SARGENT & LUNDY ENGINEERS

Calcs. For	CONDENSER BRACKET DESIGN
	Safety-Related / Non-Safety-Related

Calc. No.	L-000197
Rev. 0	Date 2-6-96
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Reviewed by	
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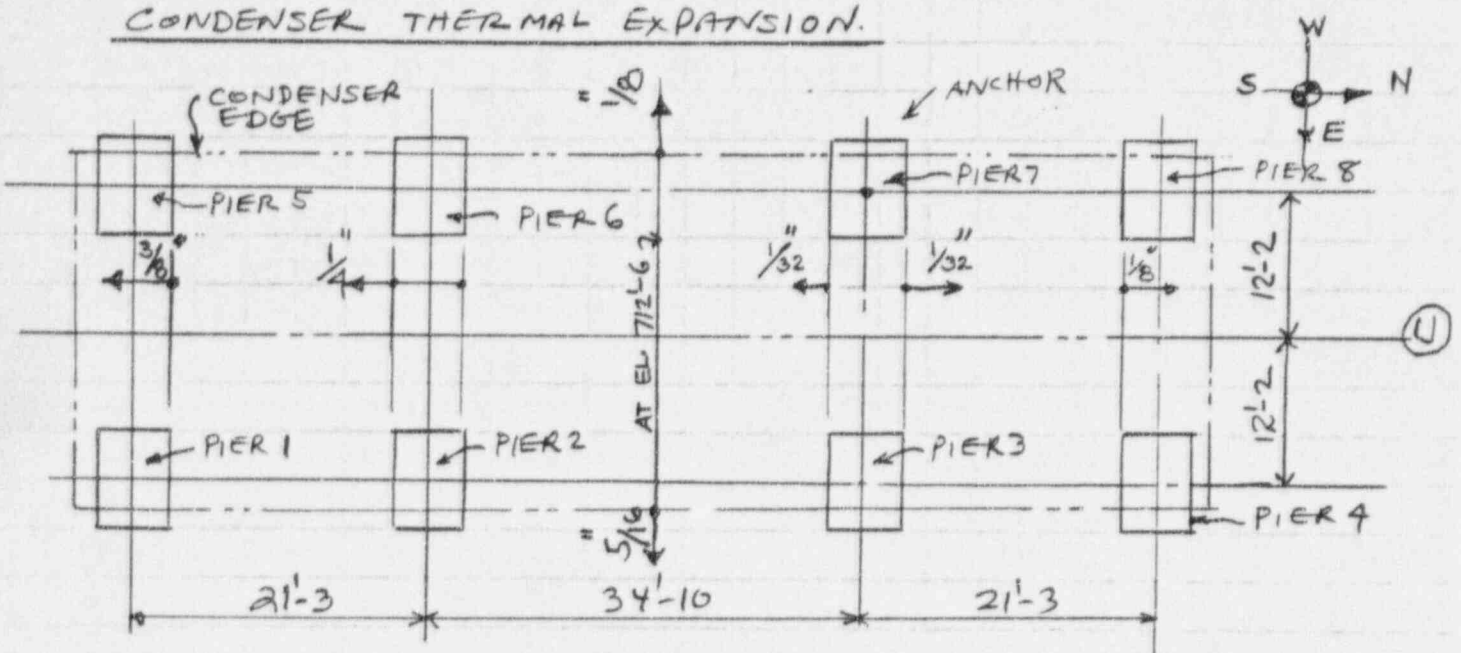
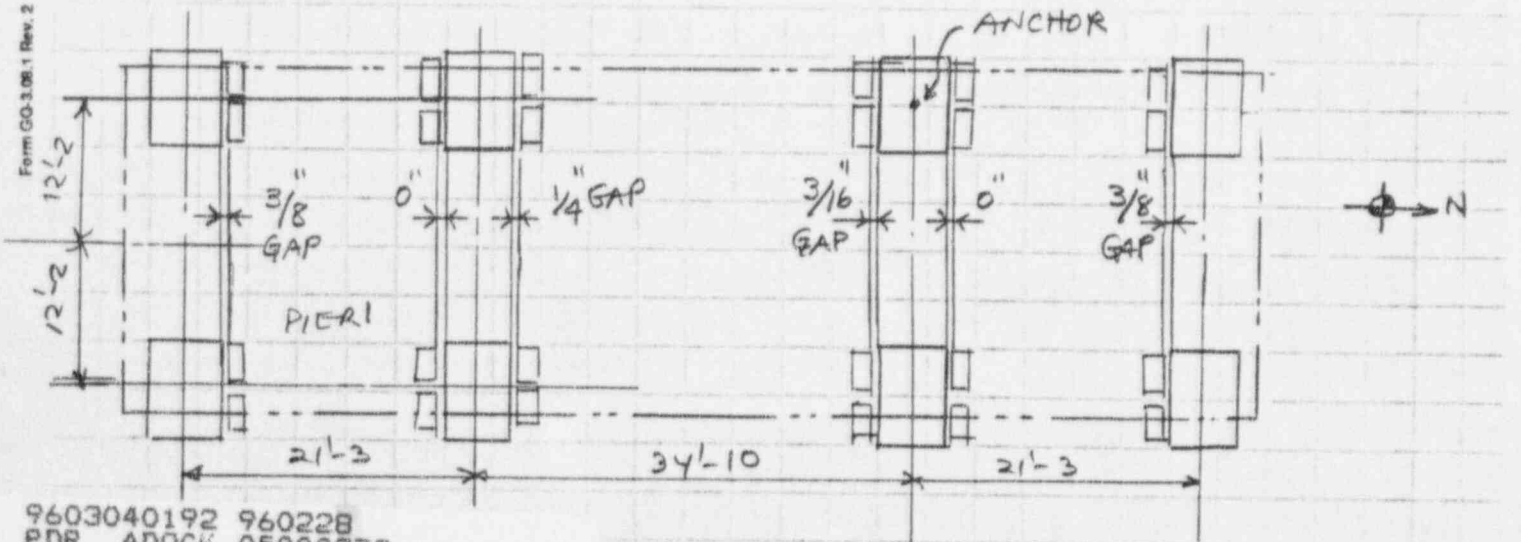
CONDENSER THERMAL EXPANSION.



