(2)

SAFETY RELATED ELECTRICAL EQUIPMENT ANCHORAGE

8302170321 830207
PDR ADOCK 05000409
P PDR

nes NUCLEAR ENERGY SERVICES, INC.

RECD JAN 1 4 1983

SAFETY-RELATED ELECTRICAL EQUIPMENT ANCHORAGES FOR THE LACROSSE BOILING WATER REACTOR

Project Application	Prepared By	Date
5101-063	R. E. Rumpf/T. Strnad	4/6/81
APPROVALS		
TITLE/DEPT.	SIGNATURE	DATE
Struct. Analysis Manager	Iqbal Husain	4-6-81
Project Manager	Richard Milos	4-6-81
V.P. Engineering	[signature]	4-6-81
Q.A. Manager	V. J. Potenti	4-6-81

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VALID ONLY IF THIS STAMP IS RED

nes NUCLEAR ENERGY SERVICES, INC.

REVISION LOG

DOCUMENT NO. 81A0041

REV. NO.	DATE	PAGE NO.	DESCRIPTION	APPROVAL
1	5-18-81	4	CRA No. 1880	[illegible]
1	5-18-81	SK-5101-063-4	CRA No. 1880	[illegible]
2	9-11-81	3	CRA No. 2121	R. Rumpf
3	1-4-83	3	CRA No. 3022	T. Strand

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LIST OF FIGURES & DRAWINGS

STEEL NOTES

1. Dimensions and tolerances are to be interpreted in accordance with ANSI Y14-5-1973.

2. All welding is to be performed in accordance with AWS standard D1.1. (1980). All welding is to be performed by welders who are qualified in accordance with Section IX of the ASME BPVC. △1

3. Material: All structural steel except tube sections per ASTM A36. Material certs are required.
   All bolts and nuts per ASTM A325 unless specified otherwise. △1

4. All structural carbon steel shall be protected from corrosion by painting with one (1) coat of a D.P.C.-approved rust-inhibiting primer. △1

5. Install "WEJ-IT" expansion anchor bolts in concrete at hole locations noted. Installation, drilling, etc. must be performed in accordance with the manufacturer's recommended procedure.

6. All expansion bolts are to be standard "WEJ-IT" type with standard "WEJ-IT" washers unless noted.

7. All structural tubing as per ASTM A500 Grade B. Material certs are required.

8. Where base plates require shimming or leveling, a non-shrink grout shall be used and shall be approved by owner.

9. All steel fabrication shall be in accordance with AISC.

NES

NUCLEAR ENERGY SERVICES

BY TS DATE 3-19-81 PROJ. 5101 TASK 063

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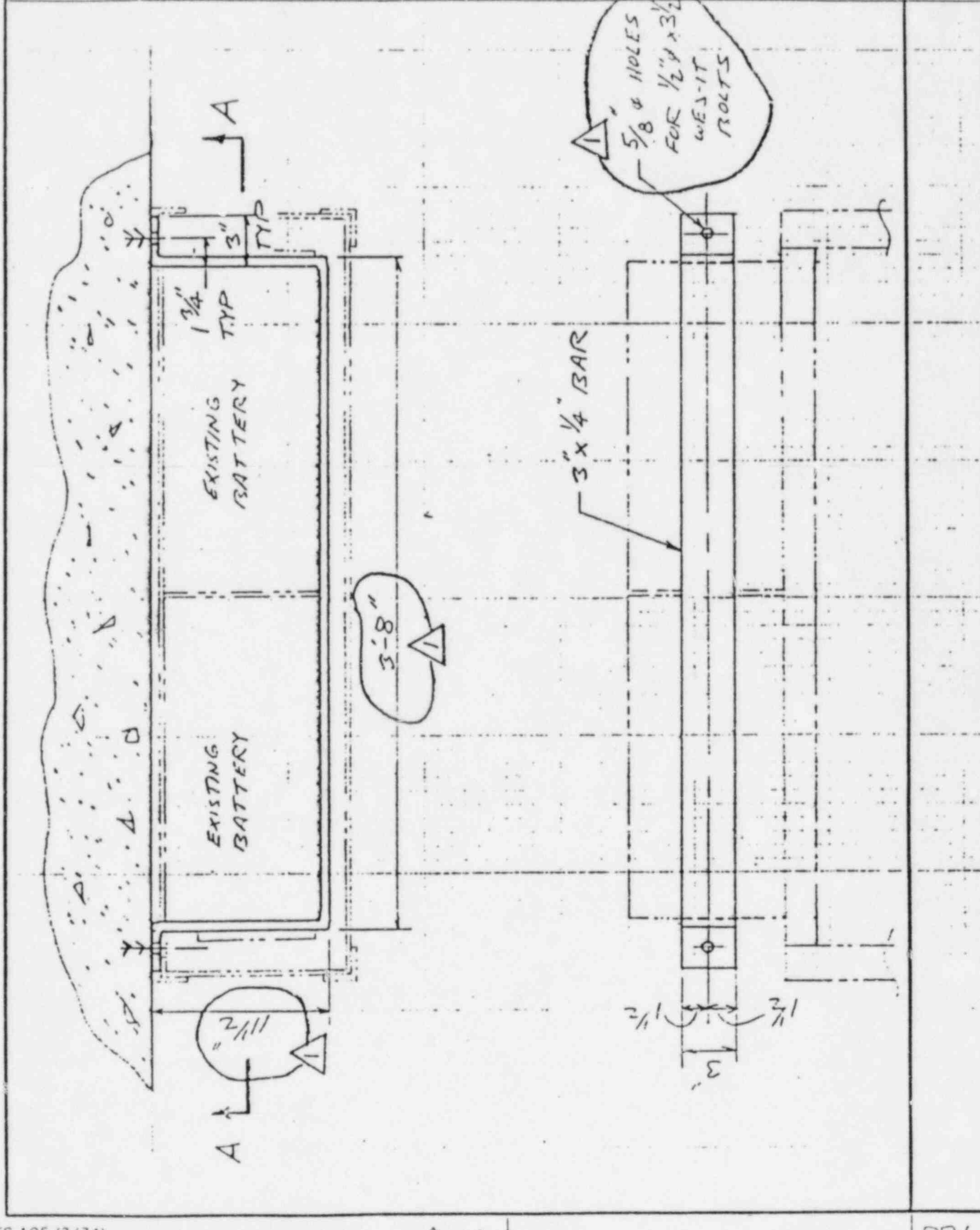
LACBWR

1-A DIESEL STARTING BATTERIES AND RACK	REF.



NES 105 (2/74)

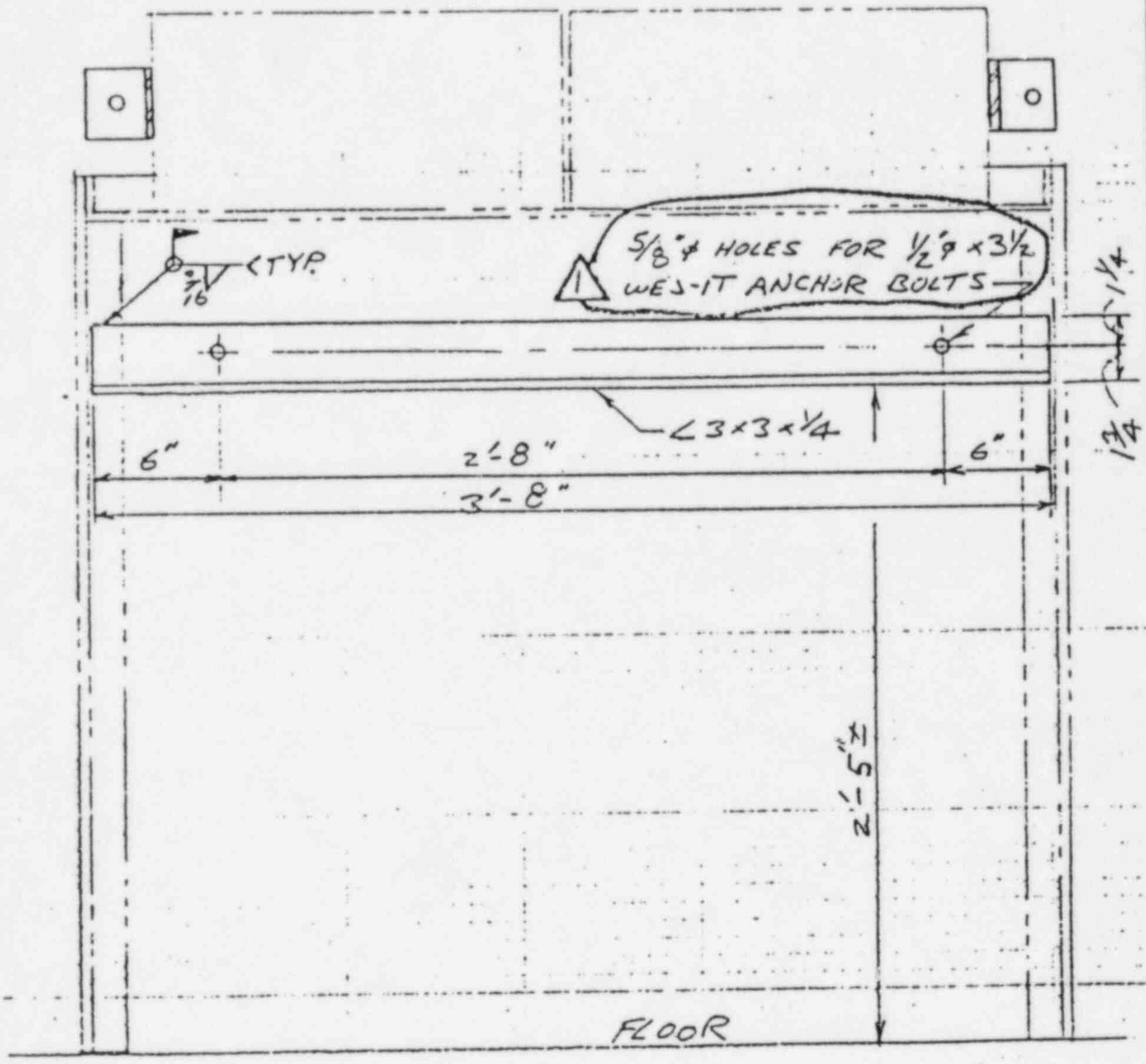
SK-5101-063-8 1 OF 2 REV 1

NUCLEAR ENERGY SERVICES

BY TS DATE 3-9-81 PROJ. 5101 TASK 063
CHKD. RR DATE 4-9-81 PAGE 11 OF
LACBWR

1-A DIESEL STARTING BATTERIES AND RACK

REF.



SECTION A-A

NES 105 (2/74)

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REV 1

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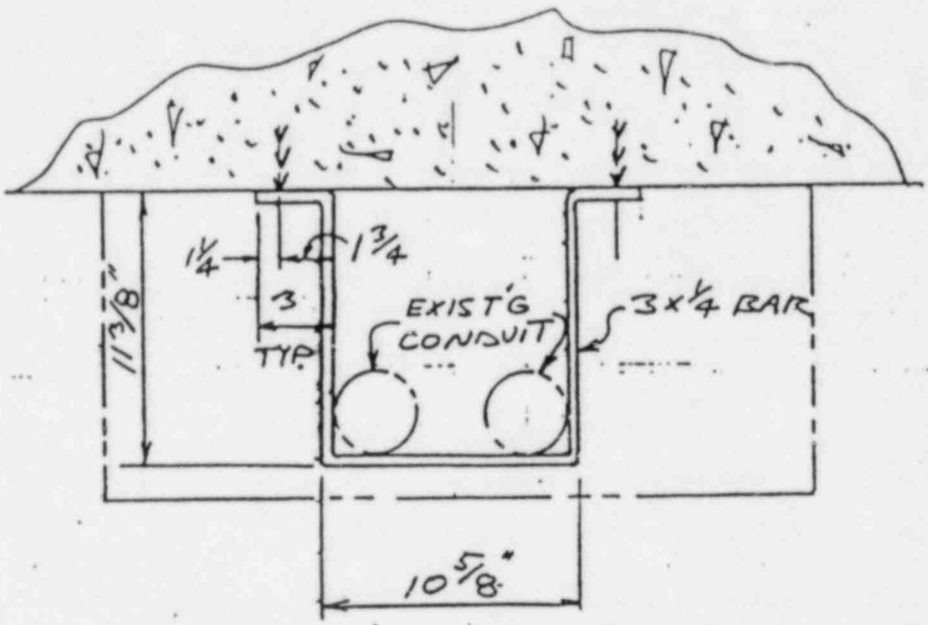
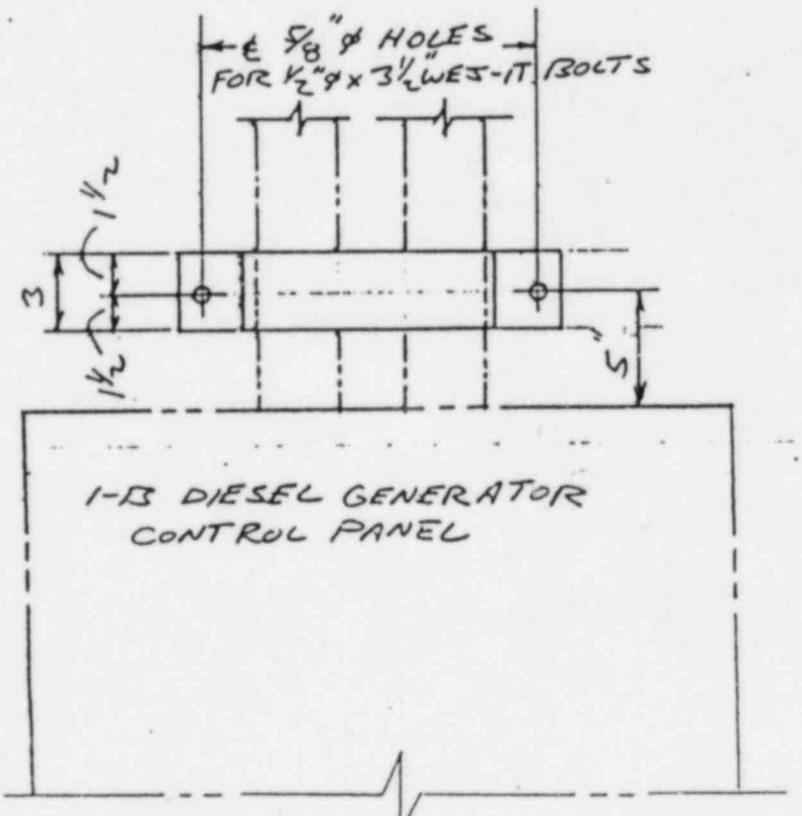
LACBWR ELECT. EQUIP. ANCHORAGE

1-B DIESEL GENERATOR CONTROL PANEL

REF.





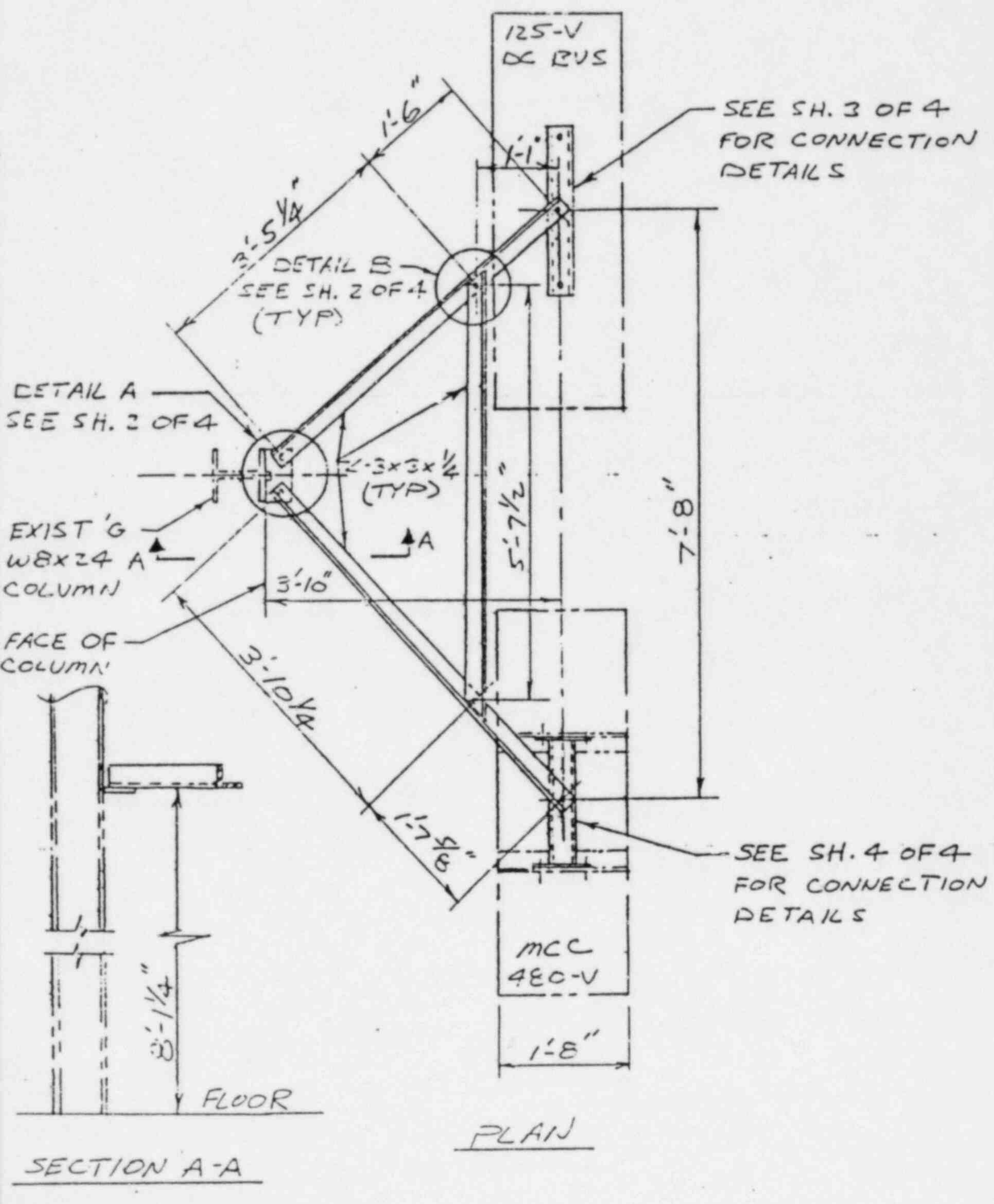
NES 105 (2/74)

SK-5101-063-9 1 OF 1 REV 1

NUCLEAR ENERGY SERVICES

BY TS DATE 3-15-92 PROJ. 5101 TASK 063
CHKD. RR DATE 3-15-92 PAGE 1 OF 4
[illegible] ELECT. EQUIP

	REF.
1-B [illegible] - ELECT. EQUIP PANELS	



NUCLEAR ENERGY SERVICES

BY ______ DATE ______ PROJ ______ TASK 063
CHKD. RR DATE 3/15/82 PAGE 2 OF 4
LACBWR ELECT EQUIP.

1-2 DIESEL BLDG - ELECT PANELS

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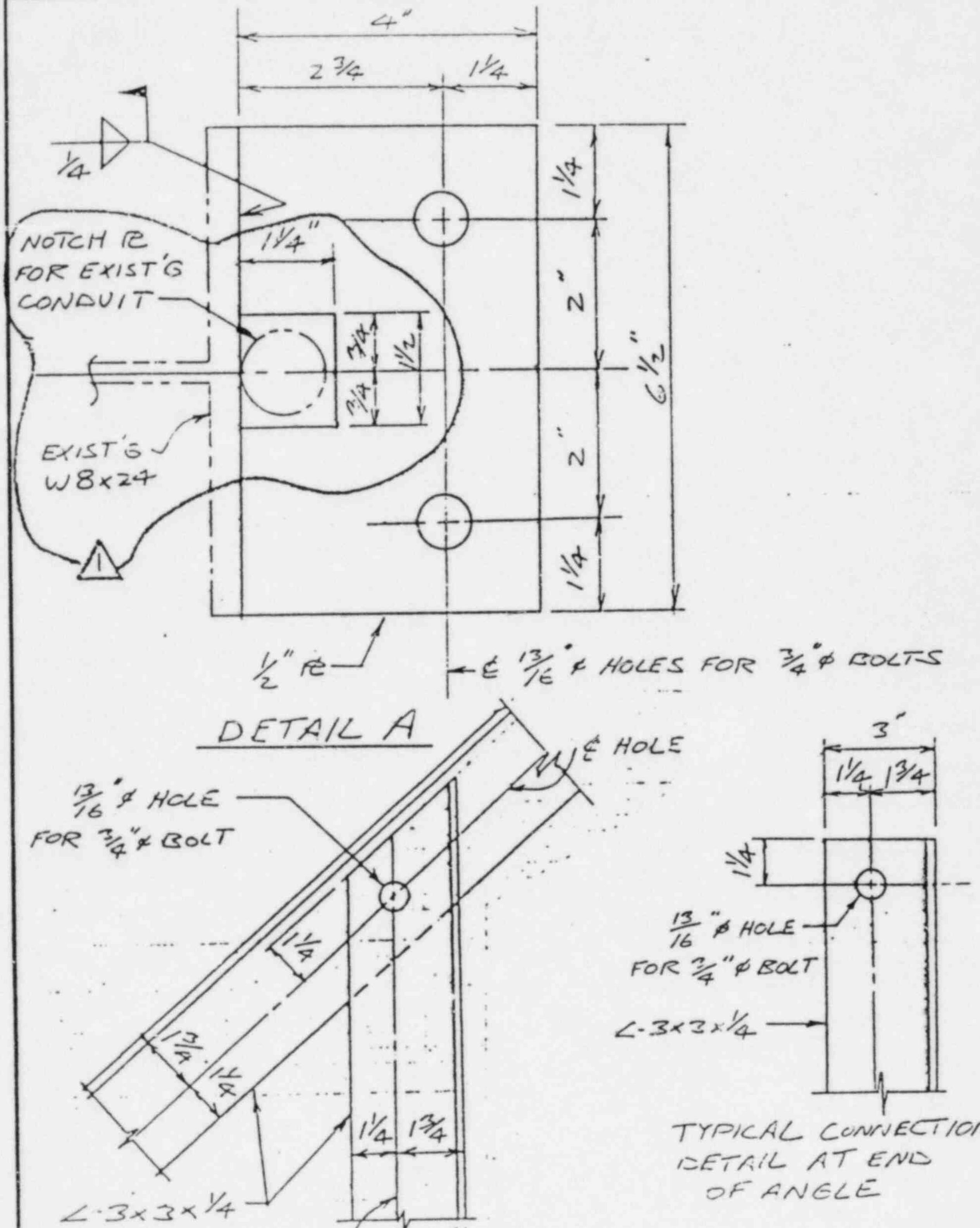

NUCLEAR ENERGY SERVICES

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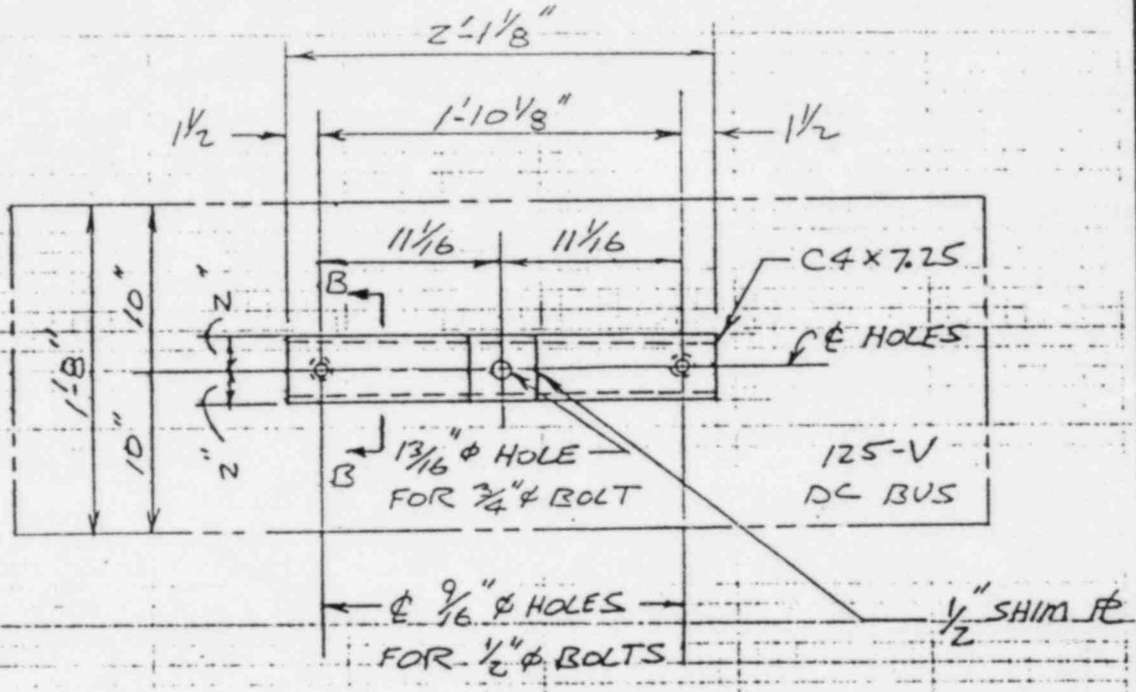
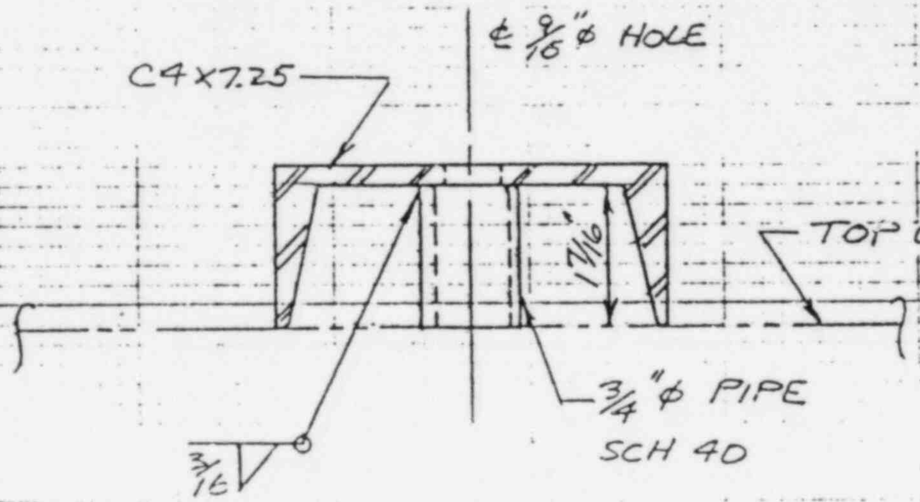
LACBWR ELECT EQUIP

1-B GEN BLDG · ELECT. EQUIP. PANELS

REF.



PLAN VIEW



SECTION B-B

NUCLEAR ENERGY SERVICES

BY TD DATE 3-15-82 PROJ. 5101 TASK 063
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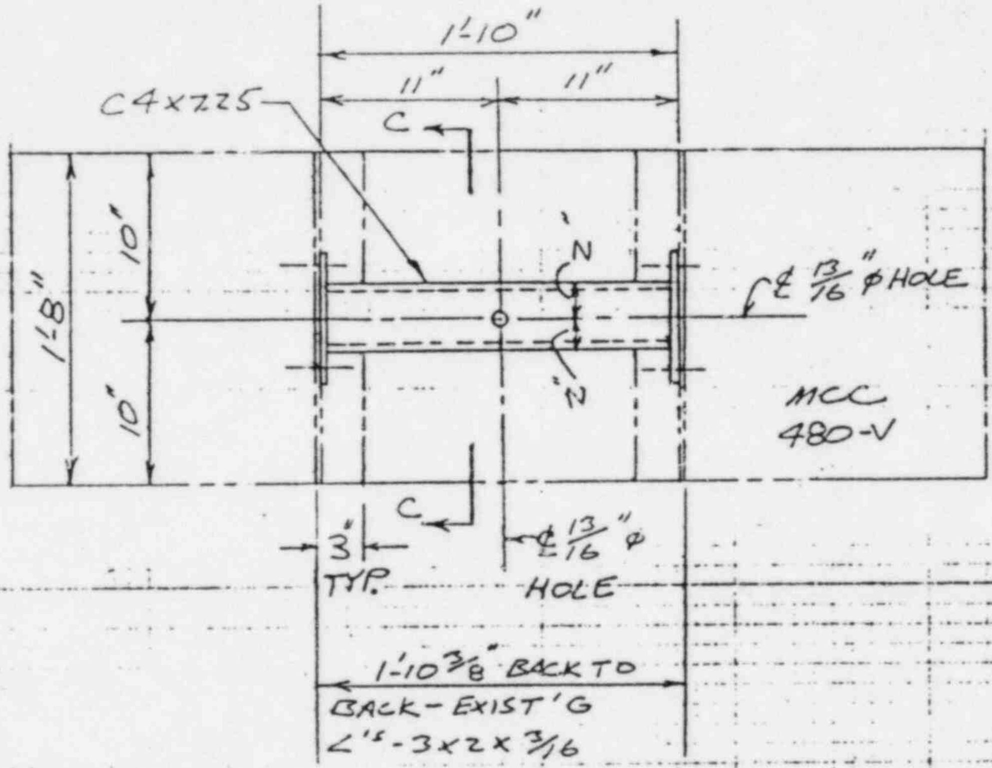
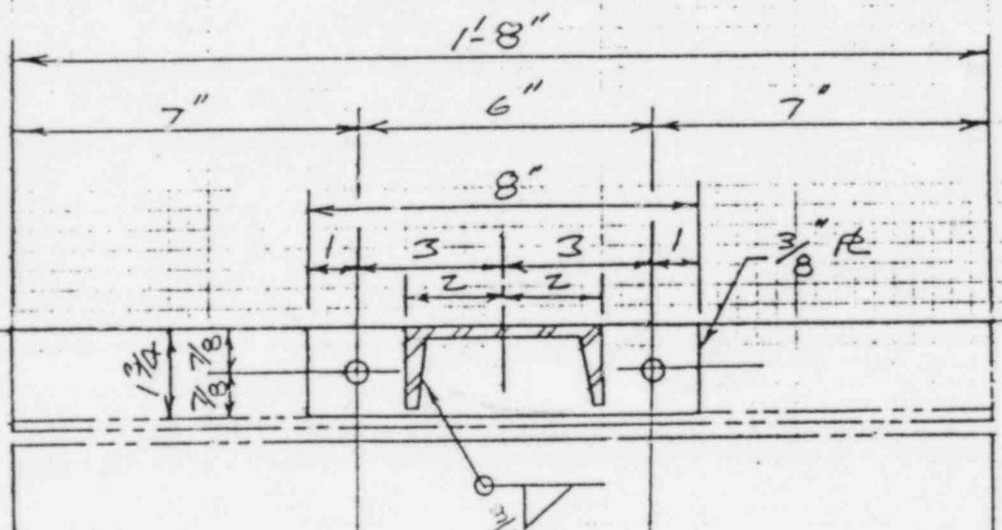
CALCULATIONS ELECT. EQUIP.

1-B GEN BLDG - ELECT. EQUIP. PANELS | REF.



PLAN VIEW



SECTION C-C

NES

NUCLEAR ENERGY SERVICES

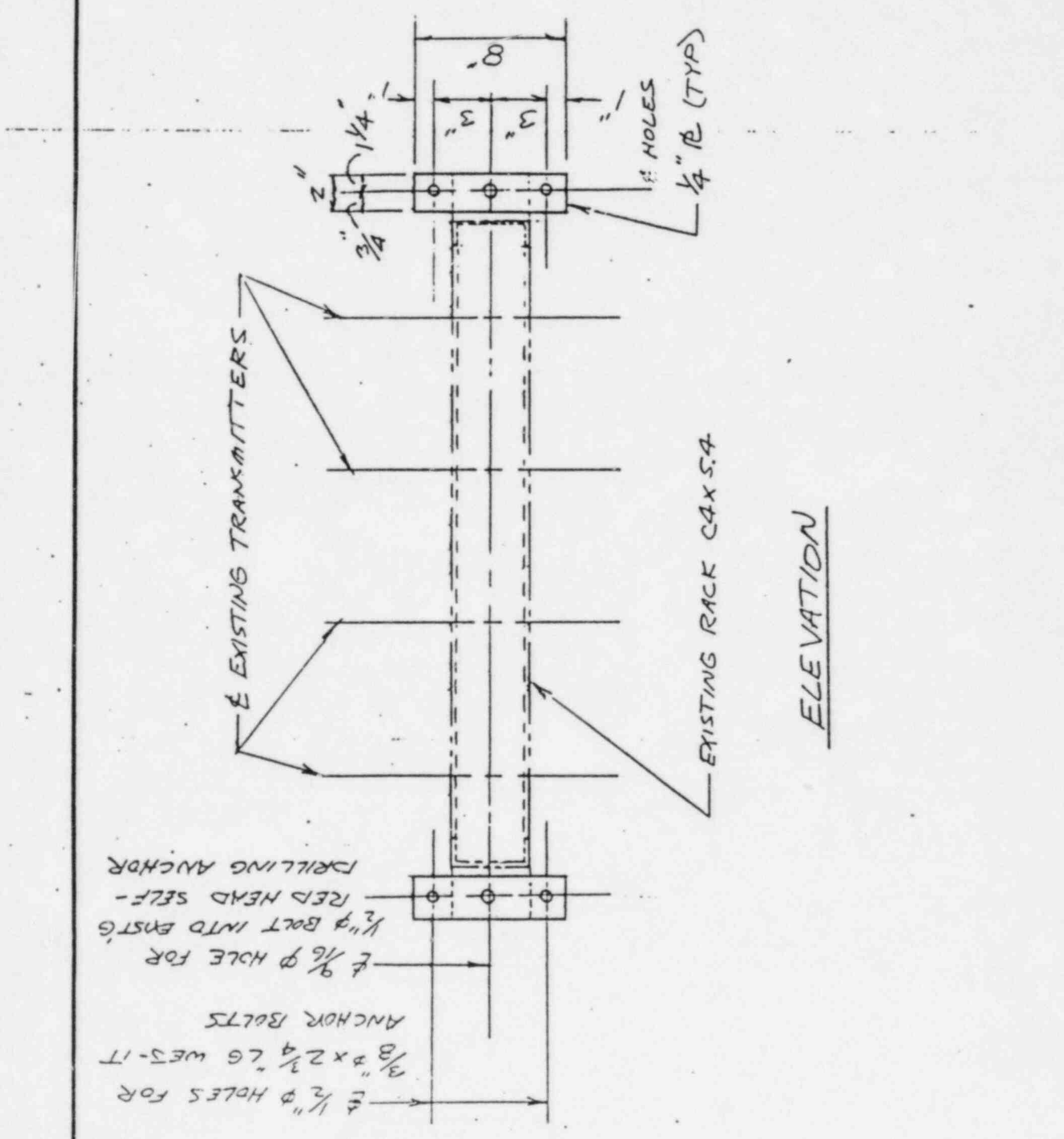
BY TS DATE 12/24/82 PROJ. 5101 TASK 063

CHKD. DLS DATE 12/28/82 PAGE ____ OF ____

LACBWR ELECT. EQUIP.

REACTOR WATER LEVEL TRANSMITTERS #1, #2

REF.



NES 105 (9/81)

3 2 SK-5101-063-12 1 OF 1

REV 1

NUCLEAR ENERGY SERVICES

BY JC DATE 12/14/81 PROJ. 5101 TASK 063
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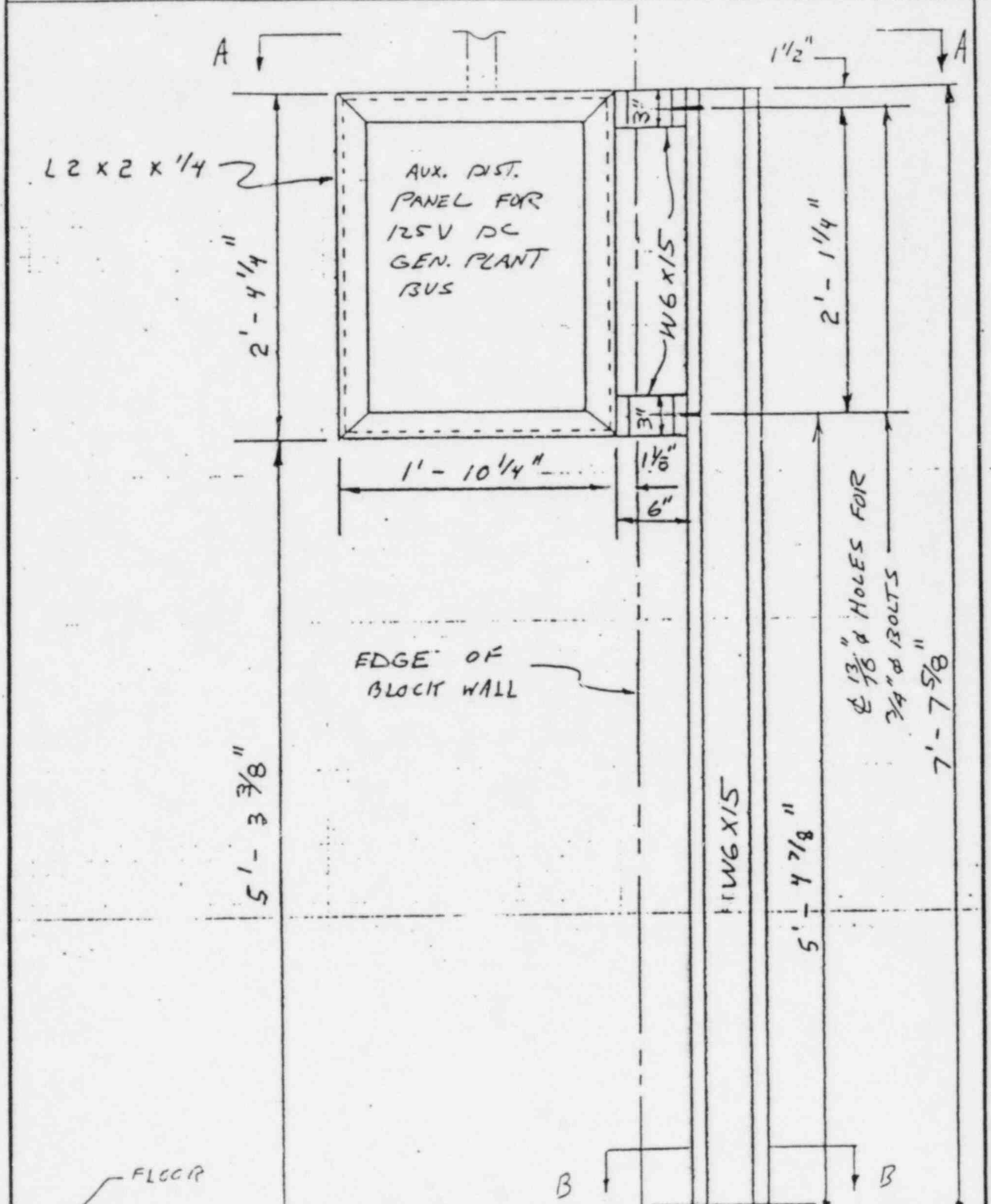
LACBWR

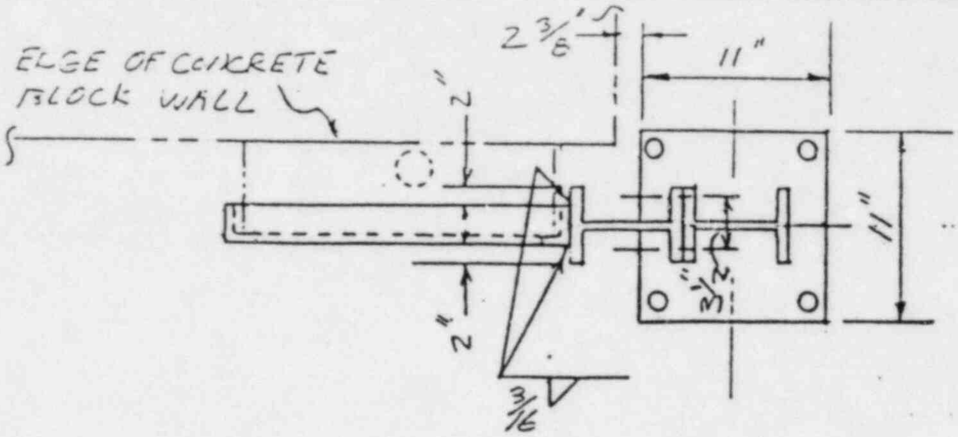
AUX. DIST. PANEL FOR 125V DC GEN PLANT BUS



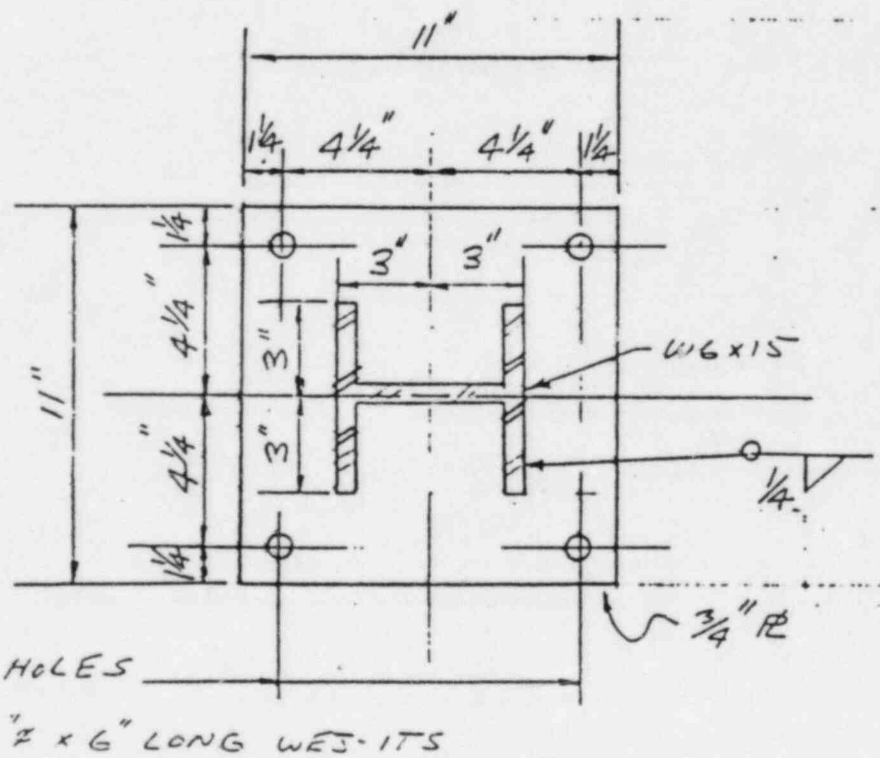
NUCLEAR ENERGY SERVICES

BY JC DATE 12/15/81 PROJ. 5101 TASK 063
CHKD. TS DATE 12/16/81 PAGE 1 OF 2
LACBWR

AUX. DIST. PANEL FOR 125V DC GEN PLANT BUS | REF.



SECTION A-A



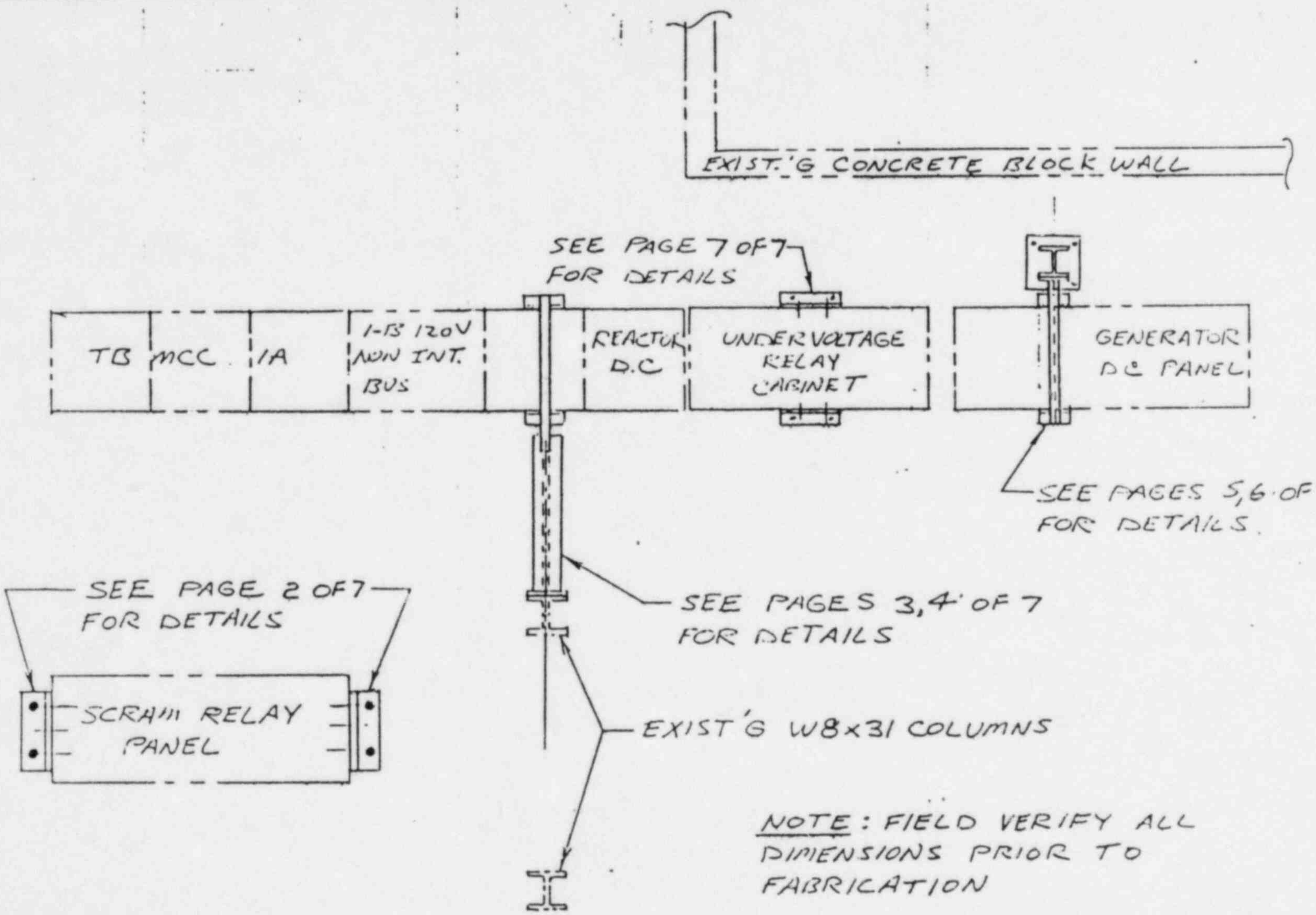
SECTION B-B

NES
NUCLEAR ENERGY SERVICES

BY TS DATE 1-25-82 PROJ. 5101 TASK 053
CHKD. RR DATE 1/26/82 PAGE ___ OF ___
LACBWR ELECT. EQUIP. RM.

REF.

ELECTRICAL EQUIPMENT ROOM



ELECTRICAL EQUIPMENT ROOM PLAN

REV 0

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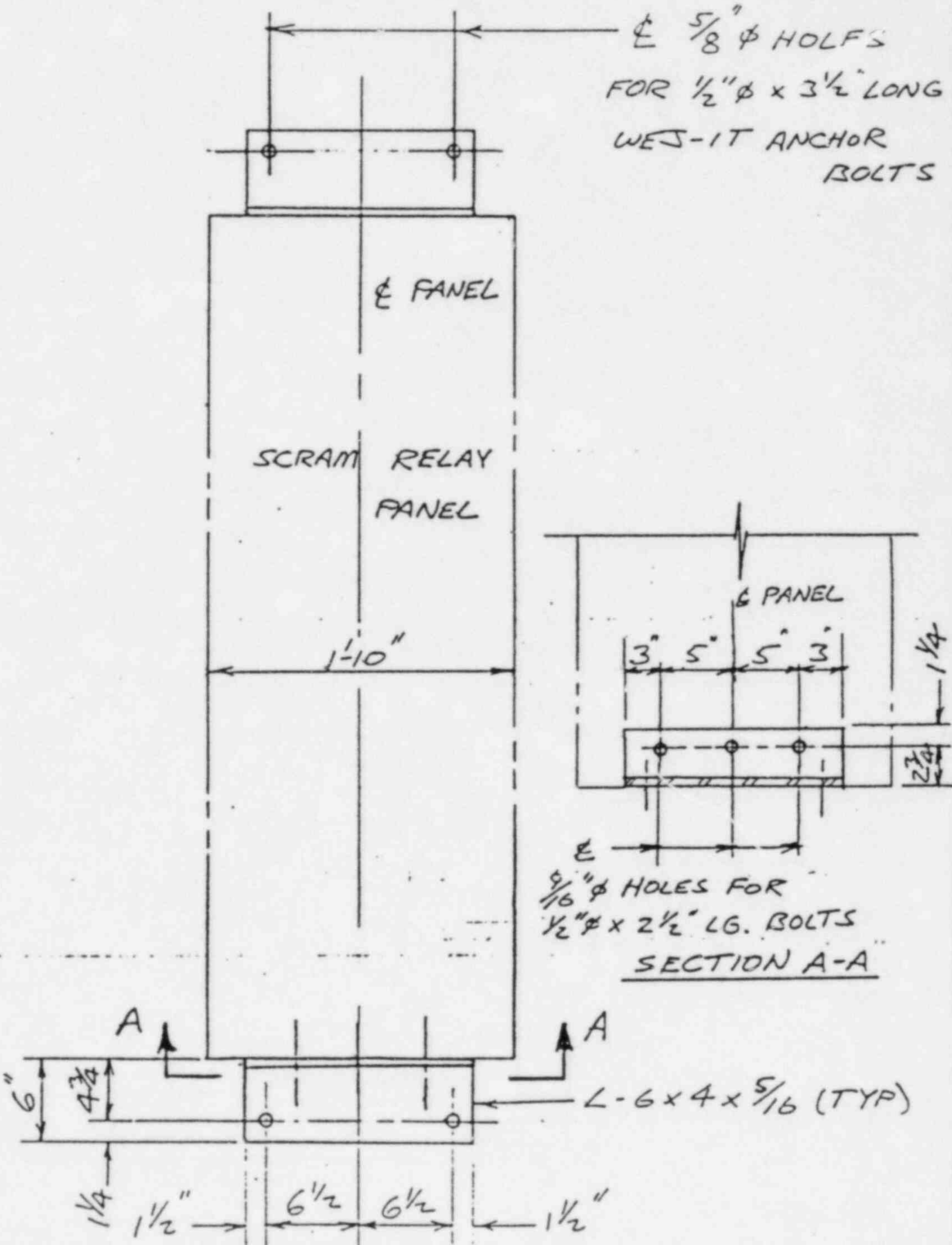
BY TS DATE 1-14-82 PROJ. 5101 TASK 063
CHKD. DLS DATE 1/22/82 PAGE ___ OF ___
LACBWR ELECT. EQUIP. RM.

SCRAM RELAY PANEL

REF.



