Ballasted System Attachment

SUNTREK®
Your Solar Energy Company

For a Non penetrating application we suggest using 1/2″ sch40 galvanized pipes, glued across the width of the solar mat at 4-5 foot intervals.

INLAND ENGINEERING & CONSULTING, INC.
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SHT. # 1 OF 8
JOB # 81348
DATE: 8-8-08

STRUCTURAL CALCULATIONS

PREPARED FOR: SUNTREK

PROJECT: SOLAR POOL HEATING ATTACHMENT
WOODSIDE HIGH SCHOOL
199 CHURCHILL AVE.
WOODSIDE, CA. 94062

8-12-08

GENERAL INFORMATION:

BUILDING CODE: 2007 CBC

MATERIAL PROPERTIES

LUMBER: (STRUC. LUMBER DOUGLAS FIR LARCH)

	GRADE	Fb	Ft	Fv	E	Fc
2x AND 4x JOIST AND BEAM.....	No. 2	875	575	95	1.6x10^6	1300
	No. 1	1000	575	95	1.7x10^6	1300
	SELECT	1450	575	95	1.9x10^6	1300
6x BEAMS & THICKER.....	No. 1	1350	675	85	1.6x10^6	925
6x POSTS.....	No. 1	1350	825	85	1.6x10^6	1000
GLU-LAMINATED BEAMS....	24-F-V4	2400	1100	165	1.8x10^6	1600
PSL-PARALLAM OR EQ.		2800	1850	285	2.0x10^6	2700

CONC.:	fc	wt.
SLAB ON GRADE.....	2500 psi	150pcf
FOOTING.....	2500 psi	150pcf

MASONRY:
CONC. BLOCK.....1500 psi

REINF. STEEL: .....# 4 BAR AND SMALLER GR. 40.
5 BAR AND LARGER GR. 60.

STRUC STEEL:
STRUC. PLATES.....Fy = 36 ksi
PIPE COLS.....Fy = 35 ksi
STL. TUBES.....Fy = 46 ksi

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BY _____ CHKD. _____ JOB NO. 81348

SCOPE OF WORK:

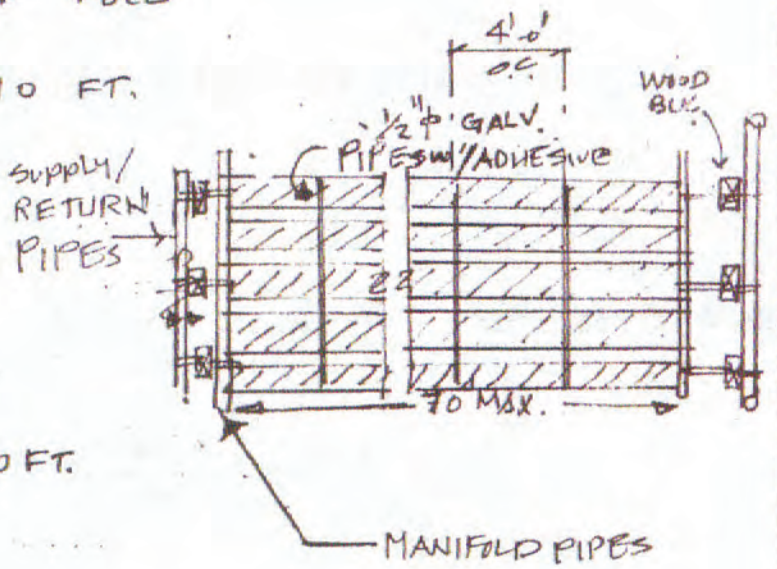
SUNTREK'S SOLAR SYSTEM ATTACHMENT ON FLAT ROOF:

WT. OF SYSTEM : 1.5 PSF FULL

MAX. COLLECTOR SPAN = 70 FT.

DESIGN LOADS:

WIND LOAD



85 MPH EXP. "C"

ASSUMED HT. OF ROOF : 20 FT.

$K_z = .90$

$K_{zt} = 1.0$

$K_d = .85$

$I = 1.0$ $\qquad q_h = .00256 (K_z)(K_{zt})(K_d) V^2 I$

$= .00256 (.9)(1.0)(.85)(85)^2 (1.0) = 14.15$ PSF

NEG. EXTERNAL PRESSURE COEFF. FOR $(GCp) = -.9$

$P_w = q_h [GCp - GCpi]$

$P_w = 14.15 [-.9 - .18] = 15.3$ PSF

SEIS. LOAD:

$$F_P = \frac{.4 a_p S_{DS} W_P}{(R_P/I_P)}\left(1 + 2\frac{z}{h}\right) \begin{cases} < F_P = 1.6 S_{DS} I_P W_P \\ > .3 S_{DS} I_P W_P \end{cases}$$

$a_P = 2.5$, $R_P = 3.0$, $I_P = 1.0$ $S_{DS} = \frac{2}{3} S_{MS}$

$S_{MS} = F_a S_S$ $F_a = 1.0$ $F_V = 1.5$ $S_S = 2.251$, $S_1 = 1.087$

$S_{MS} = (1.0)(2.251) = 2.251$

$S_{DS} = \frac{2}{3}(2.251) = 1.50$ } SITE CLASS "D" ZIP CODE: 94062

$$F_P = \frac{(.40)(2.5)(1.5)\,W_P}{(3./1)}\left(1 + 2\frac{20}{20}\right) = 1.5\,W$$

$F_{P\,MAX} = 1.6(1.5)(1.0)(W_P) = 2.4\,W_P$

$F_{P\,MIN.} = .3(1.5)(1.0)(W_P) = .45\,W_P$ } OK

NOTE: * COLLECTORS ARE 2'-0" WIDE

* COLLECTORS ARE ATTACHED TO RF. @ 4'-0" O.C. W/ 1/2"ϕ GALV. PIPES GLUED W/ SUNTREK ADHESIVE

T.A. OF COLLECTORS = 4'x4' = 16 S.F.

