

James D. Bushouse, PE

Consulting Engineers

January 15, 2024

Florida Department of Business and Professional Regulations
1940 North Monroe Street
Suite 90
Tallahassee, Florida 32399-0772

Re: Product Approval #FL 5739-6 for Elixir Industries and AMS
Inc.

To whom it may concern,

We have reviewed the updates to the Florida Building Code, 2023 and the changes to ASCE 7-22. I affirm that the changes to these codes will not adversely affect the above Product Approval and that the above product is in compliance with the new Florida Building Code.

Please see the attached calculations for the attachment of the aluminum roof rolls and the previous testing report.

If you have any questions, please contact me at the below address.

Sincerely,

James D. Bushouse, P.E.
Professional Engineer #20311
State of Florida

3140 Wedgewood Blvd., Delray Beach, FL 33445

Phone: (561) 908-2473

P.O. Box 1237, Arcadia, Florida 34265

Phone: (863) 491-8242

jim@jamesbushouseinc.com

James D. Bushouse, P.E.

Uplift Calculations

For

“Weather Lok” Aluminum Mobilehome Re-Roof System

As Installed by

A.M.S., Inc.
4100 N. Powerline Road, Bay Z-3
Pompano Beach, Florida 33073

Prepared by:

James D. Bushouse, P.E.
Professional Engineer #20311
State of Florida

3140 Wedgewood Blvd., Delray Beach, Fl 33445

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P.O. Box 1237, Arcadia, Fl 34265

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Introduction:

The following is the calculation of wind uplift forces and attachment for the Aluminum Re-Roof System as installed by A.M.S., Inc.. The system consisting of a factory seamed .024 gage rolled aluminum roof covering, seamed at every 4', and mechanically attached to the existing mobilehome roof system. The system relies on the structural integrity of the existing roof system and should only be installed over an existing solid mobilehome roof or attached structures with a solid frame and should not overhang the existing roof system. The design of the system is based on the maximum span of a single wide mobile home being 14'-0" and the maximum width of a double wide mobilehome being 28'-0", with the maximum span of the roof roll not to exceed 14' between attachment. The roof roll is to be mechanically attached to the existing framing of the structure below with a continuous load path.

The wind load calculations for uplift are as determined by ASCE Standard 7-22 for maximum winds of 185 mph, Exposure "C", using ASD design. The eave height of the home is assumed to be under 10' height with a maximum roof slope of 3/12. The system was previously tested per the attached test lab report.

Calculations:

1. Calculate uplift on #8 x 3" countersunk wood screws for 2" x 3" framing member.

Maximum uplift from attached calculations for roof for component and cladding :

Zone 1 = 48.68 psf

Zone 2 = 53.19 psf

Zone 2' = 64.60 psf

Zone 3 = 56.70 psf

Zone 3' = 74.73 psf

For 14'-0" wide mobile home the maximum uplift per foot on the side of the roof =

$14'-0''/2 = 7'$ with 6' in Zone 3' loading and 1' in Zone 2' loading = $6' \times 74.73 \text{ psf} + 1' \times 64.60 \text{ psf}$
= 448.38 plf + 64.60 plf = 512.98 plf max. each side

Assume existing and new framing is southern pine specific gravity = .55

∴ from National Design Specification for Wood Construction withdrawal for #8 screw = 141# per inch

Assume 1.75" penetration = 246.8#/per screw

Assume dry conditions for attachment

∴ $C_M = 1.0$

Assume $C_D = 1.33$ for load duration from wind

∴ Actual withdraw per screw = $246.8\# \times 1.33 \times 1.0 = 328.2\#$

Therefore use 1 – 3" screw at 6" o.c. = 2 screws per foot $\times 328.2\# = 656.4 \text{ plf} > 512.98 \text{ plf}$ required on each side of roof for worse case loading

2. Check Shear on #8 x 3# screw

#8 screw in Southern Pine = 148# for 1 1/2" side member from attached sheets

Maximum horizontal roof load assuming 3' roof projection = 3' x 42.03 psf for wind loading = 126.09 plf < 148# x 2 screws per foot = 296 plf OK

3. Check uplift on #8 x 1.5" s.m.s. into 1 1/2" framing:

Withdrawal of #8 x 1 1/4" = 141#/in penetration x 1" = 141 x 1.33 = 187#/screw

187#/screw x 4.0 screws/ft = 748# > 512.98# required

∴ OK

4. Check aluminum sheet attachment

f_t = tensile strength of .024 aluminum sheet = 12,500#/in²

f_b = bearing strength of .024 aluminum sheet = 18,100#/in²

$$f_t = \frac{TTd^2}{4} \times 12,500 = \quad \quad \quad d = .164"$$

$$f_t = \frac{TT \times .164^2}{4} \times 12,500 = 264\# \text{ per screw} \times 4.0 \text{ screws/ft} = 1,056 \text{ plf}$$

$$1,267.2 \text{ plf} > 126.36 \text{ plf}$$

∴ OK

$$f_b = \frac{TTd^2}{4} \times 18,100 = \frac{TT \times .164^2}{4} \times 18,100 = 382\# \text{ per screw} \times 4.0 \text{ screws/ft} = 1,528 \text{ plf}$$

$$1,528 \text{ plf} > 512.98 \text{ plf required}$$

∴ OK

Provide continuous aluminum attachment rail to prevent tearing of aluminum sheet and to provide protection against leaking.

MecaWind v2459

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Calculations Prepared by:

Date: Jan 18, 2024

File Location: C:\Users\James\Desktop\ams product approval.wnd

General:

Wind Load Standard	= ASCE 7-22	Basic Wind Speed	= 185.0 mph
Exposure Classification	= C	Risk Category	= II
Structure Type	= Building	Design Basis for Wind Pressures	= ASD
MWFRS Analysis Method	= Ch 27	C&C Analysis Method	= Ch 30 Pt 1
Dynamic Type of Structure	= Rigid	Show Advanced Options	= 0

Building:

Roof	= Roof Type	= Monoslope	Encl	= Enclosure Classification	= Enclosed
Help	= Help on Building Roof Type	= Help	Pitch	= Pitch of Roof	= 1.0 :12
θ	= Slope of Roof	= 4.76 Deg	R _{Ht}	= Ridge Height	= 11.167 ft
E _{Ht}	= Eave Height	= 10.000 ft	W	= Building Width	= 14.000 ft
L	= Building Length	= 60.000 ft	OH	= Type of Overhang	= All Overhang
Par	= Parapet	= None	HT _{over}	= Override Mean Roof Height	= False
Ht _{man}	= Mean Roof Height	= 10.000 ft	RA _{over}	= Override Roof Area	= False
GC _{pi_o}	= Override GC _{pi} value	= False	IsElev	= Building is Elevated	= False

