



Calcs. For **MECHANICAL COMPONENT MS-09**  
 SUPPORT NUMBER: M09-MS01-13015 REV.  
 Safety-Related  Non-Safety-Related

Calc. No. 813-MS09  
 Rev. 0 Date 10-8-81  
 Page 26 of 11

Client **COMMONWEALTH EDISON CO.**  
 Project **LA SALLE UNIT 1**  
 Proj. No. **4266-00/4266-10**

Prepared by *R. D. Madigan* Date **10-8-81**  
 Reviewed by *C* Date **10-8-81**  
 Approved by *Kenneth J. Fur* Date **10-8-81**

PRF # 1650  
**MECHANICAL COMPONENT SUPPORT DOCUMENTATION SHEET**

- Hand Prepared Detail Calculations**  
 The portion of this hand prepared design calculation was approved by me or a combination of the following (as checked):
- A detailed review of the original calculation
  - A review by an alternate, qualified or experienced member of calculation
  - A review of a representative sample of representative calculations
  - A review of the calculation against a similar calculation previously performed

DESIGN LOAD: 68632 #

LOAD TYPE:  
 DESIGN,  OPERATING,  HYDRO,  
 EMERGENCY,  OTHER: \_\_\_\_\_

ITEMS REVIEWED	SECTION OF REVIEW MANUAL USED	REMARKS
<input type="checkbox"/> NON-VENDOR CATALOG COMPONENT SUPPORT ELEMENT <input checked="" type="checkbox"/> STIFFENERS <input type="checkbox"/> CONNECTION OF NON-VENDOR CATALOG SUPPORT ELEMENTS <input type="checkbox"/> WELDS OF COMPONENT SUPPORT ATTACHMENTS <input type="checkbox"/> EXPANSION ANCHOR PLATES <input type="checkbox"/> OTHER: <input checked="" type="checkbox"/> DOCUMENTATION PROVIDED BY MD&D - ENTIRELY <u>REMAINDER:</u>		<p>ONLY STIFFENERS ARE CHECKED HERE. FOR ALL OTHER ITEMS, REV. CALCS ARE STILL VALID</p>

NOTATION FOR "REMARKS" COLUMN

"A" - Review Manual utilized with no supplemental hand calculations.  
 "B" - Review Manual utilized with supplemental hand calculations which follow  
 "C" - Non-Standard: hand calculations follow  
 9512190015 951215  
 PDR AD0CK 05000373  
 P PDR

Form 603061 Rev 2

Client C.E.CO

Project LA SALLE-1

Proj. No. 4266-00

Equip. No.

Prepared by Bndmadugula

Date 9-28-81

Reviewed by

Date

Approved by

Date

PROBLEM: STIFFENERS POSSIBLE FOR ONLY 12" HT ON ONE SIDE (FOR FULL HT ON THE OTHER SIDE)  
SOLUTION: USE REVISED LOAD OF 68.632 K AS AGAINST 141.281 K AND CHECK THE STRESSES  
 TURBINE BLDG (NON-SAFETY) CLASS D (NON-SAFETY) ∴ g-VALUES NEED NOT BE CONSIDERED.

I.P. STEEL

W 33 x 130 + INSIDE COVER PLS 1 1/2" x 8"

t<sub>f</sub> = 0.855 t<sub>w</sub> = 0.580"

