W.O. No. 3500-76 Calc. No. 8.16.0037 Sheet 1 Cont. on Sheet 2

Title MEB-50 PHASE II STUDY

CALCULATION LEAD SHEET

Lead Sheet, 1 of 2

PURPOSE

The purpose of the calculation is to demonstrate the structural adequacy of the subject against the given support loads.

REFERENCES

1.) LOADS ARE PER MEB-50 PHASE II PIPE ANALYSIS FOR ANCHOR GROUP 37 CALC. # 8.14.127C

2.) BURNS and ROE REFERENCE DRAWINGS M200-105, 110, 117, 118 RHR-597, 975N, 238, 970N, 958N, 410 AND RCIC-912N HANGER DETAILS.

DESIGN REQUIREMENTS

The basic design requirements is that the support should comply with all the applicable requirements of the Project Criteria Document, Section I, and Specification 215, Section 15B, 15R and Contract drawing No. H-501 with one permissible deviation. Whenever necessary, it is allowed to exceed the stress limitations of Criteria Document as long as the corresponding stress limits imposed by the applicable Code are not violated.

CALC. PURPOSE

TO VERIFY THAT PIPE SUPPORTS ARE WITHIN DESIGN REQUIREMENTS FOR SUPPORT LOADS AS CALCULATED BY THE MEB-50 PIPE ANALYSIS. THE MEB-50 LOAD CASE IS FOR FAULTED DYNAMIC ADDED TO DEADWEIGHT AND THERMAL LOADS. WHICH IS NOT A NORMALLY USED LOAD SUMMATION.

ASSUMPTIONS

None.

PROCEDURE

In general, the design evaluation of the support structure for the normal conditions is done using the basic theories of Engineering Mechanics.

Rev. No.	Description of Revision	Type (Prelim Design, Final Design, Study)	Originator Signature/Date	Checker Signature/Date	Approver Signature/Date
0-	~~Original Issue~~	FINAL	Ed Lomo 10/20/83	10/20/83	10/25/83

Lead Sheet 2 of 2

employing computer programs whenever the complexity of the design warrants their use. The exact procedure adopted for the subject support is self-explanatory from the appended calculations.

COMPUTER INPUT/OUTPUT

The computer input/output sheets for this calculation are included as attachments to this calculation.

CONTENT**

(a) Total number of pages in current calculation level 0. 89
(b) Total number of attachments in current calc. level 0. 7

CONCLUSIONS*

ALL PIPE SUPPORTS WERE FOUND TO BE WITHIN ACCEPTABLE DESIGN ALLOWABLES AND REQUIREMENTS AS DESIGNED UNDER EXISTING LOADS.

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W.O. No. 3900-76 Date 10/5/83 Book No. 8.16.5012 Page No.
Drawing No. RHR-597 Calc. No. 8.16.5037 Sheet 4 Cont. on Sheet 5
By [illegible] Checked [illegible] 10/11/83 Approved
Title WPPSS-NP2 PIPE SUPPORT REVIEW/REDESIGN ~~PS MARK No.~~

MEB-50 PHASE II
LOADS

LOAD CONDITIONS:

LOAD TYPE		POUNDS			POUNDS-FT.		
		Fx	Fy	Fz	Mx	My	Mz
Thermal							
Dead Wt.							
Misc.							
DYNAMIC LOADS	Normal						
	Emerg.						
	Faulted						
TOTAL LOADS	Normal						
	Emerg.						
TOTAL FAU.+THER.	Faulted	±7630					
ORIGINAL SUPPORT DESIGN LOADS PER 8.16.2057 REV. 3	Normal	+5154 -4757					
	Emerg.	+5154 -4757					
	Faulted	+2969 -6635					

Form BR 8002 2 (5 78)

THE MEB-50 ' STUDY CALCULATIONS ARE FOR A FAULTED LOAD CONDITION FOR WHICH STRUCTURAL OUT OF LOAD—PLANE - FRAME ANALYSIS IS NOT REQUIRED. THIS BEING SO, THIS SUPPORT IS THEN A COLUME ANALYSIS FOR THE SUPPORT LOAD AND THE OTHER MEMBER ARE ASSUMED NOT TO TAKE PRIMARY PIPE LOADING. THESE ARE THEN SECONDARY MEMBERS USED ONLY TO MAINTAIN FRAME STABILITY.

CONCLUSION: PER. THE CALCULATION PRESENTED HERE RHR-597 IS ACCEPTABLE FOR THE PHASE II FAULTED LOADS.

SUPPORT HARDWARE

Item 1 CLAMP 18"Ø FIG 135A STOCK SIZE 1"X6" C-C-2'8" W/1 1/8" Ø BOLTS

$$D = \frac{C\text{-}C - PIPE\ Ø}{2} = \frac{32 - 18}{2} = 7"$$

PER CHART 'A' CLAMP IS ACCEPTABLE FOR 7900 # NORMAL WITH A 1.8 FACTOR FOR FAULTED. 7.6 < 7.9(1.8) KIP

Item 3 FIG 350 SIZE 20 RIGID STRUT.

PER. DESIGN GUIDE SECTION 411-196
RIGID HAS MAX FAULTED LOAD OF
12 KIPS AT A LENGTH OF 5FT OR LESS.

12KIP > 7.6 KIP/2

AS THE RIGID'S ARE ON HORIZONTAL PIPE
AND. THERE IS TWO RIGID'S ONE ON EACH
SIDE ASSUME EACH HAS HALF THE SUPPORT LOAD

STRESS CHECK

CHECK WELD BEAM BRACKETS FOR RIGID STRUT
ITEM 3 TO 7 AND 8

2 9/16"

2 1/2"

$A_w = 2(2\frac{1}{2}) = 5"$ LENGTH OF WELD.

$P = 7630\# / 2 = 3815\#$

$$f_t = \frac{P}{A_w} = \frac{3815}{5} = 763.\ \#/in$$

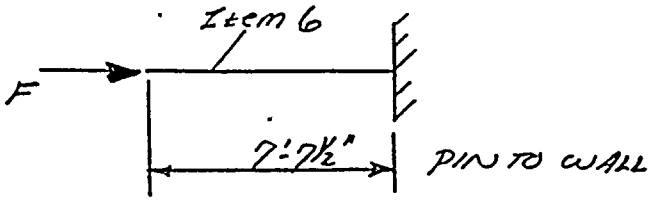
$$w = \frac{f_t}{f_{allo}} = \frac{763}{0.707(27000)*2} = 0.040" < 1/4" \text{ WELD LEG}$$

* FAULTED
< FOR EFFECTIVE THROAT OF FILLET WELD

∴ WELD IS ACCEPTABLE

AS ALL OTHER WELDS IN COLUMES HAVE EQUAL OR GREATER WELDS LENGTHS ALL WELDS ARE ACCEPTABLE.

MEMBERS



M4X13 $r = 0.939$ in

$A = 3.81$

$$\sigma_t = P/A = \frac{3815}{3.81}$$

$= 1.0$ KSI

$$\frac{KL}{r} = \frac{2.1(91.5)}{0.939}$$

$= 205 \gtrsim 200$

THIS IS OVER 200 BUT AS THE BRACING OF THIS SUPPORT C SECONARY MEMBERS WOULD CUT THE UNBRACED LENGTH DOWN TO 5' AND AS MEMBER IS ACCEPTABLE FOR KL/r OF 200 NO FURTHER CALCULATIONS ARE REQUIRED

@ $KL/r = 200$

$F_a = 3.93$ KSI $>>$ 1. KSI

$\therefore$ ACCEPTABLE

LUG CALCULATIONS

THERE IS FOUR LUGS PER SIDE OF CLAMP $\therefore$ LOAD PER. LUG IS:

$$\frac{7630}{4} = 1910 \text{ \# per LUG.}$$

RHR-(20)-2. SCH. 30 PIPE SA106

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W.O. No. 3900-76 Date 10/5/83 Book No. 8.16.5012 Page No.
Drawing No. KHP-597 Calc. No. 8.16.5037 Sheet 8 Cont. on Sheet 9
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Title WPPSS NP-2 Pipe Support Review/Redesign

TYPICAL BASEPLATE CALCULATION FORM

☐ New Baseplate
☒ As-Built Baseplate
☐ Field Modified Baseplate

Baseplate Item No. 4

STRUDL Joint No. N1A

Baseplate Size PL 3/4 x 9" x 9" Stiffener Size N/A

Size of Attachment and Eccentricity W4 x 13 NONE

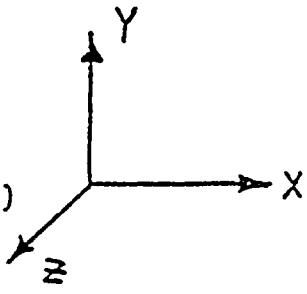
Number, Size and Type of Anchor Bolts (4) 3/4" ϕ HDT

Maximum Support Loading — Normal, (Faulted) } Circle
Emergency, Hydro } One

Fx ⊖ Mx ⊖

Fy ⊖ My ⊖

Fz 3.815 (Pullout) Mz ⊖ (Torsion)



Comparison is made to Typical Baseplate ST 4/2

$$I_t = \left\{ \left[\frac{3.82}{8.4} \right] + \left[\quad \right] + \left[\quad \right] \right\} = 0.45$$

$$I_s = \frac{\sqrt{\left[\quad + \quad \right]^2 + \left[\quad + \quad \right]^2}}{(\quad)} = \ominus$$

$$I_{Total} = \left[I_t^{4/3} + I_s^{4/3} \right]^{3/4} = 0.45 \quad \leq 0.9 \text{ or } \leq 0.75 \text{ New plate with HDI}$$

Comments:

☒ Baseplate is Qualified

LOAD CONDITIONS: DESIGN LOADS

LOAD TYPE		POUNDS			POUNDS-FT.		
		Fx	Fy	Fz	Mx	My	Mz
Thermal	+	880	510	2079	9888	634	2567
	−	-118	-421	-3492	-25419	-585	-1902
Dead Wt.		-111	3977	241	-3561	-394	315
Misc.							
DYNAMIC LOADS	Normal	±2880	±4515	±3455	±25916	±5869	±20621
	Emerg.	±2883	±4515	±3456	±25916	±5871	±20030
	Faulted	±5702	±8735	±6869	±51494	±11636	±39761
TOTAL LOADS	Normal	EACH LOAD CASE FOR ANCHORS IS INPUTED					
	Emerg.	SEPERATELY INTO THE STRUDL COMPUTER PROGRAM AND THEN THE REACTIONS ARE TOTALED DUE					
	Faulted	TO THE COMPLEXITY OF LOAD CONDITIONS AND SUPPORT STRUCTURES					

LOAD CONDITIONS: * MEB-50 PHASE II LOADS.