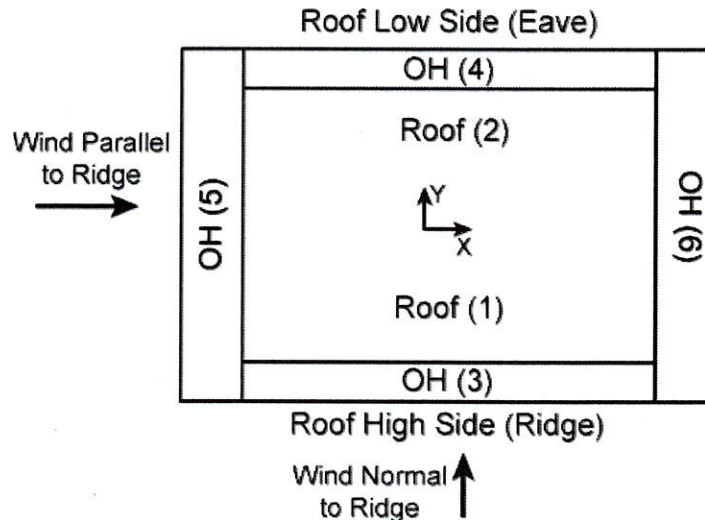
Exposure Constants [Tbl 26.11-1]:

α = 3-s Gust-speed exponent	= 9.800	Z _g = Nominal Ht of Boundary Layer	= 2460.000 ft
$\hat{\alpha}$ = Reciprocal of α	= 0.102	b = 3 sec gust speed factor	= 1.000
α_m = Mean hourly Wind-Speed Exponent	= 0.156	b _m = Mean hourly Windspeed Exponent	= 0.660
c = Turbulence Intensity Factor	= 0.200	ϵ = Integral Length Scale Exponent	= 0.2000

Overhang Inputs:

Std	= Overhangs on all sides are the same	= True
OHType	= Type of Roof Wall Intersections	= Overhang
OH	= Overhang of Roof Beyond Wall	= 0.500 ft

Main Wind Force Resisting System (MWFRS) Wind Calculations per Ch 27



h	= Mean structure height	= 10.000 ft
K _h	= $2.41 \cdot (15/Z_g)^{2/\alpha}$ [Tbl 26.10-1]	= 0.851
K _{zt}	= No Topographic feature specified	= 1.000
K _d	= Wind Directionality Factor per Tbl 26.6-1	= 0.85
+GC _{pi}	= Enclosed Positive Internal Pressure Tbl 26.13-1	= +0.18
-GC _{pi}	= Enclosed Negative Internal Pressure Tbl 26.13-1	= -0.18
LF	= Load Factor based upon ASD Design	= 0.60

K_e = Ground Elev Factor [Tbl 26.10-1] = 1.000
 q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1] = 44.74 psf
 RA = Roof Area = 918.17 ft²
 q_h = $0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1] = 44.74 psf
 q_{in} = Negative Internal Pressure: $q_h \cdot LF$ = 44.74 psf
 q_{ip} = Positive Internal Pressure: $q_h \cdot LF$ = 44.74 psf

MWFRS Wind Loads [Normal to Ridge]

h = Mean Roof Height Of Building = 10.000 ft
 RHt = Ridge Height Of Roof = 11.167 ft
 B = Horizontal Dimension Of Building Normal To Wind Direction = 60.000 ft
 L = Horizontal Dimension Of building Parallel To Wind Direction = 14.000 ft
 L/B = Ratio Of L/B used For C_p determination = 0.233
 h/L = Ratio Of h/L used For C_p determination = 0.714
 Slope = Slope Of Roof = 4.76 Deg

Gust Factor Calculation for Wind: [Normal to Ridge]

Gust Factor Category I Rigid Structures - Simplified Method

G_1 = Simplified: For Rigid Structures can use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m = Equiv Struc Height: $\text{Max}(0.6 \cdot h, Z_{min})$ = 15.000 ft
 I_{zm} = Turbulence Intensity: $c \cdot (33/Z_m)^{1/6}$ [Eq 26.11-7] = 0.228
 L_{zm} = Turbulence Integral Length Scale: $l \cdot (Z_m/33)^E$ [Eq 26.11-9] = 427.057 ft
 B = Building Width Width Normal to Wind Direction = 60.000 ft
 Q = $[1/(1+0.63 \cdot [(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8] = 0.912
 G_2 = Detailed: $0.925 \cdot [(1+1.7 \cdot g_q \cdot I_{zm} \cdot Q)/(1+1.7 \cdot g_v \cdot I_{zm})]$ [Eq 26.11-6] = 0.879

Gust Factor Used in Analysis

G = Gust Factor: $\text{Min}(G_1, G_2)$ = 0.850

C_{pww} = Windward Wall Coefficient (All L/B Values) = 0.800

C_{plw} = Leeward Wall Coefficient using L/B = -0.500

C_{psw} = Side Wall Coefficient (All L/B values) = -0.700

Wind Pressures [Normal to Ridge]

All wind pressures include a Load Factor (LF) of 0.6

Elev ft	GC_{pi} Windward	GC_{pi} Leeward	q_i psf	K_z	K_{zt}	q_z psf	Windward Press psf	Leeward Press psf	Side Press psf	Total Press psf	Minimum Pressure* psf
11.167	+0.18	+0.18	44.74	0.851	1.000	44.74	19.02	-23.01	-29.48	42.03	9.60
10.000	+0.18	+0.18	44.74	0.851	1.000	44.74	19.02	-23.01	-29.48	42.03	9.60
11.167	-0.18	-0.18	44.74	0.851	1.000	44.74	32.71	-9.32	-15.78	42.03	9.60
10.000	-0.18	-0.18	44.74	0.851	1.000	44.74	32.71	-9.32	-15.78	42.03	9.60

K_z = $2.41 \cdot (15/Z_g)^{2/\alpha}$ K_{zt} = No Topographic feature specified
 GC_{pi} = Enclosed Internal Pressure Tbl 26.13-1 q_z = $0.00256 \cdot K_z \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1]
 q_{ip} = Positive Internal Pressure: $q_h \cdot LF$ q_{in} = Negative Internal Pressure: $q_h \cdot LF$
 Side = $q_h \cdot K_d \cdot G \cdot C_{psw} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1 Leeward = $q_h \cdot K_d \cdot G \cdot C_{plw} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1
 Windward = $q_z \cdot K_d \cdot G \cdot C_{pww} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1 Total = Windward - Leeward
 * Minimum Pressure: § 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls
 * Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Roof Wind Pressures for Positive & Negative Internal Pressure ($\pm GC_{pi}$) [Normal to Ridge]

