



CALCULATION PACKAGE

FILE NO: 23.0201.11 II-31

PROJECT NO: RDV-03

 PROJECT NAME:
 QUAD CITIES STATION UNIT # 1

 CLIENT:
 Commonwealth Edison Company

 CALCULATION TITLE: PIPE SUPPORT CALCULATION

 SYSTEM: RHP PUMP 10710 DISCHARGE to 212well X13B

 LINE: HDD13-1311

 NUTECH MARK #: ND-SH-31

 MODEL: 2112

 COMPUTER NODE: DB30H

 DRAWING: 14-1611-32

PROBLEM STATEMENT OR OBJECTIVE OF THE CALCULATION:

CONSOLIDATION OF SUPPORT DESIGN CALCULATIONS

UNCONTROLLED

 96 MAY -9 PM 1:
 FOR REFERENCE
 VOID AFTER

NUCLEAR SAFETY RELATED

DOCUMENT REVISION	AFFECTED PAGES	REVISION DESCRIPTION	PROJECT ENGINEER APPROVAL/DATE	SIGNATURE, INITIALS & DATE OF PREPARERS & CHECKERS
0	1-2 Initial calculations	INITIAL CONSOLIDATION UNDER RDV-03	W. R. R. 12/1/87 for L. H. BERNSTEIN 12-1-87	M. J. KOHL MDK 11-18-87 FRANK CARONE FC 11/30/87
1	1-2 ADDENDUM 1 ADDED ADDENDUM 3	REVISED CALL TO INCLUDE SPRING CAN TOLERANCES (PROJECT XCB-57)	W. R. R. 7/3/91	K. M. THAKKAR / K.M.T. 6-19-91
2	1-2 ADDENDUM 1 & 3	REVISED DUE TO PIPING REANALYSIS (PROJ. COE-061)	J. E. Neenan 6/16/92	K. M. THAKKAR / K.M.T./399 Koiwals, KN 3-27-92

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CALCULATION PACKAGE (CONTINUATION)

FILE NO: 28.0201.1111-31

PROJECT NO: RDV-03

CALC. NO: 28.0201.1111-31

DOCUMENT REVISION	AFFECTED PAGES	REVISION DESCRIPTION	PROJECT ENGINEER APPROVAL/DATE	NAME AND INITIALS OF PREPARERS & CHECKERS
3 MF ROLL # <u>Q198</u>	2 ADDENDUM-1 ADDED 1A	REVISED ADDENDUM-1 PER PAR 5040-0058 REV. 0 (PROJECT COE 344)	<i>Curt Wurdach</i> 12/30/93	R. M. SHAM H. J. PATEL <i>RMS</i> <i>HJP</i>

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Chicago, Illinois

PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28.0201.1111-31

OWNER COMMONWEALTH EDISON COMPANY

CLIENT COMMONWEALTH EDISON COMPANY

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 B (B0 ~ B3)

Addendum 2: Pipe Support Calculation (Addendum No. 28.0201.1111-31.1)
 SYSTEMS RHR, RSHR, 10/11/92
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 Rev. 1, 11/84, Pgs 1-5.

Addendum 3: Spring can Tolerance calculation for
 support Drawing M-1611-32, Rev. A
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San Jose, California

28.0201.11-31
ADDENDUM - 1

PIPE SUPPORT CALCULATION FILE NO. 28.0201.11-31.01

PLANT OUAD CITIES UNIT / CLIENT CECO

TITLE SYSTEM: RHR PUMP IC/ID DISCHARGE LINE # 1-1008B-18"

SUPPORT # VH-H65 NUTECH MARK # N/A

MODEL # Q 1.11.2 COMPUTER NODE # Q330H

DRAWING NO/REV. M-1611-32/REV. A 2

PREPARER'S NAME: JOHN COLE CHECKER'S NAME: BOR CHAN 2

REV.	DATE	PAGE	REASON FOR REVISION	PROJECT ENGINEER'S APPROVAL COMPUTER RUN NO.																		
0	11/5/92	ALL	TO QUALIFY EXISTING SPRING HANGER	N/A																		
1	7/1/91	1-6 ADDED 7-13	REVISED TO QUALIFY SUPPORT FOR MAXIMUM LOADS FROM ADDCHOUNT-3 POINT OF LOAD (RD L) ALSO INCLUDED (PROJECT XCE-59)	P.E. APPROVAL <i>Cont W...</i>																		
2	6/11/92	1-3 8-11 2A	REVISED DUE TO PIPING SYSTEM MODEL REANALYSIS. (PROJECT: COE-061)	<i>J. S. Neenan</i>																		
3	12/30/93	1,2,2A 4-7, 12-16. ADDED 10A-10B ATTACHMENTS A & B	REVISED CALCULATIONS PER PAR 5040-0058 REV-0 (PROJECT COE 349)	<i>Cont W...</i>																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Revision</td> <td style="width: 15%;">0</td> <td style="width: 15%;">1</td> <td style="width: 15%;">2</td> <td style="width: 15%;">3</td> <td style="width: 20%;"></td> </tr> <tr> <td>Prepared By/Date</td> <td>COLE 11-1-92</td> <td>K. M. THAKKAR 6-7-91</td> <td>K. M. THAKKAR 3-9-92</td> <td>Paul 12-26-93</td> <td>Page 1 of 16</td> </tr> <tr> <td>Checked By/Date</td> <td>CC 11/5/92</td> <td>K. M. THAKKAR 6-10-91</td> <td>KM/5-24-92</td> <td>HP/12-30-93</td> <td></td> </tr> </table>					Revision	0	1	2	3		Prepared By/Date	COLE 11-1-92	K. M. THAKKAR 6-7-91	K. M. THAKKAR 3-9-92	Paul 12-26-93	Page 1 of 16	Checked By/Date	CC 11/5/92	K. M. THAKKAR 6-10-91	KM/5-24-92	HP/12-30-93	
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Project QUAD CITIES NUCLEAR POWER STATION UNIT 128.0201.111.3.01
File No.Owner Commonwealth Edison CompanyClient Commonwealth Edison Company

28.0201.111-31

REFERENCES

ADDENDUM - 1

1. HILTI Anchor & Fastener Design Manual
2. ITT Phillips Red Head Anchoring Systems Spec. Guide 1980
3. Drillco Maxi-bolts Research Report, Burdette, 8-81
4. ELCEN Metal Product (Load Capacity Data Sheets & Nuclear Parts Catalog), 3-81
5. ELCEN Metal Product, Hanger Parts Catalog
6. Bergen-Paterson Pipe Support Catalog #77NFR
7. Pacific Scientific Snubber Catalog, KIN-TECH Division
8. ITT Grinnell Pipe Hangers Catalog PH74 & PH81
9. NPS Industries, Inc. Piping & Equipment Supports Catalog 1981
10. CDC GENSAP User Information Manual 1977
11. CDC Baseplate II User Manual 3-82
12. ASME B&PV Code 1977 Ed. and Summer 77 Addenda
13. AISC Manual of steel Construction 8th Ed. 1980
14. Design of Welded Structures, BLODGETT 1966
15. PAID Index S&L Drawings #ISI-12
16. NUTECH Communication Record, File #27.0200.0001
17. Internal Memo: AT-82-003, Snubber Support Stiffness, A. Tin, 4-23-82
18. Internal Memo: AT-82-009, Concrete Expan. Anchor Stiff. Test Results, 5-28-82
19. Internal Memo: HL-82-036, Baseplate Anal. Proced., H. Liu, 3-30-82
20. Internal Memo: AT-82-013, Material Spec. for Pipe Suppt. Design, A. Tin, 8-4-82
21. Internal Memo: AT-82-016, Allowable Stress in Compress., A. Tin, 8-17-82
22. Internal Memo: RPJ-82-001, HILTI Expan. Anchor Stiff., R. Jones, 5-82
23. Internal Memo: MM-82-002, Red Head Expan. Anchor Stiff., M. Mesko, 5-82
24. Internal Memo: AT-82-020, Welding Stress Allowables, A. Tin, 9-15-82
25. Letter: ITT Grinnell Strut, B. Siekkinen to TJV 6-17-82, File: 27.0200.0003
26. Letter: Shell type anchor capacities, A. Walser to TJV, 7-12-82, File: 27.0200.00
27. Letter: 79-02 Baseplate Survey Info. A. Walser to TJV, 7-12-82, File: 27.0200.000
28. CECo Installation Specification, COM-24-085.
29. LOAD SUMMARY FILE NO. 28.0201.113.120, REV. 1
30. FIELD SURVEY FILE NO. 27.0200.002.1.F61, 10/19/82
31. ITT GRINNELL HANGER STANDARD, JAN. 1987
32. ASME B & PV CODE CASE N-318, 7-12-1981
33. NUTECH/SARGENT & LUNDY STRUCTURAL INTERFACE CONTACT INSTRUCTIONS FOR MARK I PIPING SUPPORTS, CECo, DRESDEN UNITS 2 & 3, QUAD-CITIES UNIT 1 & 2, FILE NO XCE 059-0160.04
34. TI-034, REV. 0 EVALUATION OF INTEGRAL PIPE ATTACHMENTS FOR TORUS ATTACHED PIPING AT DRESDEN & QUAD CITIES STATIONS. PROJECT XCE-085.
35. NUTECH PIPE SUPPORT DWG. M-1611-32, REV. ^B_A APERTURE CARD FILE.

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PROJECT QUAD CITIES NUCLEAR POWER STATION UNIT-1 FILE NO. 28-0201-1111-31
 OWNER COMMONWEALTH EDISON COMPANY
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

REFERENCES (CONTINUED)

- 36. VERIFICATION OF CATEGORY 3 LOTUS 1-2-3 VERSION 2.3 SPREAD SHEETS SHRLUG, ELBLUG, STANCH AND ELSTANCH. FILE GENERIC 0380.01
- 37. PIPE STRESSES AT NODES HAVING WELDED ATTACHMENTS FOR MODEL G1.11.2, CALC. NO. 28-0201.1133.138, REV.0 PROJECT COE-061. 3
- 38. LETTER NO. 2-1753 DATED 11-3-93 FROM C N PETROPOULOS STRUCTURAL ENGINEERING DIVISION, SARGENT & LUNDY ENGINEERS CHICAGO TO MR. E. WARCHOL, PROJECT MANAGER - PACIFIC NUCLEAR, NAPERVILLE, ILLINOIS, REGARDING PAR NO 5040-0058 FILE NO. COE 348.0005
- 39. S & L DRG NO. 75273 REV G, REACTOR BUILDING FRAMING MISCELLANEOUS PLANS & DETAILS SHT-1, QUAD CITIES UNIT-1
- 40. GUIDELINES FOR IN PLACE STEEL STIFFENER REQUIREMENTS CHECK COMMONWEALTH EDISON COMPANY, CHICAGO, IL, QUAD CITIES NUCLEAR POWER STATIONS UNITS 1 & 2, SARGENT & LUNDY ENGINEERS CHICAGO, ILLINOIS, PROJECT NO. 7355-0, NUCLEAR SAFETY RELATED REV.0
- 41. GEORGIA TECH STRUCL USER'S MANUAL VOLS 1 THRU 5, REVISION 11 SEPTEMBER 1991 BY CTICES SYSTEM LABORATORY GEORGIA INSTITUTE OF TECHNOLOGY ATLANTA, GEORGIA
- 42. SEISMIC DESIGN CRITERIA FOR QUAD CITIES STATIONS UNITS 1 & 2, REACTOR TURBINE BUILDING BY SARGENT & LUNDY CHICAGO, REV.1, DATED 3-31-1987 PREPARED FOR COMMONWEALTH EDISON COMPANY, PROJECT NO. 7355-0
- 43. WELDING FORMULAS & TABLES FOR STRUCTURAL AND MECHANICAL ENGINEERS & PIPE SUPPORT DESIGNERS BY I.V.I. STRUCTURAL DESIGN SERVICE, PORTLAND, OREGON ENGINEERS LIBRARY

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28.0201.1111-31

PROJECT Quad Cities Nuclear Power Station UNIT 1
OWNER Commonwealth Edison Company
CLIENT Commonwealth Edison Company

ADDENDUM-1
FILE NO. 28.0201.1111-31.01

PURPOSE OF THIS CALC PACKAGE IS TO QUALIFY
EXISTING SPRING HANGER ASSEMBLY.