AS PER NDIT-0114, THE CONDENSER BEING ANCHORED AT PIER 7, ABOVE NOTED ARE THE THERMAL EXPANSIO THE NORTH-SOUTH EXPANSION IS AT THE BOT./CONDE SER & THE EAST WEST EXPANSION IS AT EL. 712'-6, WHICH IS CONSIDERED AS THE HEIGHT LOCATING CONDENSER C.G. (SEE CALC. L-000190) IN ORDER TO ENGAGE 6 PIERS IN NORTH & SOUTH DIRECTIONS EACH, GAP DIMENSIONS AT BRACKET INSTALLATION HAVE BEEN ADJUSTED AS NOTED BELOW.



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DESIGN OF BRACKETS

TOTAL SEISMIC SHEAR = 1862 K

DESIGN MARGIN = 1.33

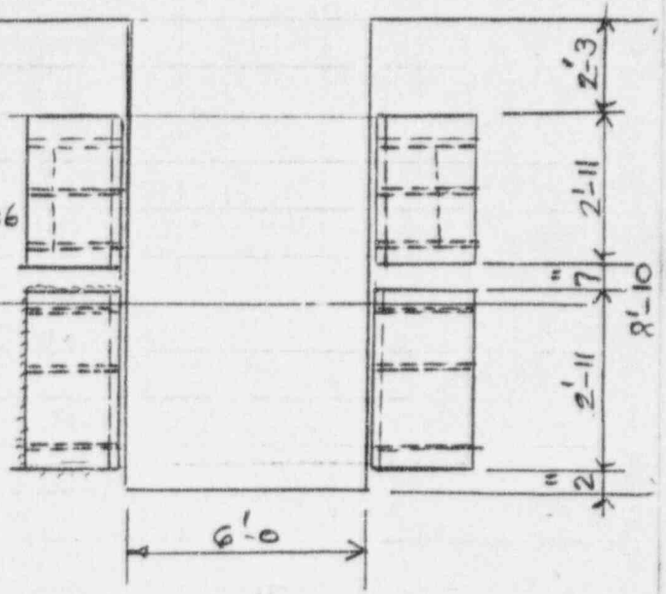
TOTAL DESIGN LOAD = 1.33 x 1862
= 2476

NO OF PIER SIDES AVAILABLE IN EACH DIRECTION (N & S EA.) = 6

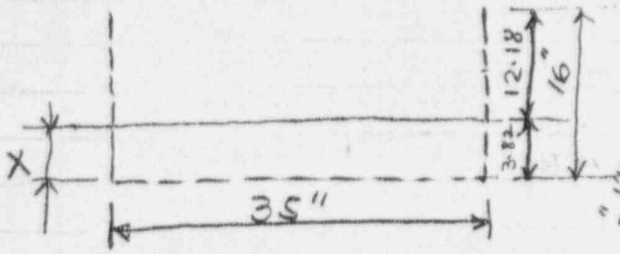
∴ SHEAR / PIER SIDE = $\frac{2476}{6}$ = 412.8 K

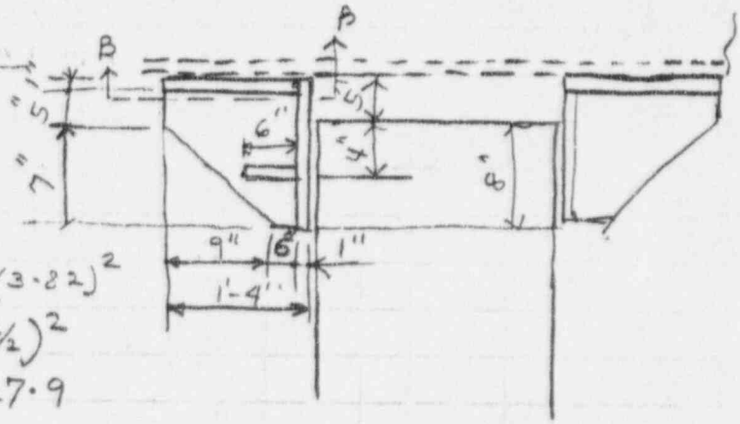
SHEAR / BRACKET = $\frac{412.8}{2}$ = 206.4 K

Moment = 206.4 x 9 = 1857.6 "



WELD CHECK:





$N.A. = \frac{(2 \times 16)8 + 35 \times 0}{2 \times 16 + 35 = 67} = 3.82$

$I = 2 \times \frac{1}{12}(12.18)^3 + 2(12.18)\left(\frac{12.18}{2}\right)^2 + 35(3.82)^2$
$+ 2 \times \frac{1}{12}(3.82)^3 + 2(3.82)\left(3.82/2\right)^2$
$= 301.1 + 903 + 511 + 9.30 + 27.9$
$= 1752 \text{ in}^3$

$S = 1752 / 12.18 = 143.8 \text{ in}^2$

Tens / Comp = 1857.6 / 143.8 = 12.91 K/in

Shear / inch of Weld = 206.4 / (2 x 16 + 35) = 3.08

Resultant = $\sqrt{(12.91)^2 + (3.08)^2} = \sqrt{166.67 + 9.48} = 13.3$ K/in

Capacity of 5/8" Weld (SSE Load) = 0.928 x 10 x 1.6 = 14.848 K

∴ 16" wide x 13" deep bracket OK with 5/8" Weld

Note: The Bracket width & height was changed to 22" wide & 11" height. See Pages 11 thru 14. Additionally per commitment to NRC, total N-S Shear used = 2400 K, as shown on Page 14.