All wind pressures include a Load Factor (LF) of 0.6

Reference	Description	Location	Start Dist ft	End Dist ft	C_p Min	C_p Max	GC_{pi}	Pressure Min psf	Pressure Max psf
OH_Bot	Overhang Bottom	3	All	All	0.800	0.800	+0.00/-0.00	25.86	25.86
OH_Top	Overhang Top (0 to $h/2$)	3, 5, 6	0.000	5.000	-0.966	-0.180	+0.00/-0.00	-31.23	-5.82

OH_Top	Overhang Top (h/2 to h) 5,6	5.000	10.000	-0.814	-0.180	+0.00/-0.00	-26.32	-5.82
OH_Top	Overhang Top (h to 2*h) 4,5,6	10.000	15.000	-0.586	-0.180	+0.00/-0.00	-18.94	-5.82
Roof	Roof (0 to h/2) All	0.500	5.000	-0.966	-0.180	+0.18/-0.18	-38.08	1.03
Roof	Roof (h/2 to h) All	5.000	10.000	-0.814	-0.180	+0.18/-0.18	-33.17	1.03
Roof	Roof (h to 2*h) All	10.000	14.500	-0.586	-0.180	+0.18/-0.18	-25.78	1.03

Roof Pressures based upon Ch 27:

Start = Start Dist from Windward Edge

End = End Dist from Windward Edge

C_{p_min} = Smallest Coefficient Magnitude

C_{p_max} = Largest Coefficient Magnitude

$Press_{Min} = q_h \cdot K_d \cdot G \cdot C_{p_min} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1 $Press_{Max} = q_h \cdot K_d \cdot G \cdot C_{p_max} - q_{in} \cdot K_d \cdot (-GC_{pi})$ Eq 27.3-1

• 0.811 Reduction Factor applied for $h/L \geq 1$ & Slope < 10 Deg

• The smaller uplift pressures due to C_{p_Min} can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

MWFRS Wind Loads [Normal to Eave]

h	= Mean Roof Height Of Building	= 10.000 ft
RHt	= Ridge Height Of Roof	= 11.167 ft
B	= Horizontal Dimension Of Building Normal To Wind Direction	= 60.000 ft
L	= Horizontal Dimension Of building Parallel To Wind Direction	= 14.000 ft
L/B	= Ratio Of L/B used For C_p determination	= 0.233
h/L	= Ratio Of h/L used For C_p determination	= 0.714
Slope	= Slope Of Roof	= 4.76 Deg

Gust Factor Calculation for Wind: [Normal to Eave]

Gust Factor Category I Rigid Structures - Simplified Method

G_1 = Simplified: For Rigid Structures can use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m = Equiv Struc Height: $\text{Max}(0.6 \cdot h, Z_{min})$ = 15.000 ft

I_{zm} = Turbulence Intensity: $c \cdot (33/Z_m)^{1/6}$ [Eq 26.11-7] = 0.228

L_{zm} = Turbulence Integral Length Scale: $l \cdot (Z_m/33)^8$ [Eq 26.11-9] = 427.057 ft

B = Building Width Width Normal to Wind Direction = 60.000 ft

Q = $[1/(1+0.63 \cdot [(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8] = 0.912

G_2 = Detailed: $0.925 \cdot [(1+1.7 \cdot g_q \cdot I_{zm} \cdot Q)/(1+1.7 \cdot g_v \cdot I_{zm})]$ [Eq 26.11-6] = 0.879

Gust Factor Used in Analysis

G = Gust Factor: $\text{Min}(G_1, G_2)$ = 0.850

C_{p_WW} = Windward Wall Coefficient (All L/B Values) = 0.800

C_{p_LW} = Leeward Wall Coefficient using L/B = -0.500

C_{p_SW} = Side Wall Coefficient (All L/B values) = -0.700

Wind Pressures [Normal to Eave]

All wind pressures include a Load Factor (LF) of 0.6

Elev ft	GC_{pi} Windward	GC_{pi} Leeward	q_i psf	K_z	K_{zt}	q_z psf	Windward Press psf	Leeward Press psf	Side Press psf	Total Press psf	Minimum Pressure* psf
10.000	+0.18	+0.18	44.74	0.851	1.000	44.74	19.02	-23.01	-29.48	42.03	9.60
10.000	-0.18	-0.18	44.74	0.851	1.000	44.74	32.71	-9.32	-15.78	42.03	9.60

$K_z = 2.41 \cdot (15/Z_g)^{2/\alpha}$

K_{zt} = No Topographic feature specified

GC_{pi} = Enclosed Internal Pressure Tbl 26.13-1

$q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1]

q_{ip} = Positive Internal Pressure: $q_h \cdot LF$

q_{in} = Negative Internal Pressure: $q_h \cdot LF$

Side = $q_h \cdot K_d \cdot G \cdot C_{p_SW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Leeward = $q_h \cdot K_d \cdot G \cdot C_{p_LW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Windward = $q_z \cdot K_d \cdot G \cdot C_{p_WW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Total = Windward - Leeward

• Minimum Pressure: § 27.1.5 no less than 9.60 psf (Incl LF) applied to Walls

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Roof Wind Pressures for Positive & Negative Internal Pressure ($\pm GC_{pi}$) [Normal to Eave]

All wind pressures include a Load Factor (LF) of 0.6

Reference	Description	Location	Start Dist ft	End Dist ft	C _p Min	C _p Max	GC _{pi}	Pressure Min psf	Pressure Max psf
OH_Bot	Overhang Bottom	4	All	All	0.800	0.800	+0.00/-0.00	25.86	25.86
OH_Top	Overhang Top (0 to h/2)	4,5,6	0.000	5.000	-0.966	-0.180	+0.00/-0.00	-31.23	-5.82
OH_Top	Overhang Top (h/2 to h)	5,6	5.000	10.000	-0.814	-0.180	+0.00/-0.00	-26.32	-5.82
OH_Top	Overhang Top (h to 2*h)	3,5,6	10.000	15.000	-0.586	-0.180	+0.00/-0.00	-18.94	-5.82
Roof	Roof (0 to h/2)	All	0.500	5.000	-0.966	-0.180	+0.18/-0.18	-38.08	1.03
Roof	Roof (h/2 to h)	All	5.000	10.000	-0.814	-0.180	+0.18/-0.18	-33.17	1.03
Roof	Roof (h to 2*h)	All	10.000	14.500	-0.586	-0.180	+0.18/-0.18	-25.78	1.03

Roof Pressures based upon Ch 27:

Start = Start Dist from Windward Edge

End = End Dist from Windward Edge

C_{p_min} = Smallest Coefficient Magnitude

C_{p_max} = Largest Coefficient Magnitude

Press_{Min} = $q_h \cdot K_d \cdot G \cdot C_{p_min} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Press_{Max} = $q_h \cdot K_d \cdot G \cdot C_{p_max} - q_{in} \cdot K_d \cdot (-GC_{pi})$ Eq 27.3-1