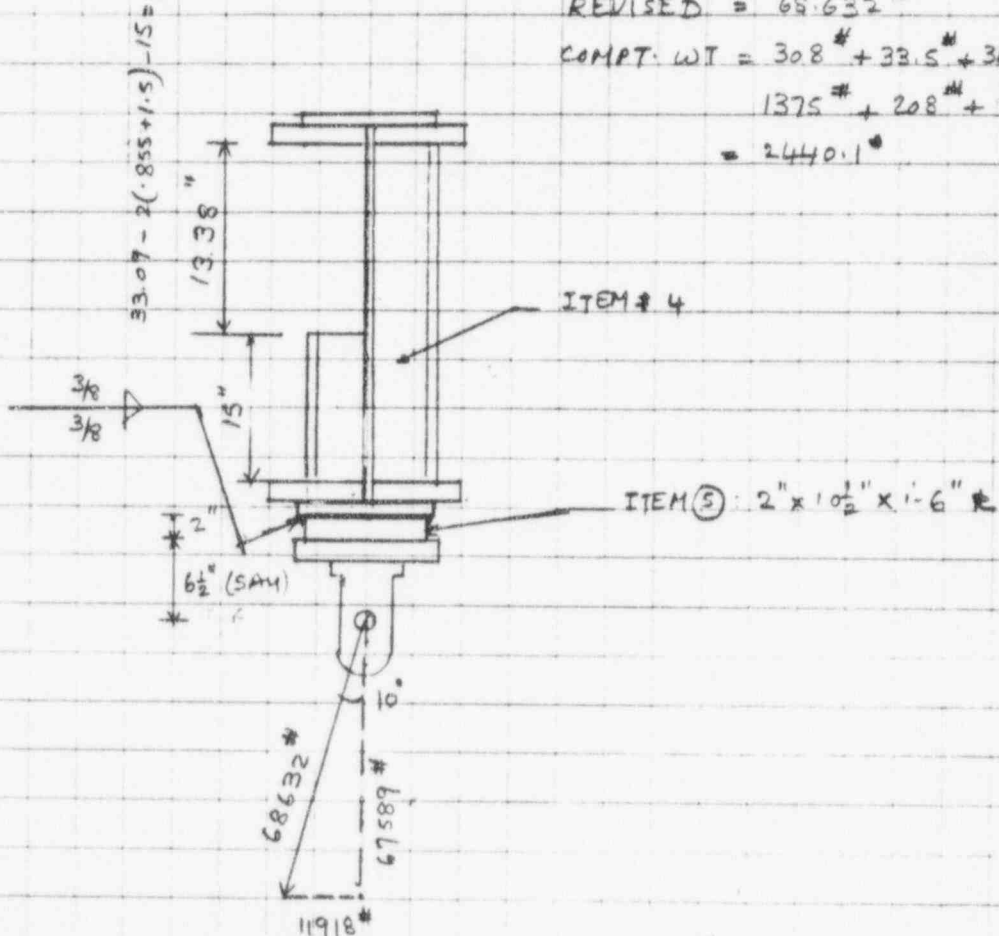
REAR BRKT AH 1546

BASE SIZE 14" x 8"

e = 6.12"

REVISED = 68.632 K

COMPT. WT = 30.8 # + 33.5 # + 36.5 # + 14.8 # + 137.5 # + 20.8 # + 224.1 # + 107 # = 2440.1 #



MOMENT = 119.18 x 8.5 = 101.303 inK

TENSION = 67.589 K + 2.440 K = 70.029 K

∴ FLANGE LOAD =  $\frac{70.029}{2} + \frac{101.303}{10.5} = 35.01 + 9.65 = 44.66 K$   
 (ON EACH SIDE)

M = 44.66 x 5.25 = 234.5 inK

Client	C E CO
Project	LA SALLE-1
Proj. No.	4266-08
Equip. No.	

Prepared by	B. Madugula	Date	9-28-81
Reviewed by		Date	
Approved by		Date	

EFFECTIVE WIDTH OF FLANGE =  $18 + 2(5.25) = 28.5"$

SECTION MODULUS OF FLANGE ALONE =  $\frac{1}{6} \times 28.5 \times 0.855^2 = 3.472 \text{ in}^3$

SECTION MODULUS OF COVER PLATE ALONE =  $\frac{1}{6} \times 28.5 \times 1.5^2 = 10.69 \text{ in}^3$

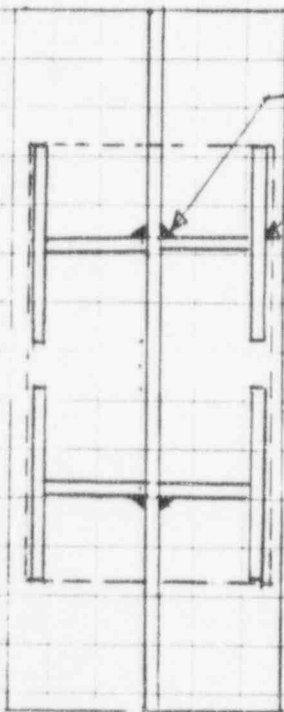
COVER PLATE FILLET WELDED TO WEB OF W33 ∴ CANNOT TAKE MOMENT.

$f_b = \frac{234.5}{3.472} = 67.54 > 27.0 \text{ KSI}$  N.G.

∴ PROVIDE STIFFENER UPTO FULL HT ON ONE SIDE & UPTO 1/2 HT ON OTHER SIDE (WT 5X22.5)

CHECK THE SIDE WITH PARTIAL-HT. STIFF. (ITEM # 4)

$t_w = 0.580"$   
SHEAR CAPACITY OF WEB =  $0.580 \times 14.40 = 8.352 \text{ K}$   
(FOR IN HT.)

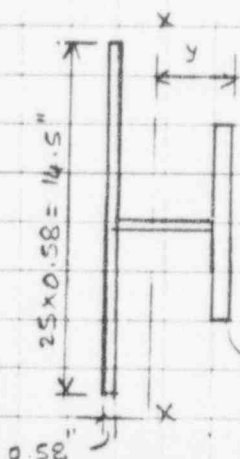


HT. OF WEB REQD. FOR 70.029 SHEAR LOAD =  
 $= \frac{70.029}{8.352} = 8.4" < 15" \text{ O.K.}$

BEARING STIFF. CHECK

CONSIDER ONLY ONE STIFFENER, THAT TOO ON ONE SIDE FOR CALCULATION PURPOSES:

$$y = \frac{(6.63 \times 0.907) + (14.5 \times 0.58 \times 5.34)}{6.63 + 14.5 \times 0.58}$$
  
$$= \frac{6.013 + 44.91}{6.63 + 8.41} = \frac{50.92}{15.04} = 3.39"$$



WT 5X22.5  
 $I_x = 10.2 \text{ in}^4$   $A = 6.63 \text{ in}^2$   $\bar{y} = 0.907$   $d = 5.05"$

Client	C. E. CO
Project	LA SALLE - 1
Proj. No.	4266-00
Equip. No.	

