

Support Calculations
ASCE 7-02 Wind Design (120mph)

For

Standard Cupola CU1162

Job Number 060118

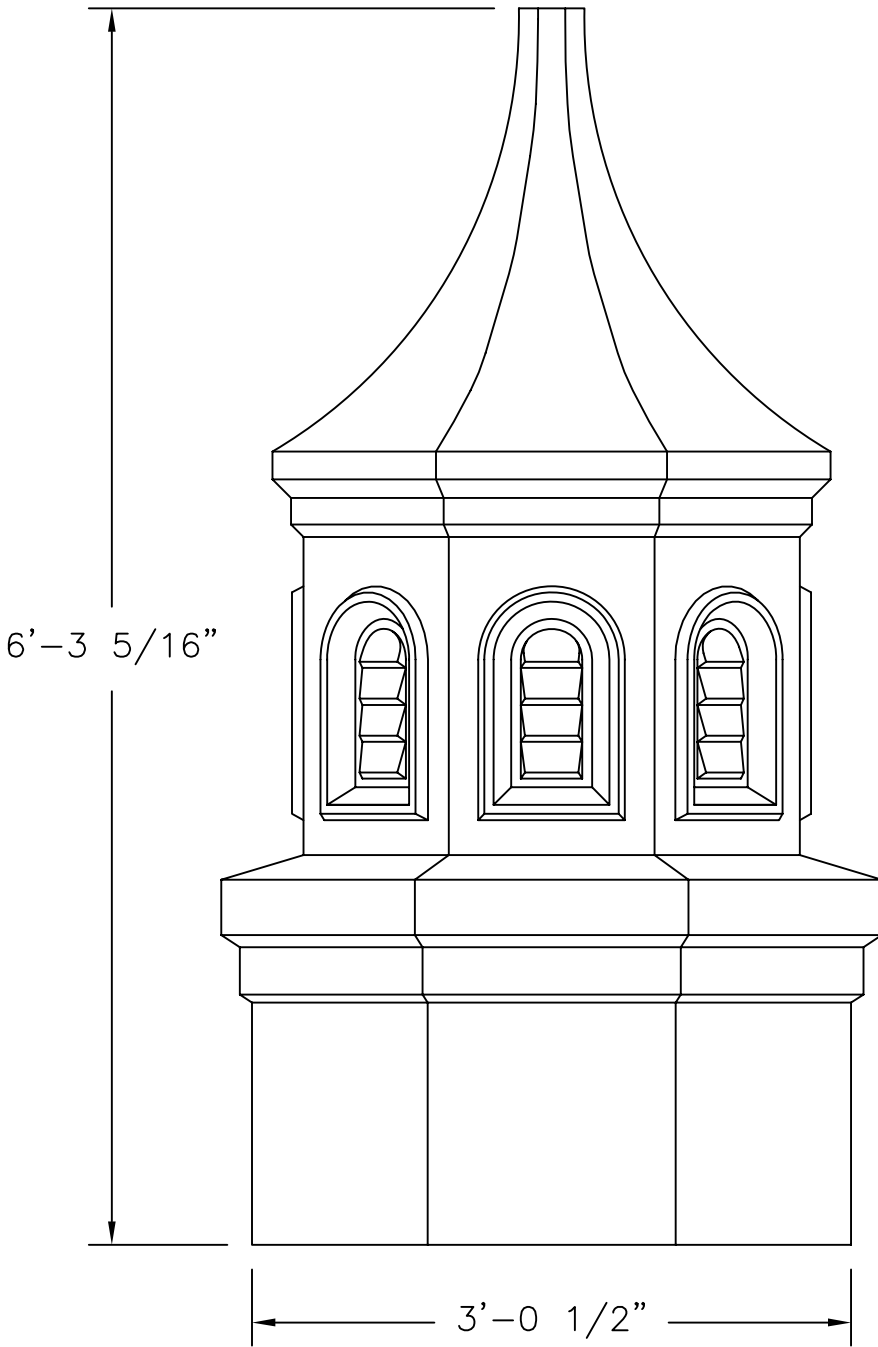
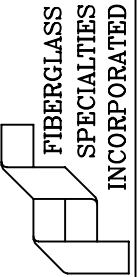
Prepared for:
Fiberglass Specialties Inc.

