



Force Engineering & Testing Inc.

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

Project Number : 13-0459T-08D-F

Test Report Date : March 3, 2009

Test Material : 8" x 2.5" ZEE w/ Tophat

Test Procedure : AISI Uplift Load Base Test

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

Miami Dade County Lab Certification No: 05-1122.13


16 GA. HIGH STRENGTH TOPHAT UPLIFT TEST

Report Prepared by:



Brandon Jasek, P.E.

Report Reviewed by:



Terrence E. Wolfe, P.E.

Project Number : 13-0459T-08D-F

PURPOSE:

The purpose of this test was to analyze the bracing effects on the purlins that the Tophat adds to a through fastened panel system when subjected to a uplift load.

TEST DATES:

December - January 2009

TEST ASSEMBLY:

Panel & Purlin Manufacturer

Manufacturer: Whirlwind Steel Buildings, Inc.
8234 Hansen Road
Houston, TX 77075

Roof Panel: 26 Ga. Super Span X, 36" Coverage, 1 1/4" tall Corrugations.

Panel Fastener: #12-14 x 1" HWH @ 12"-12"-12" Fastener Pattern
1/4-14 x 7/8" Lap Tek @ 20" O.C. in panel side lap

Panel Length: 7'-0"

Purlin: 8" x 2.5" ZEE 16 Ga.

Purlin Length: 25'-7 1/2", Span = 25'-0"

Tophat Manufacturer

Manufacturer: TopHat Framing Systems
8660 Lambright
Houston, TX 77075

Tophat: 16 Ga. High Strength, 3 1/2" Tall Hat section w/ R Panel punch out pattern, 0.062" Material Thickness, Fy = 56.8 ksi (Per Tensile Test See Appendix)

Tophat Fastener: (2) #12-14 x 1-1/4" HWH per foot

Tophat Length: 25'-0", No Splice

TESTING APPARATUS:

High Pressure Blower: New York Blower, 15 hp, 900 cfm.

Test Chamber: 26' x 8' steel chamber.

Mounting Frame: W8x10 Steel Beams

Pressure Indicator: Heise Digital Pressure Indicator Model #901B, (+/-) 300-psf range, with max./min. hold features.

Deflection Indicators: aluminum rulers calibrated to 1/64".

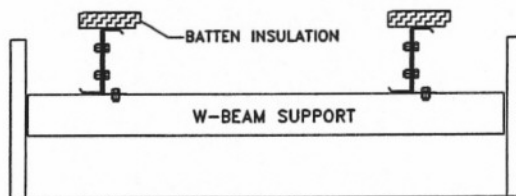
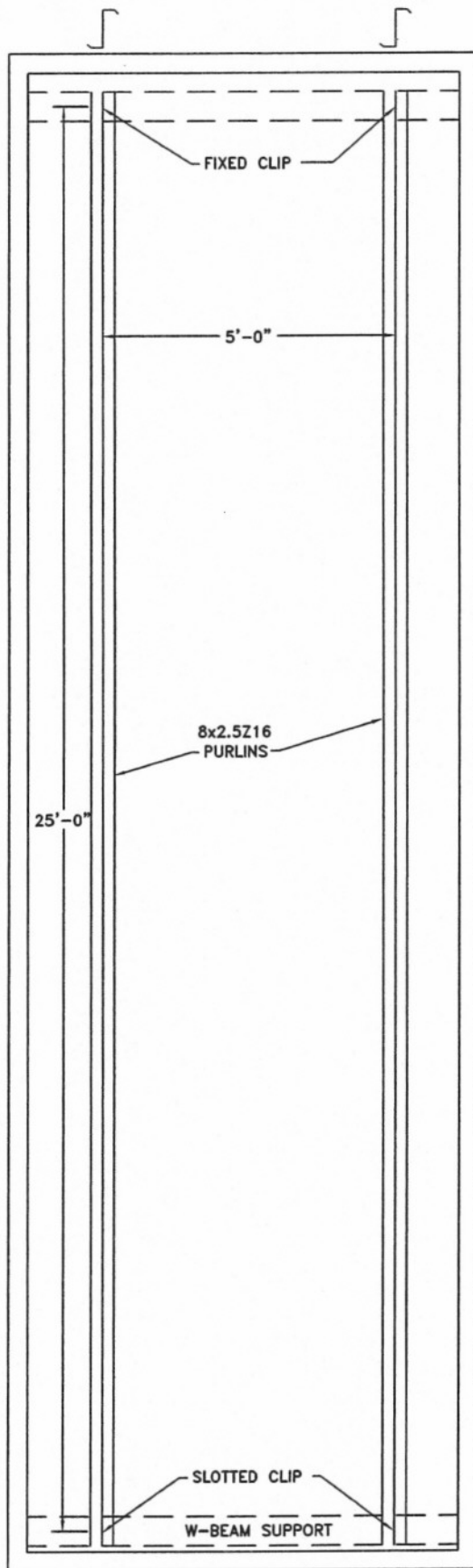
STATEMENT OF INDEPENDENCE:

Force Engineering & Testing, Inc. or any persons employed by them do not have any financial interest in Whirlwind or TopHat Framing Systems.