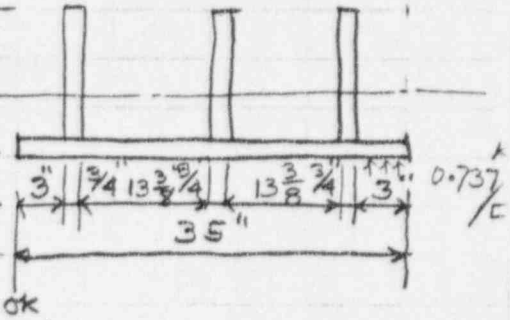
Check Bracket for Bending (BETWEEN VERT. STIFFENERS)

LOAD/bracket = 206.4 K

Conc. bearing = 206.4 / 8×35 = 0.737 K/in

allow conc. bearing = $0.7 \times 0.85 \times f_c'$

$= 0.7 \times 0.85 \times 3.5 = 2.08$ Ksi < 0.73 ∴ OK



Conc. Shear = $2\sqrt{f_c'}\, b_w d$

$= 2\sqrt{3500} \times \frac{10.6}{2} (7.2 - 3) = 432.7$ K > 206.4 OK

Shear Design Margin = 432.7/206.4 = 2.1

Plate bending: cantilever = $0.737 (3)^2/2 = 3.31$ K-in

Simple span = $0.737 \frac{(13.375)^2}{8} = 16.48$ K-in

S for 1" ℓ = $1 \times 1^2/6 = 0.166$

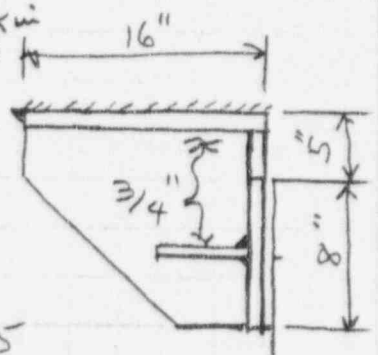
Mom. Capacity = $(0.166 \times 0.95 \times 36) = \underline{5.7}$ K-in < 16.48 N.G.

Try installing Horizontal Stiffener.

install Cantilever = 3.75"

$M = 0.737 \times (3.75)^2/2 = 5.18 < 5.7$ K-in K-in

= 3.75" Cantilever OK



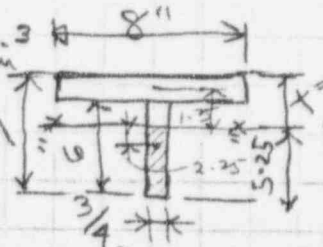
Bending in the middle at A = $(0.737 \times 8)\frac{(12.62)^2}{10}$

= 93.9 K-in

Use T Section.

$S_{reqd} = 93.9/0.95 \times 36 = \underline{2.745}$ in³

$x = \frac{\{(8 \times 1) 0.5\} + (6 \times 0.75) 4}{(8 \times 1) + 6 \times 0.75 = 12.5} = 1.76$ use 1.75

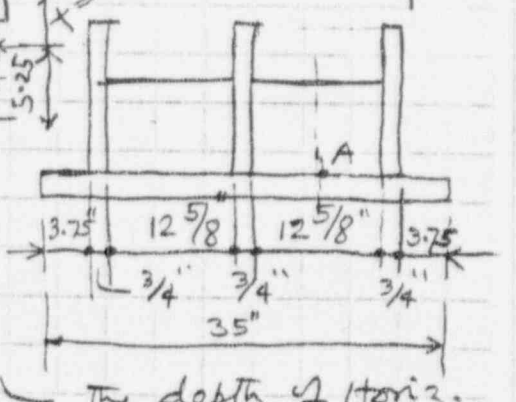


$I = \frac{1}{12}(8)(1)^3 + (8 \times 1)(1.25)^2 + \frac{1}{12}(0.75)(6)^3 + 6(0.75)(2.25)^2$

$= 0.67 + 12.5 + 13.5 + 22.78 = 49.45$

$S = 49.45/5.25 = \underline{9.41}$ in³ > 2.745 in³

Horiz stiffener OK



The depth of Horiz. stiff can be reduced.

Use 3/8" Weld to connect stiffener to plate.