Designed by Philippe Lalonde, P.E.
6617 Red Bud Road
Fort Worth, Texas 76135
817-307-8266

DESIGN PARAMETERS

The unit described in these drawings is engineered to adequately support the loads created by a wind velocity of 120 MPH at a height of 50' above ground using ASCE 7-02 exposure category "C".

P.O. BOX 1340
HENDERSON, TX 75653-1340
903/657-6522
FAX# 903/657-2318



CUPOLA UNIT #1162
WITH FALSE LOUVERS

① ELEVATION
E1

Project: CUPOLA UNIT #1162

Date: 11-21-00

Revisions

Scale: 1" = 1'

Drawing By: RLB

Checked By:

File # ALL-STL

DWG # CU1162F

Sheet #

E1F

ELEVATION

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NOTES:

1. THESE DRAWINGS ARE THE PROPERTY OF FIBERGLASS SPECIALTIES INC. AND MAY NOT BE REPRODUCED WITHOUT EXPRESS WRITTEN PERMISSION FROM FIBERGLASS SPECIALTIES, INC.
2. DIMENSIONS AND DETAILS ARE SUBJECT TO CHANGE WITHOUT NOTICE.
3. ALL CUPOLA AND STEEPLE UNITS ARE FABRICATED USING MINIMAL STANDING SEAMS UNLESS OTHERWISE NOTED. SEE SECTION VIEWS FOR APPROXIMATE LOCATION OF SEAMS.
4. ALL CUPOLA AND STEEPLE UNITS ARE DESIGNED TO BE ERECTED ON A COMPLETED ROOFING SYSTEM.
5. ALTHOUGH OUR CUPOLAS AND STEEPLES ARE WATER RESISTANT WE DO NOT GUARANTEE THEM TO BE LEAK PROOF.
6. FIBERGLASS SPECIALTIES INC. RECOMMENDS THAT THE INSTALLER USE A-325 BOLTS WHEN CONNECTING TO THE ROOF STRUCTURE BELOW.
7. ACTUAL ANCHOR BOLT LOCATIONS MAY VARY. THE INSTALLER SHOULD NOT DRILL HOLES IN ROOF UNTIL UNIT IS ON SITE.
8. DUE TO MANUFACTURING TOLERANCES AND VARIATIONS IN SITE CONDITIONS, METAL SHIMS MAY BE REQUIRED BETWEEN ADJACENT COLLARS.

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FIBERGLASS
 SPECIALTIES
 INCORPORATED

CUPOLA UNIT #1162
 CROSS SECTION SHOWING
 INTERNAL STRUCTURE

Project:

Date: 11-27-00

Revisions

Scale: 3/4" = 1'

Drawing By: RLB

Checked By: ALL-STL

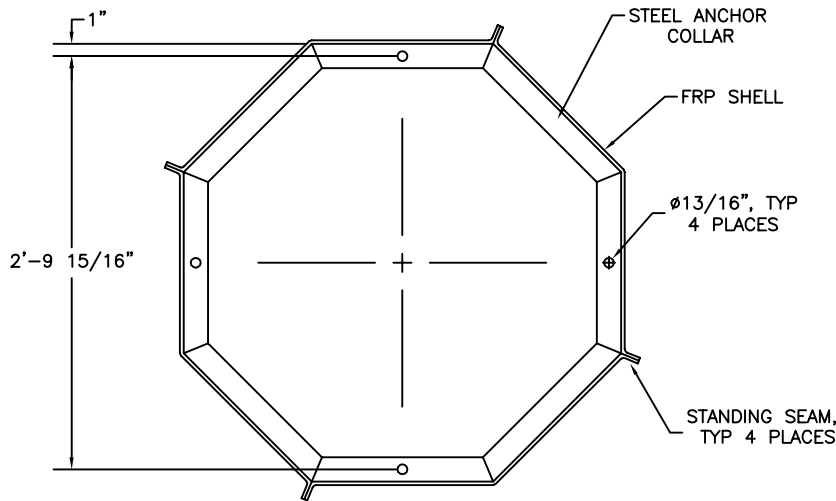
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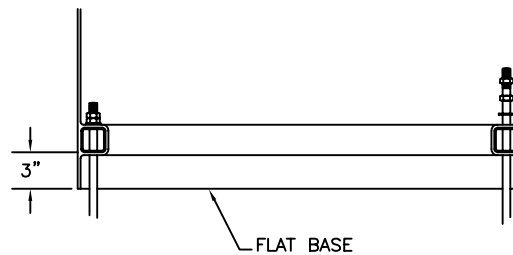
Sheet #