2

REVISED LOAD FROM ADDENDUM-3, PAGE-6,
REV. 1 ARE

UPSET = 2879 lbs.

FAULTED = 2921 lbs.

LOAD USED IN DESIGN CALC. REV. 1
ON PAGE 4 ARE

UPSET = 2880 lbs. FAULTED = 2922 lbs.

SINCE LOADS DECREASED, NO FURTHER
EVALUATION REQUIRED.

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PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28.0201.1111.31.01
 OWNER COMMONWEALTH EDISON COMPANY
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM - 1

MAXIMUM LOADS:

UPSET = 2880 # }
 FAULTED = 2922 # } SEE ADDENDUM - 3, Pg - C

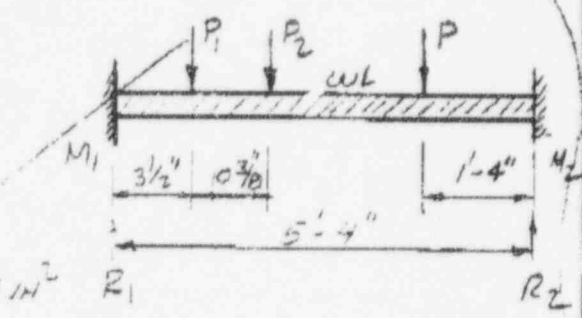
WT OF SPRING CAN = 48 # (REF 8)
 WT OF 1" ϕ ROD (1'-0") = 3 # (APPX.)
 WT OF WASHER 1" (1" ϕ) = 2 # (REF. 8)
TOTAL WT = 53 #

MAX. DESIGN LOAD = 2922 + 53 = 2975 #

SUPERSEDED PER
 REV. 3. SEE PAGE 10E

CHECK CHANNEL C5X6.7

$P = 2975 \#$
 $P_1 = P_2 = 610 \#$ (CONSIDER MAX. ALLOWABLE FOR 3/8" ROD)
 $w = 13.4 \#/FT$ [2] C5X6.7



BENDING STRESS

$S_x = 6 \text{ IN}^3$
 $A_y = 2 \times 5 \times .19 = 1.9 \text{ IN}^2$
 $d/A_y = 8.9 \text{ IN}^{-1}$

$M_2 = \frac{2975 \times 48 \times 16}{64^2} + \frac{610 \times 13.875 \times 50.125}{64^2} + \frac{610 \times 3.5 \times 60.5}{64^2} + \frac{13.4 \times 64^2}{12 \times 12}$
 $= 28703 \# \cdot \text{IN}$

$M_1 = \frac{2975 \times 48 \times 16^2}{64^2} + \frac{610 \times 13.875 \times 50.125^2}{64^2} + \frac{610 \times 3.5 \times 60.5^2}{64^2} + \frac{13.4 \times 64^3}{12 \times 12} = 16406 \# \cdot \text{IN}$

$f_b = \frac{M}{S_x} = \frac{28703}{6} = 4784 \text{ PSI}$, $F_b = \frac{12 \times 10^3 E}{L_d/A_y} = \frac{12 \times 10^3 \times 1}{64 \times 8.9} = 21 \text{ ksi} > 1.6 F_y$
 $\therefore 4784 \text{ PSI} < 1.6 \times 32800 = 52480 \text{ PSI} \therefore \text{OK}$

SHEAR STRESS:

$R_2 = \frac{2975 \times 48^2}{64^2} (48 + 3 \times 16) + \frac{610 \times 13.875^2}{64^2} (13.875 + 3 \times 50.125) + \frac{610 \times 3.5^2}{64^2} (3.5 + 3 \times 60.5) + \frac{13.4 \times 5.33}{2}$

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PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28-0201-1111-31-01
 OWNER COMMONWEALTH EDISON COMPANY
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

3
 SUPERSEDED PER
 REV-3

~~$R_2 = 2625 \#$
 $R_1 = 2975 + 2 \times 610 + 13.4 \times 533 - 2625$
 $= 1641 \#$
 $f_s = \frac{R_1}{A_1} = \frac{2625}{1.9} = 1382 \text{ PSI} < .4 \times 32800 = 13120 \text{ PSI}$
∴ OK~~

CHECK ROD 1" φ, WELD LESS EYE NUT 1" φ, WASHER A 1"

ALLOWABLE LOAD = 4960 # > DESIGN LOAD = 2975 # (REF 8)
∴ OK

CHECK RISER CLAMP H.S. 40 18" φ PIPE
 (REF 31)

ALLOWABLE LOAD = 11500 # > DESIGN LOAD = 2 × 2975 = 5950 #
∴ OK

SUPERSEDED
 PER REV-3

CHECK WELD BETWEEN CHANNEL & I.P. BEAM

~~$LW = 2 \times 5 + 4 \times 75 = 17 \text{ IN (CONS.)}$
 $SW = (1.75 \times 2) \times 5 + \frac{5^2}{3} = 25.83 \text{ IN}^2$~~

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PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28.0201.1111-31.01
 OWNER COMMONWEALTH EDISON COMPANY
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM - 1

SUPERSEDED PER REV-3

$R = 2625 \#$ $M = 28703 \#-IN$

$f_r = \left[\left(\frac{2625}{17} \right)^2 + \left(\frac{28703}{25.83} \right)^2 \right]^{1/2} = 1122 \#/IN$

REQUIRED WELD SIZE

$W = \frac{1122}{.3 \times 32800} = 0.114" < \frac{1}{8}" \quad \therefore \text{OK}$

CHECK CHANNEL C5X6.7 (FIXED ONE END, OTHER END SIMPLY SUPPORTED)

$P = 2975 \#$
 $P_1 = P_2 = 610 \#$
 $W = 13.4/FT = 1.12 \#/IN$

$S_x = 6 IN^3$
 $A_y = 1.9 IN^2$
 $A/A_y = 8.9 IN^{-1}$

REACTIONS:

$R_1 = \frac{2975 \times 48^2}{2 \times 63^3} (15 + 2 \times 63) + \frac{610 \times 13.875^2}{2 \times 63^3} (49.125 + 2 \times 63) + \frac{610 \times 13.5^2}{2 \times 63^3} (59.5 \times 2 \times 63) + \frac{3 \times 1.12 \times 63}{8}$

$= 2002 \#$

$R_2 = 2975 + 2 \times 610 + 1.12 \times 63 - 2002 = 2263 \#$

MOMENT:

ⓐ PT. OF LOAD $M = 2002 \times 15 = 30030 \#-IN$

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Chicago, Illinois

PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28-0201-1111-31-01
 OWNER COMMONWEALTH EDISON COMPANY
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

(a) FIX END

SUPPRESSED
PER REV-3

$$M_2 = \frac{2975 \times 15 \times 48}{2 \times 63^2} (15 + 63) + \frac{610 \times 49.125 \times 13.875}{2 \times 63^2} (49.125 + 63) + \frac{610 \times 3.5 \times 59.5}{2 \times 63^2} (59.5 + 63) + \frac{1.12 \times 63^2}{4}$$

$$= 29437 \text{ #-IN}$$

BENDING STRESS

$$f_b = \frac{M}{S} = \frac{30030}{6} = 5005 \text{ PSI}, \quad F_b = \frac{12 \times 10^3 \times C_b}{L \cdot d / A_t} = \frac{12 \times 10^3 \times 1}{63 \times 8.9} = 21.4 \text{ ksi} > 16 \text{ Ft.}$$

$$\therefore f_b = 5005 \text{ PSI} < 16 \times 32800 = 19680 \text{ PSI} \quad \therefore \text{OK}$$

SHEAR STRESS

$$f_s = \frac{R_2}{A_t} = \frac{2263}{1.9} = 1191 \text{ PSI} < 1.4 \times 32800 = 13120 \text{ PSI} \quad \therefore \text{OK}$$

CHECK WELD BETWEEN 15X6.7 AND BEAM W/16X16

$$L_w = 2 \times 4.36 + 4 \times 1.56$$

$$= 14.96 \text{ IN}$$

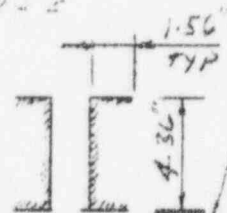
$$S_w = 2 \times 1.56 \times 4.36 + \frac{4 \times 36^2}{3} = 19.94 \text{ IN}^2$$

$$M = 29437 \text{ #-IN}, \quad R = 2263 \text{ #}$$

$$f_7 = \left[\left(\frac{2263}{14.96} \right)^2 + \left(\frac{29437}{19.94} \right)^2 \right]^{1/2} = 1484 \text{ #/IN}$$

REQUIRED WELD SIZE $W = \frac{1484}{.707 \times 18000} = 0.117 \text{ IN} < 1/8 \text{ IN} \quad \therefore \text{OK}$

OTHER WELD WILL BE OK BY COMPARISON & ENGINEERING JUDGEMENT.