• 0.811 Reduction Factor applied for h/L ≥ 1 & (0 to h/2)

• The smaller uplift pressures due to C_{p_Min} can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7

• Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

MWFRS Wind Loads [Parallel to Ridge]

h	= Mean Roof Height Of Building	= 10.000 ft
RHt	= Ridge Height Of Roof	= 11.167 ft
B	= Horizontal Dimension Of Building Normal To Wind Direction	= 14.000 ft
L	= Horizontal Dimension Of building Parallel To Wind Direction	= 60.000 ft
L/B	= Ratio Of L/B used For Cp determination	= 4.286
h/L	= Ratio Of h/L used For Cp determination	= 0.167
Slope	= Slope Of Roof	= 4.76 Deg

Gust Factor Calculation for Wind: [Parallel to Ridge]

Gust Factor Category I Rigid Structures - Simplified Method

G₁ = Simplified: For Rigid Structures can use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Z_m = Equiv Struc Height: Max(0.6*h, Z_{min}) = 15.000 ft

I_{zm} = Turbulence Intensity: $c \cdot (33/Z_m)^{1/6}$ [Eq 26.11-7] = 0.228

L_{zm} = Turbulence Integral Length Scale: $l \cdot (Z_m/33)^8$ [Eq 26.11-9] = 427.057 ft

B = Building Width Width Normal to Wind Direction = 14.000 ft

Q = $[1/(1+0.63 \cdot [(B+h)/L_{zm}]^{0.63})]^{0.5}$ [Eq 26.11-8] = 0.952

G₂ = Detailed: $0.925 \cdot [(1+1.7 \cdot g_q \cdot I_{zm} \cdot Q)/(1+1.7 \cdot g_v \cdot I_{zm})]$ [Eq 26.11-6] = 0.900

Gust Factor Used in Analysis

G = Gust Factor: Min(G₁, G₂) = 0.850

C_{p_WW} = Windward Wall Coefficient (All L/B Values) = 0.800

C_{p_LW} = Leeward Wall Coefficient using L/B = -0.200

C_{p_SW} = Side Wall Coefficient (All L/B values) = -0.700

Wind Pressures [Parallel to Ridge]

All wind pressures include a Load Factor (LF) of 0.6

Elev ft	GC _{pi} Windward	GC _{pi} Leeward	q _i psf	K _z	K _{zt}	q _z psf	Windward Press psf	Leeward Press psf	Side Press psf	Total Press psf	Minimum Pressure* psf
11.167	+0.18	+0.18	44.74	0.851	1.000	44.74	19.02	-13.31	-29.48	32.33	9.60
10.000	+0.18	+0.18	44.74	0.851	1.000	44.74	19.02	-13.31	-29.48	32.33	9.60
11.167	-0.18	-0.18	44.74	0.851	1.000	44.74	32.71	0.38	-15.78	32.33	9.60
10.000	-0.18	-0.18	44.74	0.851	1.000	44.74	32.71	0.38	-15.78	32.33	9.60

K_z = $2.41 \cdot (15/Z_g)^{2/\alpha}$

K_{zt} = No Topographic feature specified

GC_{pi} = Enclosed Internal Pressure Tbl 26.13-1

q_z = $0.00256 \cdot K_z \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1]

q_{ip} = Positive Internal Pressure: q_h · LF

q_{in} = Negative Internal Pressure: q_h · LF

Side = $q_h \cdot K_d \cdot G \cdot C_{p_SW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Leeward = $q_h \cdot K_d \cdot G \cdot C_{p_LW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Windward = $q_z \cdot K_d \cdot G \cdot C_{p_WW} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

Total = Windward - Leeward

- Minimum Pressure: $\geq 27.1.5$ no less than 9.60 psf (Incl LF) applied to Walls
- Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Roof Wind Pressures for Positive & Negative Internal Pressure ($\pm GC_{pi}$) [Parallel to Ridge]
All wind pressures include a Load Factor (LF) of 0.6

Reference	Description	Location	Start Dist ft	End Dist ft	C_p Min	C_p Max	GC_{pi}	Pressure Min psf	Pressure Max psf
OH_Bot	Overhang Bottom	5	All	All	0.800	0.800	+0.00/-0.00	25.86	25.86
OH_Top	Overhang Top (0 to h)	3,4,5	0.000	10.000	-0.900	-0.180	+0.00/-0.00	-29.10	-5.82
OH_Top	Overhang Top (h to 2*h)	3,4	10.000	20.000	-0.500	-0.180	+0.00/-0.00	-16.16	-5.82
OH_Top	Overhang Top ($\geq 2*h$)	3,4,6	20.000	60.000	-0.300	-0.180	+0.00/-0.00	-9.70	-5.82
Roof	Roof (0 to h)	All	0.500	10.000	-0.900	-0.180	+0.18/-0.18	-35.94	1.03
Roof	Roof (h to 2*h)	All	10.000	20.000	-0.500	-0.180	+0.18/-0.18	-23.01	1.03
Roof	Roof ($\geq 2*h$)	All	20.000	60.500	-0.300	-0.180	+0.18/-0.18	-16.54	1.03

Roof Pressures based upon Ch 27:

Start = Start Dist from Windward Edge

End = End Dist from Windward Edge

C_{p_min} = Smallest Coefficient Magnitude

C_{p_max} = Largest Coefficient Magnitude

$Press_{Min} = q_h \cdot K_d \cdot G \cdot C_{p_min} - q_{ip} \cdot K_d \cdot (+GC_{pi})$ Eq 27.3-1

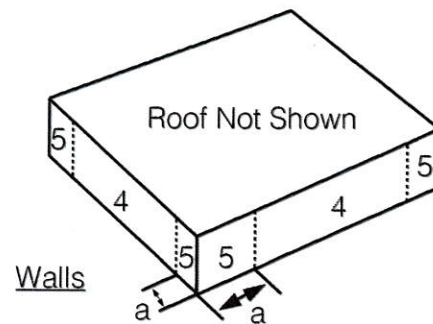
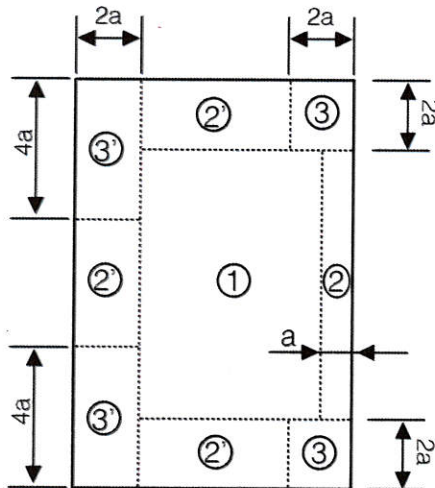
$Press_{Max} = q_h \cdot K_d \cdot G \cdot C_{p_max} - q_{in} \cdot K_d \cdot (-GC_{pi})$ Eq 27.3-1