Try using smaller length stiffener

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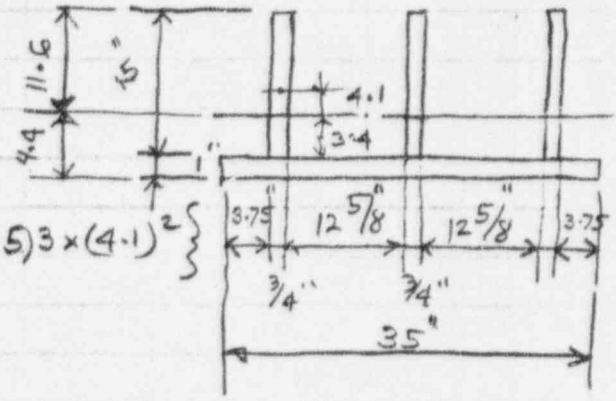
Check Bracket at Condenser End. (Sect. BB)

Moment = $206.4 \times 9 = 1857.6$

$$N.A. = \frac{(35\times1)0.5 + 3(15)(0.75)(8.5)}{35 + 45\times0.75} = \frac{17.5 + 286.875}{68.75} = \frac{4.426}{}$$



$$I = (35\times1)(3.9)^2 + 3\left(\frac{1}{12}\times0.75\times(15)^3\right) + \{(0.75)(15)3\times(4.1)^2\}$$

$= 532.35 + 632 + 567$

$= 1731$

$S_1 = 1731 / 11.6 = 149.2 \text{ in}^3$

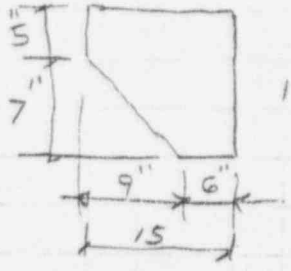
$f_b = 1857/149.2 = 12.5 \text{ Ksi} < 0.95\times36 = \underline{34.2} \text{ Ksi}$

Dead wt of each bracket.

1" thick Plate $= \frac{13}{12}\times\frac{35}{12} + \frac{15}{12}\times\frac{35}{12} = 6.81 \square'$ (3.16, 3.645)

3/4" thick Plate $= \left(15\times12 - \frac{9}{2}\times7\right)\frac{3}{144} = 3.09 \square'$ (3.5)

Horiz stiff $= 2\times\frac{4}{12}\times\frac{12.62}{12} = 0.70 \square'$



1" thk $= 6.81 \square' \times 40.8 \text{ psf} = 278 \text{ lbs}$

3/4" thk $= 3.79 \square \times 30.6 = 116$

394 lbs.

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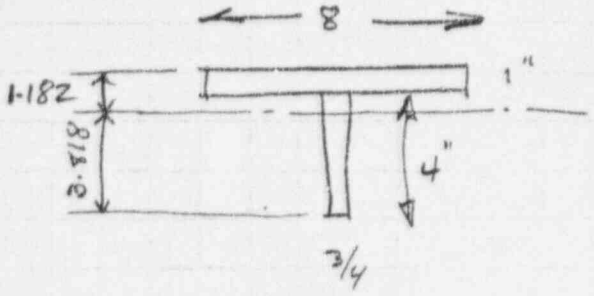

$A = 8 + 4(.75) = 11\ in^2$

$$\bar{x} = \frac{8(1)(.5) + 4(.75)3}{11} = 1.182"$$

$$I = \frac{8}{12}(1)^3 + \frac{.75}{12}(4)^3 + 8(1.182-.5)^2 + 3(3-1.182)^2$$

$$= 18.301\ in^4$$

$$S = \frac{18.3}{(5-1.18)} = 4.79\ in^3 > 2.745\ in^3 = OK.$$

WELD REQD

$$V = .737\ (8)\ 12.62\left(\tfrac{1}{2}\right) = 37.2^k$$

$$Q = 8(1)(1.182-.5) = 5.456\ in^3 \qquad b = .75$$

$$\frac{VQ}{Ib} = \frac{37.2(5.456)}{18.3\ (.75)} = 14.78\ ksi$$

WELD ALLOW = 21 ksi (1.6) = 33.6 ksi

$$\text{WELD REQD} = \frac{14.78}{33.6\ (.707)} = 0.622 \qquad = 0.31" \text{ EA}$$

Stiff to 1" PL. Weld.

Use 3/8" weld size

Shear = 37.2 K.

