Entergy Operations, Inc.
River Bend Station
5485 U.S. Highway 61N
St. Francisville, LA 70775
Tel 225-381-4374

William F. Maguire
Site Vice President
River Bend Station

RBG-47876

June 21, 2018

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: Response to License Amendment Request (LAR) for Review and Approval Of Relocation Of The Reactor Core Isolation Cooling (RCIC) Injection Point NRC Request for Additional Information (RAI)
River Bend Station, Unit 1
Docket No. 50-458
License No. NPF-47

RBF1-18-0136

References: 1) Entergy Letter: License Amendment Request (LAR) (RBG-47823 dated January 29, 2018) (ADAMS Accession No. ML18029A187)

2) NRC email: River Bend Station, Unit 1, Request for Additional Information dated May 24, 2018 (ADAMS Accession No. ML18149A288)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc (Entergy) submitted a request for the review and approval of relocation of the Reactor Core Isolation Cooling (RCIC) Injection Point from the Reactor Vessel Head Spray Nozzle to the 'A' Feedwater Line via the 'A' Residual Heat Removal (RHR) Shutdown Cooling Return Line. In an email dated May 24, 2018, (Reference 2) the NRC staff made a request for additional information (RAI), needed to complete the license amendment request. Enclosure 1 provides the responses to the RAIs. Enclosure 2 contains the pipe stress calculation updates AX-002H, AX-071AG, AX-076A, and AX-076B.

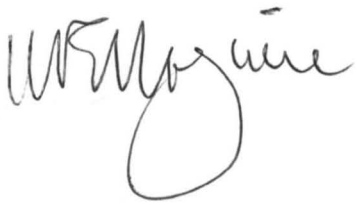
This letter does not contain any new commitments.

If you require additional information, please contact Mr. Tim Schenk at (225)-381-4177 or tschenk@entergy.com.

In accordance with 10 CFR 50.91(b)(1), Entergy is notifying the State of Louisiana and the State of Texas by transmitting a copy of this letter to the designated State Official.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 21, 2018.

Sincerely,



WFM/BAJ

Enclosure 1: Responses to Request for Additional Information
Enclosure 2: Pipe stress calculation updates AX-002H, AX-071AG, AX-076A, and AX-076B

cc: U.S. Nuclear Regulatory Commission
Region IV
1600 E. Lamar Blvd.
Arlington, TX 76011-4511

U.S. Nuclear Regulatory Commission
Attn: Ms. Lisa M. Regner, Project Manager
09-D-14
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

NRC Senior Resident Inspector
Attn: Mr. Jeff Sowa
5485 U.S. Highway 61, Ste. NRC
St. Francisville, LA 70775

Department of Environmental Quality
Office of Environmental Compliance
Radiological Emergency Planning and Response Section
Ji Young Wiley
P.O. Box 4312
Baton Rouge, LA 70821-4312

Public Utility Commission of Texas
Attn: PUC Filing Clerk
1701 N. Congress Avenue
P. O. Box 13326
Austin, TX 78711-3326

RBG-47876

Enclosure 1

Responses to Request for Additional Information

REQUEST FOR ADDITIONAL INFORMATION
RELOCATION OF THE REACTOR CORE ISOLATION COOLING (RCIC) INJECTION POINT
RIVER BEND STATION, UNIT 1
DOCKET NO.: 50-458

Background

By letter dated January 29, 2018, Entergy submitted a license amendment application. The licensee stated that the 6-inch Reactor Core Isolation Cooling (RCIC) system injection line is routed to the 20-inch Feedwater A Loop by tapping into the 10-inch Reactor Heat Removal system shutdown cooling mode return line to feedwater inside the main steam tunnel just south of the jet impingement wall. The staff noted that the piping system has to be qualified in accordance with ASME Code Section III requirements and meet 10 CFR 50.55(a) and relevant GDCs. The staff requests the licensee to address the following items related to the piping analysis:

Question a

Piping analysis model: The staff noted that this change affects 3 different systems. Figure 3A.24-1 of USAR provides RCIC piping system used in analysis of water hammer loads. The staff noted that the piping model does not appear to address the RHR piping. Please explain. Also, describe the piping model used for other load cases.

Response to Question a

PX-1037 was updated with the modification and contains the water hammer analysis of the RCIC Piping; PX-1000 was updated and contains the water hammer analysis for the feedwater piping. Both analyses were updated to show injection into Residual Heat Removal (RHR) piping RHS-010-065 that connects to the Feedwater Mixing Tee and Feedwater Line FWS-020-047. Line RHS-010-065 is the only portion of the RHR system piping that is impacted by the RCIC reroute modification as it is protected from backflow by check valve E12-VF050A and the normally closed isolation valve E12-MOVF053A (ref. PID-27-07A).

Standard Load Cases for the requested RCIC and RHR system piping are provided in the response to Question b below. Additional analyses performed as a result of MR96-0069 can be provided on request.

Question b

Please provide the piping stress summary for RCIC and RHR systems.

Response to Question b

Pipe stress calculation updates to the affected RCIC and RHR piping as a result of MR96-0069 are provided in Enclosure 2: AX-002H, AX-071AG, AX-076A, and AX-076B.

Question c

Please discuss any thermal mode or transient changes and loading condition changes since the Cumulative Usage Factors (CUFs) and stresses are shown to lessen from previous values as specified below:

1. Table 3.6A-9a of the USAR lists the CUFs and the stresses for the feedwater system inside containment. The NRC staff noted that there is no routing change inside containment. Please explain what causes the reduction in stresses and CUFs.

2. Table 3.6A-10a of the USAR lists the stresses for the feedwater system outside of containment. The NRC staff noted that there is no routing change for the feedwater system outside of the containment. Please explain what causes the reduction in stresses.

Response to Question c Part 1

Stress and CUF were calculated in AX-017D revision 3K as part of the RCIC Reroute modification MR96-0069. The fluid transient load case used in this calculation update is based on RBS calculation PX-1000 Rev. 2 (also revised with MR96-0069) curves which are smaller than the design loads of PX-1000 Rev. 1 used in the previous analysis. The transient loads have reduced as a result of installing a nozzle check valve FWS-V3052 into the Feedwater system with MR96-0069. This nozzle check valve has a faster closing time compared to the previously modeled swing check valves. The reverse flow when the nozzle check valve closes would be lower producing smaller fluid transient loads. Smaller transient loads result in lower stress and fatigue values.

This revision also incorporated and superseded 6 additional addenda and markups of calculation AX-017D that were unrelated to the RCIC Reroute modification. The changes included a temperature change, piping schedule changes, a change in valve weight, and a change in damping curves that are unrelated to the changes made by modification MR96-0069; these incorporated changes may also have impacted the stress and CUF results.

Response to Question c Part 2

See the response to Part 1 above.

Note: The break points shown in current USAR Table 3.6A-10a have since been updated and no longer reflect the values changed by the subject RCIC modification MR96-0069.