PLAN VIEW

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REV 0

NES

NUCLEAR ENERGY SERVICES

BY TS DATE 2-17-82 PROJ. 5101 TASK 063

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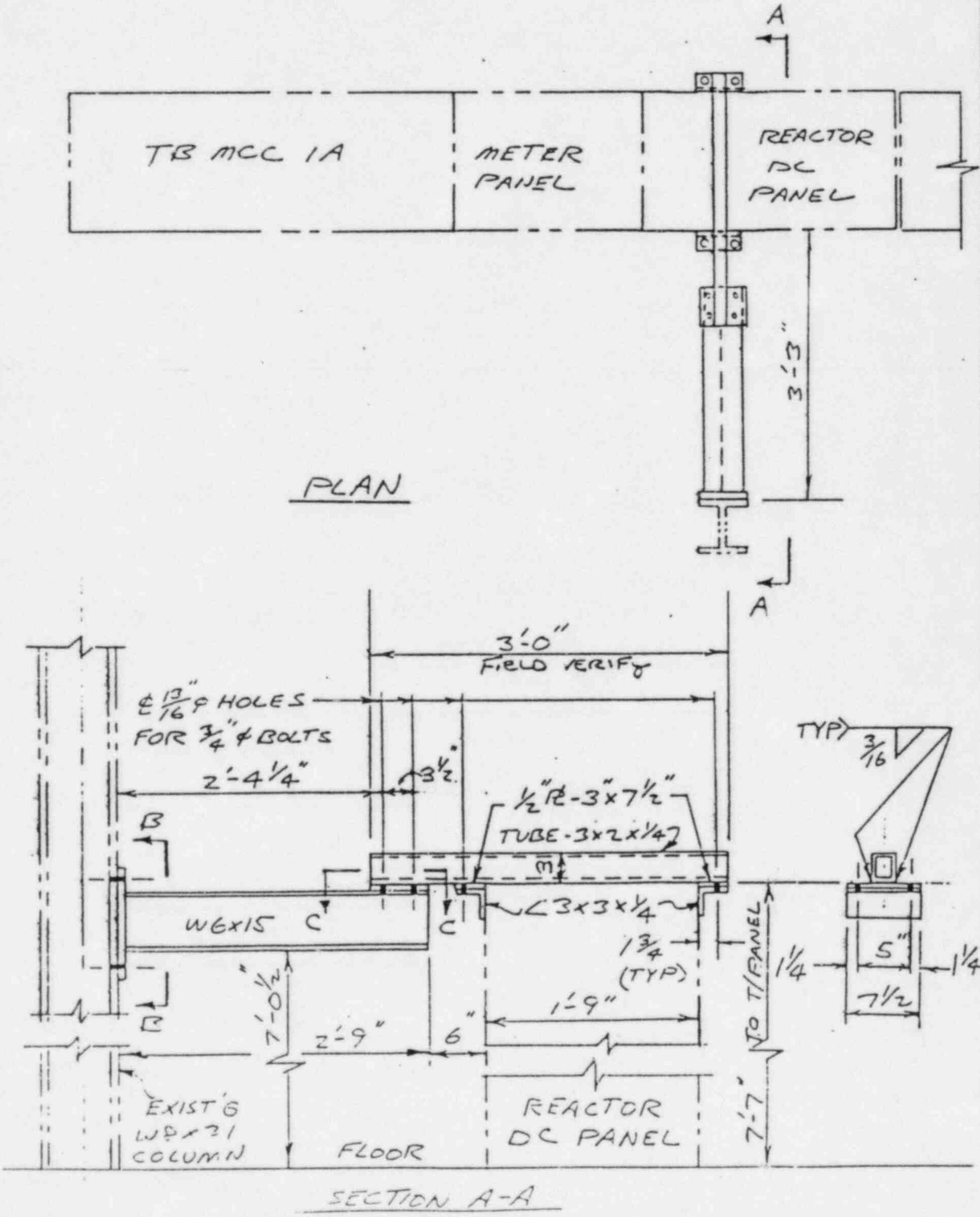
LACBWR ELECT. EQUIP. RM

ELECT. EQUIP. PANELS

REF.



NES
NUCLEAR ENERGY SERVICES

BY TS DATE 2-17-82 PROJ. 5101 TASK 063
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LACBWR ELECT. EQUIP. RM

ELECT. EQUIP PANELS

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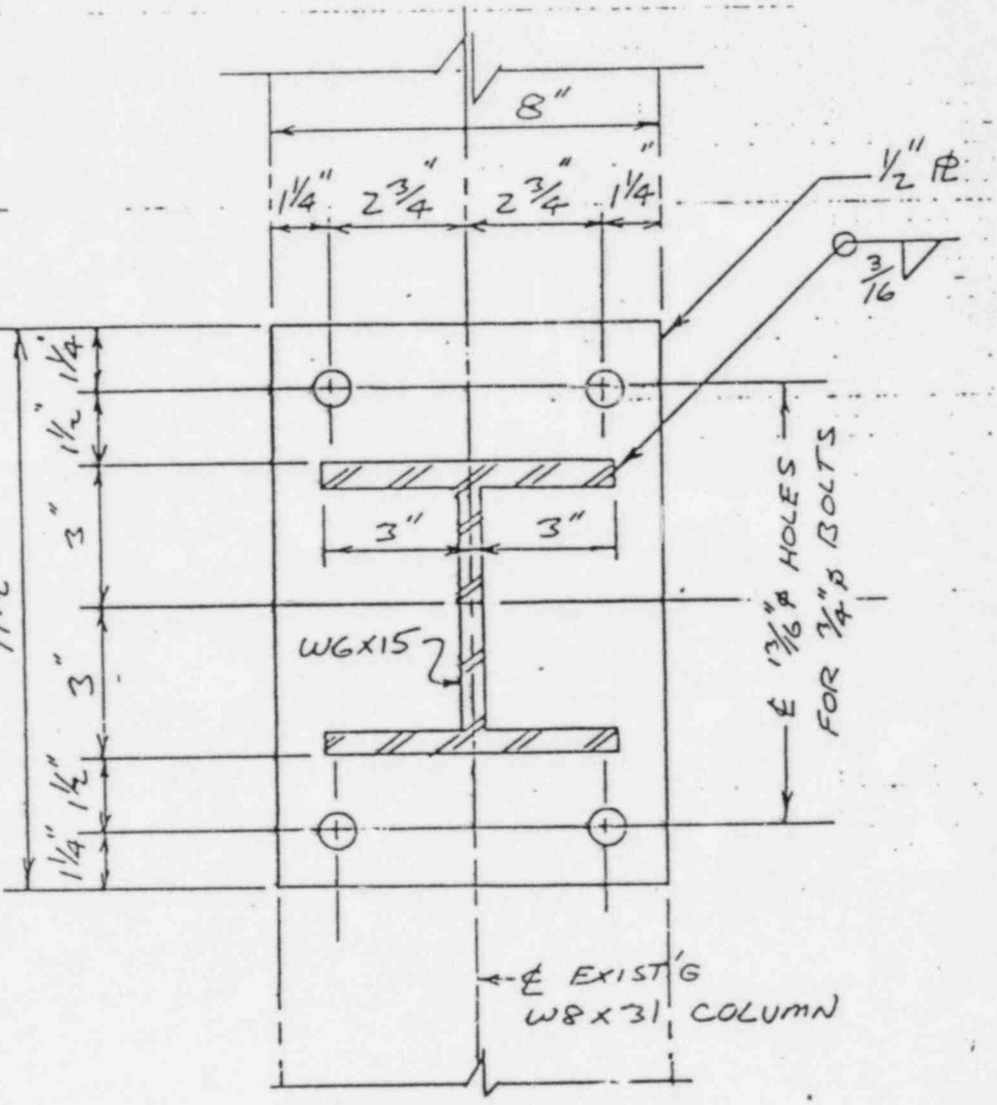
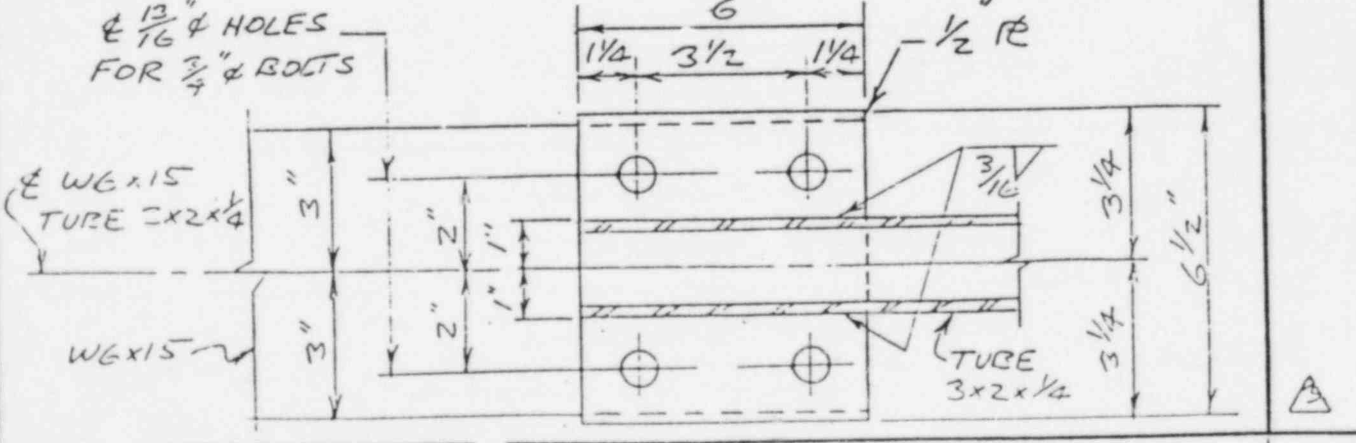


SECTION B-B



△3

NES 105 (2/74)

SECTION C-C

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REV 0

NUCLEAR ENERGY SERVICES

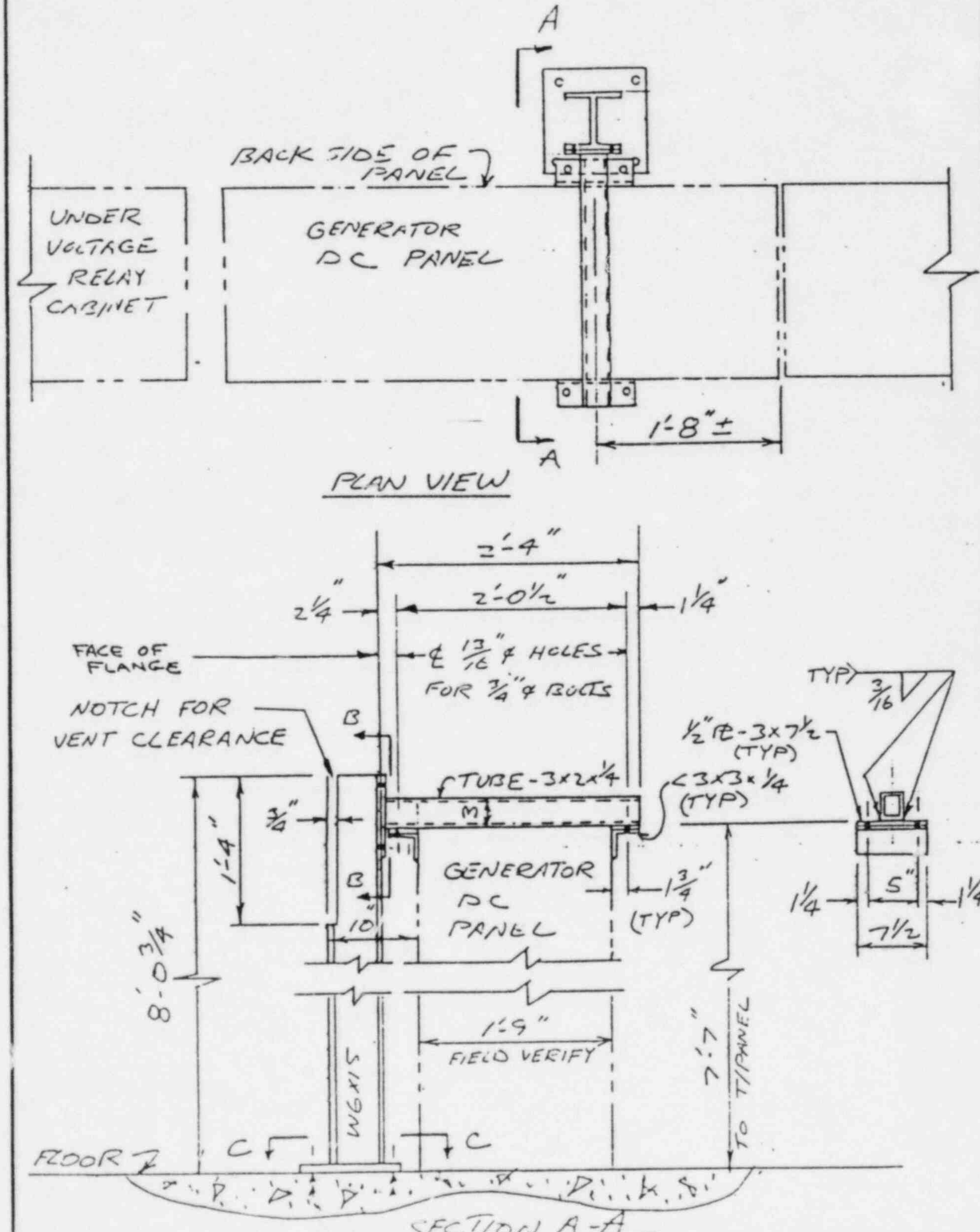
BY TI DATE 2-16-82 PROJ. 5101 TASK 063

CHKD. RR DATE 2-17-82 PAGE ____ OF ____

LACBWR ELECT. EQUIP. RM

GENERATOR DC PANEL

REF.



NES 105 (2/74)

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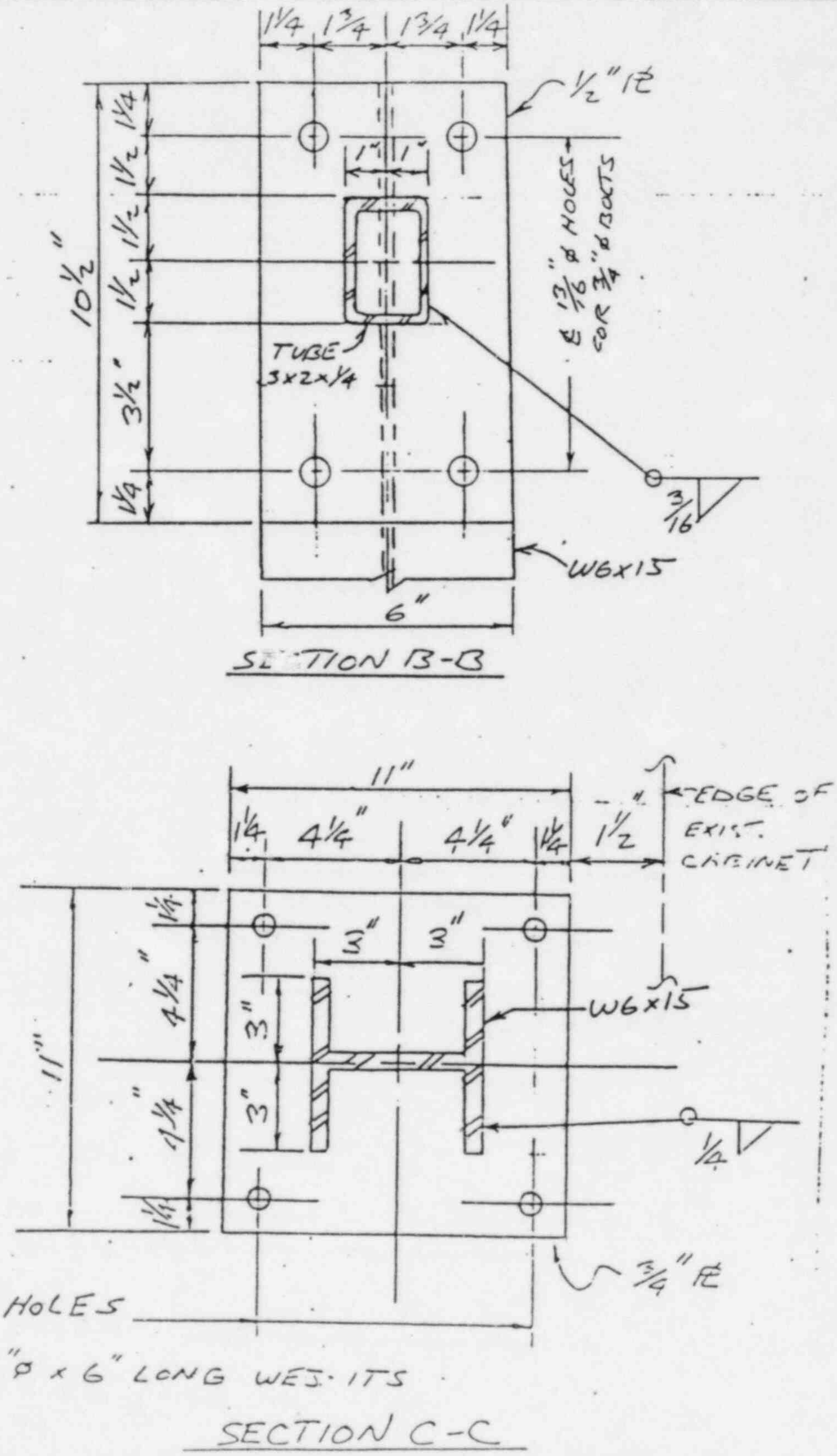
REV 0

NUCLEAR ENERGY SERVICES

BY TS DATE 2-16-82 PROJ. 5101 TASK 063
CHKD. RR DATE 2/17/82 PAGE ___ OF ___
LACIBUR ELECT EQUIP RM

GENERATOR DC PANEL

REF.

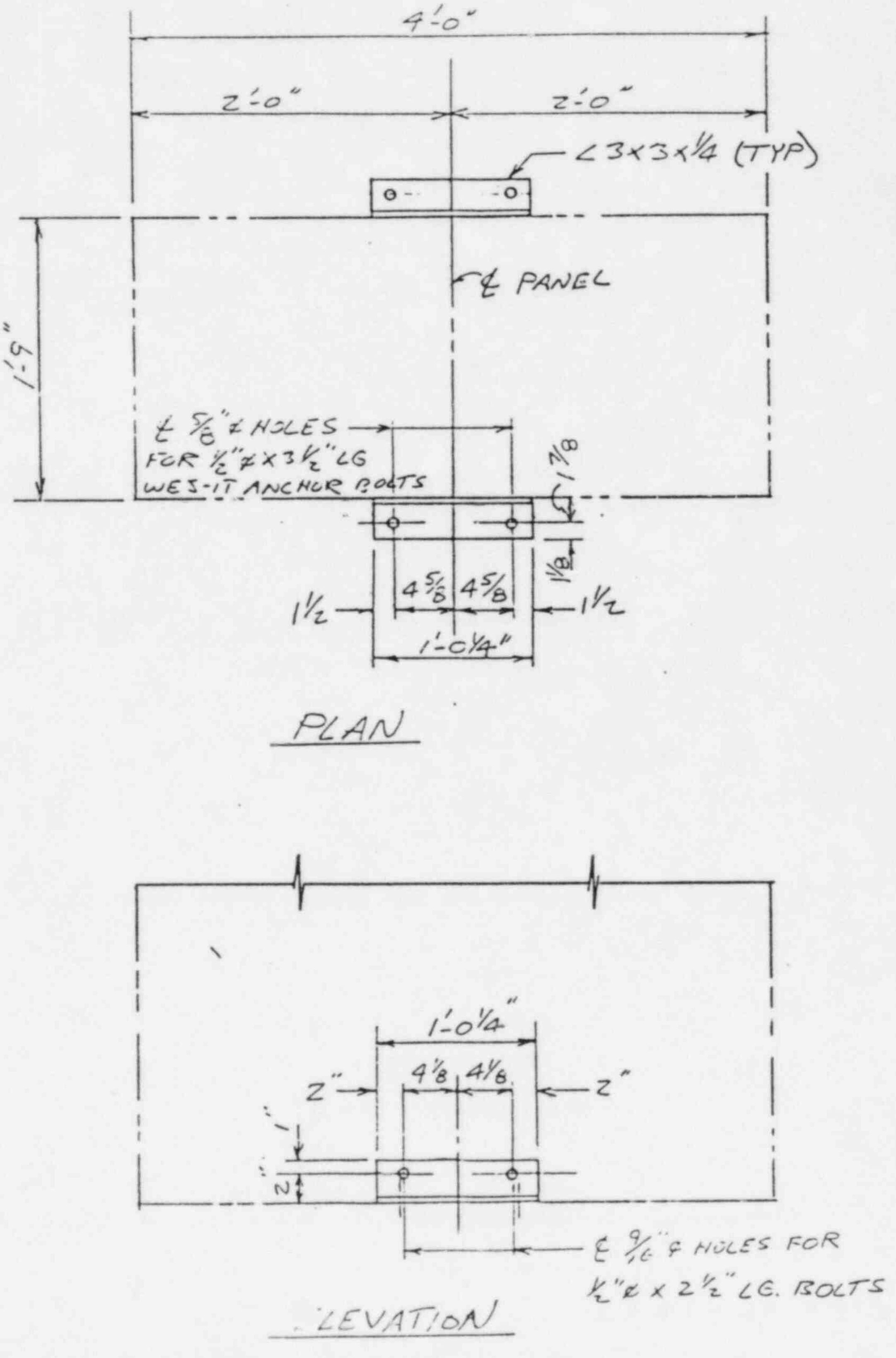


NUCLEAR ENERGY SERVICES

BY TS DATE 12/6/82 PROJ 5101 TASK 063
CHKD. DLS DATE 12/7/82 PAGE ___ OF ___
ZACBNR ELECT. EQUIP.

UNDER VOLTAGE RELAY CABINET

REF.



NES 105 (9/81)

REV 0

SECT. C-C

④ END SUPPORT - UPPER SHELF

SCALE 3"=1'0"

.CS

FOR
TYP.

EE
FOR

LF

NOTES

1. ALL STRUCTURAL TUBING PER ASTM A500 GRADE B.
2. ALL OTHER STEEL PER ASTM A36

CONTROLLED COPY

ITEM	QTY	CODE IDENT	PART NUMBER	DESCRIPTION

PARTS LIST

SIGNATURES		DATE
DRAWN	T. STRNAD	3-9-81
CHECKED	R. Rumpf	4-6-81
APPROVED		

AUTOMATION INDUSTRIES, INC.
NUCLEAR ENERGY SERVICES

TITLE: LACBWR ⚠3
GENERATOR BATTERY RACK MOD.

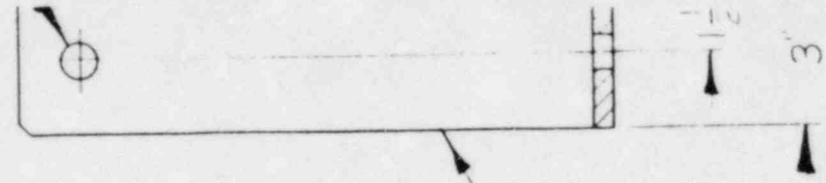
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		SK-5101-063-2	1

SCALE NOTED | PROJECT 5101-063 | SHEET 1 OF 1

A

B

JAN 1 0 1983



3" × 1/2 PL × 1'-0" LG.-TYP

SECTION A-A

SCALE: 3"=1'-0"

SK-5101-063-3 B

.SIONS

CONTROLLED COPY

ITEM	QTY	CODE IDENT	PART NUMBER	DESCRIPTION

PARTS LIST

SIGNATURES		DATE
DRAWN	J J Lunn	3-11-81
CHECKED	R. RUMPF	4-6-81
APPROVED		

AUTOMATION INDUSTRIES, INC.
NUCLEAR ENERGY SERVICES

TITLE
LACBWR
COMPRESSED GASTANK
BRACKETS

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		SK-5101-063-3	0

SCALE NOTED | PROJ. NO. 5101-063 | SHEET 1 OF 1

A

JAN 10 1983

B

CONTROLLED COPY

ITEM	QTY	CODE IDENT	PART NUMBER	DESCRIPTION

PARTS LIST

SIGNATURES	DATE
DRAWN T. J. Fields	3-11-81
CHECKED R RUMPF	4-6-81
APPROVED	

AUTOMATION INDUSTRIES, INC.
NUCLEAR ENERGY SERVICES

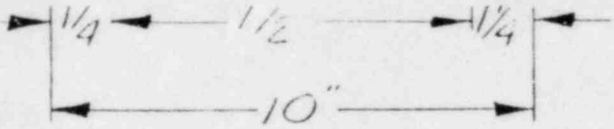
A

TITLE
LACBWR (2) (3)
480V. ESSENTIAL BUS.
MODIFICATION

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		SK-5101-063-4	2

SCALE NOTED 5101-063 SHEET 1 OF 1

JAN 1 0 1983



SECTION I-I

SCALE: 3"=1'-0"

TE: FIELD VERIFY ALL DIMENSIONS PRIOR TO FABRICATION

CONTROLLED COPY

EM	QTY	CODE IDENT	PART NUMBER	DESCRIPTION

PARTS LIST

SIGNATURES		DATE
RAWN	TJ FIELDS	3-20-81
HECKED	T. STRNAD	4-6-81
PPROVED		

AUTOMATION INDUSTRIES, INC.
NUCLEAR ENERGY SERVICES

TITLE: LACBWR REACTOR BATTERY RACK MOD.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		SK-5101-063-6	0

SCALE NOTED | PROJ. NO. 5101-063 | SHEET 1 OF 1

B

A

SK-5101-063-6

JAN 10 1983

B

A

CONTROLLED
COPY

M	QTY	CODE IDENT	PART NUMBER	DESCRIPTION

PARTS LIST

SIGNATURES		DATE
WN	R RUMPF	3-31-81
CKED	T. STRNAD	4-6-81
ROVED		
INEER		
ROVED		

AUTOMATION INDUSTRIES, INC.
NUCLEAR ENERGY SERVICES

TITLE

LACBWR
BATTERY CHARGER
MODIFICATIONS

(3)

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		SK-5101-063-7	1

SCALE NOTED	PROJECT 5101-063	SHEET 1 OF 1

JAN 10 1983

(3)

SUPPORTING CALCULATIONS FOR ITEM 2

NUCLEAR ENERGY SERVICES

BY TS DATE 7-20-81 PROJ. 5101 TASK 053

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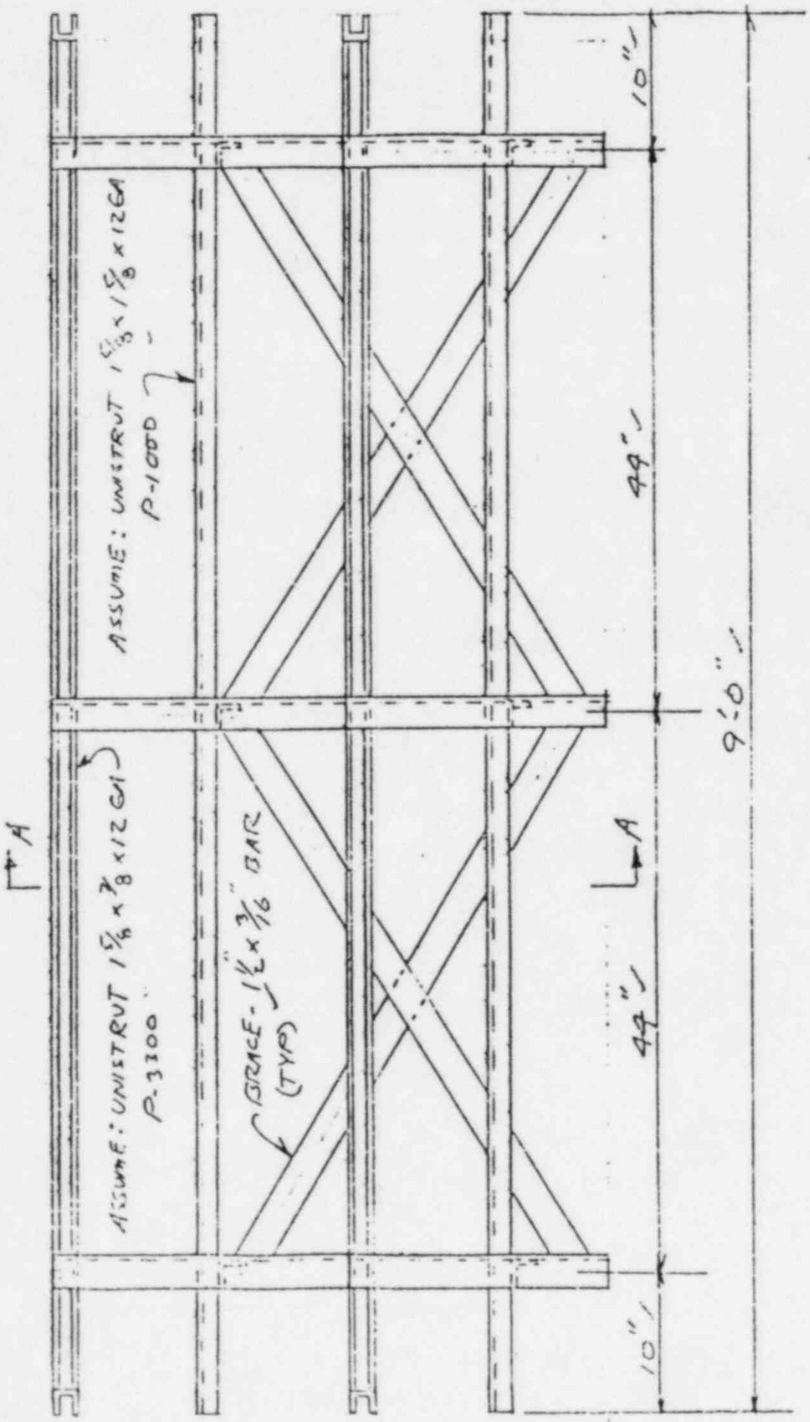
CALC'N R

1-B GEN. BLDG BATTERY RACK

REF.



ELEVATION

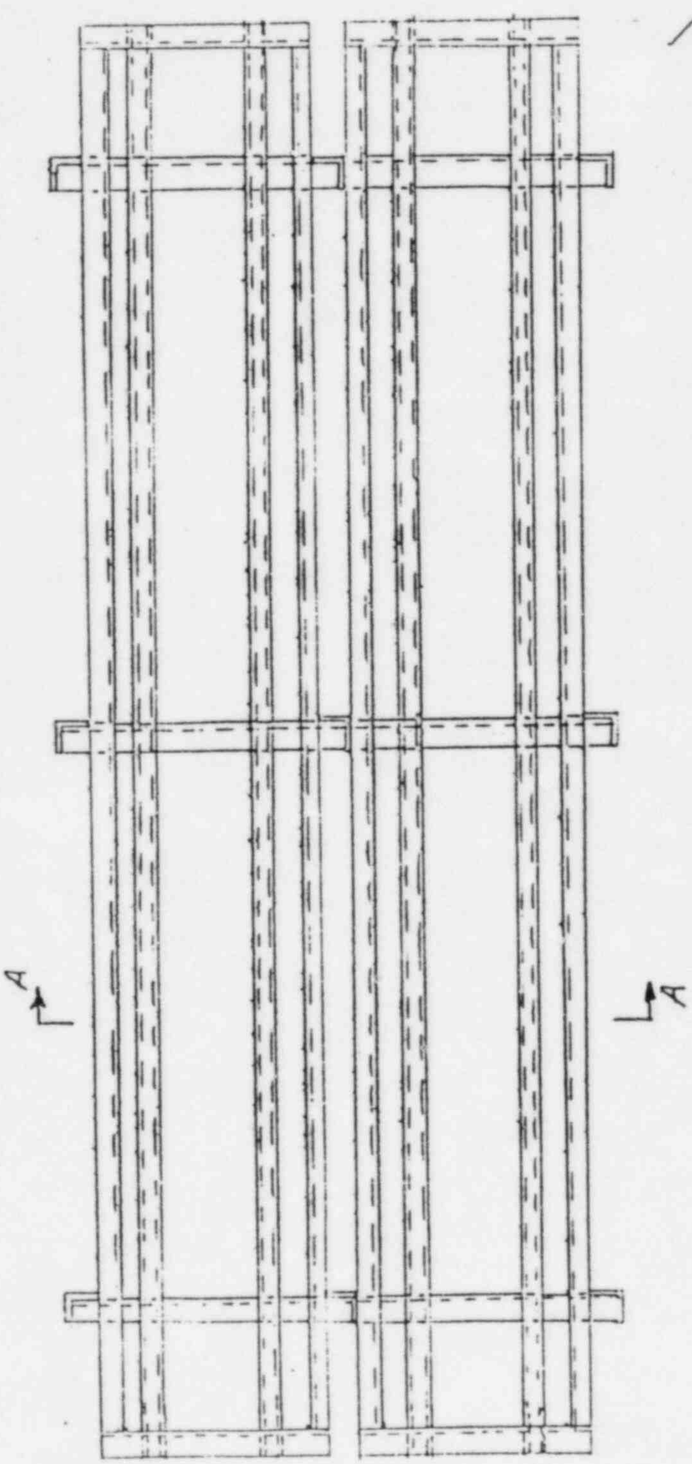
H / W / D

BATTERIES: 15¼ x 10¼ x 6.59" ASSUME WT: 90 LBS EACH

½" EXP. POLST. BETWEEN BATTERIES ✓

REFERENCE DRWG: CD BATTERIES M-6552

1-B GEN. BLDG. BATTERY RACK	REF.



NUCLEAR ENERGY SERVICES

BY 15 DATE 7-10-81 PROJ. 909 TASK 005
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CALCBWR

1-B SGN BLDG BATTERY RACK

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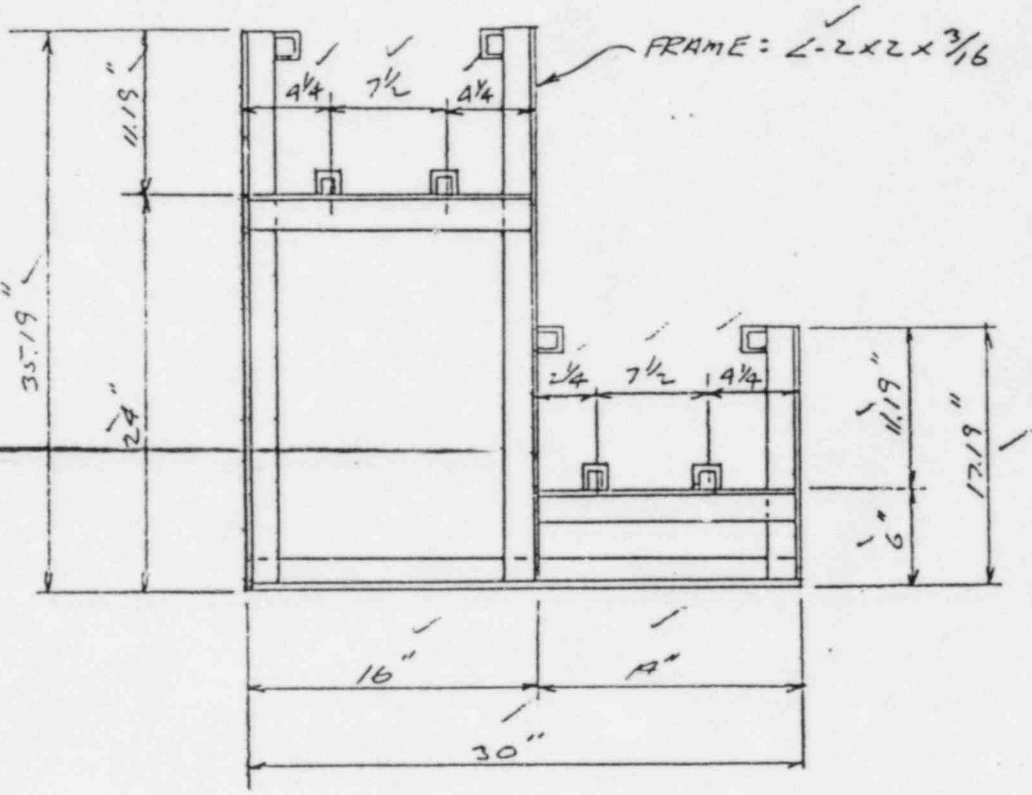

SECTION A-A

NUCLEAR ENERGY SERVICES

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I-E GEN. BLDG BATTERY RACK

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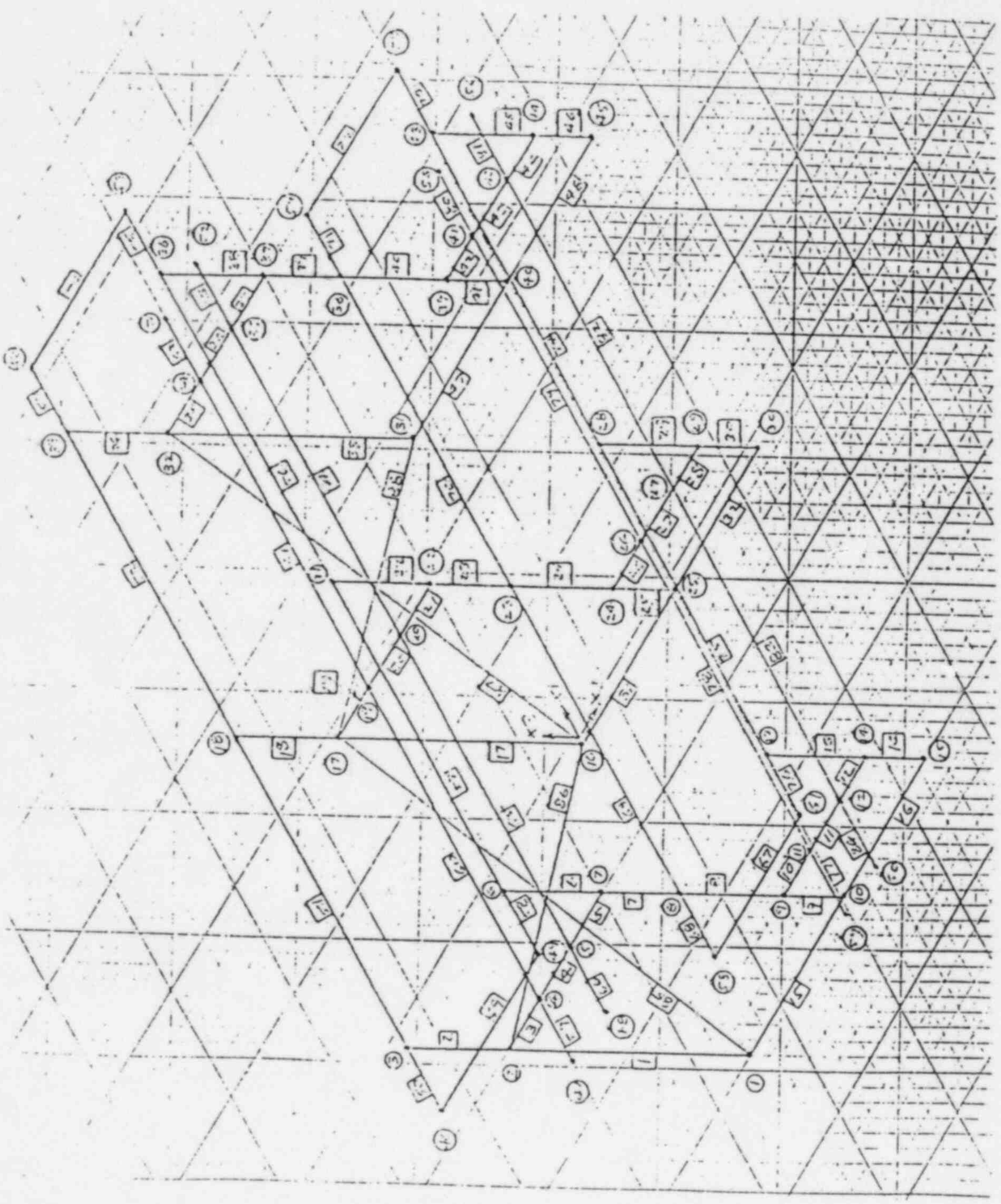


STARDYNE MODEL

NUCLEAR ENERGY SERVICES

BY 13 DATE [illegible] PROJ. [illegible] TASK [illegible]

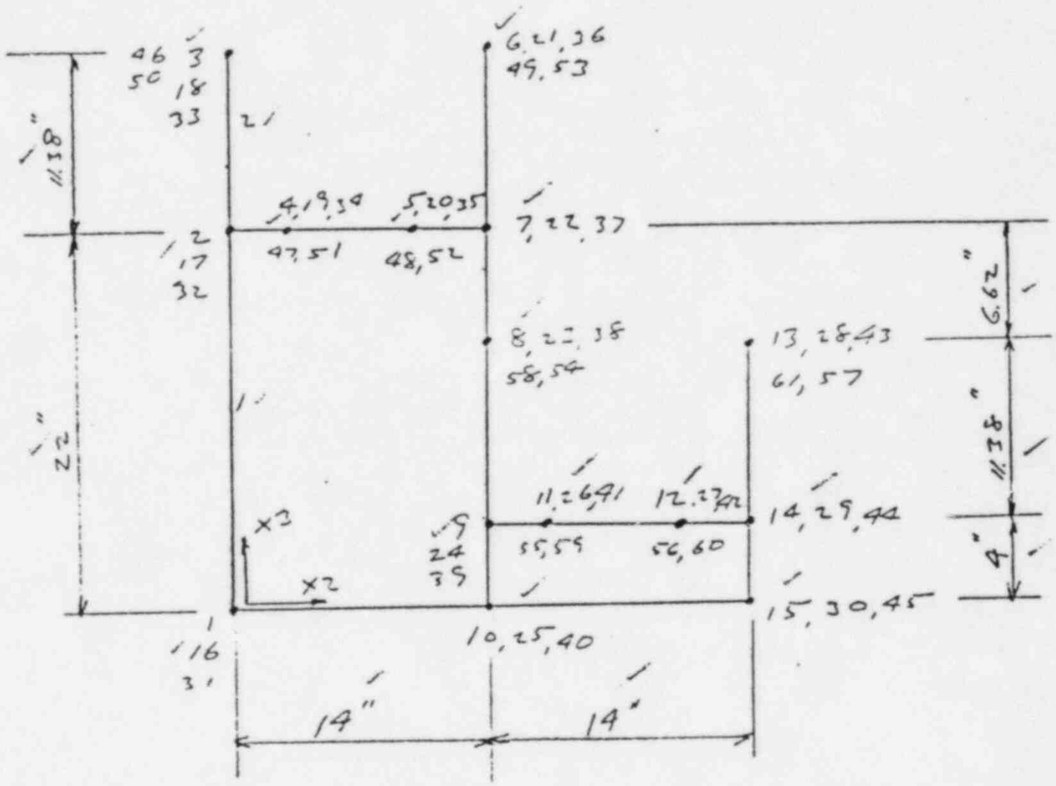
CHKD. [illegible] DATE 8-7-81 PAGE 15 OF

LACBWR

1-B BLDG BATTERY RACK

REF.

STARDYNE MODEL



NUCLEAR ENERGY SERVICES

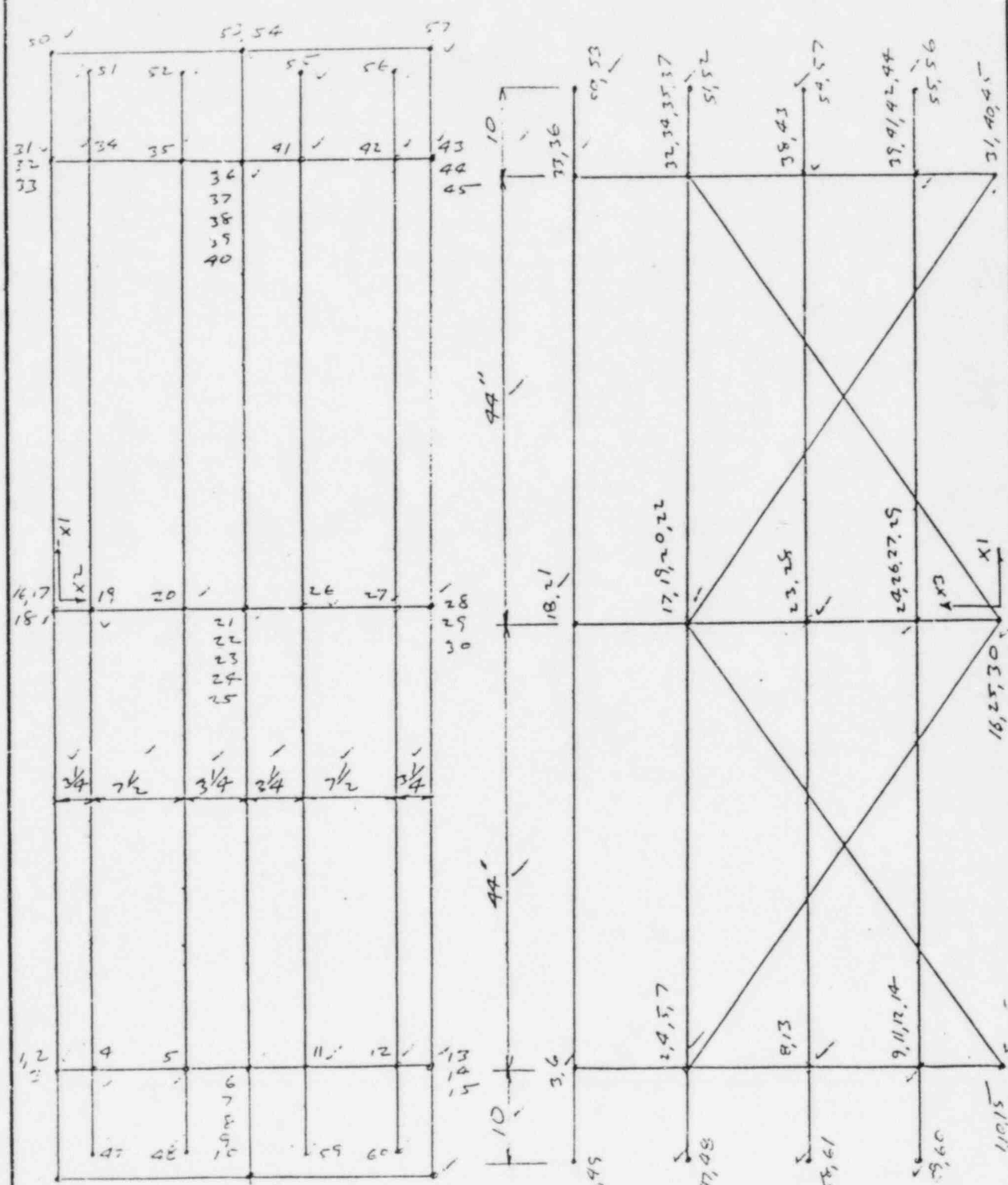
BY TS DATE 7-13-81 PROJ. 5101 TASK 053

CHKD. [illegible] DATE 8-7-81 PAGE 16 OF

LACBWR

1-B BLDG BATTERY RACK

REF.



STARDYNE MODEL

NUCLEAR ENERGY SERVICES

BY 15 DATE 7-22-81 PROJ. 5101 TASK 065

CHKD. OJJ DATE 8-10-81 PAGE 18 OF

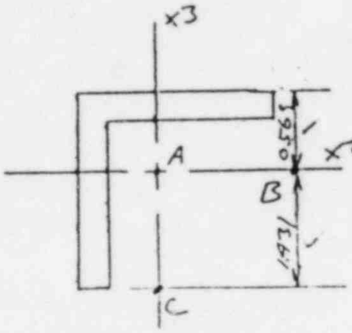
LACBWR - LB DIESEL BLDG - BATTERY RACK

STARDYNE MEMBER PROPERTIES

#1 ∠-2×2×3/16

$A = 0.715\ in^2$ ✓ $I2 = I3 = 0.272\ in^4$ ✓

$SF2 = SF3 = 0.5$ ✓



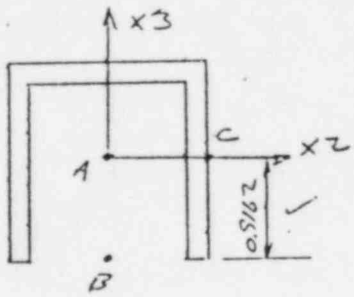
$J = \frac{1}{3} \sum b t^3$ ✓

$J = (\frac{1}{3})(\frac{3}{16})^3 (2 + 2 - \frac{3}{16}) = 0.0084\ in^4$ ✓

CTORS = 0.1875 ✓

#3 1 5/8 × 1 5/8 UNISTRUT P-1000 ✓

12 GA. ✓ $t = 0.1046"$ ✓



$A = 0.555\ in^2$ ✓

$I2 = 0.186\ in^4$ ✓

$I3 = 0.239\ in^4$ ✓

$SF2 = \frac{2 \times 1.625 \times 0.1046}{0.555} = 0.613$ ✓

$SF3 = \frac{1.625 \times 0.1046}{0.555} = 0.306$ ✓

$J = \frac{1}{3}(3 \times 1.625 - 2 \times 0.1046)(0.1046)^3 = 0.0018\ in^4$ ✓

CTORS = 0.1046 ✓

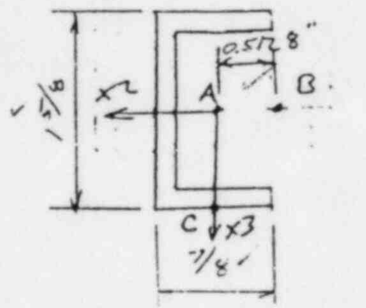
REF: "UNISTRUT METAL FRAMING FOR MECHANICAL SUPPORT SYSTEMS" MC-1 Pg 23.

	REF.

