1/4" min. embed.)	2" from each end and 10" on center thereafter - 5 fasteners total.	7
	CMU	3/4" x 1/2" lead anchors		11
"F" Track	CMU	3/4" x 1/2" lead anchors	2" from each end and 10" on center thereafter - 5 fasteners total.	8
	Wood	5/8" x 1/2" wood bushings		11
Build Out "F" Track	Wood	1/4" x 2-1/2" Lag Screw (2-3/32" min. embed.)	2" from each end and 10" on center thereafter - 5 fasteners total.	10
Build Out Stud Angle Assembly	CMU	1/4" x 2" ELCO Tapcon (1-1/4" min. embed.)	2" from each end and 10" on center thereafter - 5 fasteners total.	10
Direct	CMU	1/4" x 2" ELCO Male Panelmate (1-1/4" min. embed.)	1" from each end and 6-1/2" on center thereafter - 7 fasteners total.	12

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4/29/05

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Mounting Style	Substrate	Anchor Type	Anchor Schedule	Specimen #
Reverse "F" Track	Wood	1/4" x 2" ELCO Female Panelmate (1-1/4" min. embed.)	2" from each end and 10" on center thereafter - 5 fasteners total.	9 and 12

**TEST RESULTS**

**14.0 SUMMARY OF RESULTS:**

Test Method	Test Conditions	Specimen #
Large Missile Impact Test (ASTM E1886/1996)	--	7, 8, 9, 10, 11 and 12
Cyclic Load Test (ASTM E1886/1996)	See section 8.0	7, 8, 9, 10, 11 and 12

**15.0 TEST SEQUENCE:**

TEST SEQUENCE	Specimen #
Large Missile Impact Test. Positive Cyclic Load Test Negative Cyclic Load Test.	7, 8, 9, 10, 11 and 12

**16.0 Specimen #7-#12 - LARGE MISSILE IMPACT TEST:**

**16.1 IMPACT DATA:**

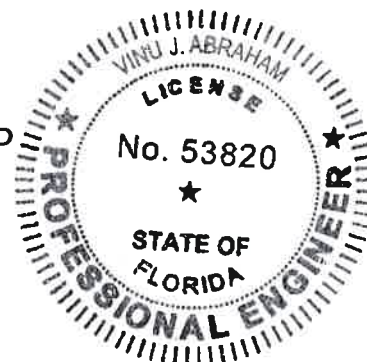
**Missile Weight:** 9 lb.  
**Missile Length:** 96 in.

Specimen #	Impact #	Velocity (ft/s)	X Coordinate (in.)	Y Coordinate (in.)	Instant Deflection (in.)	Permanent Deflection (in.)
7	1	49.53	20.50	21.50	7.50	0.63
	2	49.73	11.00	36.50	3.00	0.50
	3	49.93	32.00	7.75	7.00	0.75
8	1	49.60	19.50	20.25	7.50	1.50
	2	49.86	8.50	33.50	6.00	4.50
	3	50.03	28.00	6.00	1.50	0.00
9	1	50.00	20.50	20.00	6.00	5.00
	2	50.10	9.50	34.00	2.00	0.50
	3	50.23	29.00	7.50	2.00	0.75

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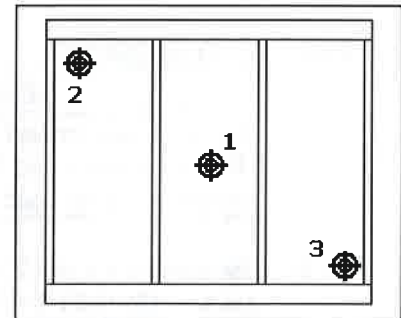
Specimen #	Impact #	Velocity (ft/s)	X Coordinate (in.)	Y Coordinate (in.)	Instant Deflection (in.)	Permanent Deflection (in.)
10	1	49.68	21.00	20.50	5.50	2.00
	2	49.24	10.00	34.00	2.00	0.75
	3	49.60	34.00	10.00	5.00	1.50
11	1	49.60	22.00	20.00	9.50	6.50
	2	49.86	7.00	34.50	1.50	1.00
	3	49.36	32.25	8.50	4.00	3.00
12	1	49.86	20.50	21.50	6.00	4.00
	2	49.41	10.50	34.00	3.50	3.00
	3	49.98	31.75	8.00	3.50	2.00

**16.2 IMPACT LOCATIONS AND REMARKS:**

Each impact test conducted on this specimen was performed in accordance with the requirements of ASTM E1886/1996.