RBG-47876

Enclosure 2

Pipe stress calculation updates AX-002H, AX-071AG, AX-076A, and AX-076B

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. -
AX-2H Rev. 3C
ATTACHMENT NO.:
JBI NO.: G13.10.2.2
PAGE 1 OF 7

TITLE:
Stress Analysis for Main Steam Vent Line per MR 96-0069

SUPERSEDES: N/A

SUPPLEMENTS: AX-2H Rev. 3

CALCULATION STATUS: ☐ APPROVED ■ PENDING ☐ CANCELED

SYSTEM NO.: 209 | **MARK NO.:**

CLASSIFICATION: ■ SAFETY RELATED | **NON-SAFETY RELATED:** ☐ QAPA ☐ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

To document the changes implemented by MR 96-0069. This MR re-routes the RCIC injection from the reactor vessel head to the feedwater nozzle. As a result of this change, line ICS-006-6-1 (previously qualified in AX-76A) is removed from the vent and spray assembly.

CONCLUSION:

The changes implemented by MR 96-0069 do not affect the piping qualified in AX-2H. The vent and spray assembly is now solely qualified by AX-2H. RPV nozzle number 7 and the vent and spray assembly remain qualified since the removal of line ICS-006-6-1 reduces the loads acting on the vent and spray assembly.

SOFTWARE USED FOR CALCULATION: ☐ YES ☐ NO **SDDF #:** N/A
Manufacturer: _____ **Name** _____ **Version/Release No.** ___

CONFIRMATIONS REQUIRED: ☐ YES ■ NO | **CONFIRMATION COMPLETE:** ☐ YES ☐ NO ☐ N/A

KEYWORDS:

RPV Vent Line, MR 96-0069, RCIC, RPV nozzle

REVIEW & APPROVAL

Camilo Cuadra 6-23-97	Lothar Kuhn 6-23-97	Rajesh Gupta 11-19-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
Preparer	☐ Reviewer (Non-Safety)	Supervisor
Camilo Cuadra, KCN 0969	☑ Design Verification Reviewer	(Printed Name, KCN, or SSN)
	Lothar Kuhn, KCN 1105	RAJESH GUPTA, 1059

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-2H Rev. 3C ATTACHMENT NO.: JBI NO.: PAGE 2 OF

Stress Analysis for Main Steam Vent Line per MR 96-0069

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Total Pages: 7

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-2H Rev. 3C ATTACHMENT NO.: (as required) JBI NO.: PAGE 3 OF

Stress Analysis for Main Steam Vent Line per MR 96-0069

REVISION HISTORY

Revision No.	Paragraph No.	Description of Change
3C	All	To document the changes implemented by MR 96-0069. This MR re-routes the RCIC injection from the reactor vessel head to the feedwater nozzle. As a result of this change, line ICS-006-6-1 (previously qualified in AX-76A) is removed from the vent and spray assembly.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-2H Rev. 3C ATTACHMENT NO.: JBI NO.: PAGE 4 OF

Stress Analysis for Main Steam Vent Line per MR 96-0069

APPLICABLE DOCUMENTS

I. APPLICABLE CODES, STANDARDS, & REFERENCES (NON-RBS):

1. ASME Boiler & Pressure Vessel Code, Section III, Division 1, 1974 Edition

II. RBS REFERENCES:

1. MR 96-0069
2. AX-76A Rev. 3E

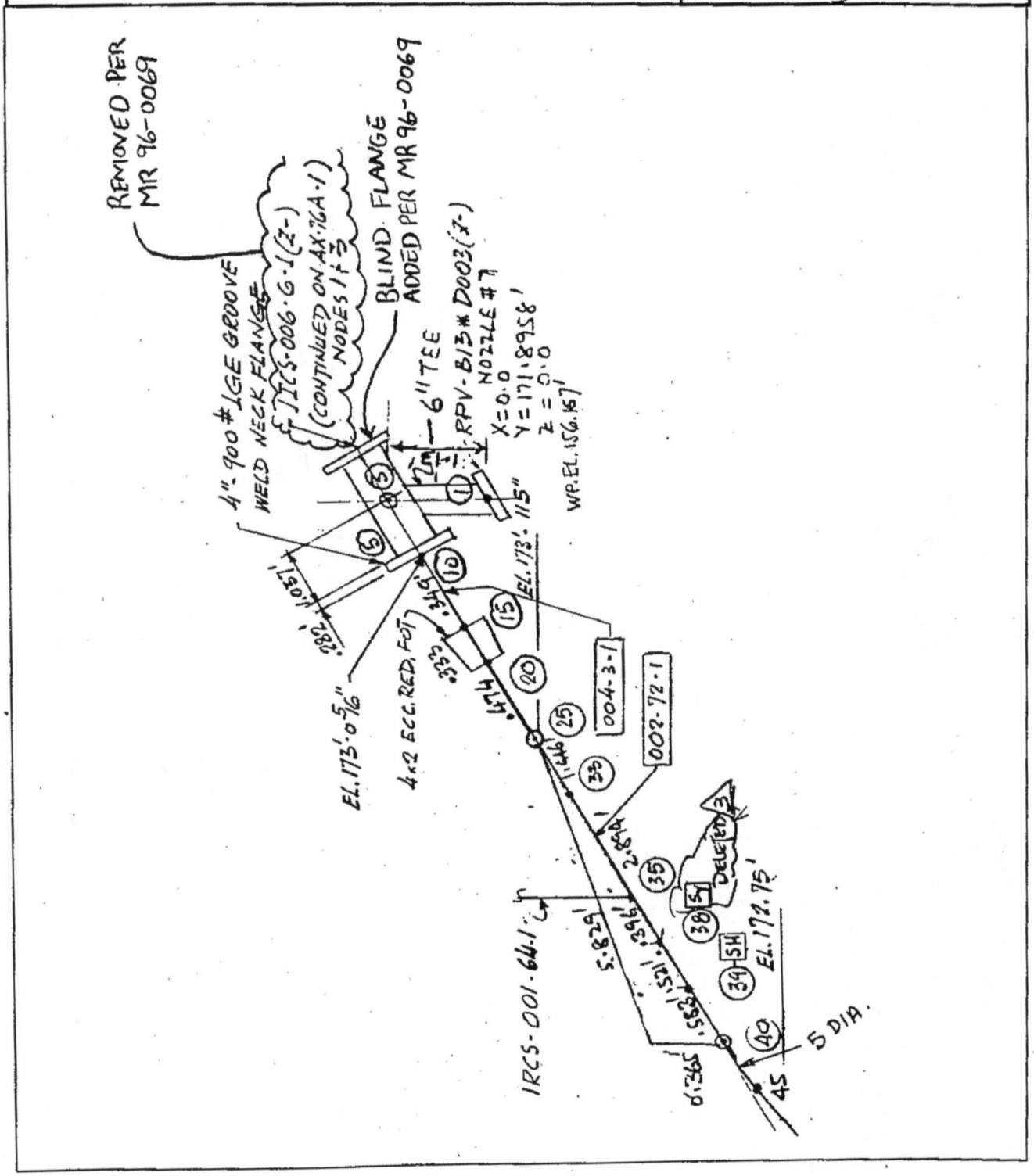
III. AFFECTED DOCUMENTS:

DOC. NO.	REV. NO.	DOCUMENT TITLE	AFFECT (Superseded, Revised, Initiated, etc.)	CHANGE DOC.