- No reduction factor was applicable

- The smaller uplift pressures due to C_{p_Min} can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7

- Positive Pressures Act TOWARD Surface and Negative Pressures Act AWAY from Surface

Components and Cladding (C&C) Wind Loads per Ch 30 Part 1 Roof & Wall



h/W	= Ratio of mean roof height to building width	= 0.714
h/L	= Ratio of mean roof height to building length	= 0.167
h	= Mean structure height	= 10.000 ft
K_h	= $2.41 \cdot (15/Z_g)^{2/\alpha}$	= 0.851
K_{zt}	= No Topographic feature specified	= 1.000
K_d	= Wind Directionality Factor per Tbl 26.6-1	= 0.85
$+GC_{pi}$	= Enclosed Positive Internal Pressure Tbl 26.13-1	= +0.18
$-GC_{pi}$	= Enclosed Negative Internal Pressure Tbl 26.13-1	= -0.18
LF	= Load Factor based upon ASD Design	= 0.60
K_e	= Ground Elev Factor [Tbl 26.10-1]	= 1.000
q_h	= $0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1]	= 44.74 psf
LHD	= Least Horizontal Dimension: $\min(B, L)$	= 14.000 ft
a_1	= $\min(0.1 \cdot LHD, 0.4 \cdot h)$	= 1.400 ft
a	= $\max(a_1, 0.04 \cdot LHD, 3 \text{ ft } [0.9 \text{ m}])$	= 3.000 ft
h/B	= Ratio of mean roof height to least horizontal dim: h/B	= 0.714

Wind Pressures for C&C Ch 30 Pt 1 Roof & Wall
All wind pressures include a Load Factor (LF) of 0.6

Description	Zone	Width ft	Span ft	Area ft ²	1/3 Rule	Figure	GCp Max	GCp Min	p Max psf	p Min psf
Zone 1	1	1.000	14.000	65.33	Yes	30.3-5A	0.218	-1.100	15.16	-48.68
Zone 2	2	1.000	14.000	65.33	Yes	30.3-5A	0.218	-1.218	15.16	-53.19
Zone 2'	2'	1.000	14.000	65.33	Yes	30.3-5A	0.218	-1.518	15.16	-64.60
Zone 3	3	1.000	14.000	65.33	Yes	30.3-5A	0.218	-1.311	15.16	-56.70
Zone 3'	3'	1.000	14.000	65.33	Yes	30.3-5A	0.218	-1.785	15.16	-74.73

Area = Span Length x Effective Width
1/3 Rule = Effective width need not be less than 1/3 of the span length
GCp = External Pressure Coefficients taken from Figures 30.3-1 through 30.3-7
p = Wind Pressure: $q_h \cdot K_d \cdot [GC_p - GC_{pi}]$ [Eq 30.3-1]
* Per § 30.2.2 the Minimum Pressure for C&C is 9.60 psf [0.460 kPa] (Includes LF)
Since Roof Slope $\leq 10^\circ$, the Wall GCp values for Zone 4 & 5 are reduced by 10%

Components and Cladding (C&C) Wind Overhang Calculations per Ch 30 Pt 4: [Roof & Wall]

h = Mean structure height = 10.000 ft
 $K_h = 2.41 \cdot (15/Z_g)^{2/\alpha}$ = 0.851
 K_{zt} = No Topographic feature specified = 1.000
 K_d = Wind Directionality Factor per Tbl 26.6-1 = 0.85
 $+GC_{pi}$ = Enclosed Positive Internal Pressure Tbl 26.13-1 = +0.18
 $-GC_{pi}$ = Enclosed Negative Internal Pressure Tbl 26.13-1 = -0.18
LF = Load Factor based upon ASD Design = 0.60
 K_e = Ground Elev Factor [Tbl 26.10-1] = 1.000
 $q_h = 0.00256 \cdot K_h \cdot K_{zt} \cdot K_e \cdot V^2 \cdot LF$ [Eq 26.10-1] = 44.74 psf

Wind Pressures for Overhangs per Section Ch 30 Pt 4 [Roof & Wall]
All wind pressures include a Load Factor (LF) of 0.6

Description	Zone	Width ft	Span ft	Area ft ²	1/3 Rule	Figure	GCpi t	GCp Max	GCp Min	p Max psf	p Min psf
Zone 1_OH	1_OH	1.000	14.000	65.33	Yes	30.3-5A/30.3-1	0.00	0.218	-1.870	9.60	-71.14
Zone 2_OH	2_OH	1.000	14.000	65.33	Yes	30.3-5A/30.3-1	0.00	0.218	-1.989	9.60	-75.65
Zone 2'_OH	2'_OH	1.000	14.000	65.33	Yes	30.3-5A/30.3-1	0.00	0.218	-2.289	9.60	-87.06
Zone 3_OH	3_OH	1.000	14.000	65.33	Yes	30.3-5A/30.3-1	0.00	0.218	-2.081	9.60	-79.16
Zone 3'_OH	3'_OH	1.000	14.000	65.33	Yes	30.3-5A/30.3-1	0.00	0.218	-2.555	9.60	-97.19

#_OH = Zone # on Overhang with Zero Internal Pressure ($GC_{pi} = 0$)
Area = Span Length x Effective Width
1/3 Rule = Effective width need not be less than 1/3 of the span length
p = Wind Pressure: $q_h \cdot K_d \cdot [GC_p - GC_{pi}]$ [Eq 30.7-1]
* Per § 30.2.2 the Minimum Pressure for C&C is 9.60 psf [0.460 kPa] (Includes LF)
Values of GCp for overhangs include contributions from both upper and lower surfaces.

