STRESS ANALYSIS

Tower Tech model TTXL-06 & TTXR-06

12' legs

FOR

TOWER TECH, Inc.

BY

J.R. KING ENGINEERING

I HEREBY CERTIFY THAT THESE CALCULATIONS WAS PREPARED BY ME AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF Florida.

SIGNED: Jerome King

DATE: 12/17/16

REG. NO. 28201

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Title:
Fiberglass modular cooling tower – TTXL-06 & TTXR-06
12' legs

Purpose:
Analyze and design the components of the fiberglass cooling tower.

References:

1. AISC, Steel Construction Manual, 8th edition
2. Structural Engineering Handbook, 2ND edition
   By Gaylord & Gaylord, 1973 McGraw-Hill
3. Aluminum Structures, 2nd edition
   By J. Randolph Kissell & Robert Ferry
4. Risa3d – Rapid interactive structural analysis,
   three dimensional, computer software

Specifications:

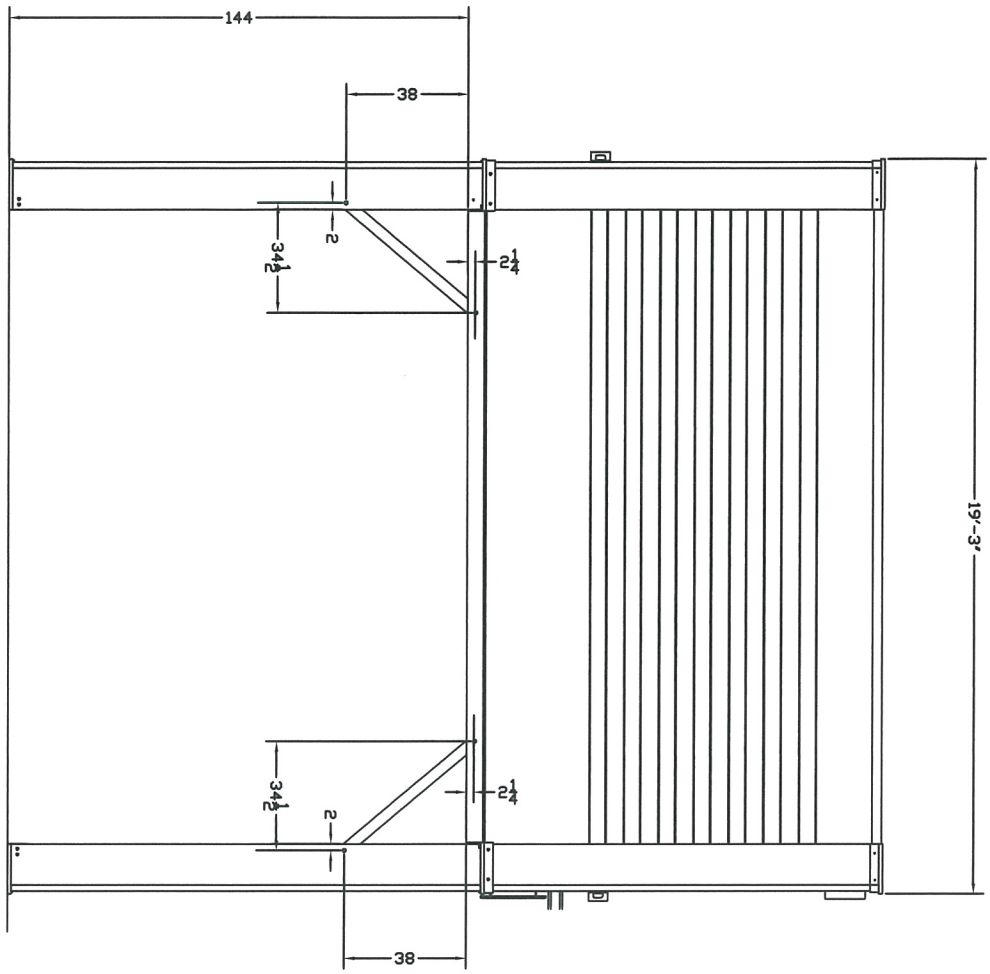
1. Tower Tech tests and material properties data
2. Creative Pultrusions, Inc. material properties data