ENTERGY

CALCULATION WORK SHEET
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-2H Rev. 3C
ATTACHMENT NO.:
JBI NO.:
PAGE 5 OF



ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-2H Rev. 3C ATTACHMENT NO.: JBI NO.: PAGE 6 OF

CALCULATION CHECKLIST

YES	NO	N/A	FORMAT	EDP-AA-20 SECTION
X			Cover Page completed.	6.4.1
X			Table of Contents completed (as required).	6.4.2
X			Revision History Sheet completed (as required).	6.4.3
		X	Revisions are identified with revision lines in right margin.	6.4.3
X			Applicable Documents Page completed.	6.4.4
		X	Definitions established (as required).	6.4.5
X			Calculation/revision/addendum/page numbers are identified correctly.	6.4.10
			CONTENTS	
X			Previous calculation for the required analysis exists.	6.3
X			Calculation is appropriately titled for the intended scope.	6.4.1-2
X			Purpose and scope are clearly and adequately established.	6.4.1-7, 7.1
X			Safety classification is correct for the identified scope.	6.4.1-6
X			Topics/documents/equipment for cross-reference/retrieval are identified.	6.4.1-11
X			Calculation is clear and comprehensible.	6.1
X			Applicable codes, standards, etc. are identified.	6.4.4-1
X			RBS references are identified.	6.4.4-2
		X	Affected documents are identified	6.4.4-3
X			Inputs and sources are identified, appropriate, and correct.	7.2.2-1
		X	Assumptions are identified and appropriate.	7.2.2-2
		X	Inputs derived from field walkdown have been witnessed/verified	7.2.2-5
		X	Engineering judgments are identified and appropriate.	7.2.2-6
		X	Calculation methodology is identified and supported by technical bases.	7.2.3
X			Conclusion is appropriate and is justified by calculation.	7.3
		X	Confirmations are identified and indicated as required on Cover Page.	7.5.7
		X	Directions for Confirmations are included.	7.5.7-3
X			Calculation data is appropriately included, attached, or referenced.	7.4
		X	Programs and software are identified and have been verified and validated.	8.0
X			Methods/calculations use to check results are identified and included.	
X			Results are accurate and in accordance with the established methodology.	
		X	Certification by Professional Engineer is required.	11.7
			VENDOR CALCULATIONS	
			Calculation is performed in accordance with EDP-AA-25.	10.2
			Calculation content and format are acceptable.	10.2
			Vendor, preparer, reviewer, and approver are clearly identified.	10.3
X			Design verification review has been completed (as applicable).	

Preparer (Signature/KCN or SSN/Date):
Carla Cuadra (0969) 6-23-97

Reviewer (Signature/KCN or SSN/Date):

(LAST)

ENTERGY	ATTACHMENT I Page 1 of 2 Typical Design Verification Record	ES-P-002-00

Page 7 of 7

Document Number AX-2H Revision 3C

METHOD

Verification methods to be used:

X Design Review
____ Qualification Testing
____ Alternate Calculations

DOCUMENT(S) REVIEWED: (Attach Additional Sheet(s), if needed)

Document Number	Revision	Document Title
AX-2H	3	Pipe Stress Calculation for Main Steam Vent Line

SUMMARY OF REVIEW: (Attach Additional Sheet(s), if needed)

Design Verification Completed By Lothar Hahn Date: 6-23-97

Comment Resolutions Accepted By _____ Date: _____

Engineering Supervisor Rajesh Gupta Date: 11-19-97

ENTERGY

Record Revision Notice

ENGMSYS Department	AX-002H_ADDC Document No.		Page 1 of 2
G13.10.2.2 JBIX No.	3C 11/19/97 Revision/Date	11665077 FileNet Location	(ASG Use Only) S10056 AB98-0558 Batch/Transmittal - Item No.

Revision Description

Change calculation / addendum status from pending to approved.

Reason For Revision

MR 96-0069 has been installed.

Approvals:

Melissa K. Litherland 1340 — 6/23/99
Originator — Date

Section Supervisor Ramat C. Jella 0658 — Date 6/23/99

KRN Pg 2 of 2

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CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - AX-2H Rev. 3C

ATTACHMENT NO.:

JBI NO.: G13.10.2.2

PAGE 1 OF 7

TITLE:
Stress Analysis for Main Steam Vent Line per MR 96-0069.

SUPERSEDES: N/A

SUPPLEMENTS: AX-2H Rev. 3

CALCULATION STATUS: ☒ APPROVED ■ PENDING 6/23/99 ☐ CANCELED

SYSTEM NO.: 209 **MARK NO.:**

CLASSIFICATION: ■ SAFETY RELATED **NON-SAFETY RELATED:** ☐ QAPA ☐ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

To document the changes implemented by MR 96-0069. This MR re-routes the RCIC injection from the reactor vessel head to the feedwater nozzle. As a result of this change, line ICS-006-6-1 (previously qualified in AX-76A) is removed from the vent and spray assembly.

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JUN 25 1999

CONCLUSION:

SA TIC

The changes implemented by MR 96-0069 do not affect the piping qualified in AX-2H. The vent and spray assembly is now solely qualified by AX-2H. RPV nozzle number 7 and the vent and spray assembly remain qualified since the removal of line ICS-006-6-1 reduces the loads acting on the vent and spray assembly.

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JUN 09 1998
SDC

SOFTWARE USED FOR CALCULATION: ☐ YES ☐ NO **SDDF #:** N/A
Manufacturer: _____ **Name** _____ **Version/Release No.** ___

CONFIRMATIONS REQUIRED: ☐ YES ■ NO **CONFIRMATION COMPLETE:** ☐ YES ☐ NO ☐ N/A

KEYWORDS:

RPV Vent Line, MR 96-0069, RCIC, RPV nozzle

REVIEW & APPROVAL

Camilo Cuadra 6-23-97	Lothar Kuhn 6-23-97	Rajesh Gupta 11-19-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
Preparer	☐ Reviewer (Non-Safety)	Supervisor
Camilo Cuadra, KCN 0969	☒ Design Verification Reviewer	(Printed Name, KCN, or SSN)
	Lothar Kuhn, KCN 1105	RAJESH GUPTA., 1059

ENTERGY

Record Revision Notice

ENGMSYS Department	AX-071AG Document No.	Page 1 of 2

613.10.2.2 JBIX No.	4 3/25/85 Revision/Date	F#50404 FileNet Location	(ASG Use Only) 510059 A598-0591 Batch/Transmittal - Item No.

Revision Description

Change calculation / addendum status from pending to approved.

Reason For Revision

MR 96-0069 has been installed.