S1E

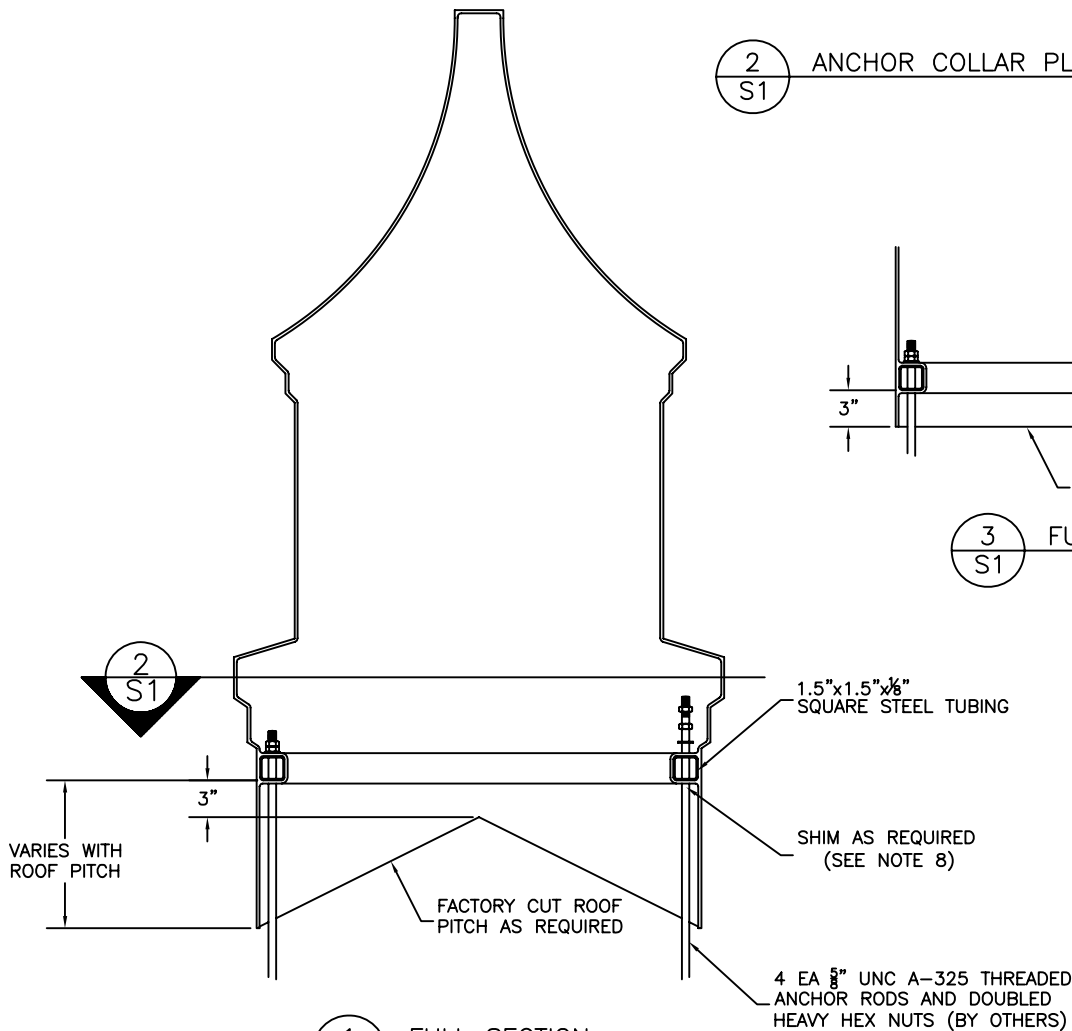
STRUCTURE



2
S1 ANCHOR COLLAR PLAN



3
S1 FULL SECTION



1
S1 FULL SECTION

Wind Load Calculations

<u>UNIT:</u>	<u>COMPONENTS</u>	<u>Wind Speed</u>
Standard Cupola CU1162	Refer to plans	V := 120

Calculated reactions are based on ASCE 7-02 data for the wind speed given above at a height of 50' to 60' above ground using exposure category 'C'. Refer to drawings for height of fiberglass structure.