Weld length = 12"

Load/in = 37.2/12 = 3.1, Capacity of 3/8" Weld = 0.928 x 6 x 1.6 = 8.9 K.

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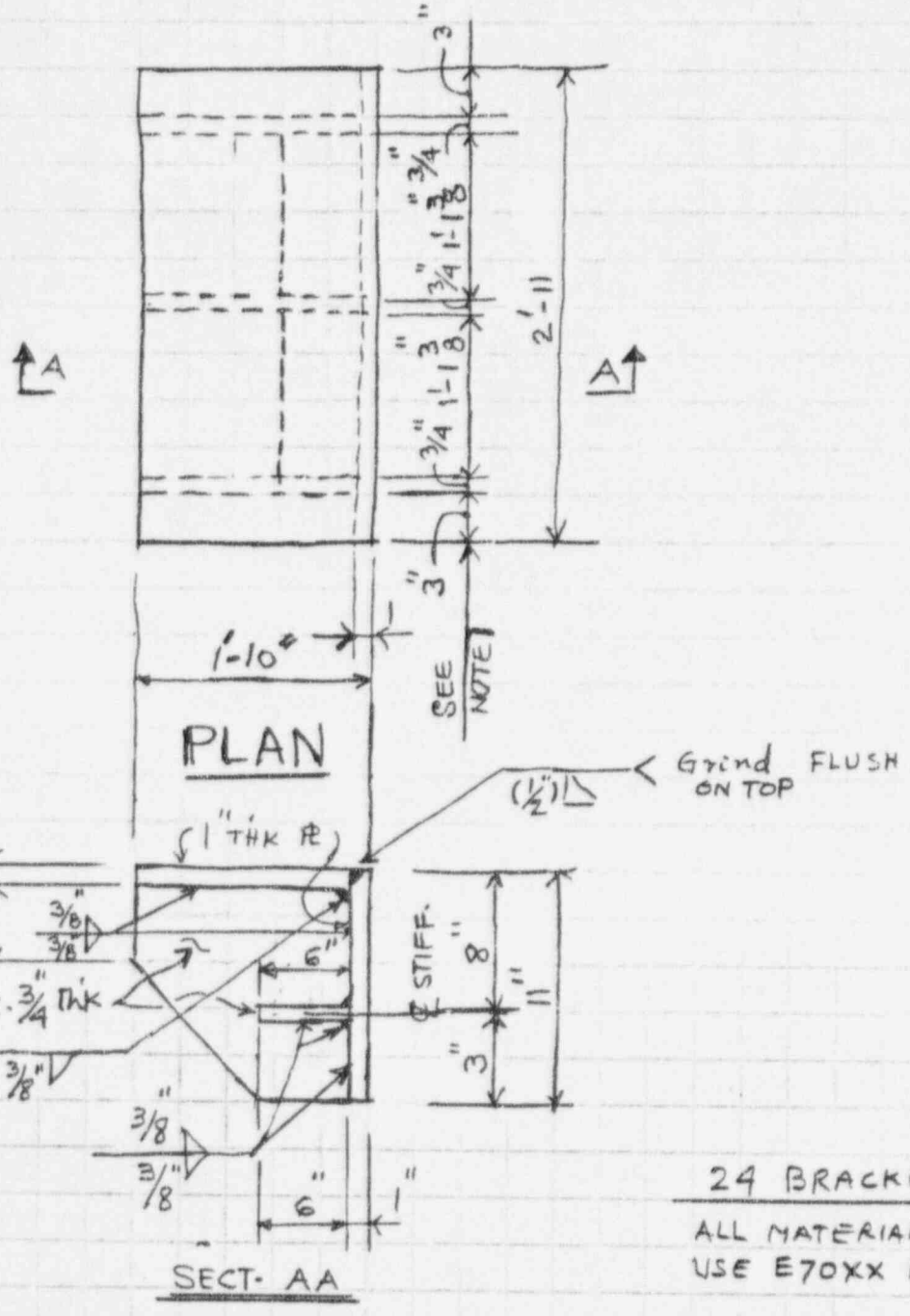