Prepared by	<i>B. Madanigula</i>	Date	9.28.81
Reviewed by		Date	
Approved by		Date	

$$I_x = 10.2 + 6.63(3.39 - 0.907)^2 + \frac{1}{12} \times 14.5(0.58)^3 + 8.41(3.39 - 5.34)^2$$

$$= 10.2 + 40.88 + 0.24 + 31.98 = 83.3 \text{ in}^4$$

$$r = \sqrt{\frac{I}{A}} = \sqrt{\frac{83.3}{1504}} = 2.353''$$

$$\frac{kl}{r} = \frac{0.75 \times 28.25}{2.353} = 9 \quad F_c = 21.21 \text{ ksi}$$

CAPACITY OF BEARING STIFF =  $21.21 \times 15.04 = 319^k \gg 70.029^k \therefore \text{O.K.}$

CHECK WELD BETWEEN ITEM # (5) & I.P. STEEL:

FLANGE LOAD (EACH SIDE) = 44.66k      SHEAR = 11.918k  
 LENGTH OF WELD = 18"      LENGTH OF WELD = 18x2 = 36"  
 $f = \frac{44.66}{18} = 2.48 \text{ k/in}$        $f_s = \frac{11.918}{36} = 0.33$   
 $f = \sqrt{2.48^2 + 0.33^2} = 2.50 \text{ k}$

CAPACITY OF  $\frac{3}{8}" \Delta = 6 \times 0.928 = 5.568 > 2.50 \therefore \text{O.K.}$

NO NEED TO CHECK THE PLATE AS THERE IS NO BENDING.

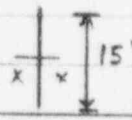
WELD BETWEEN STIFF & BEAM FLANGE

FORCES: TENSION = 44.66k  
 SHEAR =  $\frac{11.918}{2} = 5.96^k$   
 RESULTANT =  $\sqrt{44.66^2 + 5.96^2} = 45.1^k$

LENGTH OF WELD = 2x2 = 16"      STRESS =  $\frac{45.1}{16} = 2.82 \text{ k/in}$

CAPACITY OF  $\frac{5}{16}" \Delta = 5 \times 0.928 = 4.64 \text{ k/in} > 2.82 \text{ k/in} \quad \underline{\underline{\text{O.K.}}}$

WELD BETWEEN STIFF & BEAM WEB (AT EACH WT-SECTION)

$S_x = \frac{15^3}{6} = 37.5$        $M = \frac{44.66}{2} \times 5.05 = 112.77^k$        $f_1 = \frac{112.77}{37.5} = 3.0$   
  
 SHEAR PER (WT) =  $\frac{44.66}{2}$        $L = 15"$        $f_2 = \frac{44.66}{2 \times 15} = 1.49^k$        $f = \sqrt{f_1^2 + f_2^2} = 3.35^k < 4.64 \text{ O.K.}$



Calcs. For	MS-09
M09 - MS01 - 13015	
Safety-Related	<input checked="" type="checkbox"/> Non-Safety-Related

Calc. No.	E13 - MS09		
Rev.	0	Date	10-8-81
Page	10	of	11

Client	C E CO		
Project	LA SALLE - 1		
Proj. No.	4266-08	Equip. No.	

Prepared by	<i>Emmadiquela</i>	Date	9-28-81
Reviewed by	<i>W. L. ...</i>	Date	10-21-81
Approved by		Date	