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NUTECH ENGINEERS

Project	QUAD CITIES NUCLEAR POWER STATION UNIT 1	File No. 28.0201.1111-31
Owner	COMMONWEALTH EDISON COMPANY	ADDENDUM 1
Client	COMMONWEALTH EDISON COMPANY	M-1611-32

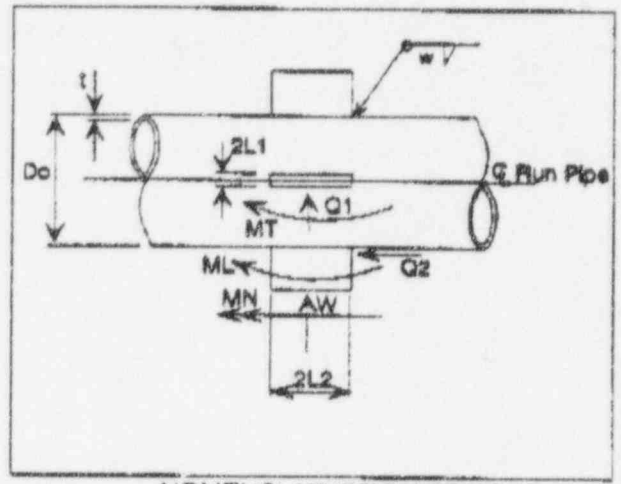
SHEAR LUG EVALUATION PER TI-034 (REF. 34)

GEOMETRY INPUT (REF. 35)

Do =	18.000 in	Ro =	9.000 in
t =	0.3750 in	r =	8.813 in
2L1 =	1.500 in	La =	0.375 in
2L2 =	2.000 in	Lb =	0.375 in
KL =	3.6 (Fillet Weld)	Lc =	0.750 in
Leg (w) =	0.25 in	Ld =	1.000 in

MATERIALS PROPERTIES

Sy =	32800 psi
Sh =	15000 psi
Sc =	15000 psi
Se =	22500 psi



NOMENCLATURE DIAGRAM

LUG LOADS AND PIPE STRESSES (lbs & psi)

ASME EQUATION	Eq. 8	Eq. 9B	Eq. 9C	Eq. 9D	Range*	Peak**	Press	Pmax
NOMENCLATURE	bw	LEVEL B	LEVEL C	LEVEL D	Max. Range	Max. Load	NA	NA
W	0	0	0	0	0	0		
Q1	0	0	0	0	0	0		
Q2 (ADDENDUM-3)	2673	2679	2921	2921	327	2921		
ML = 92K * 75"	2005	2160	2191	2191	246	2191		
MN	0	0	0	0	0	0		
MT	0	0	0	0	0	0		
MT(bar)	0	0	0	0	0	0		
NOMENCLATURE	Ma/Z	(Ma+Mb)/Z	(Ma+Mb)/Z	(Ma+Mc)/Z	Mc/Z	N/A	FDa/4	Fm/Dm
PIPE STRESS (REF. 37)	467	1955	3442	3442	2798		4264	1850

MT(bar) = Greater of { MT / [(Lc)(Ld)(t)(1 + (Lc/Ld))] , MT / [(0.8 + 0.05(Ld/Lc))(Lc)²(Ld)] }

LIMITATIONS

Gamma = r/t =	23.5	≤ 50	OK
Beta 1 = L1/r =	0.085	≤ 0.5	OK
Beta 2 = L2/r =	0.113	≤ 0.5	OK
Beta 1 x Beta 2 =	0.010	≤ 0.075	OK

$\Delta_{TH} = 0.154" < 5/16"$
 \therefore NO FRICTION FORCE.
 * Range = SPRING RATE (2K.S.E + TH)
 $= 900(2K \cdot 0.95 + 173)$
 $= 327 \text{ lbs.}$

ATTACHMENT PROPERTIES

AJ = 4 (L1) (L2) =	3.000 in ²
ZIL = (4/3) (L1) (L2) ² =	1.000 in ³
ZIN = (4/3) (L1) ² (L2) =	0.750 in ³

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NUTECH ENGINEERS

Project	QUAD CITIES NUCLEAR POWER STATION UNIT 1	File No. 28.0201.1111-31
Owner	COMMONWEALTH EDISON COMPANY	ADDENDUM 1
Client	COMMONWEALTH EDISON COMPANY	M-1611-32

SHEAR LUG EVALUATION PER TI-034 (cont.)STRESS INDICES

$$CT = 7.64 [(\text{Gamma})^{1.64} (\text{Beta } 1) (\text{Beta } 2) [(\text{Nu})^{1.54}] \geq 1.0$$

$$CL = 0.51 [(\text{Gamma})^{1.74} (\text{Beta } 1) (\text{Beta } 2)^2 [(\text{Nu})^{4.74}] \geq 1.0$$

$$CN = 0.76 [(\text{Gamma})^{1.90} (\text{Beta } 1)^2 (\text{Beta } 2) [(\text{Nu})^{3.40}] \geq 1.0$$

$$\text{Nu} = -[X1 \cos(\text{Theta}) + Y1 \sin(\text{Theta})] - (1/\text{Ao}) [X1 \sin(\text{Theta}) - Y1 \cos(\text{Theta})]^2$$

$$X1 = X0 + \log(\text{Beta } 1)$$

$$Y1 = Y0 + \log(\text{Beta } 2)$$

Index	Ao	Theta °	Xo	Yo	X1	Y1	Nu
CT	2.2	40	0.00	0.05	-1.07	-0.90	1.395
CL	2.0	50	-0.45	-0.53	-1.52	-1.50	2.102
CN	1.8	40	-0.75	-0.60	-1.82	-1.55	2.387

$$CT = 21.8$$

$$CL = 4.59$$

$$CN = 4.85$$

$$BT = (2/3) CT = 14.557$$

$$BL = (2/3) CL = 3.061$$

$$BN = (2/3) CN = 3.232$$

LOCAL STRESSES

$$\text{SML} = (BT)(W)/AL + (BL)(ML)/ZIL + (BN)(MN)/ZIN + Q1/2(L1)(La) + Q2/2(L2)(Lb) + MT(\text{bar}) \quad (\text{Eq } 3.1.3-1)$$

$$\text{SNL} = (CT)(W^*)/AL + (CL)(ML^*)/ZIL + (CN)(MN^*)/ZIN + Q1^*/2(L1)(La) + Q2^*/2(L2)(Lb) + MT(\text{bar}) \quad (\text{Eq } 3.1.3-2)$$

$$\text{SPL} = KL(\text{SNL}) \quad (\text{Eq } 3.1.3-3)$$

$$\text{SNL}^{**} = (CT)(W^{**})/AL + (CL)(ML^{**})/ZIL + (CN)(MN^{**})/ZIN + Q1^{**}/2(L1)(La) + Q2^{**}/2(L2)(Lb) + MT^{**}(\text{bar}) \quad (\text{Eq } 3.1.3-4)$$

2

ASME EQUATION	Eq 8	Eq 9B	Eq 9C	Eq 9D	Range*	Peak**
SML	9702	10451	10602	10602		
SNL					1566	
SPL					5636	
SNL**						13955

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Prepared By/Date	K.M.Thakkar/3-9-92			Of	16
Checked By/Date	Korah/3-24-92				

NUTECH ENGINEERS

Project	QUAD CITIES NUCLEAR POWER STATION UNIT 1	File No. 28.0201.1111-31
Owner	COMMONWEALTH EDISON COMPANY	ADDENDUM 1
Client	COMMONWEALTH EDISON COMPANY	M-1611-32

SHEAR LUG EVALUATION PER TI-034 (cont.)MODIFIED CODE EQUATIONS

EQ. (8)	$PD_o/4t + MA'/Z + SML$	$14433 \leq 1.0 Sy =$	32800 psi	OK	(Eq 3.1.3-5)
EQ. (9B)	$PmDo/4t + (MA' + MB')/Z + SML$	$14256 \leq 1.2 Sy =$	39360 psi	OK	(Eq 3.1.3-6)
EQ. (9C)	$PmDo/4t + (MA' + MB')/Z + SML$	$15894 \leq 1.5 Sy =$	49200 psi	OK	(Eq 3.1.3-6)
EQ. (9D)	$PmDo/4t + (MA' + MB')/Z + SML$	$15894 \leq 2.0 Sy =$	65600 psi	OK	(Eq 3.1.3-6)
EQ. (10)	$MC'/Z + SPL/2$	$5616 \leq Sa =$	22500 psi	OK	(Eq 3.1.3-7)
EQ. (11)	$PD_o/4t + (MA' + MC')/Z + SML + SPL/2$	$20048 \leq Sh + Sa =$	37500 psi		(Eq 3.1.3-8)

ADDITIONAL EQUATIONS

SNL**	$13955 \leq 2.0 Sy =$	65600 psi	OK	(Eq 3.1.3-9)
$Q1^{**}/2(L1)(La) + Q2^{**}/2(L2)(Lb) +$ $MT^{**}(\text{bar}) =$	$3895 \leq 1.0 Sy =$	32800 psi	OK	(Eq 3.1.3-10)

Additionally, since the attachment is connected with a fillet weld, the fillet weld must be qualified.

WELD PROPERTIES

$Aw = 2(2L2)(w)(.707) =$	0.707 in^2		
$Zwl = (1/3)(2L2)^2(w)(.707) =$	0.236 in^3		
$Zwn = (2L1)(2L2)(w)(.707) =$	0.530 in^3	$J = (1/6)(2L1)[3(2L2)^2 + (2L1)^2] =$	3.6 in^3
$Zwt = (J/C)(w)(.707) =$	0.504 in^3	$C = [(L1)^2 + (L2)^2]^{1/2} =$	1.25 in

Therefore, the weld is checked by the following two equations

$$\frac{W^{**}}{Aw} + \frac{ML^{**}}{Zwl} + \frac{MN^{**}}{Zwn} + \frac{2(Q1^{**} + Q2^{**})}{Aw} + \frac{MT^{**}}{Zwt} = 17560 \leq 2.0 Sy = 65600 \text{ psi} \quad \text{OK} \quad (\text{Eq 3.1.3-11})$$

$$\left\{ \left(\frac{W^{**}}{Aw} \right)^2 + 4 \left[\frac{(Q1^{**} + Q2^{**})}{Aw} + \frac{MT^{**}}{Zwt} \right]^2 \right\}^{1/2} = 8263 \leq 1.0 Sy = 32800 \text{ psi} \quad \text{OK} \quad (\text{Eq 3.1.3-12})$$

THE SHEAR LUG IS QUALIFIED AS PER TI-034; ALL EQUATIONS PASS

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Checked By/Date	K. Colaneri 3-27-92				

PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

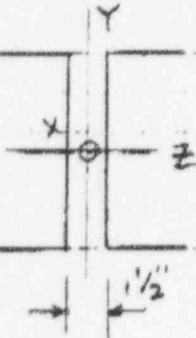
PROJECT QUAD CITIES NUCLEAR POWER STATION #1 | FILE NO. 28-0201-1111-31
 OWNER COMMONWEALTH EDISON COMPANY | CALL # 28-0201-1111-31
 CLIENT COMMONWEALTH EDISON COMPANY | ADDENDUM-1

	REF. NO.
<p><u>REVISED REACTIONS AT AUXILIARY STEEL CONNECTIONS ON INPLACE STEEL FROM PIPE SUPPORT M-1611-32</u></p>	
<p>THE PURPOSE OF THIS CALCULATION IS TO OBTAIN REVISED REACTIONS ON IN PLACE STEEL AT AUXILIARY STEEL CONNECTIONS FROM PIPE SUPPORT M-1611-32 AS REQUESTED PER S&L LETTER NO. Q-1755 DATED 11-24-93 FROM C. N. PETROPOULOS OF S & L TO MR C WARMHOL OF PACIFIC NUCLEAR (ATTACH. B, REF 3B).</p>	38
<p>IN ORDER TO CONSIDER TORSIONAL STIFFNESSES OF EXISTING IN PLACE STEEL, THE INPLACE STEEL IS MODELLED ALONG WITH AUXILIARY STEEL FOR GTSTRUDL ANALYSIS PER REF 41. (SEE PAGE 10D FOR MODEL). THE LOCAL FLEXIBILITY IS NEGLECTED & ALL FLEXIBLE IN PLACE STEEL CONNECTIONS ARE MODELLED AS PIN END CONNECTIONS. SEE GTSTRUDL COMPUTER RUN ID# 09889.931223.112307 (ATTACHMENT A) FOR INPUT & OUTPUT. INPUT DATA & EVALUATION OF ANALYSIS RESULTS FROM THE OUTPUT ARE IN THE FOLLOWING PAGES</p>	41