Kz50 := 1.09 *Table 6-3*
 Kz60 := 1.13 *Table 6-3*

Kzt := 1.0 *Section 6.5.5 Fig. 6-4*
 I := 1.0 *Table 6-1*

Velocity Pressure:

$$v_{50} := 0.00256 \cdot K_{z50} \cdot K_{zt} \cdot V^2 \cdot I$$

$$v_{50} = 40.18 \frac{\text{lb}}{\text{ft}^2}$$

$$v_{60} := 0.00256 \cdot K_{z60} \cdot K_{zt} \cdot V^2 \cdot I$$

$$v_{60} = 41.66 \frac{\text{lb}}{\text{ft}^2}$$

G := 0.85 *Gust Factor - Sec. 6.5.8.1*
 F1 := 1.4 *Force Coefficient - Table 6-7 square*
 F2 := 0.6 *Force Coefficient - Table 6-7 Round Moderately smooth*
 F3 := 1.2 *Force Coefficient - Table 6-7 Hexagon or Octagon*

Pressure Loads:

$$F_{50} := v_{50} \cdot G \cdot F_3 \quad F_{50} = 40.99 \frac{\text{lb}}{\text{ft}^2}$$

$$F_{60} := v_{60} \cdot G \cdot F_3 \quad F_{60} = 42.49 \frac{\text{lb}}{\text{ft}^2}$$

Summary of Output for Design of Structure

Maximum Plate Stress from Finite Element Analysis = 508 psi

The ultimate stress for the fiberglass skin is 18,000 psi. For this design the service stress was taken to be one third of ultimate, 6,000 psi. All plate stresses are within the allowable limits of the service stress for the Steeple.

All steel members pass the AISC code check.

Connection to Structure and Applied Loads:

Reactions : Refer to computer output for Reactions.

The STAAD report represents a summary of the output. Complete output will be supplied upon request.



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Job No 060118	Sheet No 1	Rev
Part		
Ref		
By PL	Date 19-Jul-06	Chd
Client FSI	File CU1162.std	Date/Time 19-Jul-2006 21:49

Job Information

	Engineer	Checked	Approved
Name:	PL		
Date:	19-Jul-06		

Structure Type	SPACE FRAME
-----------------------	-------------

Number of Nodes	979	Highest Node	1015
Number of Elements	43	Highest Beam	1012
Number of Plates	964	Highest Plate	1018

Number of Basic Load Cases	2
Number of Combination Load Cases	0

Included in this printout are data for:

All	The Whole Structure
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Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	WEIGHT
Primary	2	WIND



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060118

Sheet No
2

Rev

Job Title CU1162

Part

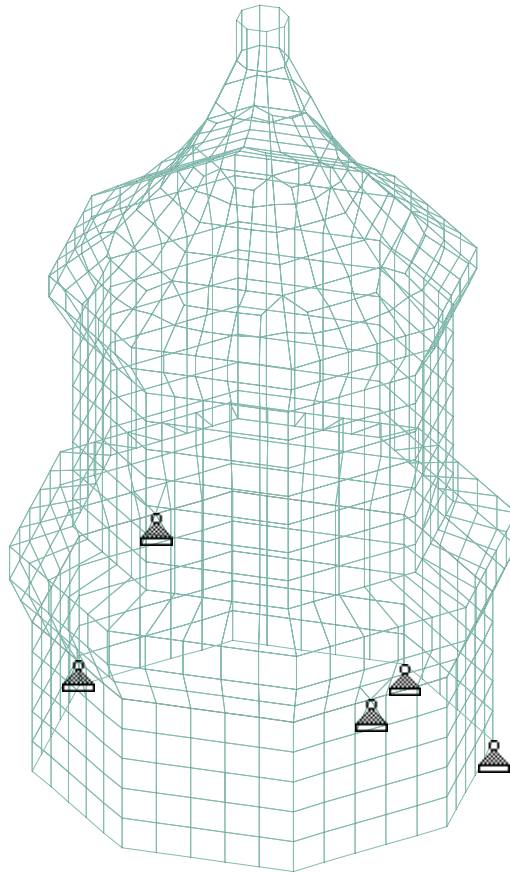
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File CU1162.std