STARDYNE MEMBER PROPERTIES

#2 $1\frac{5}{8} \times \frac{7}{8}$ UNISTRUT P-3300 ✓

12 GA ✓ t = 0.1046" ✓



$A = 0.397\ IN^2$ ✓

$I2 = 0.197\ IN^4$ ✓

$I3 = 0.090\ IN^4$ ✓

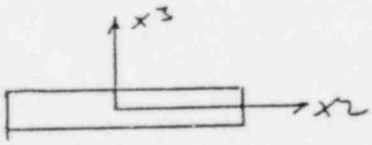
$SF2 = \frac{1.625 \times 0.1046}{0.397} = 0.428$ ✓

$SF3 = \frac{2 \times 0.875 \times 0.1046}{0.397} = 0.461$ ✓

$J = \frac{1}{3}(2 \times 0.875 + 1.625 - 2 \times 0.1046)(0.1046)^3 = 0.0012\ IN^4$ ✓

CTORS = 0.1046" ✓

#4 $1\frac{1}{2} \times \frac{3}{16}$ BAR



$A = 0.281\ IN^2$ ✓

$I2 \approx 0$ ✓

$I3 = \frac{1}{12}(\frac{3}{16})(1.5)^3 = 0.053\ IN^4$ —

$SF2 = SF3 = 0.85$ ✓

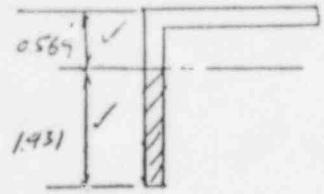
$J = \frac{1}{3}(1.5)(\frac{3}{16})^3 = 0.003$ ✓

CTORS = 0.1875" ✓

SSF2 = SSF3 = 1.5 ✓

	REF.
STARDYNE MEMBER PROPERTIES	

SHEAR STRESS FACTORS



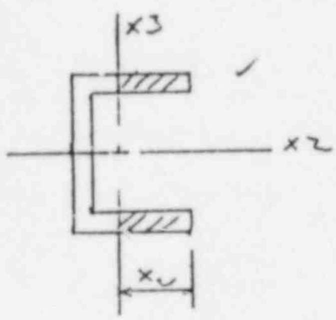
∠2 x 2 x 3/16 Bm #1

$$\tau_{max} = \frac{VQ}{It} = \frac{V[(1.431)^2/2 \times 0.1875]}{(0.272)(0.1875)} = 3.76V ✓$$

$$\tau_{AVG} = \frac{V}{A} = \frac{V}{0.715} = 1.4V ✓$$

$$SSF2 = SSF3 = \frac{\tau_{max}}{\tau_{AVG}} = \frac{3.76V}{1.4V} = 2.69 ✓$$

Bm #2 1 5/8 x 7/8 UNISTRUT



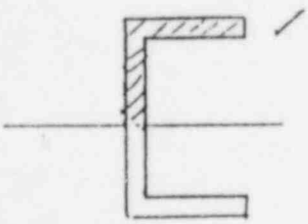
$$x_2 = \frac{(1.625 \times .1046)(0.8227) + 2(0.7709^2/2 \times .1046)}{(0.397)} ✓$$

$$x_2 = 0.509'' ✓$$

$$\tau_{max} = \frac{V[2 \times (0.509^2/2 \times 0.1046)]}{(0.040)(2)(.1046)} = 3.24V ✓$$

$$\tau_{AVG} = \frac{V}{0.397} = 2.52V ✓$$

$$SSF2 = \frac{3.24V}{2.52V} = 1.29 ✓$$



$$\tau_{max} = \frac{V[(0.875)(.1046)(0.76) + (.705)^2/2 \times .1046]}{(0.147)(.1046)}$$

$$= 6.23V ✓$$

$$SSF3 = \frac{6.23V}{2.52V} = 2.47 ✓$$

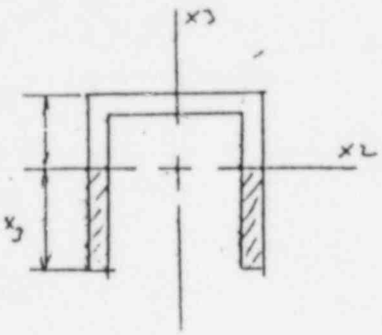
NUCLEAR ENERGY SERVICES

BY TJ DATE 7-26-81 PROJ. 5101 TASK 063
CHKD. [illegible] DATE 8-10-81 PAGE 21 OF
ENCLOSUR 1-B GEN BLDG BATTERY RACK

	REF.
STARDYNE MEMBER PROPERTIES	

SHEAR STRESS FACTORS

BM #3 1 5/8 x 1 5/8 UNISTRUT



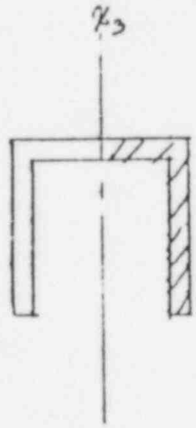
$$x_3 = \frac{(1.625 \times .1046)(1.573) + 2(1.52^2/2 \times .1046)}{0.555}$$

$$x_3 = 0.917'' \checkmark$$

$$\tau_{MAX} = \frac{V[2 \times (.917^2/2 \times .1046)]}{(0.766)(2 \times .1046)} = 2.26V \checkmark$$

$$\tau_{AVG} = \frac{V}{0.555} = 1.80V \checkmark$$

$$SSF3 = \frac{2.26V}{1.80V} = 1.26 \checkmark$$



$$\tau_{MAX} = \frac{V[(1.625)(.1046)(0.76) + (.708^2/2 \times .1046)]}{(0.239)(.1046)}$$

$$= 6.22V \checkmark$$

$$SSF2 = \frac{6.22V}{1.80V} = 3.45 \checkmark$$

NES 105 (2/74)

REF.

BATTERY LOADS

ASSUME BATTERY DIMENSIONS H x W x L 15-1/4 x 10-1/4 x 6.59" ✓

1/2" EXP. POLSTYRENE BETWEEN BATTERIES ✓

ASSUME WT = 90# EACH ✓ 15/SHELF ✓

DIST. LOAD = 90#/7.09" = 12.69 #/IN ✓

ASSUME HORIZONTAL ACCELERATION = 1.5 x PEAK g FROM ✓
SITE RESPONSE SPECTRA = 1.5 x 0.21g = 0.315g ✓
VERTICAL ACCELERATION = 2/3 x HORIZ. g = 2/3 x 0.315g = 0.21g ✓

DEAD LOAD

12.69/2 = 6.34 #/IN - BEAMS #59 - 66 ✓
#77 - 84 ✓

HORIZ. ACCEL. +X2 DIR.

12.69 #/IN x 0.315g = 4.0 #/IN ✓ BEAMS #55 - 58 ✓
#73 - 76 ✓

-X2 DIR. 4.0 #/IN ✓ BEAMS #50 - 53 ✓
#68 - 71 ✓

HORIZ. ACCEL. X1 DIR

15 BATTERIES x 90# = 1350# x 0.315g = 425.25# - BEAM #54 ✓
#72 ✓

VERTICAL ACCEL X3 DIR

6.34 #/IN x 0.21g = 1.33 #/IN ✓ - BEAMS #59 - 66 ✓
#77 - 84 ✓

	REF.

STRESS SUMMARY

$\angle\ 2 \times 2 \times \frac{3}{16}$

STARDYNE 3.0
PRINTOUT S640068 *

m_{max} IN BM #19 @ NODE 17 FOR $|DL| + \sqrt{x1_{EQ}^2 + (-x2)_{EQ}^2 + x3_{EQ}^2}$

$m2 = 3.13^{in\text{-}k}$ ✓ $m3 = 0.011^{in\text{-}k}$ ✓

$$\frac{f_{bx2}}{F_{bx2}} + \frac{f_{bx3}}{F_{bx3}} \leq 1.0 ✓ \qquad F_{bx2} = F_{bx3} = 0.6F_y = 22\ ksi ✓$$

$$f_{bx2} = \frac{(3.13)(1.431)}{0.272} = 16.47\ ksi ✓$$

$$f_{bx3} = \frac{(0.011)(1.431)}{0.272} = 0.06\ ksi ✓$$

$16.47 + 0.06 = 16.53\ ksi < 22\ ksi$ (O.K) ✓

MAX AXIAL LOAD IN BM #25 FOR $|DL| + \sqrt{x1^2 + (-x2)^2 + x3^2}$ ✓

$P = 0.86^k$ ✓ $A = 0.715\ in^2$ ✓ $l = 4''$ ✓ $r_{min} = 0.394$ ✓

$f_a = 0.86 / 0.715 = 1.20\ ksi$ ✓

$kl/r = 4 / .394 = 10.15$ ✓ $F_a = 21.15\ ksi$ ✓

$1.20 < 21.15\ ksi$ (O.K.) ✓

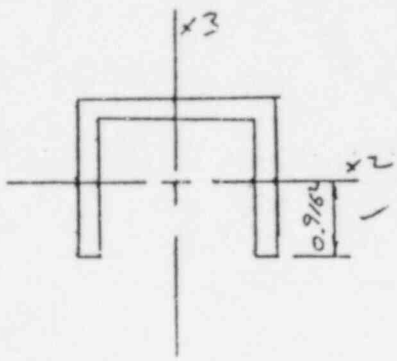
* NES COMPUTER OUTPUT BINDER S-64

REF.

STRESS SUMMARY

$1\frac{5}{8} \times 1\frac{5}{8}$ UNISTRUT P-1000

MAX MOMENT @ NODE 19 $m2 = 1.63^{\text{in-k}}$
$m3 = 0.68^{\text{in-k}}$



$I2 = 0.186 \text{ in}^4$
$I3 = 0.239 \text{ in}^4$

$F_b = 25 \text{ ksi}$

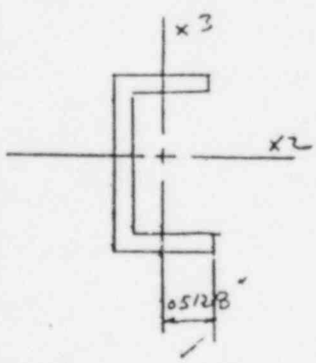
$$f_{b_{x2}} = \frac{(1.63)(0.9162)}{.186} = 8.03 \text{ ksi}$$

$$f_{b_{x3}} = \frac{(0.68)(.8125)}{.239} = 2.31 \text{ ksi}$$

$8.03 + 2.31 = 10.34 \text{ ksi} < 25 \text{ ksi}$ (OK)

$1\frac{5}{8} \times \frac{7}{8}$ UNISTRUT P-3300

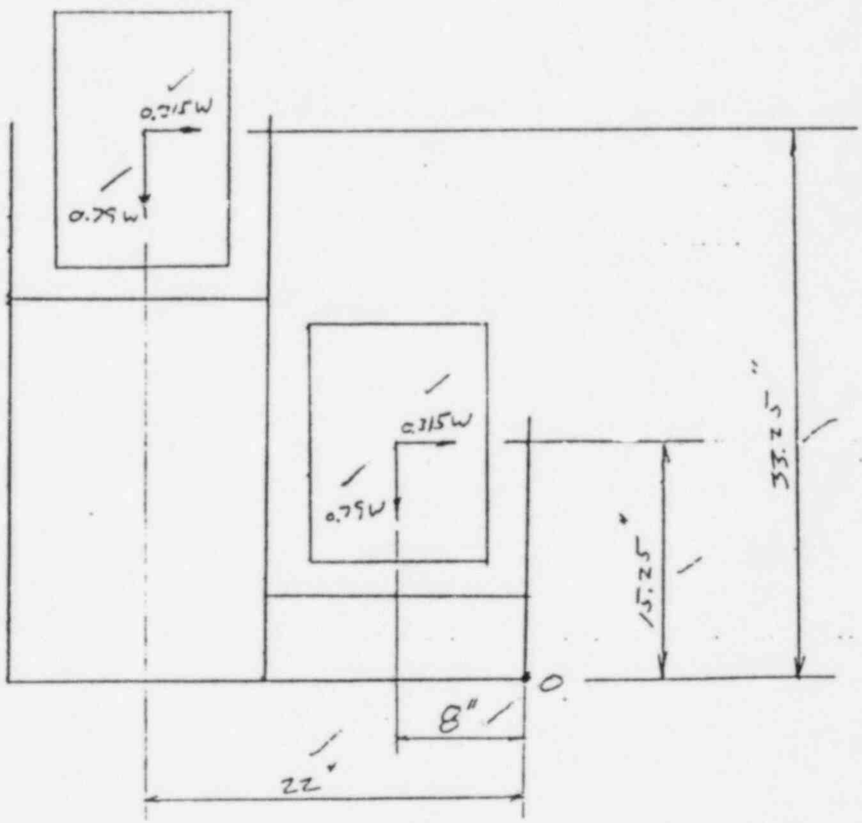
MAX MOMENT - BM 54 OR 72 = $m3 = \frac{(.425)(19)}{4} = 1.99^{\text{in-k}}$



$$f_{b_{x3}} = \frac{(1.49)(0.5128)}{0.040} = 19.1 \text{ ksi} < 25 \text{ ksi}$$
(O.K.)

1-B GEN BLDG BATTERY RACK | REF.

OVERTURNING



$M_{OVERTURNING}$

$\Sigma M_0 = 0$ $0.315W \times 15.25" + 0.315W \times 33.25" = 15.28W$ ✓

$M_{RESIST.} = 0.79W(8" + 22") = 23.7W$ ✓

FACTOR OF SAFETY $= \frac{23.7W}{15.28W} = 1.55 > 1.50$ (O.K)

NUCLEAR ENERGY SERVICES

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CHKD. [illegible] DATE 8-17-81 PAGE 25 OF
CALCULR 1-B GEN BLDG BATTERY RACK

	REF.
STRESS SUMMARY	

ANCHOR BOLT @ NODE 31

STARDYNE 3.0
PRINTOUT S6400HZ

	X1	X2	X3
DL	0.022 ✓	-0.013 ✓	-0.19 ✓
X1 DIR	0.138 ✓	-0.023 ✓	-0.246 ✓
+X2 DIR	-0.019 ✓	0.073 ✓	0.264 ✓
-X2 DIR	0.022 ✓	-0.047 ✓	-0.3 ✓
X3 DIR	0.005 ✓	-0.003 ✓	-0.041 ✓
$\sqrt{x1^2+x2^2+x3^2}$	0.139 ✓	0.077 ✓	0.363 ✓
$\sqrt{x1^2+(-x2)^2+x3^2}$	0.140 ✓	0.052 ✓	0.39 ✓

X1 - $DL \pm \sqrt{x1^2+(-x2)^2+x3^2} = 0.022 \pm 0.140 = 0.162^k$ ✓ } SHEAR

X2 - $DL \pm \sqrt{(x1)^2+x2^2+x3^2} = -0.013 \pm 0.077 = -0.09^k$ ✓ } SHEAR

X3 - $DL \pm \sqrt{x1^2+(-x2)^2+x3^2} = -0.19 \pm 0.39 = 0.20^k$ ✓ TENSION ✓

RESULTANT SHEAR $= \sqrt{0.162^2+(-0.09)^2} = 0.185^k$ ✓

TENSION $= 0.20^k$ ✓

EXISTING BOLTS 3/8" ø RED HEAD SELF DRILLING ANCHORS

~~USE 1/4 x 3" WEJ IT ANCHOR BOLTS~~ ✓

RED HEAD CATALOG F-1000

ULTIMATE CAPACITY : TENSION = ~~2473~~# ✓ 5670#
SHEAR = ~~2316~~# ✓ 3370#

ALLOWABLE CAPACITY TENSION = ~~2473/4 = 618~~# ✓ 5670/5 = 1134#
SHEAR = ~~2316/4 = 579~~# ✓ 3370/5 = 674#

Revised 12/28/82 TS

~~$\frac{200}{618} + \frac{185}{579} \le 1.0$~~

~~0.324 + 0.320 = 0.64 < 1.0~~

~~1/4 x 3" WEJ-ITS (O.K)~~

$\frac{200}{1134} + \frac{185}{674}$

$0.18 + 0.27 = 0.45 < 1.0$

EXISTING BOLTS (O.K)

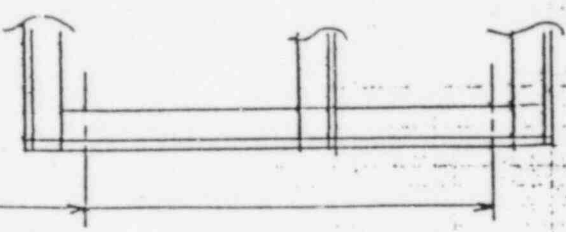
	REF.

CONCLUSION

THE 1-B GENERATOR BLDG BATTERY RACK IS CAPABLE OF WITHSTANDING SEISMIC LOADS WITHOUT MODIFICATION. HOWEVER ANCHOR BOLTS MUST BE PROVIDED IF RACK IS NOT PRESENTLY BOLTED TO FLOOR.

BOLT CAPACITY REQUIRED: 200# - TENSION ✓
185# SHEAR ✓

~~1/4 x 3" LG WEJ-IT ANCHOR BOLTS ADEQUATE~~ ✓
~~2 BOLTS PER FRAME~~ ✓



ANCHOR BOLTS REQUIRED

· PROVIDE 3/8 ⌀ BOLTS IN EXISTING RED HEAD SELF DRILLING ANCHORS.

GENERATOR BATTERY RACK SK-5101-063-2 | REF.

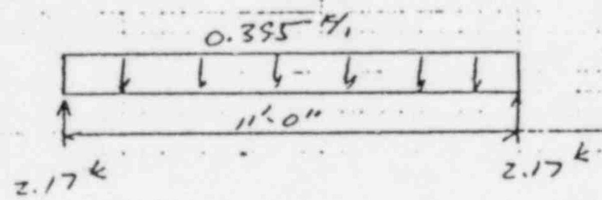
(6) CROSS BEAM

FRAME SPACING ≈ 11'-0"

BATTERY WT = 190# EACH

ASSUME 2g ACCELERATION

BEAM LOAD = 190# × 2g × $\frac{12}{8.5}$ = 395 lb/ft ✓



M_{max} = 1/8 (0.395)(11.0)^2 = 5.97 '-k ✓

FOR TUBE F_y = 46 ksi — P — 8TH ED AISC 5-21

F_b = 0.66 F_y = 30.36 ksi ✓

$S_{REQ} = \frac{5.97 \times 12}{30.36} = 2.36 \; in^3$ ✓

TUBE 3×3×5/16 S_x = 2.39 in^3 ✓

BOLT CONNECTION

FOR A 307 BOLT 3/4"φ F_v = 10.0 ksi — P — 8ED AISC 4-5

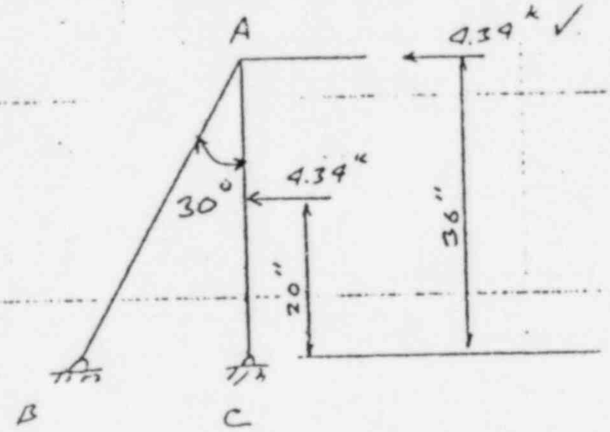
$f_v = \frac{2.17^k}{(0.442)}$ = 4.91 ksi < 10.0 (O.K) ✓

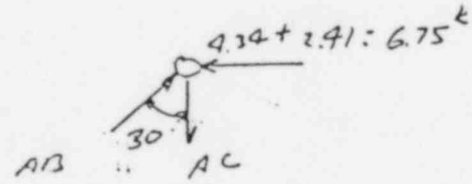
NUCLEAR ENERGY SERVICES

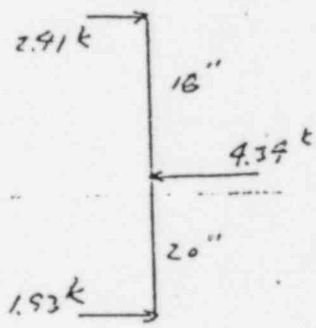
BY TS DATE 3-3-81 PROJ. 5101 TASK 063
CHKD. RR DATE 4-6-81 PAGE 2 OF
LACBWR

GENERATOR BATTERY RACK | REF.

(3) CENTER FRAME (CARRY REACTION FROM 2-CROSS BEAMS)







$M_{max} = (2.41)(16) = 38.6$ "-k

$F_{AB} = 13.5^k$ (C) ✓

$F_{AC} = 11.69^k$ (T) ✓

MEMBER AC TUBE 3×3×5/16 $A = 3.11\ in^2$ $S = 2.39\ in^3$

$f_a = \frac{11.69}{3.11} = 3.76$ ksi ✓

$f_b = \frac{38.6}{2.39} = 16.15$ ksi ✓

$\frac{f_a}{0.6F_y} + \frac{f_b}{F_b} \leq 1.0$ $\frac{3.76}{(0.6)(46)} + \frac{16.15}{30.36} = 0.67$ ✓ < 1.0 (O.K) — AISC 1.6.2

MEMBER AB TUBE 3×2×1/4 $A = 2.09\ in^2$ $r_y = 0.742\ in$

$L = 39.72$" $Kl/r = \frac{(1)(39.72)}{0.742}$ ✓ $= 53.53$ ✓ $F_a = 22.24$ ksi ✓ — AISC 1.5.1.3.1

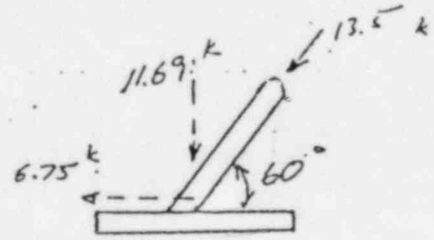
$f_a = \frac{13.5}{2.09} = 6.46$ ksi (O.K)

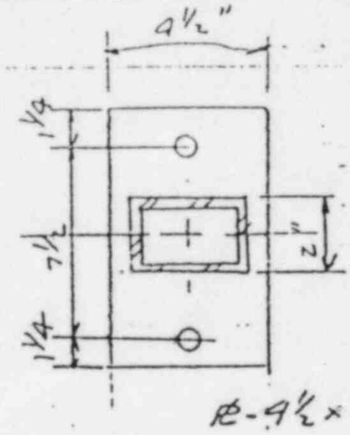
NES 106 (2/74)

GENERATOR BATTERY RACK | REF.

(3) CENTER FRAME

BASE PL - MEMBER AB



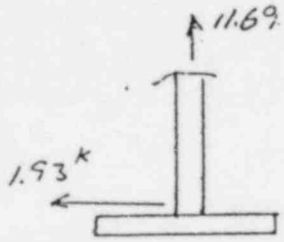


PL - 4 1/2 × 3/4 × 10"

WITH 2 3/4" φ BOLTS SHEAR: $\frac{6.75^k}{2}$ = 3.38 k/BOLT ✓

SHEAR CAPACITY: $\frac{27.6^k \times 0.9}{4}$ = 6.21 k/BOLT ✓

BASE PL - MEMBER AC



USE 4 - 3/4"φ WEJ-IT BOLTS

TENSION = 11.69^k/4 = 2.93 k/BOLT ✓

SHEAR = 1.93^k/4 = 0.48 k/BOLT ✓

BOLT CAPACITY

TENSION = 4.84 k/BOLT ✓

SHEAR = 6.21 k/BOLT ✓

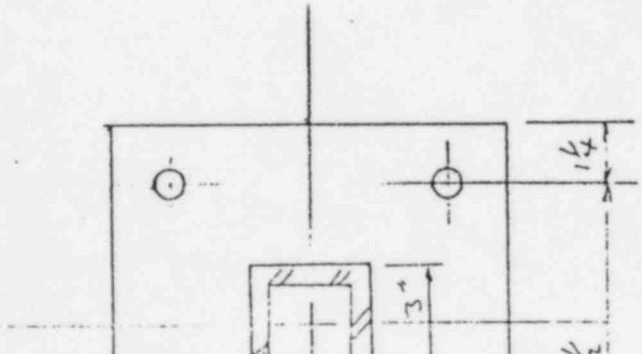


PLATE THICKNESS

M = 2 × 2.93^k × 2.25" = 13.2"^k ✓

$t = \sqrt{\frac{(13.2)(6)}{(27)(10)}} = 0.54"$ ✓

USE 3/4" PL

GENERATOR BATTERY RACK | REF.

CHECK PRYING

REF.: 8TH ED. AISC pg 4-88 - 4-90

$T = 2.93^k/\text{BOLT}$

$a = 1.25''$

$b = 2.25''$

$d = 0.75''$

$d' = 0.8125$

$p = 5''$

$t_f = 0.75''$

$b' = b - d/2 = 2.25 - 0.75/2 = 1.875''$ ✓

$a' = a + d/2 = 1.25 + 0.75/2 = 1.625''$ ✓

$\delta = 1 - d'/p = 1 - \frac{0.8125}{5} = 0.8375$ ✓

$m = p t_f^2 F_y / 8 = (5.0)(.75)^2(36)/8 = 12.66''^{-k}$ ✓

$\alpha = (Tb/m - 1)/\delta = [(2.93)(2.25)/12.66 - 1]/.8375 = -0.57$ ✓

$\alpha < 0$ ∴ PRYING FORCE = 0

$\frac{2.93^k}{4.84^k} + \frac{0.48^k}{6.21^k} = 0.68 < 1.0$ ✓ 4-3/4"⌀ BOLTS OK. ✓

NUCLEAR ENERGY SERVICES

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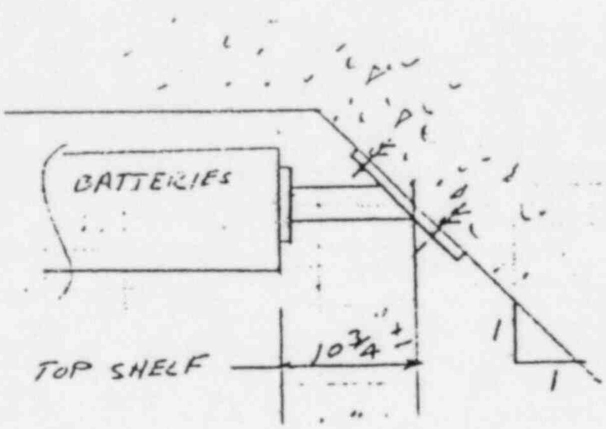
CHKD. R.R DATE 4-7-81 PAGE 5 OF
LACBWR

GENERATOR BATTERY RACK | REF.

END SUPPORT UPPER SHELF

(4)



HORIZONTAL LOAD: 30 BAT. × 190# × 2g = 8.4k ✓

SHEAR FORCE ON BOLTS = 8.4 × 0.707 = 5.94k ✓

WITH 2 - 3/4" φ BOLTS

SHEAR FORCE: 2.97k/BOLT ✓

SHEAR CAPACITY: $\frac{27.6^k \times 0.9}{4}$ = 6.21k/BOLT ✓ CATALOG #468-B

WITH 2 - 1/2" φ BOLTS

SHEAR CAPACITY: $\frac{22.6 \times 0.9}{4}$ = 5.09k/BOLT > 2.97k (O.K)

CATALOG #468-B

USE 2 - 5/8 φ × 4½ LG WES-IT ANCHOR BOLTS
EMBEDMENT = 3¼"
FROM WES-IT CATALOG #1182 INTERPOLATE CAPACITY FOR f'_c = 3500 psi

Revised 1/5/83 TJS

f'_c	ULT. SHEAR
3000 psi	10719 LBS
3500	14367
4000	15583

ALLOWABLE SHEAR CAPACITY = $\frac{14.37^k}{4}$ = 3.59k > 2.97k ✓ (O.K)

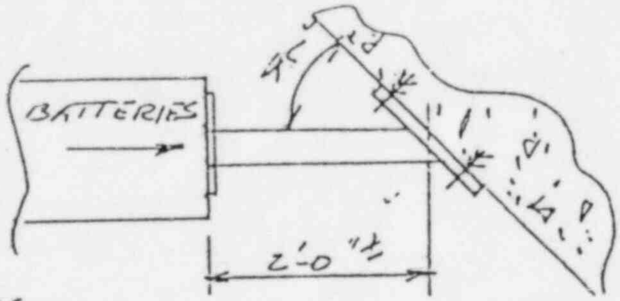
ACTUAL SHEAR FORCE/BOLT = 5.94k/2 = 2.97k ✓

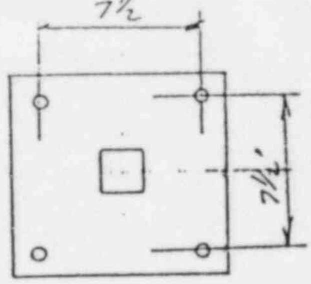
REF.

GENERATOR BATTERY RACK

(5) END SUPPORT LOWER SHELF — REVISED BOLT SIZE

USE 1.5 × PEAK G = 1.5 × 0.744 = 1.12g





SEISMIC

HORIZONTAL LOAD = 30 BAT. × 140# × 1.12g = 4.70k

SHEAR FORCE ON BOLTS = 4.7 × 0.707 = 3.32k

USE 4 - ½"φ WEJ-ITS

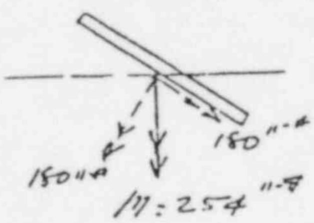
SHEAR/BOLT = 3.32k/4 = 0.83k/BOLT

WEJ-IT CATALOG #981
ALLOWABLE SHEAR CAPACITY = $\frac{9.85}{4}$ = 2.46k/BOLT

DEAD LOAD — 3×3×5/16 TUBE · 10.58#/1

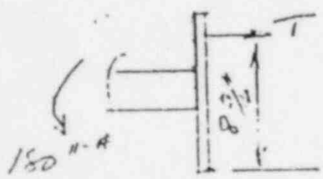
M = 10.58 × 2' × 1' = 21.16'-# = 254"-#

BENDING, TORSIONAL MOMENTS = 254 × 0.707 = 180"-#



½φ WEJ-IT
2¼" EMBEDMENT
ALLOWABLE TENSION = $\frac{5.21^k}{4}$ = 1.30k

TENSION IN BOLT



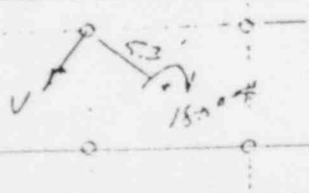
180 = 2T × 8.75"

T = 10.3#/BOLT

$\frac{.001}{1.30} + \frac{0.84}{4.91}$ = 0.18 < 1.0

(4) ½ × 3½ LG WEJ-ITS O.K.

SHEAR IN BOLT

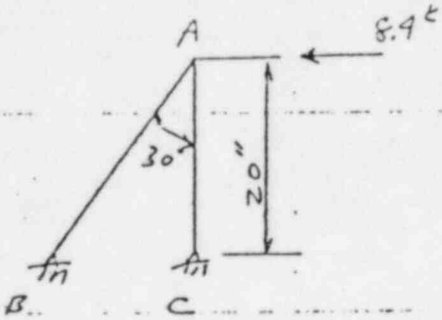


4(5.3V) = 180

V = 8.5#/BOLT

GENERATOR BATTERY RACK | REF.

(2) END SUPPORT - LOWER SHELF



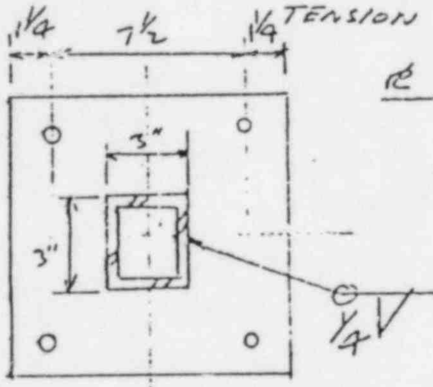
$F_{AB} = \frac{8.4}{\sin 30} \cdot 16.8^k$ (C) ✓

$F_{AC} = 16.8 \times \cos 30 = A.5^k$ (T) ✓

BASE ℞ - AC USE 4 - ¾"φ WEJ-ITS

LOAD/BOLT = 14.5/4 = 3.64ᵏ ✓

TENSION CAPACITY = 4.84 ᵏ/BOLT ✓



℞ THICKNESS $M = 2 \times 2.25'' \times 3.64^k = 16.4''^k$ ✓

$t = \sqrt{\frac{(16.4)(6)}{(27)(10)}} = 0.60''$ ✓ USE ¾" ℞ ✓

WELD CAPACITY

$12'' \times ¼ \times 0.707 \times 21$ ksi $= 44.5^k$ ✓ $> A.5^k$ (OK)

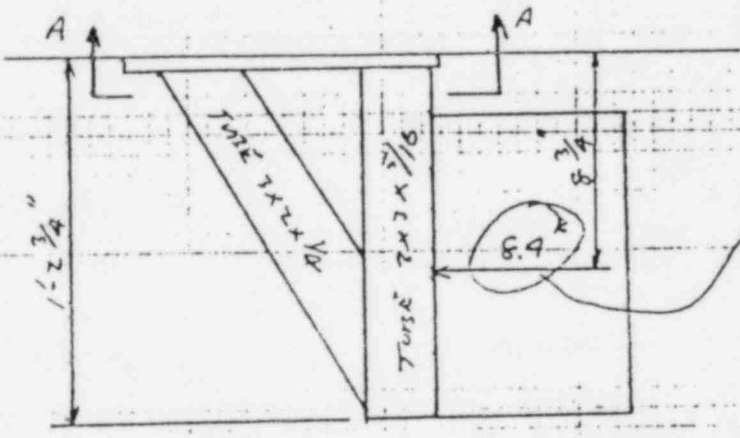
BASE ℞ - MEMBER AB

SHEAR = 8.4ᵏ; USE 2 ¾"φ WEJ-ITS · 4.2ᵏ/BOLT

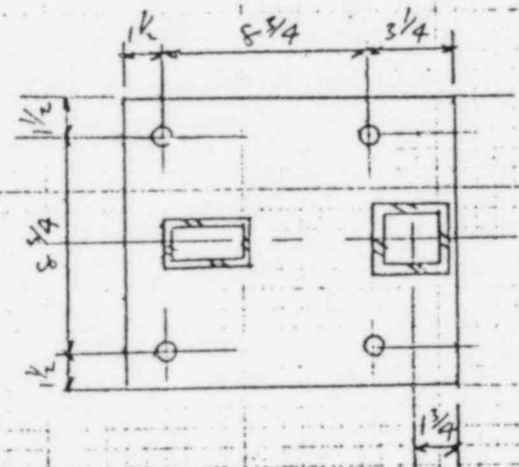
SHEAR CAPACITY = 6.21 ᵏ/BOLT ✓

GENERATOR BATTERY RACK | REF.

(1) END SUPPORT - TOP SHELF



REVISED TS 5/3/82 SEE PAGE 9



SECT A-A

PL - 11 3/4 × 3/4 × 1'-7 1/2

USE 4 - 7/8" φ UES-IT BOLTS 8 LB

BOLT CAPACITY

TENSION: $\frac{25.4 \times 0.9}{4}$: 5.72k

SHEAR - $\frac{32 \times 0.9}{4}$: 7.2k

ASSUME RIGID BASE

$\Sigma M_{EDGE\ R}$

$2T_1(10.25) + 2T_2(1.5) : (8.4^k)(8.75")$ $T_2 : 0.146T_1$

$20.94 T_1 : 73.5$

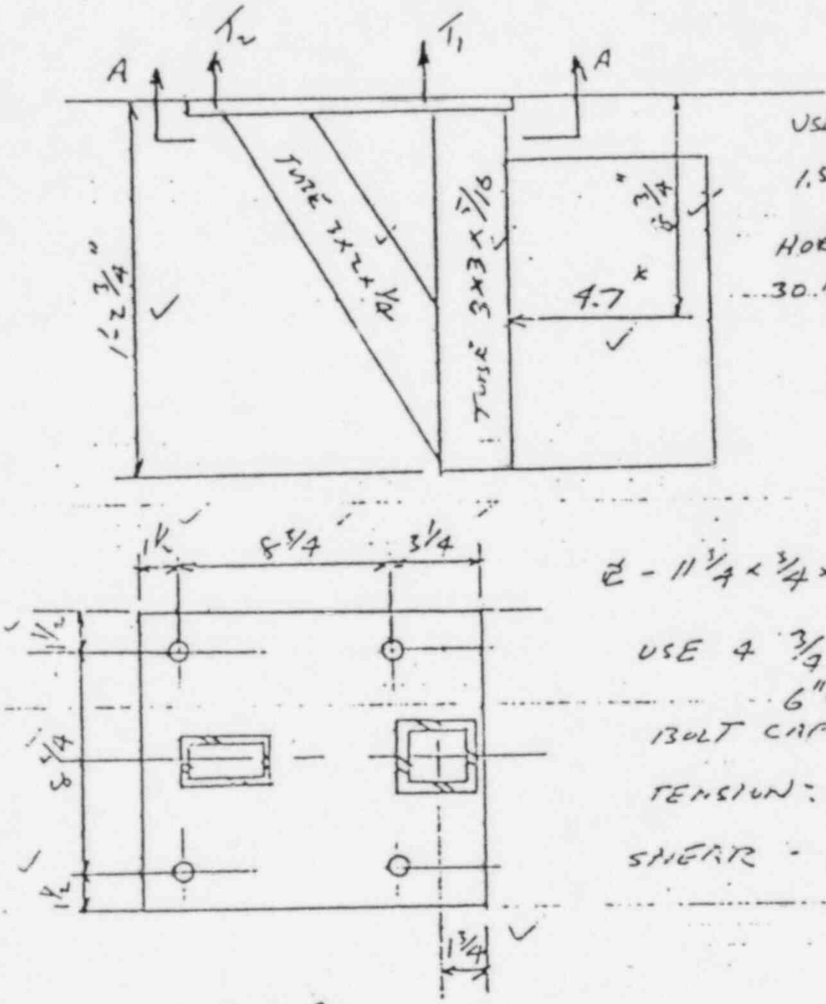
$T_1 : 3.59\ ^k/BOLT$ ✓

SHEAR: $8.4/4 : 2.1\ ^k/BOLT$ ✓

$\frac{3.59}{5.72} + \frac{2.1}{7.2}$ 0.92 < 1.0 ✓ (O.K)

GENERATOR BATTERY RACK | REF.

① END SUPPORT - TOP SHELF REVISED BOLT SIZE



USE 1.5 × PEAK G MEZZ. FLR.

$1.5 \times 0.744g = 1.12g$ ✓

HORIZ. LOAD =

30 BAT. × 140# × 1.12g = 4.70k ✓

PL - 11 3/4 × 3/4 × 1'-1 1/2

USE 4 3/4" ϕ WEJ-IT BOLTS 6" LG WEJ-IT CAT. #981

BOLT CAPACITY - $f'_c = 3500$ psi

TENSION: $\frac{19377}{4} = 4.84^k$ ✓

SHEAR - $\frac{19634}{4} = 4.91^k$ ✓

SECT A-A

ASSUME RIGID BASE

$\Sigma M_{EDGE\ R}$

$2T_1(10.25) + 2T_2(1.5) = (4.7^k)(8.75")$ $T_2 = 0.146T_1$

$20.94T_1 = 41.125$

$T_1 = 2.02^k$/BOLT ✓

SHEAR: $4.7/4 = 1.18^k$/BOLT ✓

$\frac{2.02}{4.84} + \frac{1.18}{4.91} = 0.66 < 1.0$ (O.K.)

NITROGEN TANK BRACKETS SK-5101-063-3

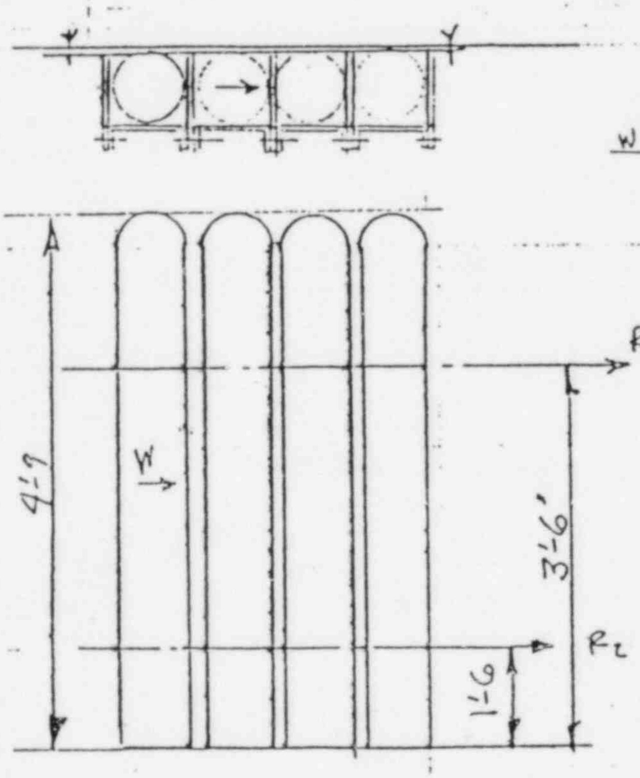
REF.

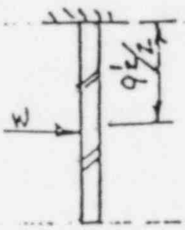
ASSUME:

MAXIMUM G WILL BE UPPER FLOOR SPECTRA EL 701

PEAK G-LEVEL = 4.13 G (FIGURE G.14) GULF UNITED REPORT SS-1162

SECTION PROPERTIES FOR PLATE $10\frac{3}{4} \times 3 \times \frac{1}{2}$





$I = \frac{bh^3}{12}$

$S = \frac{bd^2}{6} = \frac{3 \times .5^2}{6} = 0.125 \text{ in}^3$

$W = 177^{\#}$ FULL

$\frac{57''}{2} = 28.5''$

$R_1 + R_2 = W \times 4.13$

$\Sigma M_{R_2} = 0$

$4.13 W (28.5 - 18) = R_1 (42 - 18)$ (10.5; 24)

$R_1 = 319.82^{\#}$

$R_2 = 411.19^{\#}$

$M_{MAX} = 411.19 \times \frac{9.5}{2} = 1953.$ IN-#

TENSION STRESS $= \frac{411.9 \times 4}{5 [.5 \times 3 - .75 \times .5]} = 0.293$ ksi

$F_b = \frac{M}{S} = \frac{1953}{0.125} = 15.62$ ksi

MAX STRESS $= \sqrt{0.293^2 + 15.62^2} = 15.62$ ksi

NITROGEN TANK BRACKETS SK-5101-063-3 | REF.

CHECK WELDS $S_W = bd = 3 \times .5 = 1.5$ ✓

$f_w = \frac{M}{S_w} = \frac{1.95^{k\text{-}in}}{1.5}$ $1.3^k/in$ ✓

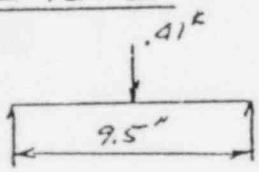
BENDING STRESS $= \frac{1.3^k/in}{.707 \times .25 \times 1} = 7.36\ ksi$ ✓

SHEAR STRESS $= 0.411/.707 \times .25 \times 3 \times 2$ ✓
$= 0.388\ ksi$

TENSION STRESS $= \frac{P}{A} = \frac{.411}{.707 \times .25 \times 3 \times 2} = 0.389\ ksi$ ✓

RESULTANT STRESS $= \sqrt{7.36^2 + 2(.388)^2}$ ✓
$= \sqrt{54.47} = 7.38\ ksi < 21.0\ ksi$

BRACE PLATE



$M_{max} = \frac{(0.41^k)(9.5)}{4} = 0.97^{in\text{-}k}$ ✓ $f_b = \frac{.97}{.031} = 31.3\ ksi$ ✓

$S = 1/6\,(3)(.25)^2 = .031\ in^3$ ✓

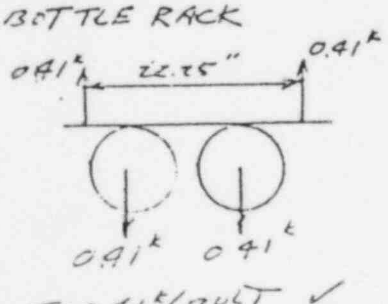
$F_b = 0.75 F_y = 27.0\ ksi$ ✓

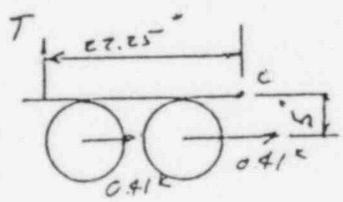
FOR SSE $F_b = 1.6 \times 27.0 = 43.2 > 36\ ksi$

USE $F_b = 36\ ksi$ ✓

3/4"φ WEJ-IT ANCHOR BOLTS

2 BOTTLE RACK





$\Sigma M_c = 0$
$22.25\,T = (2 \times .41^k)(5")$
$T = 0.18^k/BOLT$ ✓
$V = 0.41^k/BOLT$ ✓

$T = 0.41^k/BOLT$ ✓

3/4"φ × 6" LG WEJ-ITS

SRSS $T = \sqrt{.41^2 + .18^2} = 0.45^k$ ✓

	TENSILE	SHEAR
ULT. CAP.	18.38^k	24.84^k
ALL CAP. (FS=4)	4.84^k	6.21^k

$\frac{0.45}{4.84} + \frac{0.41}{6.21} = 0.16 < 1.0$ ✓

REF.

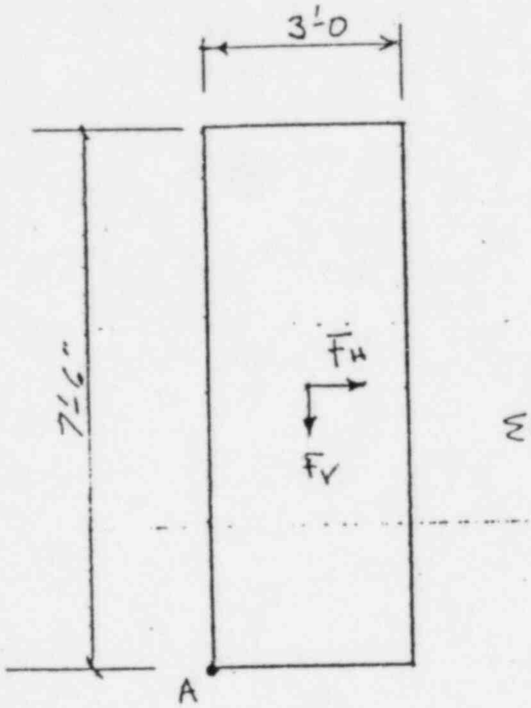
480 ESSENTIAL BUSS (PENETRATION ROOM)

SK-5101-063-4

Assume Wt = 3000#

Horizontal G-Value
$= .21 \times 1.5 = 0.315$ ✓

Vertical G-Value =
$\frac{2}{3}$ Horizontal $= 0.21$ ✓



$F_H = 0.315 \times 3^k = 0.945^k$ ✓

$F_V = 0.21 \times 3 = 0.63^k$ ✓

ΣM_A

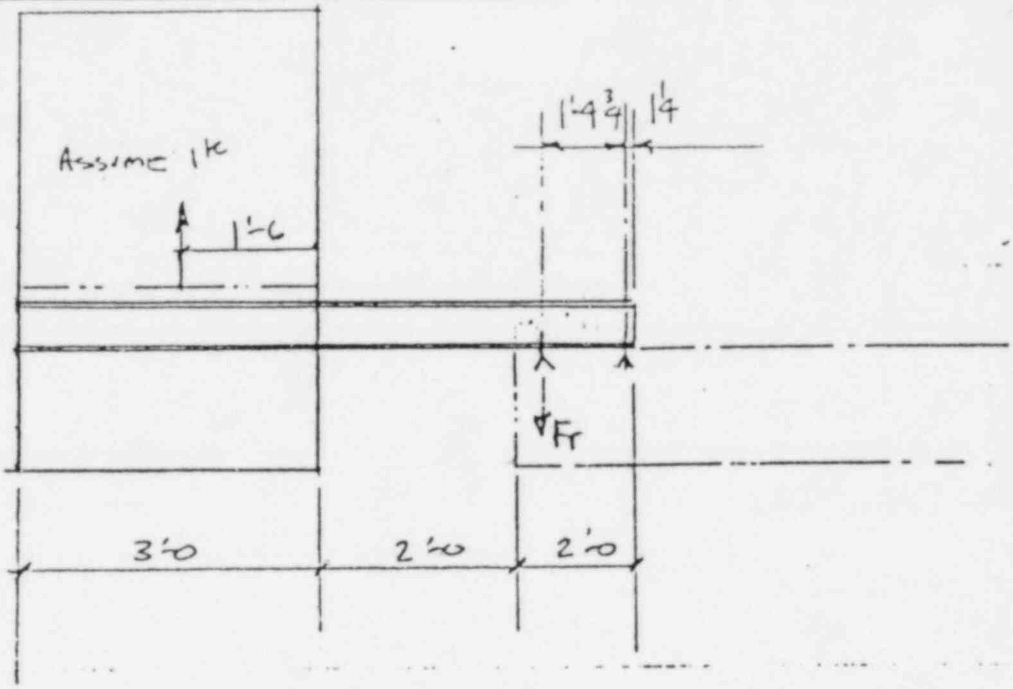
$M_O = 0.945 \times \frac{90}{2} = 42.53$ IN-K ✓

$M_S = (3.0 - 0.63)\frac{36}{2} = 42.66$ ✓

$F.S = \frac{M_S}{M_O} = \frac{42.66}{42.53} = 1.003$ ✓

Use Bracket to Ensure Stability Since Weight Is Only Estimated.

480 ESSENTIAL BUSS (PENETRATION ROOM) | REF.



$1^k\left(\frac{3}{2}+2+2\right) = F_T\ 1.5$ ✓

$F_T = 3.67^k/2$ BOLTS ✓

$F_T = 1.84^k$/BOLT

USE 3/4 WES-IT ANCHOR BOLTS 6"

$F_{T\,all} = \frac{20.45}{4} = 5.1^k$/BOLT ✓

CHECK BEAM W6x16

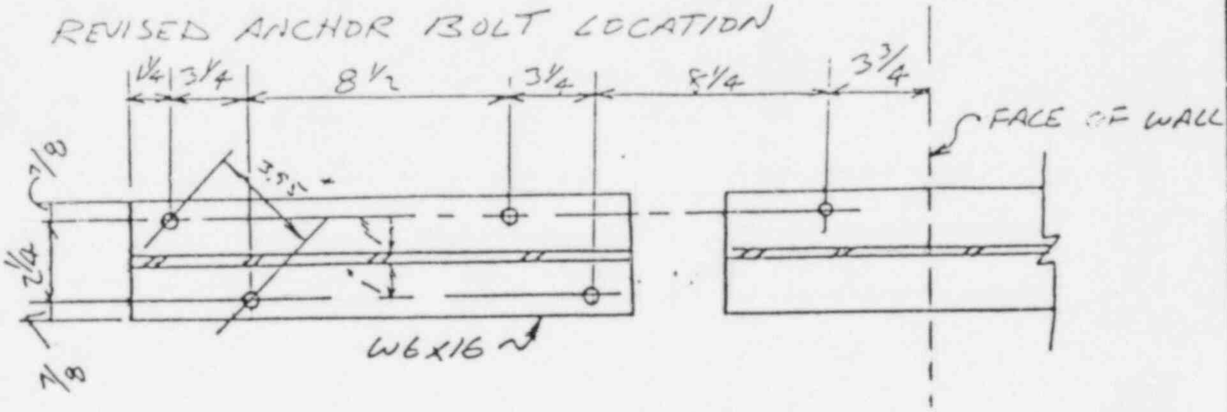
$M = \left(1 \times \frac{3}{2}+2\right) = 3.5^{1\text{-}k}$ ✓

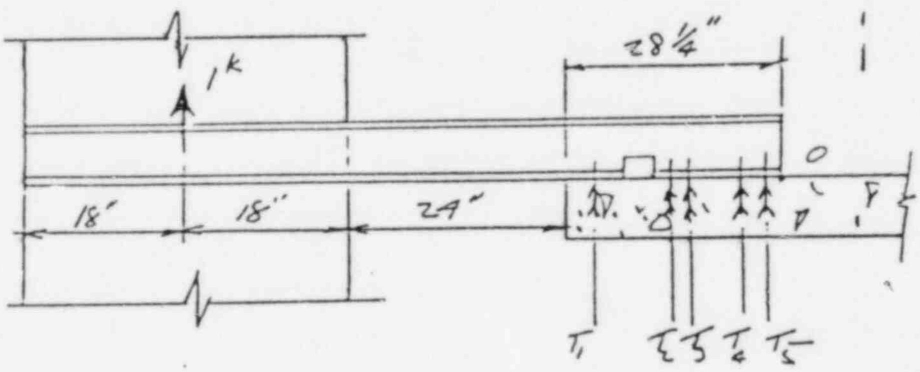
$S_{REQ} = \frac{3.5 \times 12}{21.6} = 1.95\ in^3$ ✓ $S_{xx} = 10.2\ in^3$ OK

480 V ESSENTIAL BUS (PENETRATION RM)

REF.

