SPREADER BAR

I.D. Nº 22 COLOR OF BAR: YELLOW

LOAD CAPACITY PAINTED ON BAR 1 TON

DATE CAP. & I.D. Nº PAINTED ON BAR 10-10-88

DATE OF LAST LOAD TEST. 10-6-88

WITNESS BY R. Schen / E. M. Villegas

TEST LOAD WEIGHT 1.25 TONS

TEST LOAD % 125%

STRESS CALCULATIONS:

DONE BY E. M. VILLEGAS

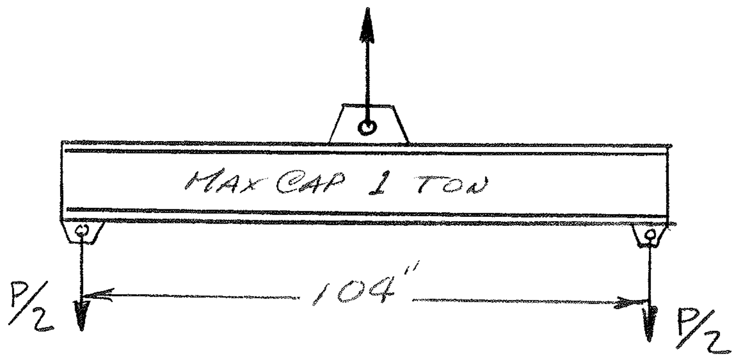
DATE 9-5-88

REMARKS:

DESIGNED FOR LIFTING E-665 CALORIMETER PANELS.

SPREADER BAR № 22 PAINT COLOR YELLOW

$P = 2000 \times 1.25 = 2500^{\#}$



BEAM SIZE ______

$d = 5\frac{1}{2}$

$L = 104''$

$d/A_f = 2.94$

$S_x = 9.2$

$t_w = .190 \times 2 = .38$

$A_W = d \cdot t_W = 1.9$

$M = \frac{PL}{4} = 65 \times 10^3$

$V = \frac{P}{2} = 1,250$

BENDING STRESS :

$F_{b\ ALLOW} = 12,000\ psi$

OR $F_{b\ ALLOW} = \frac{12 \times 10^6}{L \cdot d/A_f} = \frac{12 \times 10^6}{2.94} = 39,286$

USE THE LEAST

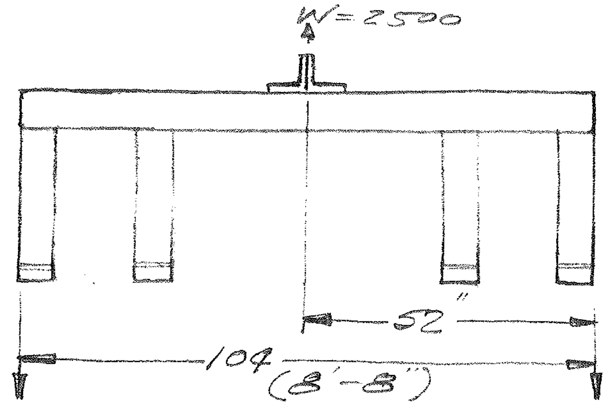
$\therefore f_{b\ MAX} = \frac{M}{S_x} = \frac{65 \times 10^3}{9.2} = 7065$

SHEAR STRESS :