24 BRACKETS REQ'D.

ALL MATERIAL - A36
USE E70XX ELECTRODE

NOTE 1 : FIT-UP TOLERANCE = $\pm \frac{1}{8}$" FOR STIFF. LOCATION

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Approved by	

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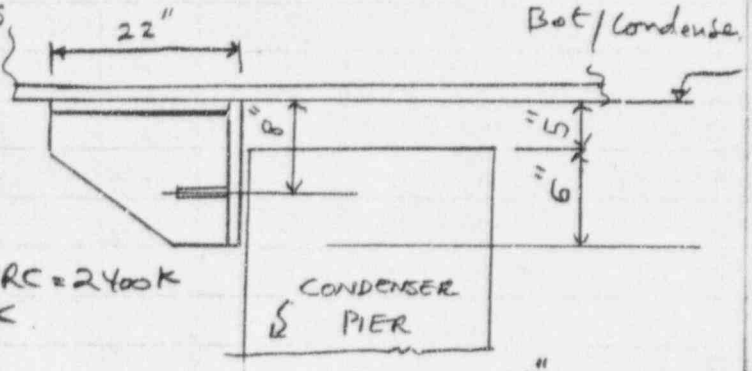
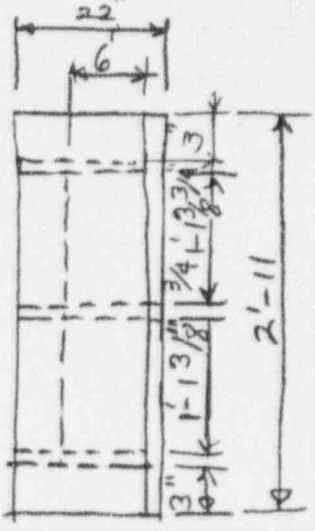
Redesign of SUPPORT BRACKETS

To reduce Moment going to the Condenser bottom, reduce the moment arm.



Total Shear committed to NRC = 2400 K
Per Pier = 2400/6 = 400 K
Per bracket = 200 K
Moment = 200 x 8 = 1600 K in
allow. Conc. bearing = 2.0 ksi
Bearing stress = $f_b = 200/6 \times 35 = 0.952$ K/in²



Check. Cantilever end.

$$\text{Mom} = 0.952\,(3.75)^2/2 = 6.69 > 5.7 \text{ K in}$$

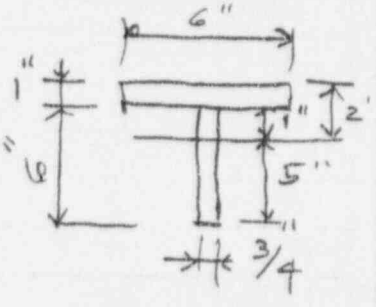
reduce Cantilever end to 3" (Page 5)

$$\text{Mom} = 0.952\,(3)^2/2 = 4.3 \text{ "K} < 5.7 \text{"K}$$

(Tee section)

Check Vert. Plate / Span for 13 3/8" span.

$$\text{N.A.S } x = \frac{(6\times1)(0.5)+(6\times0.75)4}{(6\times1)+(6\times 3/4)} = \frac{3+18}{6+4.5} = 2"$$



$$I = \tfrac{1}{3}(0.75)(5)^3 + \tfrac{1}{3}(0.75)(1)^3 + \tfrac{1}{12}6\times1^3 + 6\times(1.5)^2 =$$
$$= 31.25 + 0.25 + 0.5 + 13.5 \text{ in}^3$$
$$= 45.5 \text{ in}^4$$
$$S = 45.5/5 = 9.1 \text{ in}^3$$
$$\text{Mom} = (0.952\times6)(13.375)^2/10 = 102.18$$
$$S_{reqd} = 102.18/0.95\times36 = 2.98 \text{ in}^3 < 9.1 \text{ in}^3 \text{ (provided)}$$

use 6" x 3/4" Horizontal Stiffener

The Horizontal (top plate) of the bracket & weld need not be checked since the moment is reduced.

CONCLUSION: The Bracket Support Design is acceptable as designed above.

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