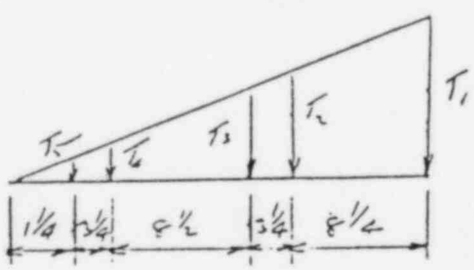
REVISED ANCHOR BOLT LOCATION





$\Sigma M_o = 0$

$1.25 T_5 + 4.5 T_4 + 13 T_3 + 16.25 T_2 + 24.5 T_1 = 70.25''(1^k)$



$\frac{T_1}{24.5} : \frac{T_2}{16.25} : \frac{T_3}{13} : \frac{T_4}{4.5} : \frac{T_5}{1.25}$

$T_2 = 0.663\,T_1$ $T_4 = 0.184\,T_1$

$T_3 = 0.531\,T_1$ $T_5 = 0.051\,T_1$

$1.25(.051T_1) + 4.5(.184T_1) + 13(.531T_1) + 16.25(.663T_1) + 24.5T_1 = 70.25$

$43.069\,T_1 = 70.25$

$T_1 = 1.63^k/\text{BOLT}$

3/4" φ x 6" LG WEJ-IT CAPACITY

CATALOG #951 FOR $f'_c = 3500$ psi

INTERPOLATE BETWEEN $f'_c = 2000, 4000$ psi

	ULT. CAPACITY	ALLOWABLE (FS=4)
TENSION	19.38k	4.84k

FOR BOLT SPACING ≥ 10 × DIAMETER

FOR BOLT SPACING = 3.95"

CAPACITY: $\frac{3.95}{7.5} = 0.527$

MAXIMUM CAPACITY = $4.84^k \times .527 = 2.55^k/\text{BOLT}$

ACTUAL LOAD = $1.63^k/\text{BOLT}$

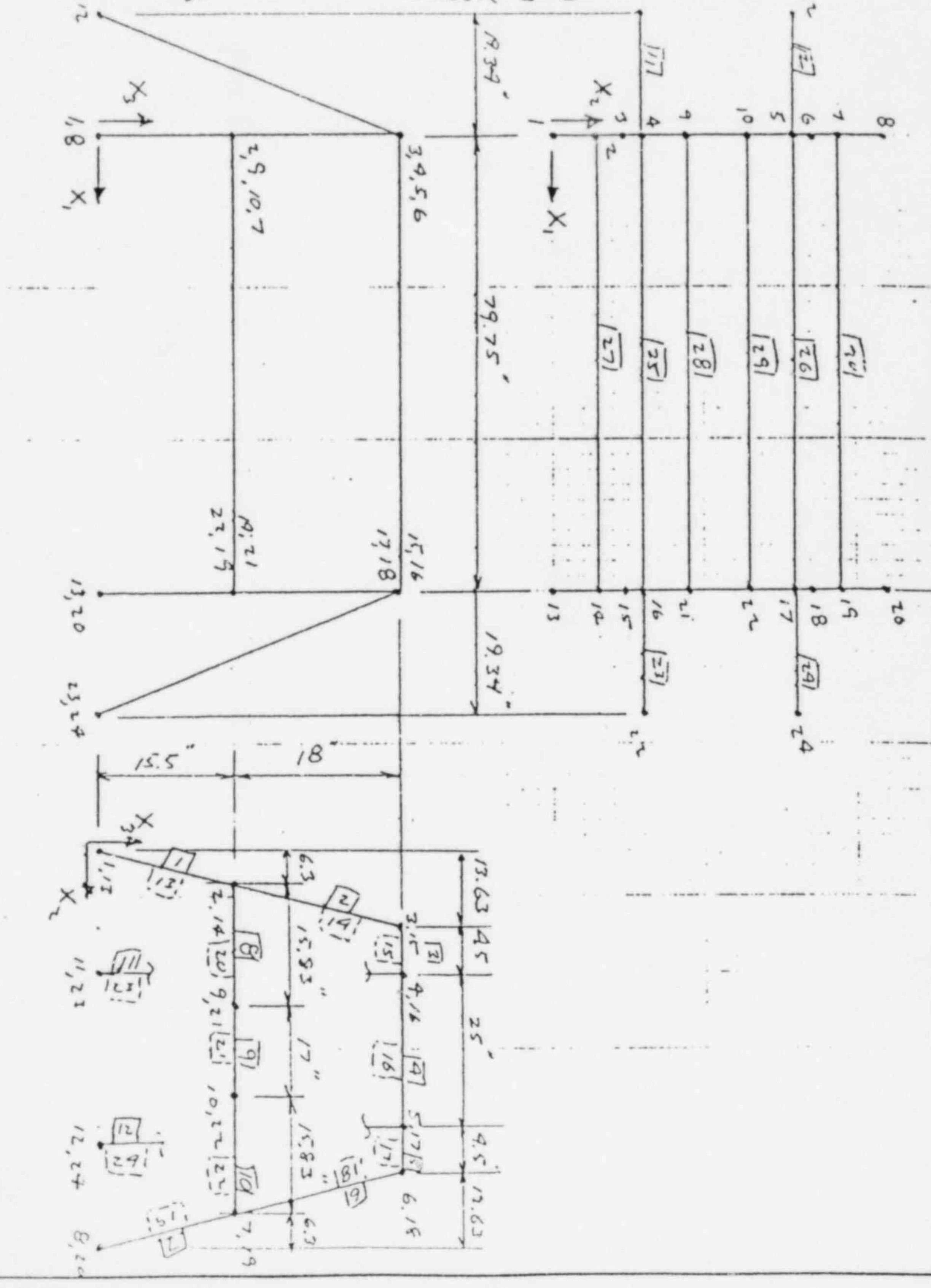
NUCLEAR ENERGY SERVICES

BY ______ DATE ______ PROJ. ______ TASK ______
CHKD. RP DATE 4-6-81 PAGE 1 OF 6

LACBWR

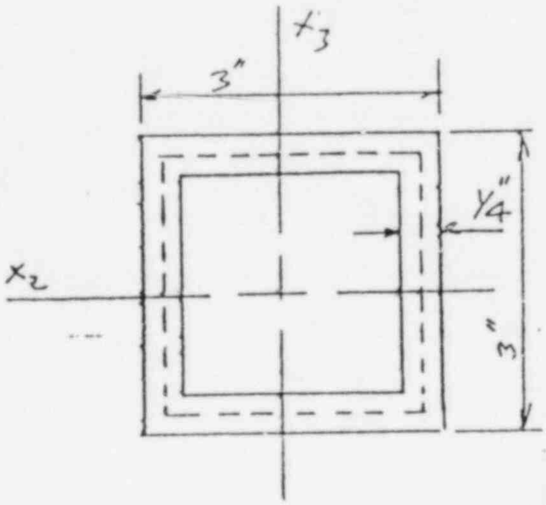
REACTOR BATTERY RACK SK-5101-063-6	REF.

STARDYNE MODEL FOR COMPUTER PROGRAM
NES COMPUTER BINDER S-60 =



REACTOR BATTERY RACK | REF.

BEAM PROPERTIES - STARDYNE BPROP1, BPROP2



$A = 2.59\ in^2$

$I_2 = I_3 = 3.16\ in^4$

$J = 5.19\ in^4$

SHEAR SHAPE FACTORS

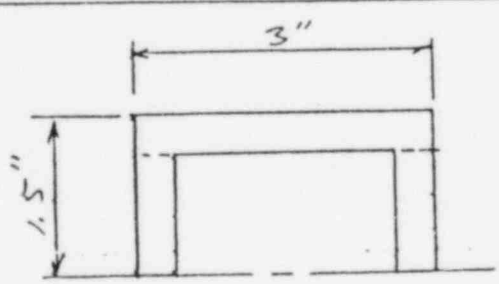
$SF2, SF3 = 0.50$

CTORS

$$\frac{T \times CTORS}{J} = \frac{T}{2At}$$

$$CTORS = \frac{J}{2At} = \frac{5.19}{(2)(2.75)^2(0.25)} = 1.373\ in\ ✓$$

SHEAR STRESS FACTOR SSF_2, $SSF3$



$$\tau_{max} = \frac{VQ}{Ib}$$

$$Q = (3)(.25)(1.375) + 2(1.25)(.75)(0.625)$$

$$Q = 1.42\ in^3\ ✓$$

$$\tau_{max} = \frac{V(1.42)}{(3.16)(2)(.25)} = 0.90V\ ✓$$

$$\tau_{AVG} = \frac{V}{2.59} = 0.386V\ ✓$$

$$SSF_2 = SSF_3 = \frac{0.90V}{0.386V} = 2.33\ ✓$$

REACTOR BATTERY RACK | REF.

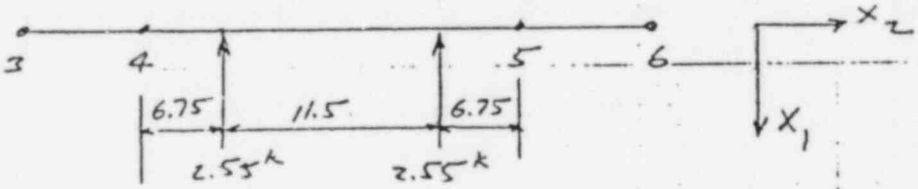
BATTERIES

WT - 85# EACH ✓
WIDTH = 4 5/8" DEPTH = 10 1/2" ✓
15 / SHELF ✓

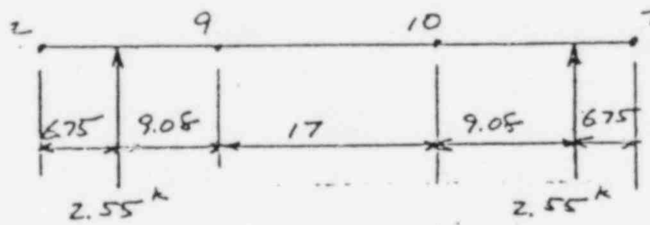
LOAD IN X1 DIRECTION

CONC. LOAD = 85#/1000 × 2g × 15 = 2.55^k ✓

UPPER SHELF



LOWER SHELF



LOADS IN X2 DIRECTION

UPPER SHELF - BEAM 26 LOADED

$$\text{DIST. LOAD} = \frac{85\# \times 2g}{4.625 + 0.5} \times 2 \text{ ROWS} = 0.066\ ^k/_{IN}\ ✓$$

LOWER SHELF - BEAMS 28, 30 LOADED

$$\text{DIST. LOAD} = \frac{85 \times 2g}{5.125} = 0.033\ ^k/_{IN}\ ✓$$

$$M_{max} = \frac{w\ell^2}{8} = \frac{(.066)(79.75)^2}{8} = 52.47\ ^{''-k}$$

TS - 3×3×1/4 $S = 2.10\ in^3$ $f_b = \frac{52.47}{2.10} = 25$ ksi

GENERATOR BATTERY RACK | REF.

BASE PLATE DETAILS - END FRAME

$$\sqrt{(X1\ DIR)^2 + (X2\ DIR)^2}$$

	FX1	FX2	FX3
END FRAME NODE 8	0.59^k ✓	2.80^k ✓	4.88^k ✓

LOADS FROM POST RUN PAGE 4

@ NODE 8 SHEAR $= \sqrt{(.59)^2 + 2.8^2} = 2.86^k$ ✓

TENSION $= 4.88^k$

USE 2 ¾"φ WEJ-IT BOLTS

SHEAR = 1.43^k/BOLT ✓
TENSION = 2.44^k/BOLT ✓

BOLT CAPACITY
TENSION : $\frac{21.53 \times 0.9}{4} = 4.84^k$ ✓
SHEAR : $\frac{27.61 \times 0.9}{4} = 6.21^k$ ✓

$$\frac{2.44}{4.84} + \frac{1.43}{6.21} = 0.73 < 1.0$$

2 - ¾φ BOLTS OK

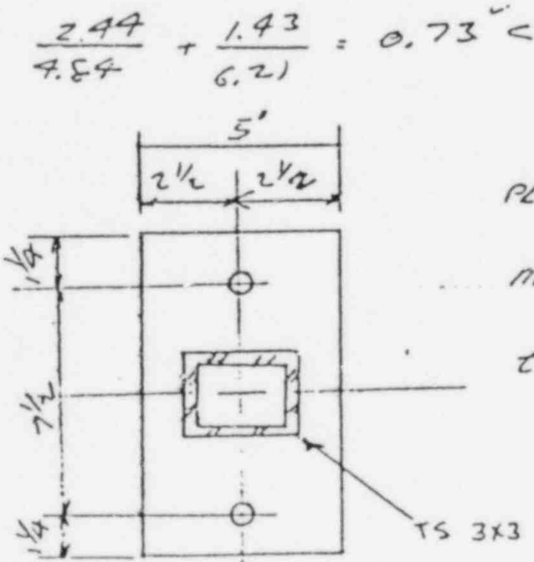


PLATE THICKNESS REQ'D

$m = 2.44^k \times 2.25'' = 5.49^{"k}$ ✓

$t = \sqrt{\frac{(5.49)(6)}{(27)(5)}} = 0.49''$ ✓

USE ¾ PL

GENERATOR BATTERY RACK | REF.

BASE PLATE - BRACING STRUT

	F_{x_1}	F_{x_2}	F_{x_3}	
2 BRACING STRUTS NODE 11	2.89 ✓	0.16 ✓	4.89 ✓	$\sqrt{(X1\,DIR)^2 + (X2\,DIR)^2}$
NODE 12	2.88	0.16	4.83	
REVISED - USE 1 STRUT	5.78^k ✓	0.32^k ✓	9.68^k ✓	

USE 4 - 3/4"ϕ WEJ-ITS

SHEAR = $\sqrt{5.78^2 + 0.32^2} = 5.79^k$ ✓ $= 1.45^k$/BOLT

TENSION = 9.68^k 2.42^k/BOLT ✓

BOLT CAPACITY = TENSION: 4.84^k ✓
SHEAR = 6.21^k ✓

$$\frac{2.42}{4.84} + \frac{1.45}{6.21} = 0.73 < 1.0$$ ✓ 4 BOLTS (O.K.)

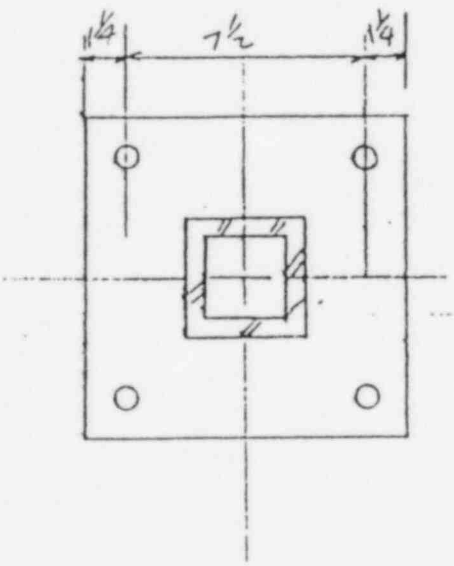


PLATE THICKNESS

$m = 2.42^k \times 2 \times 2.25'' = 10.89^{"-k}$

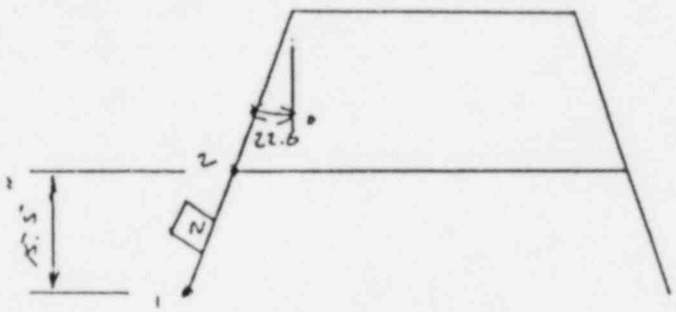
$$t = \sqrt{\frac{(10.89)(6)}{(27)(10)}} = 0.49''$$ ✓

USE 3/4 PL

REACTOR BATTERY RACK | REF.

SUMMARY OF TUBE STRESSES 3x3x1/4

FROM STARDYNE POST RUN $\sqrt{X1_{DIR}^2 + X2_{DIR}^2}$ ✓



MAX BENDING STRESS IN END FRAME IN BM·2 ✓

$m_2 = 5.46$ ksi ✓ $m_3 = 7.56$ ksi ✓

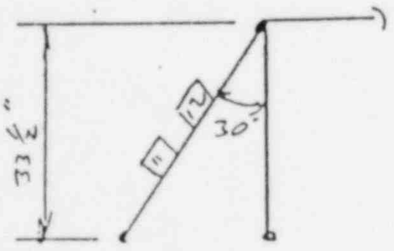
AXIAL STRESS = 2.09 ksi ✓ $l = 16.8"$ $Kl/r = \frac{(1)(16.8)}{1.10} = 15.26$ ✓

$\frac{f_a}{F_a} = \frac{2.09}{20.88} = 0.10 < 0.15$ ✓ $F_a = 20.88$ ksi ✓

USE EQ. 1.6-2 | 8TH ED AISC 1.6.1

$\frac{2.09}{20.88} + \frac{7.56}{24} + \frac{5.46}{24} = 0.64 < 1.0$ (O.K) ✓

BRACING STRUT



BRACES #11, #12 REPLACED BY ONE STRUT

∴ ADD AXIAL STRESSES TOGETHER

AXIAL STRESS = 2×2.17 ksi = 4.34 ksi ✓

$l = 38.68"$ $Kl/r = \frac{38.68}{1.10} = 35.2$ ✓

$F_a = 19.56$ ksi > 4.34 ksi ✓ (O.K)

BATTERY CHARGERS SK-5101-063-7 | REF.

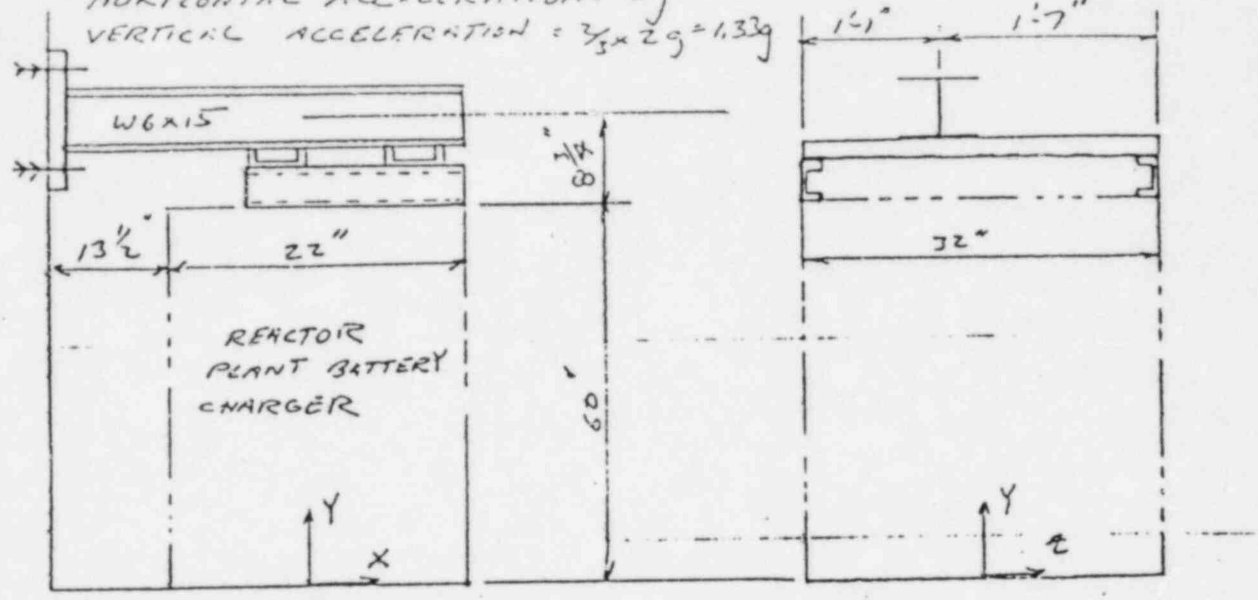
GEN. PLANT BATTERY CHARGER WT = 500# DENSITY: $\frac{500^{\#}}{72" \times 24" \times 15"} = 0.026\ \#/in^3$

ESTIMATE WT REACTOR PLANT CHARGER =

$0.026\ \#/in^3 \times (60" \times 32" \times 22") = 1100^{\#}$

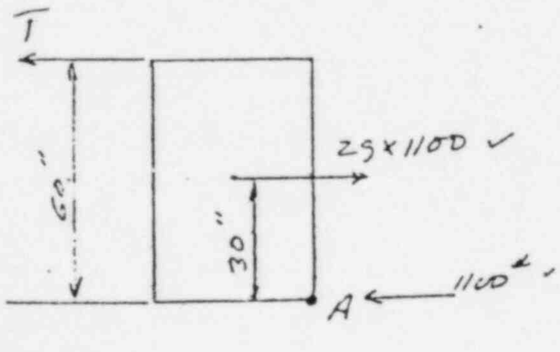
HORIZONTAL ACCELERATION: 2g

VERTICAL ACCELERATION = $2/3 \times 2g = 1.33g$



ASSUME EXIST. ANCHOR BOLTS IN BASE CARRY BASE SHEAR.

X DIRECTION

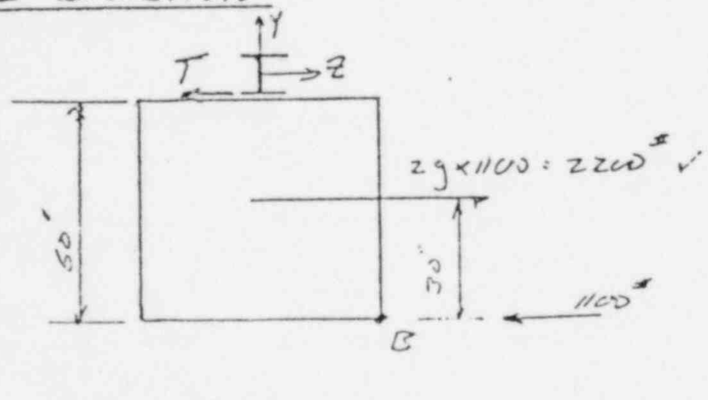


$\Sigma M_A = 0$

$(2200)(30") = 60T$

$T = 1100^{\#}$

Z-DIRECTION



$\Sigma M_B = 0$

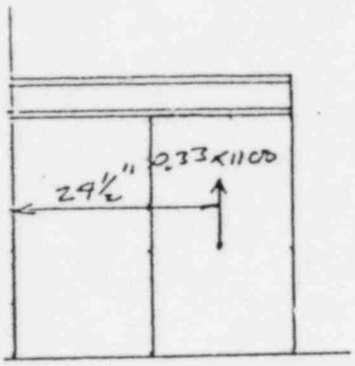
$T = 1100^{\#}$

$M_y = 1100^{\#} \times 29.5" = 27^{in\text{-}k}$

REF.

BATTERY CHARGERS

Y-DIRECTION



$M_z = 24.5'' \times .33g \times 1100^{\#} = 8.9^{"-k}$ ✓

W6x15 $A = 4.43 \text{ in}^2$ ✓ $S_z = 9.72 \text{ in}^3$ ✓ $S_y = 3.11 \text{ in}^3$ ✓

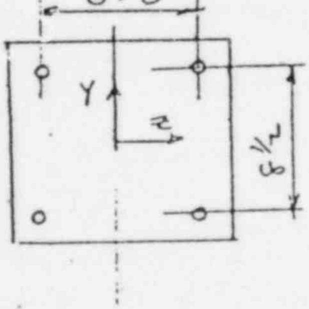
TENSION: $f_T = \frac{1.1^k}{4.43} = 0.25 \text{ ksi}$ ✓

BENDING: $f_{b_z} = \frac{8.9}{9.72} = 0.92 \text{ ksi}$ ✓

$f_{b_y} = \frac{27}{3.11} = 8.68 \text{ ksi}$ ✓

RSS TENSION STRESS $= \sqrt{0.25^2 + 0.92^2 + 8.68^2} = 8.73 \text{ ksi}$ ✓

ANCHOR BOLTS



X-DIR

TENSION $= 1.1^k / 4 \text{ BOLTS} = 0.275^k$ ✓

Y-DIR

TENSION: $\frac{8.9^{"-k}}{8.5"} = 1.05^k / 2 \text{ BOLTS} = 0.52^k$ ✓

SHEAR $= 0.363^k / 4 \text{ BOLTS} = 0.09^k$ ✓

Z-DIR

TENSION $= \frac{27}{(8.5)(2)} = 1.60^k/\text{BOLT}$ ✓

SHEAR $= 1.1/4 = 0.275^k/\text{BOLT}$ ✓

RSS FORCES

TENSION $- \sqrt{0.275^2 + 0.52^2 + 1.60^2} = 1.70^k$ ✓

SHEAR $- \sqrt{0.09^2 + 0.275^2} = 0.29^k$ ✓

REF.

BATTERY CHARGERS

USE 4 - 3/4"φ WEJ-ITS

BOLT CAPACITY - TENSION = 4.84^k/BOLT CATALOG #468-B
ALLOWABLE (FS=4) SHEAR = 6.21^k/BOLT

$$\frac{1.70^k}{4.84^k} + \frac{0.29^k}{6.21^k} = 0.40 \le 1.0 \text{ (O.K)}$$

EXISTING ANCHORAGE IN BASE: 4 - 1/4" WEDGE EXPANSION BOLTS

ASSUME CARRY BASE SHEAR

RSS SHEAR FORCE = $\sqrt{1100^2 + 1100^2}$ = 1556#/4 BOLTS = 389#

ULTIMATE CAPACITY - SHEAR = 2325# - RED HEAD CAT. F-1000 PG 6

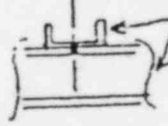
ALLOWABLE CAPACITY - SHEAR = 2325/4 = 581# > 389# (O.K)

REACTOR PLANT BATT. CHARGER

1/2"φ BOLTS CHARGER TO C4x7.25

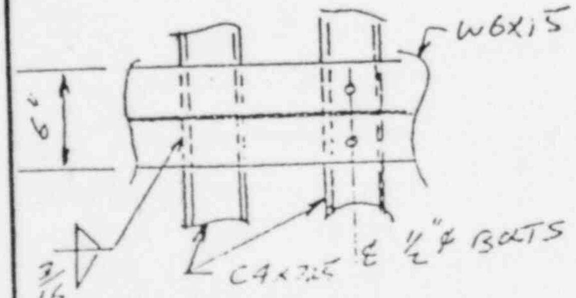
SRSS SHEAR FORCE = $\sqrt{2 \times 1100^2}$ = 1555.6# = 389#/BOLT

$f_v = \frac{.389}{.126} = 3.09$ ksi



5/8"φ BOLTS CONNECTING C4x7.25's

$f_v = \frac{389\#}{.202} = 1.93$ ksi



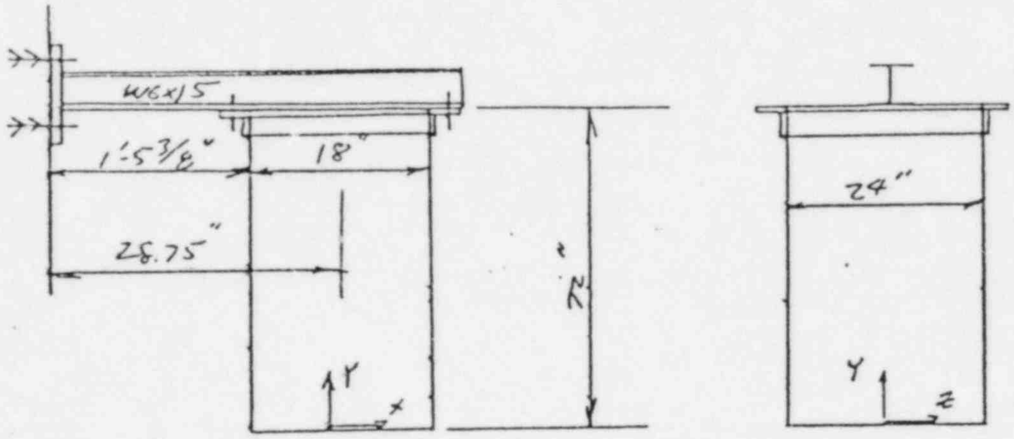
ASSUME WELDED AND BOLTED CONNECTION EACH CARRY 1/2 OF SHEAR

WELD STRESS $f_v = \frac{777.8\#}{(12)(.707)(3/16)} = 0.5$ ksi

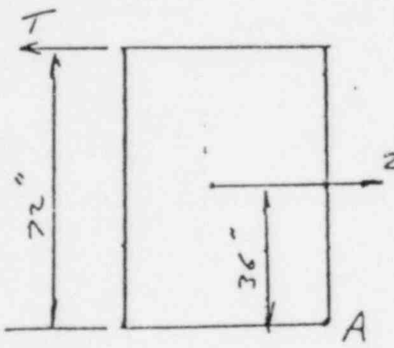
BOLT STRESS: $f_v = \frac{777.8\#}{2(.126)} = 3.08$ ksi

BATTERY CHARGERS | REF.

GENERATOR PLANT CHARGER WT = 800#



X AND Z DIRECTIONS



$\Sigma M_A = 0$

$(1600^{\#})(36") = 72T$

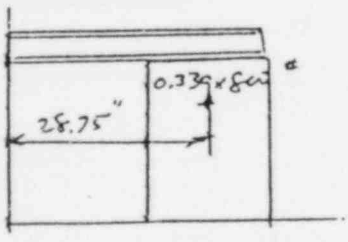
$T = 800^{\#}$ ✓

AT BASE PLATE $T = 800^{\#}$ (x-DIR) ✓

(z-DIR) $M_y = 800^{\#} \times 28.75 = 23^{"-k}$ ✓

Y-DIRECTION

$M_z = 28.75" \times .33g \times 800^{\#} = 7.59^{"-k}$ ✓



AT WALL; M_y, M_x AND TENSION FORCE FOR GENERATOR CHARGER ✓
ARE SMALLER THAN THOSE FOR REACTOR CHARGER. SINCE W6x15
AND BASE PL DETAILS THE SAME, CALCULATIONS WILL NOT BE REPEATED

5/8" φ BOLTS 2x2 L's TO W6x15

SRSS SHEAR = $\sqrt{2 \times 800^2}$ = 1131.3# 282.8#/BOLT ✓

$f_v = 282.8 / .202 = 1.4$ ksi ✓

NES

NUCLEAR ENERGY SERVICES

BY TS DATE 3-17-81 PROJ. 5101 TASK 063

CHKD. RR DATE 4-8-81 PAGE 8 OF

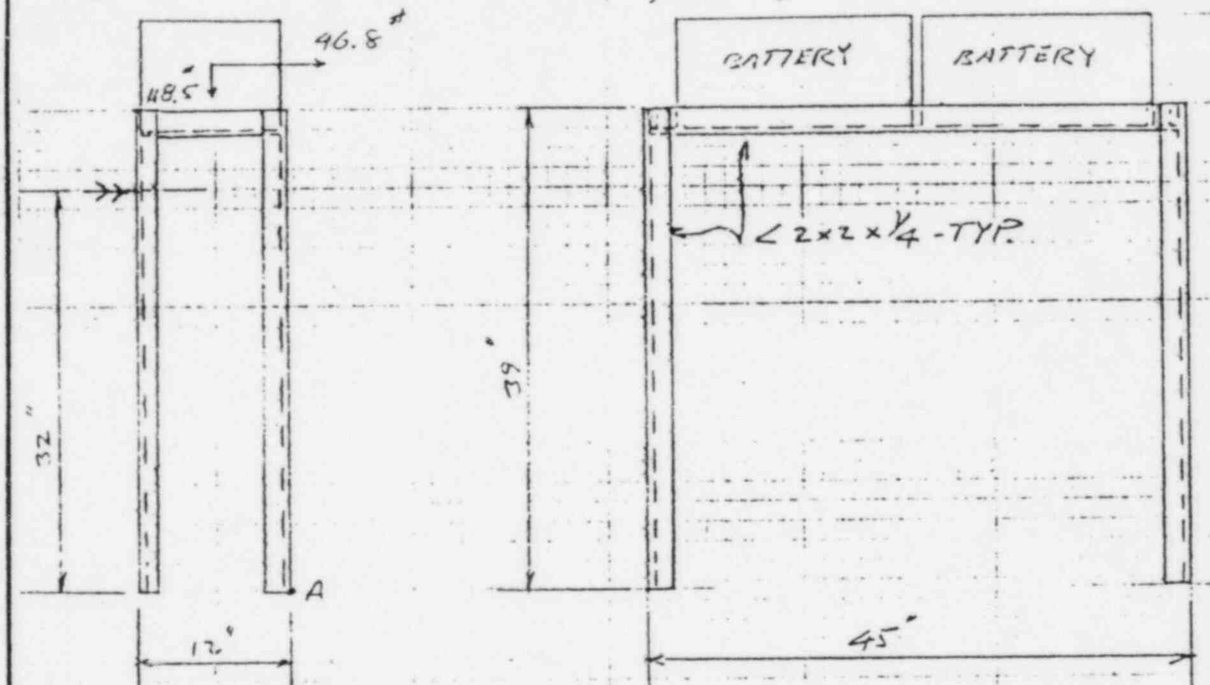
LACBWR

1-A DIESEL BATTERY RACK SK-5101-063-8	REF.

BATTERY - 19" LONG, - 11" HIGH, 9" WIDE ASSUME WT = 75# EACH

HORIZ. ACCELERATION = 0.21g × 1.5 = 0.312g } From NRC SITE SPECIFIC

VERT " = 2/3 × 0.312g = 0.21g } GROUND SPECTRA



$\Sigma M_A = 0$

$(46.8^{\#})(42.5'') - (118.5^{\#})(6) = 32T$

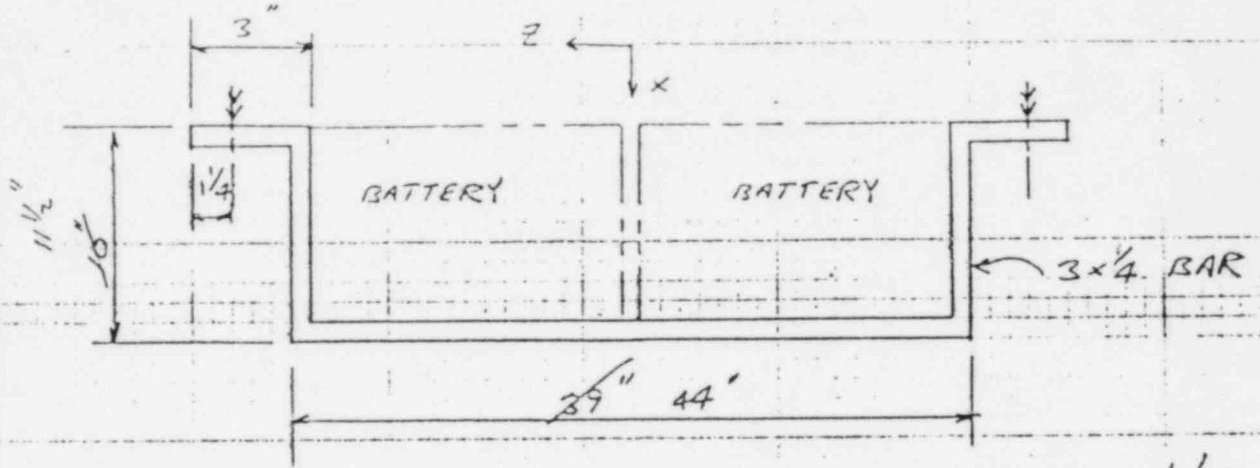
$T = 40.0^{\#}$ ✓

USE 2 ~~3/4~~ 1/2" φ WEJ-IT ANCHOR BOLTS ✓

1/2" φ × 3 1/2" LG ALLOWABLE CAPACITY = 1.3 k/BOLT TENSION ✓

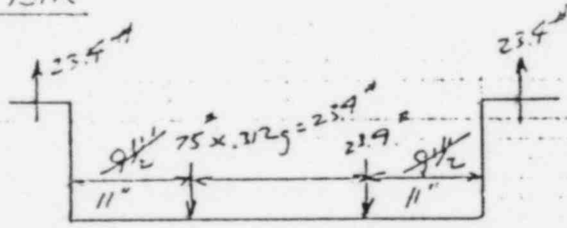
REF.

1-A DIESEL BATTERY RACK



REVISED 10/1/82
TS

X DIR



$m_{MAX} = \cancel{9\frac{1}{2}}\ 11" \times 23.4^{\#} = \cancel{222}\ 257.4''\text{-}^{\#}$ ✓

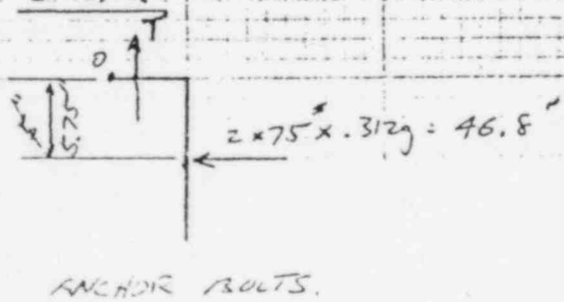
$f_b = \frac{\cancel{.222}\ .257\ ''\text{-}k}{0.03125} = \cancel{7.11}\ 8.24\ ksi$ ✓

$f_T = \frac{23.4^{\#}}{(3)(.25)} = 0.031\ ksi$ ✓

$S = \frac{bd^2}{6} = \frac{(3)(.25)^2}{6} = 0.03125\ in^3$ ✓

ANCHOR BOLTS
TENSION = 23.4 #/BOLT ✓

Z DIR.



$M_{MAX} = 46.8^{\#} \times \cancel{5}\ 5.75" = \cancel{234}\ 269''\text{-}^{\#}$ ✓

$f_b = \frac{\cancel{.234}\ .269}{0.03125} = \cancel{7.5}\ 8.61\ ksi$ ✓

ANCHOR BOLTS.

$\Sigma M_0 = 0$

$46.8^{\#} \times 5.75 = 1.25T$ ✓

$T = 215.3\ ^{\#}/BOLT$ ✓

$V = 46.8\ ^{\#}/BOLT$ ✓

Checked DLS
10/6/82

1-A DIESEL BATTERY RACK | REF.

ANCHOR BOLTS

RSS FORCES

TENSION = $\sqrt{23.4^2 + 215.3^2}$ = 216.5 # ✓

SHEAR = 46.8 #

1/2"φ x 3 1/2 LG. WEJ-IT ANCHOR BOLTS

f'_c = 3500 psi CATALOG # 981

2 1/2" EMBEDMENT

	ULTIMATE CAPACITY	ALLOWABLE CAPACITY
TENSION	5.21 k ✓	1.30 k ✓
SHEAR	9.85 k ✓	2.46 k ✓

$\frac{.217}{1.30} + \frac{.05}{2.46}$ = 0.187 < 1.0

NUCLEAR ENERGY SERVICES

BY TS DATE 10/1/82 PROJ. 5101 TASK 063

CHKD. DLS DATE 10/6/82 PAGE ____ OF ____

GALLBOR ELECT EQUIP

REF.

1-B DIESEL GENERATOR CONTROL PANEL

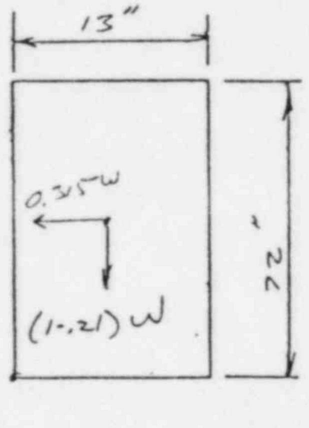
H × W × D

6'-0" 2'-6" 1'-1"

SK-5101-063-9

1.5 × PEAK HORIZ. ACCELERATION FROM NRC SITE SPECIFIC GROUND SPECTRA = 1.5 × .21g = 0.315g

VERTICAL ACCELERATION = 2/3 × 0.315g = 0.21g



$\Sigma M_A = 0$

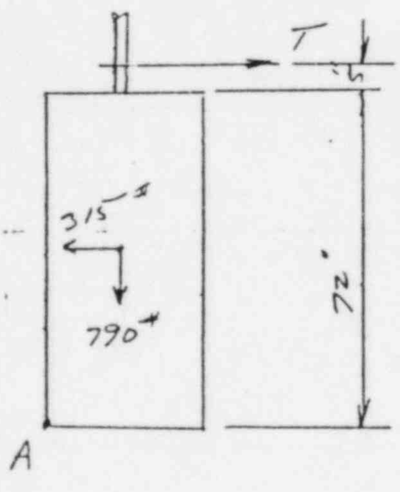
$M_{RESIST} = 0.79W \times 13/2 = 5.135W$

$M_{OVER} = 0.315W \times 72/2 = 11.34W$

OVERTURNING

FIX REQUIRED

ASSUME WEIGHT = 1000#



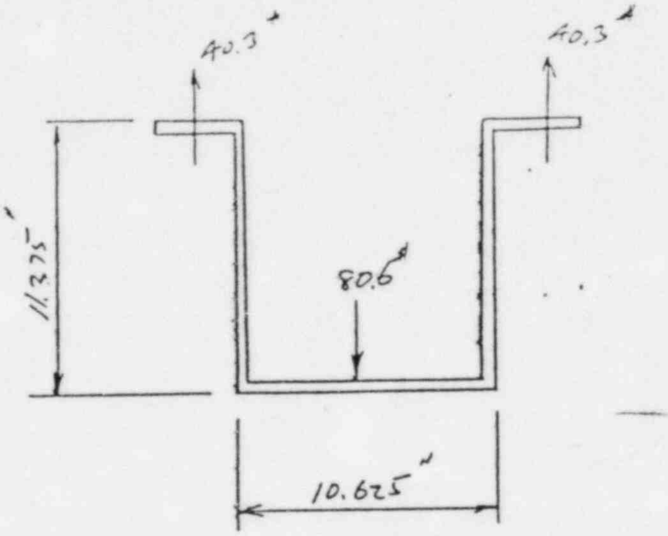
$\Sigma M_A = 0$

$790 \times 13/2 + 77T = 315 \times 72/2$

$T = 80.6^{\#}$ ✓

NES 105 (9/81)

	REF.
1-B DIESEL GENERATOR CONTROL PANEL	



$M_{max} = \frac{(.0806^k)(10.625)}{4} = 0.21^{''-k}$ ✓

FOR 3 × 1/4 BAR $S = \frac{1}{6}(3)(.25)^2 = 0.03125$ ✓

$f_b = \frac{.21}{.03125} = 6.72$ ksi < 27 ksi ✓

1/2" φ × 3 1/2 LG WEJ-IT ANCHOR BOLTS

2 1/2" EMBEDMENT $f'_c = 3500$ psi CATALOG #981

f'_c	ULT CAP#	
4000	5789	TENSION
3500	5210	
2000	3473#	

ULT CAPACITY = 5.21^k

ALLOWABLE CAPACITY = 1.30^k > 0.04^k ✓

NUCLEAR ENERGY SERVICES

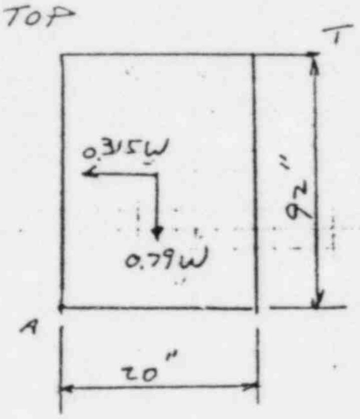
BY TS DATE 8-27-81 PROJ. 5101 TASK 063
CHKD. RR DATE 9/11/81 PAGE 5 OF
CACBWR

	REF.
1-B GENERATOR BLDG ELECT. EQUIP.	

② 125 V DC DIESEL BLDG MAIN DIST BUS.

③ MCC 480-V   SK-5101-063-10

RESTRAINT @ TOP



ASSUME WT = 2000#

$\Sigma M_A = 0$

$(0.79)(2000)(10) + 92T = (.315)(2000)\left(\frac{92}{2}\right)$

$T = 143^{\#}$ ✓

USE ∠ 3×3×1/4 $A = 1.44\ in^2$ $r_{min} = 0.592"$ ✓

g-LEVEL

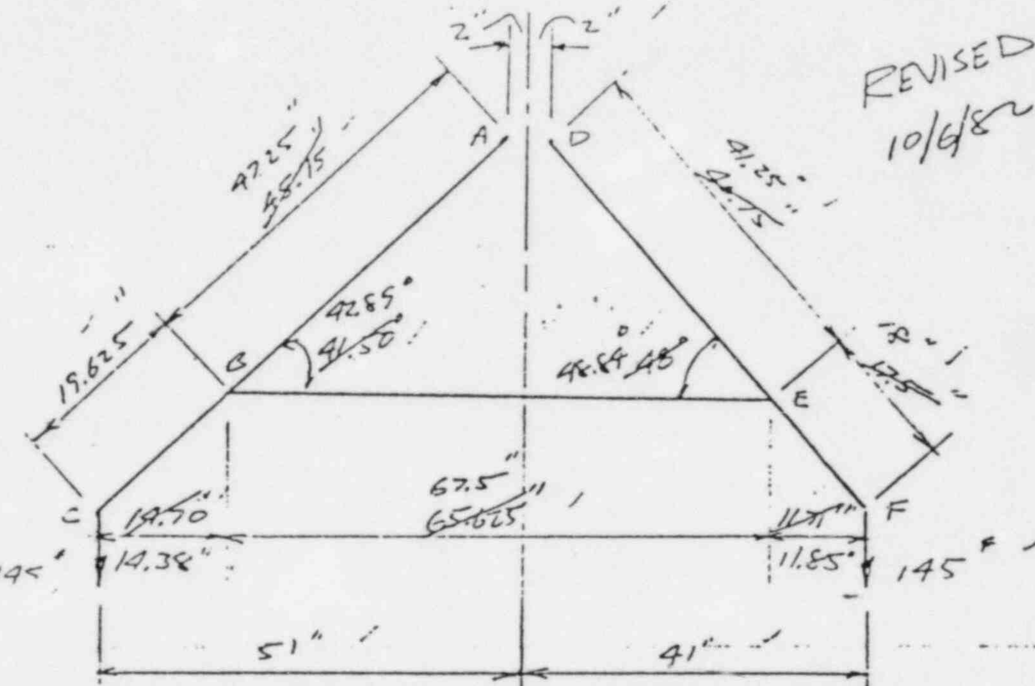
1.5 × PEAK HORIZ. ACCELERATION FROM NRC SITE SPECIFIC GROUND SPECTRA

$0.21g \times 1.5 = 0.315g$ ✓

VERTICAL g-LEVEL $= \frac{2}{3} \times 0.315g = 0.21g$ ✓

1-B DIESEL BLDG - ELECT. PANELS

REF.



USE ∠3×3×1/4 · S = 0.577 IN³

MOMENT @ PT B · 145# × 14.69" = 2130 #-ft

$f_b = \frac{2.130^{"k}}{0.577} = 3.69$ ksi < 22 ksi

MAX. COMPRESSION CAPACITY

$\frac{kl}{r} = \frac{(1)(65.625)}{.592}$ = 110.85 (revised: 67.5, 114.02) F_a = 11.56 ksi (revised: 11.13)

P_a = 11.56 × 1.94 in² = 16.65^k (revised: 11.13, 16.03^k)

ALL CONNECTIONS - 3/4"φ A325 BOLTS

SHEAR CAPACITY = 7.7^k/BOLT

APPLIED LOADS ARE SMALL COMPARED TO MEMBER CAPACITY

NUCLEAR ENERGY SERVICES

BY TS DATE 3/15/82 PROJ. 5701 TASK 063

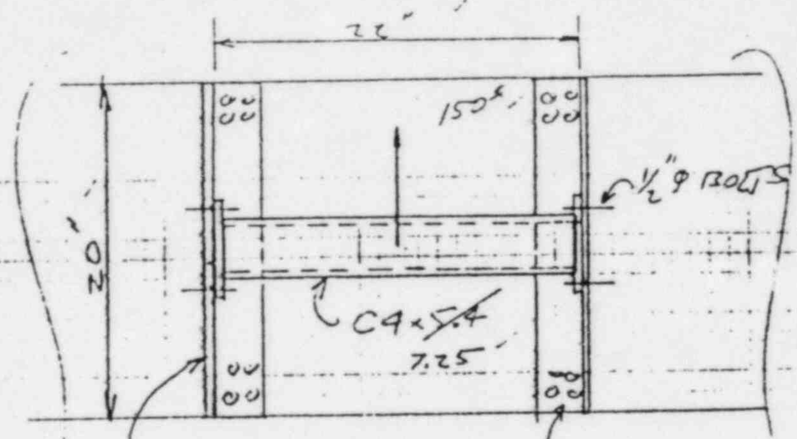
CHKD. JC DATE 3/16/82 PAGE ___ OF ___

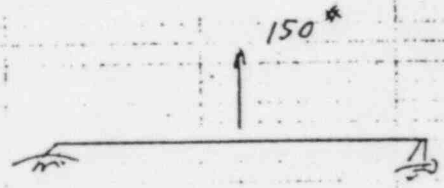
LACBWR ELECT. EQUIP.

1-B DIESEL BLDG - ELECT. EQUIP. PANELS

REF.

CONNECTION TO MCC 480-V BUS





REVISED 1/11/83 TS

$M_{max} = \frac{150(22)}{4} = 825$ "-#

C4x~~5.4~~ 7.25 S_x : ~~1.93~~ 2.29 IN^3 ; $f_b = \frac{0.825}{~~1.93~~\ 2.29} = $ ~~0.427~~ 0.360 ksi < 22 ksi

1/2" ϕ BOLTS - A307

SHEAR = 150/4 = 37.5 #/BOLT $F_V = \frac{\pi}{4}(.5)^2(10.0\ ksi) = 1.96^k$

1/4" ϕ BOLTS - A307

SHEAR = 150#/16 = 9.375 #/BOLT $F_V = \frac{\pi}{4}(.25)^2(10) = 0.49^k$/BOLT

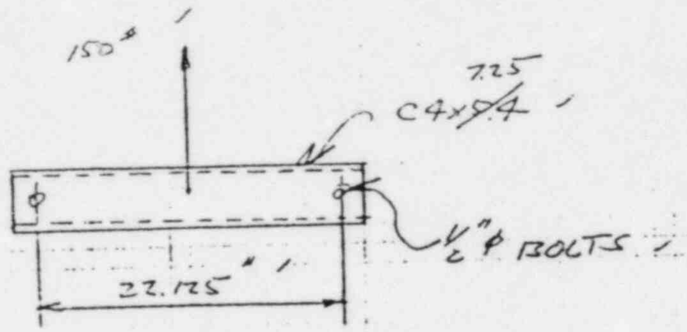
NUCLEAR ENERGY SERVICES

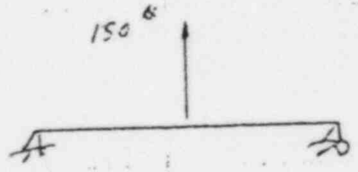
BY TS DATE 3/11/82 PROJ. 5701 TASK 063
CHKD. JC DATE 3/16/82 PAGE ____ OF ____
LACBWR ELECT. EQUIP.

REF.

1-B DIESEL BLDG - ELECT. EQUIP. PANELS

CONNECTION TO 125-V DC BUS





REVISED 1/11/83 FS

$M_{max} = \frac{(150^{\#})(22.125)}{4} = 830$ in-#

C4x7.25 (5.4 struck through) $S_x = 2.29$ (1.93 struck through) in^3 $f_b = \frac{.83}{2.29} = 0.36$ (0.43 struck through) ksi < 22 ksi

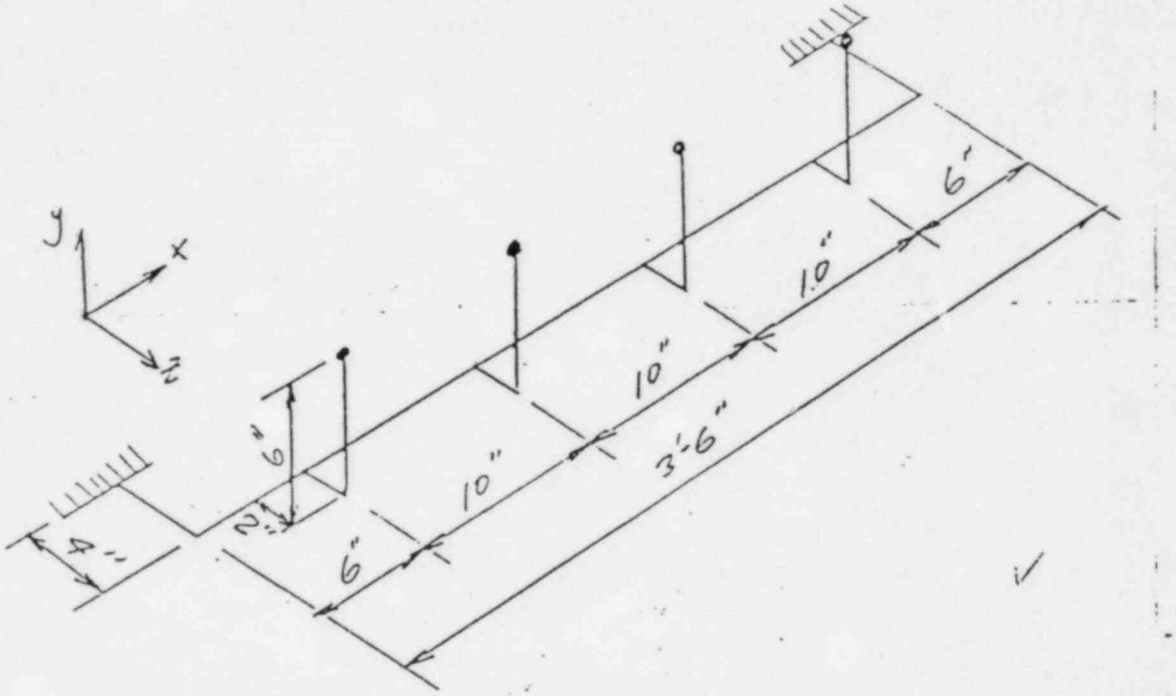
BOLT LOAD

RESULTANT SHEAR: 75#/BOLT

1/2"φ A307 BOLT $F_v = 10$ ksi

SHEAR CAPACITY = $\frac{\pi}{4}(.5)^2 \times 10 = 1.96^k > 0.075^k$
(OK)

REACTOR WATER LEVEL TRANSMITTERS #1, 2 SK-5101-063-12 | REF.