WT. = 1.5 PSF (16') = 24. LB/FT.

WIND LOAD: $F_W = 15.3\ PSF\ (16.') = 245$ LB/FT.

SEIS. LOAD: $F_S = 1.5(24) = 36.$ LB/FT.

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DATE _____ SUBJECT Woodside H.S. SHEET NO. 5

BY _____ CHKD _____ JOB NO. 81348

ADHESIVE STRENGTH (SUNTREK SEALANT)

BASED ON TEST RESULTS PROVIDED BELOW:

AVERAGE TENSILE STRENGTH IS GIVEN AS 8.04 #/IN

Ft = 48" (8.04) = 386# > 245# F.S. = 1.5

The following table is a summary of the data collected during our testing:

Substrates (Adherents)	Average Peel Strength (Pounds Per Linear Inch)
Suntrek Rubber Tubing / Ceramic Tile	12.156
Suntrek Rubber Tubing / Composition Roofing	10.996
Suntrek Rubber Tubing / Wood (maple)	8.045

PHYSICALS OF SUNTREK SOLAR TUBE

SAMPLE	SLAB-DUMBBELL	TUBE
DURO, A	80	80
TENSILE STRENGTH, psi	1728	1479
ELONGATION, %	247	224
MOD@25%, psi	355	281
MOD@50%, psi	370	473
MOD@75%, psi	807	686
MOD@100%, psi	1001	899
MOD@200%, psi	1562	1448

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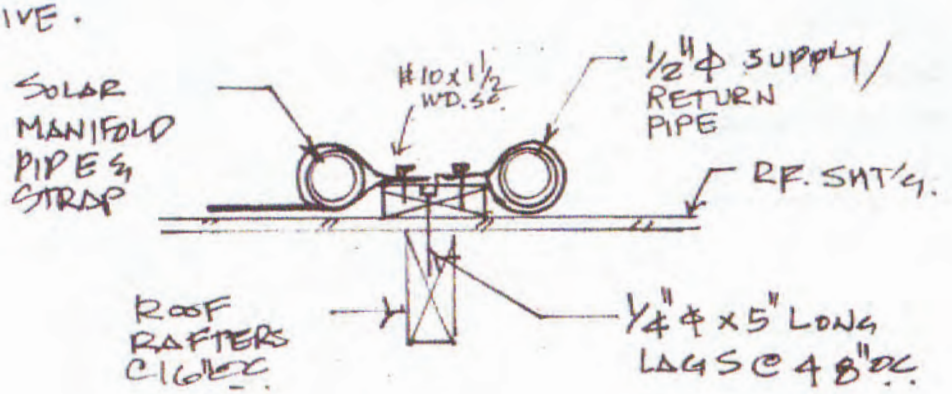
DATE _____ SUBJECT WOODSIDE H.S. SHEET NO. 6

BY _____ CHKD. _____ JOB NO. 81378

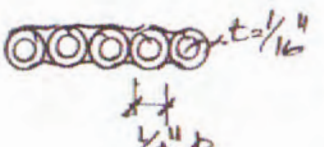
CONNECTION OF 2"ϕ MANIFOLD 3

2"ϕ PVC MANIFOLD ATTACHED TO WOOD BLKS @ 32" O.C. . WOOD BLKS ARE LAGED INTO ROOF RAFTERS W/ 1/4"ϕ x 5" LAGS @ 32" O.C. (TYP. END CONDITION)

ALSO 1/2"ϕ GALV. SCH. 40 PIPES PROVIDED @ 4'-0" O.C. ACROSS THE SOLAR PANELS W/ SUNTREK BOND ADHESIVE.



SOLAR PANEL TIES (STRAPS) CONSISTS OF 1/4"ϕ PLASTIC TUBING (TOTAL OF 5- 1/4"ϕ TUBINGS)



ALLOW. TENSILE STRENGTH = 1479 PSI

$A = \pi D^2/4 = \frac{\pi (.125^2 - .125^2)}{4} = .036\ IN^2$

$\Sigma A = 5(.036) = .184\ IN^2$

$T_{ALLOW.} = 1479\ PSI\ (.184) = 272^{\#}$

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DATE _____ SUBJECT WOODSIDE. M.S. SHEET NO. 7

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2"ϕ PVC PIPE SCH. 40 FILLED W/ WATER

$\Sigma WT. = (3.653^{\#}/_{1} + 1.453^{\#}/_{1}) \frac{48}{12} = 20.4^{\#}$

$F_W = 4' \times 2 \times 15.3 = 122.4^{\#}$ ← CONTROLS

$F_S = 20.4 \times 1.5 = 31.^{\#}$

1/4" ϕ LAG SC. INTO WOOD RAFTERS W/ 2" MIN. EMB.

TAL. $225^{\#}/_{IN}$ (2") = $450^{\#} > 122.4^{\#}$ OK

USE: 4 x 12" WOOD BLKG. W/ 1/4"ϕ WD. SC. 2" MIN. EMB. INTO ROOF RAFTERS @ MAX. 2L4"oc

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BY _____ CHKD. _____ JOB NO. 8134.8