CHECK THE STEM OF WT 5X22.5

$$M = 112.77 \text{ in.k}^{\prime}$$

$$S = \frac{1}{6} \times 0.35 \times 15^2 = 13.125 \text{ in}^3$$

$$f = \frac{112.77}{13.125} = 8.6 \text{ ksi} < 270 \text{ ksi}$$



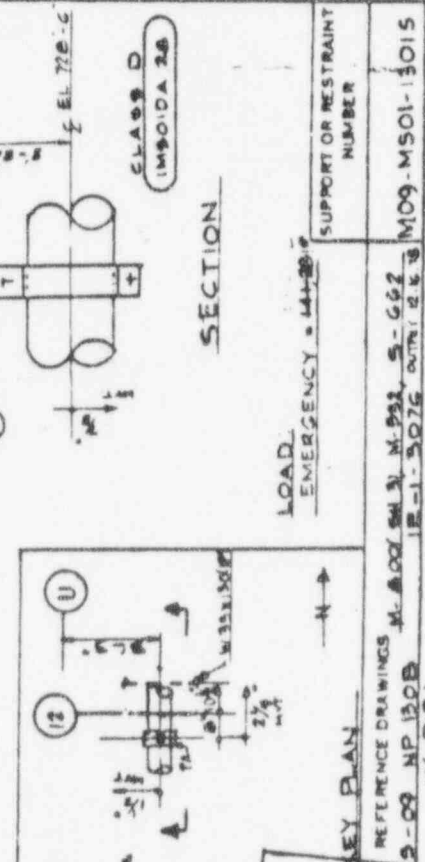
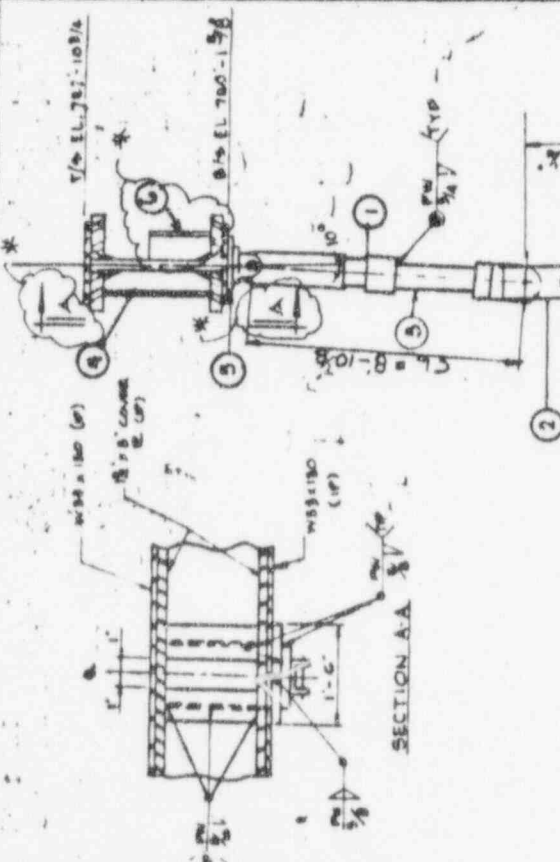
10-1-4

ITEM NO	QUANT	BILL OF MATERIAL AND DESCRIPTION
ONE		MECHANICAL SHOCK ARRESTER ASSEMBLY CONTRIBUTING OP
1	1	MODEL PMA-100 MACH SHOCK ARRESTER FOR PN 1801119-13 TW = 508 # SETTING = 2 1/2 W/ WELD ADAPTER PN 1801544-01 TW = 88 5 # END CAP PN 1801543-03 TW = 50 5 # TEAR BRACKET AH1946 TW = 182 # 28 # PIPE CLAMP PER M-1032-1-A, TW = 375
2	1	5" Ø EXTENSION PIPE SCH XXS 5'-4 1/2" LG, TW = 208
3	1	WTD = 22 D/PT. 2'-4 1/2" LG TW = 172
4	1	2" X 10 1/2" X 1/8" CS PLATE TW = 107 #
5	1	WT 5 X 1 1/2" FT. 1'-2 1/2" LG TW = 50 25
		BUNDLE & TAG FC-443
		✓ SUPPLIED BY BULK ORDER

REV.	DATE	INIT.	DESCRIPTION
A	02-21-78	QVA	CED-1092
B	8-29-79	LDK	CED-2167
C	09-12-82	NCE	CED-2597
D	10-9-88	OK	CED-3158
E		SP	



PRF - 1650  
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LOAD: EMERGENCY = 14400 #  
SUPPORT OR RESTRAINT NUMBER  
DESIGNED BY Apfmann DATE 6-10-77  
CHECKED BY Repton DATE 2-11-78  
ENGINEER David G. Mann DATE 2-13-78  
PROJECT: LA SALLE COUNTY 1 PROJECT NO 4266 SYSTEM MAIN STEAM  
CLIENT COMMONWEALTH EDISON CO  
REFERENCE DRAWINGS: M-8000 SH 31 M-892 S-662  
M-12-1-3076 OUTLINE & B M09-MS01-13015  
SUPPORT OR RESTRAINT TURBINE BLDG  
DETAIL SHEET FOR

DRAWING NUMBER  
M09 MS01-13015  
SHEET 1 OF 1

SARGENT & LUNDY  
ENGINEERING  
C-2-550  
K158

PROJECT NO. 4266-00  
CALC. NO. 813-11507  
REV 0 DATE 10/2/81  
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1100

DG REVIEW  
COMMENTS AS NOTED  
DATE 12-28-81



Calcs. For **MECHANICAL COMPONENT MS-09**  
**SUPPORT NUMBER: MS-09-MS01-12305 REV.**  
 Safety-Related     Non-Safety-Related

Calc. No. **813-MS09**  
 Rev. **0**    Date **10/27/81**  
 Page **1** of **8**

Client **COMMONWEALTH EDISON CO.**  
 Project **LA SALLE UNIT 1**  
 Proj. No. **4266-00/4266-10**

Prepared by *Brd Medina*    Date **10-14-81**  
 Reviewed by *James Baker*    Date **10-14-81**  
 Approved by *James J. Fox*    Date **10-15-81**

PRF # 1675

**MECHANICAL COMPONENT SUPPORT DOCUMENTATION SHEET**

- HAND PREPARED DESIGN CALCULATION**  
 The review of this hand prepared design calculation was accomplished by me at a combination of the following (as checked):
- A detailed review of the original calculation
  - A review by an alternate, simplified or approximate method of calculation
  - A review of a representative sample of repetitive calculations
  - A review of the calculation against a similar calculation previously performed