ASSUME WEIGHT EACH TRANSMITTER = 50# ✓

SSE g-LEVEL = 2.58g HORIZONTAL @ EL 667' GULF UNITED REPORT SS-1162

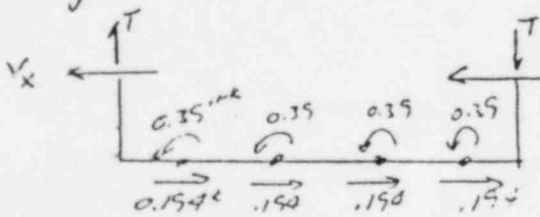
$\frac{2}{3} \times 2.58g = 1.72g$ - VERTICAL ✓

X-DIR.

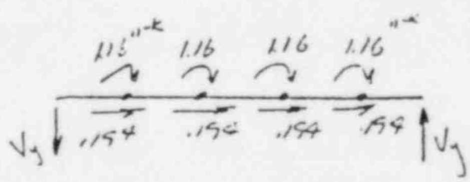
$F_x = 2.58g \times 1.5 \times 0.050^k = 0.194^k$ / TRANSMITTER ✓

$M_z = 0.194^k \times 6'' = 1.16^{''k}$ / TRANS. ✓

$M_y = 0.194^k \times 2'' = 0.39^{''k}$ / TRANS. ✓



PLAN



ELEVATION

PLAN:

$\Sigma M = 0$ $42T = (4 \times 0.39^{''k}) + (4 \times .194^k)4''$ ✓

$T = 0.11^k$ 0.037^k/BOLT ✓

$V_x = 2 \times .194^k = .39^k$. $.13^k$/BOLT

ELEVATION:

$\Sigma M = 0$

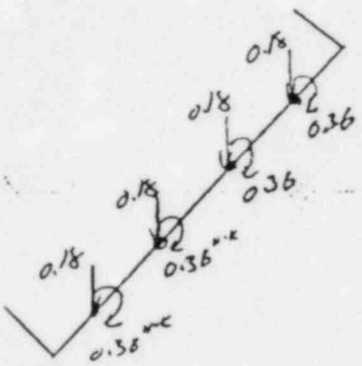
$42V_y = 4 \times 1.16^{''k}$ ✓

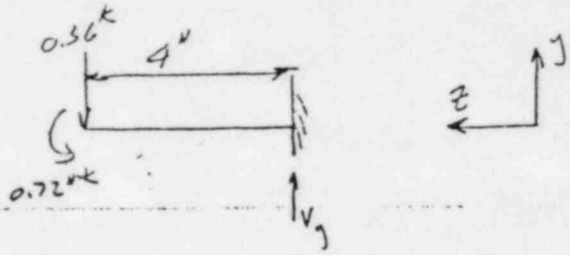
$V_y = 0.11^k$ $.037^k$/BOLT ✓

RX. TRANSMITTERS #1, #2 | REF.

Y-DIR   DL + SEISMIC $50^{\#} + 50^{\#}(1.72g \times 1.5) = 0.18^{k}$

$M_z = .18^{k} \times 2'' = 0.36^{''-k}$



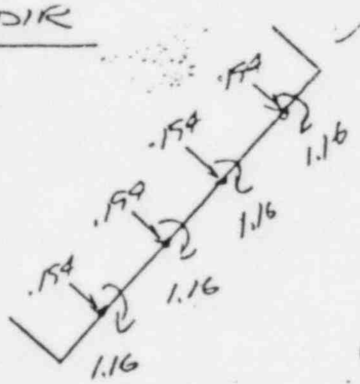


END SUPPORT
ELEVATION

$M_x = 0.72^{''-k} + 4 \times .36^{k} = 2.16^{''-k}$

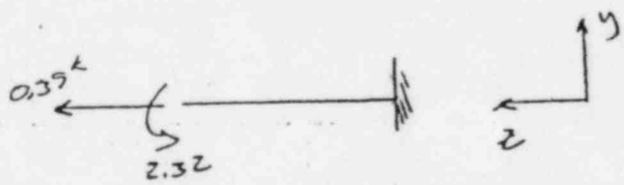
$V_y = 0.36^{k} \div 0.12^{k}/BOLT$

Z-DIR



$F_z = 0.194^{k}$

$M_x = 6'' \times .194^{k} = 1.16^{''k}$

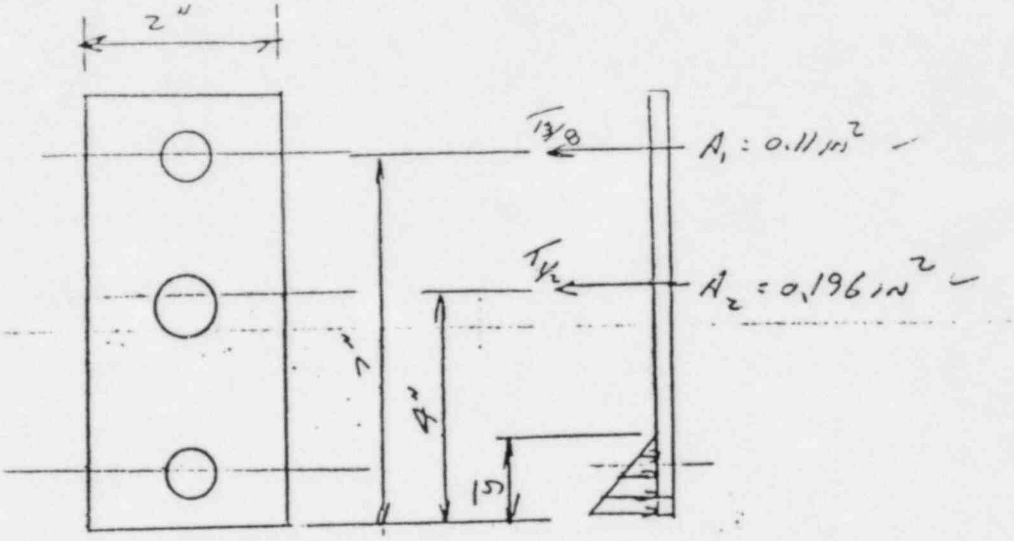


0.35' FORCE $T = .13^{k}/BOLT$

NUCLEAR ENERGY SERVICES

BY TS DATE 12/12/82 PROJ. 507 TASK 06-
CHKD. D L Summers DATE 1/11/83 PAGE ____ OF ____
LACBWR ELECT EQUIP

RX. WATER LEVEL TRANSMITTER #1, #2 | REF.



REF: McGUIRE - STEEL STRUCTURES PRENTICE-HALL, 1968 pg 840-842

$\frac{b\bar{y}^2}{2} = A_1(7-\bar{y}) + A_2(4-\bar{y})$ ✓

$\bar{y}^2 = 0.11(7-\bar{y}) + .196(4-\bar{y})$

$\bar{y}^2 = 1.554 - .306\bar{y}$

$\bar{y}^2 + .306\bar{y} + .153^2 = 1.554 + .153^2$

$(\bar{y} + .153)^2 : 1.577$

$\bar{y} + .153 = \pm 1.256$

$\bar{y} = 1.103$ ✓

$I = \frac{2}{3}\bar{y}^3 + A_1(7-\bar{y})^2 + A_2(4-\bar{y})^2$

$I = \frac{2}{3}(1.103)^3 + .11(7-1.103)^2 + .196(4-1.103)^2$

$I = 0.895 + 3.83 + 1.64$

$I : 6.37 \ in^4$

$T_{7/8} : \frac{M(7-1.103)}{6.36} \times .11 : .102M$

$T_{1/2} = \frac{M(4-1.103)}{6.36} \times .196 = 0.089M$

NES 105 (9/81)

NUCLEAR ENERGY SERVICES

BY TS DATE 12/23/82 PROJ. 5701 TASK 063

CHKD. D L Summers DATE 1/11/83 PAGE ____ OF ____

CALCWR ELECT. EQUIP.

RX. WATER LEVEL TRANS #1, #2 | REF.

BOLT TENSION

X-DIR

$T_{3/8} = T_{1/2} = .037^k$ ✓

Y-DIR $M_x = 2.16^{'k}$ ✓

$T_{3/8} = 2.16 \times .102 = 0.22^k$ ✓

$T_{1/2} = 2.16 \times .089 = 0.19^k$ ✓

Z-DIR $M_x = 2.32^{'k}$ ✓

$T_{3/8} = .13^k + 2.32^{'k} \times .102 = 0.37^k$ ✓

$T_{1/2} = .13^k + 2.32 \times .089 = 0.34^k$ ✓

SRSS TENSION

$T_{3/8} = \sqrt{.037^2 + .22^2 + .37^2} = 0.43^k$ ✓

$T_{1/2} = \sqrt{.037^2 + .19^2 + .34^2} = 0.39^k$ ✓

SRSS SHEAR

$V_x = .13^k$

$V_y = \sqrt{.037^2 + .12^2} = .13^k$ ✓

RESULTANT SHEAR $= \sqrt{.13^2 + .13^2} = 0.18^k$ ✓

NUCLEAR ENERGY SERVICES

BY [illegible] DATE [illegible] PROJ [illegible] TASK 003
CHKD. DL Summers DATE 1/11/82 PAGE ____ OF ____
LACBWR ELECT. EQUIP.

RX. WATER LEVEL TRANSMITTERS #1, #2	REF.

$\frac{3}{8} \times 2\frac{3}{4}$" WEJ-IT $2\frac{1}{2}$" EMBEDMENT

INTERPOLATE FOR f'_c: 3500 psi CATALOG #1182

EMBED: 2"

	TENSION	SHEAR
ULTIMATE CAPACITY	3771# ✓	4981# ✓
ALLOWABLE CAPACITY (F.S. = 4)	943# ✓	1245# ✓

$$\frac{0.43}{.943} + \frac{.18}{1.245} = 0.60 < 1.0 \checkmark$$

½"φ RED HEAD SELF DRILLING ANCHOR.

	TENSION	SHEAR
ULTIMATE CAPACITY	8500#	6720#
ALLOWABLE CAPACITY (F.S. = 5)	1700#	1344#

$$\frac{.39}{1.70} + \frac{.18}{1.344} = 0.363 < 1.0 \checkmark$$

125 V DC AUX DC PANEL | REF.

SRSS LOADS

$F_x = F_z = 0.056^k$ ✓ $F_y = .0375^k$ ✓

$M_x = 4.34''^{-k}$ ✓

$M_y = 1.13''^{-k}$ ✓

$M_z = \sqrt{4.34^2 + 0.75^2} = 4.40''^{-k}$ ✓

DL ± SRSS

$F_x = F_z = 0.056^k$ ✓ $F_y = -0.0875^k$ ✓

$M_x = 4.34''^{-k}$ ✓ $M_y = 1.13''^{-k}$ ✓ $M_z = 5.41''^{-k}$ ✓

W6x15 $S_z = 9.72\ in^3$ ✓ $S_x = 3.11\ in^3$ ✓ $A = 4.43\ in^2$ ✓

$f_{b_z} = \frac{5.41}{9.72} = 0.56$ ksi ✓ $f_{b_x} = \frac{4.34}{3.11} = 1.40$ ksi ✓

$f_y = \frac{0.0875^k}{4.43} = 0.020$ ksi ✓

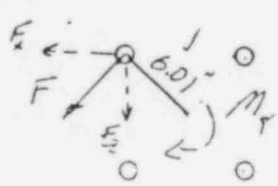
ANCHOR BOLT LOADS

TENSION

$2T \times 8.5'' = 4.34''^{k}$ ✓ $T = 0.26^k$ ✓

$2T \times 8.5'' = 5.41''^{-k}$ ✓ $T = 0.32$ ✓ } TENSION = 0.58^k/BOLT ✓

SHEAR



$6.01 F \times 4 = 1.13''^{-k}$ ✓ $F = 0.047^k$/BOLT ✓

$F_x = F_z = \frac{0.047}{\sqrt{2}} = 0.033^k$ ✓

RESULTANT $= \sqrt{2 \times (0.056 + 0.033)^2} = 0.126^k$/BOLT ✓

3/4" φ × 6" WES-1T 4" EMBED $f'_c = 3500$ psi CATALOG #981

	ULT. CAPACITY	ALLOWABLE
TENSION	19.37^k ✓	4.85^k
SHEAR	19.63^k ✓	4.91^k

$\frac{0.58}{4.85} + \frac{0.126}{4.91} = 0.145 < 1.0$

(O.K.)

NUCLEAR ENERGY SERVICES

BY TS DATE 12/15/81 PROJ. 5101 TASK 063
CHKD. JC DATE 12/18/81 PAGE ___ OF ___
LACBWR

REF.

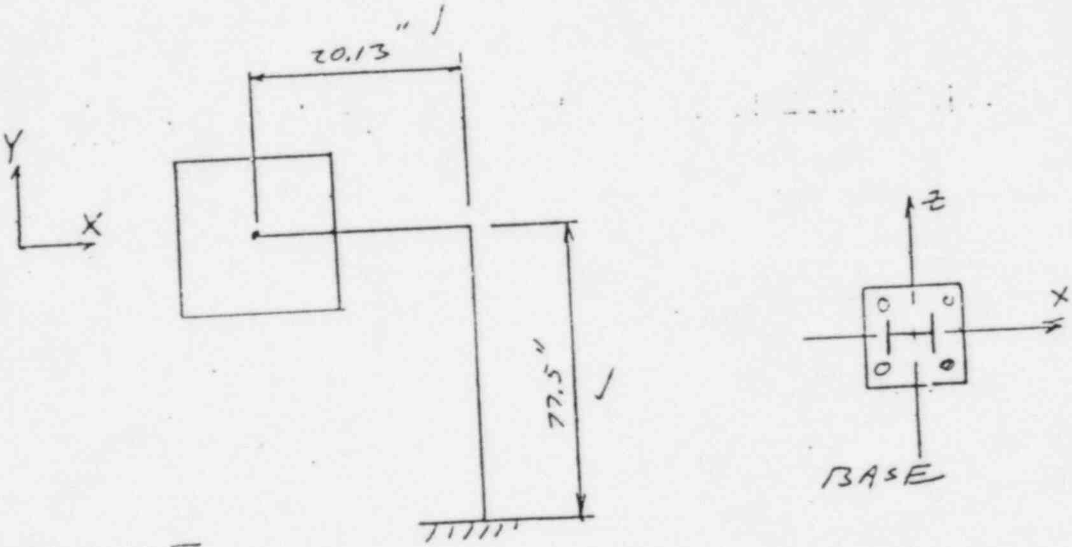
125V DC AUX. DC PANEL SK-5101-063-13

ASSUME PANEL WT = 50 LBS

PEAK g MEZZANINE FLR. SPECTRA: 0.744 g

HORIZONTAL ACCELERATION: 0.744g × 1.5 = 1.12 g

VERTICAL ACCELERATION: 2/3 × 1.12g = 0.75g



AT BASE

DEAD LOAD

$M_z = 0.050^k \times 20.13'' = 1.01^{''-k}$

$F_y = 0.050^k$

SEISMIC LOADS

X-DIRECTION

$M_z = 1.12g \times 0.05^k \times 77.5'' = 4.34^{''-k}$

$F_x = 0.056^k$

Y-DIRECTION

$M_z = 0.75g \times 0.050^k \times 20.13'' = 0.75^{''-k}$

$F_y = 0.0375^k$

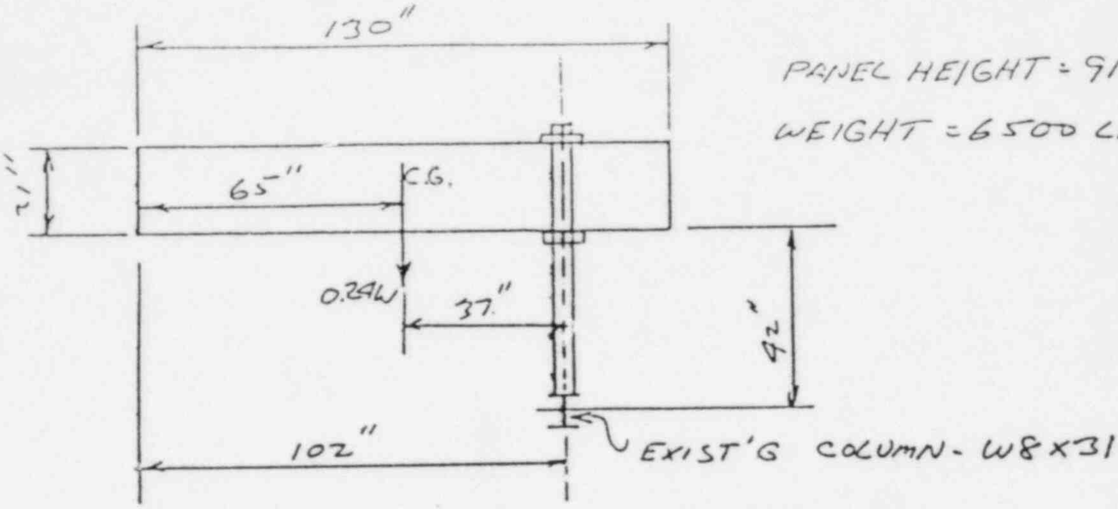
Z-DIRECTION

$F_z = 0.056^k$

$M_y = 1.12g \times 0.050^k \times 20.13' = 1.13^{''-k}$

$M_x = 1.12g \times 0.05^k \times 77.5' = 4.34^{''-k}$

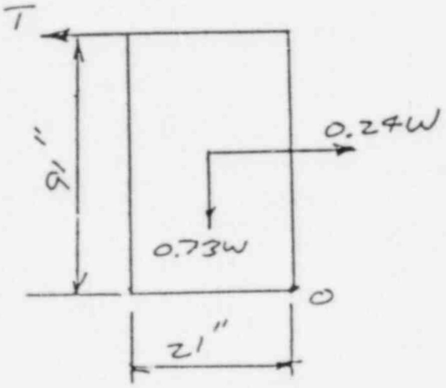
TB MCC 1A, METER PANEL, REACTOR DC PANEL — SL-5101-065-14 | REF.



PANEL HEIGHT = 91"

WEIGHT = 6500 LBS

PANELS BOLTED TOGETHER - ASSUME RIGID

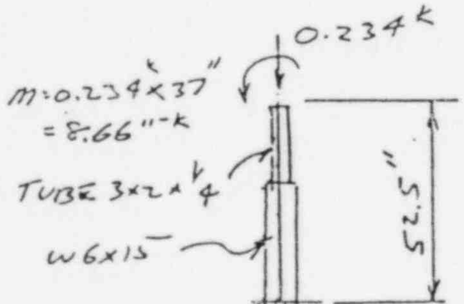


$\Sigma M_o = 0$

$0.24W(91/2) = 0.73W(21/2) + 91T$

$T = \frac{W}{91}(10.92 - 7.67)$

$T = 0.036W = 0.234^k$ ✓



W6X15 $S_y = 3.11\ IN^3$

$f_y = \frac{8.66}{3.11} = 2.78\ ksi < 27.0\ ksi$ ✓

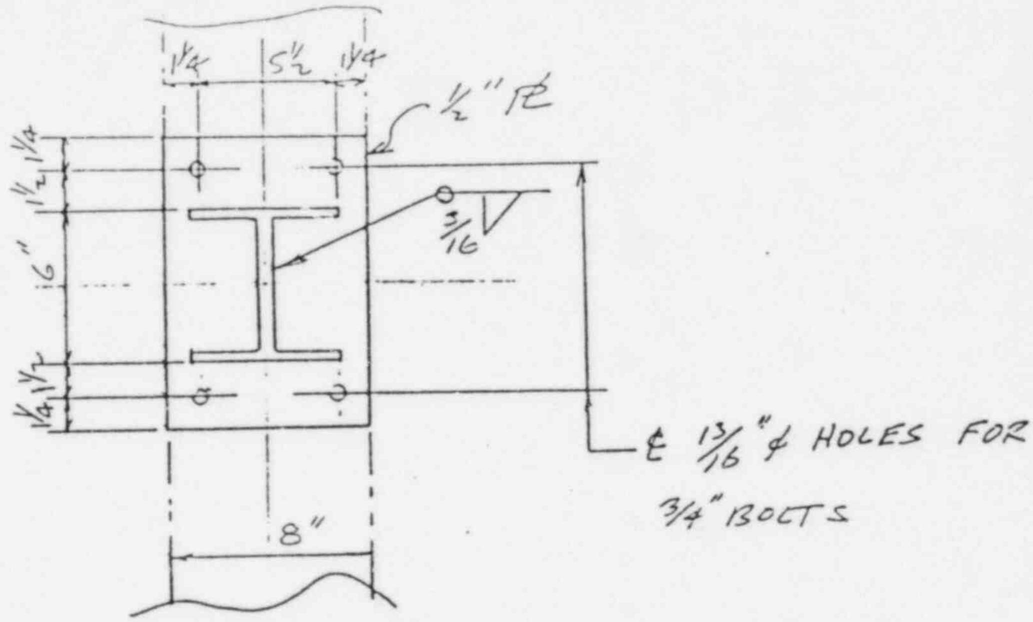
TUBE 3×2×1/4 $S_y = 1.15\ IN^3$ $F_y = 46\ ksi$

$f_y = \frac{8.66}{1.15} = 7.53\ ksi < 30.36\ ksi$ ✓

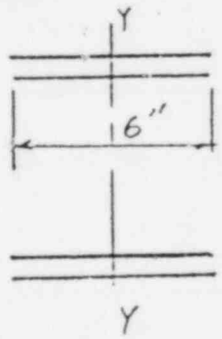
	REF.

TB MCC 1A, METER PANEL, REACTOR DC PANEL

CONNECTION DETAILS



WELD



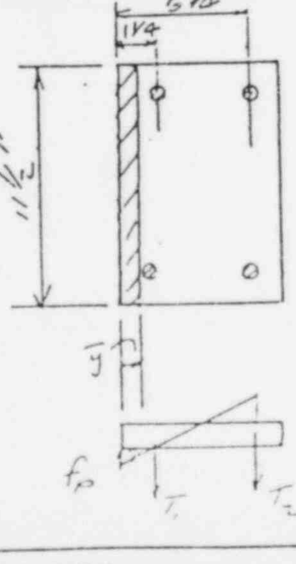
$M_y = 8.66$ IN-K

WELD $S_y = 4 \times (1/6)(1)(6)^2 = 24$ IN² ✓

$f_b = \frac{8.66}{24} = 0.361$ K/IN ✓

3/16" WELD CAPACITY: $(3/16)(.707)(21.0) = 2.78$ K/IN ✓

BOLT LOAD



$\frac{11.5}{2}\bar{y}^2 = 2 \times 0.442\left[(1.25-\bar{y}) + (6.75-\bar{y})\right]$

$\bar{y}^2 = 0.154\left[8 - 2\bar{y}\right]$

$(\bar{y} + .154)^2 = 1.256$

$\bar{y} = 0.967$ " ✓

$I = \frac{(11.5)(0.967)^3}{3} + 2 \times .442\left[(1.25-0.967)^2 + (6.75-0.967)^2\right]$

$I = 33.10$ IN⁴ !✓

$T_2 = \frac{(8.66)(6.75-.967)}{33.1} \times 0.442 = 0.67$ K/BOLT ✓

TB MCC 1A, METER PANEL, REACTOR DC PANEL | REF.

$$T_2 = \frac{(.66)(1.25 - 0.567)}{33.1} \times 0.442 = 0.033^{k}/\text{BOLT}$$ ✓

$$2(0.67 + .033) = \tfrac{1}{2}(0.567)(11.5)\, f_p$$

$$f_p = 0.253 \text{ ksi}$$ ✓

DIRECT TENSION $= 0.234/4 = 0.06^{k}/\text{BOLT}$ ✓

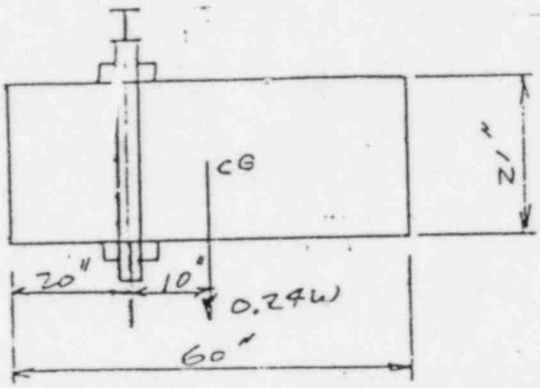
TOTAL BOLT LOAD $= 0.67^{k} + .06 = 0.73^{k}$ ✓

TENSION CAPACITY A325 BOLT - 3/4" φ = 19.4^{k} ✓ — REF: 8TH AISC p 4-3

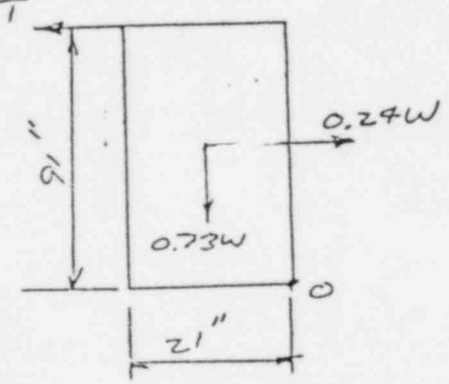
NUCLEAR ENERGY SERVICES

BY ____ DATE ____ PROJ. ____ TASK ____
CHKD. DLS DATE 11/26/82 PAGE 1 OF 4
LACBWR

GENERATOR DC PANEL 5101-063-17 | REF.



PANEL HEIGHT = 91"
ASSUME WT = 4000#



$\Sigma M_O = 0$

$0.24W(91/2) = 0.73W(21/2) + 91T$

$T = \frac{W}{91}(10.92 - 7.67)$

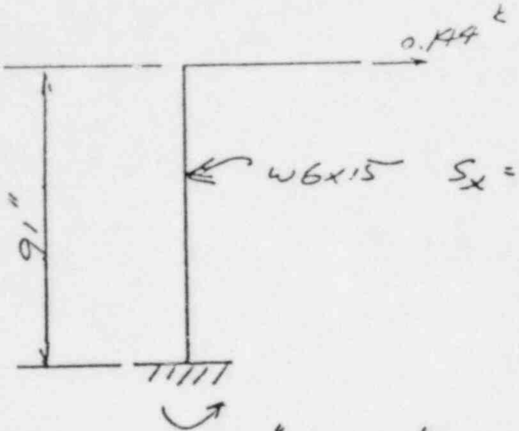
$T = 0.036W = 0.144^k$ ✓

W6x15 $S_y = 3.11\ in^3$ $f_{by} = \frac{1.44}{3.11} = 0.46\ ksi$ ✓

TUBE 3x2x1/4 $S_y = 1.15\ in^3$ $f_{by} = \frac{1.44}{1.15} = 1.25\ ksi$

$M = 0.144^k \times 10" = 1.44"^{-k}$

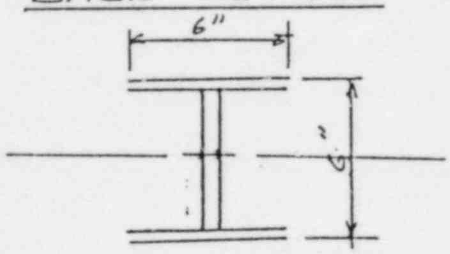
GENERATOR DC PANEL | REF.



$f_{b_x} = \frac{13.1}{9.72} = 1.35$ ksi

$M = 91'' \times 0.144^k = 13.1^{''-k}$

BASE DETAILS - WELD



$A_w = 6 \times 6'' = 36''$ ✓

$S_w = 2(6)(6) + \frac{6^2}{3} = 84\ IN^2$ ✓

$J_w = \frac{2(6)^3 + 6(6)(6)^2 + 6^3}{6} = 324\ IN^3$

MOMENT

$f_1 = \frac{13.1}{84} = 0.16\ ^k/_{IN}$

SHEAR - TORSION $M = 1.44^{''-k}$ $f_h = f_v = \frac{(1.44)(3)}{324} = 0.01\ ^k/_{IN}$ ✓

RESULTANT $= \sqrt{.01^2 + .01^2} = 0.014\ ^k/_{IN}$

WELD RESULTANT $= \sqrt{0.16^2 + 0.014^2} = 0.16\ ^k/_{IN}$ ✓

USE 1/4" WELD CAPACITY $= (1/4)(.707)(21.0) = 3.71\ ^k/_{IN}$

ANCHOR BOLTS

TENSION $T = \frac{13.1^{''-k}}{(2)(7.25)} = 0.90\ ^k$/BOLT ✓

NUCLEAR ENERGY SERVICES

BY ____ DATE ____ PROJ. ____ TASK ____

CHKD. DLS DATE 1/26/82 PAGE 3 OF 4

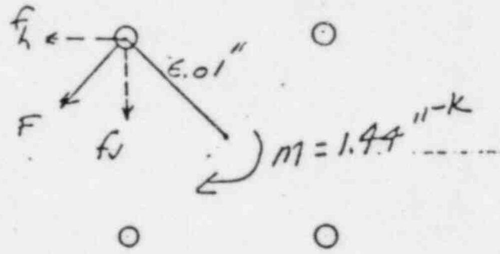
CALCBWR

GENERATOR DC PANEL

SHEAR

HORIZONTAL SHEAR = $\frac{0.144^k}{4} = 0.036^k$/BOLT ✓

TORSION



$F \times 6.01'' = \frac{1.44}{4}$

$F = 0.060^k$ ✓

$f_v = f_h = 0.707 \times 0.060$

$= 0.042^k$ ✓

SHEAR RESULTANT = $\sqrt{(.036+.042)^2 + .042^2} = 0.089^k$/BOLT ✓

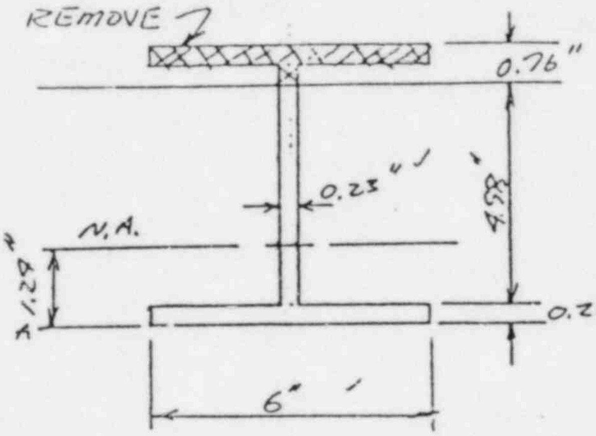
USE 3/4" ⌀ × 6" LONG WEJ-ITS 4" EMBED f'_c = 3500 psi
CATALOG #581

	ULT. CAPACITY	ALLOWABLE (FS=4)
TENSION	19.38^k ✓	4.84^k ✓
SHEAR	19.63^k ✓	4.91^k ✓

$\frac{0.90}{4.84} + \frac{0.089}{4.91} = 0.204 < 1.0$ (O.K) ✓

GENERATOR DC PANEL | REF.

W6x15 - REMOVE FLANGE - DOWN 16" FROM TOP/COLUMN



	A	d	Ad	Ad^2	I_0
FLANGE	(6)(.26) = 1.56	0.13	0.203	0.026	0
WEB	(4.58)(.23) = 1.15	2.75	3.163	8.697	2.367

$\Sigma A = 2.71\ in^2$ $\quad \Sigma Ad = 3.366$ $\quad \Sigma Ad^2 = 8.723$ $\quad \Sigma I_0 = 2.367$

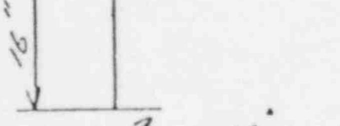
$$y_{CG} = \frac{\Sigma Ad}{\Sigma A} = \frac{3.366}{2.71} = 1.24''$$

$$I_A = \Sigma I_0 + \Sigma Ad^2 = 11.09\ in^4$$

$$I_{CG} = I_A - Ad^2 = 11.09 - (2.71)(1.24)^2 = 6.923\ in^4$$

$$S_{TOP} = \frac{6.923}{4} = 1.731\ in^3$$

$$S_{BOT} = \frac{6.923}{1.24} = 5.583\ in^3$$

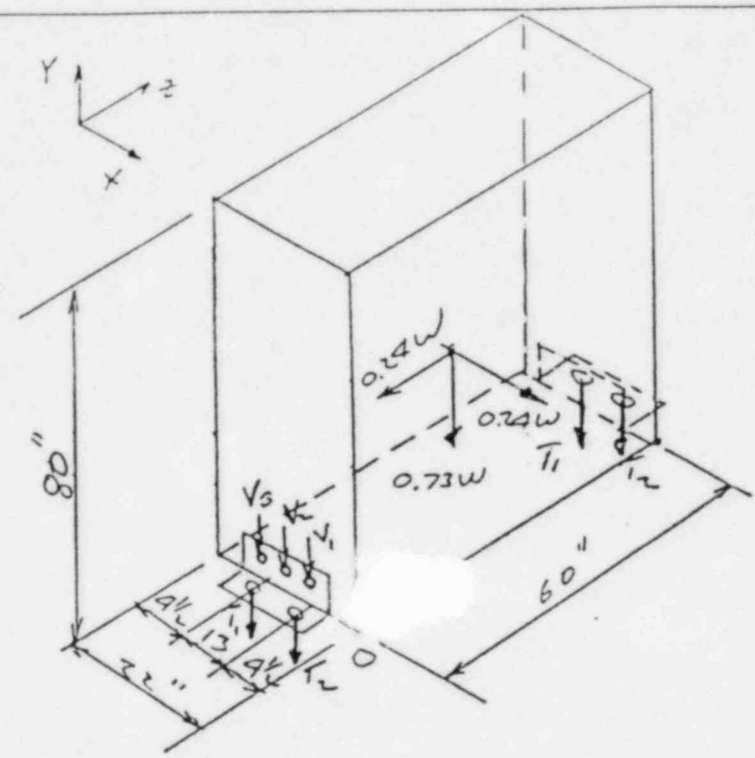


$M = 16'' \times 0.144^k = 2.304^{\text{"-k}}$

$$f_b = \frac{2.304}{1.731} = 1.33\ ksi$$

SCRAM RELAY PANEL SK-5101-063-14

REF.



MEZZANINE FLOOR

HORIZ. ACCEL.: 0.16g × 1.5 = 0.24g

VERT. ACCEL : 0.18g × 1.5 = 0.27g

Z-DIRECTION

$M_{OVERTURNING}$ = 0.24W × 40" = 9.6 W

$M_{RESISTING}$ = 0.73W × 30" = 21.9 W

$F.S. = \frac{21.9W}{9.6W} = 2.28 > 1.5$ NO OVERTURNING
NO BOLTS REQUIRED

X-DIRECTION

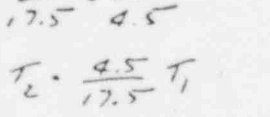
$M_{RESISTING}$ = 0.73W × 11" = 8.03W < 9.6 W ∴ ANCHOR BOLTS REQUIRED

$\Sigma M_0 = 0$ $(.24W)(40") = (0.73W)(11") + 17.5" T_1 \times 2 + 4.5" T_2 \times 2$

$37.31 T_1 = 1.57W$

$T_1 = 0.042 W$

$T_2 = 0.011 W$



$\frac{T_1}{17.5} = \frac{T_2}{4.5}$

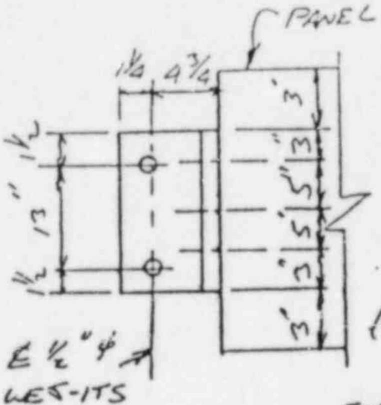
$T_2 = \frac{4.5}{17.5} T_1$

ASSUME W = 3000# T_1 = 126#
T_2 = 33#

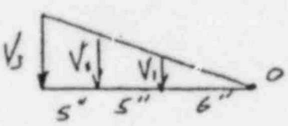
SCRAM RELAY PANEL | REF.

USE E×4×1/4 (5/16) ANGLES, 1/2"φ WEJ-ITS

REVISED 12/6/82 TJS



BOLTS - ANGLE TO PANEL -
(3) 1/2 × 2 1/2" LG GR 5



$\frac{V_3}{16} = \frac{V_2}{11}$ $V_2 = 0.69V_3$

$\frac{V_3}{16} = \frac{V_1}{6}$ $V_1 = 0.38V_3$

$\Sigma M_o = 0$

$(0.24W)(40") = (0.73W)(11") + (2V_1)(6") + (2V_2)(11") + (2V_3)(16")$

$4.56V_3 + 15.18V_3 + 32V_3 = 1.57W$

FOR $W = 3000^{\#}$ $V_3 = 91^{\#}$ $V_2 = 63^{\#}$ $V_1 = 35^{\#}$

$f_v = \frac{.091^k}{0.126} = 0.722$ ksi

CHECK PRYING - $\alpha > 0$ FOR PRYING ACTION | 8TH AISC pg 4-89

$\alpha = [Tb'/m - 1]/\delta > 0$ $Tb'/m - 1 > 0 \Rightarrow Tb' > m$ ✓

$T = 0.126^k$

$b' = 4.5 - .5/2 = 4.25"$

$m = (8)(.375)^2(36)/8 = 3.52$ ~~2.25~~ "-k ✓

$Tb' = (.126)(4.25) = 0.54$ "-k $<$ 3.52 ~~2.25~~ "-k NO PRYING ✓

PLATE BENDING

$S = 1/6\,(8)(.375)^2 = 0.130$ ~~0.0833~~ in^3 ✓

$M = 0.126 \times 4.75" = 0.60$ "-k ✓

$f_b = \frac{0.60}{0.130} = 4.62$ ~~7.18~~ ksi < 27.0 ksi (OK) ✓ | 8TH AISC 1.5.1.4.3

BOLT SHEAR - RSS SHEAR FORCE = $\sqrt{(.24W)^2 + (.24W)^2} = 0.34W$ ✓

FORCE/BOLT = $\frac{0.34 \times 3000^{\#}}{4} = 255^{\#}$ ✓

USE 1/2"φ × 3 1/2 LONG WEJ-IT BOLTS CATALOG #581

2 1/4" EMBED.

$f'_c = 3500$ psi

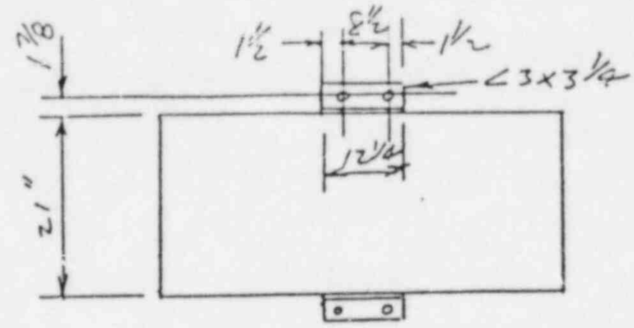
	TENSION	SHEAR
ULT. CAPACITY	5.21^k	9.85^k
ALL. CAPACITY	1.30^k	2.46^k

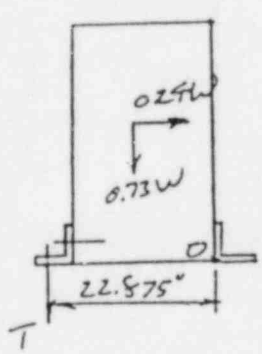
$\frac{0.126}{1.30} + \frac{0.255}{2.46} = 0.20 < 1.0$ (OK) ✓

UNDER VOLTAGE RELAY CABINET SK-5101-063-14 | REF.

PANEL HEIGHT = 91" ASSUME WT = 3000 LBS

USE (4) ½"φ x 3½" LG WEJ-IT ANCHOR BOLTS





$\Sigma M_o = 0$

$(0.24W)(91/2) = (0.73W)(21/2) + 2T(22.875)$ ✓

$T = \frac{3.26W}{45.75} = 0.071W$

$T = 213.8^{\#}/BOLT$ ✓

CHECK PRYING $\alpha > 0$ FOR PRYING ACTION

$\alpha = \left[\frac{Tb'}{m} - 1\right]/\delta > 0 \quad \frac{Tb'}{m} - 1 > 0 \Rightarrow Tb' > m$ 8TH ED AISC PG 4-89

$T = 0.214^k$

$b' = 1.625 - .5/2 = 1.375"$ ✓

$m = (6.125)(0.25)^2(36)/8 = 1.72^{"-k}$ ✓

$Tb' = (0.214)(1.375") = 0.294^{"-k} < 1.72^{"-k}$ NO PRYING ✓

PLATE BENDING

$S = 1/6(6.125)(.25)^2 = 0.064 IN^3$

$m = 0.214^k \times 1.875 = 0.40^{"-k}$

$f_b = 0.40/.064 = 6.27$ ksi $< .75F_y = 27.0$ ksi ✓

UNDERVOLTAGE RELAY CABINET | REF.

ANCHOR BOLT SHEAR

ASSUME BOLTS RESIST SHEAR FORCE FROM ADJACENT PANELS ALSO (W = 6500 #)

TOTAL SHEAR FORCE = (6500 + 3000)(0.24g) = 2.28 k ✓

PERPENDICULAR DIRECTION SHEAR FORCE = (3000)(0.24g) = 0.72 k ✓

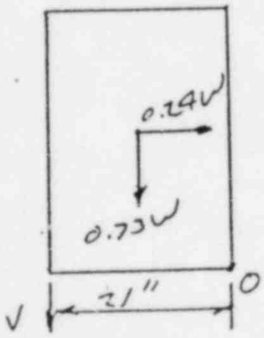
RESULTANT SHEAR = $\sqrt{2.28^2 + .72^2}$ = 2.39 k   0.60 k/BOLT

1/2" x 3 1/2 LG WEJ-ITS   2 1/4" EMBEDMENT f'_c = 3500 psi   CATALOG #981

	ULT CAPACITY	ALLOWABLE (FS=4)
TENSION	5.21 k	1.30 k ✓
SHEAR	9.85 k	2.46 k ✓

$$\frac{0.24^k}{1.30} + \frac{0.60}{2.46} = 0.41 < 1.0$$ ✓

1/2" ø BOLTS ANGLE TO PANEL



$\Sigma M_o = 0$

$(0.24W)(9\tfrac{1}{2}) = (0.73W)(\tfrac{21}{2}) + 2V \times 21"$

$V = \frac{3.26W}{42} = 0.078W$

W = 3000 #   V = 232.5 #/BOLT

$f_v = \frac{.2325^k}{0.126} = 1.85$ ksi ✓

(4)

STATIC PULL TEST SUMMARY SHEETS

REF.

TEST PROCEDURE FOR SAFETY RELATED ELECTRICAL EQUIPMENT

1. CALCULATE WEIGHT OF EQUIPMENT.
2. FIND APPROPRIATE APPLIED REACTION FORCE, GIVEN IN LOAD CHART.
3. LOCATE APPROXIMATE CENTROID OF EQUIPMENT.
4. APPLY APPROPRIATE REACTION FORCE AT CENTROID IN 4 DIRECTION. (TWO HORIZONTAL AND 2 VERTICAL DIRECTIONS) ALONG PERPENDICULAR AXES.
5. CHECK VISUALLY TO SEE IF ANY DAMAGE WAS INCURRED BY THE LOAD.

LOAD CHART
(FOR REACTOR BLDG)

FIGURE	TITLE	APPLIED REACTION LOAD	REF.
G-2	FOUNDATION LEVEL (EL 621-0)	2.16 W	0.88g
G-6	LOWER FLOOR (EL 642'-9")	3.58 W	1.46g
G-10	INTERMEDIATE FLOOR (EL 667'-0")	6.32 W	2.58g
G-14	UPPER FLOOR SPECTRA (EL 701'-0")	10.12 W	4.14g
G-18	CRANE SUPPORT SPECTRA (EL 729'-6")	13.16 W	5.38g
G-22	WATER TANK SPECTRA (EL 745'-0")	14.95 W	6.1g
G-26	REACTOR BASE SUPPORT (EL 640'-0)	4.36 W	1.78g
G-30	REACTOR BOTTOM (EL 650'-0)	5.64 W	2.31g
G-34	REACTOR MIDDLE (EL 670'-0)	4.34 W	1.78g
G-38	REACTOR TOP (EL 684'-0)	7.18 W	2.93g

$$\text{REACTION FORCE} = 1.5\sqrt{F_x^2 + F_y^2 + F_z^2}\ W$$

FACTOR TO ACCOUNT FOR MULTIPLE FREQUENCY = 1.5

$F_x = F_y$

$F_z = \frac{2}{3} F_x$

$$R = 1.5\sqrt{2.66 F_x^2}\ W$$

$$R = 2.45\ F_x\ W$$

F_x = PEAK G VALUE FROM FIGURE

EXAMPLE AT EL 621'-0 FIGURE G-2

PEAK G-VALUE = 0.88 G

$$R = 2.45 \times .88 \times W = 2.16\ W$$

REF.

EXAMPLE PROBLEM

GIVEN:

WEIGHT OF SOLENOID = 5 lbs

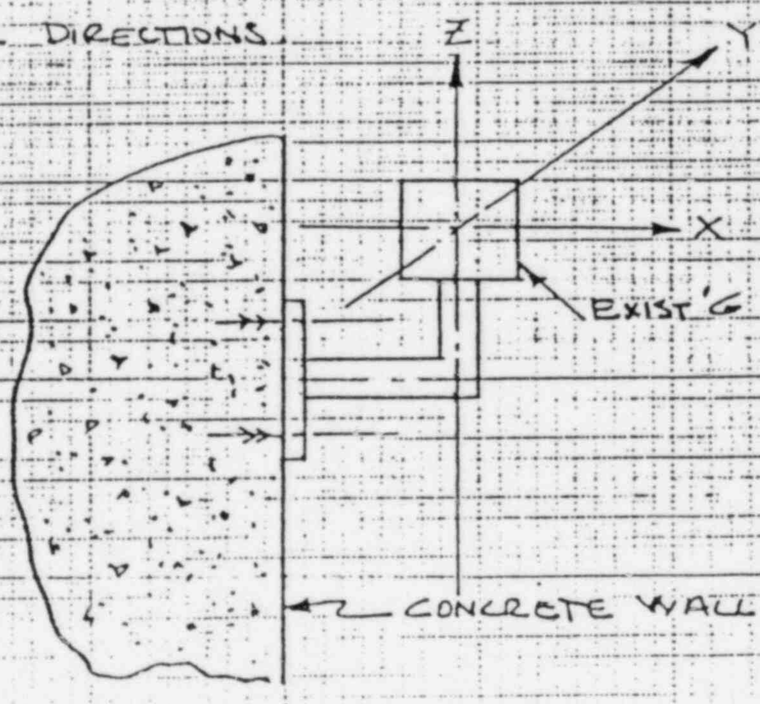
LOCATION: ON WALL EL 701 OF REACTOR BLDG.

USING LOAD CHART FOR EL 701 SPECTRA G-14

REACTION FORCE = 10.12 W

$R = 10.12 \times 5 = 50.6^{\#}$

GO TO TEST PROCEDURE AND APPLY REACTION FORCE IN FOUR DIRECTIONS.