$F_{V\ ALLOW} = \frac{.4\ F_y}{3} = 4800\ psi$

$\therefore f_{V\ MAX} = \frac{V}{A_W} = \frac{1250}{1.9} = 658^{\#}$

SUMMARY : $\therefore P =$ ______ TONS



MAT'L.: A36 STEEL

$W = 2000^{\#} \times 1.25$
$\;\;= 2500^{\#}$

$S_{b_a} = \dfrac{36\times10^3}{1.5} = 24\times10^3$ psi

$S_{s_a} = \dfrac{18\times10^3}{1.5} = 12\times10^3$ psi

$M = \dfrac{52 \times 2500}{2} = 65\times10^3$ IN-LB $\quad E = 29\times10^6$

$S_{ba} = \dfrac{Mc}{I}$

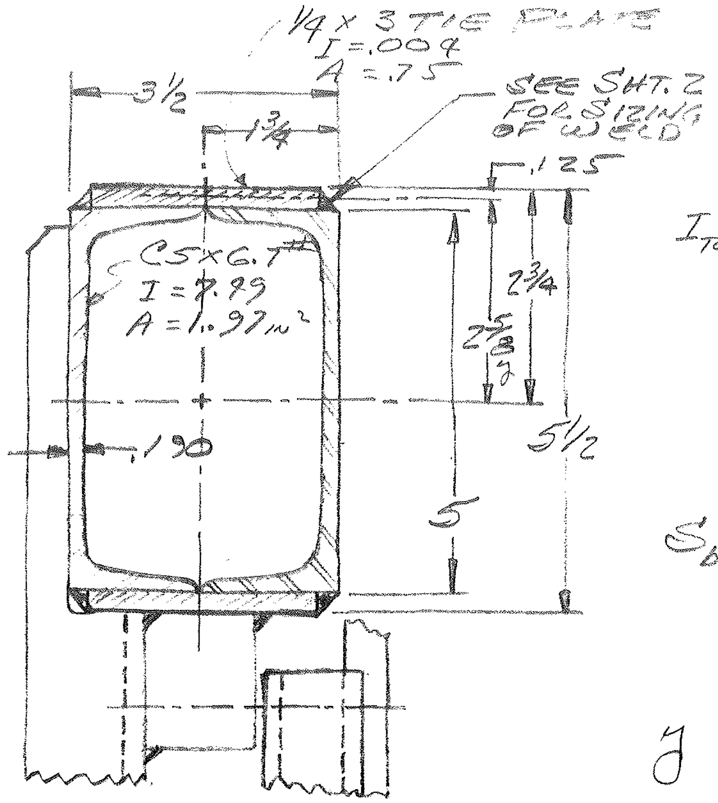
$\dfrac{I}{c} = \dfrac{M}{S_{ba}} = \dfrac{65\times10^3}{24\times10^3} = 2.7$

ASSUME $c \approx 2^3/_4$, THEN $I \approx 7.45$, REQ'D FOR BENDING STRESS.

DEFLECTION SHOULD NOT BE $> \dfrac{104''}{1200} = .087''$

$\therefore I = \dfrac{W l^3}{48 E y} = \dfrac{2500\times104^3}{48\times29\times10^6\times.087}$

$= 23.2$ in^4 REQ'D. FOR DEFLECTION CRITERIA.



SECTION A-A

$I_{TOTAL} = \Sigma(I_o + Ad^2)$

$= 2(.004 + .75\times2.625^2) + 2\times7.49$

$= 25.3$ in^4

$S_b = \dfrac{65\times10^3\times2.75}{25.3}$

$= 7{,}065$ psi

$y = \dfrac{2500\times104^3}{48\times29\times10^6\times25.3}$

$= .080''$

$S_s = \dfrac{1250}{.190\times2\times5}\; 658$ psi

TIE PLATE WELD REQUIREMENTS

$$q = \frac{VAy}{In}$$

$$= \frac{1250 \times .75 \times 2.625}{25.3 \times 2}$$

$= 48.6\ \#/\text{IN}$ (CONTINUOUS WELD)

$$\Delta = \frac{q}{S_{sa}} = \frac{48.6}{8800}$$

$= .006''$ (LEG SIZE REQ'D. CONT. WELD)

$$\%\ \text{OF WELDED JOINT} = \frac{\Delta_{CONT.} \times 100}{\Delta_{ACTUAL}}$$

$$= \frac{.006 \times 100}{.1875}$$

$= 3.2\%$

$V = \frac{2500}{2} = 1{,}250\ \#$

$A = .25 \times 3 = .75\ \text{IN}^2$

$y = 2.625$

$I = 25.3\ \text{IN}^4$

$n = 2$ (WELD ON EACH SIDE)

$\Delta = 3/16$ (MINIMUM LEG SIZE)

$S_{sa} = 8800$ psi (E60 ELECTRODE)

$r = \sqrt{\frac{.004}{.75}} = .073$

l = LENGTH BETWEEN WELDS

$P = 1{,}250$

$n_1 = 3$ (BOTH ENDS FIXED)

LENGTH OF WELD REQ'D. $= .032 \times 104''$

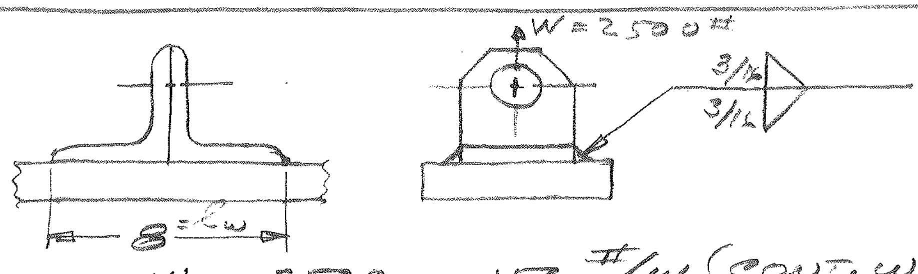
$= 3.3''$

~~DETERMINE~~ DETERMINE UNWELDED LENGTHS ON TIE PLATE

USE JOHNSONS FORMULA & SOLVE FOR l.