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PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

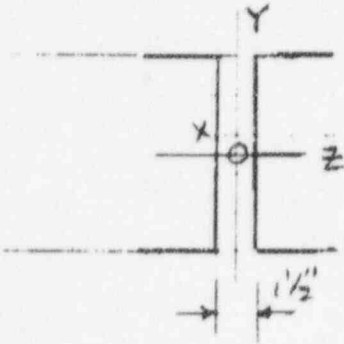
PROJECT QUAD CITIES NUCLEAR POWER STATION # (FILE NO. 28-0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALL # 28-0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

	REF. NO.
<u>PROPERTIES</u>	
<u>MEMBERS: 6-9, 11-14 (SEE PAGE 100)</u>	
2 C 5x6.7 BACK TO BACK w/1/2" GAP	
	13
$A_x = A_y = A_z = 2 \times 1.97 = 3.94 \text{ in}^2$	
$I_z = 2 \times 7.49 = 14.98 \text{ in}^4$	
$I_y = (2 \times 0.479) + \{2 \times 1.97 \times (0.484 + 0.75)^2\}$ $= 6.96 \text{ in}^4$	
$I_x = 2 \times 0.06 = 0.12 \text{ in}^4$	
$S_y = \frac{6.96}{(1.75 + 0.75)} = 2.784 \text{ in}^3$	
$S_z = \frac{14.98}{2.5} = 6 \text{ in}^3$	
<u>MEMBERS</u>	
1, 2 W 10x33	
3, 10 W 14x68	35
4, 5 W 12x53	
15 ~ 18 W 16x36	

REVISION	3			PAGE <u>10B</u>
PREPARED BY/DATE	<u>Gray 2-23-93</u>			OF <u>16</u>
CHECKED BY/DATE	<u>HCP/12-30-93</u>			

PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 | FILE NO. 28-0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY | CALC # 28-0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY | ADDENDUM-1

	REF. NO.
<u>PROPERTIES</u>	
<u>MEMBERS: 6-9, 11-14 (SEE PAGE 100)</u>	
2 C 5x67 BACK TO BACK w/1/2" GAP	
	13
$A_x = A_y = A_z = 2 \times 1.97 = 3.94 \text{ in}^2$	
$I_z = 2 \times 7.49 = 14.98 \text{ in}^4$	
$I_y = (2 \times 0.479) + \{2 \times 1.97 \times (0.484 + 0.75)^2\}$ $= 6.96 \text{ in}^4$	
$I_x = 2 \times 0.06 = 0.12 \text{ in}^4$	
$S_y = \frac{6.96}{(1.75 + 0.75)} = 2.784 \text{ in}^3$	
$S_z = \frac{14.98}{2.5} = 6 \text{ in}^3$	
<u>MEMBERS</u>	
1, 2 W 10x33	
3, 10 W 14x68	35
4, 5 W 12x53	
15 ~ 18 W 16x36	
REVISION	5
PREPARED BY/DATE	R.../12-27-93
CHECKED BY/DATE	H.../12-30-93
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PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

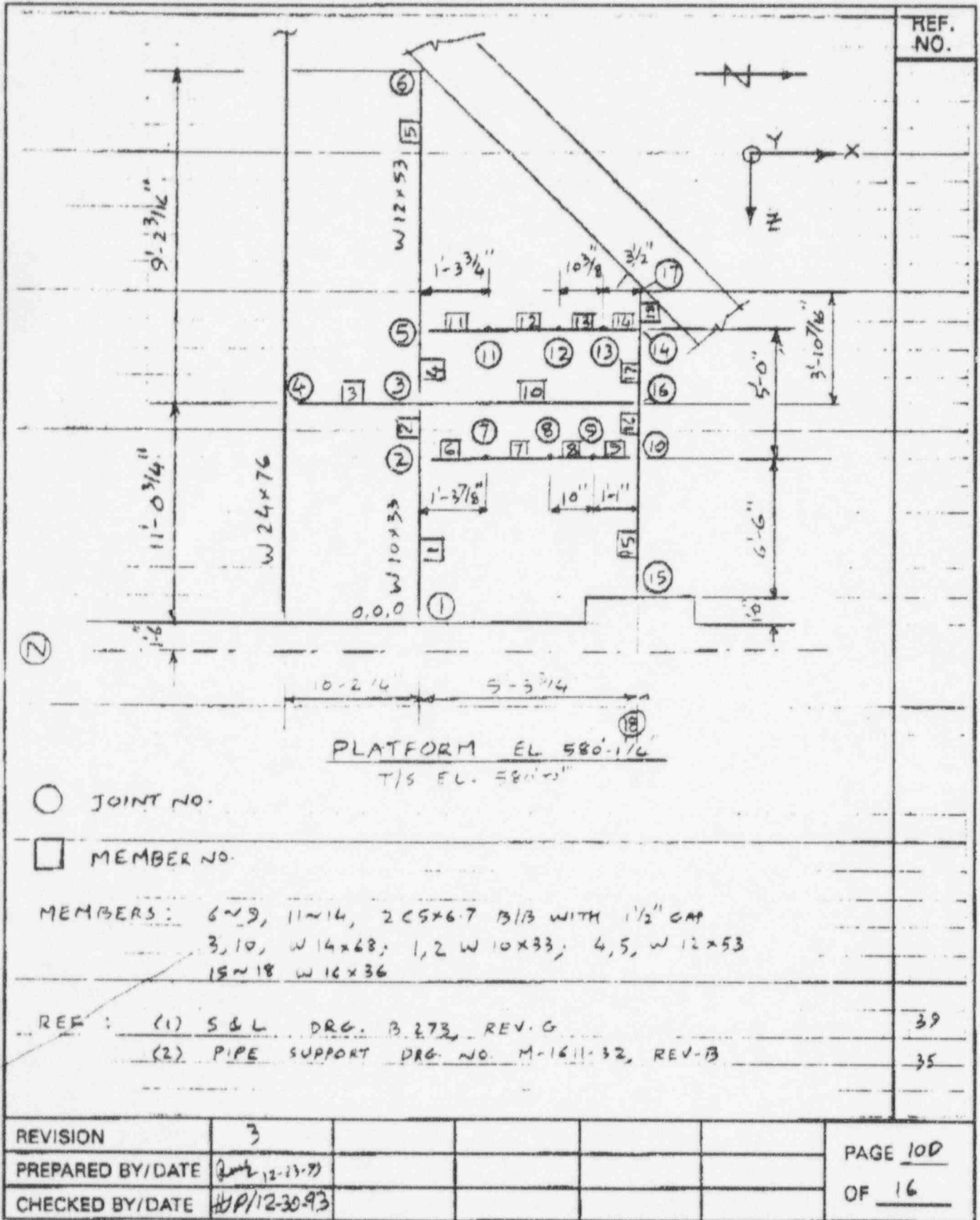
PROJECT QUAD CITIES NUCLEAR POWER STATION #1 FILE NO. 28.0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALL # 28.0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

	REF. NO.
<u>LOADS</u>	
<p><u>PIPING LOADS AT JOINTS 11, & 7 (SEE NEXT PAGE)</u></p> <p>UPSET : $2880 + 53 = 2933^{\#}$ } SEE PAGE 4</p> <p>FAULTED : $2922 + 53 = 2975^{\#}$ }</p>	
<p><u>LOADS FROM 3/8" ROOFS FOR CONDUITS: AT JOINTS 8, 9, 12, 13</u></p> <p><u>610[#] UPSET & FAULTED (SEE PAGE 4)</u></p>	

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PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 | FILE NO. 28-0201-1111-31
 OWNER COMMONWEALTH EDISON COMPANY | CALC # 28-0201-1111-31
 CLIENT COMMONWEALTH EDISON COMPANY | ADDENDUM-1



PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

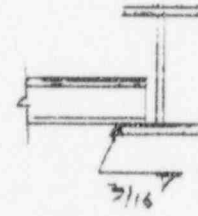
PROJECT QUAD CITIES NUCLEAR POWER STATION #1 FILE NO. 28-0201-1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALC # 28-0201-1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

	REF. NO.
<u>REVIEW OF GTSTRUDL OUTPUT</u>	
STRESSES IN AUXILIARY STEEL (MEMBERS 6, 9, & 11-14)	
MAXIMUM NORMAL ENVELOPED STRESS IN THE ABOVE EIGHT MEMBERS IS 6851 PSI (MEMBER 6. SEE PAGE A10 ATTACH A)	
ALLOWABLE STRESS IN KSI FOR CHANNELS	
$= \frac{12000 \times C_{13}}{L \times d/A_4} \quad (\text{FORMULA 1.5.7 REF-13})$ $C_{13} = 1, \quad L = 63.75", \quad d/A_4 = 8.93 \text{ FOR C6X6}$	
ALLOWABLE STRESS FOR CHANNELS WITH $S_4 = 32.8 \text{ KSI}$	
$= \frac{12000 \times 1}{63.75 \times 8.93} \times \frac{32.8}{36}$ $= 19.20 \text{ KSI} > 6.851 \text{ KSI} \quad \text{OK}$	
MAXIMUM SHEAR STRESS (ENVELOPED) IN THE ABOVE MEMBERS IS OF 667 PSI AT MEMBER C.	
ALLOWABLE SHEAR STRESS OF $0.4 \times 52800 = 13120 \text{ PSI} > 667 \text{ PSI} \quad \text{OK}$	
AUXILIARY STEEL CHANNELS ARE OK	

REVISION	3					
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PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 FILE NO. 28-0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY CASE # 28-0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY APPENDUM # 1

	REF. NO.
<p><u>CHECK WELDING ON AUXILIARY STEEL WITH IN PLACE STEEL</u></p> <p>WELDS OF AUXILIARY STEEL CHANNELS WITH IN PLACE STEEL W16X36 & W10X33 ARE EVALUATED ON PAGES 10G & 10H WITH LOADS AS BELOW.</p> <p>PAGE: 10G : WELD WITH W16X36 USING ENVELOPED LOAD AT JOINT 14 OF MEMBER 14 OR AT JOINT 10 OF MEMBER 9</p> <p>PAGE: 10H : WELD WITH W10X33 USING LOADS AT JOINT 2 OF MEMBER 5.</p> <p><u>WELD AT W12X53</u></p> <p>FAULTED LOAD JOINT 5 OF MEMBER 11</p> <p>= 2445 #</p> <p>STRESS ON WELD</p> $= \frac{2445}{2 \times 1.75} = 699 \text{ #/IN}$ <p>ALLOWABLE STRESS FOR 3/16" WELD</p> $= 0.3 \times 3/16 \times 32800 = 1845 > 699 \text{ #/IN}$ 	

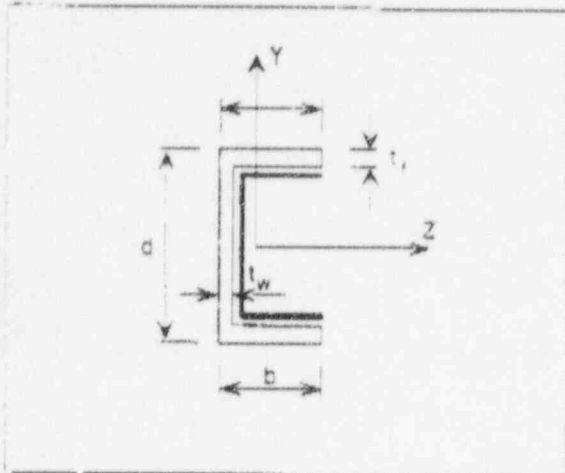
REVISION	3						PAGE <u>10F</u>
PREPARED BY/DATE	<i>John</i> 12-11-93						OF <u>16</u>
CHECKED BY/DATE	H20/R-30-93						

NUTECH ENGINEERS

Project: QUAD CITIES NUCLEAR POWER STATION UNIT 1 File No: 28.0201 1111-31
 Owner: COMMONWEALTH EDISON COMPANY CALC # 28.0201 1111-31
 Client: COMMONWEALTH EDISON COMPANY ADDENDUM-1

Description: WELD QUALIFICATION BETWEEN C5X6.7 AND IN PLACE STEEL W16X36

Support No. M-1611-92 Structural Member: C5X6.7 Weld Type: 3 Weld Size: 0.125



b = 1.75 in. d = 5 in.
 t = 0.32 in. t_w = 0.19 in.