LOAD TYPE		POUNDS			POUNDS-FT.		
		Fx	Fy	Fz	Mx	My	Mz
Thermal							
Dead Wt.							
Misc.							
DYNAMIC LOADS	Normal						
	Emerg.						
	Faulted						
TOTAL LOADS	Normal						
	Emerg.						
	* Faulted	4981	13288	8349	55599	7631	37257
ORIGINAL SUPPORT DESIGN LOADS	Normal						
	Emerg.						
	Faulted						

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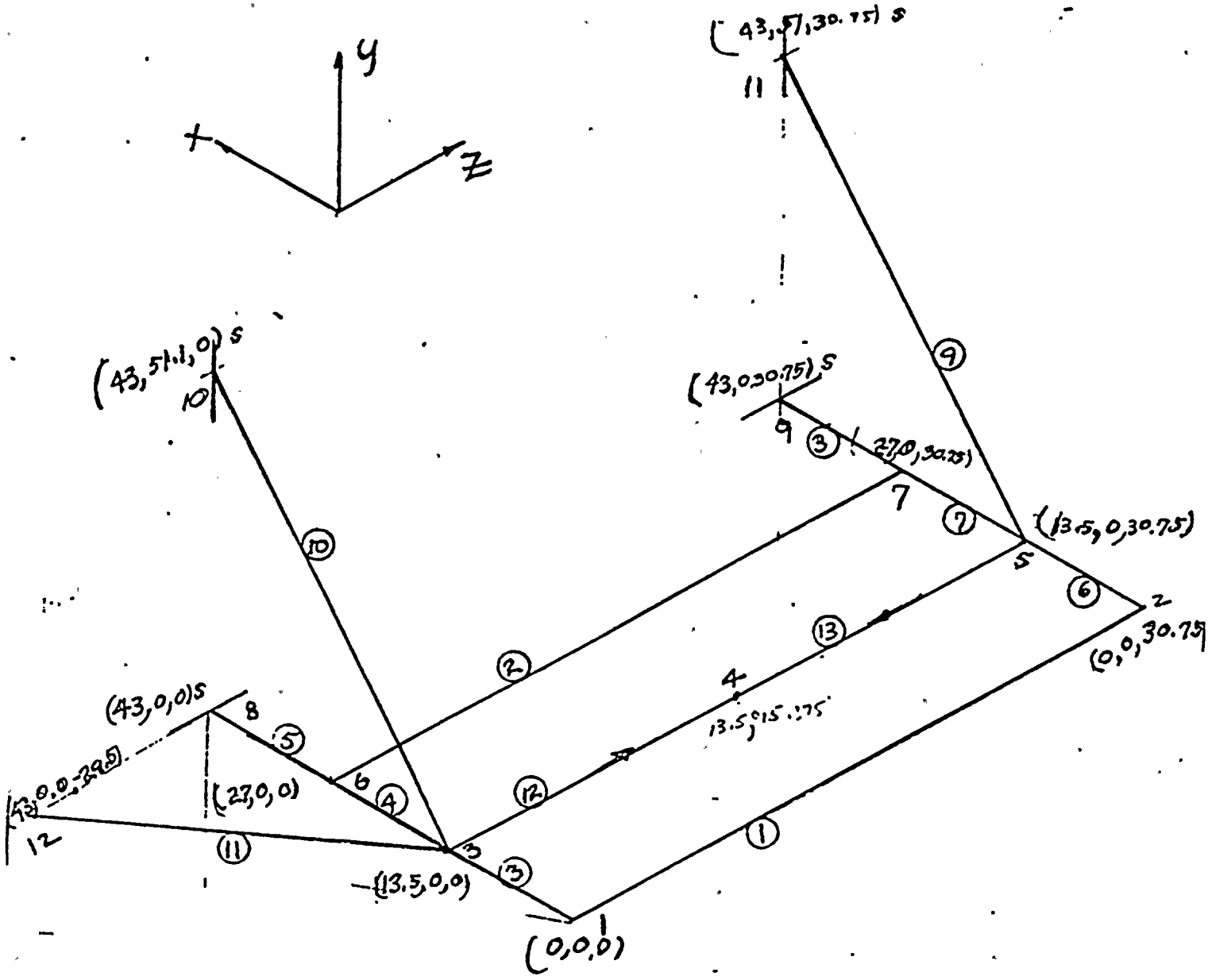
W.O. No. 3900-76 Date 8-11-83 Book No. 8.16.5037 Page No.
Drawing No. RHR-238 Calc. No. 8.16.5037 Sheet 11 Cont. on Sheet 12
By Ed Chmiel Checked S.L. Rodgers Approved
Title MEB-50 STUDY

COMPUTER MODEL



REFERENCE STRUDL RUN NO. 664 DATED 10-11-83
SEE ATTACH. 'A'
MAXIMUM ABSOLUTE SUMMATIONS OF MEB-50 PHASE II LOADS ARE PERFORMED BY STRUDL COMMAND - GENERATE 'PKMEB50'.

MEMBER STRESSES:

BY INSPECTION OF STRUDL OUTPUT PAGES 27 TO 31, MAXIMUM NORMAL MEMBER STRESS OCCURS IN STRUDL MEMBER NO. 7 AT JOINT NO. 5.

$\sigma_{max.} = 30,400$ PSI

$\sigma_{allows.} = 40,600$ PSI (PER DESIGN GUIDE M402, PG. 3)

CHECK CRITICAL BUCKLING:

BY INPECTION OF STRUDL PAGES 4&5, CRITICAL MEMBER LENGTHS ARE FOR MEMBERS NO. 9, 10 & 11.
BY COMPARISON OF MEMBER LENGTHS, SIZES AND AXIAL FORCES (PER STRUDL OUTPUT PAGES NO. 22 & 23), MEMBER NO. 10 IS CRITICAL.

SLENDERNESS RATIO: $\frac{Kl}{r} = \frac{1.2(56.85)}{1.45} = 47$

ALLOWABLE COMPRESSIVE STRESS: $F_a = 21.33$ KSI, (PER AISC APPENDIX A, PAGE 5-85. TABLE 1-42)
THIS IS NORMAL ALLOWABLE STRESS AND ∴ CONSERVATIVE.
MAXIMUM AXIAL FORCE = 37,662 # (STRUDL PG. 23)
MEMBER SIZE = TS4x4x.375 ⇒ $A = 5.08\ in^2$

$f_a = \frac{37662\ \#}{5.08\ in^2} = 7414$ PSI

$\frac{f_a}{F_a} = \frac{7414}{21330} = 0.35 > 0.15$

MEMBER STRESSES: (CONT'D)

USE FORMULAS 1.6-1a & 1.6-1b FROM AISC MANUAL, PG. 5-22.

FORMULA 1.6-1a: $\frac{f_a}{F_a} + \frac{C_{mx} f_{bx}}{\left(1 - \frac{f_a}{F'_{ex}}\right) F_{bx}} + \frac{C_{my} f_{by}}{\left(1 - \frac{f_a}{F'_{ey}}\right) F_{by}} \leq 1.0$

$F'_{ex} = F'_{ey} = \frac{12\pi^2 E}{23(47)} = 3177264$

Conservatively use: $C_{mx} = C_{my} = 0.85$

$$.35 + \frac{0.85\,(8117\ \text{in-lb}/5.35\ \text{in}^3)}{\left(1 - \frac{7414}{3177264}\right)(40600)} + \frac{.85\,(24569\ \text{in-\#}/5.35\text{in}^3)}{\left(1 - \frac{7414}{3177264}\right)(40600)} = 0.48$$

$0.48 < 1.0$ ∴ Formula 1.6-1a is satified.

FORMULA 1.6-1b: $\frac{f_a}{.6F_y} + \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}} \leq 1.0$

$$\frac{7414}{.6(42000)} + \frac{(8117 + 24569)/5.35}{40600} = 0.44 < 1.0$$

∴ Formula 1.6-1b is satisfied

MEMBER No. 10 IS ADEQUATE FOR BUCKLING.

ALL OTHER MEMBERS ARE ADEQUATE IN BENDING & BUCKLING BY COMPARISON TO ABOVE CALCULATIONS.

CHECK CRITICAL SHEAR STRESS:

BY INSPECTION OF STRUDL OUTPUT PAGES 19 TO 23, CRITICAL TUBE STEEL SECTION IS STRUDL MEMBER No. 7 (TS 5X5X0.375)
PER STRUDL OUTPUT PAGE 21,
TORSION = 10,720 #-IN
FY = 10941 #
FZ = 2705 #

MEMBER STRESSES: (CONT'D.)