All of the impacts hit their intended targets resulting in the recorded measurements.

Upon completion of the missile impact test, this sample subsequently underwent the cyclic load test as specified by ASTM E1886/E1996.



**17.0 CYCLIC LOAD TEST**

**17.1 CYCLIC TEST PRESSURE:**

Specimen #	CYCLIC TEST PRESSURE	
	$(P_d)_{in} = P_{max}$	$(P_d)_{out} = P_{max}$
7, 8 and 9	104 psf	104 psf
10, 11 and 12	120 psf	120 psf

**17.2 CYCLIC LOAD SPECTRUM:**

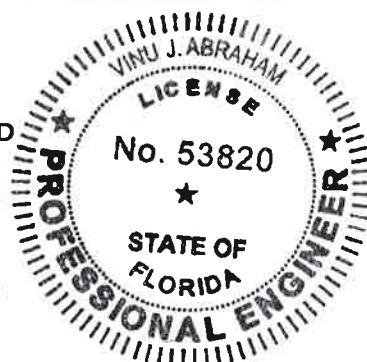
**17.2.1 POSITIVE CYCLIC LOAD SPECTRUM:**

Specimen #	# OF INWARD ACTING CYCLES/STAGE			
	3500	300	600	100
7, 8 and 9	20.8 – 52 (psf)	0 – 62.4 (psf)	20.8 – 83.2 (psf)	21.2 – 104 (psf)
10, 11 and 12	24 – 60 (psf)	0 – 72 (psf)	60 – 96 (psf)	36 – 120 (psf)

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4/29/05

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**17.2.2 NEGATIVE CYCLIC LOAD SPECTRUM:**

Specimen #	# OF OUTWARD ACTING CYCLES/STAGE			
	3500	300	600	100
<b>7, 8 and 9</b>	21.2 – 104 (psf)	20.8 – 83.2 (psf)	0 – 62.4 (psf)	20.8 – 52 (psf)
<b>10, 11 and 12</b>	36 – 120 (psf)	60 – 96 (psf)	0 – 72 (psf)	24 – 60 (psf)

**17.3 DEFLECTION DATA:**

SPECIMEN #	Location	POSITIVE LOAD		NEGATIVE LOAD	
		Measured % Recovery	Allowable % Recovery	Measured % Recovery	Allowable % Recovery
<b>7</b>	Geometric Center of Panel	90.00	80.00	100.00	80.00
<b>8</b>		85.71	80.00	85.29	80.00
<b>9</b>		100.00	80.00	82.14	80.00
<b>10</b>		92.31	80.00	90.00	80.00
<b>11</b>		88.89	80.00	93.33	80.00
<b>12</b>		87.50	80.00	88.88	80.00

**17.4 REMARKS:**

This sample was inspected carefully upon completion of the cyclic test for failures. None were found. As such, this specimen was found to satisfy the cyclic test requirements of ASTM E1886-97/1996-02.

**MISCELLANEOUS INFORMATION**

**18.0 CERTIFICATION & DISCLAIMER STATEMENT:**

All tests performed on this test specimen were conducted in accordance with the specifications of the applicable codes, standards & test methods listed below by the Hurricane Test Laboratory, LLC located at 6655 Garden Road, Riviera Beach, FL 33404. HTL does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested at HTL. HTL is not owned, operated or controlled by any company manufacturing or distributing products it tests. This report is only intended for the use of the entity named in section 1.0 of this report. Detailed assembly drawings showing wall thickness of all members, corner construction and hardware applications are on file and have been compared to the test specimen submitted. A copy of this test report along with representative sections of the test specimen will be retained at HTL for a period of three (3) years. All results obtained apply only to the specimen tested and they do indicate compliance with the performance requirements of the test methods and specifications listed in the following section.

**19.0 APPLICABLE CODES, STANDARDS & TEST METHODS:**

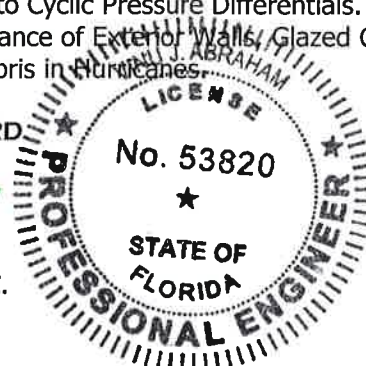
**ASTM E1886-97** – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.