S_y of Base Metal = 32.8 ksi (Ref. 12)
 At design temperature = 200 °F

FAULTED LOADS: (Ref.) 50% OF LOADS AT JOINT 16 OF MEMBER 14 (SEE PAGE A7, ATTACH A)

F_x = 0 lb. M_x = 0 in-lb
 F_y = 920 lb. M_y = 0 in-lb
 F_z = 0 lb. M_z = 190 in-lb

Weld Properties: (Ref 43)

A_w = 2(b - t_w - t) + d = 7.48 in. J_w = S_{wy}(C_z) + S_{wz}(C_y) = 23.47 in.³

C_y = (d - 2t) / 2 = 2.18 in. S_{wy} = (1/3)(b - t_w)²[b - t_w + 2(d - 2t)] / (b - t_w + d - 2t) = 1.41 in.²

C_z = b - t_w - [(b - t_w)² / A_w] = 1.23 in. S_{wz} = (d - 2t)[b - t_w + (d - 2t) / 6] = 9.97 in.²

Stress

t_x = F_x / A_w + M_z / S_{wz} + M_y / S_{wy} = 19 lb./in.

t_y = F_y / A_w + (M_x * C_z) / J_w = 123 lb./in.

t_z = F_z / A_w + (M_x * C_y) / J_w = 0 lb./in.

f_r = (t_x² + t_y² + t_z²)^{1/2} = 124 lb./in.

F_r = 3S_y = 9840 psi Controlling failure mode lamellar tearing (Ref. 12.)

Weld Size Req'd = f_r / F_r = 0.013 in.

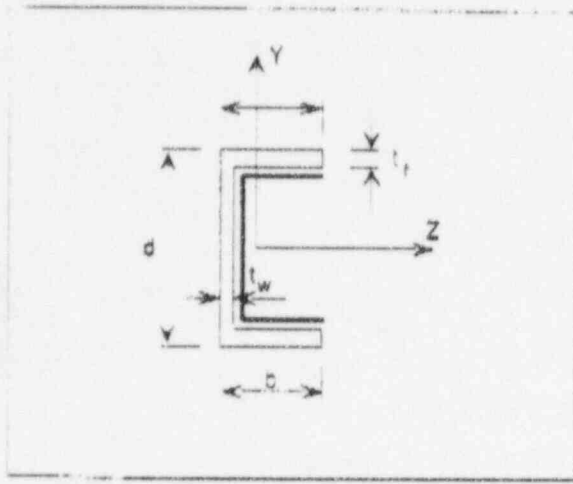
Interaction Ratio IR = 0.101 **WELD SIZE IS ACCEPTABLE!**

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Checked By/Date	<u>HDP / 12-30-93</u>					

NUTECH ENGINEERS

Project: QUAD CITIES NUCLEAR POWER STATION UNIT 1 File No. 28.0201.1111-31
 Owner: COMMONWEALTH EDISON COMPANY *CALC # 28.0201.1111-31*
 Sent: COMMONWEALTH EDISON COMPANY *ADDENDUM - 1*

Description: WELD QUALIFICATION BETWEEN C5X6.7 AND IN PLACE W10X33
 Support No: M-1611-32 Structural Member: C5X6.7 Weld Type: 3 (CONSERVATIVE) Weld Size: 0.125



b = 1.75 in. d = 5 in.
 t_f = 0.32 in. t_w = 0.19 in.

S_y of Base Metal = 32.8 ksi (Ref. 12)
 At design temperature = 200 °F

FAULTED LOADS: (Ref.) 50% OF LOAD AT JOINT 2 OF MEMBER 6 SEE PAGE A7, ATTACHMENT A

F_x = 0 lb M_x = 0 in-lb
 F_y = 1315 lb. M_y = 0 in-lb
 F_z = 0 lb. M_z = 210 in-lb

Weld Properties: (Ref. 4)

$A_w = 2(b - t_w - t_f) + d = 7.48 \text{ in.}$ $J_w = S_{wy}(C_z) + S_{wz}(C_y) = 23.47 \text{ in.}^3$
 $C_y = (d - 2t_f)/2 = 2.18 \text{ in.}$ $S_{wy} = (1/3)(b - t_w)^2[b - t_w + 2(d - 2t_f)] / (b - t_w + d - 2t_f) = 1.41 \text{ in.}^2$
 $C_z = b - t_w - [(b - t_w)^2 / A_w] = 1.23 \text{ in.}$ $S_{wz} = (d - 2t_f)[b - t_w + (d - 2t_f)/6] = 9.97 \text{ in.}^2$

Stress

$f_x = F_x/A_w + M_z/S_{wz} + M_y/S_{wy} = 21 \text{ lb./in.}$
 $f_y = F_y/A_w + (M_x \cdot C_z)/J_w = 176 \text{ lb./in.}$
 $f_z = F_z/A_w + (M_x \cdot C_y)/J_w = 0 \text{ lb./in.}$
 $f_r = (f_x^2 + f_y^2 + f_z^2)^{1/2} = 177 \text{ lb./in.}$

$F_r = 3S_y = 9840 \text{ psi}$ Controlling failure mode lamellar tearing (Ref. 12)

Weld Size Req'd = $f_r/F_r = 0.018 \text{ in.}$

Interaction Ratio IR = 0.144 **WELD SIZE IS ACCEPTABLE!**

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Checked By/Date	<i>HDD/12-30-93</i>					

PACIFIC NUCLEAR

ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 FILE NO. 28-0201-1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALC # 28-0201-1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

	REF. NO.
<p style="text-align: center;">CHECK STIFFENER REQUIREMENTS FOR IN PLACE STEEL</p> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 30%;"> <p style="text-align: center;">W10x33</p> </div> <div style="width: 65%;"> <p style="text-align: right;">EL 579'-9 1/2 (SEE PAGE 14 OF 15)</p> <p style="text-align: center;">FAULT LOADS AT BEAM W10x33:</p> <p style="text-align: right;">FY = 2626 #, FX = FZ = 0, MZ = 403 MY = MY = 0 (SEE PAGE A7, ATTACH 'A')</p> </div> </div> <p style="text-align: right; margin-right: 50px;">IN-3 40</p>	
<p style="text-align: center;">FOR W10x33, (REF # 13)</p> <p style="text-align: center;">d = 9.73", It = 0.435", Lt = 7.96", KL = 0.29"</p> <p style="text-align: center;">AS PER REF # 40,</p> <p style="text-align: center;">$L = 9.73 - 2 \times 0.435 = 8.86"$</p> <p style="text-align: center;">$L_a = (2 \times 1.75) + 1.5 = 5.0"$</p> <p style="text-align: center;">$e_y = \frac{9.73}{2} - (2.5 + 2.5) = 0.135"$</p>	13
<p style="text-align: center;">FOR WEB BENDING STRESS,</p> <p style="text-align: center;">$L_{e4} = L_a + 12 KL = 5 + (12 \times 0.29) = 8.48"$</p> <p style="text-align: center;">$S_W = \frac{L_{e4} KL^2}{6} = \frac{8.48 \times 0.29^2}{6} = 0.119 \text{ IN}^3$</p>	
<p style="text-align: center;">$M_W = P_x \left(\frac{L}{4} - \frac{e_y^2}{L} \right) + M_Z \left(\frac{1}{2} + \frac{e_y}{L} \right)$</p> <p style="text-align: center;">$= 0 + 403 \left(0.5 + \frac{0.135}{8.86} \right) = 208 \text{ IN} \cdot \text{IN}$</p>	
<p style="text-align: center;">fLW, STRESS IN WEB</p> <p style="text-align: center;">$= \frac{M_W}{S_W} + \frac{L_a \cdot 0.15 \times M_Z}{L_a \cdot KL^2}$</p> <p style="text-align: center;">$= \frac{208}{0.119} = 1745 \text{ PSI} < \text{ALLOWABLE OF } 18180 \text{ PSI FOR UPSET CONDITION}$</p> <p style="text-align: center;">OK</p>	
<p>REVISION 3</p> <p>PREPARED BY/DATE Boone 12-23-93</p> <p>CHECKED BY/DATE BGP/12-30-93</p>	PAGE 10 I OF 16

PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 | FILE NO. 28-0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY | CALC # 28-0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY | APPENDUM-1

REF. NO.

WFB SHEAR STRESS

$$f_{LV} = \frac{P}{A_{eff}}$$

$$P = P'_x \left(\frac{1}{2} + \frac{e^2}{l} \right) + \frac{M_x}{l}$$

$$P'_x = P_x + \frac{0.8M_x}{l}$$

= 0 SINCE P_x & M_x ARE 0

$$P = \frac{403}{8.86}$$

$$= 45.5$$

$$f_{LV} = \frac{45}{16 \times 36}$$

$$= \frac{45}{576}$$

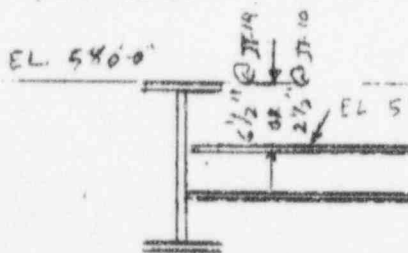
= 31 PSI < ALLOWABLE OF
0.4 x 32800 = 13120 PSI
OK

STIFFENERS ARE NOT REQUIRED

W 16x36

ENVELOPED LOADS FROM MEMBER 14 AT JOINT 14 &
FROM MEMBER 9 AT JOINT 13. THE
GOVERNING LOADS FOR CHECKING STIFFENER
REQUIREMENTS FOR THIS BEAM

RESULTED LOADS ARE: F_y = 1838 #, F_x = 0 #, M_x = 375 #-ft, M_y = 0 #-ft
 (LOADS AT JOINT 14 OF MEMBER 14. PAGE A7)



FOR W 16x36, (REF 13)
 $d = 15.86''$, $I_x = 0.43''$, $L_x = 6.985''$
 $L_w = 0.295''$