TORSIONAL SHEAR STRESS:
(REF. BLODGETT "DESIGN OF WELDED STRUCTURES", SECTION 2.10)

TORSIONAL SHEAR STRESS: $\gamma = \frac{T}{2[A]t}$

$$\gamma = \frac{10720\ \#\text{-}IN}{2[5" - 0.375"]^2 .375"} = 668\ PSI$$

$\gamma = 668\ PSI < 27000\ PSI$

∴ MEMBER IS ADEQUATE IN TORSION.

NORMAL SHEAR STRESS: (TS 5X5X.375; $A = 6.45\ IN^2$)

$$V_y = \frac{10941\ \#(2)}{6.45\ IN^2} = 3393\ PSI$$

$$V_z = \frac{2705\ \#(2)}{6.45\ IN^2} = 839\ PSI$$

ALLOWABLE SHEAR STRESS >> ACTUAL SHEAR STRESS
(27000 PSI)

CHECK PIPE TRUNNION SHEAR STRESS:
MATERIAL: A106 Gr. B, 14"ø SCH. 40 PIPE
$S_y = 27.1\ KSI$ (NORMAL)

SECTION PROPERTIES:
$A = 18.662\ IN^2$
$S = 61.356\ IN^3$
thickness of wall = 0.438" = t
Torsional Resistance = $R = 2\pi r^3 t = 2\pi(6.562")^3(.438") = 778\ IN^4$

REF. STRUDL OUTPUT PAGES 23 & 24, MEMBERS # 12 & 13.
BY INSPECTION OF MEMBER FORCES, MEMBER 12
AT JOINT 4 IS CRITICAL.

MEMBER STRESSES: (CONT'D.)

REF. STRUDL OUTPUT PG. 23, MEM 12, JOINT 4

TORSION = 266915 #-IN
FY = 27233 #
FZ = 7094 #

TORSIONAL SHEAR STRESS:

$$\tau = \frac{TC}{R} = \frac{266915\ \#\text{-IN}(7\text{IN})}{944\ \text{IN}^4} = 1979\ \text{PSI}$$

TOTAL SHEAR STRESS:

$$\sigma_V = \tau + \frac{[F_Y^2 + F_Z^2]^{\frac{1}{2}}(2)}{A}$$

$$\sigma_V = 1979\text{PSI} + \frac{[(27233\#)^2 + (7094\#)^2]^{\frac{1}{2}}2}{18.662\ \text{IN}^2}$$

$$\sigma_V = 4995\text{PSI} < .4S_y = (.4(27100\text{PSI})) = 10840\ \text{PSI}$$

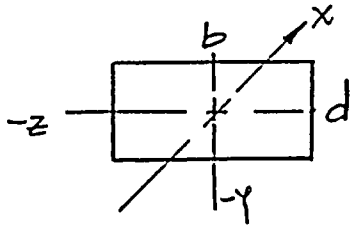
∴ PIPE TRUNNIONS ARE ADEQUATE.

WELD ANALYSIS:

CHECK WELD AT MEMBER 11 JOINT 12
PER STRUDL OUTPUT PG. 25, JOINT 12:

FX = 7987 # MX = 34125 #-IN
FY = 2996 # MY = 9824 #-IN
FZ = 7713 # MZ = 27391 #-IN

WELD PROPERTIES:
REF. RFI-C0500-AB1464



TS 4x4x.375 AT 45°

$b = \sqrt{2}(4") = 5.657"$; $d = 4"$

$S_{WY} = \frac{5.657"}{3}[5.657" + 3(4")] = 33.295\ \text{IN}^2$

$A_W = 2(4" + 5.657") = 19.314\ \text{IN}$

$S_{WZ} = \frac{4"}{3}(3(5.657") + (4")) = 27.961\ \text{IN}^2$

$J_W = [4" + 5.657"]^3/6 = 150.098\ \text{IN}^3$

WELD OF MEMBER 11, JOINT 12: (CONT'D)

WELD FORCE: (#/IN)

$$f_W = \left[\left(\frac{FX}{AW} + \frac{MY}{3Y} + \frac{MZ}{SZ}\right)^2 + \left(\frac{FY}{AW} + \frac{b/2\,(MX)}{JW}\right)^2 + \left(\frac{FZ}{AW} + \frac{d/2\,(MX)}{JW}\right)^2\right]^{\frac{1}{2}}$$

$$f_W = \left[\left(\frac{7987}{19.514} + \frac{9824}{33.225} + \frac{27391}{27.961}\right)^2 + \left(\frac{2996}{19.314} + \frac{(5.657/2)(34125)}{150.098}\right)^2 + \left(\frac{7713}{19.514} + \frac{2(34125)}{150.098}\right)^2\right]^{\frac{1}{2}}$$

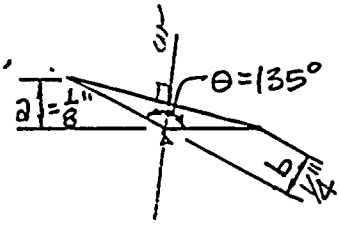
$f_W = 2053\ \#/IN$

MINIMUM EFFECTIVE THROAT OF WELD REQUIRED:

$$w_{reqd.} = \frac{2053\ \#/IN}{27000\ PSI} = 0.08"$$

REF. RFI-C0500-AB1464

MINIMUM EXISTING EFFECTIVE THROAT:



$$w = \frac{a \cdot b}{\left[a^2 + b^2 - 2ab\cos\theta\right]^{1/2}}$$

$$\text{EXIST. } w_{min} = \frac{(1/8)(1/4)}{\left[(1/8)^2 + (1/4)^2 - 2(1/8)(1/4)\cos 135°\right]^{\frac{1}{2}}}$$

EXIST. $w_{min} = 0.089" > 0.08"$ (REQ'D.)

∴ EXISTING WELD AT JOINT 12 IS ADEQUATE.

CHECK WELD AT MEMBER 11, JOINT 3

FROM STRUDL OUTPUT PG. 23, MEM 11, JOINT 3

AXIAL = 11102 #	TORSION = 11074 #-IN
FY = 2987. #	MY = 11561 #-IN
FZ = 560 #	MZ = 70116 #-IN

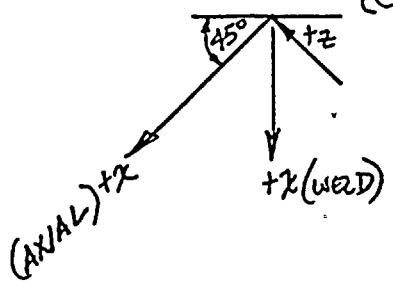
WELD PROPERTIES & ORIENTATION:

SAME AS FOR MEMBER 11, JOINT 12 (ABOVE CALC.)

WELD ANALYSIS: (CONT'D.)

RESOLVE FORCES INTO PLANE OF WELD:

(CONSERVATIVELY ADD ALL RESOLVED FORCES)



$F_X = 111.02^{\#}(.7071) + (.7071)(560^{\#}) = 8246\ \#$

$F_Z = F_X = 8246\ \#$

$F_Y = 2987\ \#$

$M_X = 11074\ \#\text{-IN}(.7071) + (.7071)(70116\ \#\text{-IN}) = 57410\ \#\text{-IN}$

$M_Z = M_X = 57410\ \#\text{-IN}$

$M_Y = 11561\ \#\text{-IN}$

WELD FORCE: (#/IN)

$$f_w = \left[\left(\frac{8246}{19.314} + \frac{57410}{27.961} + \frac{11561}{33.295}\right)^2 + \left(\frac{2987}{19.314} + \frac{(5.657)(57410)}{150.098}\right)^2 + \left(\frac{8246}{19.314} + \frac{2(57410)}{150.098}\right)^2\right]^{1/2}$$

$f_w = 3308\ \#/\text{IN}$

REQUIRED EFFECTIVE THROAT OF WELD:

$$w_{req'd} = \frac{3308\ \#/\text{IN}}{27000\ \text{PSI}} = 0.123"$$

MINIMUM EXISTING EFFECTIVE THROAT PER RFI-C0500-AB1464: REF. PREVIOUS WELD CALC. ($a = b = 7/16"$; $\theta = 135°$)

$$w_{exist.} = \frac{(7/16)(7/16)}{\left[(7/16)^2 + (7/16)^2 - 2(7/16)(7/16)\cos 135°\right]^{1/2}} = 0.237"$$ (SKEWED WELD)

EXISTING $w = 3/16"\left(\frac{1}{\sqrt{2}}\right) = 0.133"$ ($3/16"$ FILLET WELD)

$w_{min} = 0.133" > 0.123"$ (REQUIRED)

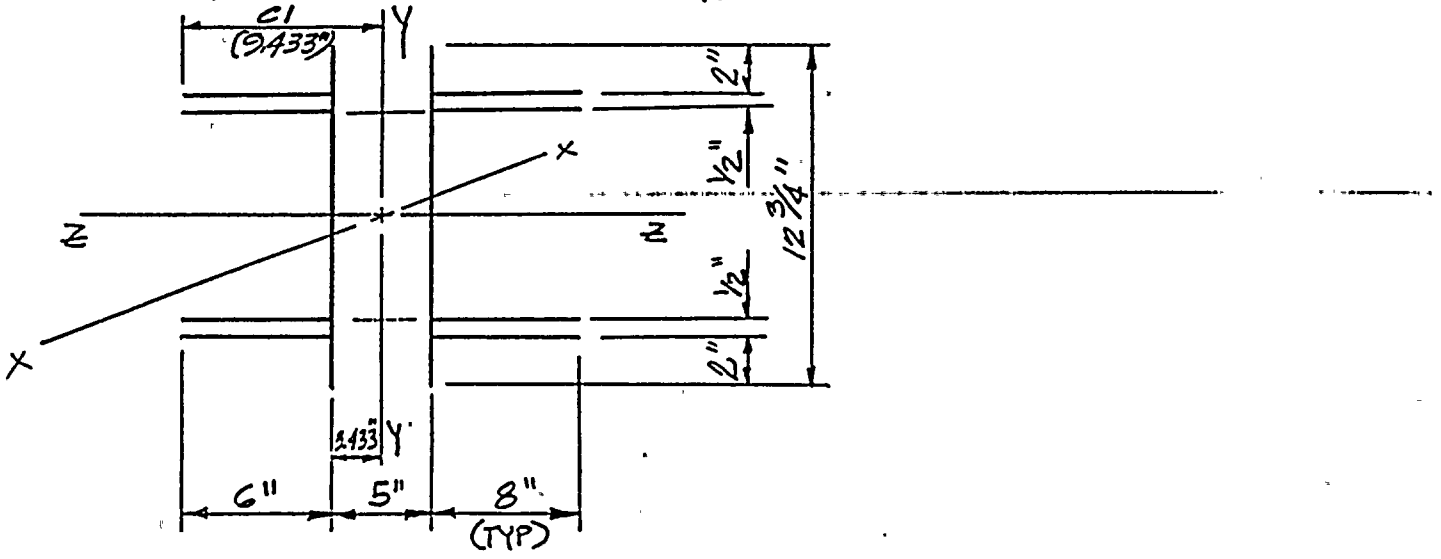
∴ EXISTING WELD AT STRUDL JOINT 3 IS ADEQUATE.