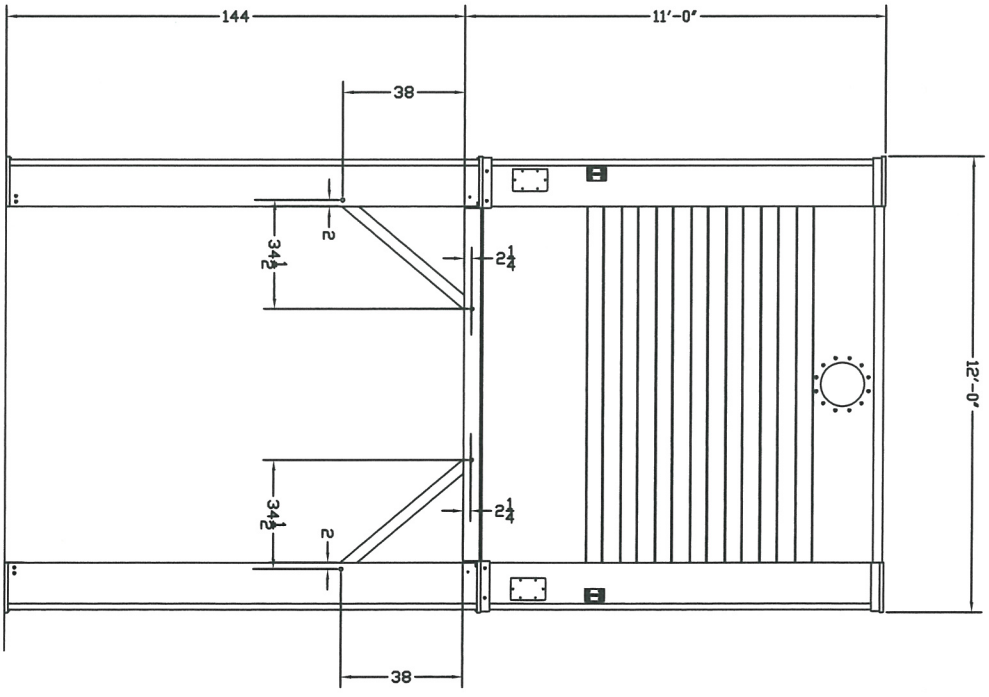
Design Requirements:
The design loads shall be in accordance with the IBC (International Building Code). Wind, seismic and gravity loadings are applied. The illustrated tower shell and substructure is designed to withstand a wind pressure of 91.6 psf. (ASCE7-10 200 mph wind, exposure C) and a seismic force factors: SDC E, Ss = 3, S1 = 2, soil class D.

Procedures:
Procedures are the methodologies indicated in the listed references, as specifically presented within the calculations. To use the AISC equations and built-in sections within risa3d, the fiberglass properties have been put in place of the steel; the printouts that have "Steel" headings are calculated as fiberglass and should be interpreted as such. The properties of the fill material are based on actual in-house tests. Safety factors are calculated and compared to those for steel, aluminum, and wood.

Conclusions:
The analysis and design of the subject cooling tower and their appurtenances have been completed satisfactorily.

STANDARD BRACING UP TO 144 INCH SUBSTRUCTURE





DATE:	23 Jan 2016
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DWG TYPE:	SPECIAL
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CONSTRUCTION LIBRARY DRAWING

Bracing Scheme for Seismic and Wind Load Applications

TTXL-06 & TTXR-06

Model #

TOWER TECH, Inc.
THE TECHNOLOGY COMPANY
Oklahoma City, Oklahoma

Modular Cooling Tower

LATERAL FORCES

Lateral Wind

200 mph, exposure "C" RISK III OR IV

qz = .00256(200)*2x.9x.9=82.9

Fx=82.9x.85.1.3xAf=91.6Af

Seismic Forces

Largest spectral response accelerations

Ss = 300%g, S1 = 200%g Soil class "D" , Fa = 1.0, Fv = 1.5

Sms = 1 x 3.0 = 3.0 Sds = 2/3 x Sms = 2.0

Sm1 = 1.5 x 2 = 3.0 Sd1 = 2/3 x Sm1 = 2.0

Importance Factor = 1.0

Seismic Design Category = E

Select R = 3.0 Omega = 2 Cd = 2.5 (table 15.4-1)

Elevated tanks, vessels, on symmetrically braced legs (sec 15.7.10)

ASCE/SEI 7-10 (Chapter 15)

Section 15.4 go to Section 12.8

Seismic base shear: V = Cs x W

Operational weight, W= 19,727 lbs

Cs = Sds/(R/I) = 2/3

V=Cs x W = 13,151 lbs

SECTION 1609 WIND LOADS

FIGURE 1609A ULTIMATE DESIGN WIND SPEEDS, V_{alt} FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES

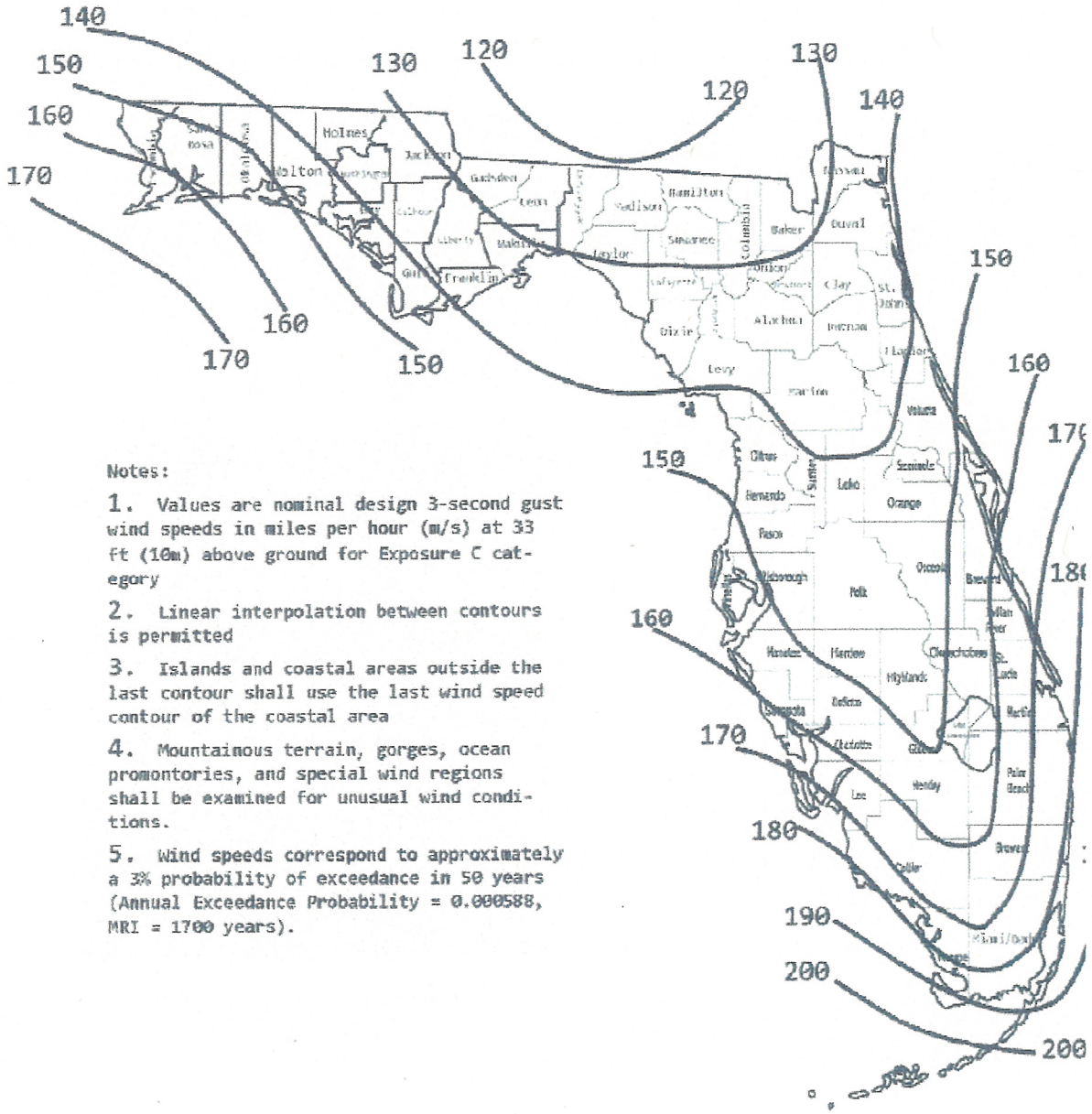

FIGURE 1609B ULTIMATE DESIGN WIND SPEEDS, V_{alt} FOR RISK CATEGORY III AND IV BUILDINGS AND OTHER STRUCTURES

Envelope Only Solution

J.R. King Engineering	Tower Tech TTXL-06 TTXR-06	SK - 1
Jerry King		Dec 16, 2016 at 10:46 AM
		TTXL-06.r3d