$$l = \sqrt{\frac{-4r^2 n_1 \pi^2 E\left(\frac{P}{A\, S_{sa}} - 1\right)}{S_{sa}}}$$

$= 26.640''$ ——→ USE 3/16 4-25 / 3/16 4-25



$$q = \frac{W}{l_w} = \frac{2500}{2 \times 8} = 156\ \#/\text{IN (CONT. WELD)}$$

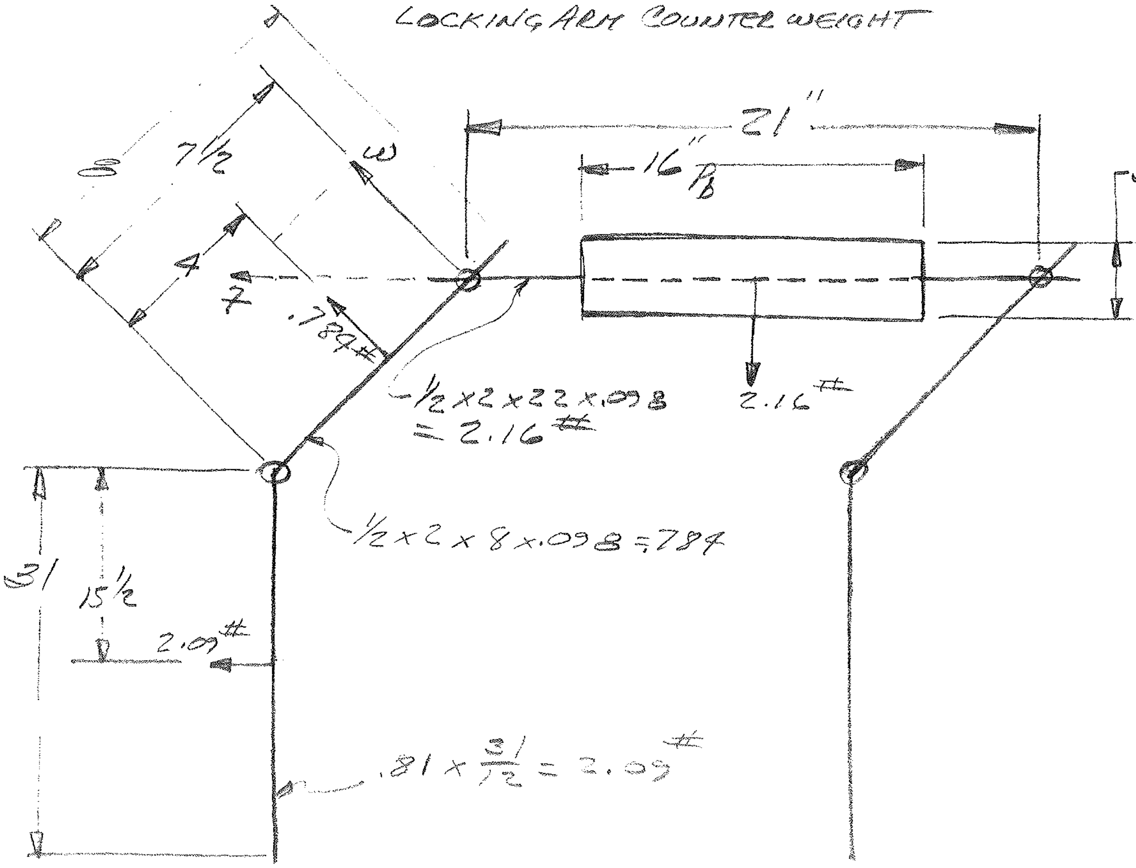
$$\Delta = \frac{q}{S_{sa}} = \frac{156}{8800} = .018''\ \text{(LEG SIZE REQ'D, CONT. FILLET)}$$

USING THE 3/16 MINIMUM WELD REQUIREMENT

GIVES $q = .1875 \times 8800 = 1{,}650\ \#/\text{IN}$

AND $16'' \times 1650 = 26{,}400\ \#$

LOCKING ARM COUNTERWEIGHT



$$15.5 \times (2 \times 2.09) = 4 \times (2 \times .784) + 7.5\omega$$

$$\omega = 7.8^{\#}$$

$$7 = \sqrt{2(7.8)^2} + 2.16$$

$$= 13.2^{\#} \text{ say } 13.2^{\#} + 5^{\#} = 18.2^{\#}$$ TO HOLD LOCKING ARMS IN PLACE.

$$h \times 3 \times 16 \times .410 = 18.2^{\#}$$

$h = .925''$ say 1" THICK × 3" WIDE × 16" LG. LEAD COUNTERWEIGHT.