WELD ANALYSIS: (CONT'D.)

CHECK AT STRUDL JOINT 10 & 11
BY INSPECTION OF OUTPUT LOADS JOINT 10 IS CRITICAL
REF. STRUDL OUTPUT PG'S 24 & 25

FX = 20420 # MX = 6154 #-IN
FY = 31662 # MY = 5596 #-IN
FZ = 390 # MZ = 24569 #-IN

THE FOLLOWING WELD CONFIGURATION & PROPERTIES WILL BE ANALYZED AS IT IS ASSURED TO EXIST PER RFI-C0500-AB1464.
WELDING EXISTS BETWEEN STIFFENER PLATES AND EMBEDDED PLATE.



WELD PROPERTIES:

$A_W = 2(12.75") + 4(8"+6") = 81.5"$

$c_1 = \left[4(6")(3") + 12.75"(6"+11") + 4(8")(15")\right] \div (81.5") = 9.433"$

$I_Z = 2\left(\frac{(12.75")^3}{12}\right) + 4(6")(4.13")^2 + 4(8")(4.13")^2 = 1300.63\,IN^3$

$I_Y = 12.75"\left[(3.433")^2 + (1.567")^2\right] + 4(6")(6.433")^2 + 4(8")(5.567")^2 + \left(\frac{6^3}{12} + \frac{8^3}{12}\right)4$

$I_Y = 2409.170\,IN^3$

WELD ANALYSIS: (CONT'D.)

$$S_{Z_W} = I_Z / 6.375" = \frac{1300.63\ IN^3}{6.375\ IN} = 204.02\ IN^2$$

$$S_{Y_{W_R}} = I_Y / 9.567" = \frac{2409.170\ IN^3}{9.567\ IN} = 251.821\ IN^2$$

$$S_{Y_{W_L}} = I_Y / 9.433" = \frac{2409.170\ IN^3}{9.433\ IN} = 255.398\ IN^2$$

$$J_W = I_Z + I_Y = 1300.63\ IN^3 + 2409.170\ IN^3 = 3709.8\ IN^3$$

WELD FORCE: (#/IN)

$$f_W = \left[\left(\frac{20420}{81.5} + \frac{5596}{255.398} + \frac{24569}{204.02}\right)^2 + \left(\frac{31662}{81.5} + \frac{2567(6154)}{3709.8}\right)^2 + \left(\frac{390}{81.5} + \frac{6.375(6154)}{3709.8}\right)^2\right]^{\frac{1}{2}}$$

$$f_W = 564\ \#/IN$$

REQUIRED WELD SIZE: (FILLET WELD)

$$W_{req'd} = 564\ \#/IN\ \sqrt{2}\ /\ 27000PSI = 0.03"$$

EXISTING MINIMUM FILLET WELD SIZE:

$$W_{exist.} = 0.25" > 0.03" \text{ (REQUIRED)}$$

∴ EXISTING WELD IS ADEQUATE.

WELD ANALYSIS: (CONT'D.)

CHECK WELD AT MEMBER 13, JOINT 5 & MEMBER 12, JOINT 3.

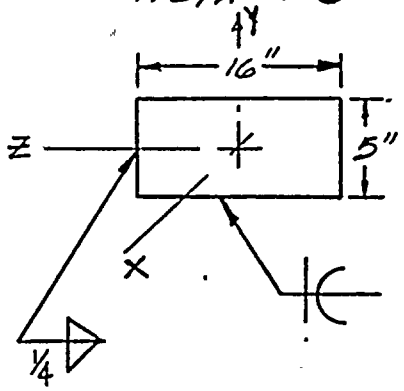
BY INSPECTION OF OUTPUT LOADS, JOINT 3 OF MEMBER 12 IS CRITICAL PER STRUDL OUTPUT PG.'S 23 & 24:

AXIAL = 7982 #
FY = 27233 #
FZ = 7094 #

TORSION = 266915 #-IN
MY = 48092 #-IN
MZ = 135535 #-IN

WELD PROPERTIES & CONFIGURATION:

CRITICAL WELD IS BETWEEN HANGER DETAIL ITEM # 5 & ITEM # 2.



$A_w = 2(5" + 16") = 42$ IN

$S_{wy} = \frac{16"}{3}(16" + 3(5")) = 165.33$

$S_{wz} = \frac{5"}{3}(5" + 3(16")) = 88.33$

$J_w = \frac{(16" + 5")^3}{6} = 1543.5$

WELD FORCES: (#/IN)

$$f_w = \left[\left(\frac{7982}{42} + \frac{48092}{165.33} + \frac{135535}{88.33}\right)^2 + \left(\frac{27233}{42} + \frac{266915\,(8)}{1543.5}\right)^2 + \left(\frac{7094}{42} + \frac{266915\,(2.5)}{1543.5}\right)^2\right]^{1/2}$$

$f_w = 2924$ #/IN

WELD STRESS:

DETERMINE MINIMUM EXISTING EFFECTIVE THROAT OF WELD: 1/4" FILLET WELD $\Rightarrow$ w = .7071(.25") = .177"
3/4" Rad. FLARE-BEVEL WELD $\Rightarrow$ w = 5/16(.75") = .234"

1/4" FILLET WELD IS CRITICAL:

$$\tau_w = \frac{2924\ \#/IN}{0.177\ IN} = 16521\ PSI < 27000\ PSI \therefore OK$$

WELD ANALYSIS: (CONT'D.)

CHECK WELDS AT STRUDL MEMBER 5, JOINT 8 AND MEMBER 8, JOINT 9.

BY INSPECTION OF STRUDL OUTPUT PAGE 24, JOINT 9 IS CRITICAL.

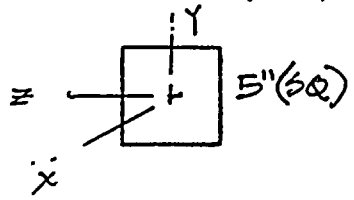
$F_X = 25360\ \#$ $M_X = 10640\ \#\text{-IN}$

$F_Y = 10969\ \#$ $M_Y = 27710.\ \#\text{-IN}$

$F_Z = 2646\ \#$ $M_Z = 114023\ \#\text{-IN}$

WELD PROPERTIES & CONFIGURATION:

(CONSERVATIVELY, NEGLECT STIFFENER PLATE WELDS)



$A_W = 4(5") = 20"$

$S_{W_Y} = S_{W_Z} = \frac{5}{3}(4(5")) = 33.33\ IN^2$

$J_W = (2(5")^3/6 = 166.67\ IN^3$

WELD FORCE: (#/IN)

$$f_W = \left[\left(\frac{25360}{20} + \frac{27710 + 114023}{33.33}\right)^2 + \left(\frac{10969}{20} + \frac{2.5(10640)}{166.67}\right)^2 + \left(\frac{2646}{20} + \frac{2.5(10640)}{166.67}\right)^2\right]^{1/2}$$

$f_W = 5573\ \#/IN$

WELD STRESS: (3/8" FILLET WELD)

$$\tau_W = \frac{5573\ \#/IN\ (\sqrt{2})}{0.375"} = 21018\ PSI < 27000\ PSI$$

∴ 3/8" FILLET WELD IS ADEQUATE

WELD ANALYSIS: (CONT'D)

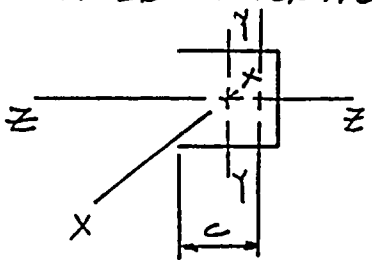
CHECK WELD AT STRUDL MEMBER 2, JOINT 6 AND MEMBER 2, JOINT 7.
BY INSPECTION OUTPUT LOADS MEMBER 2 JOINT 7 IS CRITICAL.