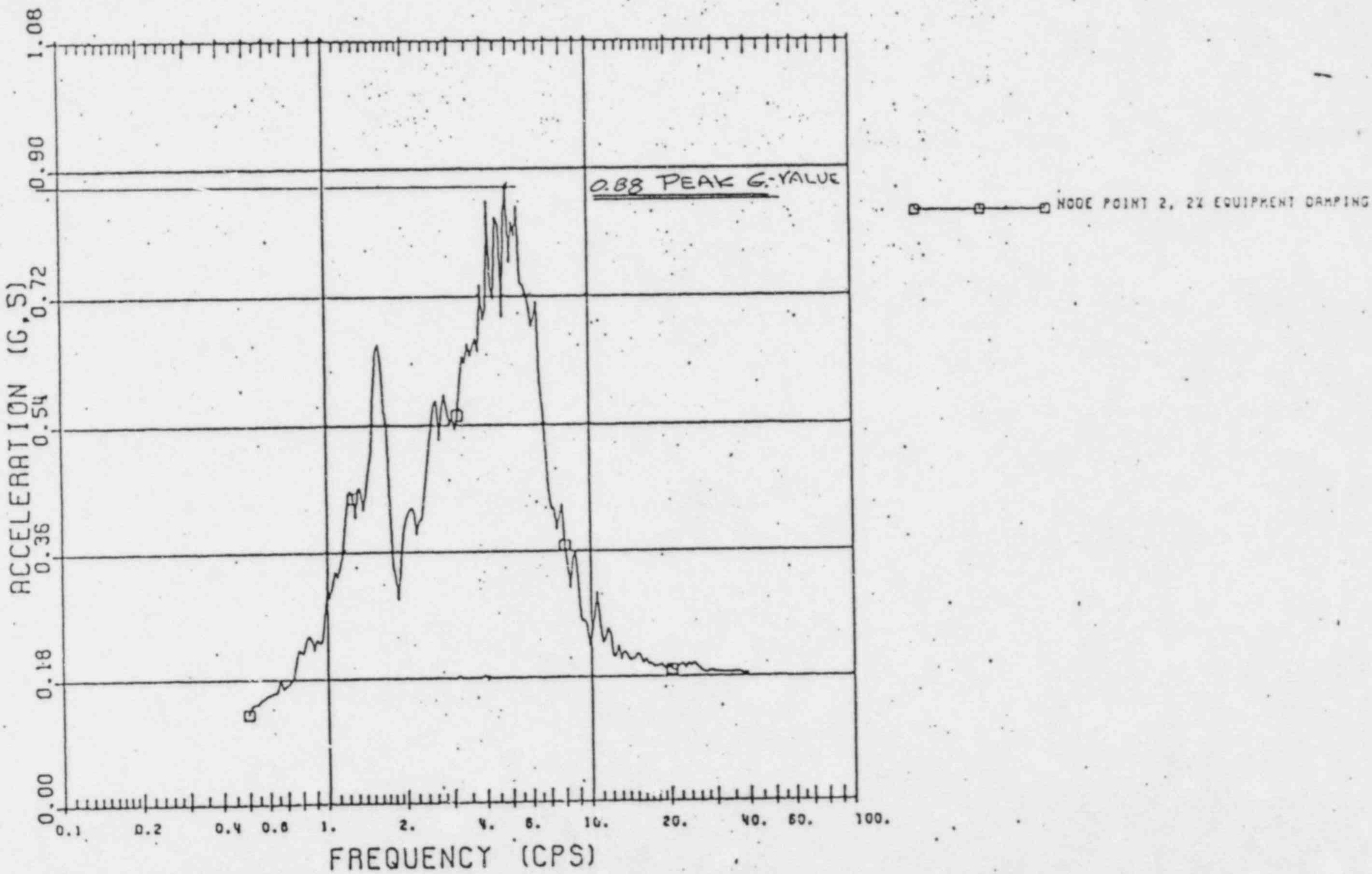


FIG. G.2 — FOUNDATION LEVEL SPECTRA, SSE SEISMIC INPUT (EL 621')

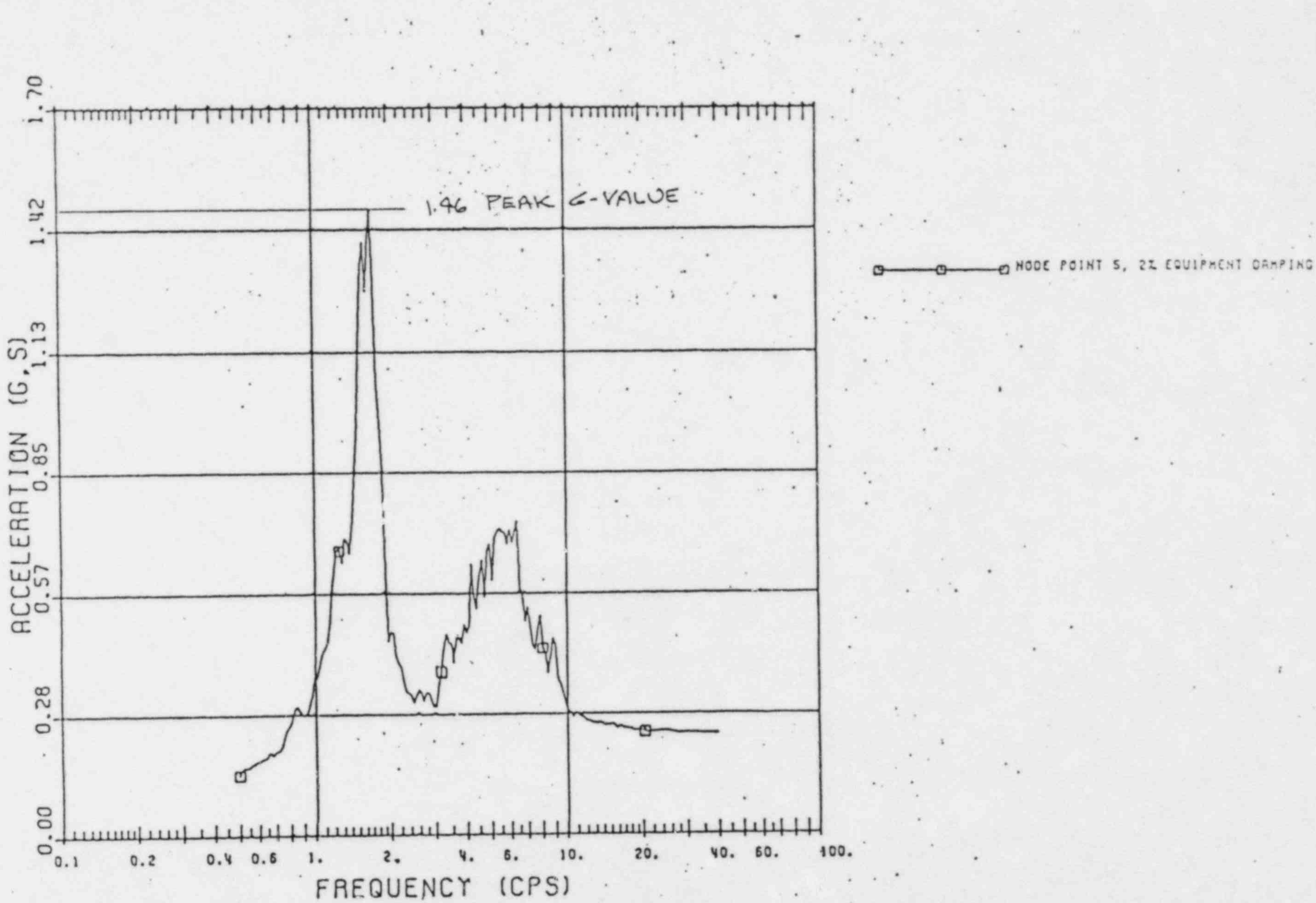


FIG.G.6 — LOWER FLOOR SPECTRA, SSE SEISMIC INPUT (EL 642'-9")

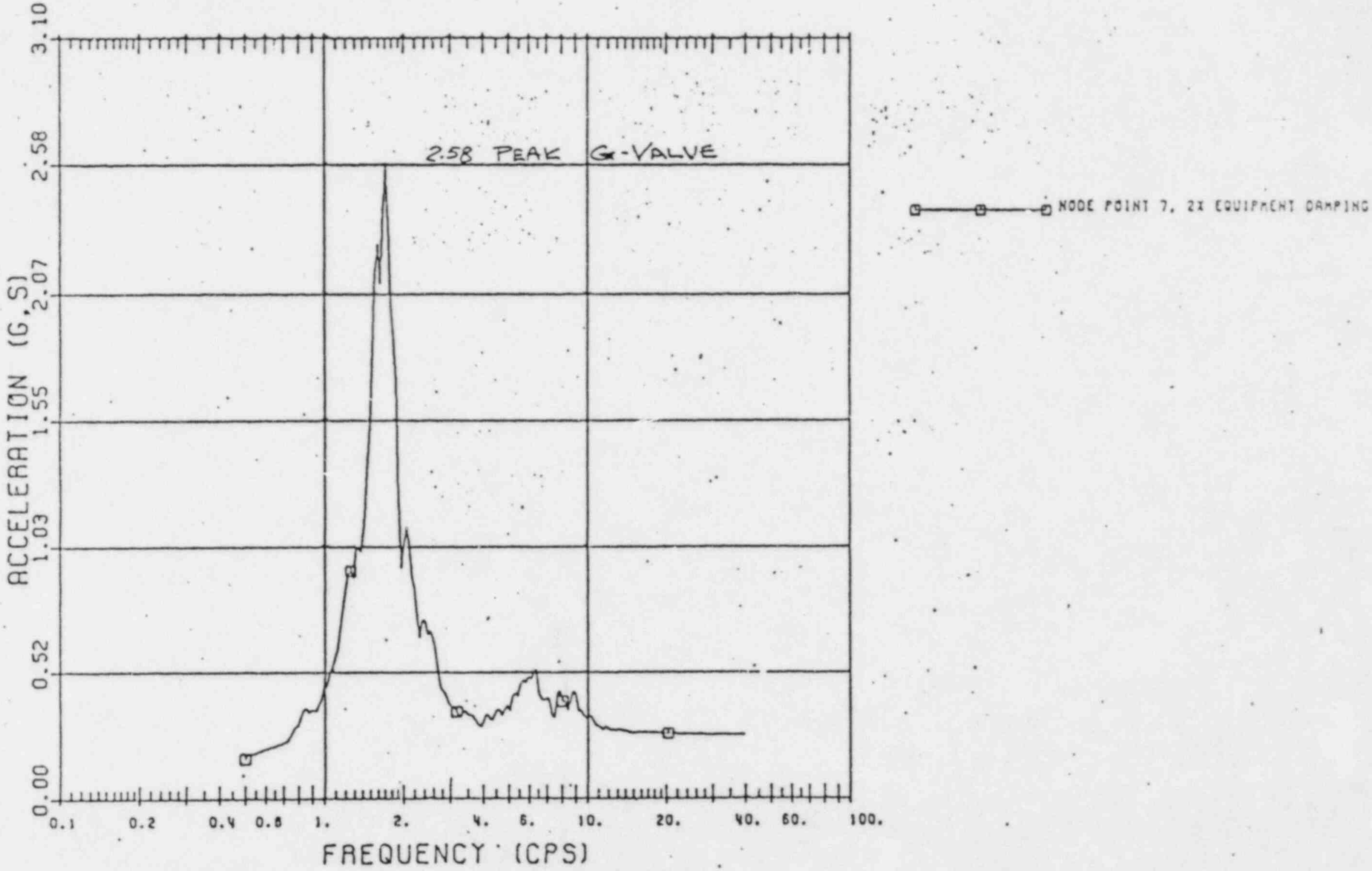


FIG. G.10 – INTERMEDIATE FLOOR SPECTRA, SSE SEISMIC INPUT (EL 667')

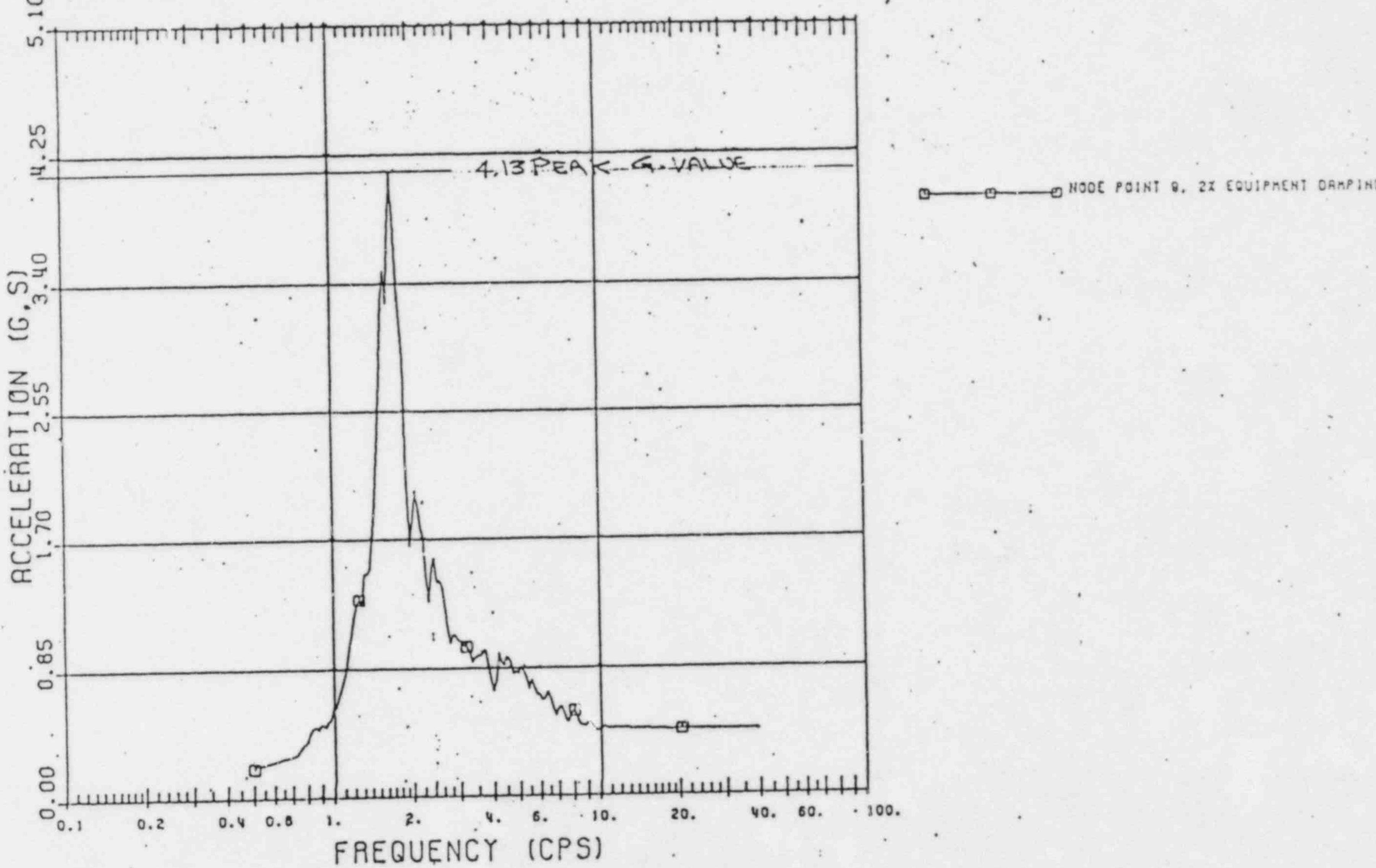


FIG. G.14 — UPPER FLOOR SPECTRA, SSE SEISMIC INPUT (EL 701')

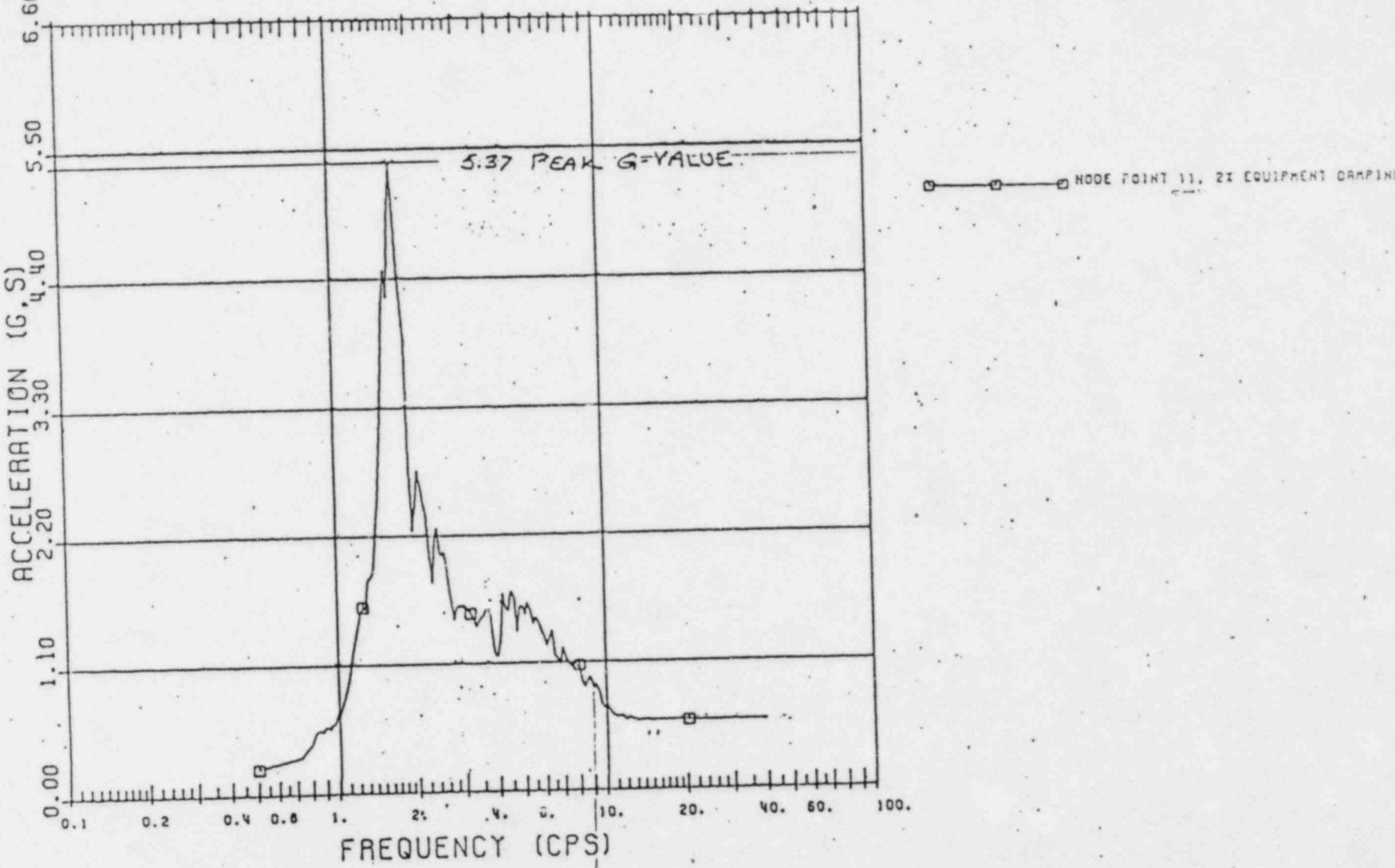


FIG. G.18 — CRANE SUPPORT SPECTRA, SSE SEISMIC INPUT (EL 729'-6")

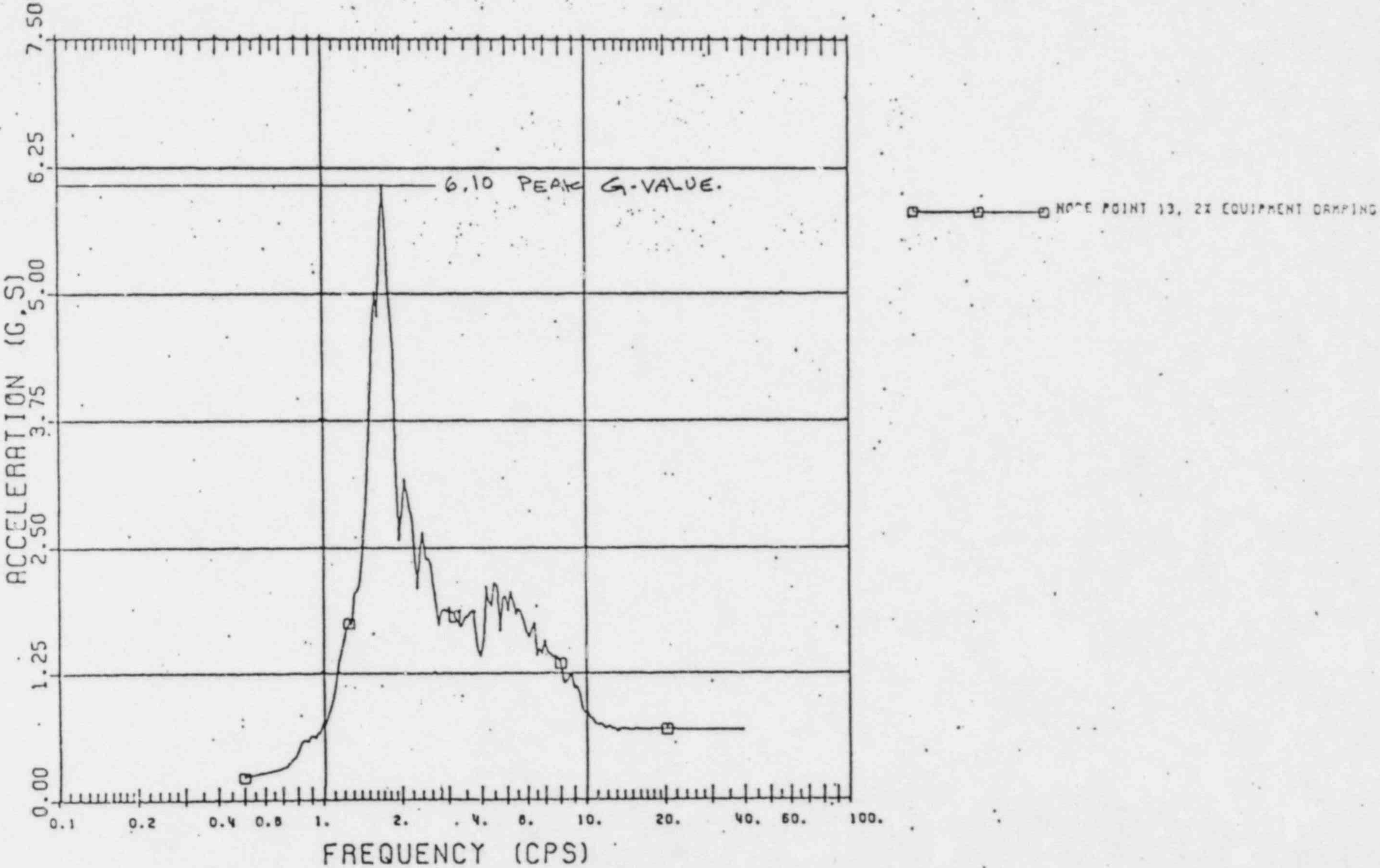


FIG. G.22 – WATER TANK SPECTRA, SSE SEISMIC INPUT (EL 745)

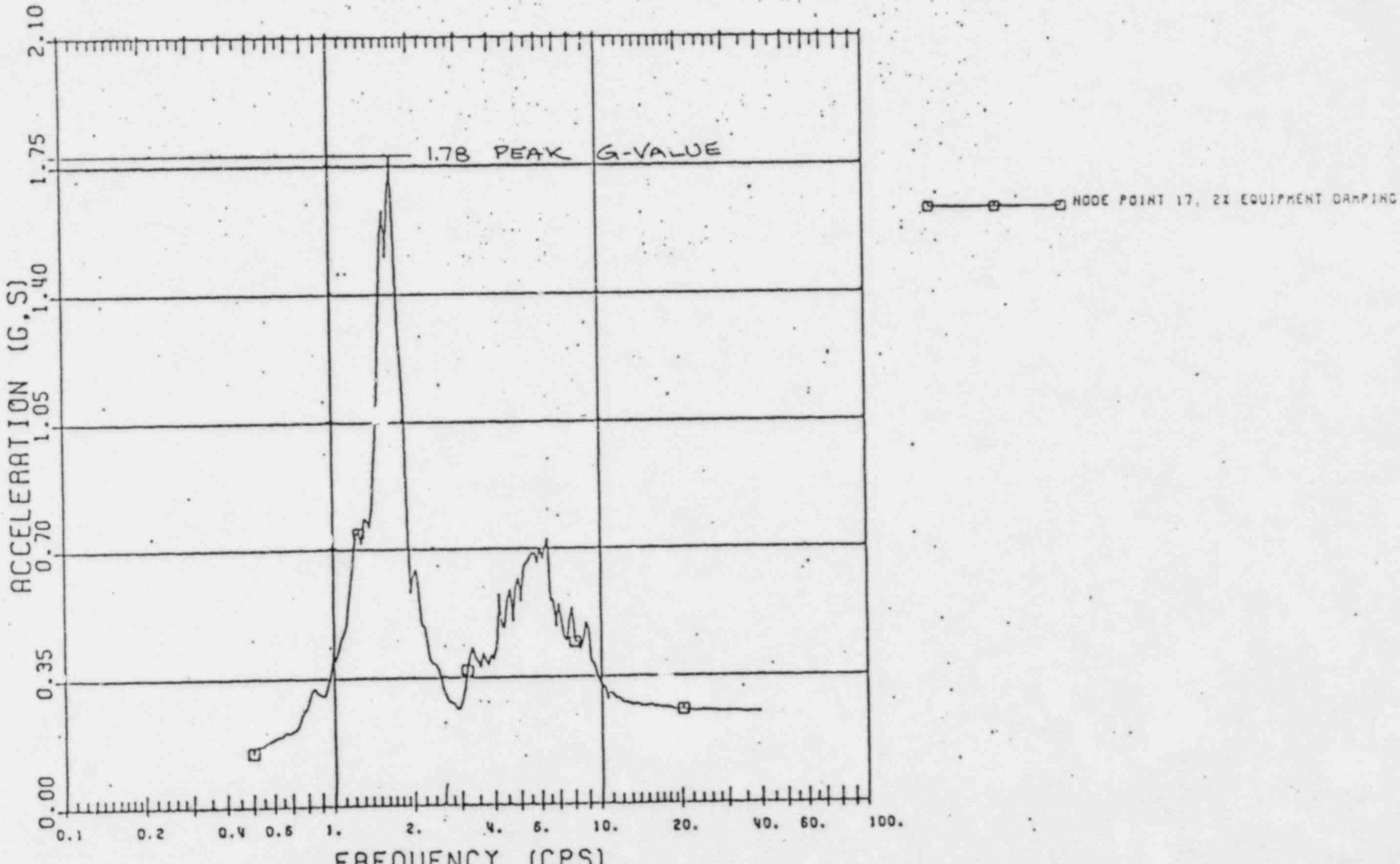


FIG.G.26 — REACTOR BASE SUPPORT SPECTRA, SSE SEISMIC INPUT (EL 648')

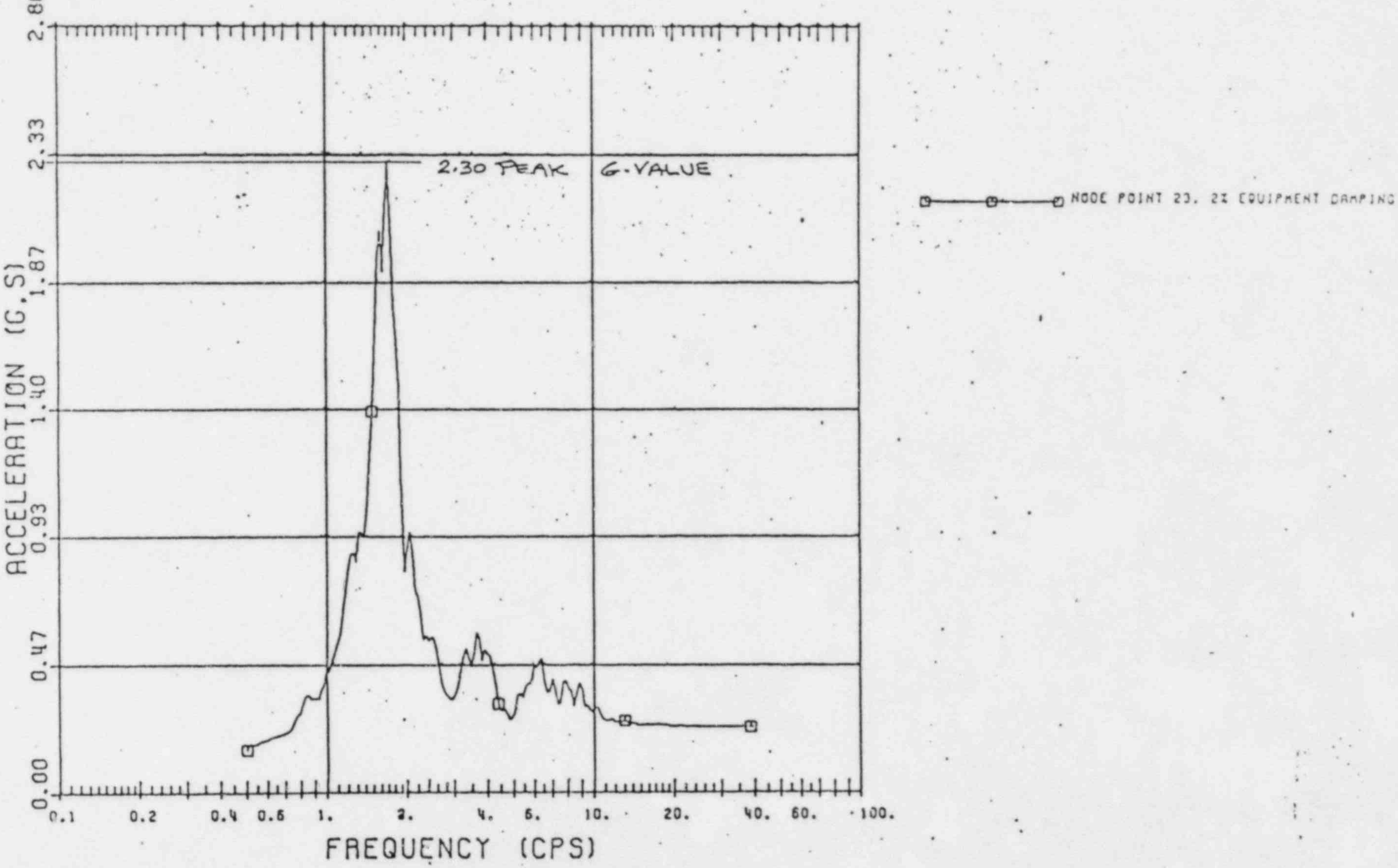


FIG. G.30 — REACTOR BOTTOM SPECTRA, SSE SEISMIC INPUT (EL 650')

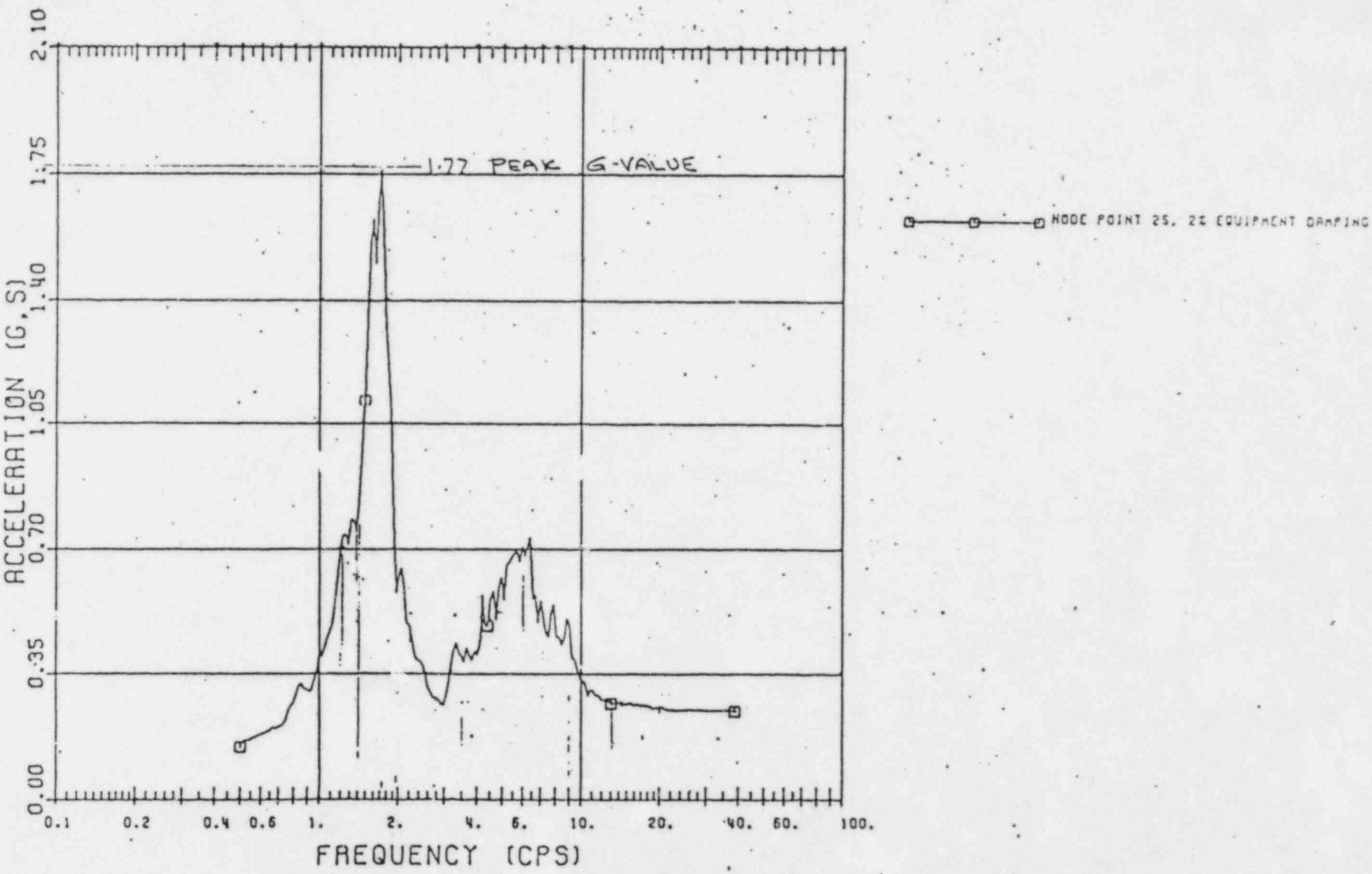


FIG.G.34 — REACTOR MIDDLE SPECTRA, SSE SEISMIC INPUT (EL 668')

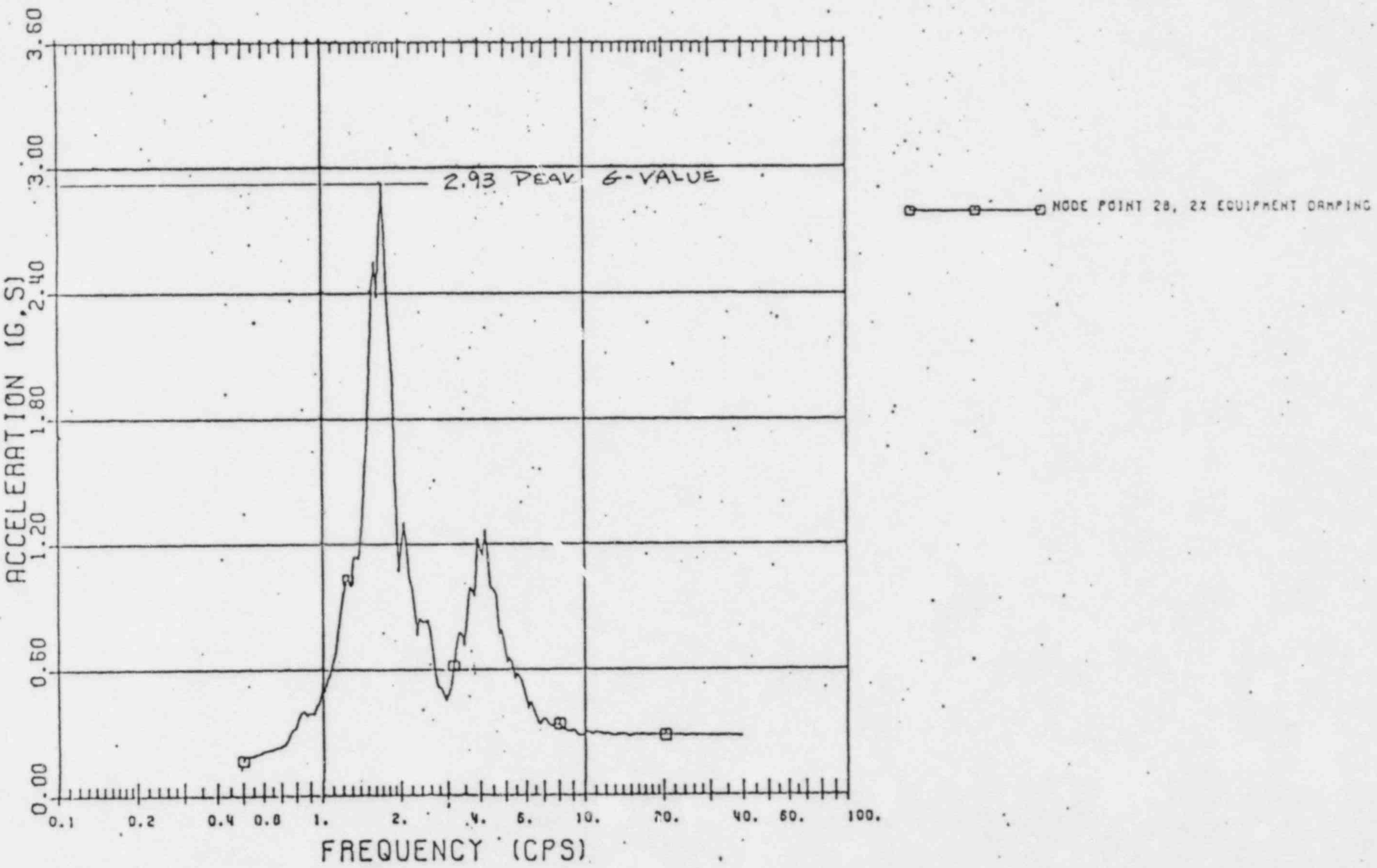


FIG.G.38 – REACTOR TOP SPECTRA, SSE SEISMIC INPUT (EL 685')

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING PRESSURE TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 37-35-301

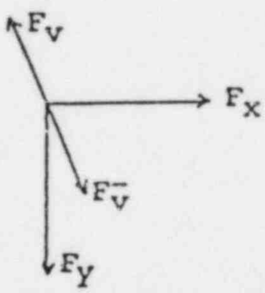
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PIPE TUNNEL 629'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 32 lbs.



$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Actual	Yield or Deformed
F_x =	22.7	60	No
F_y =	22.7	60	No
F_v =	15.0	45	No
$F_{\bar{v}}$ =	15.0	45	No

PERFORMED BY ______ APPROVED BY ______

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING PRESSURE TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 37-35-302

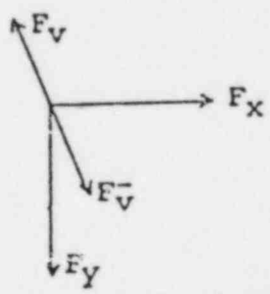
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PIPE TUNNEL 629'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 32 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\, F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	22.7	60	No
F_Y =	22.7	60	No
F_V =	15.0	45	No
$F_{\bar{V}}$ =	15.0	45	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING LEVEL TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 37-42-301

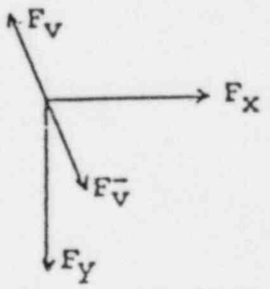
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PIPE TUNNEL 629'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 32 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	22.7	60	No
F_Y =	22.7	60	No
F_V =	15.0	45	No
$F_{\bar{V}}$ =	15.0	45	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING LEVEL TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 37-42-302

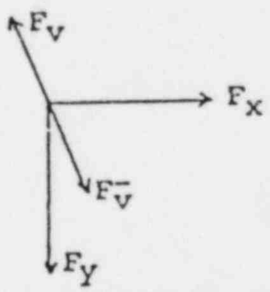
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PIPE TUNNEL 629'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 32 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	22.7	60	No
F_Y =	22.7	60	No
F_V =	15.0	45	No
$F_{\bar{V}}$ =	15.0	45	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING PRESSURE SWITCH

EQUIPMENT IDENTIFICATION NO. 37-35-701

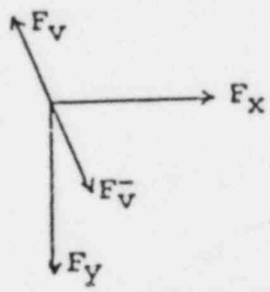
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PENETRATION ROOM 640'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 2.5 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	1.775	10	No
F_Y =	1.775	10	No
F_V =	1.18	10	No
$F_{\bar{V}}$ =	1.18	10	No

PERFORMED BY ____ APPROVED BY ____

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING PRESSURE SWITCHES

EQUIPMENT IDENTIFICATION NO. 37-35-703

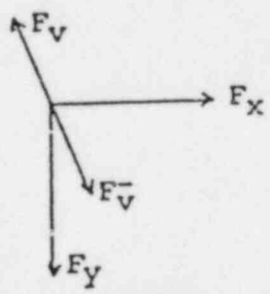
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PENETRATION ROOM 640'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 2.5 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	1.775	10	No
F_Y =	1.775	10	No
F_V =	1.18	10	No
$F_{\bar{V}}$ =	1.18	10	No

PERFORMED BY ________ APPROVED BY ________

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT BUILDING PRESSURE SWITCH

EQUIPMENT IDENTIFICATION NO. 37-35- 702

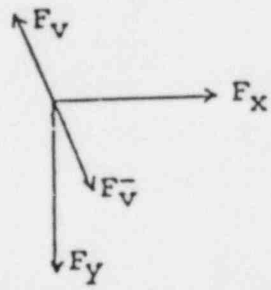
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PENETRATION ROOM 640'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 2.5 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	1.775	10	No
F_Y =	1.775	10	No
F_V =	1.18	10	No
$F_{\bar{V}}$ =	1.18	10	No

PERFORMED BY *Robert L. Odegard* APPROVED BY *[signature]*

DATE MAY 28, 1981

EQUIPMENT NOMENCLATURE 1A POWER TO FLOW TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 50-37-301

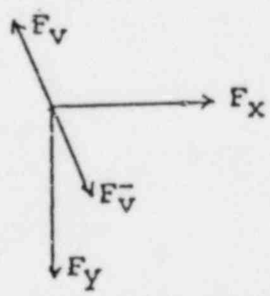
LOCATION:

BUILDING CONTAINMENT

ELEVATION 633'

PEAK G LEVEL 1.15 g. Ref. 3

MASS OF EQUIPMENT 28 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	78.7	79	No
F_Y =	78.7	79	No
F_V =	52.5	59	No
$F_{\bar{V}}$ =	52.5	59	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 28, 1981

EQUIPMENT NOMENCLATURE 2A POWER TO FLOW TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 50-37-302

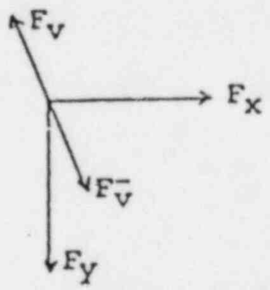
LOCATION:

BUILDING CONTAINMENT

ELEVATION 633'

PEAK G LEVEL 1.15 g. Ref. 3

MASS OF EQUIPMENT 28 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

		Applied Force		
		Required	Actual	Yield or Deformed
F_X	=	78.7	79	No
F_Y	=	78.7	79	No
F_V	=	52.5	59	No
$F_{\bar{V}}$	=	52.5	59	No

PERFORMED BY *[signature]* APPROVED BY *[signature]*

DATE MAY 28, 1981

EQUIPMENT NOMENCLATURE 2B POWER TO FLOW TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 50-37-303

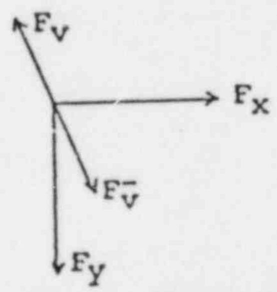
LOCATION:

BUILDING CONTAINMENT

ELEVATION 633'

PEAK G LEVEL 1.15 g. Ref. 3

MASS OF EQUIPMENT 28 lbs.



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Actual	Yield or Deformed
F_x =	78.7	79	No
F_y =	73.7	79	No
F_v =	52.5	59	No
$F_{\bar{v}}$ =	52.5	59	No

PERFORMED BY APPROVED BY

DATE MAY 28, 1981

EQUIPMENT NOMENCLATURE 1B POWER TO FLOW TRANSMITTER

EQUIPMENT IDENTIFICATION NO. 50-37-304

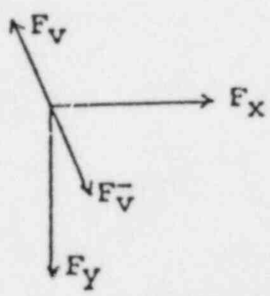
LOCATION:

BUILDING CONTAINMENT

ELEVATION 633'

PEAK G LEVEL 1.15 g. Ref. 3

MASS OF EQUIPMENT 28 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	78.7	79	No
F_Y =	78.7	79	No
F_V =	52.5	59	No
$F_{\bar{V}}$ =	52.5	59	No

PERFORMED BY ____________ APPROVED BY ____________

DATE 7/22/82

EQUIPMENT NOMENCLATURE EMERGENCY CORE SPRAY (HIGH PRESSURE) ~~LPCS INLET VALVE SOLENOID~~

EQUIPMENT IDENTIFICATION NO. 53-25-005

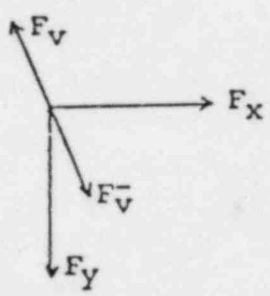
LOCATION:

BUILDING CONTAINMENT

ELEVATION 677'

PEAK G LEVEL 3.237 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Actual	Yield or Deformed
F_X =	31.7	40	No
F_Y =	31.7	40	No
F_V =	21.1	30	No
$F_{\bar{V}}$ =	21.1	30	No

PERFORMED BY *George Miles* APPROVED BY *[signature]*

DATE 7/22/82

EQUIPMENT NOMENCLATURE EMERGENCY CORE SPRAY (HIGH PRESSURE)

EQUIPMENT IDENTIFICATION NO. 53-25-006

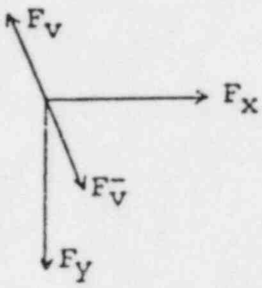
LOCATION:

BUILDING CONTAINMENT

ELEVATION 677'

PEAK G LEVEL 3.237g. ref. 3

MASS OF EQUIPMENT 7 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	35.4	75	No
F_Y =	55.4	75	No
F_V =	36.9	55	No
$F_{\bar{V}}$ =	36.9	55	No

PERFORMED BY George Miles APPROVED BY [illegible]

DATE 7/22/82

EQUIPMENT NOMENCLATURE VENT & GASEOUS WASTE

EQUIPMENT IDENTIFICATION NO. 55-25-013

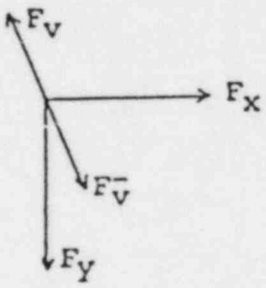
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 2.017 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force		
	Required	Actual	Yield or Deformed
F_X =	19.7	30	No
F_Y =	19.7	30	No
F_V =	13.2	30	No
$F_{\bar{V}}$ =	13.2	30	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE MAY 27, 1981

EQUIPMENT NOMENCLATURE OFFGAS VENT HEADER SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 55-25-014

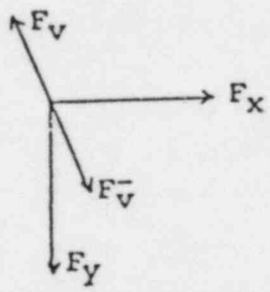
LOCATION:

BUILDING TURBINE BUILDING

ELEVATION PIPE TUNNEL 635'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 6 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	4.26	20	No
F_Y =	4.26	20	No
F_V =	2.8	20	No
$F_{\bar{V}}$ =	2.8	20	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE VENT & GASEOUS WASTE

EQUIPMENT IDENTIFICATION NO. 55-25-022

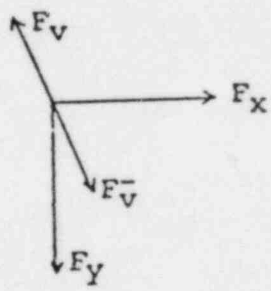
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 2.017 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	19.7	30	No
F_Y =	19.7	30	No
F_V =	13.2	30	No
$F_{\bar{V}}$ =	13.2	30	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE DECAY HEAT REMOVAL

EQUIPMENT IDENTIFICATION NO. 56-25-002

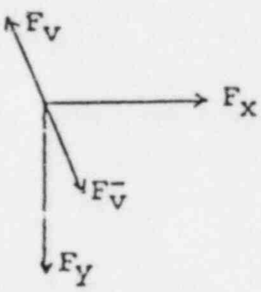
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.596 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	27.3	30	No
F_Y =	27.3	30	No
F_V =	18.2	30	No
$F_{\bar{V}}$ =	18.2	30	No

PERFORMED BY *George Miles* APPROVED BY *R. Brenier*

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE MSIV SOLENOID

EQUIPMENT IDENTIFICATION NO. 61-22-005(B)

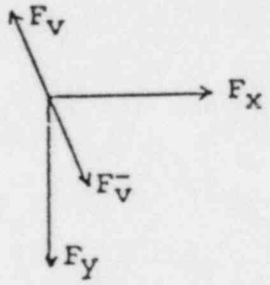
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.70g. ref. 3

MASS OF EQUIPMENT 6 POUNDS



$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{v}} = F_v = 2/3\ F_x$

	Applied Force Required	Actual	Yield or Deformed
F_x =	24.9	25	No
F_y =	24.9	25	No
F_v =	16.6	20	No
$F_{\bar{v}}$ =	16.6	20	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE JULY 22, 1982

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO. 62-25-006

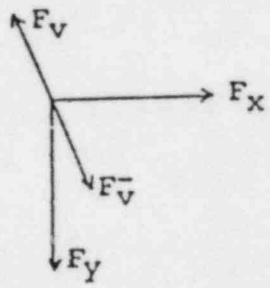
LOCATION:

BUILDING CONTAINMENT

ELEVATION 725'

PEAK G LEVEL 5.258 g. ref. 2

MASS OF EQUIPMENT 6.25 lbs.