AS PER REF. 40,
 $L = 15.86 - 2 \times 0.43 = 15.0''$
 $L_w = 6.0''$

13

REVISION	3					PAGE <u>105</u>
PREPARED BY/DATE	QWR/12-23-93					OF <u>16</u>
CHECKED BY/DATE	HP/12-30-93					

PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 FILE NO. 28-0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALL # 28-0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

	REF. NO.
$\text{MAX. } e_f = \frac{15.86}{2} - (2.5 + 2.9) \text{ OR } \frac{15.86}{2} - (6.5 + 2.5)$ $= 2.93'' \quad \text{USE ENVELOPED HIGHER } e_f \text{ OF } 2.93''$	410
<p>FOR WEB BENDING STRESS,</p> $r_{FE} = U_{61} + 12 \times W$ $= 5 + (12 \times 0.295) = 8.54''$ $S_W = \frac{r_{FE}^2 \times C_W^2}{6} = \frac{8.54^2 \times 0.295^2}{6} = 0.124 \text{ in}^3$ $M_W = P \times (L/4 + \frac{e_f^2}{2}) + M_Z (\frac{1}{2} - \frac{e_f}{L})$ $= 0 + 375 (0.5 + \frac{2.93^2}{15}) = 261 \text{ in-lb}$ <p>FLW, WEB STRESS</p> $= \frac{M_W}{S_W} + \frac{5 \times 0.15 \times M_Z}{U_{61} \times C_W^2}$ $= \frac{261}{0.124} = 2103 \text{ PSI} < \text{ALLOWABLE OF } 9180 \text{ PSI}$ <p style="text-align: right;">FOR UPSET CONDITION</p> <p style="text-align: center;">O.K.</p> <p>WEB SHEAR STRESS</p> $FLV = \frac{P}{A_{EF}} \quad P = \frac{M_Z}{L} \quad \text{AS } P \times S \text{ MAY BE 0}$ $= \frac{375}{15} = 25 \text{ PSI}$ $FLV = \frac{25}{U_{61} \times C_W}$ $= \frac{25}{5 \times 0.295} = 17 \text{ PSI} < \text{ALLOWABLE OF } 15120 \text{ PSI}$ <p style="text-align: center;">O.K.</p> <p style="text-align: center;">STIFFENERS NOT REQUIRED.</p>	
REVISION	3
PREPARED BY/DATE	(Signature) 12-23-92
CHECKED BY/DATE	(Signature) 12-30-92
PAGE <u>10K</u>	
OF <u>16</u>	

PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28-0201-1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALC # 28-0201-1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

	REF. NO.
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> </div> <div style="width: 65%;"> <p> $DM, a' = 12.06 - 0.575 - 5.0$ $= 6.485$ T/S OF CHANNEL $\frac{580.0}{(-) 0.248}$ 579.552 (i.e. 579.5") </p> <p> LOADS AT W12x53 ARE LOADS FROM MEMBER 11 AT JOINT 5. FAULTED LOADS ARE $FY = 2445$ #, $Fx = Fz = 0$ $Mx = My = Mz = 0$ (SEE PAGE 07 OF ATTACHMENT A) </p> <p> FOR W12x53 (REF 13) $d = 12.06$, $KW = 0.345$, $Lf = 9.995$, $Cf = 0.575$ </p> <p> PER REF 40, $LW = (2 \times 1.75) + 1.5 = 5.0$ </p> <p> LW, FLANGE WIDTH LOADED $\frac{9.995}{2} - 1.00 = 4.0$ </p> <p> ECCENTRICITY $ex = \frac{9.995}{2} - \frac{4.0}{2} = 3.0 > \frac{LW}{2}$ </p> <p> $Dp = ex - Kw$ FOR $ex > \frac{LW}{2}$ $= 3.00 - 0.345$ $= 2.655$ </p> <p> $Dt = 1.0$ FOR $ex > \frac{LW}{2}$ </p> <p> $bel = 2Lf + LW = (2 \times 9.995) + 5 = 24.99$ " SAY 25" </p> <p> $Sf = \frac{bel \times I^2}{6}$ $= \frac{25 \times 0.575^2}{6} = 1.377$ in </p> <p> $Mf = (Py \times Dp) + Mz \times Dt$ $= 2445 \times 2.655 + 0 = 6471$ in-lb </p> </div> </div>	
REVISION	3
PREPARED BY/DATE	RWP/12-27-93
CHECKED BY/DATE	JJP/12-30-93
	PAGE 106 OF 16

PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 FILE NO. 28.0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY CALC # 28.0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM-1

REF. NO.

$$f_{LF} = \frac{M_f}{S_x}$$

$$= \frac{5348}{1.577} = 3392 \text{ PSI} < \text{ALLOWABLE OF } 14280 \text{ PSI FOR UPSET 10005}$$

OK

CHECK WEB COMBINED STRESSES

$$f_{LW} = \frac{P_y}{L_{r3} \times L_w} + \frac{3M_x}{L_{r2} \times L_w \times U_u} + \frac{d \cdot M_w}{S_w}$$

$M_x = 0$

$$L_{r3} = L_w + 2K = 5 + 2 \times 125 = 7.5''$$

$$M_w = (P_x \times K) + M_z + (P_y \times K) = 0 + 0 + (2445 \times 3.00) = 7335 \text{ IN-LB}$$

$$S_w = \frac{L_{r1} \times I_w^2}{6} = \frac{25 \times 0.345^2}{6} = 0.496 \text{ IN}^3$$

$$f_{LW} = \frac{2445}{7.5 \times 0.345} + 0 + \frac{0.7 \times 7335}{0.496}$$

$$= 11298 \text{ PSI} < \text{ALLOWABLE OF } 18180 \text{ PSI FOR UPSET}$$

∴ STRESSES ARE OK & STIFFENERS ARE NOT REQUIRED

REVISION	3				
PREPARED BY/DATE	JW/12-23-93				PAGE 104
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PACIFIC NUCLEAR ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION #1 | FILE NO. 28.0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY | CASE # 28.0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY | ADDENDUM-1

	REF. NO.																								
<p style="text-align: center;"><u>REPORT OF LOADS ON IN PLACE BEAMS</u></p> <p style="text-align: center;">TRANSFORM LOADS FROM CONTROL RUN (ATTACHMENT A) TO ROL SYSTEM 123</p> <p><u>BEAM W 10x33</u> (POINT B PAGE 14) SEE LOADS AT JOINT 2 OF MEMBER 6 PAGE A7 ATTACHMENT 'A'.</p> <p><u>UPSET LOADS</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">$F_1 = 0$</td> <td style="width: 50%;">$M_1 = 0.033 \text{ K}'$</td> </tr> <tr> <td>$F_2 = 0$</td> <td>$M_2 = 0$</td> </tr> <tr> <td>$F_3 = 2.6 \text{ K}$</td> <td>$M_3 = 0$</td> </tr> </table> <p><u>FAULTED LOADS</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">$F_1 = 0$</td> <td style="width: 50%;">$M_1 = 0.033 \text{ K}'$</td> </tr> <tr> <td>$F_2 = 0$</td> <td>$M_2 = 0$</td> </tr> <tr> <td>$F_3 = 0 \text{ K}$</td> <td>$M_3 = 0$</td> </tr> </table> <p><u>BEAM W 15x36</u> (POINT D PAGE 16) SEE LOADS AT JOINT 10, MEMBER 9 PAGE A7, ATTACHMENT 2</p> <p><u>UPSET LOADS</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">$F_1 = 0$</td> <td style="width: 50%;">$M_1 = 0.015 \text{ K}'$</td> </tr> <tr> <td>$F_2 = 0$</td> <td>$M_2 = 0$</td> </tr> <tr> <td>$F_3 = 1.64 \text{ K}$</td> <td>$M_3 = 0$</td> </tr> </table> <p><u>FAULTED LOADS</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">$F_1 = 0$</td> <td style="width: 50%;">$M_1 = 0.015 \text{ K}'$</td> </tr> <tr> <td>$F_2 = 0$</td> <td>$M_2 = 0$</td> </tr> <tr> <td>$F_3 = 1.65 \text{ K}$</td> <td>$M_3 = 0$</td> </tr> </table>	$F_1 = 0$	$M_1 = 0.033 \text{ K}'$	$F_2 = 0$	$M_2 = 0$	$F_3 = 2.6 \text{ K}$	$M_3 = 0$	$F_1 = 0$	$M_1 = 0.033 \text{ K}'$	$F_2 = 0$	$M_2 = 0$	$F_3 = 0 \text{ K}$	$M_3 = 0$	$F_1 = 0$	$M_1 = 0.015 \text{ K}'$	$F_2 = 0$	$M_2 = 0$	$F_3 = 1.64 \text{ K}$	$M_3 = 0$	$F_1 = 0$	$M_1 = 0.015 \text{ K}'$	$F_2 = 0$	$M_2 = 0$	$F_3 = 1.65 \text{ K}$	$M_3 = 0$	
$F_1 = 0$	$M_1 = 0.033 \text{ K}'$																								
$F_2 = 0$	$M_2 = 0$																								
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$F_1 = 0$	$M_1 = 0.015 \text{ K}'$																								
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$F_3 = 1.64 \text{ K}$	$M_3 = 0$																								
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$F_3 = 1.65 \text{ K}$	$M_3 = 0$																								
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PREPARED BY/DATE	J. J. [unclear] - 12-93																								
CHECKED BY/DATE	HJD/12-30-93																								
PAGE <u>10</u> N																									
OF <u>16</u>																									

PACIFIC NUCLEAR

ENGINEERING SERVICES GROUP

PROJECT QUAD CITIES NUCLEAR POWER STATION # | FILE NO. 28 0201.1111-31
 OWNER COMMONWEALTH EDISON COMPANY | CALC # 28.0201.1111-31
 CLIENT COMMONWEALTH EDISON COMPANY | ADDENDUM-1

REF.
NO.