Approvals:

Melissa L Litherland 1240 — Originator — Date 6/23/99

Section Supervisor Ronald C. Felix 0658 — Date 6/23/99

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CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-71AG , Rev. 4
ATTACHMENT NO.:
1 of 1307
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TITLE: Pipe Stress Analysis for ICS function added through FWS system per MR 96-0069

SUPERSEDES: AX-71AG Rev. 3

SUPPLEMENTS:

CALCULATION STATUS: ☒ APPROVED ☒ PENDING 11/20 6/23/99 ☐ CANCELED

SYSTEM NO.: 204, 209

MARK NO.:

CLASSIFICATION: ☒ SAFETY RELATED

NON-SAFETY RELATED: ☐ QAPA ☒ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

See page 3 RJG 11-20-97

CONCLUSION:

This piping analysis demonstrates the acceptability of the piping system within acceptable design limits of ASME Section III Code for MR 96-0069.

SOFTWARE USED FOR CALCULATION: ☒ YES ☐ NO SDDF #: 6229.400-100-001A

Manufacturer: Bechtel Name ME101 Version/Release No. N4

CONFIRMATIONS REQUIRED: ☐ YES ☒ NO CONFIRMATION COMPLETE: ☐ YES ☐ NO ☒ N/A

KEYWORDS: *pipe, stress calculation, MR 96-0069*

REVIEW & APPROVAL

Preparer	Reviewer	Supervisor
Rajni R Patel 6/19/97	Lothar Kuhn 6/18/97	Rajesh Gupta 11-20-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
(Printed Name, KCN, or SSN)	☐ Reviewer (Non-Safety)	
Rajni R. Patel (0861)	☒ Design Verification Reviewer	Supervisor
	Lothar Kuhn(1105)	Rajesh Gupta(KCN) 1059

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-71AG , Rev. 4
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TITLE: Pipe Stress Analysis for ICS function added through FWS system per MR 96-0069

SUPERSEDES: AX-71AG Rev. 3

SUPPLEMENTS:

CALCULATION STATUS: ☐ APPROVED ☒ PENDING ☐ CANCELED

SYSTEM NO.: 204, 209 **MARK NO.:**

CLASSIFICATION: ☒ SAFETY RELATED **NON-SAFETY RELATED:** ☐ QAPA ☒ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

See page 87 RJG 11-20-97

RECEIVED
JUN 0 9 1998
SDC

CONCLUSION:

This piping analysis demonstrates the acceptability of the piping system within acceptable design limits of ASME Section III Code for MR 96-0069.

SOFTWARE USED FOR CALCULATION: ☒ YES ☐ NO **SDDF #:** 6229.400-100-001A

Manufacturer: Bechtel **Name** ME101 **Version/Release No.** N4

CONFIRMATIONS REQUIRED: ☐ YES ☒ NO **CONFIRMATION COMPLETE:** ☐ YES ☐ NO ☒ N/A

KEYWORDS: *pipe, stress calculation, MR 96-0069*

REVIEW & APPROVAL

Rajni R Patel 6/19/97	Lothar Kuhn 6/18/97	Rajesh Gupta 11-20-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
Preparer	☐ Reviewer (Non-Safety)	Supervisor
(Printed Name, KCN, or SSN)	☒ Design Verification Reviewer	Rajesh Gupta(KCN) 1059
Rajni R. Patel (0861)	Lothar Kuhn(1105)	

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. -REV. ADDENDUM AX-71AG, Rev. 4 ATTACHMENT NO.: PAGE 2 OF

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REVISION HISTORY

Revision No.	Paragraph No.	Description of Change
4	All	Per MR 96-0069 the RCIC injection function was added to feedwater system by routing the renumbered RCIC injection line ICS-006-101-2 via RHR line RHS-010-65-2 into the West loop feedwater line. This revision incorporates all of former stress calc AX-76B into AX-71AG, except the portion of former line ICS-006-7-1 which was cut near node 78 and abandoned in place from node 86 to the penetration Z19.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. 4 ATTACHMENT NO.: PAGE 5 OF

APPLICABLE DOCUMENTS

I. APPLICABLE CODES, STANDARDS, & REFERENCES (NON-RBS):

1. ASME Boiler and Pressure Vessel Code, Section III, 1974 edition
2. ME101 Version N4 Pipe Stress Analysis Computer Program
3. Piping Design and Engineering by ITT Grinnell Industrial Piping, Inc. Fifth Edition
4. Bergen-Paterson Pipe Supports, Catalog No. 82

II. RBS REFERENCES:

1. Pipe stress analysis summary, Calculation No. AX-76B Including Addenda
2. EDS-ME-014, "Pipe Stress Analysis and Pipe Support Design Standard"
3. Specification No. 228.000, Rev. 2 "Piping Engineering and Design"
4. CHOC-EMTR-601, "Design and Installation of Seismic Small Bore Piping, Instrumentation Tubing & Supports for River Bend", dated Sept. 1980
5. EMTR 605-0, "Procedure for Qualification of Flanged Joints for ASME III, Class 1, 2, and 3 Piping Systems"
6. CHOC-EMDM 82-80, "Stress Intensification Factors and Stresses for Reduced Outlet Branch Connections,"
7. CHOC-EMDM-80-4, Use of Pipe Support Stiffness Values in Pipe Stress analysis
8. CHOC-EMDM-81-8, "Valve Modelling Procedure"
9. LEM-34, "Frequencies and Acceptable Accelerations for Valve Qualification"
10. Calculation RBI-EQ-352, "Acceptable Acceleration for Manual Valves"
11. Calculation RBI-EQ-416, "Valve Modelling and Acceptable Accelerations"
12. Environmental Design Criteria No. 215.150, Rev. 2
13. Design Criteria No. 228.010, "Pipe Stress and Pipe Support Design Criteria"
14. Design Criteria No: 220.950/960, "High Energy Line Break Evaluation"
15. Design Criteria No: 220.940, "Moderate Energy Line Crack Evaluation"
16. Line Designation Table Change Notice - LDTCN No.: 97-ICS-01
17. PICL Change No: AP-71-02
18. PICL Change No: AP-76-01
19. PICL Change No: AP-17-01
20. Calculation G13.18.1.5*08, Rev. 1, "Peak Spread ARS for Seismic Events Including Curves with N-411-1 Damping"
21. Calculation G13.18.1.5*09, Rev. 1, "Peak Spread ARS for SRV, Chugging, CO and Pool Swell events Including Curves with N-411-1 Damping"

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. 4 ATTACHMENT NO.: PAGE 6 OF