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Actual	Yield or Deformed
F_x =	80.3	85	No
F_y =	80.3	85	No
F_v =	53.6	70	No
$F_{\bar{v}}$ =	53.6	70	No

PERFORMED BY George Miles APPROVED BY [illegible]

DATE 7/22/82

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO 62-25-007

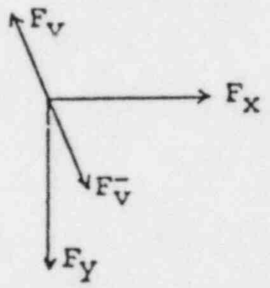
LOCATION:

BUILDING CONTAINMENT

ELEVATION 716'

PEAK G LEVEL 4.879 ref 2

MASS OF EQUIPMENT 7 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Actual	Yield or Deformed
$F_X =$	83.5	90	No
$F_Y =$	83.5	90	No
$F_V =$	55.7	60	No
$F_{\bar{V}} =$	55.7	60	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO. 62-25-008

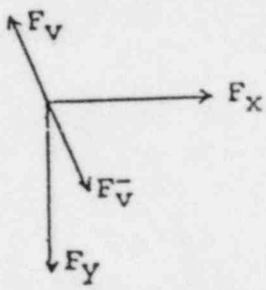
LOCATION:

BUILDING CONTAINMENT

ELEVATION 716'

PEAK G LEVEL 4.879 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_x =	83.5	90	No
F_y =	83.5	90	No
F_v =	55.7	60	No
$F_{\bar{v}}$ =	55.7	60	No

PERFORMED BY George Miles APPROVED BY R. Bierman

DATE JULY 22, 1982

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO. 62-25-009

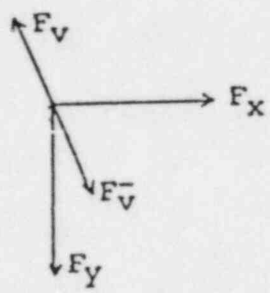
LOCATION:

BUILDING CONTAINMENT

ELEVATION 725'

PEAK G LEVEL 5.258 g. ref. 2

MASS OF EQUIPMENT 6.25 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	80.3	85	No
F_Y =	80.3	85	No
F_V =	53.6	70	No
$F_{\bar{V}}$ =	53.6	70	No

PERFORMED BY *George Miles* APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO. 62-25-010

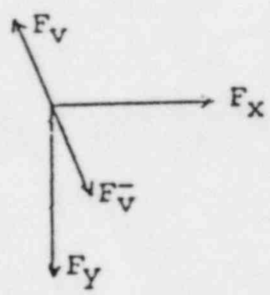
LOCATION:

BUILDING CONTAINMENT

ELEVATION 716'

PEAK G LEVEL 4.879 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	83.5	90	No
F_Y =	83.5	90	No
F_V =	55.7	60	No
$F_{\bar{V}}$ =	55.7	60	No

PERFORMED BY George Milo APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO. 62-25-015

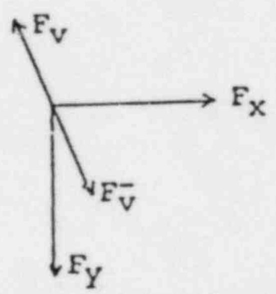
LOCATION:

BUILDING CONTAINMENT

ELEVATION 719'

PEAK G LEVEL 5.005 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	48.9	90	No
F_Y =	48.9	90	No
F_V =	32.6	60	No
$F_{\bar{V}}$ =	32.6	60	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE SHUTDOWN CONDENSER

EQUIPMENT IDENTIFICATION NO. 62-25-016

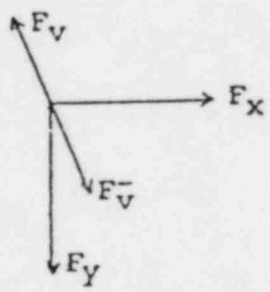
LOCATION:

BUILDING CONTAINMENT

ELEVATION 719'

PEAK G LEVEL 5.005 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	85.7	90	No
F_Y =	85.7	90	No
F_V =	57.1	60	No
$F_{\bar{V}}$ =	57.1	60	No

PERFORMED BY George Mile APPROVED BY R. Brimer

DATE 7/22/82

EQUIPMENT NOMENCLATURE MAIN STEAM (BYPASS VALVE)

EQUIPMENT IDENTIFICATION NO. 64-25-002

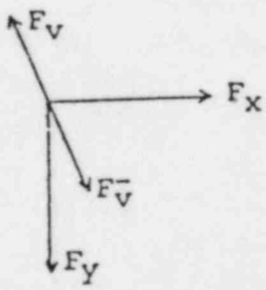
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.596 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_V^- = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	27.3	30	No
F_Y =	27.3	30	No
F_V =	18.2	30	No
F_V^- =	18.2	30	No

PERFORMED BY *Georg Miles* APPROVED BY [illegible signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE MAIN STEAM (BYPASS VALVE)

EQUIPMENT IDENTIFICATION NO. 64-25-003

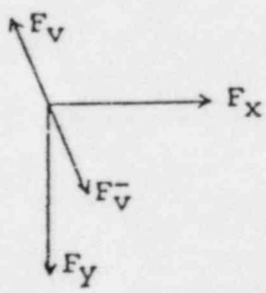
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.596 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	27.3	30	No
F_Y =	27.3	30	No
F_V =	18.2	30	No
$F_{\bar{V}}$ =	18.2	30	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE DEMINERALIZED WATER

EQUIPMENT IDENTIFICATION NO. 67-25-002

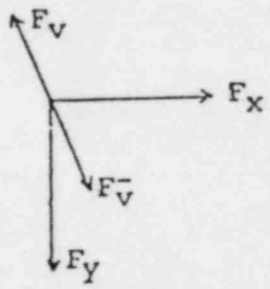
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.596 g. ref. 2

MASS OF EQUIPMENT 7 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_V^- = F_V = 2/3\ F_X$

	Applied Force		
	Required	Actual	Yield or Deformed
F_X =	27.3	30	No
F_Y =	27.3	30	No
F_V =	18.2	30	No
F_V^- =	18.2	30	No

PERFORMED BY George Miles APPROVED BY [illegible]

DATE 7/22/82

EQUIPMENT NOMENCLATURE DEMINERALIZED WATER

EQUIPMENT IDENTIFICATION NO. 67-25-003

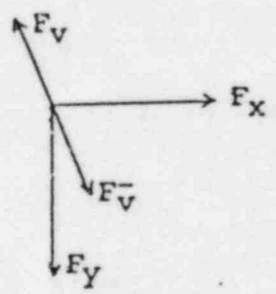
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.2 g Ref. 3

MASS OF EQUIPMENT 7 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	20.5	30	No
F_Y =	20.5	30	No
F_V =	13.7	30	No
$F_{\bar{V}}$ =	13.7	30	No

PERFORMED BY George Miles APPROVED BY [illegible]

DATE 7/22/82

EQUIPMENT NOMENCLATURE OVERHEAD STORAGE TANK (OHST)

EQUIPMENT IDENTIFICATION NO. 69-25-002

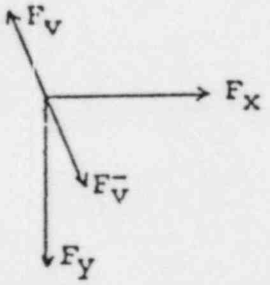
LOCATION:

BUILDING CONTAINMENT

ELEVATION 706'

PEAK G LEVEL 4.458 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{v}} = F_v = 2/3\ F_x$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_x =	43.6	60	No
F_y =	43.6	60	No
F_v =	29.1	40	No
$F_{\bar{v}}$ =	29.1	40	No

PERFORMED BY George Miles APPROVED BY D. Bennier

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-003

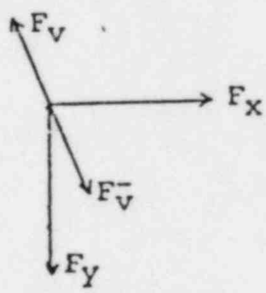
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7g. ref. 3

MASS OF EQUIPMENT 6.25 POUNDS



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	26.0	30	No
F_Y =	26.0	30	No
F_V =	17.3	20	No
$F_{\bar{V}}$ =	17.3	20	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-004

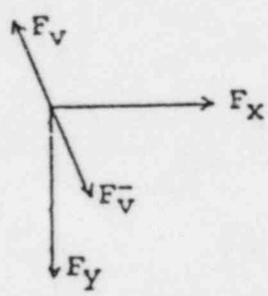
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.70g. ref. 3

MASS OF EQUIPMENT 6.25 POUNDS



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

		Applied Force Required	Actual	Yield or Deformed
F_x	=	26.0	30	No
F_y	=	26.0	30	No
F_v	=	17.3	20	No
$F_{\bar{v}}$	=	17.3	20	No

PERFORMED BY *Robert L D [signature]* APPROVED BY *[signature]*

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-007

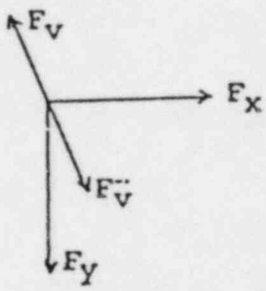
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7 g. Ref. 3

MASS OF EQUIPMENT 6.25 lbs.



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Actual	Yield or Deformed
F_x =	25.9	29	No
F_y =	25.9	29	No
F_v =	17.3	24	No
$F_{\bar{v}}$ =	17.3	24	No

PERFORMED BY APPROVED BY

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-008

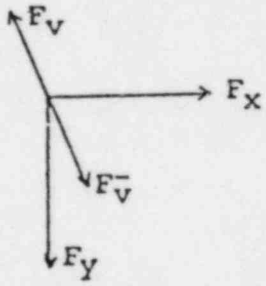
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.70g. ref. 3

MASS OF EQUIPMENT 6.25 POUNDS



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	26.0	30	No
F_Y =	26.0	30	No
F_V =	17.3	20	No
$F_{\bar{V}}$ =	17.3	20	No

PERFORMED BY *Robert L. Odegard* APPROVED BY *[signature]*

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-016

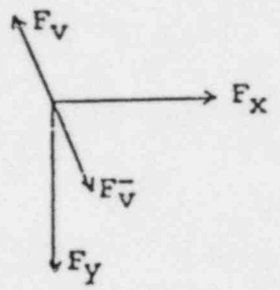
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 170g. ref. 3

MASS OF EQUIPMENT 6.25 POUNDS



$$F_x = F_y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force		
	Required	Actual	Yield or Deformed
F_x =	26.0	30	No
F_y =	26.0	30	No
F_v =	17.3	20	No
$F_{\bar{v}}$ =	17.3	20	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-017

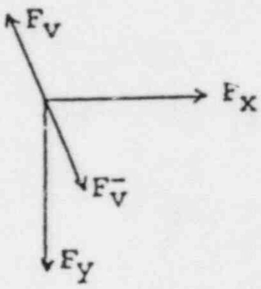
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.70g. ref. 3

MASS OF EQUIPMENT 6.25 POUNDS



$$F_x = F_y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_x =	26.0	30	No
F_y =	26.0	30	No
F_v =	17.3	20	No
$F_{\bar{v}}$ =	17.3	20	No

PERFORMED BY *Robert L. Odegard* APPROVED BY *[signature]*

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-018

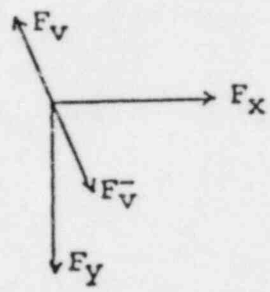
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7 g. Ref. 3

MASS OF EQUIPMENT 6.25 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5):$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	25.9	29	No
F_Y =	25.9	29	No
F_V =	17.3	24	No
$F_{\bar{V}}$ =	17.3	24	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION SOLENOID VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-019

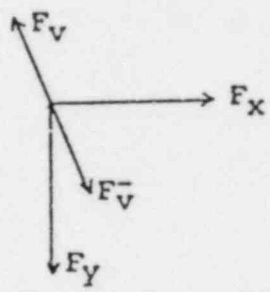
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.70g. ref. 3

MASS OF EQUIPMENT 6.25 POUNDS



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	26.0	30	No
F_Y =	26.0	30	No
F_V =	17.3	20	No
$F_{\bar{V}}$ =	17.3	20	No

PERFORMED BY APPROVED BY

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION INLET VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-001 used with 73-25-003 & -016

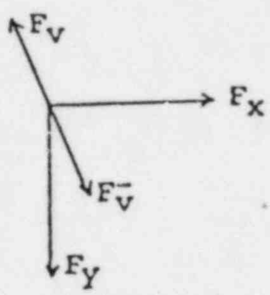
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7 g. Ref. 3

MASS OF EQUIPMENT 12.5 lbs. (SOV's)



$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_x$

	Applied Force Required	Actual	Yield or Deformed
F_x =	51.9	54	No
F_y =	51.9	54	No
F_V =	34.6	39	No
$F_{\bar{V}}$ =	34.6	39	No

PERFORMED BY Robert L. O'Dazod APPROVED BY C. Kime

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION EXHAUST VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-005 used with 73-25-007 & -018

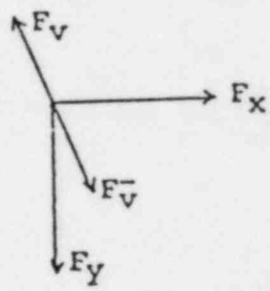
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7 g. Ref. 3

MASS OF EQUIPMENT 12.5 lbs. (SOV's)



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	51.9	54	No
F_Y =	51.9	54	No
F_V =	34.6	39	No
$F_{\bar{V}}$ =	34.6	39	No

PERFORMED BY APPROVED BY

DATE MAY 22, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION INLET VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-002 used with 73-25-004 & -017

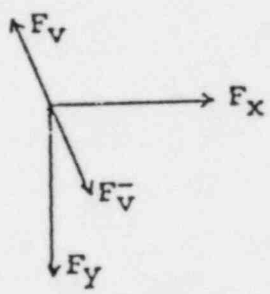
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7 g. Ref. 2

MASS OF EQUIPMENT 12.5 lbs. (SOV's)



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	51.9	54	No
F_Y =	51.9	54	No
F_V =	34.6	39	No
$F_{\bar{V}}$ =	34.6	39	No

PERFORMED BY APPROVED BY

DATE MAY 26, 1981

EQUIPMENT NOMENCLATURE CONTAINMENT VENTILATION EXHAUST VALVE

EQUIPMENT IDENTIFICATION NO. 73-25-006 used with 73-25-008 & -019

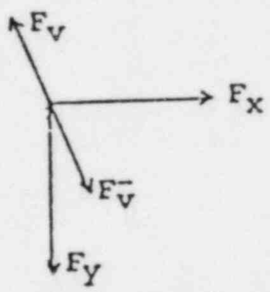
LOCATION:

BUILDING CONTAINMENT

ELEVATION 648'

PEAK G LEVEL 1.7 g. Ref. 3

MASS OF EQUIPMENT 12.5 lbs. (SOV's)



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	51.9	54	No
F_Y =	51.9	54	No
F_V =	34.6	54	No
$F_{\bar{V}}$ =	34.6	54	No

PERFORMED BY [signature] APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE HIGH PRESSURE SERVICE WATER (HPSW)

EQUIPMENT IDENTIFICATION NO. 75-25-003

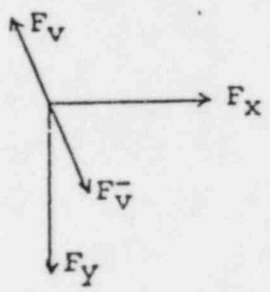
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.596 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Actual	Yield or Deformed
F_X =	15.6	30	No
F_Y =	15.6	30	No
F_V =	10.4	30	No
$F_{\bar{V}}$ =	10.4	30	No

PERFORMED BY George Mile APPROVED BY [signature]

DATE 7/22/82

EQUIPMENT NOMENCLATURE HIGH PRESSURE SERVICE WATER (HPSW)

EQUIPMENT IDENTIFICATION NO. 75-25-004

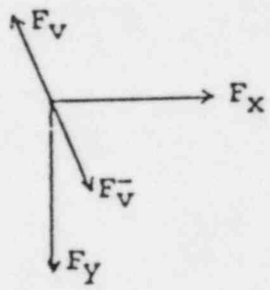
LOCATION:

BUILDING CONTAINMENT

ELEVATION 638'

PEAK G LEVEL 1.596 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	15.6	30	No
F_Y =	15.6	30	No
F_V =	10.4	30	No
$F_{\bar{V}}$ =	10.4	30	No

PERFORMED BY George Miles APPROVED BY R. [illegible]

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (METERING VALVE)

EQUIPMENT IDENTIFICATION NO. 84-22-001

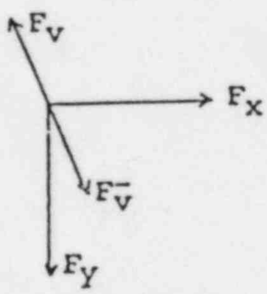
LOCATION:

BUILDING TURBINE BUILDING (PIPE TUNNEL)

ELEVATION 635'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 5 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Actual	Yield or Deformed
F_X =	3.5	30	No
F_Y =	3.5	30	No
F_V =	2.4	30	No
$F_{\bar{V}}$ =	2.4	30	No

PERFORMED BY George Miles APPROVED BY R. Bierman

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE

EQUIPMENT IDENTIFICATION NO. 84-25-001

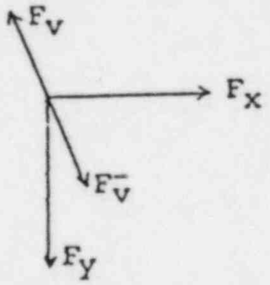
LOCATION:

BUILDING CONTAINMENT (BASEMENT 635')

ELEVATION 640'

PEAK G LEVEL 1.35 g. ref. 3

MASS OF EQUIPMENT 28 LBS.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	92.4	100	No
F_Y =	92.4	100	No
F_V =	61.6	80	No
$F_{\bar{V}}$ =	61.6	80	No

PERFORMED BY *Georg Miles* APPROVED BY *[signature]*

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-002

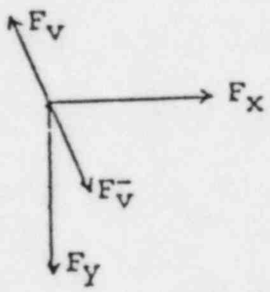
LOCATION:

BUILDING TURBINE (PIPE TUNNEL)

ELEVATION 635'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 28 lbs.



$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{v}} = F_v = 2/3\ F_x$

	Applied Force Required	Actual	Yield or Deformed
F_x =	19.9	50	No
F_y =	19.9	50	No
F_v =	13.2	50	No
$F_{\bar{v}}$ =	13.2	50	No

PERFORMED BY George Mile APPROVED BY [illegible]

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-003

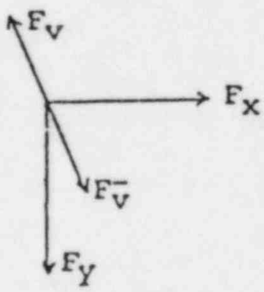
LOCATION:

BUILDING TURBINE BUILDING (PIPE TUNNELS)

ELEVATION 640'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 4 lbs.



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Actual	Yield or Deformed
F_x =	2.8	30	No
F_y =	2.8	30	No
F_v =	1.9	30	No
$F_{\bar{v}}$ =	1.9	30	No

PERFORMED BY George Miles APPROVED BY [illegible signature]

DATE 5/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-004

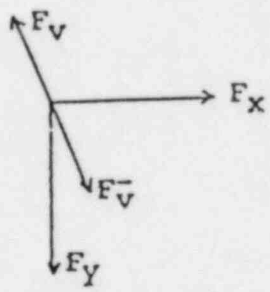
LOCATION:

BUILDING TURBINE BUILDING (PIPE TUNNEL)

ELEVATION 640'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 10.5 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force		
	Required	Actual	Yield or Deformed
F_X =	7.4	30	No
F_Y =	7.4	30	No
F_V =	5.0	30	No
$F_{\bar{V}}$ =	5.0	30	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-005

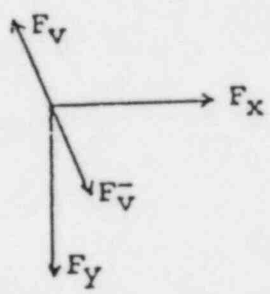
LOCATION:

BUILDING TURBINE BUILDING (PIPE TUNNEL)

ELEVATION 640'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	2.8	30	No
F_Y =	2.8	30	No
F_V =	2.8	30	No
$F_{\bar{V}}$ =	2.8	30	No

PERFORMED BY George Miles APPROVED BY R. Bianco

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-006

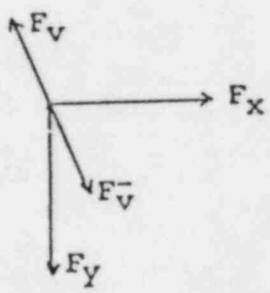
LOCATION:

BUILDING TURBINE BUILDING (PIPE TUNNEL)

ELEVATION 635'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 10.5 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	7.4	30	No
F_Y =	7.4	30	No
F_V =	5.0	30	No
$F_{\bar{V}}$ =	5.0	30	No

PERFORMED BY George Miles APPROVED BY R. Biemer

DATE 6/23/82

EQUIPMENT NOMENCLATURE LIQUID SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-007

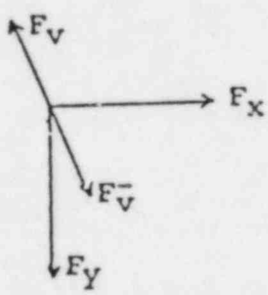
LOCATION:

BUILDING TURBINE BUILDING (PIPE TUNNEL)

ELEVATION 635'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 10.5 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	7.4	30	No
F_Y =	7.4	30	No
F_V =	5.0	30	No
$F_{\bar{V}}$ =	5.0	30	No

PERFORMED BY George Miles APPROVED BY R. Brimer

DATE 6/15/81

EQUIPMENT NOMENCLATURE AIR SAMPLE

EQUIPMENT IDENTIFICATION NO. 84-25-013

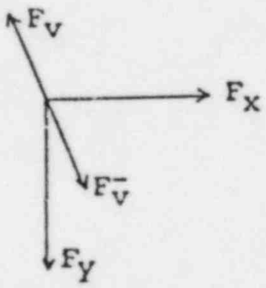
LOCATION:

BUILDING CONTAINMENT

ELEVATION 680'

PEAK G LEVEL 3.364 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$$F_x = F_y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{v}} = F_v = 2/3\ F_x$$

	Applied Force Required	Actual	Yield or Deformed
F_x =	32.9	50	No
F_y =	32.9	50	No
F_v =	21.9	50	No
$F_{\bar{v}}$ =	21.9	50	No

PERFORMED BY *Robert Z. Odegard* APPROVED BY *[signature]*

DATE 6/15/81

EQUIPMENT NOMENCLATURE AIR SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-014

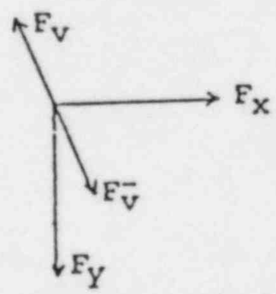
LOCATION:

BUILDING TURBINE BUILDING (ELECTRICAL PENETRATION)

ELEVATION 650'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Actual	Yield or Deformed
F_X =	2.8	40	No
F_Y =	2.8	40	No
F_V =	1.9	30	No
$F_{\bar{V}}$ =	1.9	40	No

PERFORMED BY *Robert L. Odegard* APPROVED BY *[signature]*

DATE 6/23/82

EQUIPMENT NOMENCLATURE AIR SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-015

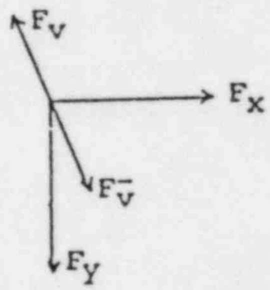
LOCATION:

BUILDING TURBINE BUILDING (ELECTRICAL PENETRATION ROOM)

ELEVATION 650'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	2.8	50	No
F_Y =	2.8	50	No
F_V =	1.9	50	No
$F_{\bar{V}}$ =	1.9	50	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 6/23/82

EQUIPMENT NOMENCLATURE AIR SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-016

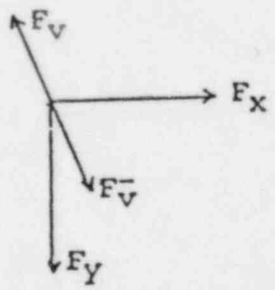
LOCATION:

BUILDING TURBINE BUILDING (ELECTRICAL PENETRATION ROOM)

ELEVATION 650'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = \text{(Mass)(Peak G For Elevation)(1.63)(1.5)}$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force		
	Required	Actual	Yield or Deformed
F_X =	2.8	50	No
F_Y =	2.8	50	No
F_V =	1.9	50	No
$F_{\bar{V}}$ =	1.9	50	No

PERFORMED BY *George Miles* APPROVED BY [illegible signature]

DATE 6/15/81

EQUIPMENT NOMENCLATURE AIR SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-017

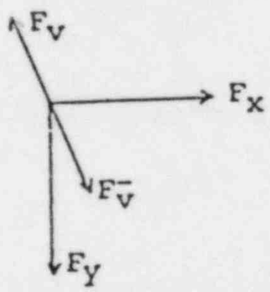
LOCATION:

BUILDING TURBINE BUILDING (ELECTRICAL PENETRATION ROOM)

ELEVATION 650'

PEAK G LEVEL .29 g. Ref. 1

MASS OF EQUIPMENT 4 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force		
	Required	Actual	Yield or Deformed
F_X =	2.8	40	No
F_Y =	2.8	40	No
F_V =	1.9	30	No
$F_{\bar{V}}$ =	1.9	40	No

PERFORMED BY APPROVED BY

DATE 6/15/81

EQUIPMENT NOMENCLATURE AIR SAMPLE

EQUIPMENT IDENTIFICATION NO. 84-25-018

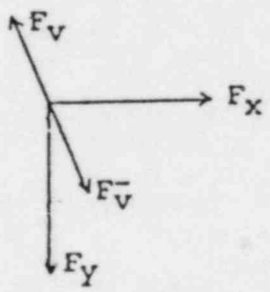
LOCATION:

BUILDING CONTAINMENT

ELEVATION 680'

PEAK G LEVEL 3.364 g. ref. 2

MASS OF EQUIPMENT 4 lbs.



$$F_X = F_Y = (\text{Mass})(\text{Peak G For Elevation})(1.63)(1.5)$$

$$F_{\bar{V}} = F_V = 2/3\ F_X$$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	32.9	50	No
F_Y =	32.9	50	No
F_V =	21.9	50	No
$F_{\bar{V}}$ =	21.9	50	No

PERFORMED BY *[signature]* APPROVED BY *[signature]*

DATE 6/23/82

EQUIPMENT NOMENCLATURE AIR SAMPLE (SOL. VALVE)

EQUIPMENT IDENTIFICATION NO. 84-25-019

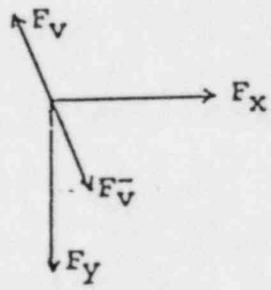
LOCATION:

BUILDING TURBINE BUILDING (ELECTRICAL PENETRATION ROOM)

ELEVATION 650'

PEAK G LEVEL .29 g Ref. 1

MASS OF EQUIPMENT 4 lbs.



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_X =	2.8	50	No
F_Y =	2.8	50	No
F_V =	1.9	50	No
$F_{\bar{V}}$ =	1.9	50	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 6/23/82

EQUIPMENT NOMENCLATURE HOPE CAST IRON JB H3229

EQUIPMENT IDENTIFICATION NO. RP-72

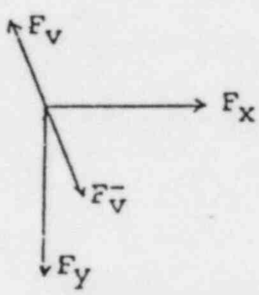
LOCATION:

BUILDING CONTAINMENT (MAIN RELIEF VALVES)

ELEVATION 684'

PEAK G LEVEL 2.93 g Ref. 1

MASS OF EQUIPMENT 41 lbs.



NOTE: $F_w = 293.72$

$F_h = 2/3\ F_w = 195.85$

$F_x = F_y = \frac{1}{4}\ F_w$

$F_v = F_{\bar{v}} = \frac{1}{4}\ F_h$

Each anchor was individually pulled on, in two different planes. On each pull the anchor was observed and did not move

$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{v}} = F_v = 2/3\ F_x$

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_x =	73.43	90	No
F_y =	73.43	90	No
F_v =	48.95	90	No
$F_{\bar{v}}$ =	48.95	90	No

PERFORMED BY George Miles APPROVED BY [signature]

DATE 7/14/82

EQUIPMENT NOMENCLATURE KILLARC CAST ALUM. DBS10106

EQUIPMENT IDENTIFICATION NO. RP-16

LOCATION:

BUILDING CONTAINMENT

ELEVATION 672'

PEAK G LEVEL 3.027 g. ref. 2

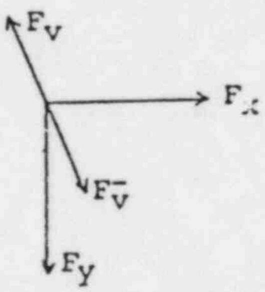
MASS OF EQUIPMENT 16 lbs.

Note: $F_w = 118.4$

$F_h = 2/3\ F_w = 78.9$

$F_x = F_y = 1/4\ F_w$

$F_v = F_{\bar{v}} = 1/4 F_h$



$F_x = F_y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{v}} = F_v = 2/3\ F_x$

Each anchor was individually pulled on in the different planes. On each pull the anchor was observed and did not move.

	Applied Force Required	Applied Force Actual	Yield or Deformed
F_x =	29.6	50	No
F_y =	29.6	50	No
F_v =	19.7	50	No
$F_{\bar{v}}$ =	19.7	50	No

PERFORMED BY George Miles APPROVED BY [illegible]

DATE 7/22/82

EQUIPMENT NOMENCLATURE ELECTRICAL JUNCTION BOX

EQUIPMENT IDENTIFICATION NO. J.B. DR-2

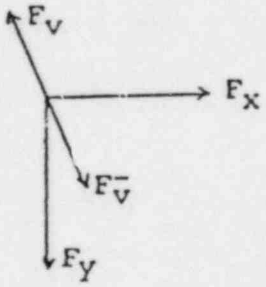
LOCATION:

BUILDING 1B DIESEL BUILDING

ELEVATION 641'

PEAK G LEVEL 0.29 g. Ref. 1

MASS OF EQUIPMENT 30 lbs.



$F_x = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_x$

Maximum force 21.3 lb.

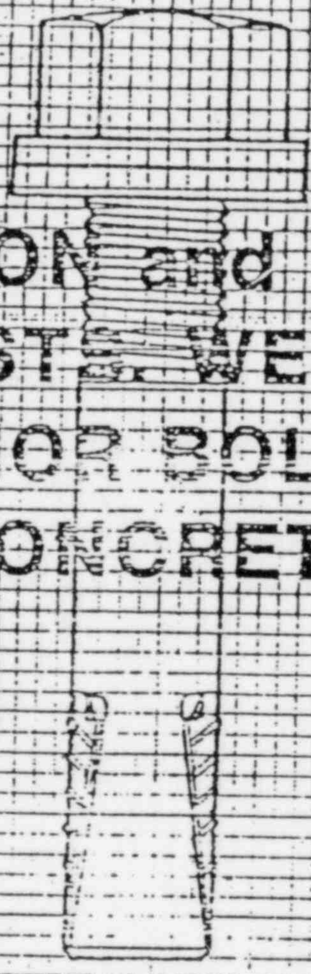
Use four 3/8" WEJ-IT to anchor junction box to diesel building wall. Torque to required valve Tensile and shear stress of anchors far exceed the maximum anticipated force. (See attached data.)

PERFORMED BY George Miles APPROVED BY [signature]

WEJ-IT®
CORPORATION
500 Alter Street
Broomfield, Colo. 80020
Phone: 303-466-1822
ALLIED PRODUCTS CORPORATION

TEST REPORT #1

E-MI
ANSI/ASTM E488
ICBO



TENSION and SHEAR TESTS of WEJ-IT ANCHOR BOLTS IN CONCRETE

ENGINEERS & ASSOCIATES, INC.
893 South Lipan, Denver, Colorado 80223 303-936-3423

Conducted and Prepared By
K. S. ADNAN, P.E.
W. TOPPING
J. KALMES
J. P. SPRINGER

(CONTINUED)

TESTING PROCEDURES

Electric drill model #RH-90 (800W 8A 110V 60cycle 230 R.P.M.) was utilized. Drill bits utilized were of Wej-It manufacture, and ranged in diameter from 0.264 inches through 1.540 inches.

The testing equipment consisted of a mobile gantry fitted with a five ton capacity motor driven hoist, and two tension and shear assemblies, equipped with "TL" Series Load Cell transducers connected to a SC 11 3/PH Signal Conditioner, manufactured by Precision Force Measurement, Inc. The two assemblies have a loading capacity of 20,000 pounds for the small assembly and a capability of 100,000 pounds applied load for the larger. The steel frame assembly is connected to a hydraulic pump system; (refer accompanying photographs). The pressure regulating valve permits the hydraulic ram of the fixture to move upward and downward and is regulated by a low-high speed valve. Loads are applied by the hydraulic system and are recorded on an "OmniScribe" X-Y recording graph produced by Houston Instrument. The graph revealed both displacement and applied loading. The vertical stand legs for tension pull-out testing and the assembly for shear testing were designed to conform to the requirements of the E.A.M.I. Test Standard.

The direction of loading for all tensile testing was co-axial with the embedded test anchors.

The SC 11 3/PH is a completely solid state strain gauge transducer conditioning system with Signal Peak Holding circuitry.

(CONTINUED)

TESTING PROCEDURES

The concrete slab of a designated strength was placed in position directly below the gantry assembly. Holes were drilled by unskilled workers using no excessive pressure, to depths equal to the full length of the representative Wej-It bolt specimen. Holes were drilled perpendicular to the concrete test specimen surface and the drill tool was raised and lowered to remove dust and reduce binding. Upon completion of drilling, the holes were cleaned in accordance with the manufacturers published recommendation. Test holes were measured with a micrometer dialed instrument and recorded on the accompanying tabulations of engineering data. Typical arrangement of drilled holes for the tension pullout and shear tests are shown on diagrams "A", "B", "C" and "D", and on accompanying photographs.

The specimen Wej-It bolt was inserted into a drilled hole that was measured within the minimum-maximum tolerances shown below; and tapped down with the fixture in place. The Wej-It was then tightened by means of a torque wrench to manufacturers specified table of applied load torque in foot pounds. Torque was found to approximate 2-3 turns of the nut from finger tight.

DIAMETER OF WEJ-IT	TORQUE ft/lbs	HOLE DIAMETER Min.	HOLE DIAMETER Max.
1/4"	4-5	.260	.268
------> 3/8"	15-20	.390	.398
1/2"	30-35	.520	.530
5/8"	50-75	.650	.660
3/4"	75-100	.775	.787
1"	150-260	1.030	1.042
1 1/4"	260-330	1.285	1.300
1 1/2"	330-650	1.535	1.550

Specifications and

labor saving data for estimators

Comparison of in-place costs, among a variety of concrete anchors is often neglected. There is a dramatic difference when proper analysis is made. And any difference is substantial when you figure labor costs.

1. Estimators know the high cost of correcting misplaced cast-in-place anchor bolts, for instance.
2. They know the high cost of correcting misaligned Shield-type anchors such as self-drills, lead shields, lag shields, etc. . . . plus the high cost of gathering separate nuts, washers, and bolts to accommodate these out-dated anchors.
3. They also know about the high cost of correcting concrete "spall-outs" often experienced with "floating wedge" type stud anchors.

With superior Wej-it expansion anchor bolts, these costs are eliminated because the Wej-it design is exclusively patented. There is no other bolt designed to duplicate its inherent, superior design characteristics . . . which make it possible to keep "in-place costs" down, as low as possible . . . at the greatest degree of SAFETY.

drilling procedure

1. Use carbide-tip, solid bits, whenever possible. Tip diameters to ANSI standard B94,12—1977.
2. Don't use excessively worn bits.
3. Keep the drill in a perpendicular line while drilling.
4. Let the drill do the work. Don't apply excessive pressure.
5. Lift up and down, to remove dust and reduce "binding."
6. DRILL HOLE TO A DEPTH EQUAL TO THE *FULL* LENGTH OF THE WEJ-IT.
7. Blow out the dust from the hole. Cleaning adds to the holding values of the WEJ-IT.

TIME GUIDE — DRILLING/INSERTING/TIGHTENING ONE WEJ-IT

Size	Min. Sec.	Size	Min. Sec.	Size	Min. Sec.
¼ x 1¼	13	3½	45	⅞ x 8	2 20
1¾	16	5	49	10	2 31
2¾	24	6	58	12	2 48
3	26	7	1 10	1 x 8	2 53
5/16 x 1½	17	⅝ x 3½	48	10	3 15
2	24	4½	50	12	3 28
3	32	5	53	1⅛ x 8	3
⅜ x 1½	19	5½	56	10	3 24
2	26	⅝ x 6	1 8	12	3 35
2¾	29	7	1 20	1¼ x 8	3 38
3½	39	¾ x 4	51	10	3 59
5	46	5	55	12	4 18
6	50	6	1 15	1½ x 8	4 9
½ x 2	28	7	1 28	10	4 26
2¾	35	10	1 42	12	4 58

**Using Electric Roto-Hammers. In 3750 psi concrete, 28 day cure, 1:3:2 mix.*

Installation information

SPACING AND HOLE TOLERANCES

Wej-It Diameter	Reccommended Hole Diameter		Edge Distance	Bolt-to-next-nearest-bolt spacing
	Minimum Inches	Maximum Inches		
¼	.260	.268	5 bolt diameters (For 100% efficiency)*	10 bolt diameters (For 100% efficiency)**
5/16	.327	.335		
⅜	.390	.398		
½	.520	.530		
⅝	.650	.660		
¾	.775	.787		
⅞	.905	.917		
1	1.030	1.042		
1⅛	1.160	1.175		
1¼	1.285	1.300		
1½	1.535	1.550		

*NOTE: *The edge distance spacing may be reduced to a 50% efficiency rating using 2½ diameter placement from the edge. **Bolt-to-nearest-bolt spacing may be reduced to a 50% efficiency rating using 5 diameter spacing. MEETS I.A.M.I. TEST STANDARD.*

TYPICAL DESIGN-SPECIFICATION TERMINOLOGY

Contractors shall furnish and install ________ size Wej-It Concrete Anchors as manufactured by Wej-It Corporation of Broomfield, Colorado, or equal. The anchor shall be the Double-Wedge Expansion Type, made of cold drawn steel having the accredited pullout and shear values as published by WEJ-IT.

CHOICE OF METALS

Steel: Cold rolled, 84,000 PSI, Brinnell 156. Minimum Yield 70,000 PSI. Elongation—15% in two inches. Area reduction 55%. Finish: Rust resistant zinc coating with final clear acetate coating which exceeds U.S. Government ASTM salt spray test (B-117), and in accordance with Fed. Spec. QQZ-325, Type 1, Class 3.
Stainless Steel: Routinely available in types 303, 304. Type 316 by special request.
Hot-Dipped Galvanized: Available on request.
Aluminum: Routinely available — Type 2024 — T6. Other types by request.

SPECIAL ASTM'S, IN STEEL — available on request.

A-307 grades 1-5
A-325
A-354 grade BB
A-354 grade BC
A-354 grade 5.1
A-354 grade 8
A-354 grade BD
A-449
A-490

load data for WEJ-ITS

HOW MUCH TORQUE TO APPLY

2-3 turns of the nut is sufficient on normal installations, where average concrete exists, at about 28-day cure. The number of turns required, however, may be less, depending on the strength of concrete. Where abnormally high ranges of concrete are experienced, for example 6000-7000 psi concrete, 1-2 turns may only be necessary. Wej-its need not, and should not, be *forced* excessively, into clamp load modes, through overtorquing. It is not necessary with Wej-its. Torque valves upon request.

THREAD CLASSIFICATION

National Coarse, Class 2A fit on Standard Wej-its and nose cone Wej-its.
Expansion Screws only are National fine on ¼". National coarse on ⅜, ½, ⅝, ¾.

MEETS O.S.H.A. REQUIREMENTS

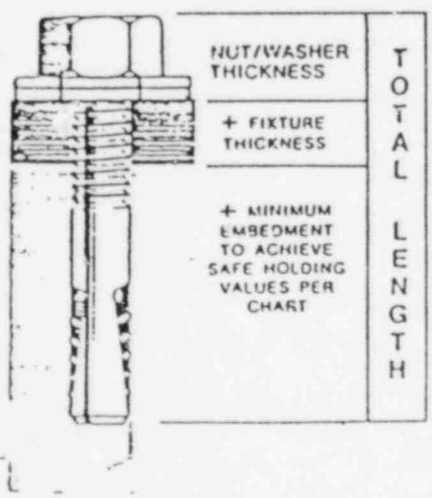
Section No. 1910.212(b)

Choosing the size

Selection of any anchor is not absolutely scientific because much depends on these factors:

1. Diameter of the hole already in the fixture or equipment.
2. Depth, mix, strength and age of concrete.
3. Tensile or Shear Values desired.
4. Safety Factor required.

The diagram below can be helpful for choosing the minimum length desired.



TENSILE AND SHEAR VALUES

Applies to all Steel Standard and Nose Cone WEJ-ITS

As Tested in 4000 PSI Concrete at these Minimum Embedments

Wej-It Diameter and Hole Diameter	Wej-It Length	How Deep to Drill Hole	Tensile Strength	Shear Strength	28-day cure
Inches	Inches	Inches	Lbs.	Lbs.	Inches
¼	1¼	Drill Hole to a Depth Equal to the Full Shank Length of the Wej-It	1450	2316	1
	1¾		1760	2316	1⅛
	2¼		2331	2316	1¼
	3		2473	2316	1½
5/16	1½		2402	2500	1
	2		2742	2500	1¼
	3		3185	2500	1¼
⅜	1½	"	3198	4807	1⅛
	2		3580	4807	1¼
	2¾		3834	4807	1½
	3½		4022	4807	2
	5		4399	4807	3½
	6		4650	4807	4
½	2	"	5645	22597	1½
	2¾		5717	22597	2
	3½		5789	22597	2¾
	5		6411	22597	3½
	6		7213	22597	4
	7		8015	22597	5
⅝	3½	"	8284	25674	2
	4½		11185	25674	3
	5		12636	25674	3½
	5½		13893	25674	3¾
	6		14372	25674	4
	7		15299	25674	4½
¾	4	"	19299	27607	3
	5		20415	27607	3½
	6		21530	27607	4
	7		22583	27607	5
	10		25740	27607	7
⅞	8	"	25444	32000	4½
	10		27115	32000	5½
	12		28320	32000	7
1	8	"	27252	47903	5½
	10		28490	47903	6
	12		29728	47903	7
1⅛	8	"	33844	48000	5½
	10		34934	48000	6¼
	12		36023	48000	7
1¼	8	"	40436	48827	5½
	10		41377	48827	6
	12		42317	48827	7
1½	8	"	53951	58000	5½
	10		55698	58000	6½
	12		57444	58000	8

SOURCE: AA Engineers & Associates, Inc., Denver, Colorado. Recommended safe working load is one-fourth Tensile and Shear values shown.

Conversion to 2000 psi, multiply by .75 for 1/4", 5/16", 3/8"
" 2000 " " " .60 for other diameters
" 3000 " " " .90
" 5000 " " " 1.25
" 6000 " " " 1.40

Test Report available on request

Meets A.C.M.I. Test Standard

ANSI/ ASTM E488

ICBO Report #1821

CONCRETE BLOCK AND LIGHTWEIGHT CONCRETE LOAD DATA

Wej-It and Hole Diameter	2000 psi Concrete Block (Idealite) Tensile	5000 psi Lightweight Concrete (Idealite) Tensile	5000 psi Lightweight Concrete (Idealite) Shear
¼	545 lbs.	1861 lbs.	2316 lbs.
5/16	852 lbs.	2493 lbs.	3562 lbs.
⅜	1277 lbs.	3125 lbs.	4807 lbs.
½	2025 lbs.	4778 lbs.	22597 lbs.
⅝	——	6455 lbs.	25674 lbs.
¾	——	17293 lbs.	27607 lbs.
1	——	21616 lbs.	47903 lbs.

DATE JUNE 2, 1981

EQUIPMENT NOMENCLATURE MINERAL INSULATED CABLE FASTENERS

EQUIPMENT IDENTIFICATION NO. N/A

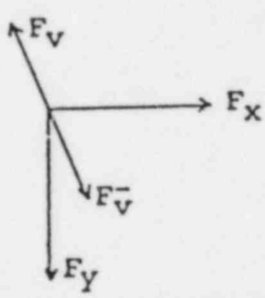
LOCATION:

BUILDING VARIOUS

ELEVATION VARIOUS

PEAK G LEVEL MOST LIMITING G LEVEL, 5.005 g. 719' IN CONTAINMENT REF. 2

MASS OF EQUIPMENT 3 POUNDS/6 FEET FOR MI CABLE



$F_X = F_Y =$ (Mass)(Peak G For Elevation)(1.63)(1.5)

$F_{\bar{V}} = F_V = 2/3\ F_X$

	Applied Force		
	Required	Actual	Yield or Deformed
F_X =	36.7	60	No
F_Y =	36.7	60	No
F_V =	24.5	60	No
$F_{\bar{V}}$ =	24.5	60	No

PERFORMED BY Robert L Odegard APPROVED BY

(5)

ATTACHMENT 2 OF DPC LETTER,
LINDER TO CRUTCHFIELD, LAC-7484
DATED APRIL 23, 1981

ATTACHMENT 2

ANCHORAGE OF SAFETY RELATED COMPONENTS WITHIN PANELS, CABINETS, AND ENCLOSURES

1.0 PURPOSE

To provide assurance that internal components of safety related cabinets, panels, and enclosures are positively anchored or restrained in the event of an earthquake at the LACBWR site.

2.0 SCOPE

Those safety related components required to mitigate the consequences of an accident shall be visually inspected for loose or improperly secured mountings. Devices that supply vital power, indication or control functions shall be included in this review.

3.0 FINDING

This review was conducted during a plant shutdown on 3/10/81 and 3/11/81. The components inspected include these major categories:

(1) Switchgear,
(2) Inverter and Battery Chargers, and
(3) Various Distribution and Instrument Panels.

3.1 The following switchgear internals were visually inspected:

(1) 1B Essential 480V
(2) 1B 480V Diesel Building MCC
(3) 1B 125 VDC Diesel Building
(4) 1A Essential 480V
(5) Turbine Building 480V MCC 1A
(6) Reactor Plant 125 VDC
(7) Generator Plant 125 VDC MCC

All of the breakers used in the above switchgear are positively secured in one of two ways. The original Allis-Chalmers switchgear breakers are screwed into their normal operating position and additionally held by a spring tensioned latch. In order to remove the breakers, both mechanisms must be operated. Much of the equipment added after the original construction is locked into place with two tabs that are fastened with screws. All of the switchgears have door covers that are secured by at least two screws.

The transformers, bus bars, and instrument portions of the switchgear are firmly bolted to the frame or door panels.

3.2 The internals of the following inverters and battery chargers were visually inspected.

(1) 1B Inverte-
(2) 1B Diesel Building Battery Charger
(3) 1A Diesel Battery Charger Assembly and Output Breaker
(4) Reactor Plant Battery Charger
(5) Generator Plant Battery Charger

The internal components of the inverters and battery chargers are substantially anchored. The major items such as the transformers, rectifiers, and bus bars are bolted to the frame of the housing. The metering, switches, and control circuits are bolted to the frame or doors of the equipment. Access to these cabinets is secured by screws or heavy door latch mechanisms.

3.3 A variety of panels required inspection. They are listed in related groups to simplify the presentation of inspections results.

(1) Distribution Panels:

(a) 125 VDC Diesel Building Distribution
(b) 125 VDC Reactor Plant Distribution
(c) 125 VDC Generator Plant Distribution
(d) 1A Non-Interruptible 120V Bus
(e) 1B Non-Interruptible 120V Bus
(f) 1A Non-Interruptible 120V Bus Fuse Panel
(g) Auxiliary Distribution Panel 125 VDC Generator Plant
(h) 120V Turbine Building MCC1A

The circuit breakers in these applications snap into place and are held by screws or a cover plate secured by screws. The close fit between components allows no room for movement.

(2) <u>Relay Panels</u>:

(a) Reactor Relay Cabinet
(b) 480V Essential Bus Undervoltage Relay Cabinet

The internal components and relays are bolted or screwed to the internal framework of the cabinets. Several undervoltage relays are door mounted with bolts. These components are adequately secured.

(3) <u>Instrument Panels</u>

(a) Benchboards D and E
(b) 1B Diesel Generator Control Panel
(c) Control Room Panels A, C, D, E, F, and G

Due to the diversity of instruments and switches, no uniform method of mounting was used. The majority of the metering is bolted to the panels or drawers. Switches are mounted on the panels and retained by flush mounting nuts. Most instrument modules (power suppliers, amplifiers, square root converters, relays, etc.) are mounted to the internal panel framework with one or more screws. Depending on the size, recorders are bolted into the vertical panels at two or four locations. Panel mounted drawers are secured by screws or rear mounted latches.

4.0 SUMMARY

The anchorage of the equipment inspected is reasonably assured to remain in place during a seismic event. At the maximum, assumed ground acceleration of .12 G, the existing mounting, if properly connected after maintenance or calibration, will sufficiently restrain the motion of internal components. As a result of this inspection a list of outstanding safety related, and non-safety related equipment was identified. This equipment will be modified as soon as possible to provide the added assurance of its anchorage during a seismic event.

(6)

NES TRANSMITTAL 5101-803,
DATED JUNE 2, 1982

NES
NUCLEAR
ENERGY
SERVICES, INC.

June 2, 1982
Reference No.: 5101-803

Mr. Richard E. Shimshak
Dairyland Power Cooperative
LaCrosse Boiling Water Reactor
P. O. Box 135
Genoa, WI 54632

Subject: Emergency Power Equipment Anchorages - Transmittal of Calculations

Dear Mr. Shimshak:

Per your request, we are forwarding copies of calculations performed by NES for the subject task relating to items for which no modifications were required. The items in this category for which calculations are enclosed are as follows:

Turbine Building 120-V Bus. Aux. Dist. Panel
Solatron for Turbine Bldg. Reg. Bus.
Transformer for Turbine Bldg. 120-V Bus. 480-240/120-V
1-B Emergency Diesel Generator
1-B Diesel Fuel Oil Day Tank
1-B Emergency Diesel Gen. Starting Batteries and Racks
1-B 480-V Ess. Bus.
1-B Static Inverter
1-B Diesel Building Battery Charger
ACS Valve DC Motor Starter
ACS Flow Transmitter
Reactor Water Level No. 3 Transmitter
HPCS Motor 1A
HPCS Motor 1B
1C Static Inverter
1A 1 KVA Inverter
1A Inverter Input and Output Breakers
1A Inverter Meter Panel
120-V AC Non-Int. Bus. 1A
120-V AC Non-Int.Bus. 1A Fuse Panel

Based on discussions held between Tom Strnad, Paul Sampson and Bob Brimer, documentation for the remainder of the items analyzed (those requiring modifications) will be completed as follows. NES will forward additional copies of all previously transmitted drawings and sketches of required or proposed modifications to DPC. LACBWR personnel will modify these drawings as necessary to reflect the as-built condition and return the drawings to NES. NES will evaluate any deviations from the original modification recommendation and will update the calculations as required. Backup calculations corresponding to the actual installation details will then be forwarded to DPC.

Very truly yours,

NUCLEAR ENERGY SERVICES, INC.
NES Division

Craig F. Finnan

Craig F. Finnan,
Project Engineer

/al
enclosures

cc: W. Manion
R. Brimer
P. Sampson
J. Taylor

nes

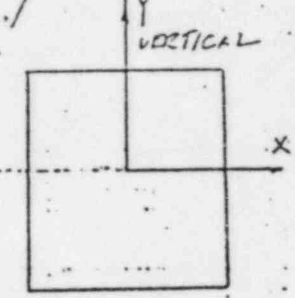
ENCLOSURE

BACKUP CALCULATIONS FOR ITEMS
REQUIRING NO MODIFICATION

TURBINE BLDG 120V BUS AUX. DIST. PANEL	REF.

H × W × D
16" × 10½" × 4" ✓

ATTACHMENT: 4 - 3/8" ∅ BOLTS CONNECTED TO ✓ SHEET METAL CABINET



ASSUME WT = 50# ✓

HORIZONTAL ACCELERATION = 2g ✓

VERTICAL ACCELERATION = 2/3 × 2g = 1.33g ✓

X-DIR

SHEAR = $\frac{2 \times 50}{4}$ = 25#/BOLT ✓

TENSION = 0 ✓

Y-DIR

SHEAR = $\frac{2.33 \times 50}{4}$ = 29#/BOLT ✓

TENSION = 0 ✓

Z-DIR

TENSION = $\frac{2 \times 50}{4}$ = 25#/BOLT

RSS FORCES — SHEAR = $\sqrt{25^2 + 29^2}$ = 38.3#/BOLT ✓

TENSION = 25#/BOLT ✓

ASSUME A307 UNFINISHED BOLTS

F_t = 20 ksi ✓ F_v = 10 ksi ✓

CAPACITY: TENSION = 20 × $\frac{\pi}{4}(\frac{3}{8})^2$ = 2.21 K ✓

SHEAR = 10 × $\frac{\pi}{4}(\frac{3}{8})^2$ = 1.10 K ✓

$\frac{.025}{2.21} + \frac{.0383}{1.10}$ = 0.046 < 1.0 (O.K.) ✓

NO FIX REQUIRED

NUCLEAR ENERGY SERVICES

BY TS DATE 3-31-81 PROJ. 5101 TASK 06

CHKD. R.R. DATE 4-8-81 PAGE 1 OF 1

LACBWR

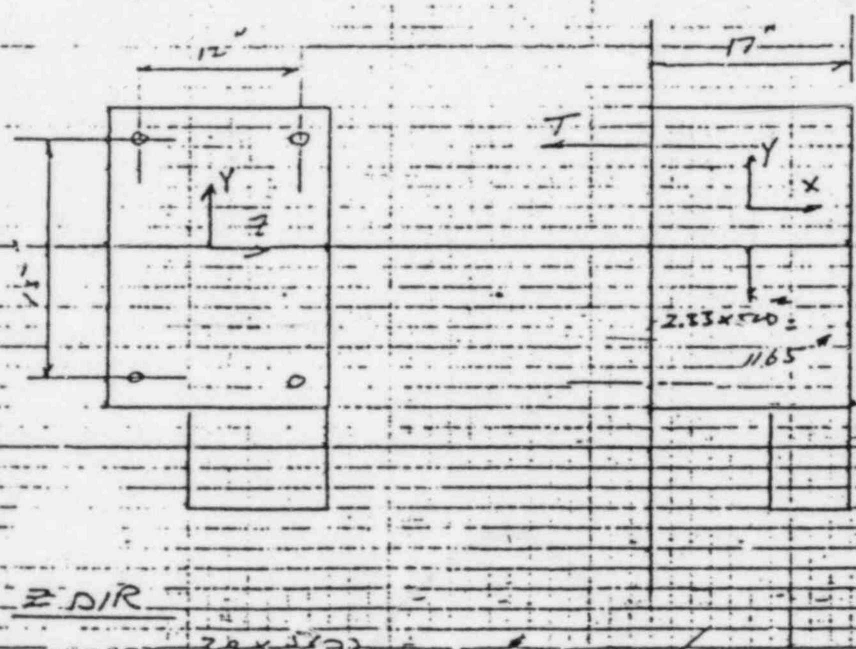
SOLATRON FOR TURBINE BLDG REG. BUS | REF.