**ASTM E1996-02** – Standard Specification for Performance of Exterior Walls, Glazed Curtain Walls, Doors, and Storm Shutters Impacted by Windborne Debris in Hurricanes.

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4/29/05

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 FL Reg. # 53820





**20.0 LIST OF OFFICIAL OBSERVERS:**

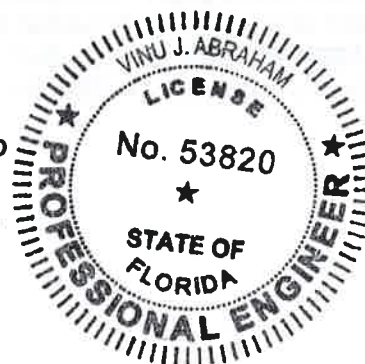
Vinu J. Abraham – HTL, Professional Engineer  
Urmilla Jokhu-Sowell – HTL, Professional Engineer  
Dylan O’Berry – HTL, Technician  
Fred Ciavola – HTL, Technician  
Scott Kuntz - Transparent Protection System, Inc



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4/29/05

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FL Reg. # 53820



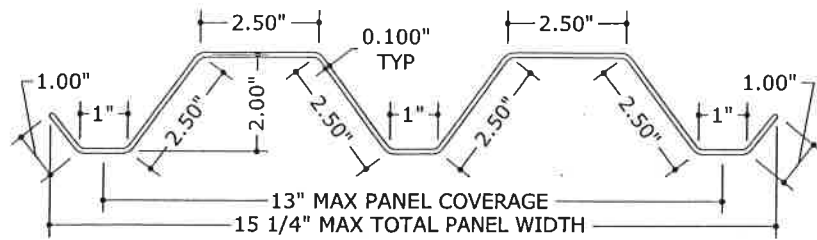


# POLYCARBONATE STORM PANELS (Non-HVHZ)

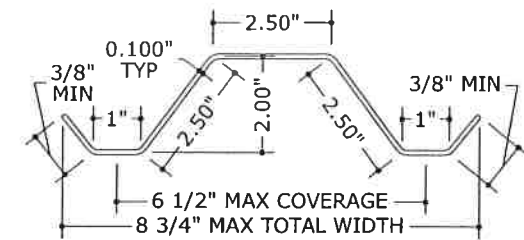
FRANK L. BENNARDO, P.E.  
# PE0046549

10/25/2004

VALID FOR (1) JOB(S) ONLY  
VALID ONLY WITH RAISED ENGINEER SEAL



**1 FULL PANEL PROFILE**  
3" = 1'-0" (SEE GEN NOTE 7)



**2 HALF PANEL PROFILE**  
3" = 1'-0" (SEE GEN NOTE 7)

Hurricane Test Laboratory, LLC

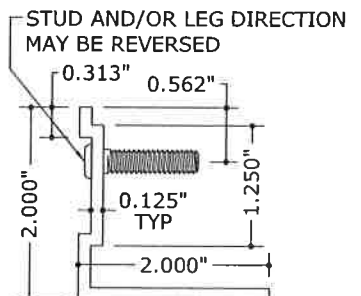


AS TESTED UNLESS OTHERWISE NOTED  
Date: 5/2/05  
Job#: 02-39-0101-03

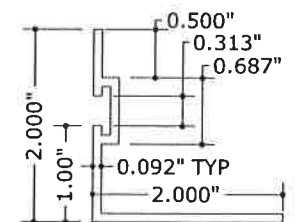
5.000"