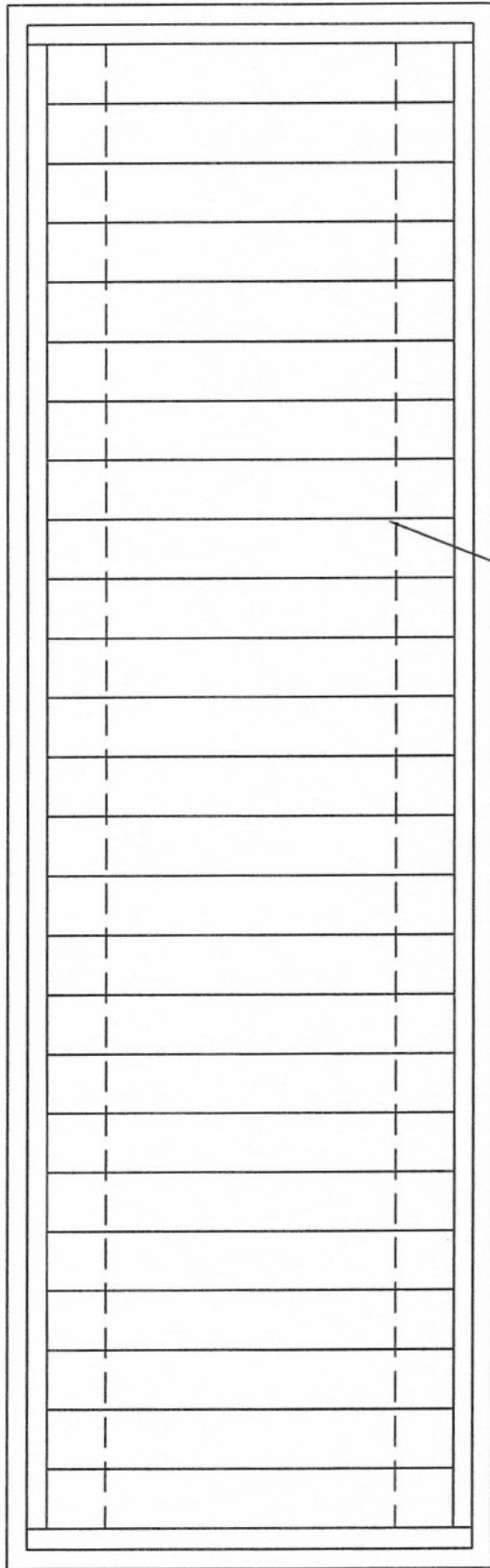
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Appendix

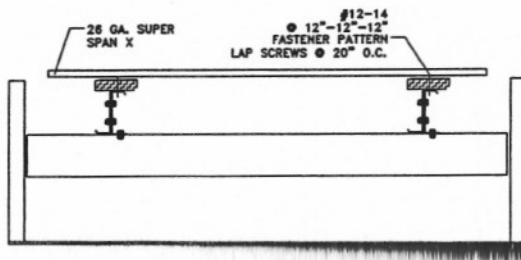
PURLIN LAYOUT



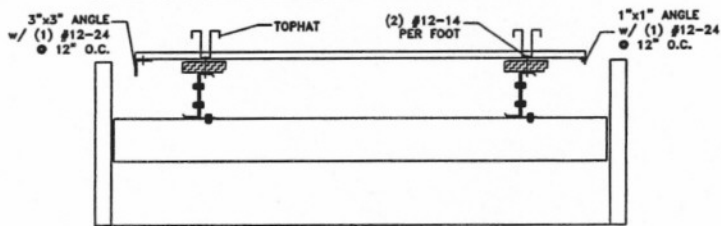
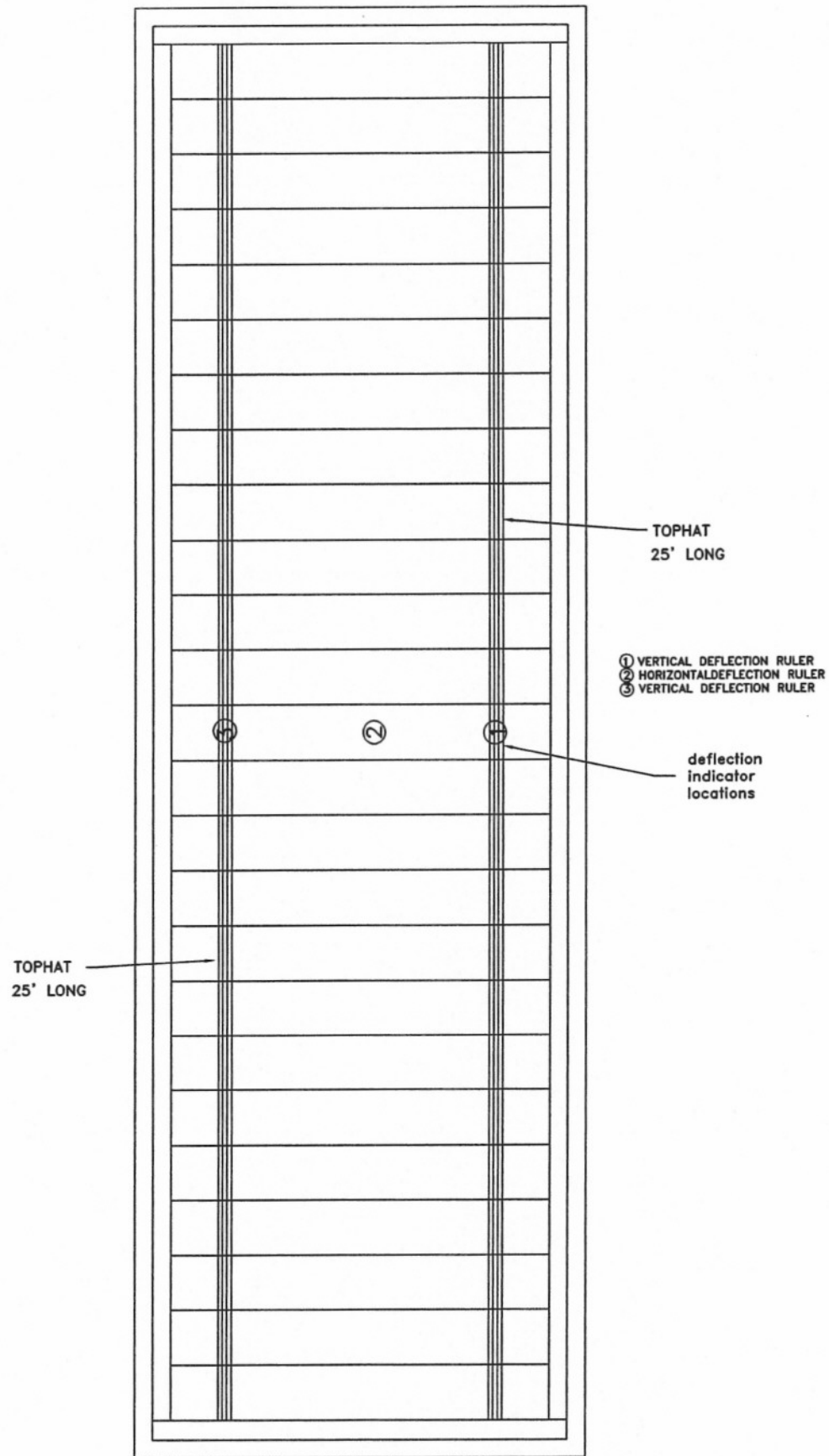
PANEL LAYOUT