ASSUME: HORIZONTAL ACCELERATION = 2g

VERTICAL ACCEL. = 2/3 × 2g = 1.33g

ASSUMED WEIGHT = 500#

4 - 1/2" RED HEAD BOLTS



Z DIR

SHEAR: 2g × 500 / 4 = 250#/BOLT ✓

TENSION: ΣM = 0 1000# × 8.5" = 2T × 12" T = 354#/BOLT ✓

Y DIR

SHEAR = 250#/BOLT

TENSION: 1165# × 8.5" = 2T × 15 T = 330#/BOLT ✓

X-DIR

TENSION = 2g × 500 / 4 = 250#/BOLT ✓

RSS FORCES TENSION = $\sqrt{354^2 + 330^2 + 250^2}$ = 545# ✓

SHEAR = $\sqrt{250^2 + 250^2}$ = 354# ✓

CAPACITY 1/2 RED HEAD EXP. ANCHORS

TENSION = 1975# SHEAR = 2100# FS = 4

$\frac{545}{1975} + \frac{354}{2100}$ = 0.54 < 1.0 (OK) ✓ No Fix Required

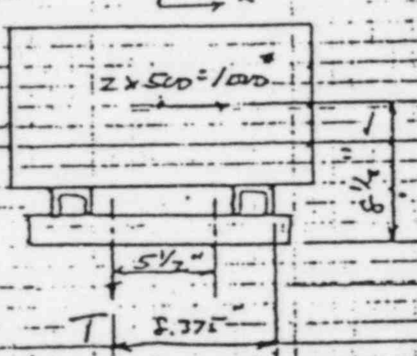
TRANSFORMER FOR TURBINE BLDG 120V BUS 480-240/120V

REF.

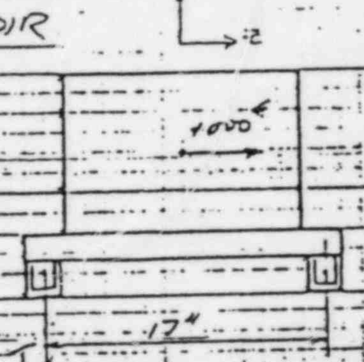
ASSUME: HORIZONTAL ACCELERATION = 2g ✓
VERTICAL ACCEL. = 2/3 × 2g = 1.33g ✓
ASSUMED WEIGHT = 500# ✓

ATTACHMENT - 4 - 1/2" RED HEAD BOLTS

X DIR



Z DIR



ΣM=0
1000 × 8.5" = 2T × 8.375
T = 507#/BOLT ✓
SHEAR = 1000/4 = 250#/BOLT ✓

ΣM=0
1000 × 8.5" = 2T × 17"
T = 250#
SHEAR = 250#/BOLT

Y-DIR

TENSION = $\frac{0.33 \times 500}{4}$ = 41#/BOLT ✓

RSS FORCES

TENSION = $\sqrt{507^2 + 250^2 + 41^2}$ = 567#/BOLT ✓

SHEAR = $\sqrt{250^2 + 250^2}$ = 359#/BOLT ✓

CAPACITY - 1/2" RED HEAD EXPANSION BOLTS

TENSION = $\frac{5900}{4}$ = 1975# ✓

SHEAR = $\frac{8400}{4}$ = 2100# ✓

$\frac{567}{1975} + \frac{354}{2100}$ = 0.55 < 1.0 ✓ (O.K) ∴ NO FIX REQUIRED!

WALL PANELS - ELECT. EQUIP. RM | REF.

ANCHOR BOLTS

4-½" RED HEAD WEDGE ANCHORS

FOR ITEMS FOR THE FOLLOWING EQUIPMENT.

1. 1-C STATIC INVERTER
2. 1A 1 KVA INVERTER
3. 1A INVERTER INPUT & OUTPUT BREAKERS
4. 1A INVERTER METER PANEL
5. 120V AC NONINTERRUPTIBLE BUS 1A
6. 120V AC NONINTERRUPTIBLE BUS 1A FUSE PANEL

For Electrical Equipment Room

ASSUME 2g HORIZ. ACCELERATION VERT. ACCEL. = ⅔ x 2g = 1.33g

MAXIMUM EQUIPMENT WEIGHT = 100 LBS

X DIR

$F_x = 2 \times 100 = 200$ ✓

SHEAR = 200/4 = 50 #/BOLT ✓ TENSION = 0

Y DIR

$F_y = 2.33 \times 100 = 233$ ✓ SHEAR = 233/4 = 58 #/BOLT ✓

TENSION = 0

Z DIR

SHEAR = 0 TENSION = 200/4 = 50 #/BOLT ✓

RSS FORCES

SHEAR = $\sqrt{50^2 + 58^2}$ = 77# TENSION = 50#

BOLT CAPACITY

FOR A307 BOLT $F_t = 26 - 1.8 f_v \le 20$ (AISC TABLE 1.6.3)

$f_v = \frac{0.077}{0.196} = 0.393$ ksi ✓

$F_t = 26 - (1.8)(0.393) = 25.29 > 20 \Rightarrow F_t = 20$ ksi ✓

BOLT CAPACITY = 20 ksi x 0.196 = 3.92k ✓ > 0.050k (OK)

NUCLEAR ENERGY SERVICES

BY TS DATE 1-15-81 PROJ. 5101 TASK
CHKD. R.R DATE 4-7-81 PAGE 2 OF
LACBWR SAFETY RELATED EQUIP.

WALL PANELS - ELECT. EQUIP. RM | REF

PULLOUT CAPACITY - ½" WEDGE ANCHOR

ULTIMATE CAPACITY - TENSION - 5900# } RED HEAD ✓ CATALOG F-1000 pg 6
SHEAR - 8400#

FOR 3500 psi CONCRETE

FACTOR OF SAFETY = 4 NRC I.E. BULL. 79-02 ✓

ASSUME f'_c = 3000 psi CONCRETE

TENSION - 87% OF 3500 psi CAPACITY } RED HEAD ENGINEERING BULLETIN NO. 102 pg 1 ✓
SHEAR - 95% " " "

SPACING - ASSUME 3½ DIA. = 80% CAPACITY - RED HEAD ENG. BULL. NO. 101 pg 2 ✓

ALLOWABLE CAPACITY

$$TENSION = \frac{(5900)(0.87)(0.80)}{4} = 1026.6 ✓$$

$$SHEAR = \frac{(8400)(0.95)(0.80)}{4} = 1596^{\#} ✓$$

$$\frac{50}{1027} + \frac{77}{1596} \leq 1.0 ✓$$

$$0.049 + 0.048 = 0.097 ✓ < 1.0 \quad (OK)$$

4 - ½" RED HEAD WEDGE ANCHORS ADEQUATE ✓

NOTE: NO FIX REQUIRED

1-B DIESEL GENERATOR	REF.

ANCHORAGE DETAIL: 12 - 1"φ BOLTS

GENERATOR WEIGHT = 18,500 LBS ✓

HORIZ. ACCEL. = 1.5 × PEAK g FROM GROUND SPECTRA = 0.21g × 1.5 = 0.315 g ✓

VERTICAL ACCEL. = 2/3 × 0.315 g = 0.21 g ✓

CHECK SHEAR

HORIZONTAL FORCE = 18,500# × 0.315 g = 5828# ✓ EACH DIRECTION ✓

SHEAR FORCE / BOLT = $\frac{5828}{12}$ = 486 LBS ✓

RESULTANT SHEAR FORCE = $\sqrt{486^2 + 486^2}$ = 687 #/BOLT ✓

ANCHOR CAPACITY - 1"φ RED HEAD WEDGE ANCHORS.

ULTIMATE SHEAR CAPACITY = 35,400 LBS ✓ pg. 6 RED HEAD CAT. F-1000

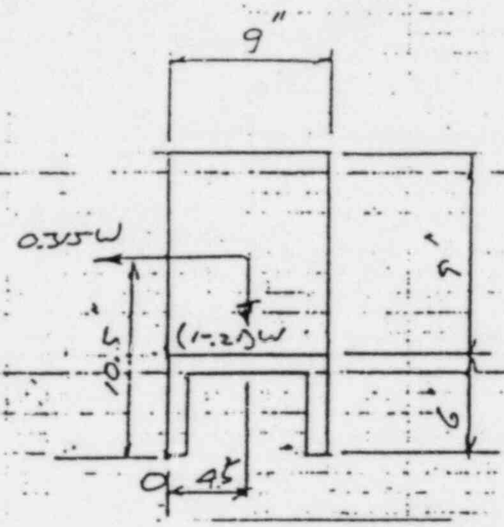
ALLOWABLE CAPACITY = 35,400/4 = 8850 LBS ✓

8850# > 687# ✓ (O.K.)

NO FIX REQUIRED ✓

H3 DIESEL STARTING BATTERIES

REF.



ASSUME HORIZONTAL ACCELERATION = 1.5 x 0.21g = 0.315g
VERTICAL ACCELERATION = 2/3 x 0.315g = 0.21g

$\Sigma M_o = 0$

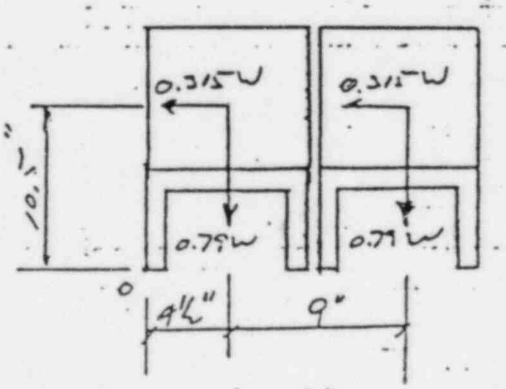
OVERTURNING MOMENT = 10.5 x 0.315W = 3.31W ✓

RESISTING MOMENT = 4.5" x 0.79W = 3.56W ✓

FACTOR OF SAFETY = $\frac{3.56W}{3.31W}$ = 1.08 ✓

2 RACKS STRAPPED TOGETHER

NO FIX REQUIRED



$\Sigma M_o = 0$

OVERTURNING MOMENT = 2 x (10.5 x 0.315W) = 6.62W ✓

RESISTING MOMENT = 0.79 x (4.5 + 13.5) = 14.22W

FACTOR OF SAFETY = 14.22W / 6.62W = 2.15 > 1.5 (O.K.) ✓

NES

NUCLEAR ENERGY SERVICES

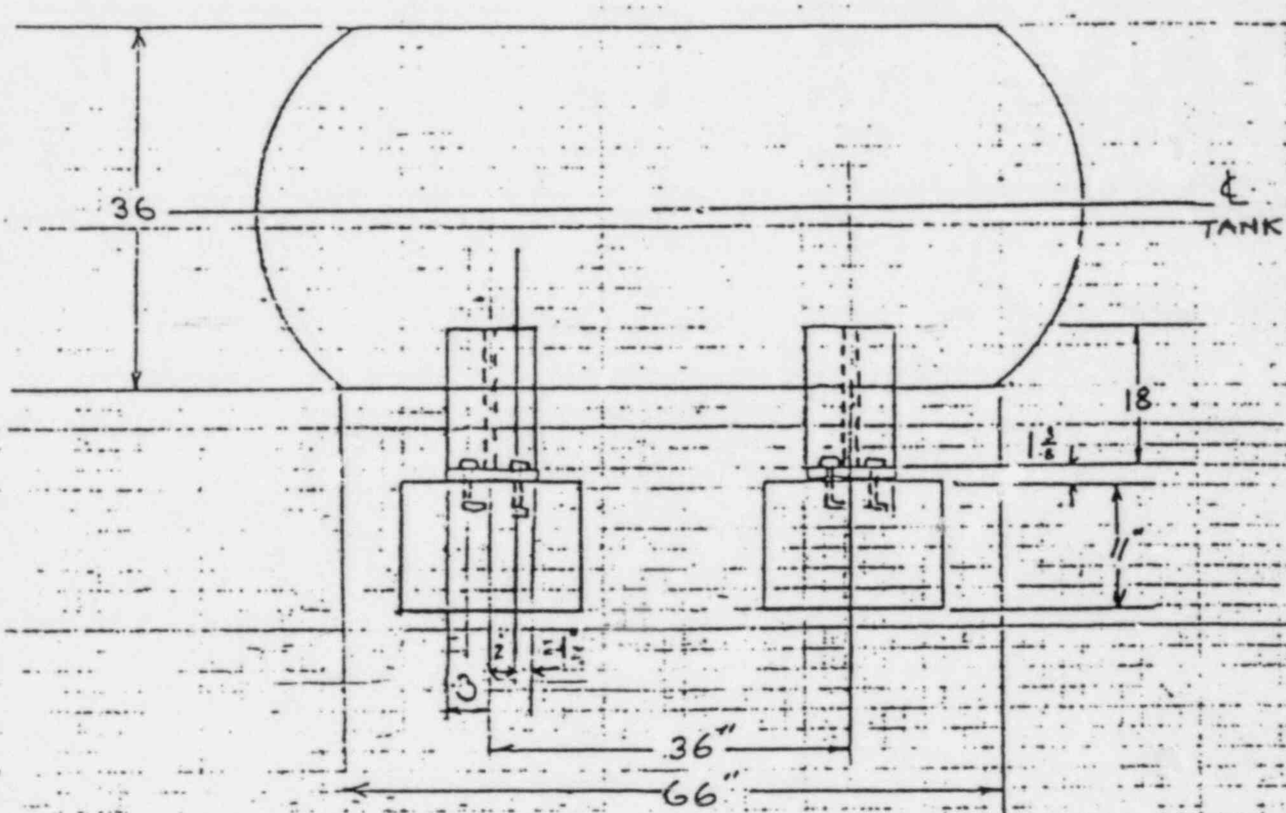
BY AZ DATE 5/?/82 PROJ. 5101 TASK 0

CHKD. TS DATE 6/1/82 PAGE 1 OF 5

LACBWR

1-B DIESEL FUEL OIL DAY TANK ANCHORAGE

REF.

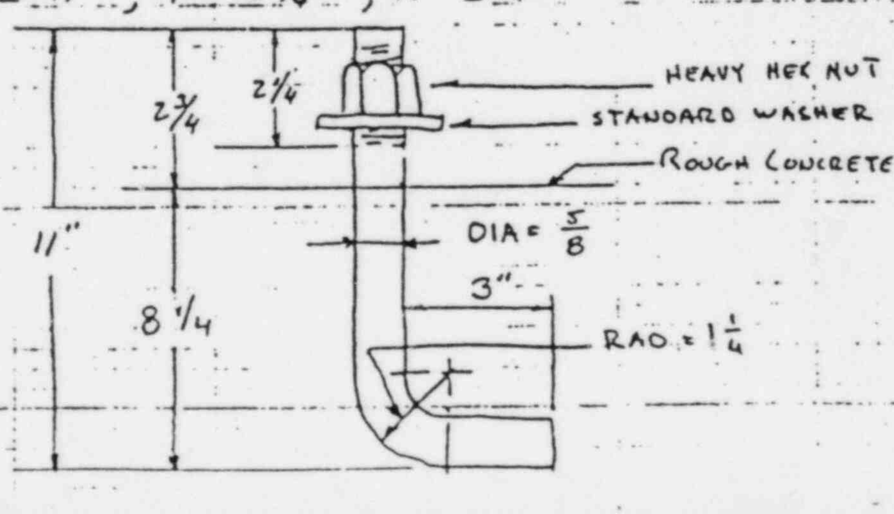


REF DRAWING S&L M-120

ANCHOR BOLTS: EIGHT 5/8" BOLTS

S&L SPEC 1737-A TYPE-4 ANCHOR BOLTS

L-11", P-2 3/4", R-2 1/4"



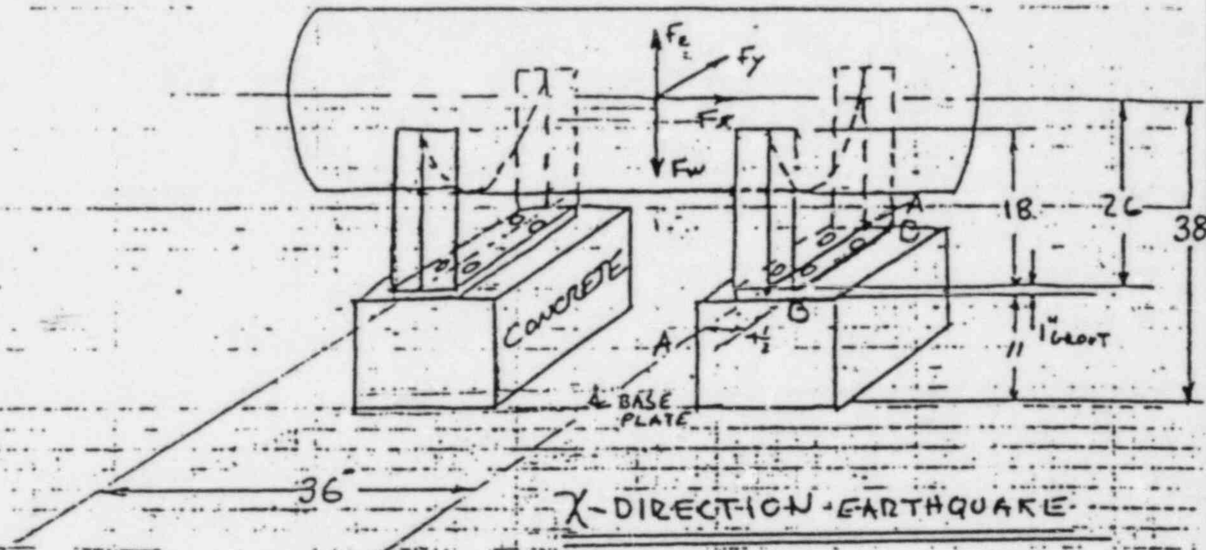
DAY FUEL TANK ANCHORS - 1B | REF.

REF DRAW S&L M-10

FULL WEIGHT $F_W = 3177$ lbs ✓

LATERAL FORCE $F_X = F_Y = 3177 \times .315g = 1000$ lbs ✓

VERTICAL FORCE $F_Z = 3177 \times .21g = 667$ lbs ✓



X-DIRECTION EARTHQUAKE

CHECK FOR OVERTURNING ABOUT A-A AXIS

$\Sigma M_{A_{OVERTURNING}} = 26(F_X) = 26000$ in-lbs ✓

$\Sigma M_{A_{RESISTING}} = 18(F_W - F_Z) = 45180$ in-lbs ✓

$FS = \frac{45180}{26000} = 1.74$ ✓

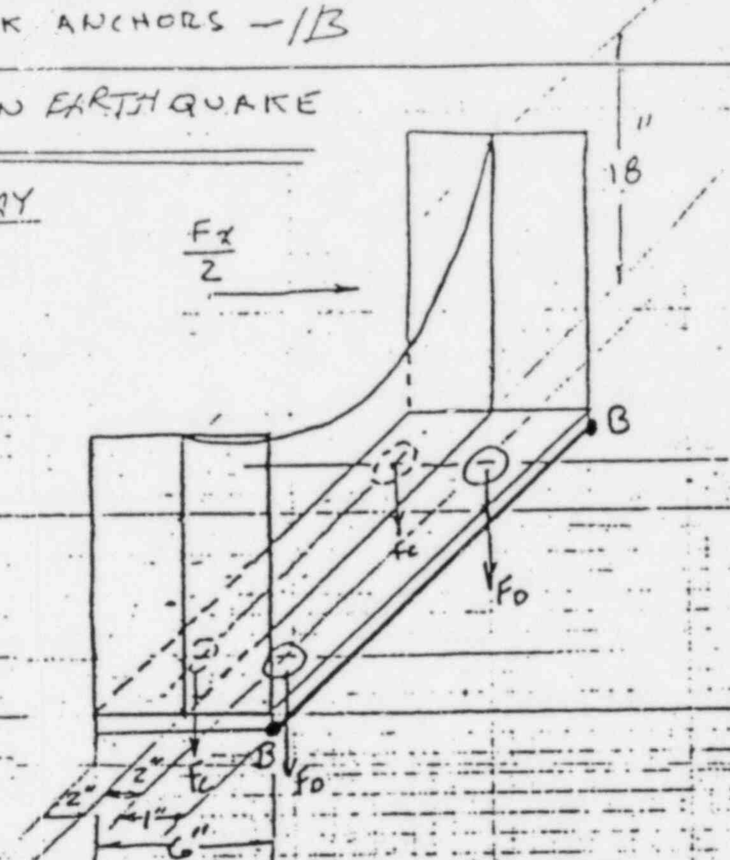
SINCE RESISTING MOMENT IS GREATER THAN OVERTURNING MOMENT, ANCHOR BOLTS ARE NOT IN TENSION DUE TO OVERTURNING. ✓

DAY FUEL TANK ANCHORS — 1B

REF.

X-DIRECTION EARTHQUAKE

SIDESWAY



CHECK TENSION IN ANCHOR BOLTS DUE TO LATERAL FORCE

$\Sigma M_B = 18(F_x/2) - 5(2F_c) - 1(2F_D) = 0$

$\Rightarrow 9000 = 10F_c + 2F_D$

ALSO WE HAVE:

$\frac{1}{5} = \frac{F_D}{F_c} \Rightarrow F_D = \frac{1}{5}F_c$

SUBSTITUTING ABOVE

$10.4F_c = 9000 \Rightarrow F_c =$ **865 lbs TEN**

AND $F_D =$ **173 lbs TEN**

SHEAR FORCE IN EACH BOLT:

$\frac{F_x}{2} \div 4\text{bolts} = \frac{1000}{2} \div 4 =$ **125 lbs SHEAR**

DAY FUEL OIL TANK ANCHORS - 1B

REF.

Y- DIRECTION EARTHQUAKE

$F_x = F_y = 3177 \times .315g = 1000$ lbs

$F_z = 3177 \times .21g = 667$ lbs

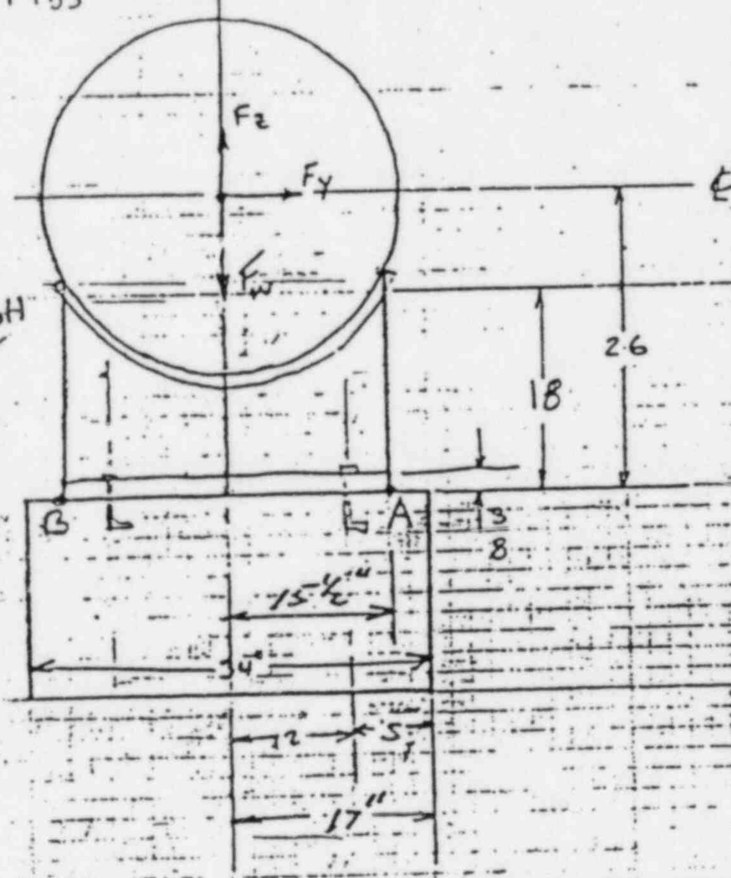
$F_W = 3177$ lbs

SHEAR FORCE

$\Sigma F_y = 1000.$

$\frac{1000 \text{ lbs}}{8 \text{ bolts}} = 125 \text{ lbs/bolt}$

⇒ SHEAR FORCE IS 125 lbs/bolt



OVERTURNING

OVERTURNING MOMENT:

$M_A = 26" \times 1000 \# = 26000 \text{ in-}\#$

RESISTING MOMENT:

$15.5" \times (3177 - 667) = 38,905 \text{ in-}\#$

$FS = \frac{38905}{26000} = 1.50$

NO OVERTURNING DUE Y-DIR. EARTHQUAKE

1-B DIESEL FUEL OIL DAY TANK ANCHOR BOLTS	REF.

RSS MAXIMUM STRESSES

$F_{SHEAR} = \sqrt{125^2 + 125^2} = 177$ lbs SHEAR ✓

DUE TO OVERSIZE HOLES THE ANCHOR BOLTS MAY NOT BE ABLE TO DEFORM SUFICIENTLY SO THAT ALL EIGHT BOLTS COULD BE COUNTED UPON TO CARRY THE SHEAR LOAD. THEREFORE WE ASSUME ONLY FOUR BOLTS WILL CARRY THE LOAD, SO THE SHEAR FORCE WILL BE: (P.87 STRUCTURAL DETAILS IN INDUSTRIAL BLDGS SEE REF BELOW)

$177 \times 2 = 354$ lbs/Bolt ✓

$F_{TEN} = 865$ LBS ✓

ASSUME A36 STEEL ANCHOR BOLTS

FROM AISC 8TH ED pg 4-5 ALLOWABLE SHEAR FORCE PER BOLT IS 9.9 ksi × .3068 = 3.04k ✓ SHEAR

354 < 3040 lbs/bolt SHEAR ✓

∴ ALLOWABLE SHEAR FORCE IS NOT EXCEEDED.

FROM AISC 8TH ED pg 4-3 ALLOWABLE TENSILE FORCE PER BOLT IS 5900 lbs/BOLT TEN.

865 < 5900 ✓

∴ ALLOWABLE TENSILE FORCE IS STEEL BOLT IS NOT EXCEEDED. $\frac{f_t}{F_T} + \frac{f_v}{F_v} = \frac{865}{5900} + \frac{354}{3040} = 0.26 < 1.0$ O.K. ✓

FROM ENGINEERING JOURNAL / AISC, "STRUCTURAL DETAILS IN INDUSTRIAL BUILDINGS" P85,86 THIRD QUATER 1981.

$\phi = .7$ ULTIMATE HOOK STRENGTH = $\phi f'_c d L' = 3937$ lbs/bolt ✓

$f'_c = 3000$ psi ASSUME LOAD FACTOR = 1.7 ALLOWABLE CAPACITY = 2316 LBS ✓

$d = 5/8$ 865 < 2316#

$L' = 3"$ ∴ PULL OUT STRENGTH IS NOT EXCEEDED

CONCLUSION: ANCHOR BOLTS ARE ADEQUATE.

NO FIX REQUIRED.

1-B GENERATOR BLDG - ELECTRICAL EQUIPMENT	REF.

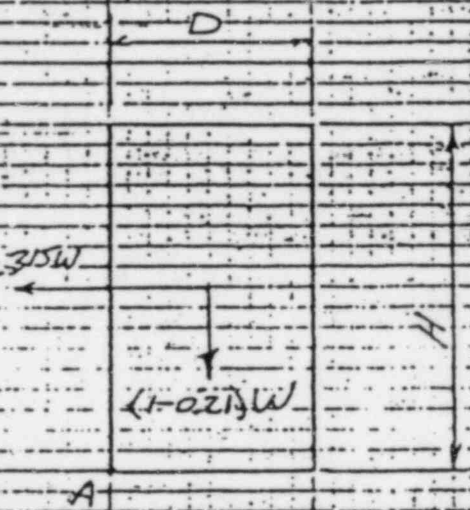
THE FOLLOWING PANELS ARE INCLUDED IN THIS CALCULATION

1. 1-B 480-V ESS. BUS
2. 1-B STATIC INVERTER
3. 1-B DIESEL BUILDING BATTERY CHARGER

1.5X NRC SITE SPECIFIC

PEAK HORIZ. ACCELERATION FROM GROUND SPECTRA = 0.21g x 1.5 = 0.315g

VERTICAL ACCELERATION = $\frac{2}{3} \times 0.315g = 0.21g$



ΣM_A

$M_{RESIST} = 0.79W \times D/2$

$M_{OVER} = 0.315W \times H/2$

FOR $M_{RESIST} = M_{OVER}$

$0.79W \times D/2 = 0.315W \times H/2$

$H/D = 2.51$ ✓

FOR $H/D < 2.51$ NO OVERTURNING

1-B GENERATOR BLDG - ELECTRICAL EQUIPMENT | REF.

1. 1-B 480-V ESS. BUS

W x D x H
WIDTH DEPTH HEIGHT
6'-6" x 4'-8" x 7'-8" ✓ H/D = 92/56 = 1.64 NO OVERTURNING

NO FIX REQUIRED

2. 1-B STATIC INVERTER

4'-7½ x 3'-0" x 6'-6" H/D = 78/36 = 2.17 NO OVERTURNING

NO FIX REQUIRED

3. 1-B DIESEL BLDG BATTERY CHARGER

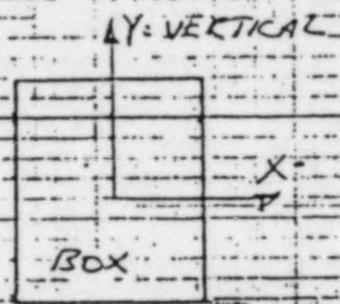
4'-0" x 3'-0" x 6'-6" H/D = 78/36 = 2.17 NO OVERTURNING

NO FIX REQUIRED

ACS VALVE DC MOTOR STARTER

ANCHORAGE: 4-1/4" RED HEAD WEDGE ANCHORS ✓
WEIGHT = 40 LBS ✓

ASSUME: 2g HORIZONTAL ACCELERATION
VERTICAL ACCEL. = 2/3 × 2g = 1.33g



X DIRECTION
$F_x = 2 \times 40 = 80$# ✓
SHEAR = 80/4 = 20#/BOLT ✓

Y-DIR.
$F_y = 2.33 \times 40 = 93.2$# ✓ SHEAR = 93.2/4 = 23.3#/BOLT ✓

Z-DIR
$F_z = 80$# ✓ TENSION = 20#/BOLT ✓

RSS FORCES SHEAR = $\sqrt{20^2 + 23.3^2}$ = 30.7# ✓ TENSION = 20# ✓

ULTIMATE BOLT CAPACITY
TENSION = 2400# ✓ } for f'_c = 3500 psi ✓ RED HEAD CATALOG
SHEAR = 2325# } F-1000 pg. 6

ALLOWABLE CAPACITY
FACTOR OF SAFETY = 4 TENSION = 2400/4 = 600# ✓
SHEAR = 2325/4 = 581# ✓

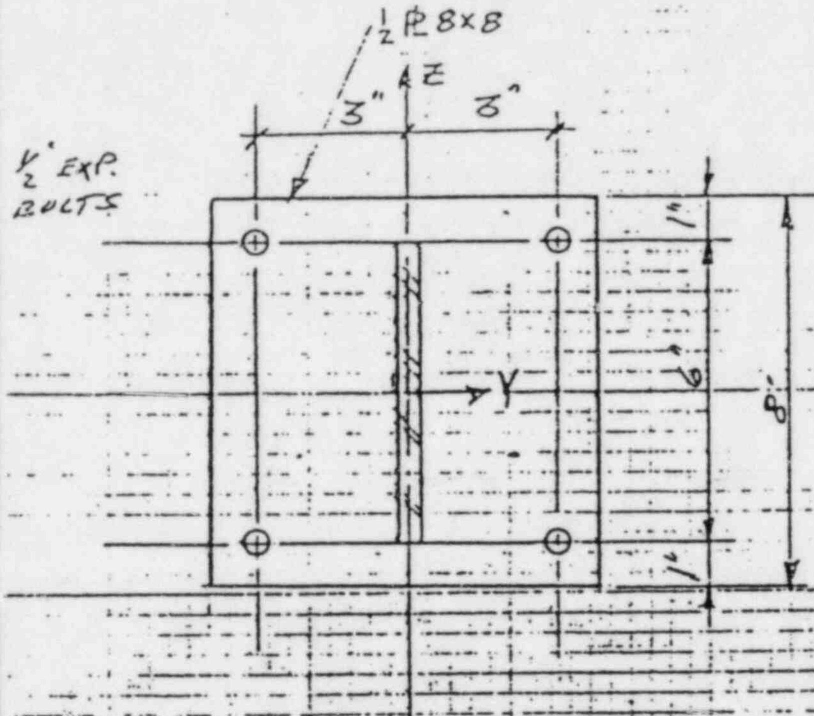
$$\frac{20}{600} + \frac{30.7}{581} \le 1.0$$

0.086 < 1.0 ✓ (O.K.)

4-1/4 RED HEAD WEDGE ANCHORS ADEQUATE NO FIX REQUIRED

LACBWR

WATER LEVEL TRANSMITTER #3



* ASSUME WT = 50#

G-VALUE = 2.58 @ EL667

X-DIRECTION CONSIDERATION

$F = 2.58 \times .05 \times 1.5$

$F = 0.194^{K}$ ✓

$d = 12"$ ✓

$M = Fd = 0.194 \times 12$

$M_y = 2.33^{IN-K}$ ✓

$A_b = \frac{\pi d^2}{4} = 0.196$

FORCE IN BOLT =

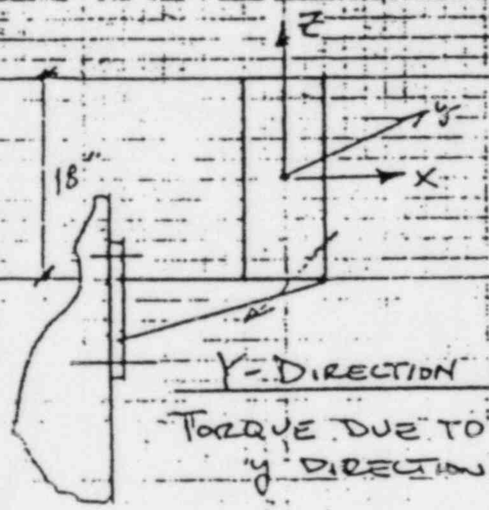
FORCE $f_t = \frac{M}{d} = \frac{2.33}{6} = 0.388^{K}/2$

$= 0.194^{K}$/BOLT

TENSION STRESS $f_t = \frac{0.194}{0.196} = 0.98$ KSI

$f_v = \frac{0.05}{A_b} = \frac{0.05}{0.196 \times 4} = 0.063$ KSI ✓

NEGLECT



Y-DIRECTION CONSIDERATION

TORQUE DUE TO Y DIRECTION $= 0.194 \times 9 = 1.75^{IN-K}$ ✓

M_z MOMENT $= 0.194 \times 12 = 2.33^{IN-K}$ ✓

SECTION AT BASE = $6 \times \frac{1}{2}$

$S = \frac{bd^2}{6} = \frac{6(.5)^2}{6} = 0.25$ ✓

f_b BENDING STRESS $= \frac{2.33}{0.25} = 9.32^{KSI}$ ✓

$\tau = \frac{3T}{bt^2} = \frac{3 \times 1.75}{6 \times .5^2} = 3.5$ KSI ✓

NUCLEAR ENERGY SERVICES

BY K.K DATE 3-2-81 PROJ. 5101 TASK 4
CHKD. FS DATE 9-9-81 PAGE 2 OF 5
LACBWR

WATER LEVEL TRANSMITTER #3

REF.

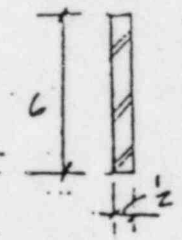
Z - DIRECTION CONSIDERATION

$M_y = 0.194 \times 12 = 2.33^{\text{in-k}}$ ✓

SECTION MODULUS

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

$S = 3 \text{ in}^3$ ✓



$f_b = \frac{M}{S} = \frac{2.33}{3} = 0.78 \text{ ksi}$ ✓

RSS RESULTANT STRESS

$f_b = \sqrt{2 \times 0.78^2 + 9.32^2}$ ✓

$f_b = 9.39 \text{ ksi}$ ✓

CHECK BOLTS (NOTE DIRECT ADDITION OF ALL FORCES WAS USED - CONSERVATIVE)

$M_y = 2.33^{\text{in-k}} + 2.33 = 4.66^{\text{in-k}}$ ✓

$M_z = 2.33^{\text{in-k}} = 2.33^{\text{in-k}}$ ✓

$F_T = \frac{3}{2}\frac{M}{d} = \frac{4.66 \times 3}{6 \quad 2} = 1.16^k / 2 \text{ BOLTS} = 0.58^k/\text{BOLT}$ ✓

X-DIR $F_{TEN} = 0.194/4 \text{ BOLTS} = 0.0485$ ✓

TOTAL TENSION/BOLT $= 0.629^k$ ✓

$\text{SHEAR} = F_x + F_z = 2 \times 0.194 = 0.388^k / 4 \text{ BOLTS} = 0.097^k/\text{BOLT}$

FOR RED HEAD 1/2 EXP BOLTS

5900# PULL OUT = 1975 ✓
8400# SHEAR = 2100
F.S = 4

NUCLEAR ENERGY SERVICES

BY K.K. DATE 5-12-81 PROJ. 5101 TASK 0
CHKD. TS DATE 6-7-81 PAGE 3 OF 3
LACBWR

WATER LEVEL TRANSMITTER #3	REF.

$$\frac{\text{APPLIED TENSILE LOAD}}{\text{TENSION CAPACITY}} + \frac{\text{APPLIED SHEAR}}{\text{SHEAR LOAD CAPACITY}} \leq 1$$

$$\frac{\overset{0.426}{0.629}}{1.475} + \frac{\overset{0.096}{0.097}}{2.100} = 0.47 \leq 1 \quad \text{OK} \checkmark$$

NUCLEAR ENERGY SERVICES

BY TS DATE 3-31-81 PROJ. 5161 TASK C
CHKD. R.R DATE 4-6-81 PAGE 1 OF 1
LACBWR

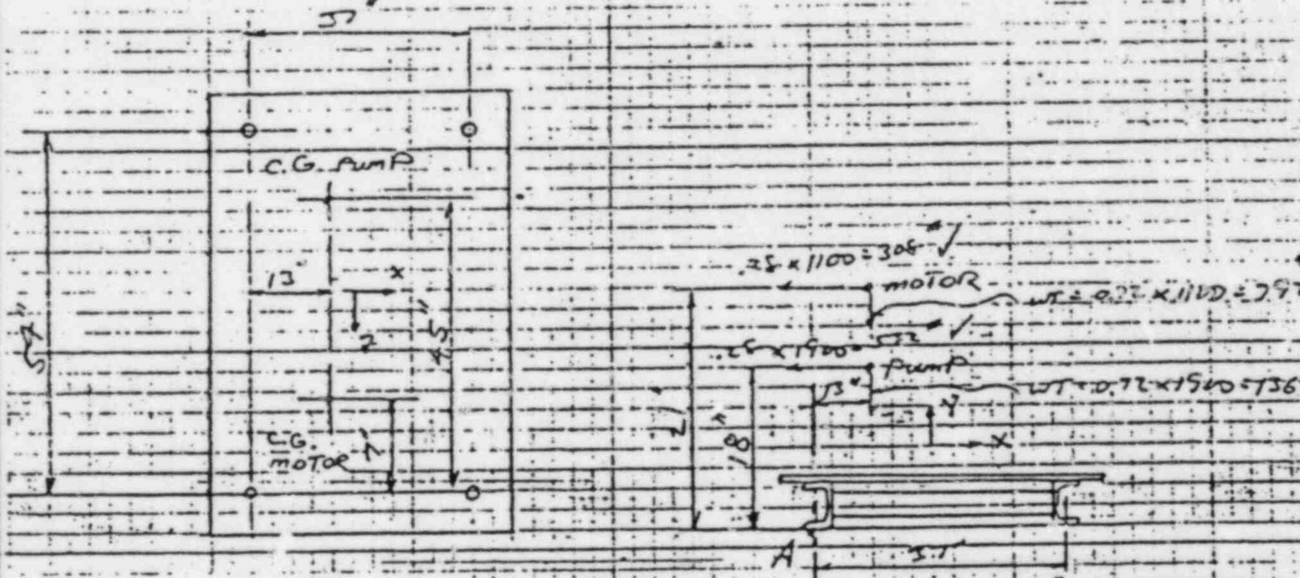
HPCS PUMP 1A, 1B | REF.

HORIZONTAL, VERTICAL ACCELERATION = 0.28 g

REF: GULF UNITED REPORT - FIG. 6.10 - INT. FLOOR SPECTRA, SSE EVENT FOR HIGH FREQUENCY STRUCTURE

MOTOR WT = 1100#
PUMP WT = 1900#

4 - 9/16" ⌀ ANCHOR BOLTS



X-DIR

$\Sigma M_A = 0$

OVERTURNING MOMENT = 18 × 532# + 27" × 308# = 16,044"-# ✓

RESISTING MOMENT = 13"(792# + 1368#) = 28,080"-# ✓

F.S. OVERTURNING = $\frac{28,080}{16,044}$ = 1.75 ✓

SHEAR = $\frac{308 + 532}{4}$ = 210#/BOLT ✓

Z-DIR

SHEAR 210#/BOLT

RESULTANT SHEAR = $\sqrt{210^2 + 210^2}$ = 297#/BOLT ✓

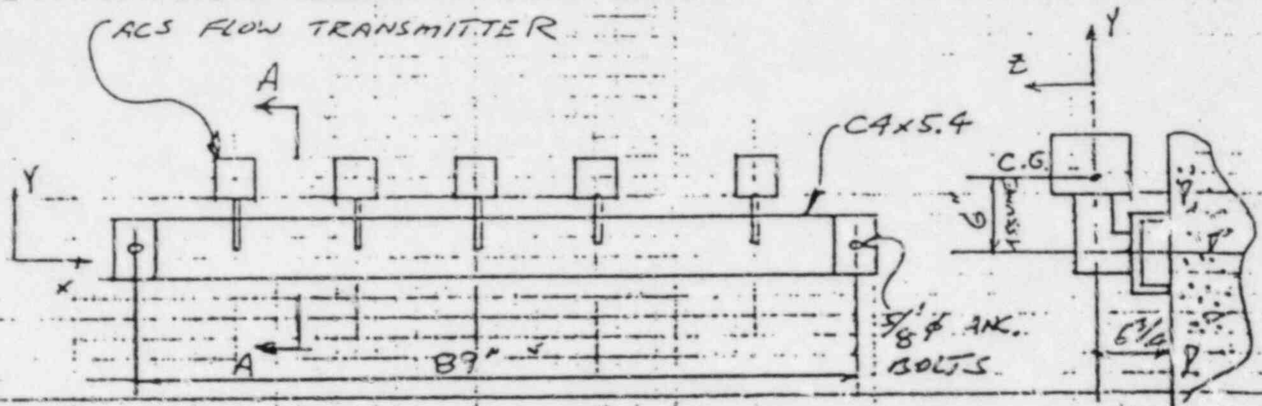
BOLT MATERIAL: ASSUME A36 : $F_v = 0.17 F_u = (0.17)(58) = 9.9$ ksi | 8TH ED. AISC 4-5

$f_v = \frac{0.3^k}{0.249} = 1.21$ ksi < 9.9 ksi (O.K.) ✓

NUCLEAR ENERGY SERVICES

BY TJ DATE [illegible] PROJ. 3701 TASK [illegible]
CHKD. JC DATE 12-28-81 PAGE 1 OF 3
LACBWR

ALT. CORE SPRAY FLOW TRANSMITTER. REF.

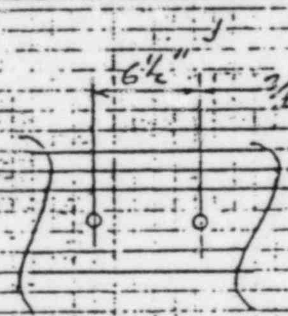


TRANSMITTER WT = 30 LBS EACH

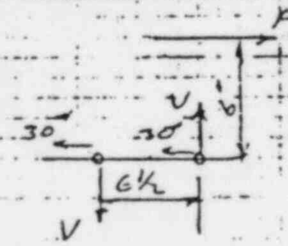
ASSUME HORIZONTAL ACCELERATION = 2g

VERTICAL ACCELERATION = 2/3 x 2g = 1.33g

TRANSMITTER TO CHANNEL CONNECTION



X-DIR



F = 2g x 30 = 60

6 x 60 = 6.5 V

V = 55.4 #/BOLT

RESULTANT SHEAR = $\sqrt{55.4^2 + 30^2}$ = 63 #/BOLT

Y-DIR

SHEAR = $\frac{30 \times 2.33g}{2}$ = 35 #/BOLT

Z-DIR

ΣM = 0

60 x 6 = 2 x 2T

T = 120 #/BOLT

RSS FORCES

SHEAR = $\sqrt{63^2 + 35^2}$ = 72 #/BOLT

TENSION = 120 #/BOLT

ACS FLOW TRANSMITTER | REF.

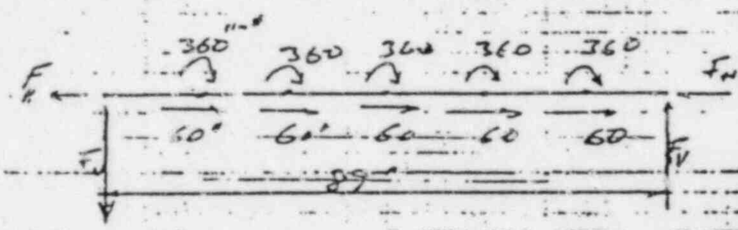
FOR 3/8" ϕ BOLT ✓ FOR A36 $F_u = 58$ ksi ✓ | 8TH ED AISC pg 4-3, 4-5

$f_v = 72/.0110 = 0.65$ ksi ✓ $F_v: 0.17 F_u = 9.86$ ksi ✓ (OK)

$f_t = 120/.0110 = 1.09$ ksi ✓ $F_t = 19.1$ ksi ✓ (O.K.)

CHANNEL ANCHOR BOLTS

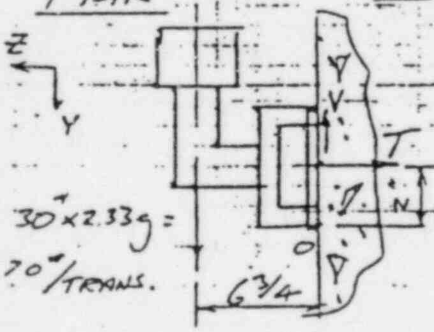
X-DIR



$F_H = 5 \times 60"/2 = 150$ #/BOLT ✓ SHEAR $= \sqrt{150^2 + 20^2} = 151$ #/BOLT

$F_V = \frac{5 \times 360}{89} = 20$ #/BOLT ✓

Y-DIR



30# × 2.33g = 70#/TRANS.

$\Sigma M_o = 0$ (70# × 6.75")(5) = 2T × 2"

T = 590#/BOLT ✓

SHEAR = $\frac{5 \times 70}{2}$ = 175#/BOLT ✓

Z-DIR

$\Sigma M_o = 0$

(60 × 8")(5) = 2T × 2" ✓

T = 600#/BOLT ✓

RSS FORCES

SHEAR $= \sqrt{151^2 + 175^2} = 231$ #/BOLT ✓

TENSION $= \sqrt{600^2 + 590^2} = 841$ /BOLT ✓

NUCLEAR ENERGY SERVICES

BY TS DATE 7-9-81 PROJ. 5101 TASK C
CHKD. JC DATE 12-28-81 PAGE 3 OF –
LACBWR

ACS FLOW TRANSMITTER | REF.

FOR 5/8" ϕ RED HEAD WEDGE ANCHOR

ULTIMATE CAPACITY TENSION = 7825# ✓

SHEAR = 12,000# ✓

ALLOWABLE CAPACITY - TENSION 7825/4 = 1956# ✓

SHEAR 12,000/4 = 3,000# ✓

$$\frac{841}{1956} + \frac{231}{3000} \leq 1.0$$

0.43 + 0.08 = 0.51 < 1.0 5/8" ϕ ANCHORS O.K.

NO FIX REQUIRED

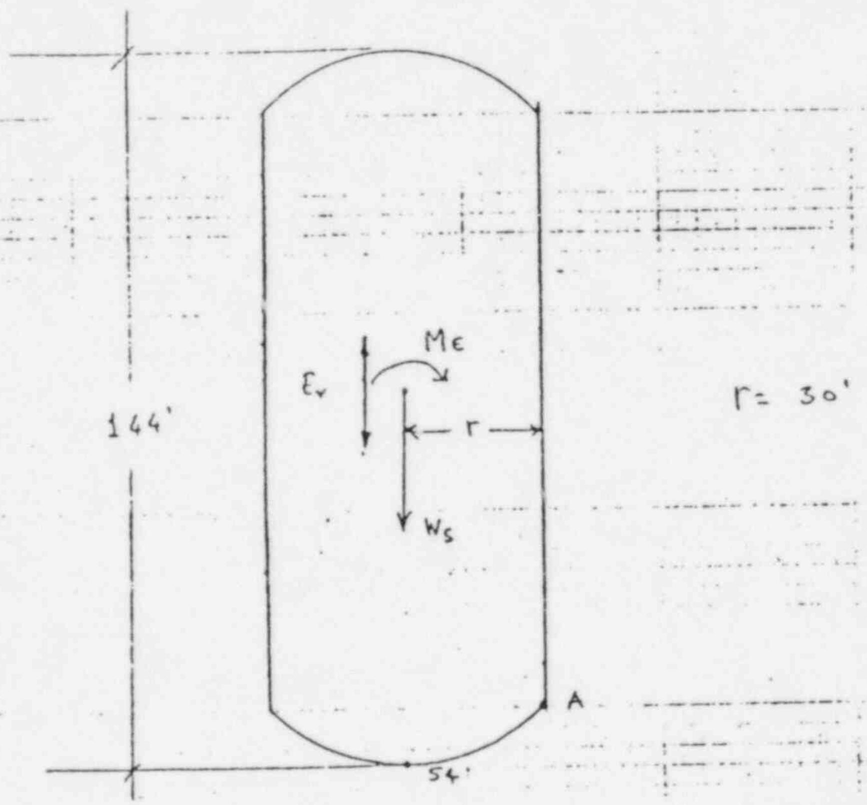
(7)

NES TRANSMITTAL 5101-832,
DATED JANUARY 17, 1983

INVESTIGATION OF STABILITY OF CONTAINMENT BUILDING | REF.

INVESTIGATION OF STABILITY OF CONTAINMENT BUILDING

NRC Concern #
(1)(b)



FROM "SEISMIC AND STRESS ANALYSIS OF THE LACBWR CONTAINMENT BUILDING", P. B 244

VERTICAL LOAD DUE TO DEAD LOAD = $W_S = 17.08 \times 10^3$ K

VERTICAL LOAD DUE TO SRSS EARTHQUAKE

$= E_V = 1.51 \times 10^3$ K.

RESTORING MOMENT ABOUT A = M

$$M = (W_S - E_V)30 = (17.08 \times 10^3 - 1.51 \times 10^3)\,30$$

$$= 4.671 \times 10^5 \text{ K-ft}$$

$$= 5.61 \times 10^6 \text{ K-in}$$

INVESTIGATION OF STABILITY OF CONTAINMENT BUILDING | REF.

MAX. MOMENT = $\sqrt{Mx_1^2 + Mx_2^2}$

Mx_1 = MOMENT IN X1-DIRN. = 1.7322×10^6 K-in — Page 6-244

MX_2 = MOMENT IN X2-DIRN. = 2.6038×10^6 K-in

$$M_{MAX} = \sqrt{1.7322^2 + 2.6038^2}\ (10^6)$$

$$= 3.13 \times 10^6 \text{ k-in.}$$

FACTOR OF SAFETY AGAINST TIPPING.

$$= \frac{5.61 \times 10^6}{3.13 \times 10^6}$$

$$= 1.79$$