## GENERAL NOTES:

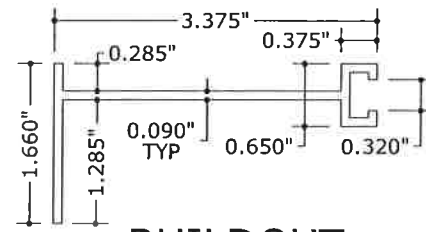
- THIS SYSTEM HAS BEEN TESTED AND EVALUATED AS A LARGE MISSILE IMPACT PROTECTIVE SYSTEM IN ACCORDANCE WITH THE REQUIREMENTS OF THE 2001 FLORIDA BUILDING CODE AND THE 2000 INTERNATIONAL BUILDING/RESIDENTIAL CODE PER ASTM STANDARDS E330, E1886, & E1996. PANELS ARE APPROVED FOR USE IN FLORIDA OUTSIDE THE HIGH VELOCITY HURRICANE ZONE, OR THROUGHOUT OTHER AREAS GOVERNED BY THE 2000 IBC/IRC.
- TESTING HAS BEEN PERFORMED IN ACCORDANCE WITH THE ASTM E1996-02 STANDARD FOR USE IN HIGH VELOCITY WIND ZONES (WIND ZONE 4) WHERE THE BASIC WIND SPEED IS GREATER THAN 140 MPH.
- NO 33-1/3% INCREASE IN ALLOWABLE STRESS HAS BEEN USED IN THE DESIGN OF THIS PRODUCT.
- POSITIVE AND NEGATIVE DESIGN PRESSURES TO BE USED WITH THESE DRAWINGS SHALL BE DETERMINED BY OTHERS FOR SPECIFIC JOBS IN ACCORDANCE WITH THE GOVERNING CODE. WHEN CALCULATING PRESSURES PER ASCE 7-98, USE OF DIRECTIONALITY FACTOR  $K_d=0.85$  IS ALLOWED.
- THE SYSTEM DETAILED HEREIN IS GENERIC AND DOES NOT PROVIDE INFORMATION FOR A SPECIFIC SITE. IF SITE CONDITIONS DEVIATE FROM THE CONDITIONS DETAILED HEREIN, A LICENSED ENGINEER OR REGISTERED ARCHITECT SHALL PREPARE SITE SPECIFIC DOCUMENTS TO BE USED IN CONJUNCTION WITH THIS DOCUMENT.
- PERMIT HOLDER SHALL VERIFY THE ADEQUACY OF THE EXISTING STRUCTURE TO WITHSTAND NEW SUPERIMPOSED LOADS.
- CLEAR POLYCARBONATE STORM PANELS (FULL AND HALF) MAY VARY IN "COVERAGE" WIDTH UP TO THE RESPECTIVE MAXIMA SHOWN HEREIN, PROVIDED THAT THE PANEL PROFILE HEIGHT BE MAINTAINED. HALF PANEL PROFILE IS ALSO KNOWN AS "MADDEN DESIGN HALF PANEL".
- ALL POLYCARBONATE PANELS SHALL BE MANUFACTURED BY TRANSPARENT PROTECTION SYSTEMS, Inc.
- THIS PRODUCT APPROVAL IS FOR THE USE OF CLEAR POLYCARB PANELS ONLY. ALL POLYCARB PANELS SHALL BE EXTRUDED WITH THICKNESS  $t=0.100"$  ( $\pm 0.010"$ ) AND SHALL BE FABRICATED FROM 100% G.E. SYNTHETIC THERMOPLASTIC POLYMER LEXAN RESIN #103-112 (UV STABILIZED) OR EQUIVALENT. THIS MATERIAL IS COMPARABLE TO G.E. LEXAN POLYMER SHEET #9034, AS APPROVED UNDER MIAMI-DADE COUNTY NOTICE OF ACCEPTANCE #03-0924.01. MINIMUM SYNTHETIC THERMOPLASTIC POLYMER TENSILE STRENGTH  $F_y=8.908$  KSI, FLEXURAL STRENGTH  $F_{by}=12.90$  KSI, & FLEXURAL MODULUS IS 328.7 KSI.
- ALL EXTRUSIONS SHALL BE 6063-T6 ALUMINUM ALLOY, U.N.O.
- PANELS SHALL BE PERMANENTLY LABELED WITH A MINIMUM OF ONE LABEL PER PANEL CONTAINING THE FOLLOWING:  
TRANSPARENT PROTECTION SYSTEMS, INC.  
WEST PALM BEACH, FLORIDA
- STORM PANELS HAVE BEEN DESIGNED AND TESTED TO THE MAXIMUM SPANS AND CORRESPONDING LOADS SHOWN HEREIN. REFERENCE CONSTRUCTION TESTING CORPORATION (CTC OF MIAMI, FL) TEST REPORTS #04-009-FE-ASTM & #04-009-LE-ASTM.
- TOP & BOTTOM MOUNTING SECTIONS MAY BE INTERCHANGED AS FIELD CONDITIONS DICTATE. PANELS MAY BE MOUNTED VERTICALLY OR HORIZONTALLY AS APPLICABLE.
- USE OF KEYHOLE WASHERS IS OPTIONAL IN CONJUNCTION WITH ANY MOUNTING CONDITION. WASHERED WINGNUTS SHALL HAVE 0.865" MINIMUM WASHER DIAMETER.
- ALL BOLTS & WASHERS SHALL BE ZINC COATED STEEL, GALVANIZED STEEL, OR STAINLESS STEEL WITH A MINIMUM TENSILE YIELD STRENGTH OF 60 KSI.