26 GA. SUPER SPAN X PANEL



TOPHAT LAYOUT



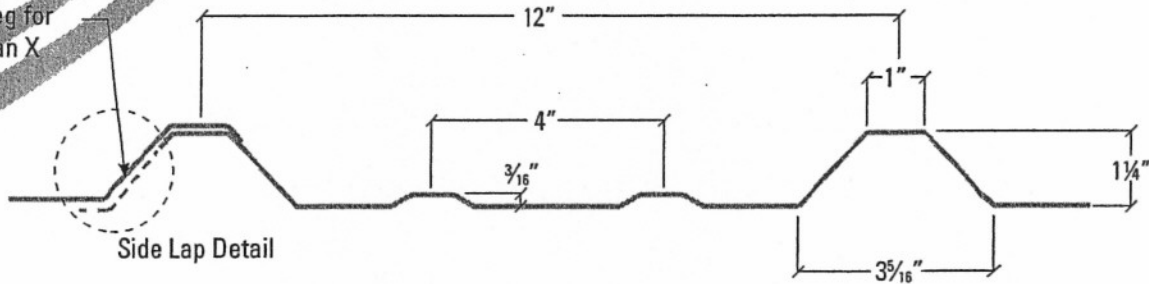


WHIRLWIND BUILDING COMPONENTS
 Corporate Headquarters • 8234 Hansen Rd, Houston, TX 77075
 (Phone) 713.946.7140 | (Fax) 832.553.4700 | (US Wats) 800.324.9992

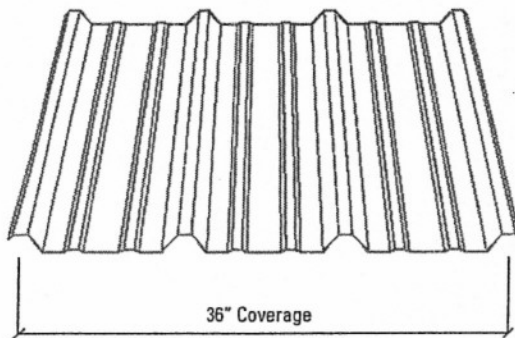


SUPER SPAN-X

Bearing leg for Super Span X



Side Lap Detail



SUPER SPAN-X DESIGN PROPERTIES						
GAUGE/ THICKNESS	F _y (KSI)	F _b (KSI)	TOP IN COMPRESSION		BOTTOM IN COMPRESSION	
			I _x (In ⁴ -Ft)	M _a (Kip-In/Ft)	I _x (In ⁴ -Ft)	M _a (Kip-In/Ft)
26 (t=.0170")	60*	0.83	0.0370	1.2697	0.0323	1.6610
26 (t=.0176")	60*	0.86	0.0380	1.4057	0.0337	1.7230
24	50	1.09	0.0570	1.7500	0.0467	1.8633

* F_y is 80-ksi reduced to 60-ksi in accordance with the 2001 edition of the North American Specification For Design Of Cold-Formed Steel Structural Members - A2.3.2.

NOTES:

- All section properties are calculated in accordance with the 2001 edition of the North American Specification For Design Of Cold-Formed Steel Structural Members.
- I_x is for deflection determination.
- M_x is allowable bending moment.

MATERIALS

Unless otherwise specified, the exposed surfaces of all panels shall be either clear acrylic coated or factory painted GALVALUME®. GALVALUME® is a zinc-aluminum alloy coating that is applied to the base steel material. Acrylic coated GALVALUME® shall have a Coating Class AZ55 (0.55 ounces (combined total of both sides) per square foot). Factory painted GALVALUME® shall have a minimum Coating Class AZ50 (0.50 ounces (combined total of both sides) per square foot). GALVALUME® coated steel for panels shall conform to ASTM A792, Structural Quality. The 26 gauge panel shall conform to Grade 80 (80 ksi minimum yield strength); the 24 gauge panel shall conform to Grade 50 (50 ksi minimum yield strength). All material shall be ordered to a minimum decimal thickness. Minimum ordered thickness for coated steel products always includes the thickness of the coating.

PAINTED FINISH

All painted GALVALUME® shall be factory coated by a firm which coats coil products exclusively. The coater shall be responsible for ensuring color consistency, paint film hardness, and paint film thickness. Each side of the GALVALUME® will be coated with 0.2 mils baked-on primer before the color coating. The 26 gauge panel shall receive a baked-on silicone polyester finish coat on the exposed side. The 24 gauge panel shall receive a KYNAR 500® Fluoropolymer finish coat on the exposed side. Thickness of the finish coat will be a nominal 1.0 mils (including the primer coat). A baked-on straight polyester wash coat will be applied on the non-exposed side. Thickness of the wash coat will be a nominal 0.5 mils (including the primer coat).

LIMITED MATERIAL WARRANTY

Specific conditions concerning each finish shall be covered in detail on the written warranty issued, on request, with each order. Minimum roof slope - 1/2:12. GALVALUME® panels shall have a twenty-five year limited warranty providing that GALVALUME® panels will not rupture, fail structurally, or perforate within a period twenty-five years after shipment due to exposure to normal atmospheric corrosion. The clear acrylic finish does not carry a warranty. The 26 gauge factory coated GALVALUME® panel shall have a thirty-year limited color finish warranty from peeling and cracking, and a twenty-five year limited color finish warranty from excessive chalking and color change (fading). The 24 gauge factory coated GALVALUME® panel shall have a thirty-year limited color finish warranty from excessive chalking and color change (fading), peeling and cracking. The wash coat does not carry a warranty.

PANELS

Panel coverage will be 36" to the weather. Maximum panel length shall be 40'-0". Where endlaps are required, they shall be a minimum of 4" and shall occur at a purlin. A roof installed as listed in UL Construction No. 167 shall meet the requirements of Underwriters Laboratories standard UL 580 Class 90 for uplift resistance. All installations shall be in accordance with standard industry practices. Before securing, all laps of roof panels shall be sealed with a continuous ribbon of tape sealant. A closure strip shall be installed at the eave. Panels shall be secured to intermediate framing members with sheet metal screws at a maximum spacing of 12" on center. At endlaps, the maximum screw spacing shall be 6" on center. Sheet metal stitch screws at a maximum of 20" on center shall be installed at sidelaps. The panel must not rest on the concrete foundation; the panel must sit 1/8" above the concrete. Panels shall be furnished square cut.