DESIGN LOAD: **28,417** #

LOAD TYPE:  
 DESIGN,     OPERATING,     HYDRO,  
 EMERGENCY,     OTHER: \_\_\_\_\_

ITEMS REVIEWED	SECTION OF REVIEW MANUAL USED	REMARKS
<input checked="" type="checkbox"/> NON-VENDOR CATALOG COMPONENT SUPPORT ELEMENT		C
<input type="checkbox"/> STIFFENERS		
<input checked="" type="checkbox"/> CONNECTION OF NON-VENDOR CATALOG SUPPORT ELEMENTS		C
<input type="checkbox"/> WELDS OF COMPONENT SUPPORT ATTACHMENTS		
<input checked="" type="checkbox"/> EXPANSION ANCHOR PLATES		C
<input type="checkbox"/> OTHER:		
<input checked="" type="checkbox"/> DOCUMENTATION PROVIDED BY MD&DD - ENTIRELY/REMAINDER:		

NOTATION FOR "REMARKS" COLUMN

- "A" - Review Manual utilized with no supplemental hand calculations.
- "B" - Review Manual utilized with supplemental hand calculations which follow
- "C" - Non-Standard: hand calculations follow

Client	C. E. Co
Project	LACALLE - 1
Proj. No.	4266-00      Equip. No.

Prepared by	<i>BMD Madugula</i>	Date	10.14.81
Reviewed by		Date	
Approved by		Date	

PRF # 1675

NON-SAFETY BLDG      TURBINE BLDG EL 697'-0"  
NON-SAFETY PIPE       $g_H = 1.1$        $g_V = 1.0$   
SEISMIC RESTRAINT.

CONSERVATIVELY CONSIDER g-VALUES      COMPT. WT = 800 #  
TAKE LOAD AS 30k (INSTEAD OF 28417#) CONSERVATIVELY

CHECK ITEM # 7.      TS  $\frac{8" \times 8" \times 8"}{2} \times 3'-8"$  LONG      WT = 59.32 #/l  
A = 17.4 in<sup>2</sup>  
I = 153 in<sup>4</sup>  
S = 38.3 in<sup>3</sup>  
 $\gamma = 2.96"$

$P = 30 + 1.1(0.8) = 30.88^k$   
 $P_x = 30.88 \times 0.707 = 21.83^k$   
 $P_y = 30.88 \times 0.707 = 21.83^k$

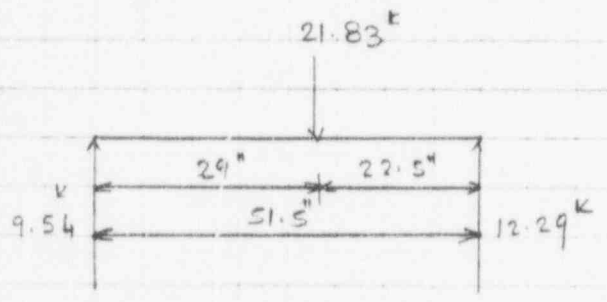
CONSERVATIVELY CONSIDER LOAD TO BE IN THE MIDDLE (ALLOWING FOR 6" TOLERANCE)

$M_x = \frac{21.83 \times 51.5}{4} = 281 \text{ "k}$        $f_{bx} = \frac{281}{38.3} = 7.34 \text{ ksi}$   
 $M_y = 281 \text{ "k}$        $f_{by} = \frac{281}{38.3} = 7.34 \text{ ksi}$

I.A.C =  $\frac{7.34 + 7.34}{21.6} = 0.68 < 0.75 \therefore \text{O.K}$

TORSION =  $21.83 \times 4 = 87.32 \text{ in.k}$

SHEAR DUE TO TORSION      k/in<sup>2</sup>  
 $= \frac{87.32}{2[9.375 \times 7.375] \times 0.6:5}$       = 1.28  
 $< 14.4 \times 0.75 \text{ O.K}$

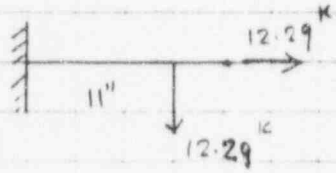




Client	C. E. CO
Project	LA SALLE - 1
Proj. No.	4266-00 Equip. No.

Prepared by	B. Madugula	Date	10-14-81
Reviewed by		Date	
Approved by		Date	

CHECK ITEM # 6 TS 8"x6"x $\frac{1}{2}$ " x 1'-0" Lg



$M_x = 12.29 \times 11 = 135.19 \text{ in-k}$   
 $P = 12.29 \text{ k}$

$A = 12.4 \text{ in}^2$   
 $S_x = 25.8 \text{ in}^3$   
 $S_y = 21.9 \text{ in}^3$   
 $r_y = 2.31 \text{ in}$

I.A.C.