Warnings & Notes:

Overhang GCp determined from adding applicable roof GCp on top to applicable Wall GCp on bottom

TABLE 11.3A-CUT THREAD WOOD SCREW DESIGN VALUES (Z)^{1,2}
for SINGLE SHEAR (two member) CONNECTIONS with both members of identical species

SIDE MEMBER THICKNESS	WOOD SCREW DIAMETER	WOOD SCREW GAGE	G=0.57 RED OAK	G=0.55 MIXED MAPLE SOUTHERN PINE	G=0.50 DOUGLAS FIR- LARCH	G=0.49 DOUGLAS FIR- LARCH (N)	G=0.46 DOUGLAS FIR (S) HEM-FIR (N)
t_s inches	D inches		Z lbs.	Z lbs.	Z lbs.	Z lbs.	Z lbs.
1/2	0.138	6g	111	35	75	73	58
	0.151	7g	123	95	34	32	76
	0.164	8g	140	108	96	94	38
	0.177	9g	152	119	107	104	97
	0.190	10g	156	122	109	106	100
	0.216	12g	173	138	124	121	114
	0.242	14g	183	146	132	128	121
	0.268	16g	212	171	155	151	143
5/8	0.294	18g	235	190	172	168	159
	0.138	6g	127	95	33	30	74
	0.151	7g	140	105	92	39	33
	0.164	8g	157	119	105	101	94
	0.177	9g	170	130	114	111	103
	0.190	10g	173	133	117	114	106
	0.216	12g	189	147	131	127	119
	0.242	14g	198	155	138	134	125
3/4	0.268	16g	227	179	161	156	147
	0.294	18g	252	199	178	174	163
	0.138	6g	132	106	92	88	81
	0.151	7g	150	117	102	98	90
	0.164	8g	177	132	114	111	102
	0.177	9g	190	142	124	120	111
	0.190	10g	193	145	127	123	114
	0.216	12g	208	159	140	135	126
1	0.242	14g	217	166	146	142	132
	0.268	16g	246	190	169	164	153
	0.294	18g	272	210	187	182	170
	0.320	20g	310	242	216	210	197
	0.372	24g	362	283	252	246	230
	0.138	6g	132	110	101	99	93
	0.151	7g	150	125	115	112	106
	0.164	8g	177	148	135	132	121
1-1/4	0.177	9g	199	167	147	142	130
	0.190	10g	205	171	150	144	132
	0.216	12g	239	186	161	156	143
	0.242	14g	256	193	168	162	150
	0.268	16g	290	217	190	184	170
	0.294	18g	320	240	210	203	188
	0.320	20g	359	272	239	232	215
	0.372	24g	419	317	279	270	251
1-1/2	0.138	6g	132	110	101	99	93
	0.151	7g	150	125	115	112	106
	0.164	8g	177	148	135	132	125
	0.177	9g	199	167	152	149	141
	0.190	10g	205	171	157	153	145
	0.216	12g	239	200	183	179	164
	0.242	14g	256	213	193	186	170
	0.268	16g	305	249	215	208	191
1-1/2	0.294	18g	340	275	238	229	211
	0.320	20g	403	308	268	259	238
	0.372	24g	471	359	312	302	278
	0.138	6g	132	110	101	99	93
	0.151	7g	150	125	115	112	106
	0.164	8g	177	148	135	132	125
	0.177	9g	199	167	152	149	141
	0.190	10g	205	171	157	153	145
1-1/2	0.216	12g	239	200	183	179	169
	0.242	14g	256	213	195	191	181
	0.268	16g	305	253	233	228	214
	0.294	18g	340	284	260	254	236
	0.320	20g	403	336	300	289	265
	0.372	24g	471	394	349	337	309

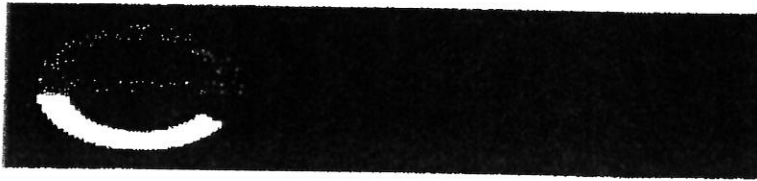
1. Tabulated lateral design values (Z) for wood screw connections shall be multiplied by all applicable adjustment factors (see Table 7.3.1).
2. Tabulated lateral design values (Z) are for cut thread wood screws inserted in side grain with wood screw axis perpendicular to wood fibers, and with the following wood screw bending yield strengths (F_{yb}):

$F_{yb} = 100,000$ psi for 6g wood screws	$F_{yb} = 70,000$ psi for 14g and 16g wood screws
$F_{yb} = 90,000$ psi for 7g, 8g and 9g wood screws	$F_{yb} = 60,000$ psi for 18g and 20g wood screws
$F_{yb} = 80,000$ psi for 10g and 12g wood screws	$F_{yb} = 45,000$ psi for 24g wood screws

TABLE 11.2A-CUT THREAD or ROLLED THREAD WOOD SCREW WITHDRAWAL DESIGN VALUES (W)¹
 Tabulated withdrawal design values (W) are in pounds per inch of thread penetration into side grain of main member.
 Thread length is approximately $\frac{2}{3}$ the total wood screw length (see Reference 4).

Specific Gravity G	Wood Screw Gage										
	6g	7g	8g	9g	10g	12g	14g	16g	18g	20g	24g
0.73	209	229	249	268	288	327	367	406	446	485	564
0.71	198	216	235	254	272	310	347	384	421	459	533
0.68	181	199	216	233	250	284	318	352	387	421	489
0.67	176	193	209	226	243	276	309	342	375	409	475
0.58	132	144	157	169	182	207	232	256	281	306	356
0.55	119	130	141	152	163	186	208	231	253	275	320
0.51	102	112	121	131	141	160	179	198	217	237	275
0.50	98	107	117	126	135	154	172	191	209	228	264
0.49	94	103	112	121	130	147	165	183	201	219	254
0.47	87	95	103	111	119	136	152	168	185	201	234
0.46	83	91	99	107	114	130	146	161	177	193	224
0.44	76	83	90	97	105	119	133	148	162	176	205
0.43	73	79	86	93	100	114	127	141	155	168	196
0.42	69	76	82	89	95	108	121	134	147	161	187
0.41	66	72	78	85	91	103	116	128	141	153	178
0.40	63	69	75	81	86	98	110	122	134	146	169
0.39	60	65	71	77	82	93	105	116	127	138	161
0.38	57	62	67	73	78	89	99	110	121	131	153
0.37	54	59	64	69	74	84	94	104	114	125	145
0.36	51	56	60	65	70	80	89	99	108	118	137
0.35	48	53	57	62	66	75	84	93	102	111	130
0.31	38	41	45	48	52	59	66	73	80	87	102

1. Tabulated withdrawal design values (W) for wood screw connections shall be multiplied by all applicable adjustment factors (see Table 7.3.1).