- **UL CONSTRUCTION NO. 167**
- **UL 580 UP-LIFT TESTED CLASS 90 RATED**
- **UL 2218 HAIL IMPACT RESISTANT TESTED**
- **INCLINED: UNLIMITED IMPACT: CLASS 4**
- **FLORIDA PRODUCT APPROVAL FL# 1845.3**

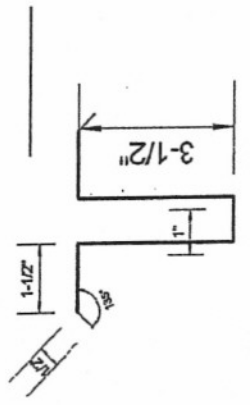
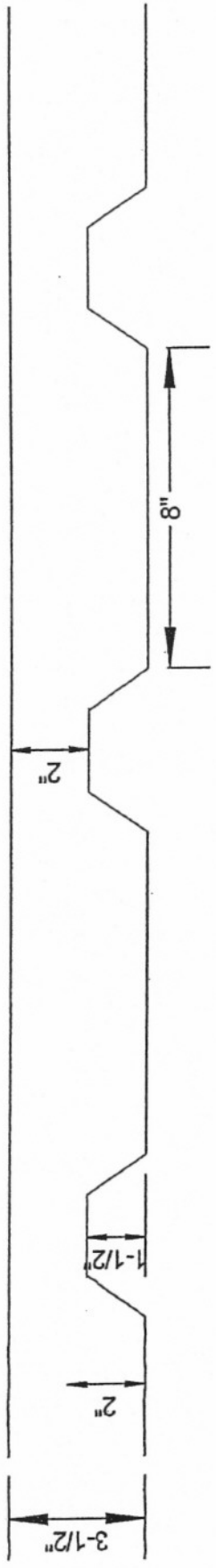
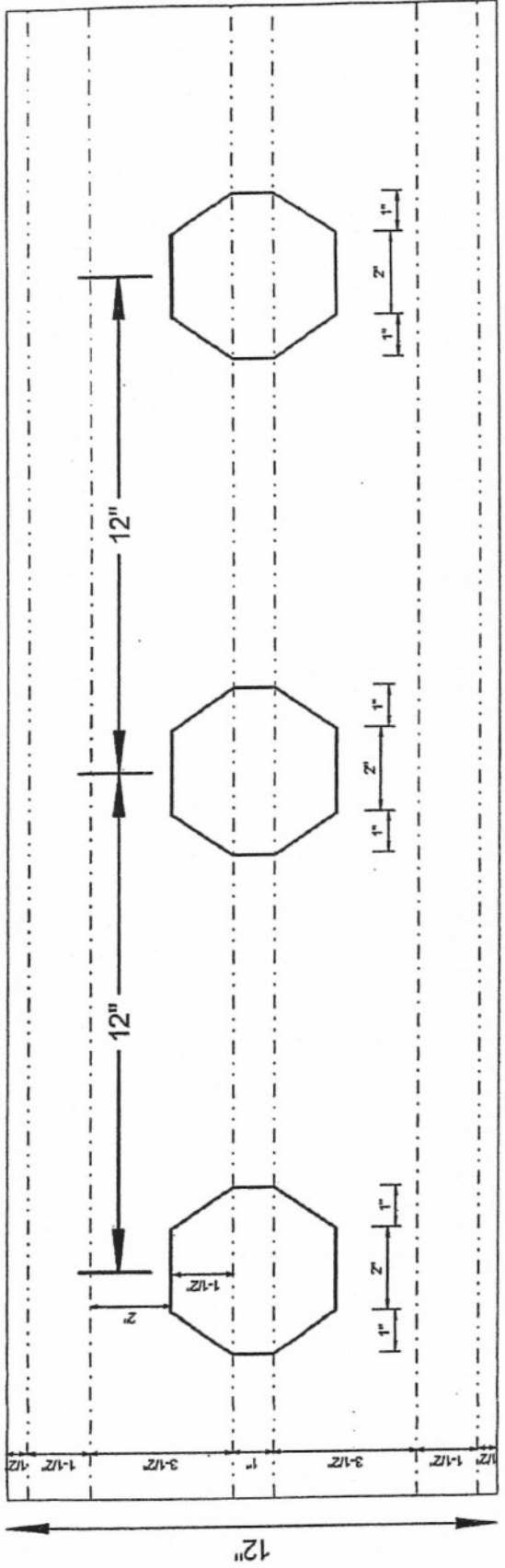
Houston, TX
(800) 324-9992

Lithia Springs, GA
(800) 363-8142

Claremore, OK
(877) 875-0077

Lathrop, CA
(866) 922-2216

Freeport, MN
(888) 836-7203



MTEC
MECHANICAL
TESTING
SERVICES

ISO 9001-2000

CERTIFICATE OF TEST

ATTENTION : BRANDON JASEK
CUSTOMER : FORCE ENGINEERING & TESTING INC.
19530 RAMBLEWOOD DR
HUMBLE, TX 77338

8676 TAUB ROAD
Houston, TX 77064
281/469-2609

LAB# : W0901583

DATE : 02/12/09 12:15:05
PO NO :13-0459T-08
SPECIMEN :16HSTP

TEST DATA

REDUCED SECTION TENSILE

UTS PSI	YS.2%PSI	%EL	%RA	WIDTH	THICK	AREA IN.
70,100	56,800	28.80	60.10	0.505	0.062	0.031


MTEC Representative

Data Sheets

Base Test Deflection Readings

Project #: 13-0459T-08D
Test: Uplift Base Test #1
Panel: 26 Ga. PBR 12"-12"-12" Fastener Pattern x 7'-0" Long
Purlin: 8x2.5ZEE 16 Ga. 25' Span spaced @ 5'-0" O.C. Facing same direction
Tophat: 16 ga. High Strength Tophat over PBR panel, attached to Purlin w/ (2) #12-14 x 1-1/4" Per foot
Date: 12/4/2008

LOAD (psf)	Vertical Deflection of Purlin 1 (in)	Vertical Deflection of Purlin 2 (in)	Horizontal Deflection of Panel (in)
0.00	26.8750	26.7500	19.7500
3.00	27.0625	26.9375	19.7500
6.00	27.2500	27.1250	19.7500
9.00	27.4375	27.2500	19.7500
12.00	27.6250	27.4375	19.7500
15.00	27.7500	27.6250	19.7500
18.00	27.9375	27.7500	19.7500
21.00	28.1875	27.9375	19.7500
24.00	28.3750	28.0625	19.7500
27.00	28.5625	28.2500	19.7500
30.00	28.7500	28.4375	19.8125
33.00	FAILED @ 32.06 PSF		