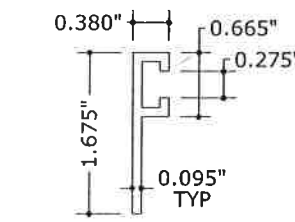
**3 STUD ANGLE**  
6" = 1'-0"



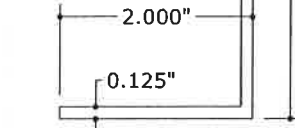
**4 REVERSE 'F' ANGLE**  
6" = 1'-0"



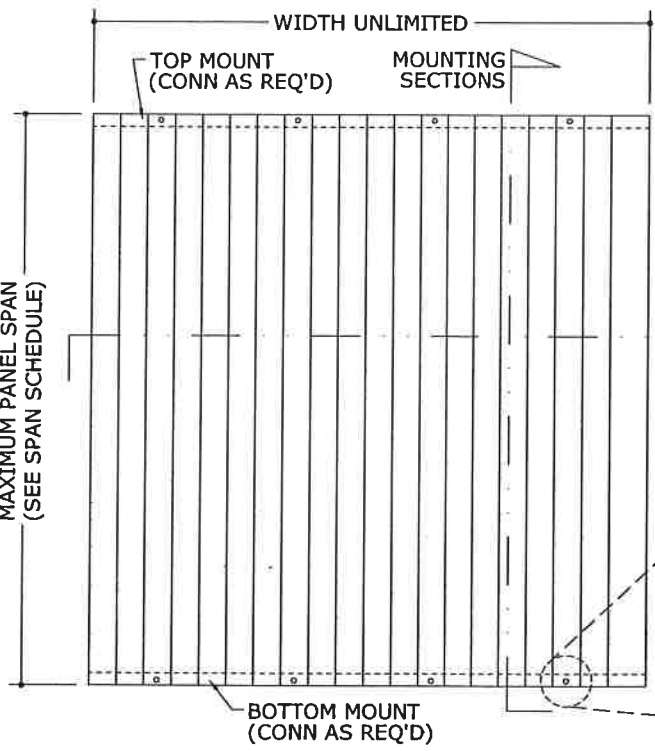
**5 BUILDOUT 'F' TRACK**  
6" = 1'-0"



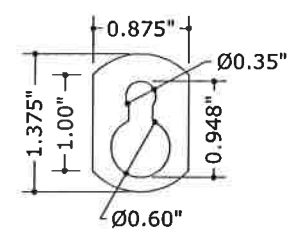
**6 'F' TRACK**  
6" = 1'-0"



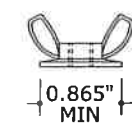
**7 CLOSURE ANGLE**  
6" = 1'-0"



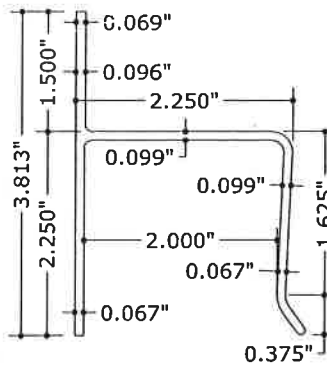
**1 TYPICAL ELEVATION**  
1 N.T.S.