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1...	Density[k/ft^3]	Yield[ksi]	Ry	Fu[ksi]	Rt
1	fiberglass	2000	500	.12	.44	.11	20	1.2	58	1.1

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E5 F)	Density[k/ft^3]
1	FIBERGLASSPL	2000	500	.12	.44	.11
2	RIGID	1e+5		0	0	0
3	GM3	25	6	.12	.44	0

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Ru...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	C-1	HSS12x12x6	Column	Single Angle	fiberglass	Typical	16	357	357	561
2	C-2	L8x8x14	Column	Single Angle	fiberglass	Typical	13.3	79.7	79.7	3.46
3	B-1	HSS20x8x10	Beam	Tube	fiberglass	Typical	30.3	338	1440	916
4	B-2	HSS20x8x10	Beam	Tube	fiberglass	Typical	30.3	338	1440	916
5	B-3	HSS20x8x10	Beam	Tube	fiberglass	Typical	30.3	338	1440	916
6	B-4	L4x4x8	Beam	Single Angle	fiberglass	Typical	3.75	5.52	5.52	.322
7	B-5	L4x4x8	Beam	Single Angle	fiberglass	Typical	3.75	5.52	5.52	.322
8	B-6	W6x20	Beam	Wide Flange	fiberglass	Typical	5.87	13.3	41.4	.24
9	PIPE	PIPE_10.0	Beam	Pipe	fiberglass	Typical	11.5	151	151	302
10	BR-1	HSS3.5x3.5x4	VBrace	Tube	fiberglass	Typical	2.91	5.04	5.04	8.35
11	COLLECTOR	C8x11.5	Beam	Channel	fiberglass	Typical	3.37	1.31	32.5	.13

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	GEN1	RE4X4	Beam	FIBERGLASSPL	16	21.333	21.333	31.573
2	RIGID		None	RIGID	1e+6	1e+8	1e+8	1e+6
3	FILL	RE2X2	Beam	GM3	4	1.333	1.333	1.973

Load Combinations

	Description	Sol...	PDelta	SRSS	BLC	Fa...	BLC	Factor	BLC	Fac...	BLC	Fa...	BLC	Fa...	BLC	Fa...	...	...	...	...	BLC	Fact...	BLC	Fact...
1	SEISMIC				SX*...	1	SZ*SF	1																
2	IBC 16-9	Yes			DL	1	LL	1																
3	IBC 16-12 (a) ...	Yes			DL	1	WLX	.6																
4	IBC 16-12 (a) ...	Yes			DL	1	WLZ	.6																
5	IBC 16-13 (a) ...	Yes			DL	1	WLX	.45	LL	.75														
6	IBC 16-13 (a) ...	Yes			DL	1	WLZ	.45	LL	.75														
7	IBC 16-13 (c) ...	Yes			DL	1	WLX	.45	LL	.75														
8	IBC 16-13 (c) ...	Yes			DL	1	WLZ	.45	LL	.75														
9	IBC 16-12 (b) ...	Yes			DL	1	Sds*DL	.14	SX*SF	.7	SZ*...	.21												
10	IBC 16-12 (b) ...	Yes			DL	1	Sds*DL	.14	SZ*SF	.7	SX*...	.21												
11	IBC 16-12 (b) ...	Yes			DL	1	Sds*DL	.14	SX*SF	.7	SZ*...	-.21												
12	IBC 16-12 (b) ...	Yes			DL	1	Sds*DL	.14	SZ*SF	.7	SX*...	-.21												
13	IBC 16-14 (a) ...	Yes			DL	1	Sds*DL	.105	SX*SF	.525	SZ*...	.158	LL	.75										
14	IBC 16-14 (a) ...	Yes			DL	1	Sds*DL	.105	SZ*SF	.525	SX*...	.158	LL	.75										
15	IBC 16-14 (a) ...	Yes			DL	1	Sds*DL	.105	SX*SF	.525	SZ*...	-.1...	LL	.75										
16	IBC 16-14 (a) ...	Yes			DL	1	Sds*DL	.105	SZ*SF	.525	SX*...	-.1...	LL	.75										
17	IBC 16-16 (a)	Yes			DL	.6	Sds*DL	-.14	SX*SF	.7	SZ*...	.21												
18	IBC 16-16 (b)	Yes			DL	.6	Sds*DL	-.14	SZ*SF	.7	SX*...	.21												
19	IBC 16-16 (c)	Yes			DL	.6	Sds*DL	-.14	SX*SF	.7	SZ*...	-.21												
20	IBC 16-16 (d)	Yes			DL	.6	Sds*DL	-.14	SZ*SF	.7	SX*...	-.21												