REF. STRUDL PG'S. 19 & 20:

AXIAL = 59. #
FY = 23. #
FZ = 1257 #

TORSION = 6851 #-IN
MY = 16201 #-IN
MZ = 254 #-IN

WELD PROPERTIES & CONFIGURATION:



$c = \frac{2(4)(2)+4(4)}{12} = 2.67"$

TS 4X4X.375

$A_W = 3(4") = 12\ IN$

$S_{WZ} = \frac{4}{6}(7(4")) = 18.67\ IN^2$

$S_{WY_R} = \frac{4}{3}(3(4")) = 16\ IN^2$

$S_{WY_L} = \frac{4^2}{3}\left(\frac{3(4")}{2(4")}\right) = 8\ IN^2$

$J_W = \frac{4^3}{3}\left(\frac{3(4")}{3(4")}\right) + \frac{4"^2}{12}(7(4")) = 58.67$

WELD FORCE: (#/IN)

$$f_w = \left[\left(\frac{59}{12} + \frac{16201}{8} + \frac{254}{18.67}\right)^2 + \left(\frac{23}{12} + \frac{6851(2.67)}{58.67}\right)^2 + \left(\frac{1257}{12} + \frac{6851(2)}{58.67}\right)^2\right]^{\frac{1}{2}}$$

$f_w = 2095\ \#/IN$

WELD STRESS: (1/4" FILLET WELD)

$\sigma_W = 2095\ \#/IN(\sqrt{2})/.25" = 11852\ PSI < 27000\ PSI$

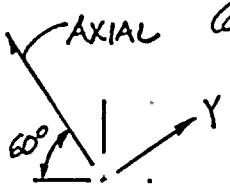
∴ 1/4" FILLET WELD IS ADEQUATE.

WELD ANALYSIS: (CONT'D)

CHECK WELDS AT STRUDL MEMBERS 9 & 10, JOINTS 5 & 3, RESPECTIVELY.
BY INSPECTION OF FORCES ON STRUDL OUTPUT PAGES 22&23, MEMBER 9 JOINT 5 IS CRITICAL.

AXIAL = 34833 # TORSION = 1762 #-IN
FY = 1345 # MY = 13751 #-IN
FZ = 382 # MZ = 48531 #-IN

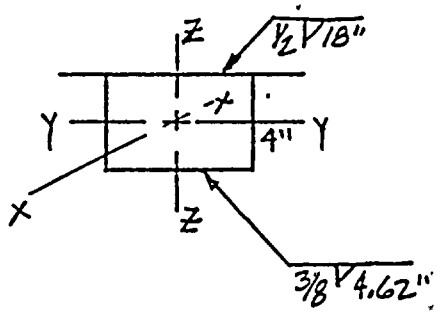
RESOLVING FORCES IN PLANE OF WELD:



(CONSERVATIVELY ADD ABSOLUTE COMPONENT VALUES)

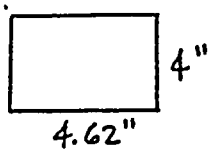
$FX = 34833\ \#\sin 60° + 1345\ \#\cos 60° = 30839\ \#$
$FY = 34833\ \#\cos 60° + 1345\ \#\sin 60° = 18581\ \#$
$FZ = -382\ \#$
$TORSION = 1762\ \#\text{-IN}(\sin 60°) + 13751\ \#\text{-IN}(\cos 60°) = 8401\ \#\text{-IN}$
$MY = 1762\ \#\text{-IN}(\cos 60°) + 13751\ \#\text{-IN}(\sin 60°) = 12790\ \#\text{-IN}$
$MZ = 48531\ \#\text{-IN}$

WELD PROPERTIES & CONFIGURATION:



EXISTING WELD

CONSERVATIVELY EVALUATE THE FOLLOWING WELD CONFIGURATION:



$A_W = 2(4.62" + 4") = 17.24"$
$S_{WZ} = \frac{4.62}{3}(4.62 + 3(4)) = 25.6\ IN^2$
$S_{WY} = \frac{4}{3}(4 + 3(4.62)) = 23.8\ IN^2$
$J_W = \frac{(4+4.62)^3}{6} = 106.8\ IN^3$

MINIMUM EXISTING EFFECTIVE THROAT OF WELDS:

¼ x 5/16 @ 120° ANGLE:

$$\text{EFFECTIVE THROAT} = \frac{(.25)(.3125)}{\sqrt{(.25)^2 + (.3125)^2 - 2(.25)(.3125)\cos 120°}} = 0.16"$$

WELD ANALYSIS: (CONT'D)

WELD STRESS: (BASED ON MINIMUM EFFECTIVE THROAT)

$$\sigma_w = \left[\left(\frac{30839}{17.24} + \frac{12790}{23.8} + \frac{48531}{25.6}\right)^2 + \left(\frac{18581}{17.24} + \frac{2(8401)}{106.8}\right)^2 + \left(\frac{382}{17.24} + \frac{2.31(8401)}{106.8}\right)^2\right]^{\frac{1}{2}} / .16''$$

σ_w = 27523 PSI ≯ 27000 PSI

SINCE THE WELD CONFIGURATION AND PROPERTIES USED TO ARRIVE AT "OVERSTRESS" RESULT, ABOVE, TRY SUBSTITUTING ONLY THE ACTUAL WELD AREA (LENGTH) INTO THE ABOVE EQUATION.

* ACTUAL A_w = 17.24" + (18" − 4.62") = 30.62 IN

$$\sigma_w = \left[\left(\frac{30839}{30.62} + \frac{12790}{23.8} + \frac{48531}{25.6}\right) + \left(\frac{18581}{30.62} + \frac{2(8401)}{106.8}\right)^2 + \left(\frac{382}{30.62} + \frac{2.31(8401)}{106.8}\right)^2\right]^{\frac{1}{2}} / .16''$$

σ_w = 22059 PSI < 27000 PSI

∴ EXISTING WELDS AT JOINTS 3 & 5 ARE ADEQUATE,

* THIS NOW INCLUDES THE WELD OF ITEM 11 TO ITEM 2

CALC. No. # 3900-76 R. 1
P25 CONT. 26

INFORMATION FORM -- EMBEDDED PLATE

A. HANGER MARK NO. RHR-238 S/U No. 9.0 REV No. 3

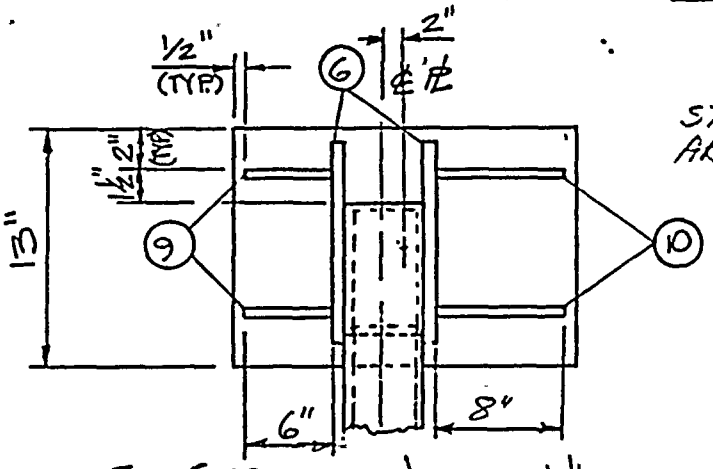
PLATE SIZE: 9" Strip ____ 13"x21" ✓ 12"x12" ____ Other ____

SIZE OF ATTACHMENT (e.g. TS4x4, W8x24, End Brkt. 5"x5", etc.) TS 4X4X.375@30°

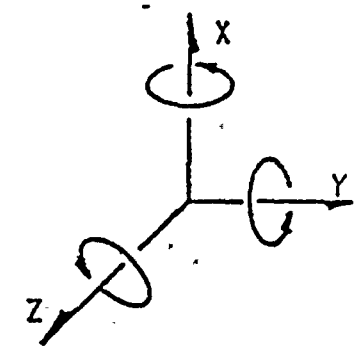
B. IS SUPPORT INSTALLED? Yes ✓ No ____ Location: ____

C. ~~OTHER ATTACHMENTS (Identify Contractor & Mark No. & Locate on Plate Sketch Below)~~

D. SKETCH (Plate & Attachment Location on Plate) ____



STIFFENNERS ARE PL ½"x3"



NOTE: Orientation of Forces Shown is Positive

E. LOAD TABLE FOR STRUDL JOINT 11

	ATTACHMENT LOAD AT PLATE					
Type of Loading	Fx (KIPS)	Fy (KIPS)	Fz (KIPS) PULLOUT	Mx (IN-K)	My (IN-K)	Mz (IN-K) TORSION
Normal/Upset						
Emergency						
Faulted	29.34	0.38	18.93	6.05	27.2	5.5

LOADS ±

SOURCE OF INFORMATION: STRUDL RUN # 664 (10-11-83)

GROUP: HANGERS SIGNED/DATED: Ed Ramos 10-11-83

CHECKED: [signature] 10/11/83

F. COMMENTS BY BURNS & ROE COGNIZANT GROUP:

☐ APPROVED PER ____

☐ CALC. NO. ____ CALC. BOOK NO. ____

☑ APPROVAL BASED ON LOAD PER TABLE SHOWN ABOVE.