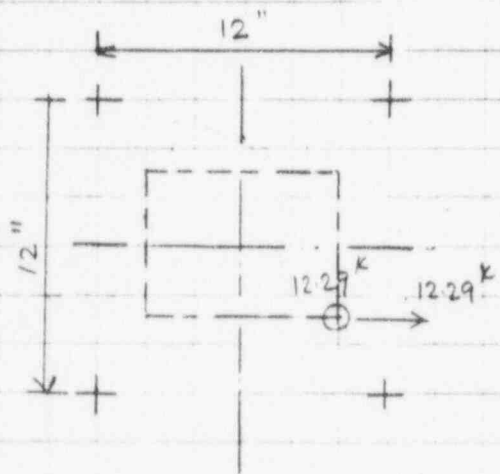
$\frac{12.29}{12.4(21.6)} + \frac{135.19}{25.8(21.6)} = 0.46 + 0.24 = 0.70 < 0.65$

i. O.K

TORSION IS NEGLIGIBLE ON TUBE.

CHECK ITEM # 4

$\frac{3}{4}$ "  $\phi$  CORE-DRILLED BOLTS ASTM A193 B-7



TENSION ON EACH BOLT

$= \frac{12.29}{4} + \frac{12.29 \times 4}{2 \times 12} + \frac{12.29 \times 3}{2 \times 12}$   
 $= 3.07 + 2.048 + 1.536 = 6.654 \text{ k}$

SHEAR ON EACH BOLT:

$\frac{12.29}{4} + \frac{12.29 \times 3}{2 \times 12} = 3.07 + 1.54 = 4.61 \text{ k}$

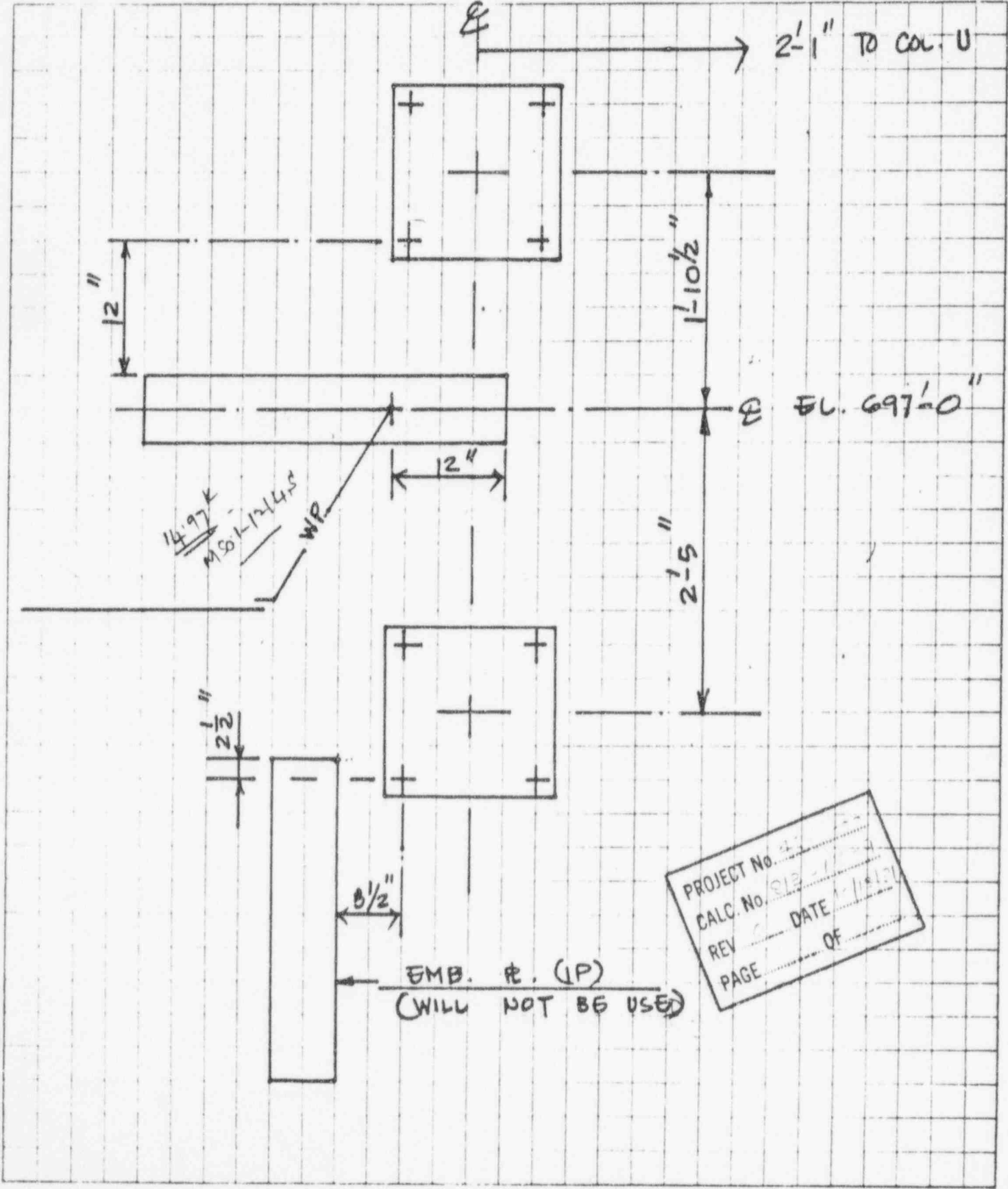
TOTAL EQUIVALENT TENSION =  $6.654 + \frac{4.61}{0.7} = 13.24$