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu..	Area(Me...	Surface...
1	DEAD	DL		-1						
2	FILL	DL						2		
3	WATER	LL						2		
4	WIND-Z	WLZ								209
5	WIND-X	WLX								121
6	DEFLECTION	None								

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N3	max	.861	3	10.336	12	2.846	4	0	2	0	2	0	2
2		min	-2.332	17	-6.078	4	-2.372	10	0	2	0	2	0	2
3	N2	max	.787	3	12.204	4	2.897	4	0	2	0	2	0	2
4		min	-2.393	9	-5.46	20	-2.343	18	0	2	0	2	0	2
5	N1	max	.861	3	12.176	4	2.885	4	0	2	0	2	0	2
6		min	-2.335	19	-5.46	18	-2.343	20	0	2	0	2	0	2
7	N4	max	.787	3	10.336	10	2.859	4	0	2	0	2	0	2
8		min	-2.39	11	-6.105	4	-2.372	12	0	2	0	2	0	2
9	Totals:	max	3.296	3	20.968	15	11.487	4						
10		min	-9.358	11	3.903	18	-9.352	10						

Envelope AISC 14th(360-10): ASD Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear..	Loc[..	Dir	LC	Pnc/o...	Pnt/om...	Mnyy/om [k-ft]	Mnzz/om [k...	Cb	Eqn
1	M30	HSS3.5x3...	.902	1.986	4	.018	0	y	11	17.484	34.85	3.313	3.313	1..	H1-1a
2	M32A	HSS3.5x3...	.898	1.986	4	.017	4.423	y	9	17.484	34.85	3.313	3.313	1..	H1-1a
3	M31A	HSS3.5x3...	.742	1.986	9	.025	4.423	y	4	17.484	34.85	3.313	3.313	1..	H1-1a
4	M30A	HSS3.5x3...	.742	1.986	11	.025	0	y	4	17.484	34.85	3.313	3.313	1..	H1-1a
5	M31	HSS3.5x3...	.736	1.986	10	.017	0	y	11	17.484	34.85	3.313	3.313	1..	H1-1a
6	M29A	HSS3.5x3...	.736	1.986	12	.018	4.423	y	9	17.484	34.85	3.313	3.313	1..	H1-1a
7	M2	HSS12x1...	.667	8.694	10	.184	8.816	y	4	85.839	191.617	44.088	44.088	1..	H1-1b
8	M1	HSS12x1...	.667	8.694	12	.183	8.816	z	4	85.839	191.617	44.088	44.088	1..	H1-1b
9	M3	HSS12x1...	.656	8.694	11	.186	8.816	z	4	85.839	191.617	44.088	44.088	1..	H1-1b
10	M4	HSS12x1...	.645	8.694	4	.185	8.816	y	4	85.839	191.617	44.088	44.088	1..	H1-1b
11	M32	HSS3.5x3...	.363	2.347	19	.025	4.423	y	4	17.484	34.85	3.313	3.313	1..	H1-1a
12	M29	HSS3.5x3...	.363	2.347	17	.025	0	y	4	17.484	34.85	3.313	3.313	1..	H1-1a
13	M6	L8x8x14	.322	0	9	.077	0	y	4	19.504	159.281	15.023	18.973	3..	H2-1
14	M5	L8x8x14	.295	0	11	.094	0	z	4	19.504	159.281	15.023	28.689	4..	H2-1
15	M7	L8x8x14	.256	0	16	.078	0	z	4	19.504	159.281	15.023	28.087	4..	H2-1
16	M24	PIPE_10.0	.237	9	4	.043	18		4	33.549	137.725	28.992	28.992	1..	H1-1b

Envelope Joint Displacements

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotatio...	LC	Z Rotatio...	LC
1	N351	max	2.765	19	.012	18	3.078	18	7.601e-04	18	1.357e-03	4	3.822e-05	17
2		min	-1.194	3	-.094	6	-11.685	4	-7.235e-02	4	-6.335e-05	3	-1.146e-05	12
3	N134	max	2.762	9	.017	4	3.078	18	7.643e-04	10	2.953e-03	4	3.811e-05	11
4		min	-1.193	3	-.079	14	-11.742	4	-7.017e-02	4	-2.667e-05	19	-1.143e-05	20
5	N1408	max	2.839	19	.004	18	3.077	18	3.452e-04	18	7.768e-04	4	6.671e-05	17
6		min	-2.165	3	-.078	6	-11.686	4	-8.265e-04	4	-6.047e-03	3	-2.001e-05	12
7	N1415	max	2.837	9	0	4	3.077	18	3.992e-04	10	6.044e-03	3	6.654e-05	11
8		min	-2.166	3	-.071	14	-11.722	4	-7.584e-04	4	-4.764e-04	19	-1.996e-05	20
9	N1409	max	2.845	19	0	18	3.077	18	3.51e-04	18	6.741e-04	4	3.6e-05	17
10		min	-2.254	3	-.07	6	-11.687	4	-8.221e-04	4	-2.487e-03	3	-1.08e-05	12