Ultimate Test Pressure: 32.06 psf
Mode of Failure: Purlin Bottom Lip Buckled

Base Test Deflection Readings

Project #: 13-0459T-08F
Test: Uplift Base Test #3
Panel: 26 Ga. PBR 12"-12"-12" Fastener Pattern x 7'-0" Long
Purlin: 8x2.5ZEE 16 Ga. 25' Span spaced @ 5'-0" O.C. Facing same direction
Tophat: 16 ga. High Strength Tophat over PBR panel, attached to Purlin w/ (2) #12-14 x 1-1/4" Per foot
Date: 1/27/2009

LOAD (psf)	Vertical Deflection of Purlin 1 (in)	Vertical Deflection of Purlin 2 (in)	Horizontal Deflection of Panel (in)
0.00	24.5000	24.6250	20.6875
3.00	24.6875	24.8125	20.6250
6.00	24.8125	24.9375	20.6250
9.00	25.0000	25.1250	20.6250
12.00	25.1875	25.2500	20.5625
15.00	25.3750	25.4375	20.5625
18.00	25.5625	25.6250	20.5625
21.00	25.7500	25.8125	20.5625
24.00	25.9375	26.0000	20.5625
27.00	26.1875	26.1250	20.5625
30.00	26.4375	26.3750	20.5625
33.00	FAILED @ 33.21 PSF		

Ultimate Test Pressure: 33.21 psf
Mode of Failure: Purlin Bottom Flange/Web Buckled

Calculations

CALCULATIONS

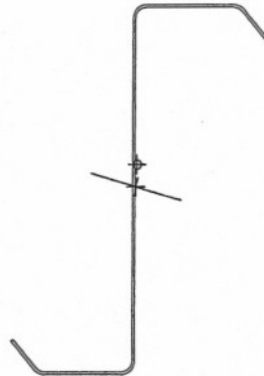
PANEL : 26 Ga. PBR 7'-0" long
CLIP : NA
FASTENER : #12-14 x 1-1/4" HWH
PURLIN : 8x2.5Zee w/ Tophat attached w/ (2) #12-14 every foot
TOPHAT : 16 Ga. High Strength Tophat
DESCRIPTION : 25'-0" Span Uplift Base Test

#1 12-4-08	8X2.5X16GA. ZEE		
b	purlin flange width	2.125	in.
B	purlin spacing	60.00	in.
d	purlin depth	8.00	in.
t	purlin thickness	0.059	in.
pts	failure load	32.06	psf
pd	weight of the specimen	2.350	psf
s	purlin tributary width	3.500	ft
PI	lateral anchorage force	12.86	lbs/ft
wts	failure load	103.99	lbs/ft
L	purlin span	25.00	ft
Mts	failure moment	97.49	k-in
Set	section modulus of the specimen	1.7152	in ³
Se	section modulus	1.7701	in ³
Fy	design yield strength	57.00	ksi
Fyt	measured yield strength	62.20	ksi
Mn	nominal flexural strength	100.90	k-in
Mnt	flexural strength	106.69	k-in
Rt	modification factor	0.9138	

#2 1-26-09	8X2.5X16GA. ZEE		
b	purlin flange width	2.125	in.
B	purlin spacing	60.00	in.
d	purlin depth	8.00	in.
t	purlin thickness	0.059	in.
pts	failure load	33.01	psf
pd	weight of the specimen	2.350	psf
s	purlin tributary width	3.500	ft
PI	lateral anchorage force	13.22	lbs/ft
wts	failure load	107.31	lbs/ft
L	purlin span	25.00	ft
Mts	failure moment	100.60	k-in
Set	section modulus of the specimen	1.7126	in ³
Se	section modulus	1.7701	in ³
Fy	design yield strength	57.00	ksi
Fyt	measured yield strength	62.40	ksi
Mn	nominal flexural strength	100.90	k-in
Mnt	flexural strength	106.87	k-in
Rt	modification factor	0.9414	

#3 1-27-09	8X2.5X16GA. ZEE		
b	purlin flange width	2.125	in.
B	purlin spacing	60.00	in.
d	purlin depth	8.00	in.
t	purlin thickness	0.059	in.
pts	failure load	33.21	psf
pd	weight of the specimen	2.350	psf
s	purlin tributary width	3.500	ft
PI	lateral anchorage force	13.29	lbs/ft
wts	failure load	108.01	lbs/ft
L	purlin span	25.00	ft
Mts	failure moment	101.26	k-in
Set	section modulus of the specimen	1.6467	in ³
Se	section modulus	1.7701	in ³
Fy	design yield strength	57.00	ksi
Fyt	measured yield strength	67.90	ksi
Mn	nominal flexural strength	100.90	k-in
Mnt	flexural strength	111.81	k-in
Rt	modification factor	0.9056	

AVERAGE Rt	0.920
STANDARD DEVIATION	0.019
Rt min.	0.902
Mnt min.	108.454



Section Inputs

Material: A1011 HSLAS Grade 55/2
 No strength increase from cold work of forming.
 Modulus of Elasticity, E 29500 ksi
 Yield Strength, Fy 57 ksi
 Tensile Strength, Fu 65 ksi
 Warping Constant Override, Cw 0 in⁶
 Torsion Constant Override, J 0 in⁴

Z-Section, Thickness 0.0589 in
 Placement of Part from Origin:
 X to center of gravity 0 in
 Y to center of gravity 0 in

Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705
2	2.1250	0.000	0.25000	Single	0.000	0.0000	1.0625
3	8.0000	90.000	0.25000	Zee	0.000	0.0000	4.0000
4	2.3750	0.000	0.25000	Single	0.000	0.0000	1.1875
5	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705

Fully Braced Strength - 2001 AISI Specification - US (ASD)