ALLOWABLE TENSION AS PER AISC SEC. 1.6.3 =  $(0.43 F_u - 1.8 f_v) 0.442$   
 $= 0.43 \times 125 \times 0.442 - 1.8(4.61)$   
 $= 23.76 - 8.3 = 15.46 \text{ k} > 13.24 \text{ k}$  (i. O.K)

ALLOWABLE TENSION AS PER VOL # 801 (SEE p.5) = 16.5 k USE 15.46 k

Client \_\_\_\_\_  
Project \_\_\_\_\_  
Proj. No. \_\_\_\_\_ Equip. No. \_\_\_\_\_

Prepared by \_\_\_\_\_ Date \_\_\_\_\_  
Reviewed by \_\_\_\_\_ Date \_\_\_\_\_  
Approved by \_\_\_\_\_ Date \_\_\_\_\_



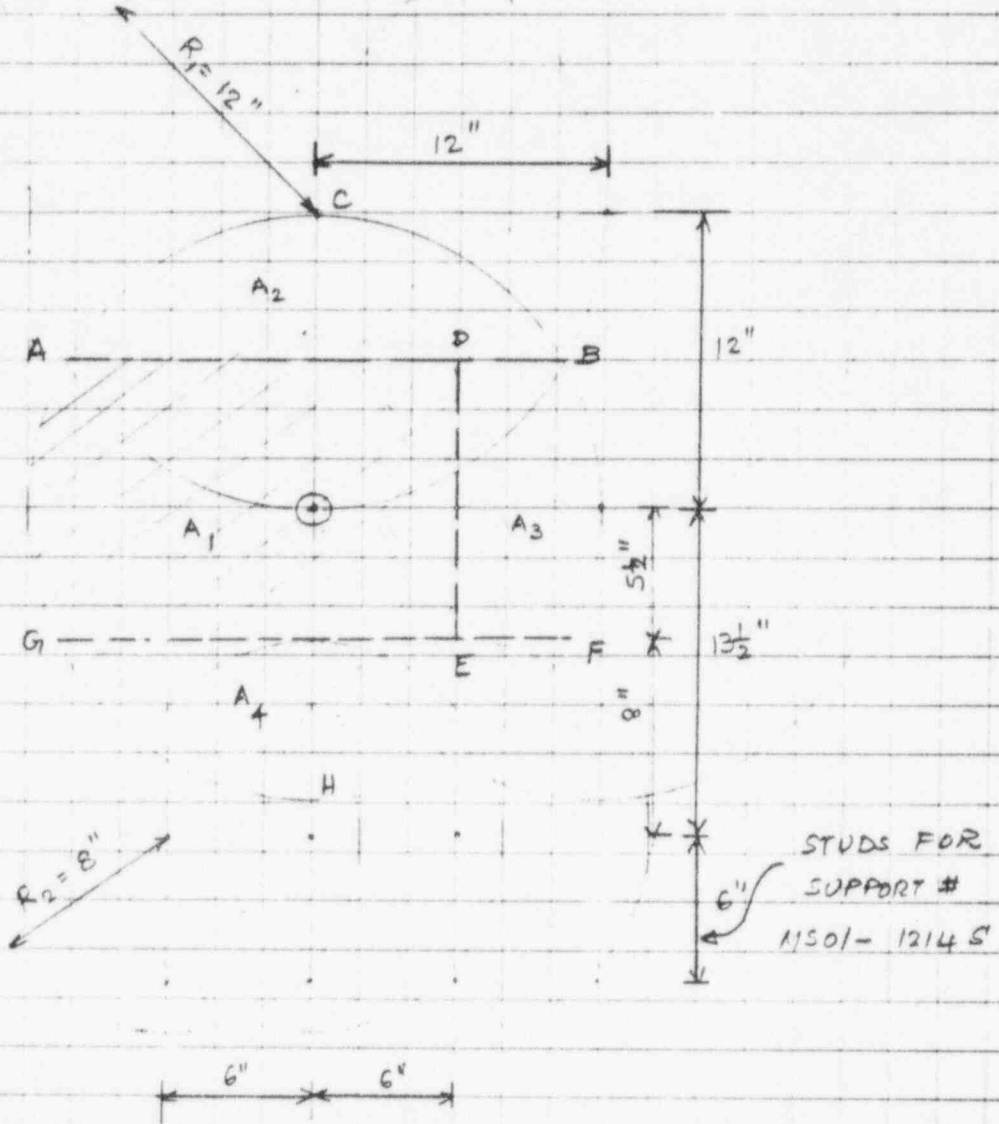
PROJECT No. \_\_\_\_\_  
CALC. No. 813-M509  
REV. \_\_\_\_\_ DATE 10/27/51  
PAGE \_\_\_\_\_ OF \_\_\_\_\_

Client C.E.CO  
Project LASALLE-1  
Proj. No. 4266-00 Equip. No.