Envelope Joint Displacements (Continued)

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotatio...	LC	Z Rotatio...	LC
11	N1414	max	2.844	9	-.008	19	3.077	18	3.912e-04	10	2.484e-03	3	3.587e-05	9
12		min	-2.254	3	-.067	14	-11.713	4	-7.713e-04	4	-1.987e-04	19	-1.076e-05	20
13	N1410	max	2.848	19	-.004	18	3.077	18	3.571e-04	18	6.972e-04	4	2.639e-05	3
14		min	-2.293	3	-.063	6	-11.69	4	-8.164e-04	4	-1.194e-03	3	-3.847e-06	12
15	N1413	max	2.847	9	-.009	19	3.077	18	3.817e-04	10	1.2e-03	3	2.63e-05	3
16		min	-2.293	3	-.064	14	-11.705	4	-7.85e-04	4	-1.048e-04	19	-3.824e-06	20

Envelope Plate/Shell Principal Stresses

	Plate		Surf...	Sigma1 [ksi]	LC	Sigma2 [ksi]	LC	Tau Max [ksi]	LC	Angle [rad]	LC	Von Mises [ksi]	LC
1	P206	max	T	.619	3	.014	3	2.593	4	2.311	17	5.436	4
2		min		-.47	4	-5.656	4	.018	15	-.583	19	.071	13
3		max	B	5.662	4	.386	4	2.638	4	2.311	17	5.479	4
4		min		-.103	3	-.664	3	.037	13	-.23	18	.071	13
5	P393	max	T	.241	10	-.021	20	2.581	4	2.349	19	5.41	4
6		min		-.468	4	-5.629	4	.106	20	-.288	5	.203	20
7		max	B	5.635	4	.384	4	2.626	4	2.349	19	5.454	4
8		min		-.08	12	-.317	9	.053	12	-.768	13	.162	12
9	P196	max	T	5.495	4	.357	4	2.569	4	2.216	2	5.325	4
10		min		-.048	13	-.269	12	.018	13	-.66	16	.07	15
11		max	B	.238	12	.03	18	2.542	4	2.216	2	5.317	4
12		min		-.438	4	-5.523	4	.037	15	-.299	5	.07	15
13	P9	max	T	5.468	4	.355	4	2.556	4	1.579	4	5.299	4
14		min		-.09	3	-.427	3	.097	12	-.039	20	.203	2
15		max	B	.441	3	.03	20	2.53	4	1.613	20	5.292	4
16		min		-.436	4	-5.496	4	.095	20	.03	4	.203	2
17	P207	max	T	.66	3	.041	3	2.524	4	2.312	17	5.281	4
18		min		-.437	4	-5.486	4	.029	15	-.536	19	.062	13
19		max	B	5.506	4	.36	4	2.573	4	2.312	17	5.335	4
20		min		-.11	3	-.702	3	.033	13	-.21	18	.062	13