Element Materials Technology
1924 Premier Row Orlando, FL 32809
C 407-505-8102
O 651-645-3601
jim.blakely@element.com

Report No.: ESP008983P
Report Date: March 1, 2012

STRUCTURAL PERFORMANCE TEST REPORT

Test Requested By - John E. Murray
941 S.W. 8th Street
Pompano Beach, FL 33069

Test Conducted: ASTM E 1592-01 "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference"

TEST SPECIMENS

DESCRIPTION

Overall Size:
All Specimens 12' wide x 14' long

Chamber Configuration: Element Materials Technology provided a strong chamber consisting of a steel tested bed constructed of C8" x 11.5 A36 Steel "C" channel. The "C" channel was vertically oriented and butted, fully seam welded at each corner connection on the exterior face. Attached to the web of the "C" channel on the interior of the bed was a continuous perimeter 2" x 2" x .250" thick A36 Steel angle secured with 3" fillet welds 2.00" c/l from each corner and 16.00" on center thereafter. Attached to said channel a continuous perimeter SYP 2" x 4" mounting surface in the flat secured mechanically to the steel angle with .150" diameter x 3" long Hilti Power Fasteners on 12" centers. Attached to the 2" x 4" with mounting surface with .150" diameter x 3" long Hilti Power Fasteners on 12" centers, was a .750" thick continuous plywood deck, supported across the bed in the 12' dimension with three (3) equally spaced 2" x 2" x .250" A36 Steel angle supports. Mechanical attachment of the .750" plywood deck to angles was achieved via .150" diameter x 3" long Hilti Power Fasteners on 12" centers. The reaction mass was constructed out of wood. Consisting of 4" x 8" roof truss, 2" x 6" wall studs on 12" centers, and .750" thick plywood sheathing. All connections were mechanical and secured with #8 x 3.00" long C.S., P.H. screws. The reaction mass was placed on the test bed, and a tight seal was achieved with .625" closed cell foam tape.



MATERIAL CHARACTERISTICS

Test Specimen Construction:

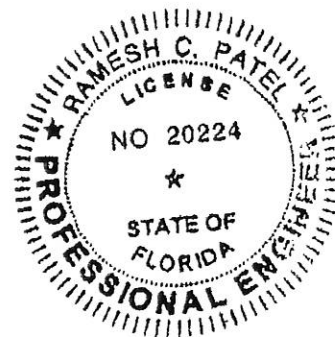
All Specimens:

The aluminum roof over assembly measured 144" wide by 168" long overall. The specimens were fabricated with four (4) aluminum sheets measuring 12.500", 48", 48", and 35.500" x 14' long and each was painted white on the exterior. The sheets were joined together at each longitudinal edge by means of an aluminum cleat to form one (1) continuous member. The sheet stock was a minimum 0.024" thick. The cleat stock was 0.030" minimum thick. Joining of the .024 sheet stock with the .030" cleat is achieved via pressure clamping and application of a continuous strip of Birdsong Ind. Product # 2535 Butyl Rubber tape on both sides of the seam. Premier Industries Insulfoam molded EPS 2" thick polystyrene foam panel's min. #1 lb. density between the 2" x 4" P.T. installation members, underneath the aluminum sheeting. A continuous ribbon of SikaLastomer -95 Isobutylene Triopolymer butyl rubber tape was applied to the top of the 2" x 4" before the aluminum sheet was attached. A .9375" wide x .062" thick extruded aluminum attachment rail was placed at the perimeter edge of the assembly, on top of the aluminum sheet. Attachment of the assembly rail to the aluminum sheet was as achieved as follows: #8 x 1.500" S.M.S., 3" O.C. thru the aluminum sheet into the 2" x 4" P.T. installation members. #8 x 3" wood screws 9" O.C. thru the aluminum sheet, thru the .750" plywood into the 2" x 4" test chamber mounting surface.

Summary of Test Method

Paragraph 4.0

This Test method consists of the following: (1) sealing the test specimen into or against one face of a test chamber, (2) supplying air to, or exhausting air from, the chamber at the rate required to maintain the test pressure difference across the specimen, and (3) observing, measuring, and recording the deflection, deformations, and nature of any failures of principal or critical elements of the panel profile or members of the anchor systems.



Performance Test Results

SEQUENCE OF TESTS PERFORMED:

ASTM E-1592-01

Test Results: Measurement location center mid-span of test specimens. Numbers recorded are net results taking out end play and chamber movement.

Specimen 1	Deflection	Set	Specimen 2	Deflection	Set	Specimen 3	Deflection	Set
43.77 psf	.710"	.130"	43.77 psf	.768"	.000"	43.77 psf	.320"	.003"
58.38 psf	1.030"	.092"	58.38 psf	1.330"	.004"	58.38 psf	.413"	.035"
72.99 psf	1.720"	.220"	72.99 psf	1.090"	.037"	72.99 psf	.635"	.071"
87.60 psf	2.170"	.252"	87.60 psf	1.170"	.190"	87.60 psf	1.578"	.082"
102.2 psf	3.035"	.315"	102.2 psf	1.720"	.098"	102.2 psf	2.220"	.143"
116.8 psf	Fail		116.8 psf	Fail		116.8 psf	Fail	

Results: Each specimen experienced the same mode of failure. Where the two (2) 4' panels were joined (cleated) the longitudinal seam dis-engaged at center mid-span.



DRAWINGS TO BE SUBMITTED:

Submittal drawings numbered 1 thru 5 and marked with the Element Materials Technology stamp are a part of this report submitted by our client (Elixir/AMS)

Test Date: January 26, 2012

Test Completion Date: January 27, 2012

Remarks: Detail drawings were available for laboratory records and comparison to the tested specimens at the time of this report. A copy of this report along with representative sections of the test specimen will be retained by Element Materials Technology for a period of four (4) years. The results obtained apply only to the specimen tested.

This test report does not constitute certification of this product, but only the above test results were obtained using the designated test methods and they indicate compliance with the performance requirements (paragraphs as listed) of the above referenced specifications.

Element Materials Technology assumed that all information provided by the client is accurate and that the physical and chemical properties of the components are as stated by the manufacturer.

Tests Witnessed by:

Steve Gibbs. Lab. Manager- Element Materials Technology
Washington Romero. Lab Tech.- Element Materials Technology

Client Present:

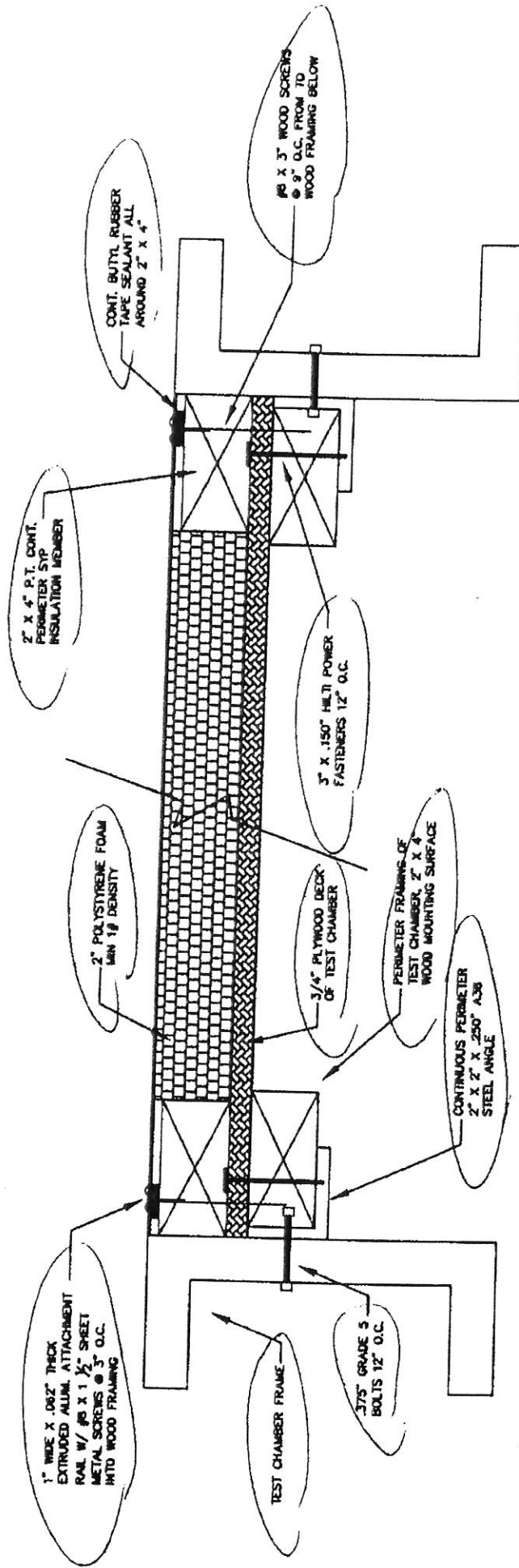
James Bushouse, P.E.
Ed Moses- AMS
Dennis Boudreau- Elixir

Michael Miller

Michael Miller
Lab Technician, Element Materials Technology
Architectural Division



Cc: AMS (2)
Elixir (2)
James Bushouse P.E. (1)
Ramesh Patel P.E. (1)
File (1)



SECTION AA

ELEMENT MATERIALS TECHNOLOGY
1924 Premier Row
Orlando, FL 32809

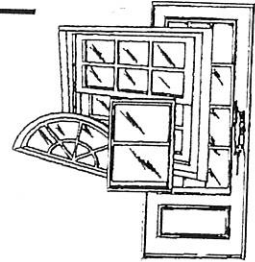
ESP NO. ESP008983P
Date Verified: Feb 28/12
Verified By: ing

Certified Testing Laboratories

Architectural Division _ 1924 Premier Row _ Orlando, FL 32809

(407) 438-2019 _ Toll Free (800) 381-7744 _ Fax (407) 438-4064

E-mail: www.certifiedtestinglaboratories.com



June 18, 2015

Florida Department of Business and Professional Regulations
1940 North Monroe Street
Suite 90
Tallahassee, Florida 32399-0772

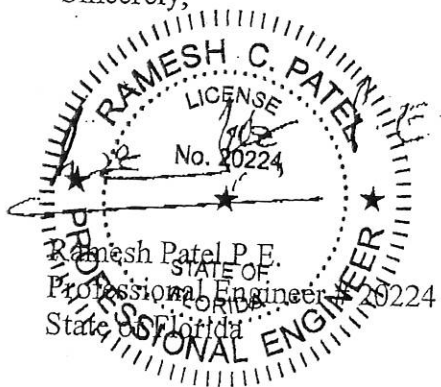
Re: Product Approval #FL 5739 for Elixir Industries and AMS Inc.

To whom it may concern:

This letter is in regards to certifying that the new test standards from ASTM E 1592-01 to ASTM E 1592-05 do not have any impact on the test results for Elixir Industries Report performed by Element Materials at the time and now under Certified Testing Laboratories.

If you should have any further questions please contact me at mike@ctlarch.com or 312-594-0365.

Sincerely;





element™

Element Materials Technology
1924 Premier Row
Orlando, Florida
32809
407-505-8102

Statement of Independence

To whom it may concern,

Element Materials Technology is a privately owned, corporation. The Laboratory or its officers are not financially affiliated or associated with any manufacturer or supplier of goods, or distributor/dealer in manufactured products.

The Laboratory is not owned nor does it employ anyone who is financially affiliated or associated with, any manufacturer or supplier of goods, or distributor/dealer in manufactured products.

God Bless,

James W. Blakely
Operations Mgr.
Orlando, Fl. / Wausau, Wis.



- 1) THIS DESIGN COMPLIES TO THE 2023 FLORIDA BUILDING CODE FOR A CATEGORIED 1 BUILDING FOR WIND LOADING OF 185 MPH EXPOSURE C AS NOTED ON THE DRAWING.
- 2) THE DESIGN MEETS THE MINIMUM REQUIREMENTS OF 15% DRAINAGE FOR MOBILE/HOME-ANCHORED HOME REPAIRS AND RELOCATIONS.
- 3) ALUMINUM ROOFING IS DESIGNED FOR USE OVER A SOLID ROOF ONLY, IT SHALL NOT BE USED AS A STRUCTURAL ROOF SYSTEM.
- 4) THE ROOF COVERING SHALL NOT OVERLAP THE EXISTING ROOF.
- 5) THE STRUCTURE OF THE EXISTING ROOF SHALL BE THE SAME AS THE EXISTING ROOF. THE EXISTING ROOF SHALL BE REMOVED AND RE-ROOFED.
- 6) MAXIMUM WIDTH OF A DOUBLE WIDE MOBILE HOME NOT TO EXCEED 14'-0".
- 7) MAXIMUM HEIGHT OF MOBILE HOME NOT TO EXCEED 11'-0".
- 8) MAXIMUM HEIGHT OF MOBILE HOME NOT TO EXCEED 11'-0".
- 9) MINIMUM THICKNESS OF ALL ROOF FLASHING TO BE .024 ALUM.
- 10) THE R-VALUE OF THE EPS INSULATION IS R=6-7.

Date: 2024.01.22 14:56:03 -05'00'

James D
Bushouse

OWNER:	NOT VALID UNLESS DATED & SEALED WITH EMBOSSED ENGINEER'S SEAL		
ADDRESS:			
CITY:	STATE:	ZIP:	
LOT#	BLOCK#	RANGE:	
JAMES BUSHOUSE, P.E. PROFESSIONAL ENGINEER 20311 STATE OF FLORIDA			

NOT VALID UNLESS DATED
& SEALED WITH EMBOSSED
ENGINEER'S SEAL

C.A. #27565

3140 WEDGEWOOD BLVD.
DELRAY BEACH, FL 33445
PHONE: 561.908.2473

P.O. BOX 1237
ARCADIA, FL 34265
PHONE: 863.491.8242

DATE _____

4100 N. Powerline Road, Bay Z-3

Pompano Beach, Florida 33073

1.800.226.6677