Prepared by Brodmanaduguiz Date 10-13-81  
Reviewed by \_\_\_\_\_ Date \_\_\_\_\_  
Approved by \_\_\_\_\_ Date \_\_\_\_\_

CHECK INTERFERENCE OF STUDS:

SEE P 8 & 9 VOL # 801



NET PROJECTED AREA OF CONCRETE CONE (A) i.e., AREA SHOWN SHADED

=  $A_1 - A_2 - A_3 - A_4$  WHERE

$A_1$  = FULL AREA OF 12" RADIUS CIRCLE

$A_2$  = AREA OF SEGMENT (ACB)

$A_3$  = AREA OF PORTION OF SEGMENT (DBFE)

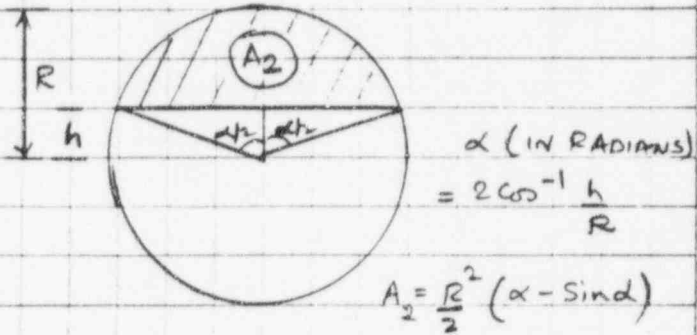
$A_4$  = AREA OF SEGMENT (FGH)

Client C E. CO  
Project LA SALLE - 1  
Proj. No. 4266-00 Equip. No.

Prepared by B. Madugula Date 10-13-81  
Reviewed by \_\_\_\_\_ Date \_\_\_\_\_  
Approved by \_\_\_\_\_ Date \_\_\_\_\_

$$A_1 = \pi (12)^2 = 452 \text{ in}^2$$

$$A_2 = \frac{12^2}{2} (2.09 - 0.866) = 88 \text{ in}^2$$



$$\alpha = 2 \cos^{-1} \frac{6}{12} = 2.09 \text{ (radians)}$$

$$A_4 = \frac{12^2}{2} (2.19 - 0.815) = 99 \text{ in}^2$$

$$\alpha = 2 \cos^{-1} \frac{5.5}{12} = 2.19 \text{ radians}$$

$$A_3 = 11.5 \times 6 = 69 \text{ in}^2$$

$$A = A_1 - A_2 - A_3 - A_4 = 452 - 88 - 69 - 99 = 196 \text{ in}^2$$

$$\text{CAPACITY OF CONC} = 4 (0.65) \frac{\sqrt{3500}}{1000} (196) = (0.154) (196) = 30.2 > 15.46$$

AS PER VOL. #801 PG. 829

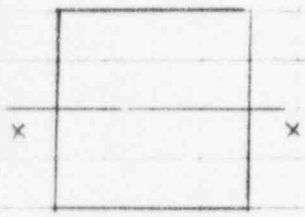
$\therefore$  O.K

Client	Prepared by <u>En. D. ...</u>	Date
Project	Reviewed by	Date
Proj. No.	Approved by	Date
Equip. No.		

CHECK WELDS

WELD BETWEEN (6) & (7)  $S = bd + \frac{d^2}{3} = 64 + \frac{64}{3} = 85.33$   $J = \frac{(bd)^2}{6} = 682.7$

$L = 4 \times 8 = 32''$



STRESS ON WELD

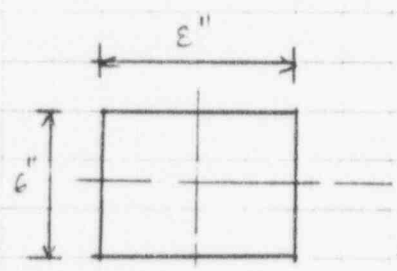
$= \frac{12.29 + 12.29}{32} + \frac{87.32 \times 4 \times 2}{682.7} = 0.77 + 1.02 = 1.79 \text{ ksi}$

CAPACITY OF WELD  $\frac{5}{16} \text{ K} = 4.64 > 1.79$

FOR BEVEL WELDS TAKE SIZE  $\approx 0.7 \times 0.5 = 0.35 > \frac{5}{16}$

∴ O.K.

WELDS BETWEEN (6) & (5)



$L = 2(8 + 4) = 28''$   $S = 48 + \frac{36}{3} = 60$

$J = \frac{(8+6)^2}{6} = 457.3$

STRESS ON WELD

$\frac{12.29 \times 3}{457.3} + \frac{12.29}{28} + \frac{135.17}{60} = 0.08 + 0.44 + 2.253 = 2.77$

CAPACITY OF  $\frac{5}{8}'' \text{ K} = 5.568 \text{ k/} > 2.77 \text{ k/} ∴ \text{O.K.}$

CHECK ITEM # 5

$M = 2 \times 1.654 (6 - 3) = 40$

$S = \frac{1}{6} \times 15 \times 15^2 = 5.625$

$f = \frac{40}{5.625} = 7.1 < 27.0$