Properties

	ASTM TEST METHOD	UNITS/ VALUE	SERIES 500/525 SHAPES	SERIES 625 SHAPES	SERIES 500/525 PLATE ⑤ 1/8" 3.175mm	SERIES 500/525 PLATE ⑤ 3/16" - 1/4" 4.76-6.35mm	SERIES 500/525 PLATE ⑤ 3/8" - 1" 9.5-25.4mm	SERIES 625 PLATE ⑤ 1/8" 3.175mm	SERIES 625 PLATE ⑤ 3/16" - 1/4" 4.76-6.35mm	SERIES 625 PLATE ⑤ 3/8" - 1" 9.5-25.4mm
MECHANICAL										
Tensile Stress, LW	D638	psi N/mm²	30,000 207	30,000 207	20,000 138	20,000 138	20,000 138	20,000 138	20,000 138	20,000 138
Tensile Stress, CW	D638	psi N/mm²	7,000 48.3	7,000 48.3	7,500 51.7	10,000 68.9	10,000 68.9	7,500 51.7	10,000 68.9	10,000 68.9
Tensile Modulus, LW	D638	10^6 psi 10^3N/mm²	2.5 17.2	2.6 17.9	1.8 12.4	1.8 12.4	1.8 12.4	1.8 12.4	1.8 12.4	1.8 12.4
Tensile Modulus, CW	D638	10^6 psi 10^3N/mm²	0.8 5.52	0.8 5.52	0.7 4.83	0.9 6.21	1.4 9.65	1.0 6.89	1.0 6.89	1.4 9.65
Compressive Stress, LW	D695	psi N/mm²	30,000 207	30,000 207	24,000 165	24,000 165	24,000 165	24,000 165	24,000 165	24,000 165
Compressive Stress, CW	D695	psi N/mm²	15,000 103	16,000 110	15,500 107	16,500 114	20,000 138	16,500 114	17,500 121	17,500 121
Compressive Modulus, LW	D695	10^6 psi 10^3N/mm²	2.5 17.2	2.6 17.9	1.8 12.4	1.8 12.4	1.8 12.4	1.8 12.4	1.8 12.4	1.8 12.4
Compressive Modulus CW	D695	10^6 psi 10^3N/mm²	0.8 6.89	0.8 6.89	0.7 6.89	0.9 6.89	1.4 6.89	1.0 6.89	1.0 6.89	1.4 6.89
Flexural Stress, LW	D790	psi N/mm²	30,000 207	30,000 207	35,000 241	35,000 241	30,000 207	35,000 241	35,000 241	30,000 207
Flexural Stress, CW	D790	psi N/mm²	10,000 68.9	10,000 68.9	13,000 89.6	15,000 103	18,000 124	13,000 89.6	15,000 103	18,000 124
Flexural Modulus, LW	D790	10^6 psi 10^3N/mm²	1.6 11.0	1.6 11.0	1.8 12.4	2 13.8	2 13.8	1.8 12.4	2 13.8	2 13.8
Flexural Modulus, CW	D790	10^6 psi 10^3N/mm²	0.8 5.52	0.8 5.52	0.9 6.21	1.1 7.58	1.4 9.65	1.0 6.89	1.1 7.58	1.4 9.65
Modulus of Elasticity ①	full section	10^6 psi 10^3N/mm²	2.6 17.9	2.8 19.3						
Modulus of Elasticity: W & I shapes > 4" W & I shapes > 102mm	full section	10^6 psi 10^3N/mm²	2.5 17.2	2.5 17.2						
Parallel Compressive Shear Stress, LW ②⑨	D3846	psi N/mm²	3,000 20.7	3,000 20.7						
Shear Modulus, LW ③⑨	—	10^6 psi 10^3N/mm²	0.425 2.93	0.425 2.93						
Short Beam Shear, LW ⑧⑨	D2344	psi N/mm²	4,500 31.0	4,500 31.0						
Bearing Stress, LW	D953	psi N/mm²	30,000 207	30,000 207	32,000 220.6	32,000 221	32,000 221	32,000 221	32,000 221	32,000 221
Poisson's Ratio, LW ⑨	D3039	in/in mm/mm	0.33 .330	0.33 .330	0.31 .310	0.31 .310	0.31 .310	0.32 .320	0.32 .320	0.32 .320
Notched Izod Impact, LW	D256	ft-lbs/in J/mm	25 1.33	25 1.33	15 .801	10 .533	10 .533	15 .801	10 .533	10 .533
Notched Izod Impact, CW	D256	ft-lbs/in J/mm	4 .214	4 .214	5 .267	5 .267	5 .267	5 .267	5 .267	5 .267
PHYSICAL										
Barcol Hardness	D2583	—	45 ④	45 ④	40	40	40	40	40	40
24 hr Water Absorption ⑦	D570	% Max	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Density	D792	lbs/in³ 10^{-3}g/mm³	.062-.070 1.72-1.94	.062-.070 1.72-1.94	.060-.068 1.66-1.88	.060-.068 1.66-1.88	.060-.068 1.66-1.88	.060-.068 1.66-1.88	.060-.068 1.66-1.88	.060-.068 1.66-1.88
Coefficient of Thermal Expansion, LW ⑨	D696	10^{-6} in/in/°F 10^{-6} mm/mm/°C	4.4 8.0	4.4 8.0	4.4 8.0	4.4 8.0	4.4 8.0	4.4 8.0	4.4 8.0	4.4 8.0
Thermal Conductivity ⑨	C177	BTU-in/ft²Hr/°F w(m**K)	4 .58	4 .58						

All values are minimum ultimate properties from coupon tests except as noted.