☐ APPROVAL BASED ON REDUCED LOADS (Source) ____

☐ APPROVED AS NOTED (MARK-UP DETAIL ETC.) ____

☐ NOT APPROVED. COMMENTS, ETC. ____

REVIEWED BY: [signature] DATED: 10/12/83

CHECKED BY: [signature] DATED: 10/13/83

INFORMATION FORM -- EMBEDDED PLATE Book 8,16.5012 W.O # 3900-70 P26 CONT 27

A. HANGER MARK NO. RHR-238 S/U No. 9.0 REV No. 3

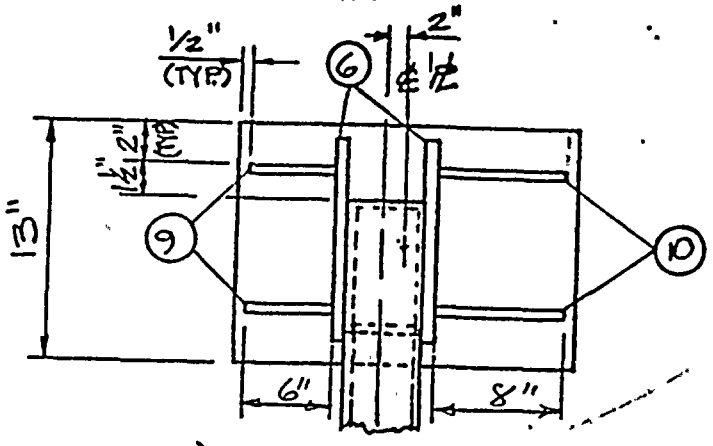
PLATE SIZE: 9" Strip ____ 13"x21" ✓ 12"x12" ____ Other ____

SIZE OF ATTACHMENT (e.g. TS4x4, W8x24, End Brkt. 5"x5", etc.) TS4x4x.375 @30°

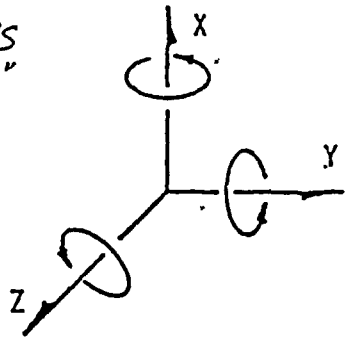
B. IS SUPPORT INSTALLED? Yes ✓ No ____ Location: ____

~~C. OTHER ATTACHMENTS (Identify Contractor & Mark No. & Locate on Plate Sketch Below)~~

D. SKETCH (Plate & Attachment Location on Plate) ____



STIFFENNGRS ARE PL ½"x3"



FOR STRUDL JOINT 10

NOTE: Orientation of Forces Shown is Positive

E. LOAD TABLE

	ATTACHMENT LOAD AT PLATE					
Type of Loading	Fx (KIPS)	Fy (KIPS)	Fz (KIPS)	Mx (IN-K)	My (IN-K)	Mz (IN-K)
Normal/Upset						
Emergency						
Faulted	31.7	0.39	20.4	5.6	24.6	6.15

LOADS ±

SOURCE OF INFORMATION: STRUDL #664 (10/11/83)

GROUP: HANGERS SIGNED/DATED: Ed Ramos

F. COMMENTS BY BURNS & ROE COGNIZANT GROUP: CHECKED: J. H. Rodgers 10/11/83

☐ APPROVED PER ____

☐ CALC. NO. ____ CALC. BOOK NO. ____

☑ APPROVAL BASED ON LOAD PER TABLE SHOWN ABOVE.

☐ APPROVAL BASED ON REDUCED LOADS (Source) ____

☐ APPROVED AS NOTED (MARK-UP DETAIL ETC.) ____

☐ NOT APPROVED. COMMENTS, ETC. ____

REVIEWED BY: M. L. Clark DATED: 10/12/83

CHECKED BY: [illegible] DATED: 10/13/83

BURNS AND ROE, INC.
Headquarters Office—Oradell, N.J.

W.O. No. 3900-76 Date 10/20/83 Book No. 8,16,5012 Page No.
Drawing No. RHR-970N Calc. No. 8.16.5032 Sheet 70 Cont. on Sheet 71
By L.A. Rodgers Checked Ed Ramos Approved
Title CMEB-50 STUDY PHASE II ~~DC WORK NO.~~

LOAD CONDITIONS: DESIGN LOADS

LOAD TYPE		POUNDS			POUNDS-FT.		
		Fx	Fy	Fz	Mx	My	Mz
Thermal		-63	378	-167	-822	705	515
Dead Wt.		106	-10025	39	328	494	-631
Misc.							
DYNAMIC LOADS	Normal	±3810	±13327	±1753	±17265	±5358	±34916
	Emerg.	±3810	±13327	±1753	±17265	±5358	±34916
	Faulted	±7619	±26653	±3506	±34530	±10717	±69833
TOTAL LOADS	Normal	EACH LOAD CASE FOR ANCHORS IS INPUTED					
	Emerg.	SEPERATELY INTO THE STRUDL COMPUTER PROGRAM AND THEN THE REACTIONS ARE TOTALED DUE					
	Faulted	TO THE COMPLEXITY OF LOAD CONDITIONS AND SUPPORT STRUCTURES					

Form BR 8002 2 (5 78)

BURNS AND ROE, INC.
Headquarters Office—Oradell, N.J.

W.O. No. 3900-76 Date 10/14/83 Book No. 8.16.5012 Page No.
Drawing No. PHR-920N Calc. No. 8.16.5037 Sheet 71 Cont. on Sheet 72
By [signature] Checked [signature] Approved
Title WPPSS NP2 PIPE SUPPORT REVIEW/REDESIGN PS MARK No. -

LOAD CONDITIONS: MEB-50 PHASE II LOADS

LOAD TYPE		POUNDS			POUNDS-FT.		
		Fx	Fy	Fz	Mx	My	Mz
Thermal	CASE D	317	-3626	1483	6569	-4622	-2139
	CASE E	133	-3688	666	-813	-5214	-400
	CASE F	166	2614	624	-1189	-5444	-711
Dead Wt.		106	-10025	39	328	494	-631
Misc.							
DYNAMIC LOADS	Normal						
	Emerg.						
	Faulted MEB-50	3810	13327	1753	17265	5358	34916
TOTAL LOADS	Normal						
	Emerg.						
	Faulted	SEE	STRUDL	RUN			
ORIGINAL SUPPORT DESIGN LOADS	Normal						
	Emerg.						
	Faulted						

Form BR 8002.2 (5/78)

THE MEB-50 CALCULATION IS FOR A LOAD CASE WHERE DEADWEIGHT (DW), THERMAL (TH) AND FAULTED (FD) (ORSSE) ARE ADDED TOGETHER. THIS LOAD CASE IS THEN USED TO VERIFY RHR-920N MEMBERS AND WELDS ARE WITHIN STRESS ALLOWABLES.

STRUDL RUN #1342 DATED 10/13/83 IS USED TO FIND REACTIONS AND FORCE/MOMENTS IN RHR-920N STRUCTURAL MEMBERS. THE LOADING INPUT IS FOR THREE THERMAL CASES (D, E & F), ONE DEAD WEIGHT AND EACH OF THE SIX FAULTED LOADS. LOADED INDIVIDUALLY. THE THREE THERMAL CASE'S RESULTS ARE ADDED TOGETHER WITH THE DW. THE FAULTED LOADS ARE 'PEAKED'; THIS ADDITION IS BY 'ABS' ABSOLUTE VALUE. TO GIVE WORST CASE ADDITION. THE FINAL TOTAL LOAD IS THE SUMMATION OF THE PEAKED FAULTED CASE 'PKN' WITH EACH OF THE ADDED THERMAL CASES, THESE ARE 'PEAKED' LOAD CASES AND THEREFORE WORST CASE ('ABS') SUMMATIONS

FOR STRUDL RUN #1342 SEE ATTACH. 'D'

1.) a.) THE REACTIONS AT BASE ℝ'S FOR JOINTS 3, 4 AND 5 ARE LOWER FOR THE BASE ℝ'S THAN THOSE USED IN DESIGN ANALYSIS CALC. # 8.15.658 BOOK 8.15.14 (4) AND THEREFORE NO FURTHER ANALYSIS OF BASE ℝ REQUIRED

b.) THE RAACTIONS AT BASE ℝ FOR JOINT 6 ARE HIGHER AND ARE WITHIN ALLOWABLES SEE NEXT SHT. FOR BASE ℝ ACCEPTANCE.

NOTE' MEMBERS 6 AND 7 ARE DUMMY MEMBERS WITH HIGH STIFFNESS TO MODEL THE PIPE INTO COMPUTER MODEL

BASEPLATE INFORMATION FORM

CAL 8.16.5030 Book 8.16.5012
CALC.# 39007G SHT 73 Cont 74

HANGER MARK NO. RHR-9[redacted]N S/U NO. 9.0 RE[redacted] NO. 2

BASEPLATE SIZE 1"x 24"x24" SIZE OF STIFFENERS 3/4" x 4"

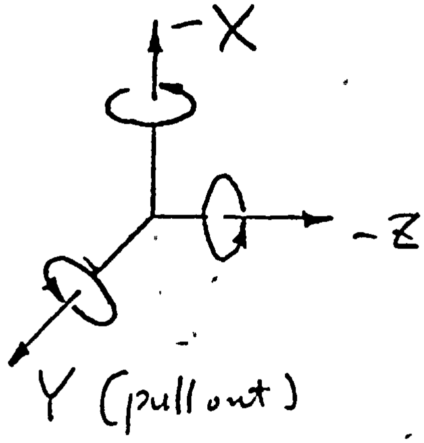
SIZE & LOCATION OF ATTACH. (e.g., W8x24, End Brkt. 5"x5", etc.) TS 10x10

BASEPLATE DETAIL NO. OR ITEM NO. DWG Item (4) (As-Built), "Struddl" joint 6

NEW PLATE ☐ AS-BUILT PLATE ☑ FIELD MODIFIED PLATE ☐

TYPE, SIZE & LOCATION OF BOLTS (12) 3/4"φ HDI

Center of Attachment moved 1½" from ℄ in Z-direction (See Attached.)