APPLICABLE DOCUMENTS

II. RBS REFERENCES:

22. Calculation PX-334, Rev. 2, "1/2 SSE Structural Seismic Displacements Data and Input Procedure for Piping Analysis"
23. Calculation PX-SB-316, "Pipe Stress Calc. for Vent, Drain & Instrument Connections"
24. Calculation PX-SB-304, "Pipe Stress Calc for Vent/Drain Connections"
25. Calculation AX-17D, "Pipe Stress Calc. For F.W. PPG. in Reactor & Aux. Bldg"
26. Calculation PX-873, "LPCI Pump Discharge Lines Water Hammer Analysis with Trapped air"
27. Calculation PX-1037, "Water Hammer Analysis on Reactor Core Isolation Cooling Piping Due to Pump Trip"
28. Calculation PX-897, "RCIC Pump Discharge Lines Water Hammer Analysis with Trapped Air"
29. Calculation PX-1015, "Fluid Transient on RHS Piping Associated with Check Valve Slam Following a Pump Trip"
30. Calculation PX-1024, "Fluid Transient on RHS Piping Associated with Suppression Pool Cleaning Mode with Trapped Air"
31. Calculation PX-888, "LPCI Pump Discharge Line Water Hammer Analysis with Trapped Air for Mode B"
32. Calculation PX-1005, "Water Hammer Analysis on RHR Piping Line During Shutdown Cooling"

III. AFFECTED DOCUMENTS:

DOC. NO.	REV. NO.	DOCUMENT TITLE	AFFECT (Superseded, Revised, Initiated, etc.)	CHANGE DOC.
G13.18.10.3*221	0	Pipe Support	Initiated	MR 96-0069
Z-76-2073A	0A	Pipe Support	Supplements	MR 96-0069
AX-76B	2	Pipe Sress	Revised	MR 96-0069

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 7 OF

PURPOSE / SCOPE / OBJECTIVE

MR 96-0069 reroutes the RCIC Injection Line from its original connection to the RPV Head to the FWS system through a short portion of the RHS piping covered by this AX. The objective of Revision 4 is to evaluate the subject piping for the new function of ICS injection in addition to the existing function of the RHS piping. A new run of 6" piping with a new check valve connecting line RHS-010-65-2 to the existing ICS piping is to be added. Since some of the original ICS piping beyond the diversion point is left inplace and was downgraded to ASME Class 2, the active ICS line was renumbered from ICS-006-7-1 to ICS-006-101-2. The design pressure in the lines RHS-010-65-2 and WCS-004-22-2 upto the first check valve were reduced from 1885 to 1525 psig. The piping is to be evaluated for thermal, fluid transient, dynamic, and hydrodynamic events associated with both the RHS and ICS system operation.

As a consequence, the piping of stress problem AX-71AG is now being extended top cover the ICS (RCIC) piping back to its nearest anchors. The added piping comprises all of the existing stress problem AX-76B, except the portion beyond the diversion point of which the first 6 ft is remained and the remainder abandoned in place is evaluated in calcualtion AX-76B. There are no support configuration changes; the rerouted ICS runs unsupported from its last existing support to the new check valve at the new junction to the RHS line.

METHOD OF ANALYSIS

The ICS piping was originally analyzed for hydrodynamic loads (SRV etc.) because it was connected to the containment penetration Z-19. Now it is connected to the reactor building via the feedwater line and therefore at least some of it has to be analyzed for the ARS transmitted from that end. The fluid transient due to ICS injection is also changed. There is no other physical or operational change to this stress problem.

The ICS piping in this stress problem includes CNS piping and tie back into RHS line of AX-71AG which previously in AX-76B had been modeled as a fictitious anchor. The thermal operating conditions of the incorporated piping from the AX-76B model have to be incorporated into those of the existing AX-71AG model.

ME101

The piping was analyzed using ME101, Version N4.

The input files have been annotated with comments describing the changes made from the existing ME101 input file. Such changes cover incorporation into the coding of various notes made in previous revisions as well as the changes/additions due to this Revision.

Fluid Transient Input

The piping experiences a fluid transient due to RHR injection into the feedwater line and another FT due to ICS injection into the feedwater line via the RHR line. In order to simplify the analysis by executing it in a single ME101 run, the second fluid transient is appended after the end of the first fluid transient, so that the piping response from the first transient has ceased and then responds to the second transient. The maximum loads of this load case correspond to the envelope of the individual fluid transient loads. The RCIC transient input file is derived from PX-1037 and run from t=0 to t=0.6 sec; the RHR transient input file is derived from PX-1015 and is delayed 0.6 sec. To implement this, the time histories of the segments affected by the RHR transient are delayed.

The fluid transient model of PX-1037 uses a preliminary routing of the RCIC line. The final routing breaks up the long north-south segment into a short segment running at 45 deg to this segment and the remainder. It also corrects the length of the west-east segment at El. 119'-9" from 9 ft to 3 ft. Addendum A to the PX calculation reconciles these differences by recommending an adjustment in the application. This is implemented by using conservative multipliers for the existing curves as follows:

LENGTH ADJUSTMENT

SEGMENT	PRELIMINARY LENGTH (FT)	FINAL LENGTH (FT)	FT MODEL PIPE SEGMENT	CURVE NO	APPLIED AX NODE	CURVE MULTIPLIER
X75-X78	9	3	6-6	36	X75	1.0
X79-X80	-	2.2	N/A	38	X79	0.5
X80-X82	12	9.8	7-2	38	X80	1.0

METHOD OF ANALYSIS (cont.)

Response Spectra Input

The ARS input differs from Revision 3 mainly in that N-411 Code case spectra are now replacing 1% 2% spectra; but in addition, the Shield Building spectra are now also included, and no change to the piping mass points is needed to separate regions affected by Reactor Building spectra from those which experience only Auxiliary Building spectra.

The Reactor Building spectra that are picked up from the feedwater line connection have been input as follows:

The FWS penetration for AX-17D is at elevation 121'-6" and is rigidly connected to the drywell wall and the Shield Building wall at that elevation. The drywell wall is a rigid 6 way anchor (AX-17D node 200), while the Shield Building support is a 2 way guide (AX-17D node 183). The Jet Impingement wall also provides 2 way guide support to the Feedwater line at the Auxiliary Building (AX-17D node 280). The Feedwater line runs in the plant global X direction.

OBEA analysis uses the alternate Auxiliary Building displacement curves.

High energy Line Break has been addressed in the calculation no: 228.850-CBC-2024 Rev. 0. Since the flooding has been addressed in the HELB calculation, Moderate Energy Line Crack need not to be considered for this calculation.

CONCLUSION

The completed analysis shows that the stresses and reactions on the subject piping are within acceptable limits in accordance with the requirements of the ASME Section III Code.

Valve accelerations are within acceptable limits.

Functional capability has been assured.

Stresses on vents, drains, and test connections are within acceptable limits.

Sleeve clearances are adequate.

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NOTES

1. The Coordinate system for all data expressed in the global system is defined as follows:

   (-X) Is plant "called north" per piping drawing

   (Y) Is vertical "up"

   (Z) According to right hand rule

   The local system is defined as follows for straight piping members:

   (X) Is along the axis of the pipe, positive in the direction of coding.

   (Y) In the plane of the local X-Axis and the global +Y-Axis unless the local X-Axis is aligned with the global Y-Axis; then the local Y-Axis will be parallel to the global X-Axis.

   (Z) According to right hand rule.