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Load 2

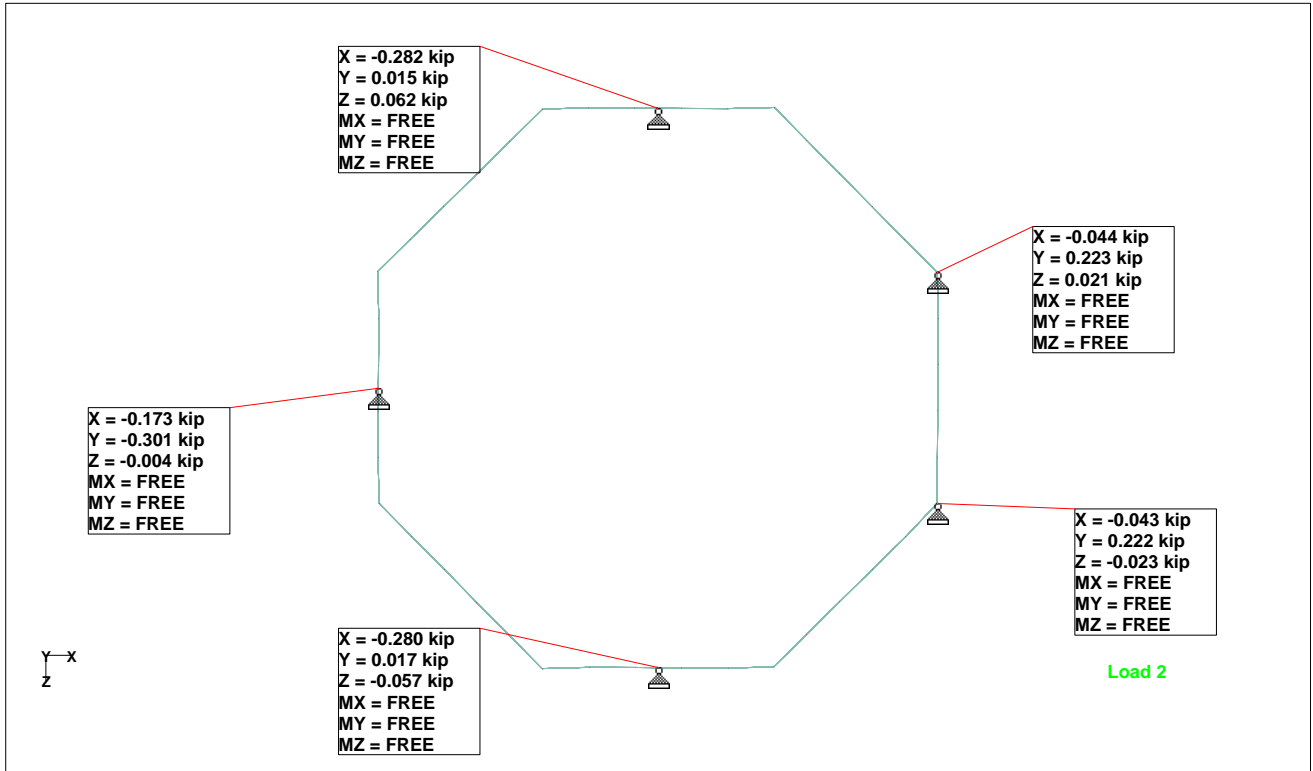
Whole Structure



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Job Title CU1162





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Sheet No
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Job Title CU1162