BEAM W16x36 (POINT 'C' PAGE 15)

SEE LOADS AT JOINT 14 OF MEMBER 14
PAGE A7 ATTACHMENT A

UPSET LOADS

$$\begin{array}{ll} F_1 = 0 & M_1 = 0.03 \text{ K}^1 \\ F_2 = 0 & M_2 = 0 \\ F_3 = 1.82 \text{ K} & M_3 = 0 \end{array}$$

FAULTED LOADS

$$\begin{array}{ll} F_1 = 0 & M_1 = 0.03 \text{ K}^1 \\ F_2 = 0 & M_2 = 0 \\ F_3 = 1.84 \text{ K} & M_3 = 0 \end{array}$$

BEAM W12x53 (POINT A PAGE 13)

(SEE LOADS AT JOINT 5 OF MEMBER 11
PAGE A7, ATTACHMENT A)

UPSET LOADS

$$\begin{array}{ll} F_1 = 0 & M_1 = 0 \\ F_2 = 0 & M_2 = 0 \\ F_3 = 2.4 \text{ K} & M_3 = 0 \end{array}$$

FAULTED LOADS

$$\begin{array}{ll} F_1 = 0 & M_1 = 0 \\ F_2 = 0 & M_2 = 0 \\ F_3 = 2.45 \text{ K} & M_3 = 0 \end{array}$$

REVISION	3							PAGE 10 ϕ
PREPARED BY/DATE	Rat 12-15-93							OF 16
CHECKED BY/DATE	KP/12-30-93							

nutech

Chicago, Illinois

PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28-0201.1111.31.01OWNER COMMONWEALTH EDISON COMPANYCLIENT COMMONWEALTH EDISON COMPANYADDENDUM -1SHEAR LUG QUALIFICATION PER ASME CODE CASE N-318 (REF. 32)CHECK EQ. 7 & EQ. 8

SUPERSEDED

BY

PAGE - 10

EQ. 7

$$S_{mt}^{**} \leq 2S_y$$

$$S_{mt}^{**} = \frac{C_T W^{**}}{A_L} + \frac{C_L M_L^{**}}{Z_L L} + \frac{C_C M_C^{**}}{Z_C C} + \frac{Q_1^{**}}{Z_L L_1} + \frac{Q_2^{**}}{Z_L L_2} + M_T^{**}$$

$$C_L = 4.5916 \quad Z_L L = 1.0 \quad (\text{PG. 8})$$

$$S_{mt}^{**} = 0 + \frac{4.5916 \times 2922}{1} + 0 + 0 + \frac{2922}{2 \times 0.75} + 0$$

$$= 15365 \text{ PSI} < 2S_y = 2 \times 31900 = 63800 \text{ PSI} \quad \therefore \text{OK}$$

EQ. 8

$$\frac{Q_1^{**}}{Z_L L_1} + \frac{Q_2^{**}}{Z_L L_2} + M_T^{**} < S_y$$

$$= 0 + \frac{2922}{2 \times 0.75} + 0 < S_y$$

$$= 1948 \text{ PSI} < 31900 \text{ PSI} \quad \therefore \text{OK}$$

REVISION		2				PAGE 11
PREPARED BY/DATE	Ko/	6-7-91	KMT/3-9-92			OF 16
CHECKED BY/DATE	KMT/6-19-91		Ko/3-24-92			

PROJECT QUAD CITIES NUCLEAR POWER STATION FILE NO. 28.0201.1111.31.01
 OWNER COMMONWEALTH EDISON COMPANY
 CLIENT COMMONWEALTH EDISON COMPANY ADDENDUM - 1

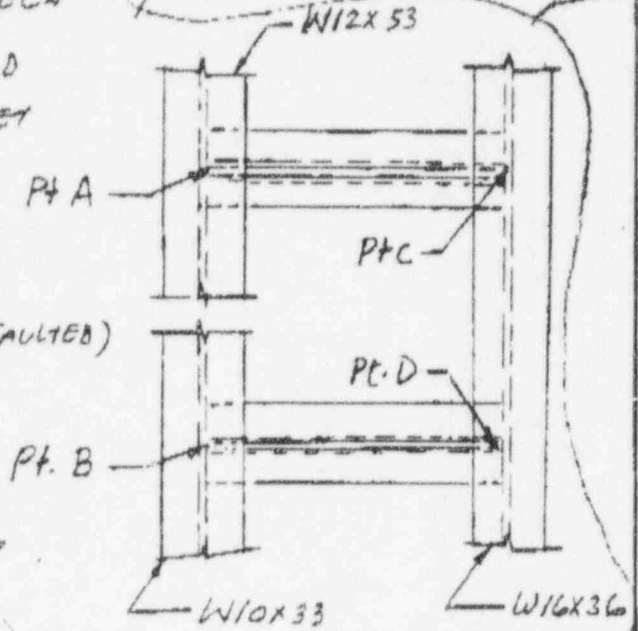
SUPERSEDED PIR REV-3
SEE PAGES 10 N & 10 D

REPORT OF LOADS: (R.O.L.)

SINCE THE DIFFERENCE BETWEEN UPSET LOAD AND FAULTED LOAD IS 1.5%, THE REACTIONS UPSET AND FAULTED ARE CONSIDERED SAME

REACTIONS @ PT A (UPSET & FAULTED)

$$\left. \begin{array}{l} F_x = 0 \\ F_y = 2002 \# \\ F_z = 0 \end{array} \right\} \begin{array}{l} M_x = 0 \\ M_y = 0 \\ M_z = 0 \end{array} \left. \right\} \text{SEE PG. 6}$$



REACTION @ PT B (UPSET & FAULTED)

$$\left. \begin{array}{l} F_x = 0 \\ F_y = 2625 \\ F_z = 0 \end{array} \right\} \begin{array}{l} M_x = 28103 \#-IN \\ M_y = 0 \\ M_z = 0 \end{array} \left. \right\} \text{SEE PG. 4, 5}$$

REACTION @ C (UPSET & FAULTED)

$$\left. \begin{array}{l} F_x = 0 \\ F_y = 2263 \# \\ F_z = 0 \end{array} \right\} \begin{array}{l} M_x = 29437 \#-IN \\ M_y = 0 \\ M_z = 0 \end{array} \left. \right\} \text{SEE PG. 6}$$

REACTION @ D (UPSET & FAULTED)

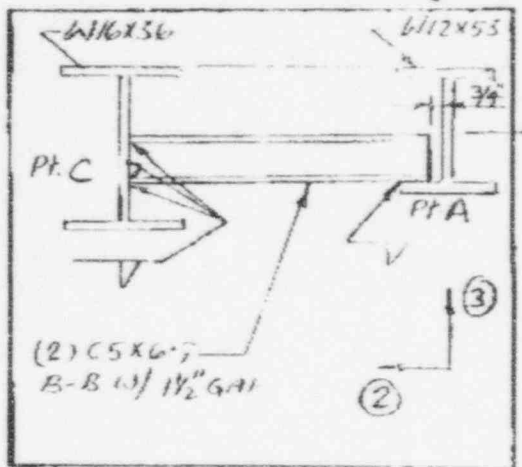
$$\left. \begin{array}{l} F_x = F_z = 0 \\ F_y = 1641 \end{array} \right\} \begin{array}{l} M_x = 16406 \#-IN \\ M_y = M_z = 0 \end{array} \left. \right\} \text{SEE PG. 4, 5}$$

REVISION	1	3				PAGE 12
PREPARED BY/DATE	KMT/6-7-91	R/12-23-93				OF 16
CHECKED BY/DATE	KMT/6-19-91	R/12/30/93				

PIPE SUPPORT LOADING ON EXISTING STEEL

REFERENCES:

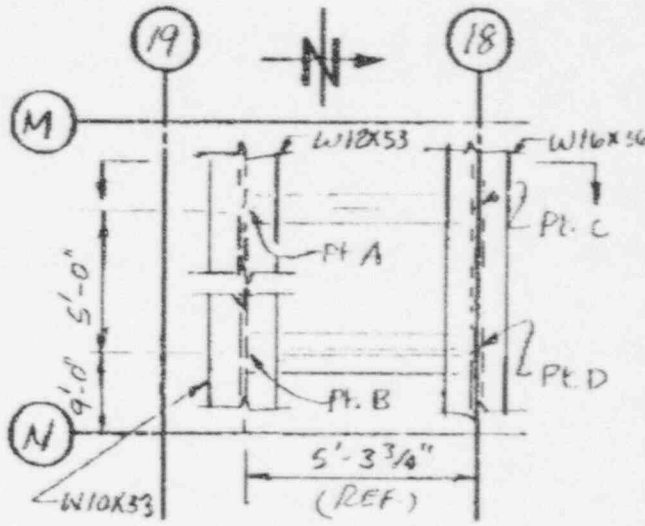
SKETCH NO. M-1611-32, REV. B (PK 1 of 4)
 STRUCTURAL B275
 ISOMETRIC EDS-M-994A-SHT. 20
 PROBLEM NO. PT.



VIEW OF EXISTING STEEL

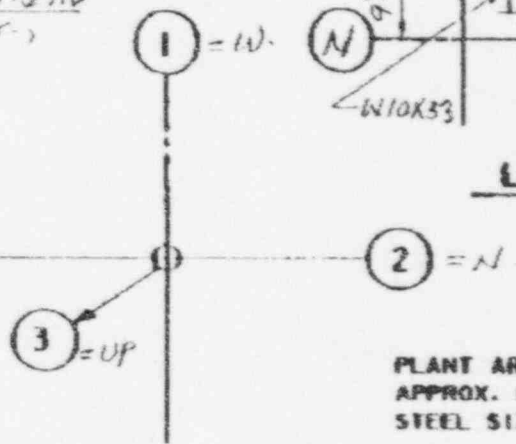
PLAN ELEVATION

EL 580'-0"
 REF.
 EL 579'-6 1/16"
 (REF.)



LOCATION PLAN

PLANT AREA REACTOR
 APPROX. ELEV. 580'-0"
 STEEL SIZE W12x53



LOCAL COORDINATES

NOTES:

1. LOAD UNITS-FORCE IN KIPS. MOMENT IN KIP-FeET.
2. LOADS ARE MAXIMUM ABSOLUTE VALUE UNLESS NOTED OTHERWISE.
3. LOCAL STRESS EFFECTS ON I.P. STEEL HAVE BEEN EVALUATED. STIFFNESS NOT REQUIRED.

REACTIONS @ Pt. A

PLANT CONDITION	LOAD IN DIRECTION:		
	1	2	3
NORMAL/UPSET (OBE)	F	-	2.4
	M	-	-
FAILED (OBE)	F	-	2.4
	M	-	-

REV.	BY	DATE	CHECKED	DATE
3	Runde	6-7-98		

CLIENT: CECO
 PROJECT: SQUAD CITIES UNIT-1
 REPORT OF LOADS ON EXIST. STRUCTURAL STEEL

FOR CONCURRENCE
 JOB NO. XCE-59
 CALC NO. 28.0201-1111-31.01
 PAGE 13 OF 16

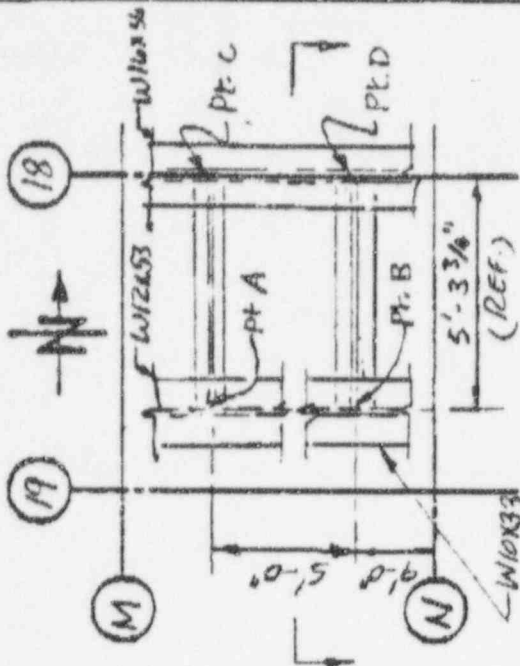
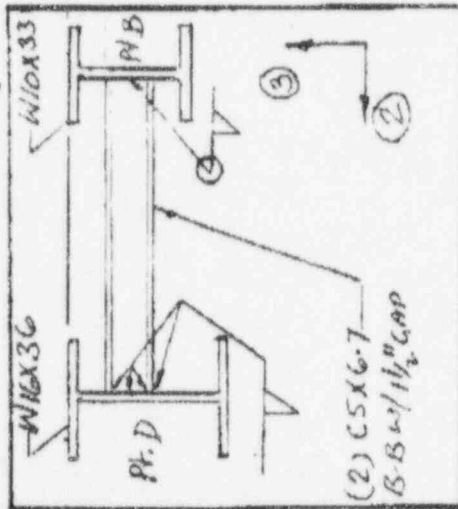
FIGURE 2

ADDENDUM-1

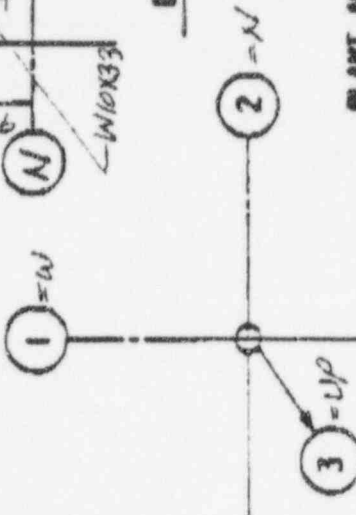
PIPE SUPPORT LOADING ON EXISTING STEEL

REFERENCES: SKETCH NO. M-1611-32, Div. B (Pg 2 of 4)

STRUCTURAL B 27.5
 ISOMETRIC EDS-M-994A-SPT. 2.0
 PROBLEM NO. PT.