Compression		Positive Moment		Positive Moment	
Pao	14942 lb	Maxo	61.130 k-in	Mayo	11.825 k-in
Ae	0.47186 in ²	Ixe	7.2926 in ⁴	Iye	1.0183 in ⁴
		Sxe (t)	1.7910 in ³	Sye (l)	0.3755 in ³
Tension		Sxe (b)	1.8565 in ³	Sye (r)	0.3465 in ³
Ta	26677 lb				
		Negative Moment		Negative Moment	
		Maxo	60.415 k-in	Mayo	12.367 k-in
Shear		Ixe	7.3990 in ⁴	Iye	1.0370 in ⁴
Vay	2463 lb	Sxe (t)	1.9370 in ³	Sye (l)	0.3718 in ³
Vax	4525 lb	Sxe (b)	1.7701 in ³	Sye (r)	0.3623 in ³



Section Inputs

Material: [A1011 HSLAS Grade 55/2]
 No strength increase from cold work of forming.
 Modulus of Elasticity, E 29500 ksi
 Yield Strength, Fy 62.2 ksi
 Tensile Strength, Fu 76.4 ksi
 Warping Constant Override, Cw 0 in⁶
 Torsion Constant Override, J 0 in⁴

Z-Section, Thickness 0.059 in
 Placement of Part from Origin:
 X to center of gravity 0 in
 Y to center of gravity 0 in
 Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705
2	2.1250	0.000	0.25000	Single	0.000	0.0000	1.0625
3	8.0000	90.000	0.25000	Zee	0.000	0.0000	4.0000
4	2.3750	0.000	0.25000	Single	0.000	0.0000	1.1875
5	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705

Fully Braced Strength - 2001 AISI Specification - US (ASD)

Compression		Positive Moment		Positive Moment	
Pao	15826 lb	Maxo	65.139 k-in	Mayo	12.723 k-in
Ae	0.45800 in ²	Ixe	7.1940 in ⁴	Iye	1.0068 in ⁴
		Sxe(t)	1.7489 in ³	Sye(l)	0.3724 in ³
		Sxe(b)	1.8510 in ³	Sye(r)	0.3416 in ³
Tension		Negative Moment		Negative Moment	
Ta	30623 lb	Maxo	63.884 k-in	Mayo	13.397 k-in
		Ixe	7.2719 in ⁴	Iye	1.0267 in ⁴
Shear		Sxe(t)	1.9338 in ³	Sye(l)	0.3671 in ³
Vay	2476 lb	Sxe(b)	1.7152 in ³	Sye(r)	0.3597 in ³
Vax	4946 lb				



Section Inputs

Material: [A1011 HSLAS Grade 55/2]
 No strength increase from cold work of forming.
 Modulus of Elasticity, E 29500 ksi
 Yield Strength, Fy 62.4 ksi
 Tensile Strength, Fu 74.5 ksi
 Warping Constant Override, Cw 0 in⁶
 Torsion Constant Override, J 0 in⁴

Z-Section, Thickness 0.059 in
 Placement of Part from Origin:
 X to center of gravity 0 in
 Y to center of gravity 0 in

Outside dimensions, Open shape							
	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705
2	2.1250	0.000	0.25000	Single	0.000	0.0000	1.0625
3	8.0000	90.000	0.25000	Zee	0.000	0.0000	4.0000
4	2.3750	0.000	0.25000	Single	0.000	0.0000	1.1875
5	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705

Fully Braced Strength - 2001 AISI Specification - US (ASD)

Compression		Positive Moment		Positive Moment	
Pao	15857 lb	Maxo	65.248 k-in	Mayo	12.748 k-in
Ae	0.45740 in ²	Ixe	7.1876 in ⁴	Iye	1.0057 in ⁴
		Sxe(t)	1.7462 in ³	Sye(l)	0.3721 in ³
		Sxe(b)	1.8506 in ³	Sye(r)	0.3412 in ³
		Negative Moment		Negative Moment	
		Maxo	63.993 k-in	Mayo	13.436 k-in
		Ixe	7.2655 in ⁴	Iye	1.0262 in ⁴
		Sxe(t)	1.9335 in ³	Sye(l)	0.3669 in ³
		Sxe(b)	1.7126 in ³	Sye(r)	0.3596 in ³
Tension					
Ta	30627 lb				
Shear					
Vay	2476 lb				
Vax	4962 lb				



Section Inputs

Material: [A1011 HSLAS Grade 55/2]
 No strength increase from cold work of forming.
 Modulus of Elasticity, E 29500 ksi
 Yield Strength, Fy 67.9 ksi
 Tensile Strength, Fu 78.6 ksi
 Warping Constant Override, Cw 0 in⁶
 Torsion Constant Override, J 0 in⁴

Z-Section, Thickness 0.059 in
 Placement of Part from Origin:
 X to center of gravity 0 in
 Y to center of gravity 0 in
 Outside dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705
2	2.1250	0.000	0.25000	Single	0.000	0.0000	1.0625
3	8.0000	90.000	0.25000	Zee	0.000	0.0000	4.0000
4	2.3750	0.000	0.25000	Single	0.000	0.0000	1.1875
5	0.9410	-50.000	0.25000	None	0.000	0.0000	0.4705

Fully Braced Strength - 2001 AISI Specification - US (ASD)

Compression		Positive Moment		Positive Moment	
Pao	16668 lb	Maxo	68.153 k-in	Mayo	13.443 k-in
Ae	0.44187 in ²	Ixe	7.0206 in ⁴	Iye	0.9795 in ⁴
		Sxe(t)	1.6762 in ³	Sye(l)	0.3643 in ³
		Sxe(b)	1.8419 in ³	Sye(r)	0.3306 in ³
		Negative Moment		Negative Moment	
		Maxo	66.951 k-in	Mayo	14.487 k-in
		Ixe	7.1012 in ⁴	Iye	1.0142 in ⁴
		Sxe(t)	1.9258 in ³	Sye(l)	0.3616 in ³
		Sxe(b)	1.6467 in ³	Sye(r)	0.3563 in ³
Tension					
Ta	32312 lb				
Shear					
Vay	2476 lb				
Vax	5399 lb				