Part

Ref

By PL

Date 19-Jul-06

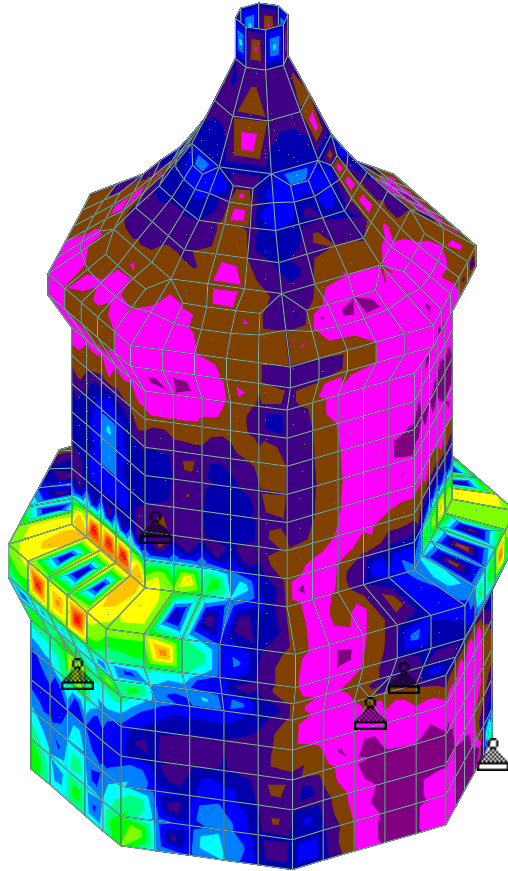
Chd

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Max Absolute
psi



Load 2

wind Stress Contours

Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
2	HSST1.5X1.5X0.125	0.608	0.188	0.188	0.308	STEEL

Plate Thickness

Prop	Node A (in)	Node B (in)	Node C (in)	Node D (in)	Material
1	0.250	0.250	0.250	0.250	FRP



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Materials

Mat	Name	E (kip/in ²)	v	Density (kip/in ³)	α (1/°K)
1	FRP	1.8E 3	0.300	0.000	0.000
2	STEEL	29E 3	0.300	0.000	3.61E -6
3	ALUMINUM	10E 3	0.330	0.000	7.11E -6
4	CONCRETE	3.15E 3	0.170	0.000	3.06E -6

Supports

Node	X (kip/in)	Y (kip/in)	Z (kip/in)	rX (kip*ft/deg)	rY (kip*ft/deg)	rZ (kip*ft/deg)
2	Fixed	Fixed	Fixed	-	-	-
152	Fixed	Fixed	Fixed	-	-	-
1013	Fixed	Fixed	Fixed	-	-	-
1014	Fixed	Fixed	Fixed	-	-	-
1015	Fixed	Fixed	Fixed	-	-	-

Basic Load Cases

Number	Name
1	WEIGHT
2	WIND

Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	27	2:WIND	0.076	-0.006	0.000	0.076	0.000	0.001	-0.002
Min X	173	2:WIND	-0.003	-0.001	0.003	0.004	-0.000	0.000	-0.000
Max Y	541	2:WIND	0.043	0.022	-0.000	0.048	-0.000	-0.000	-0.002
Min Y	13	2:WIND	0.033	-0.027	-0.000	0.042	-0.000	-0.000	-0.002
Max Z	424	2:WIND	0.011	0.001	0.010	0.015	-0.001	0.001	0.001
Min Z	679	2:WIND	0.011	0.001	-0.010	0.015	0.001	-0.001	0.001
Max rX	209	2:WIND	0.004	-0.003	-0.002	0.006	0.002	-0.000	0.002
Min rX	953	2:WIND	0.004	-0.003	0.002	0.006	-0.002	0.000	0.002
Max rY	549	2:WIND	0.012	0.001	-0.000	0.012	0.000	0.004	0.001
Min rY	555	2:WIND	0.011	0.000	-0.000	0.011	-0.000	-0.004	0.001
Max rZ	74	2:WIND	0.005	-0.004	-0.001	0.006	-0.000	0.000	0.004
Min rZ	600	2:WIND	0.016	0.019	0.000	0.025	-0.000	0.000	-0.003
Max Rst	27	2:WIND	0.076	-0.006	0.000	0.076	0.000	0.001	-0.002