NOTE: Orientation of Forces Shown is Positive

LOAD TABLE

Type of Loading	Fx (KIPS)	Fy (KIPS)	Fz (KIPS)	Mx (K-INS)	My (K-INS)	Mz (K-INS)
Normal/Emergency						
Faulted *	4.822	21.678	9.109	60.757	20.953	47.086
Hydro						

* Loads from "Strudl" Run # 1342, Joint 6 "PKDMEB"

INFORMATION SUPPLIED BY: Hang Kuan 10/13/83

CHECKED BY: [signature]

DATED: 10/13/83

IE Bulletin 79-02 Comments

☒ Approved

☐ Comparison with Typicals

☒ Finite Element Calc. No. 8.16.6550 Calc. Book No. 8.16.6000

☐ Approved Based on Reduced Loads

☐ Approved as Noted (MARK-UP DETAIL ETC)

☐ Not Approved. (COMMENTS ETC)

REVIEWED BY: K.A.J. DATED: 10/14/83

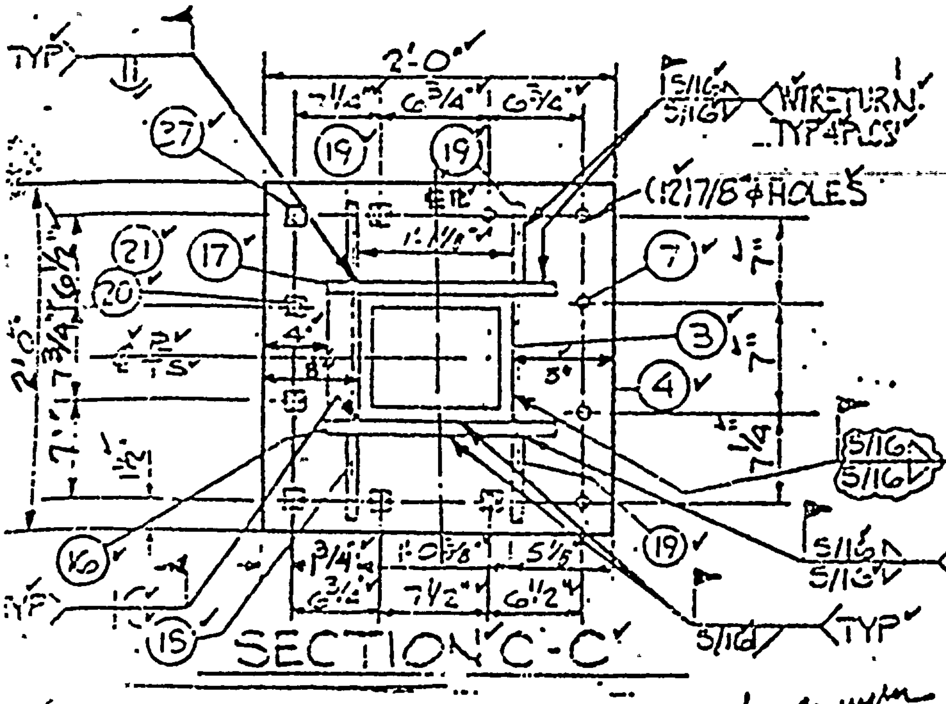
CHECKED BY: MD Locke DATED: 10/14/83

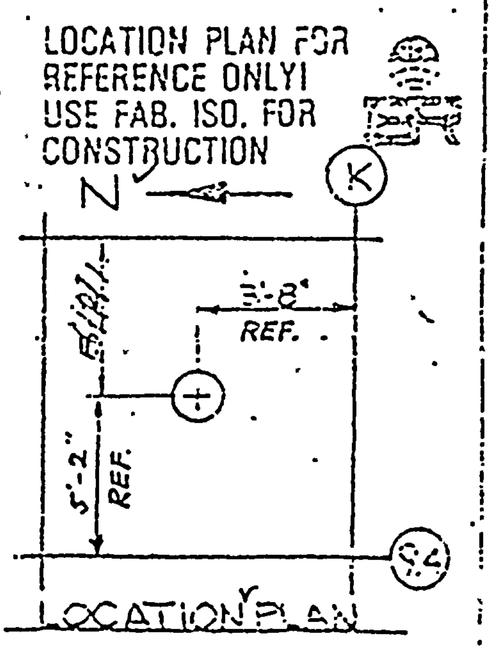
1	1	6"ϕ X 0'-10" LG SCH 80 PIPE ~~(CUT TO SUIT)~~	A-106GRB	5?
2	1	TS 10 X 10 X .500 X 5'-8 1/2"	A-500GRB	343
3	1	TS 10 X 10 X .500 X 3'-3 1/4"	A 500GRB	199
4	2	PL 1" X 24" X 2'-0"	A-36	3?6
5	1	PL 1" X 15" X 1'-6"	A-36	[illegible]
6*	1*	3/8 X 32" X 2'-8" (PAD)(CUT FROM 18"ϕ STD SCH PIPE)	A106GRB	109
7	15	3/4"ϕ X 2 3/8" LG HVY HEX MACH BOLT W/LW	A-307GRB	9
8	1	PL 1" X 19" X 2'-0" (SEE DETAIL B)	A-36	129
38	1	16"ϕ X (6'-6" LG) SCH 80 PIPE ~~(Cut to Suit)~~		
39		(DELETED)		
40	10	1/2"ϕ HSK 13 1/8" EMB. (Z)		
41	4	PL 3/4" X 4" X (6" LG) ~~(Cut to Suit)~~ SEE SECT. X-X		
42*	1*	PL 3/8" X 20" X 2'-8" (PAD) (BEND TO RAD OF 18" PIPE)	A 106GRB	
43	1	PL 1" X 2'-7" X 3'-11"	A-36	
44	2	3/4" X 4" X 2'-3" LG. STIFF. PL	A-36	

* CANNOT VERIFY DUE TO INSULATION.

ACCEPT — "CUT TO SUIT"
[signature]
5/4/83

MOMENTS FT-LBS.			
	Mx	My	Mz
THERMAL	822	705	515
DEAD WT	338	494	631
SEISMIC	2728	5??96	1??916





** SEE SKEWED WELDS @ SHT. 4 OF 6

[signature]
5-2-83

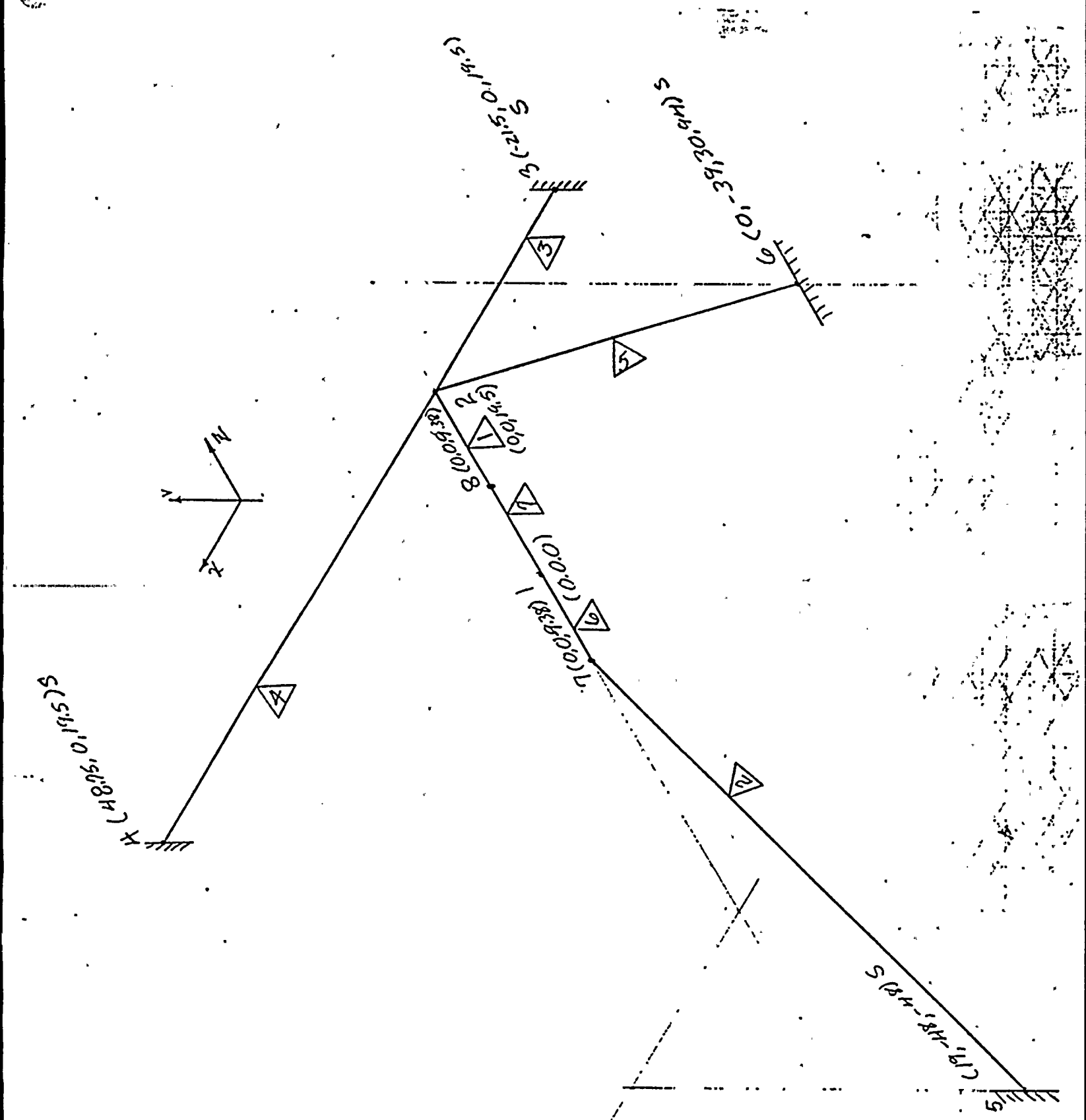
REV. NO.	REVISION	DATE	BY	CHK
3	REVISED IN ACCORDANCE W/SWP/P-P-6	5-2-83	[signature]	[signature]

CAL 8.16.5037
Book 8.16.5012
W.O. # 3900-76
SHT 74 of 75

REF: C 0906 H-01067
WPPSS NUCLEAR PROJECT NO. 2
PAGE PARA
BURNS AND ROE, INC.
REF DWG: CHR-867-3.12H
DWG ZONE R-31
SHT ~~6 of 6~~
TITLE: RHR-970N
~~AB-695~~
REVIEWED DATE

BURNS AND ROE, INC.
Headquarters Office—Oradell, N.J.