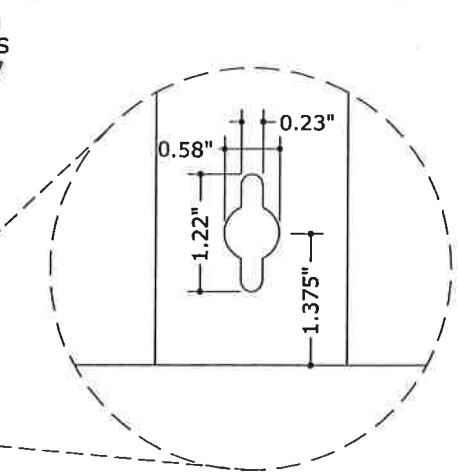
**8 KEYHOLE WASHER**  
6" = 1'-0"



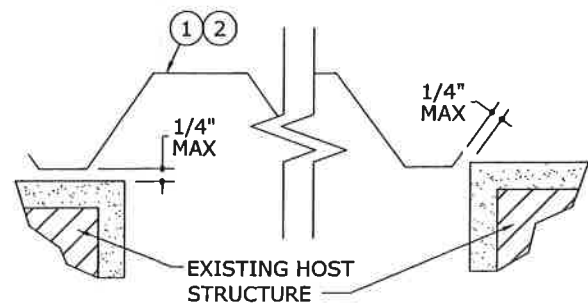
**9 WASHERED WINGNUT**  
6" = 1'-0"



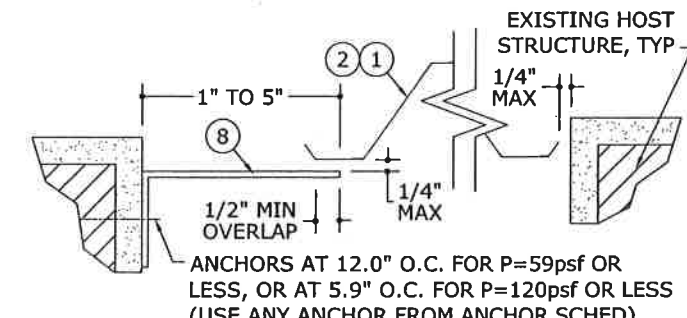
**10 'H' HEADER**  
6" = 1'-0"



**2 KEYHOLE DETAIL**  
1 N.T.S.



**3 WALL MOUNT CLOSURE**  
1 3" = 1'-0" PLAN VIEW



**4 TRAP MOUNT CLOSURE**  
1 3" = 1'-0" PLAN VIEW

FRANK L. BENNARDO, P.E., INC.  
CONSULTING ENGINEERS  
4441 NORTH DIXIE HIGHWAY  
BOCA RATON, FL 33431  
(561) 391-2888 FAX: (561) 391-2862  
WWW.FLBENGINEERING.COM  
CERTIFICATE OF AUTHORIZATION: #9885

Transparent Protection Systems, Inc.  
TPS  
6643 42nd Terrace North  
West Palm Beach, FL 33407

CLEARGUARD POLYCARBONATE STORM PANEL (NON-HVHZ)  
FLORIDA STATEWIDE APPROVAL

REMARKS	ORIG ISSUE	2ND ISSUE	DWN	CHKD	DATE
				FLB	8/17/04
				FLB	9/15/04

THIS DOCUMENT IS THE PROPERTY OF FRANK L. BENNARDO, P.E. AND SHALL NOT BE REPRODUCED IN WHOLE OR PART WITHOUT WRITTEN CONSENT OF FRANK L. BENNARDO, P.E. MARKING THIS DOCUMENT AS REPRODUCED OR OTHER MARKING TO THIS DOCUMENT ARE NOT PERMITTED AND INVALIDATE OUR CERTIFICATION.

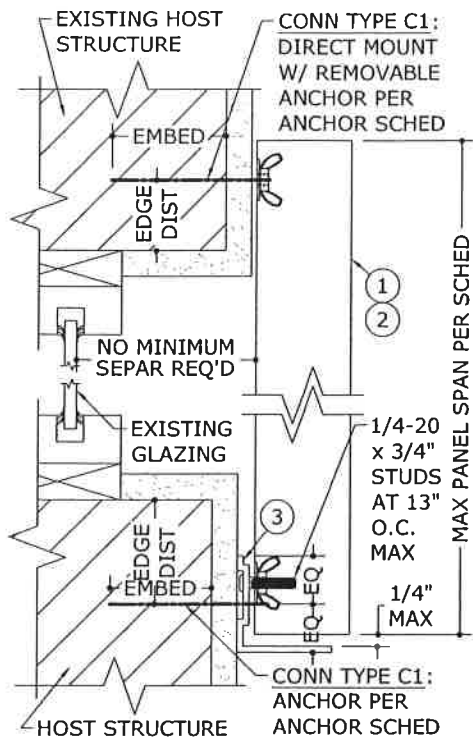
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03-155-1343b