MTEC
MECHANICAL
TESTING
SERVICES

ISO 9001-2000

CERTIFICATE OF TEST

ATTENTION : BRANDON JASEK
CUSTOMER : FORCE ENGINEERING & TESTING INC.
19530 RAMBLEWOOD DR
HUMBLE, TX 77338

8676 TAUB ROAD
Houston, TX 77064
281/469-2609

LAB# : W0901585

DATE : 02/13/09 15:45:23
PO NO :13-0459T-08
SPECIMEN :16HSU1

TEST DATA

REDUCED SECTION TENSILE

UTS PSI	YS.2%PSI	%EL	%RA	WIDTH	THICK	AREA IN.
76,400	62,200	15.00	47.30	0.503	0.059	0.030


MTEC Representative

MTEC
MECHANICAL
TESTING
SERVICES

ISO 9001-2000

CERTIFICATE OF TEST

ATTENTION : BRANDON JASEK
CUSTOMER : FORCE ENGINEERING & TESTING INC.
19530 RAMBLEWOOD DR
HUMBLE, TX 77338

8676 TAUB ROAD
Houston, TX 77064
281/469-2609

LAB# : W0901586

DATE : 02/13/09 15:45:23
PO NO :13-0459T-08
SPECIMEN :16HSU2

TEST DATA

REDUCED SECTION TENSILE

UTS PSI	YS.2%PSI	%EL	%RA	WIDTH	THICK	AREA IN.
74,500	62,400	18.10	76.40	0.501	0.059	0.030


MTEC Representative

MTEC
MECHANICAL
TESTING
SERVICES

ISO 9001-2000

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LAB# : W0901587

DATE : 02/13/09 15:45:23
PO NO :13-0459T-08
SPECIMEN :16HSU3

TEST DATA

REDUCED SECTION TENSILE

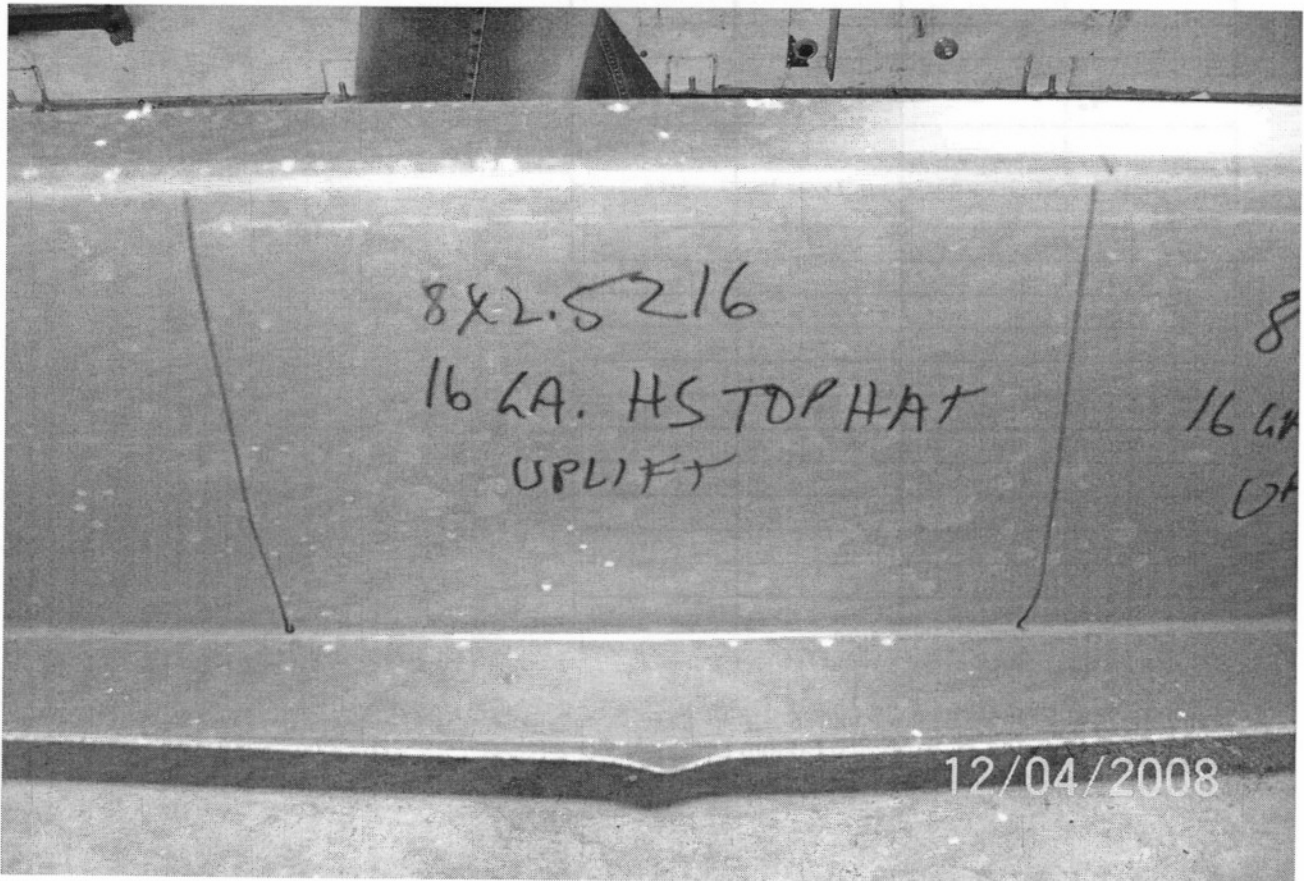
UTS PSI	YS.2%PSI	%EL	%RA	WIDTH	THICK	AREA IN.
78,600	67,900	17.10	57.40	0.499	0.059	0.029