W.O. No. 3900-76 Date 10/5/83 Book No. 816.50 Page No.
Drawing No. RHR-920-D Calc. No. 816.5037 Sheet 15 Cont. on Sheet 16
By A.A. Rodgers Checked Ed Lanno Approved
Title MER-50 STUDY



Form BR8002A (9/82) 200M

W.O. No. 3900-76 Date 10/4/83 Book No. 8.16.50 Page No.
Drawing No. RHR-970N Calc. No. 8.16.50.37 Sheet 26 Cont. on Sheet 27
By [illegible] Checked Ed Lanio Approved
Title: C MER-50 STUDY

2. MEMBER STRESS

PER STRUDL RUN PAGES 34 to 38 THE MAX. NORMAL STRESS IS IN MEMBER 5 AT JOINT 2 ON PAGE 37

$$6.1\ KSI << 40.6\ KSI$$

∴ ALL MEMBERS ARE ACCEPTABLE IN TENSION / COMPRESSIONAL STRESS.

SHEAR STRESSES

THERE ARE TWO MEMBER SIZES USED IN RHR-970N. CHECK WORST CASE FOR EACH.

MEMBERS 3, 4 & 5 ARE TS10X10X½

A REVIEW OF STRUDL PAGES 26 to 28 MEM. 3 JT. 2 HAS WORST CASE SHEAR FORCES. PAGE 26. LOAD CASE 'PKEMEB' IS USED:

$F_y = 8700\ lb$ $M_{TOR} = 39991\ lb\text{-}in$
$F_z = 6596\ lb$

$$\tau_s = \left[\left(\frac{P}{A}\right)^2 + \left(\frac{M_{TOR}}{Z[A]t}\right)^2\right]^{1/2} =$$

PER DESIGN OF WELDED STRUCTURES BY BLODGETT 2.10-4

SHEAR AREA PER STRUDL P7 $A_Z = 10\ in^2$ SMALL AREA CONSERVATIVE)

$$\tau_s = \left[\left(\frac{8700}{10} + \frac{39991}{2(9.5\times 9.5)\frac{1}{2}.5}\right)^2 + \left(\frac{6596}{10} + \frac{39991}{2(9.5)^2.5}\right)^2\right]^{1/2}$$

$$= 1.7\ KSI << 27.00\ KSI$$

MEMBERS 1 & 2 ARE 16"Ø SCH 30 PIPE

A REVIEW OF SHEAR LOADS PAGES 24 & 25 OF STRUDL SHOWS MEM 1 JOB PAGE 24 IS WORSE CASE. LOAD CASE PKDMEB USED!

$F_y = 25182$ lb $M_{TOR} = 330940$ lb-in
$F_z = 9968$ lb

$$\tau_S = \frac{(F_y^2 + F_z^2)^{1/2}}{A} + \frac{M_{TOR}\, R}{J}$$

(PER PAGE 2 STRUDL)

$$= \frac{[25182^2 + 9968^2]^{1/2}}{9.213} + \frac{330940\,(8)}{1124}$$

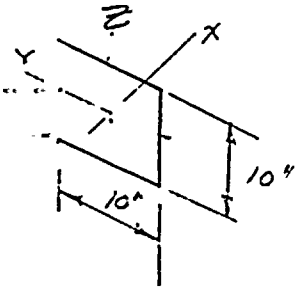
$$= 5.3 \text{ KSI} << 27.0 \text{ KSI}$$

∴ ALL MEMBER STRESS ARE LOW AND ACCEPTABLE.

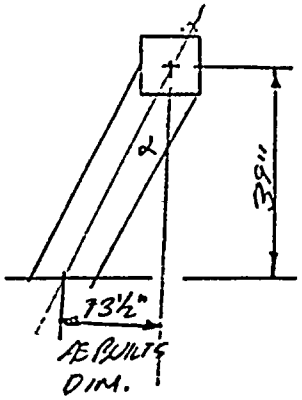
3. WELD STRESS

FOR MEMBERS 3,4 & 5 MEM. 5 JT 2 HAS THE WORST CASE, WITH HIGH REACTION LOADS AND MINIMAL WELD

LOAD CASE PKDMEB PAGE 28



$P_A = 23153$ lb $M_T = 12910$ lb-in
$P_y = 5026$ lb $M_H = 127659$ lb-in
$P_z = 48221$ lb $M_2 = 123153$ lb-in



$\alpha = \tan^{-1}\frac{a}{b} = \tan^{-1}\frac{13\frac{1}{2}}{39} = 19.09°$

ROTATE LOAD IN WORST CASE SUMMATION ABS

$F_x = 23153\cos 19° + 5026\sin 19° = 23528$ lb
$F_y = 23153\sin 19° + 5026\cos 19° = 12290$ lb
$F_z = 48221$ lb

$M_x = 12910\cos 19° + 127652\sin 19° = 53767$ lb-in
$M_y = 12910\sin 19° + 127652\cos 19° = 124905$ lb-in
$M_z = 123153$ lb-in

$A_w = 10(3) = 30$ in

WELD TREATED AS A LINE

$S_{wz} = bd + d^2/6 = 10(10) + 10^2/6 = 116.6$ in^2

$S_{wy} = \frac{d^2(2b+d)}{3(b+d)} = \frac{10^2(2\cdot 10+10)}{3(10+10)} = 50$ in^2

$J_w = \frac{(b+d)^3}{12} - \frac{d^2(b+d)^2}{(b+2d)} = \frac{(10+10)^3}{12} - \frac{10^2(10+10)^2}{(10+20)}$

$= 916.66$

$c_y = d - \frac{d^2}{2d+b} = 10 - \frac{10^2}{30} = 6.67$ in $\quad c_z = 5$ in

$f_R = \left[\left(\frac{P_y}{A_w} + \frac{M_z}{S_z} + \frac{M_x}{S_{wy}}\right)^2 + \left(\frac{P_x}{A_w} + \frac{M_T c_y}{J_w}\right)^2 + \left(\frac{P_z}{A_w} + \frac{M_T c_z}{J_w}\right)^2\right]^{1/2}$

$= \left[\left(\frac{23528}{30} + \frac{123153}{116.6} + \frac{124905}{50}\right)^2 + \left(\frac{12290}{30} + \frac{53767(5)}{916.66}\right)^2 + \left(\frac{48221}{30} + \frac{53767(6.66)}{916.66}\right)^2\right]^{1/2}$

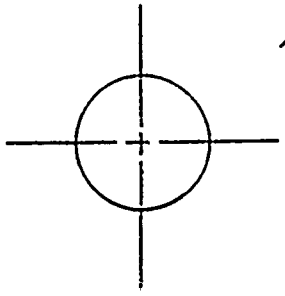
$= 4430$ lb/in

WELD LEG. $w = \frac{f_R}{f_{ALL}} = \frac{4430}{0.707(27000)} = 0.232" < 7/16 (.438")$

W.O. No. 3911-26 Date 10/24/83 Book No. 8.16.50 Page No.
Drawing No. RHC-970N Calc. No. 8.16.5032 Sheet 79 Cont. on Sheet 80
By [redacted] Checked Ed Ramos Approved
Title 11. MEB-50 STUDY

WELD STRESS IS VERY LOW ∴ WELD IS ACCEPTABLE
THE OTHER WELDS MEM 4 JT 4 AND MEM. 3 JT 3
ARE ACCEPTABLE BY COMPARISON.

FOR MEMBERS 1 & 2 WELD AT MEMBER 1 JT 2
IS DONE FOR AN EXAMPLE. IT HAS BOTH HIGH
LOAD REACTIONS AND THE SMALLEST WELD AREA.



16" ϕ PIPE

$A_w = 2\pi r = 2\pi 8 = 50.3_{in}$

$S_w = \frac{\pi d^2}{4} = \frac{\pi 16^2}{4} = 201._{in^2}$

$J_w = \frac{\pi d^3}{4} = \frac{\pi 16^3}{4} = 3216.99$

LOAD CASE 'PKFMEB' PAGE 25

$F_A = 12011\ lb$ $M_T = 321931\ lb\text{-}in$
$F_y = 19852\ lb$ $M_y = 200083\ lb\text{-}in$
$F_z = 9981\ lb$ $M_z = 154689\ lb\text{-}in$

$$f_r = \left[\left(\frac{P_A}{A_w} + \frac{M_x + M_z}{S_w}\right)^2 + \left(\frac{(P_y^2 + P_z^2)^{1/2}}{A_w}\right)^2 + \left(\frac{M_T r}{J_w}\right)^2\right]^{1/2}$$

$$= \left[\left(\frac{12011}{50.3} + \frac{200083 + 154689}{201}\right)^2 + \left(\frac{(19852^2 + 9921^2)^{1/2}}{50.3}\right)^2 + \left(\frac{321931(8)}{3216.99}\right)^2\right]^{1/2}$$

$= 2103\ lb/in$

WELD LEG $w = \frac{f_r}{f_{all}} = \frac{2103}{0.707(27000} = 0.11\ in < 5/16"\ (0.313)$

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W.O. No. 3900-76 Date 10/14/83 Book No. 8.16.50[illegible] Page No.
Drawing No. RHR-910N Calc. No. 8.16.5037 Sheet 80 Cont. on Sheet 81
By [illegible]Rodgers Checked E.Ramos Approved
Title MEB-50 STUDY

WELD STRESS IS VERY LOW ∴ WELD IS ACCEPTABLE.

THE OTHER WELDS ON MEM. 1 JT 8 AND MEM. 2 JT 7 AND 5 ARE ACCEPTABLE BY COMPARISON

∴ SUPPORT IS ACCEPTABLE