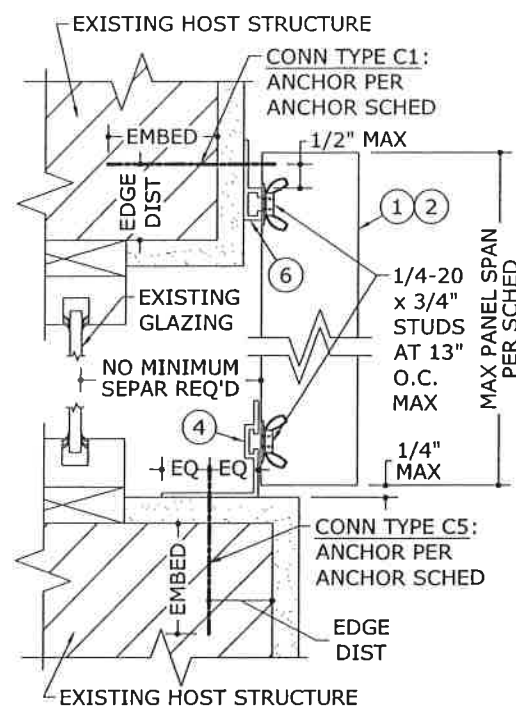
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DESCRIPTION:

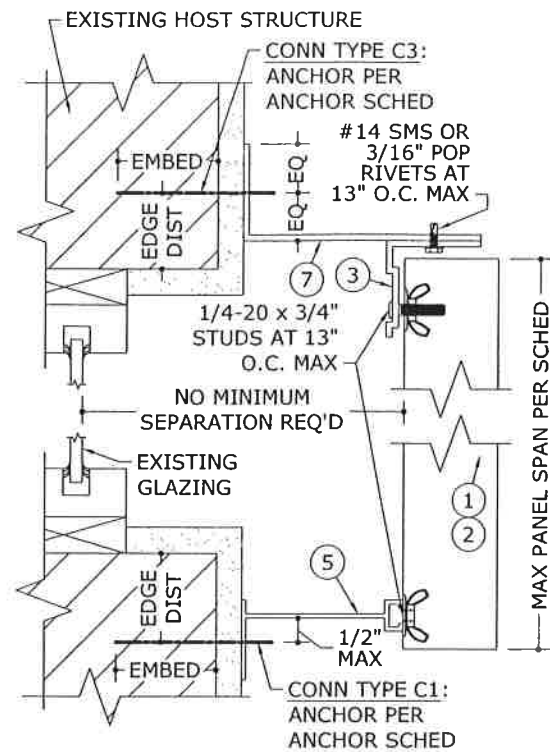
10/25/2004 - 4:36pm cleangley F:\Project Files\Transparent Protection (155)\03-155-1343b Clear Polycarb Panels - Non-HVHZ (FSA).dwg



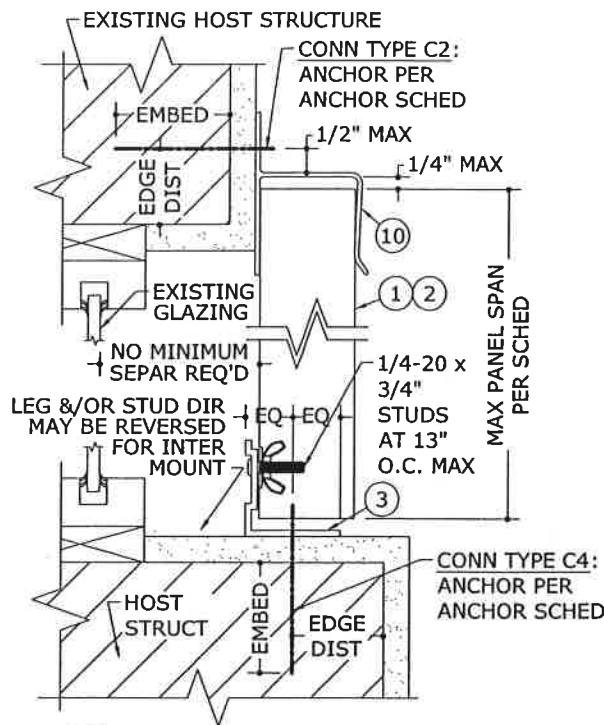
**1 MOUNTING SECTION**  
2 3" = 1'-0" VERT SECTION