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Plate Centre Stress Summary

	Plate	L/C	Shear		Membrane			Bending		
			Qx (psi)	Qy (psi)	Sx (psi)	Sy (psi)	Sxy (psi)	Mx (lb·in/in)	My (lb·in/in)	Mxy (lb·in/in)
Max Qx	526	2:WIND	17.985	-7.849	-230.989	89.306	-45.008	-0.446	-2.019	0.310
Min Qx	522	2:WIND	-18.068	-7.748	-231.579	86.297	45.110	-0.481	-2.006	-0.315
Max Qy	531	2:WIND	5.188	24.579	-13.762	124.239	-63.752	1.066	2.277	1.060
Min Qy	45	2:WIND	-6.116	-25.350	15.145	-116.267	45.368	-1.212	-2.134	-1.139
Max Sx	536	2:WIND	-12.392	-21.681	252.928	58.163	-77.432	0.411	2.340	0.125
Min Sx	525	2:WIND	-1.035	-8.244	-273.707	-19.701	-34.428	-1.473	-4.084	-0.036
Max Sy	397	2:WIND	0.413	-0.657	42.942	180.644	-30.877	0.304	0.884	-0.099
Min Sy	5	2:WIND	-1.446	1.582	-82.218	-145.522	80.381	0.114	-0.320	0.075
Max Sxy	637	2:WIND	0.200	-0.547	-125.583	-37.263	93.254	-0.330	-0.186	-0.111
Min Sxy	401	2:WIND	0.210	-1.209	-116.197	-28.401	-95.426	-0.298	0.052	0.131
Max Mx	372	2:WIND	6.648	0.074	-26.287	2.112	-2.338	2.984	0.789	0.122
Min Mx	489	2:WIND	0.171	-0.580	-3.107	-1.401	-0.025	-2.861	-0.131	0.023
Max My	533	2:WIND	-2.242	-7.971	218.445	31.035	37.404	1.558	4.289	-0.136
Min My	49	2:WIND	-2.377	5.366	-190.326	-25.572	32.214	-1.736	-4.104	-0.515
Max Mxy	41	2:WIND	6.024	-25.045	15.812	-112.993	-45.705	-1.189	-2.110	1.124
Min Mxy	45	2:WIND	-6.116	-25.350	15.145	-116.267	45.368	-1.212	-2.134	-1.139

Plate Centre Principal Stress Summary

	Plate	L/C	Principal		Von Mis		Tresca	
			Top (psi)	Bottom (psi)	Top (psi)	Bottom (psi)	Top (psi)	Bottom (psi)
Max (t)	525	2:WIND	451.443	374.345	418.703	456.435	75.851	508.470
Max (b)	533	2:WIND	450.165	386.470	412.823	428.542	89.300	460.870
Max VM (t)	525	2:WIND	451.443	374.345	418.703	456.435	75.851	508.470
Max VM (b)	525	2:WIND	451.443	374.345	418.703	456.435	75.851	508.470
Tresca (t)	1001	2:WIND	323.092	148.623	305.908	138.586	285.192	125.686
Tresca (b)	525	2:WIND	451.443	374.345	418.703	456.435	75.851	508.470



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Sheet No
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Part

Job Title CU1162

Ref

By PL Date 19-Jul-06 Chd

Client FSI

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Date/Time 19-Jul-2006 21:49

Reactions

Node	L/C	Horizontal	Vertical	Horizontal	Moment		
		FX (kip)	FY (kip)	FZ (kip)	MX (kip·in)	MY (kip·in)	MZ (kip·in)
2	1:WEIGHT	-0.001	0.023	-0.007	0.000	0.000	0.000
	2:WIND	-0.043	0.222	-0.023	0.000	0.000	0.000
152	1:WEIGHT	-0.001	0.023	0.007	0.000	0.000	0.000
	2:WIND	-0.044	0.223	0.021	0.000	0.000	0.000
1013	1:WEIGHT	-0.002	0.044	-0.000	0.000	0.000	0.000
	2:WIND	-0.173	-0.301	-0.004	0.000	0.000	0.000
1014	1:WEIGHT	0.002	0.043	-0.001	0.000	0.000	0.000
	2:WIND	-0.282	0.015	0.062	0.000	0.000	0.000
1015	1:WEIGHT	0.002	0.043	0.001	0.000	0.000	0.000
	2:WIND	-0.280	0.017	-0.057	0.000	0.000	0.000