LOCATION PLAN



LOCAL COORDINATES

PLANT AREA REACTOR
 APPROX. ELEV. 580'-0"
 STEEL SIZE W16x36, W10x33

REACTIONS @ Pt. B

PLANT CONDITION	LOAD IN DIRECTION:		
	1	2	3
NORMAL UPSET (CORE)	0.033	-	2.6
FAULTED (CORE)	0.033	-	2.6

VIEW OF EXISTING STEEL

PLAN ELEVATION

NOTES:

1. LOAD UNITS-FORCE IN KIPS. MOMENT IN KIP-Feet.
2. LOADS ARE MAXIMUM ABSOLUTE VALUE UNLESS NOTED OTHERWISE.
3. LOCAL STRESS EFFECTS ON I.P. STEEL HAVE BEEN EVALUATED. STIFFENERS NOT LOADED.

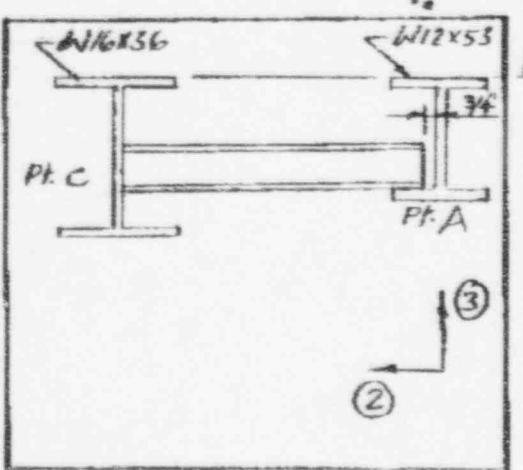
1	Kotale	6751	K.M. Thakkar	6/19/93	CLIENT: CECO	PROJECT: QUAD CITIES UNIT-1
3	Zumber	12-22-93	H.J. Patel	12/30/93	REPORT OF LOADS ON EXIST. STRUCTURAL STEEL	
					FOR	JOB NO. XCE-59
					CONCURRENCE	PAGE 14
REV.	BY	DATE	CHECKED	DATE	28.0201-1111-31-01	OF 16

Figure 2

ADDENDUM-1

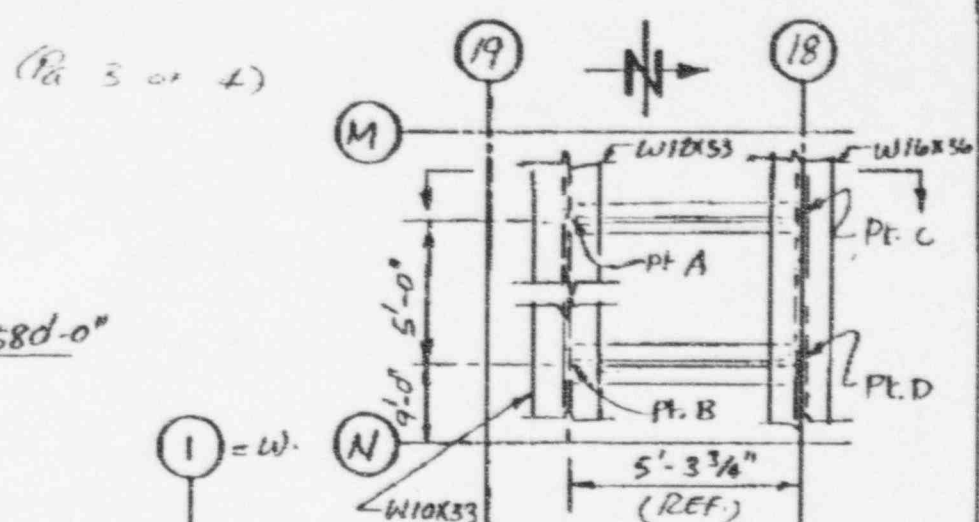
PIPE SUPPORT LOADING ON EXISTING STEEL

REFERENCES:
 SKETCH NO. M-1611-32, Rev. B (Pg 3 of 4)
 STRUCTURAL B273
 ISOMETRIC EDS-M-994A, SHT. 20
 PROBLEM NO. PT.

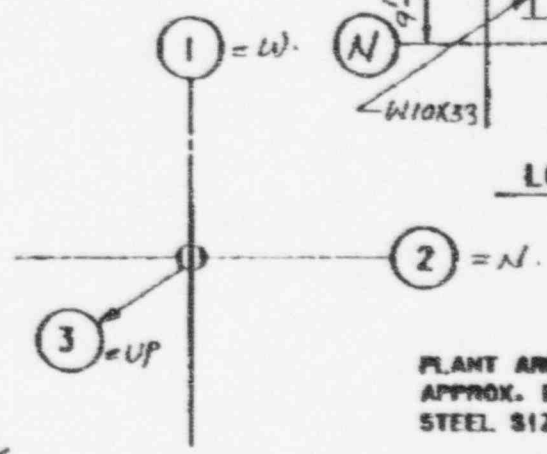


VIEW OF EXISTING STEEL

PLAN ELEVATION



LOCATION PLAN



LOCAL COORDINATES

PLANT AREA REACTOR
 APPROX. ELEV. 580'-0"
 STEEL SIZE W16x36

NOTES:

1. LOAD UNITS-FORCE IN KIPS. MOMENT IN KIP-FEET.
2. LOADS ARE MAXIMUM ABSOLUTE VALUE UNLESS NOTED OTHERWISE.
3. LOCAL STRESS EFFECTS ON I.P. STEEL HAVE BEEN EVALUATED. STIFFENERS NOT REQUIRED. 3

REACTIONS @ Pt. C

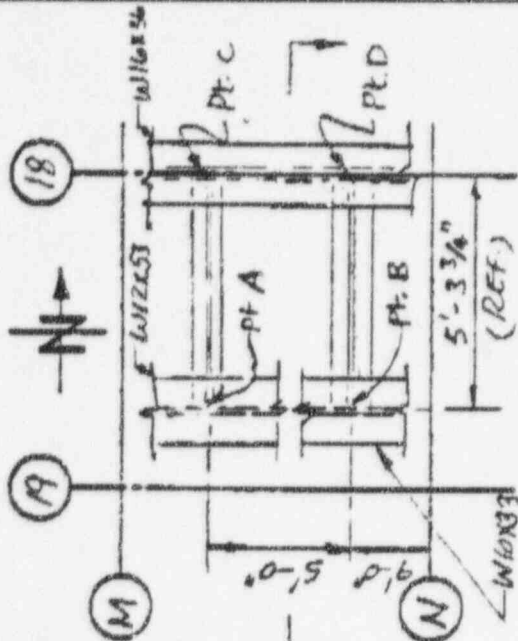
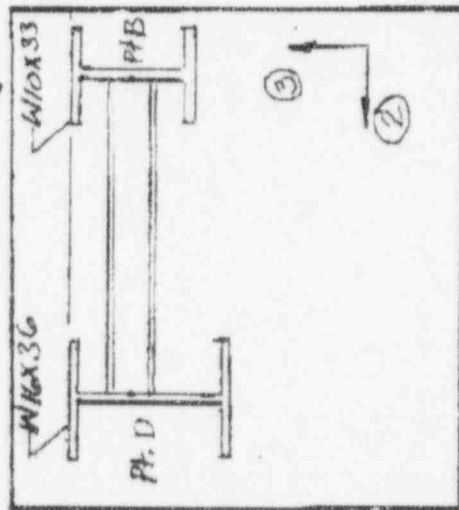
PLANT CONDITION		LOAD IN DIRECTION:		
		1	2	3
NORMAL/UPSET (OBE)	F	-	-	1.82
	M	0.03	-	-
FAULTED (OBE)	F	-	-	1.84
	M	0.03	-	-

REV.	BY	DATE	CHECKED	DATE	FOR CONCURRENTS	JOB NO. XCE-57	CALC NO. 28.0201-1111-31-01	OF 16
1	KOHLER	6-29-81	KM THORAKA	6-15-81	CLIENT: CECO	PROJECT: GUADALUPE UNIT-1	REPORT OF LOADS ON EXIST. STRUCTURAL STEEL	PAGE 15
3	KOHLER	12-15-83	HIPBACH	12/20/83	PROJECT: GUADALUPE UNIT-1	REPORT OF LOADS ON EXIST. STRUCTURAL STEEL		

Figure 2 Addendum-1

PIPE SUPPORT LOADING ON EXISTING STEEL

REFERENCES:
 SKETCH NO. M-1011-32, Rev. B (Pa 4 of 1)
 STRUCTURAL B275
 ISOMETRIC EDS-M 944A-SMT.20
 PROBLEM NO. PT.



LOCATION PLAN

PLANT AREA REACTOR
 APPROX. ELEV. 580'-0"
 STEEL SIZE W16x36, W10x33

VIEW OF EXISTING STEEL

PLAN ELEVATION

LOCAL COORDINATES

NOTES:

1. LOAD UNITS-FORCE IN KIPS. MOMENT IN KIP-FEET.
2. LOADS ARE MAXIMUM ABSOLUTE VALUE UNLESS NOTED OTHERWISE.
3. LOCAL STRESS EFFECTS ON I.P. STEEL HAVE BEEN EVALUATED. STIFFENERS NOT REQUIRED.

REACTIONS @ PT. D

PLANT CONDITION	LOAD IN DIRECTION:		
	1	2	3
NORMAL UPSET (OR)	0.015	-	1.64
FAIRED (OR)	0.015	-	1.64

1	KoPals	6-29-91	K.M. Thakkar	6-19-91	CLIENT: CECO	PROJECT: QUAD CITIES UNIT-1
3	Quare	12-13-91	H.V. Patil	12/20/91	REPORT OF LOADS ON EXIST. STRUCTURAL STEEL	
					FOR	JOB NO. XCE-59
					CONCURRENCE	CALC NO. 28.0201-1111-31-01
REV.	BY	DATE	CHECKED	DATE		PAGE 16 OF 16

Figure 2

ADDENDUM-1