**2 MOUNTING SECTION**  
2 3" = 1'-0" VERT SECTION



**3 MOUNTING SECTION**  
2 3" = 1'-0" VERT SECTION



**4 MOUNTING SECTION**  
2 3" = 1'-0" VERT SECTION

**MAXIMUM PANEL SPAN SCHEDULE (POSITIVE CONN.)**

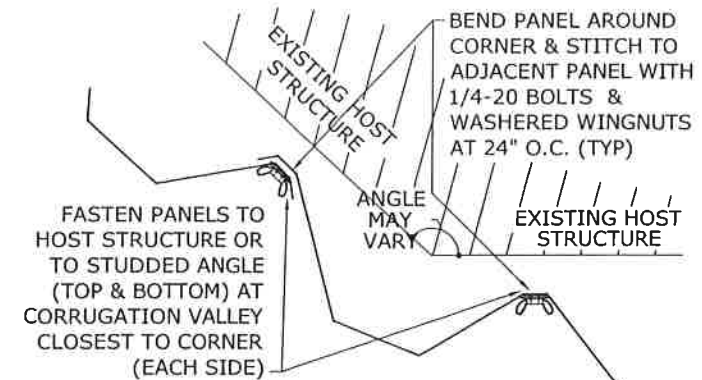
LOAD (psf)	MAX SPAN (ft)
25	11'-4"
30	10'-4"
35	9'-7"
40	8'-11"
45	8'-5"
50	8'-0"
55	7'-7"
60	7'-4"
65	7'-0"
70	6'-7"
75	6'-1"
80	5'-9"
90	5'-1"
100	4'-7"
110	4'-2"
120	3'-10"

**MAXIMUM PANEL SPAN SCHEDULE (W/ "H" HEADER)**

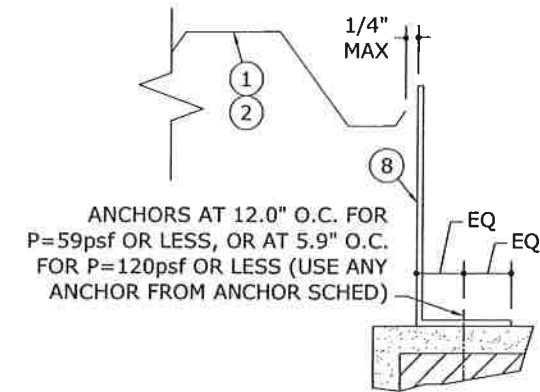
LOAD (psf)	MAX SPAN (ft)
17.3	8'-7"
24.2	7'-9"
34.6	7'-0"
41.6	6'-0"
55.4	5'-0"
104	4'-0"

**MAXIMUM SPAN SCHEDULE NOTES:**

1. SPANS SHOWN IN "MAX PANEL SPAN SCHEDULE" ABOVE ARE MAXIMUM ALLOWABLE SPANS AT EACH RESPECTIVE DESIGN PRESSURE.
2. THIS SCHEDULE MAY BE USED TO DETERMINE MAXIMUM ALLOWABLE SPANS FOR PANELS INSTALLED USING ANY COMBINATION OF MOUNTING EXTRUSIONS INVOLVING A POSITIVE CONNECTION - i.e. ALL INSTALLATIONS WHICH DO NOT INCLUDE AN "H" HEADER.
3. TABLE ABOVE IS VALID FOR PANELS MOUNTED HORIZONTALLY OR VERTICALLY. SPAN DIRECTION IS ALWAYS PERPENDICULAR TO LINE OF ANCHORAGE.



**5 CORNER CLOSURE**  
2 N.T.S. PLAN VIEW



**6 BUILD-OUT CLOSURE**  
2 3" = 1'-0" PLAN VIEW

Hurricane Test Laboratory, LLC



AS TESTED UNLESS OTHERWISE NOTED

Date: 5/2/05  
Job#: 025A-0107-05

10/25/2004

VALID FOR (1) JOB(S) ONLY  
VALID ONLY WITH RAISED ENGINEER SEAL

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CLEARGUARD POLYCARBONATE STORM PANEL (NON-HVHZ)  
FLORIDA STATEWIDE APPROVAL

REMARKS	CHKD	DATE
ORIG ISSUE	CL	8/17/04
2ND ISSUE	CL	9/15/04

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