MTEC Representative

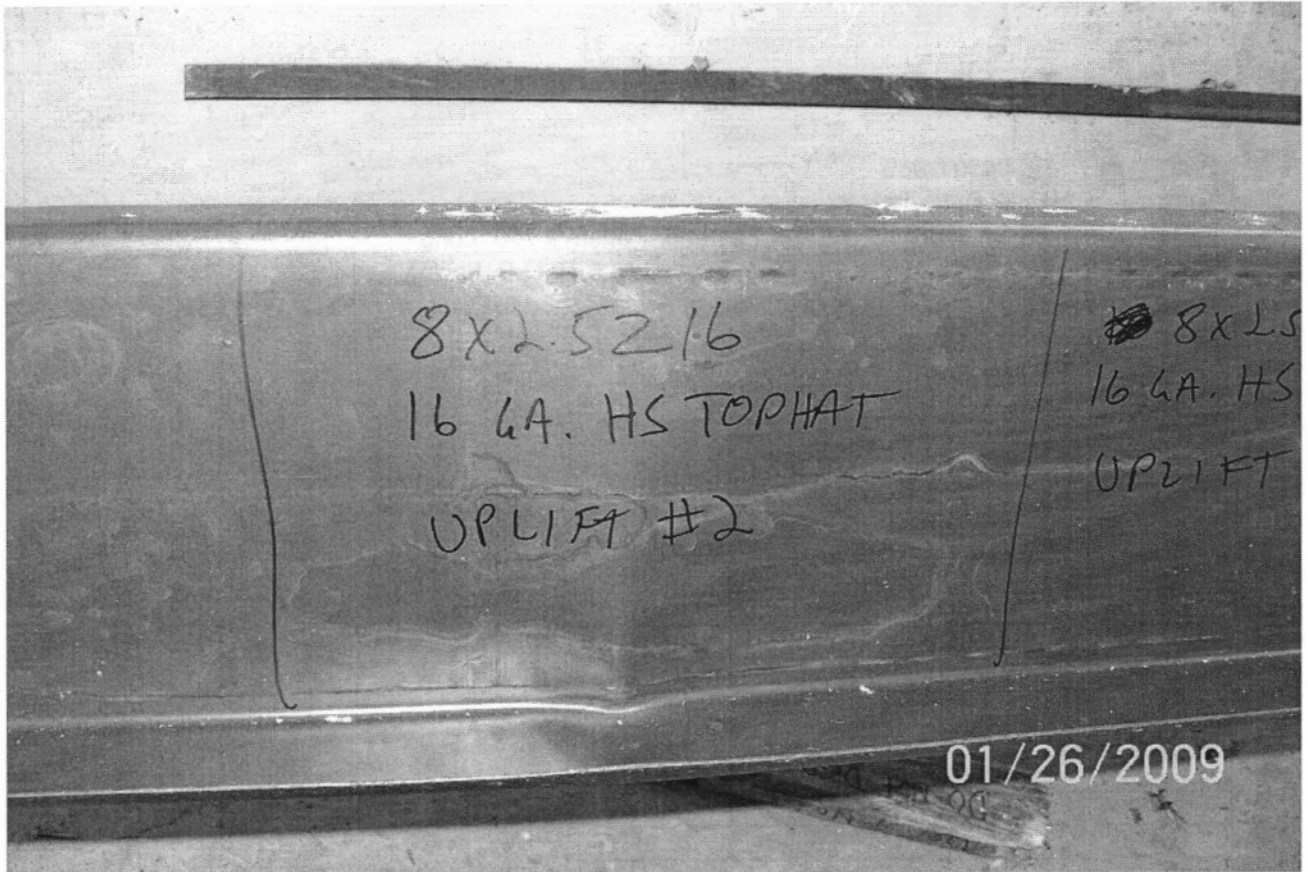
Photos



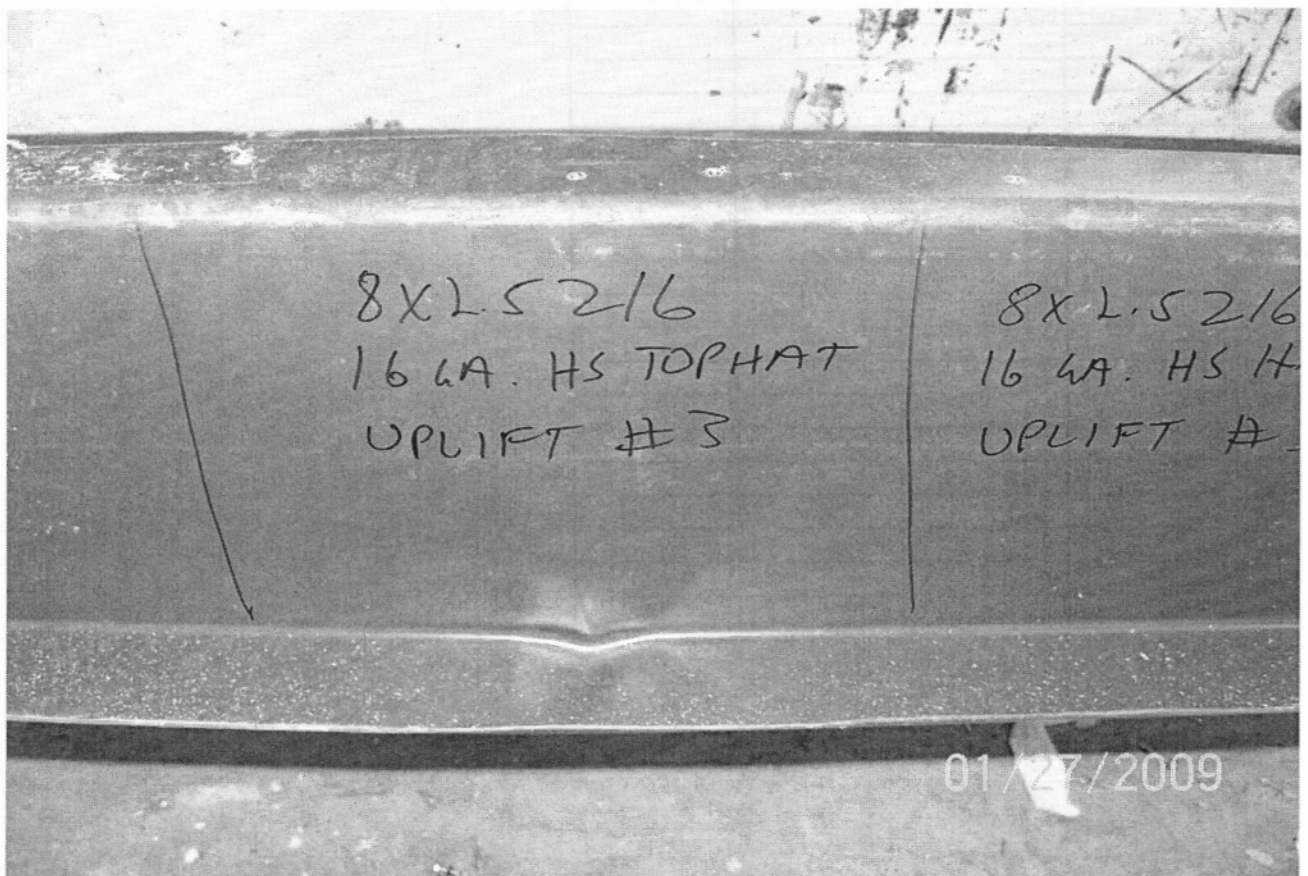
TYPICAL TEST SET UP



TEST D FAILURE



TEST E FAILURE



TEST F FAILURE