① This value is determined from full section simple beam bending of EXTREN® structural shapes.

② The shear stress test results will change radically if the notched orientation is altered. The value in this chart represents the test configuration where the notches are machined parallel to the reinforcing mat. For notches machined perpendicular to the reinforcing mat, this value would be two to three times larger.

③ The Shear Modulus value has been determined from tests with full sections of EXTREN® structural shapes. (See Strongwell's Strongwell *Design Manual* for further information.)

④ Value would be 50 if the surfacing veil were not there.

⑤ Plate compressive stress/modulus measured edgewise and flexural stress/modulus measured flatwise.

⑥ Values apply to Series 525 and 625.

⑦ Measured as a percentage maximum by weight.

⑧ Span to depth ratio of 3:1; EXTREN® angles will have a minimum value of 4000 psi and the I/W shapes are tested in the web.

⑨ Typical values because these are shape and composite dependent tests.

LW — Lengthwise
CW — Crosswise
PF — Perpendicular to laminate face
N.T. — Not Tested

Specifications for Wall Sections of Tower Tech, Inc. ("Buyer")

1. Definition of "Products": The terms "Products," as used hereinafter, shall mean finished "Perimeter Basin Wall," finished "Center Basin," finished "Mid Wall," and finished "Top Wall," all manufactured by the pultrusion process.

2. Material Technical Properties: Products to, at a minimum, conform to the following typical properties of pultruded materials:

Mechanical Properties (Coupon Sample, u.n.o.)	ASTM Test Method	Polyester
Properties at 100% at 77°F (90% at or below 100°F, 80% at 100-125°F, 70% at 125-150°F)		
Specific Gravity	ASTM D792	1.75
Density, lb/in cubed	ASTM D792	0.07
Tensile Strength, LW, psi	ASTM D638	33,000
Tensile Strength, CW, psi	ASTM D638	7,500
Tensile Modulus of Elasticity, LW, ksi	ASTM D638	3,000
Tensile Modulus of Elasticity, CW, ksi	ASTM D638	1,000
Compressive Strength, LW, psi	ASTM D695	33,000
Compressive Strength, CW, psi	ASTM D695	17,000
Comp. Modulus of Elasticity, LW, ksi	ASTM D695	3,000
Comp. Modulus of Elasticity, CW, ksi	ASTM D695	1,000
Flexural Strength, LW, psi	ASTM D790	33,000
Flexural Strength, CW, psi	ASTM D790	10,000
Flexural Modulus, LW, ksi	ASTM D790	2,000
Flexural Modulus, CW, ksi	ASTM D790	1,000
Modulus of Elasticity, ksi	Perimeter Basin & Center Basin, Full Section	3,200
Modulus of Elasticity, ksi	Mid Wall & Top Wall, Full Section	2,200
Shear Modulus, ksi	Full Section	420
Shear Strength by Punch, PF, psi	ASTM D732	6,000
Bearing Stress, LW, psi	ASTM D953	30,000
Bearing Stress, CW, psi	ASTM D953	18,000
Izod Impact, Notched, LW, ft-lb/in	ASTM D256	30
Izod Impact, Notched, CW, ft-lb/in	ASTM D256	5
Barcol Hardness	ASTM D2583	45
Possion's Ratio, LW, in/in	ASTM D3039	0.35
Possion's Ratio, CW, in/in	ASTM D3039	0.1+E105

(LW = Lengthwise; CW = Crosswise; PF = Perpendicular to Laminate Face)

Thermal Properties	ASTM Test Method	Polyester
Coef. Of Linear Expansion in/in/F	ASTM D696	?
Thermal Conductivity, BTU/hr/sq ft/F/in	ASTM D C177	?

Flammability	ASTM Test Method	Polyester
Flammability Classification	UL94	94V-O
Flammability Extinguishing	ASTM D635	Self-exinguish.
NBS Smoke Chamber	ASTM E662	650
Flame Resistance (Ignition/Burn), sec	FTMS 406-2023	55/30

Other Properties	ASTM Test Method	Polyester
Water Absorption, % 24 hr.	**ASTM D570**	**0.5 Max**
Customer Standard Color	----------	Specific Beige
NSF Potable Water Approved	----------	----------