2. Forces and moments on restraints, supports, and equipment are those imposed by the piping systems (i.e., actions, not reactions).

3. Unless otherwise noted, forces and moments reported at an inline anchor represent the total forces and moments acting upon that anchor considering contributions from piping on all sides of that anchor. Reactions reported on terminal anchors are due to piping shown in this report only. For total reactions, values must be combined with those from continuation summaries shown on isometrics.

4. Unless otherwise indicated, stresses at intersections have assumed an unreinforced branch connection.

5. Piping support loads may be found in pipe support summary in Attachment B.

6. For lines requiring seismic analysis, the reactions reported are cyclic in character, and reactions must be considered as acting in either the positive or negative direction.

7. On systems requiring time-history dynamic analysis for flow-induced transients, reactions and deflections reported are the maximum values in magnitude. Reactions and deflections that may occur in opposite directions are not reported in this summary, but are available if required.

8. Abbreviations

RH----------Rod Hanger	SH----------Spring Hanger
V.C.----------Vertical Restraint	RX----------X-Restraint
RZ----------Z-Restraint	RSKew----------Skewed Restraint
SX----------X-Snubber	SY----------Y-Snubber
SZ----------Z-Snubber	SSKew----------Skewed Snubber
El----------Elevation	Rdcr----------Reducer
S.R. Elb----------Short Radius Elbow	

9. The magnitude of the forces from flow transient PX-1015 are much larger than those from flow transient PX-888, PX-873, PX-1005 and PX-1024. Therefore, flow transient PX-1015 is enveloping the other transient cases and is the only one to be considered in the analysis.

10. ME101 model and isometric has a small dimensional discrepancy between nodes 330 and 805 which is insignificant.

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ASSUMPTIONS

The weight of the new 6" check valve is assumed to be 430 lbs.

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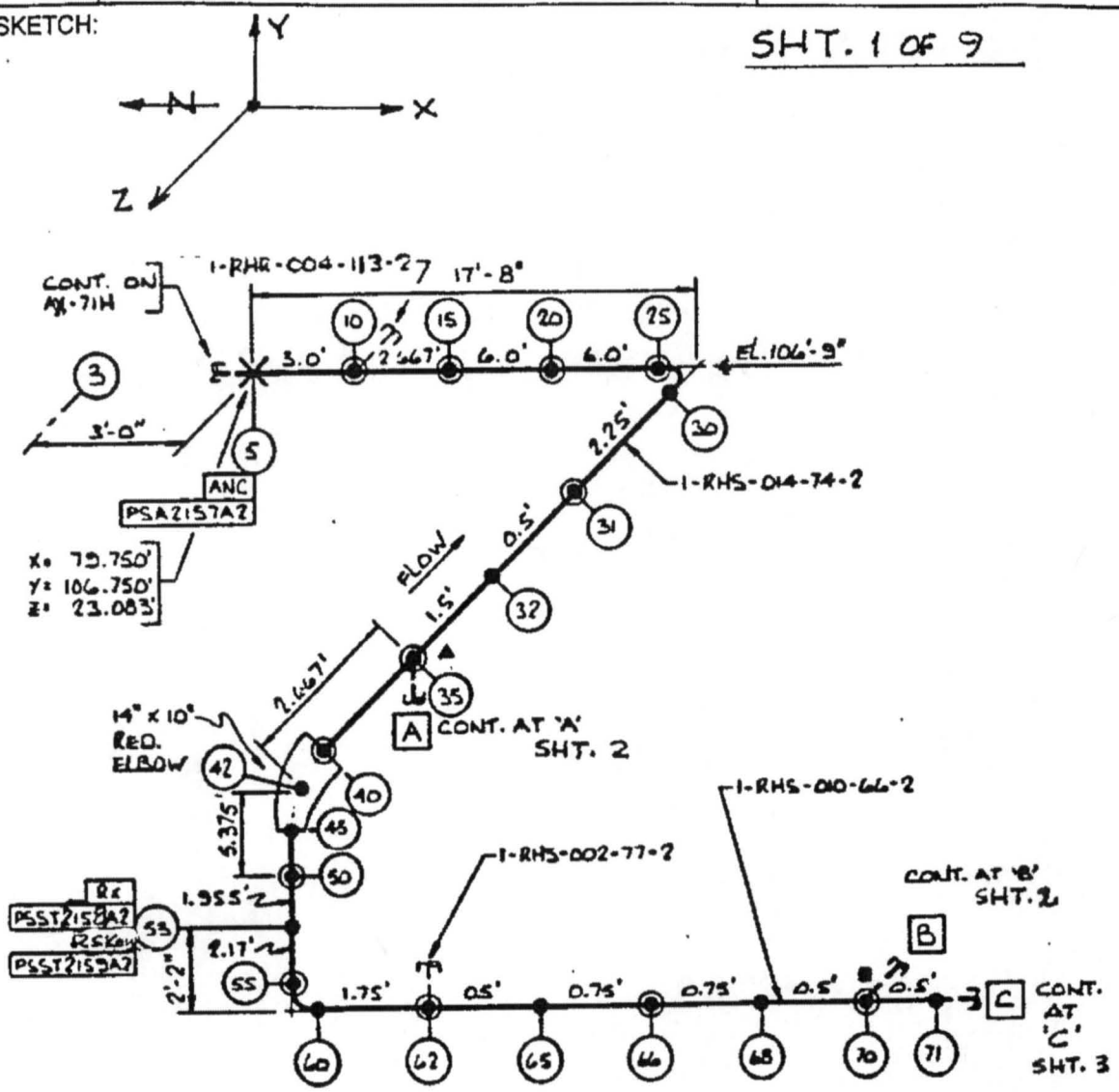
WORK SKETCH:

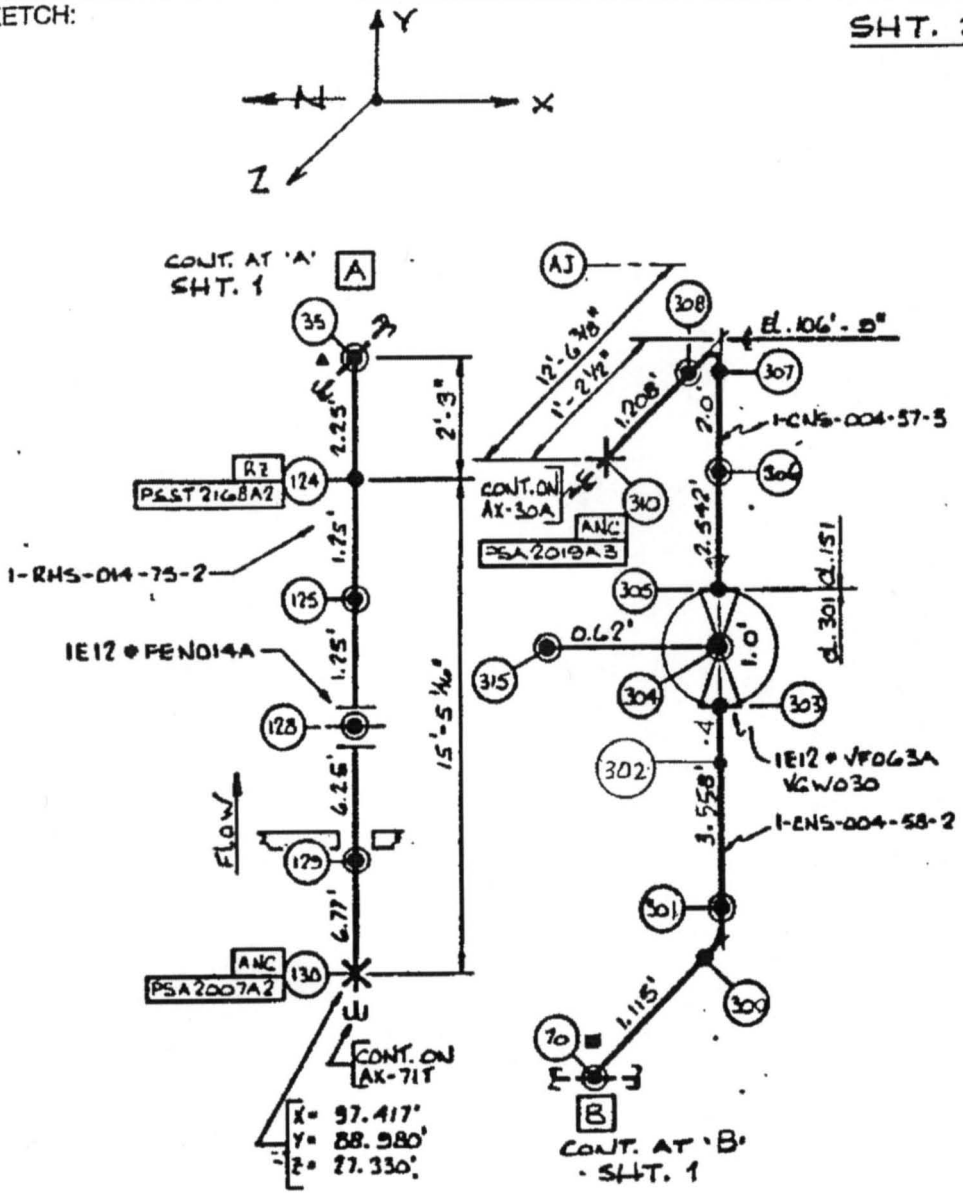
SHT. 1 OF 9



ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 14 OF

WORK SKETCH:

SHT. 2 OF 9



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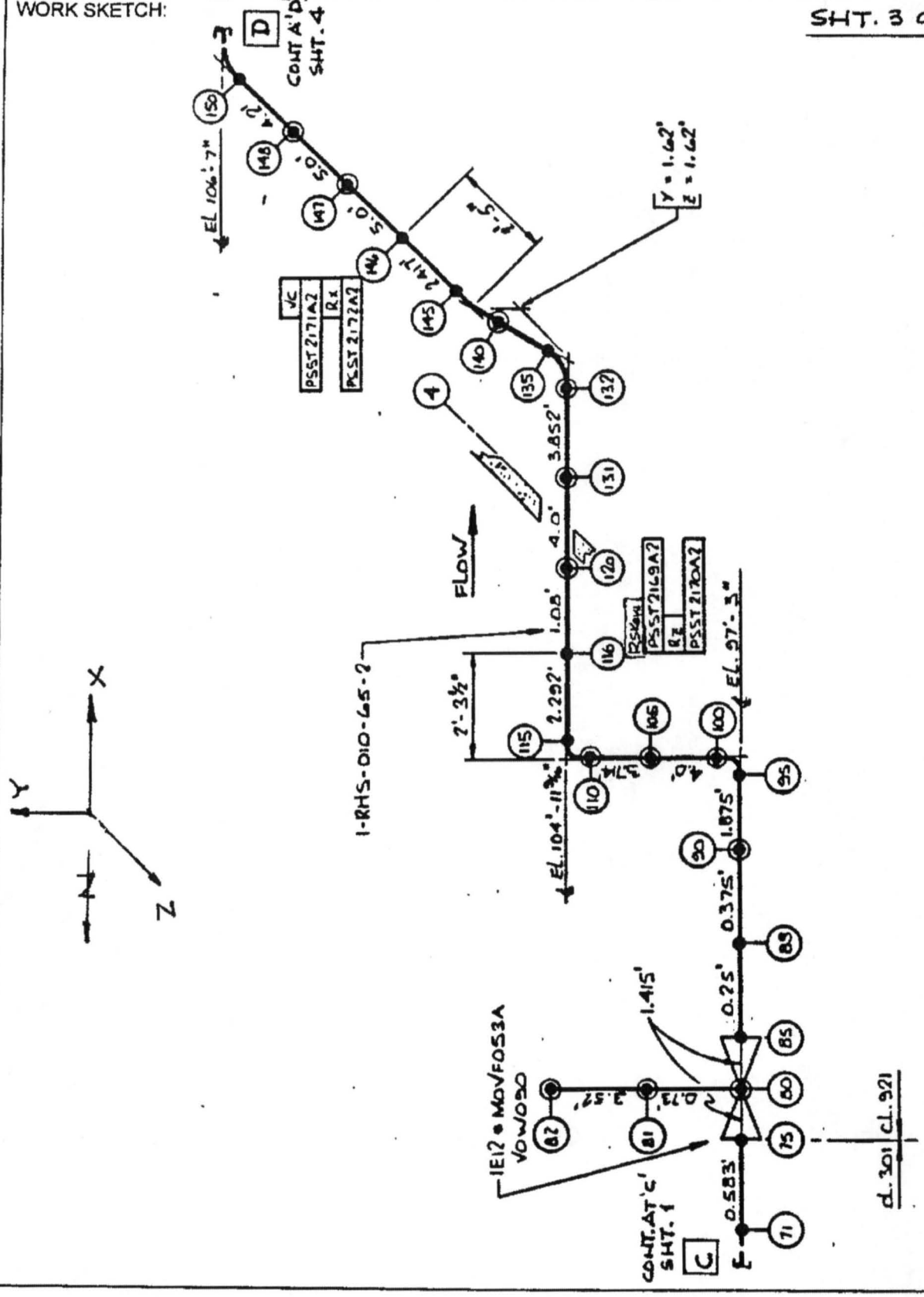
WORK SKETCH:

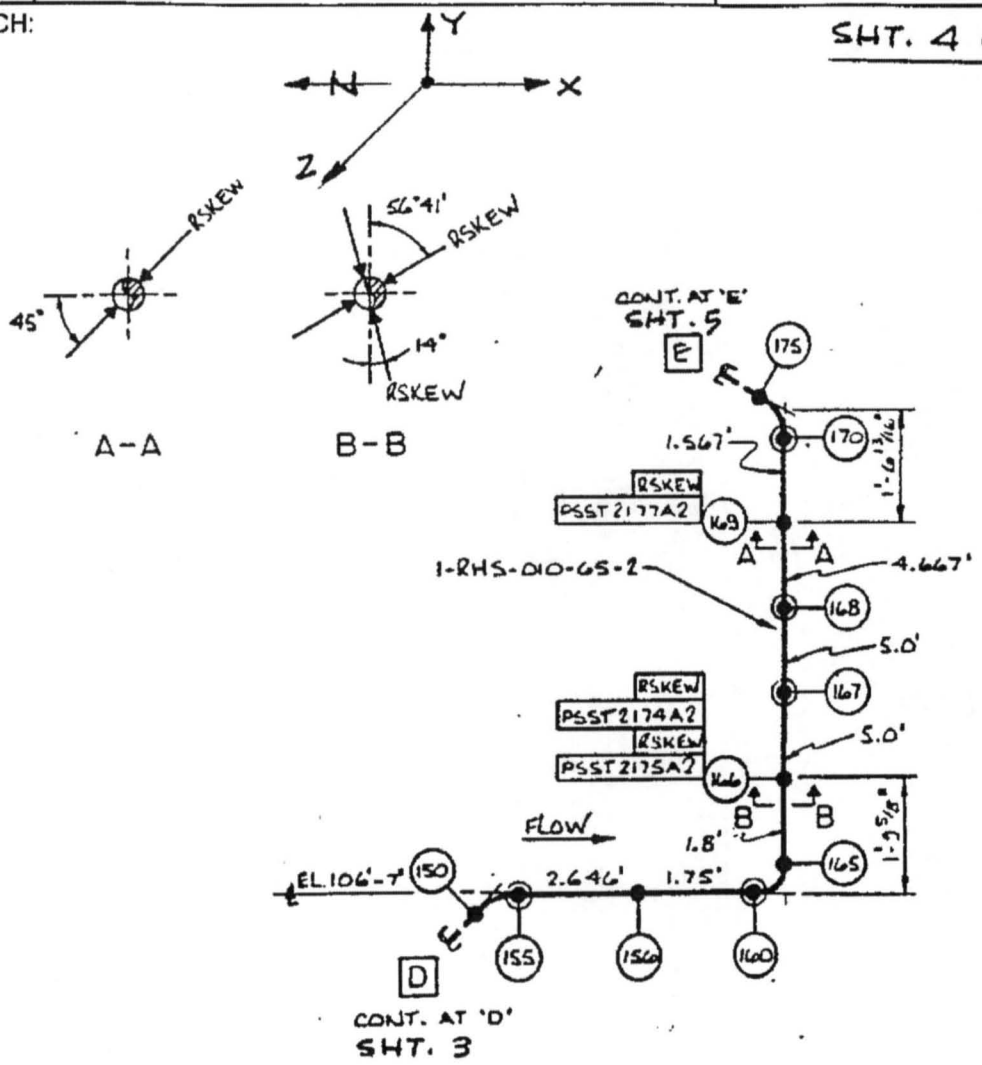
SHT. 3 OF 9



ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 16 OF

WORK SKETCH:

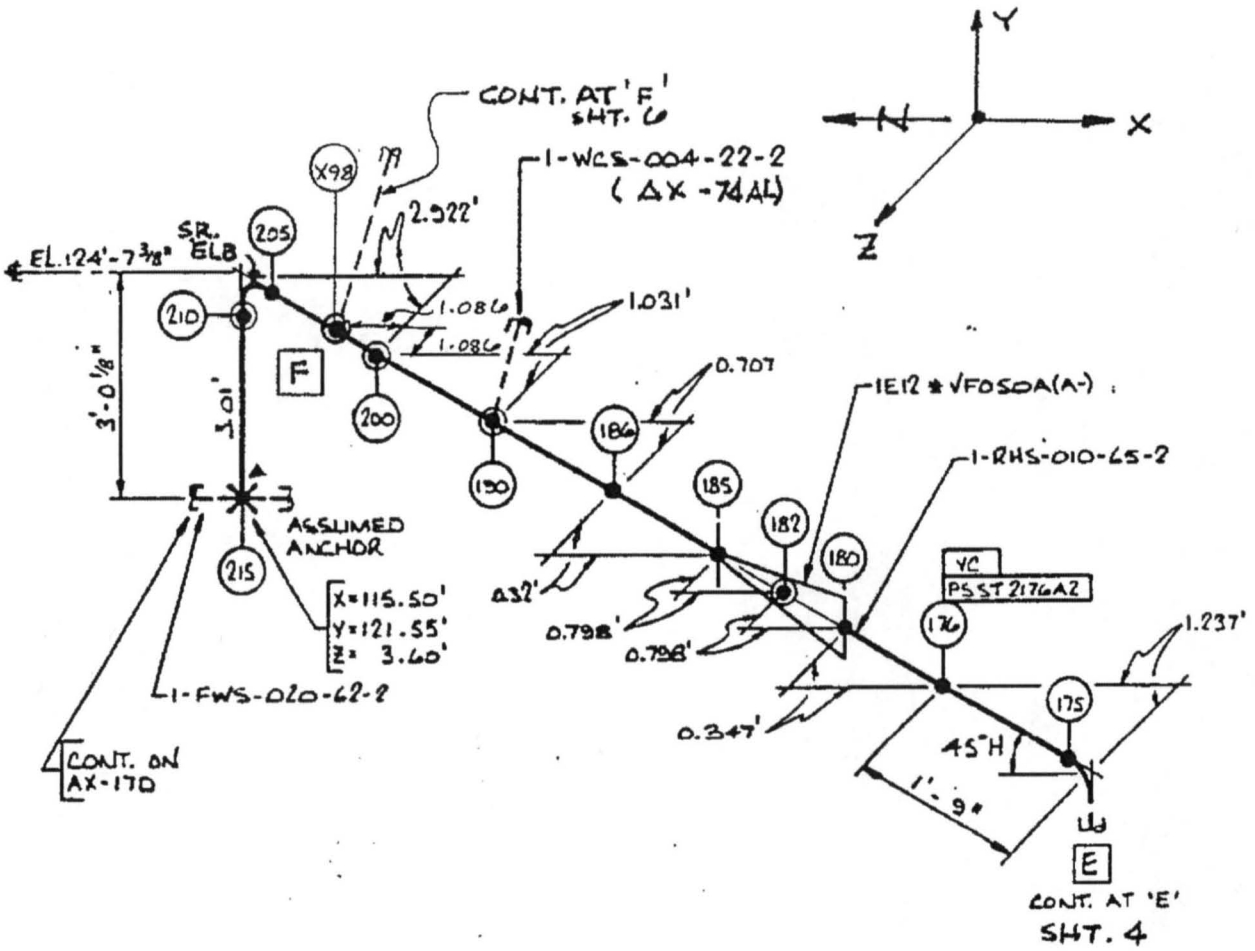
SHT. 4 OF 9



ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 17 OF

WORK SKETCH:

SHT. 5 OF 9



ENTERGY

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WORK SKETCH:

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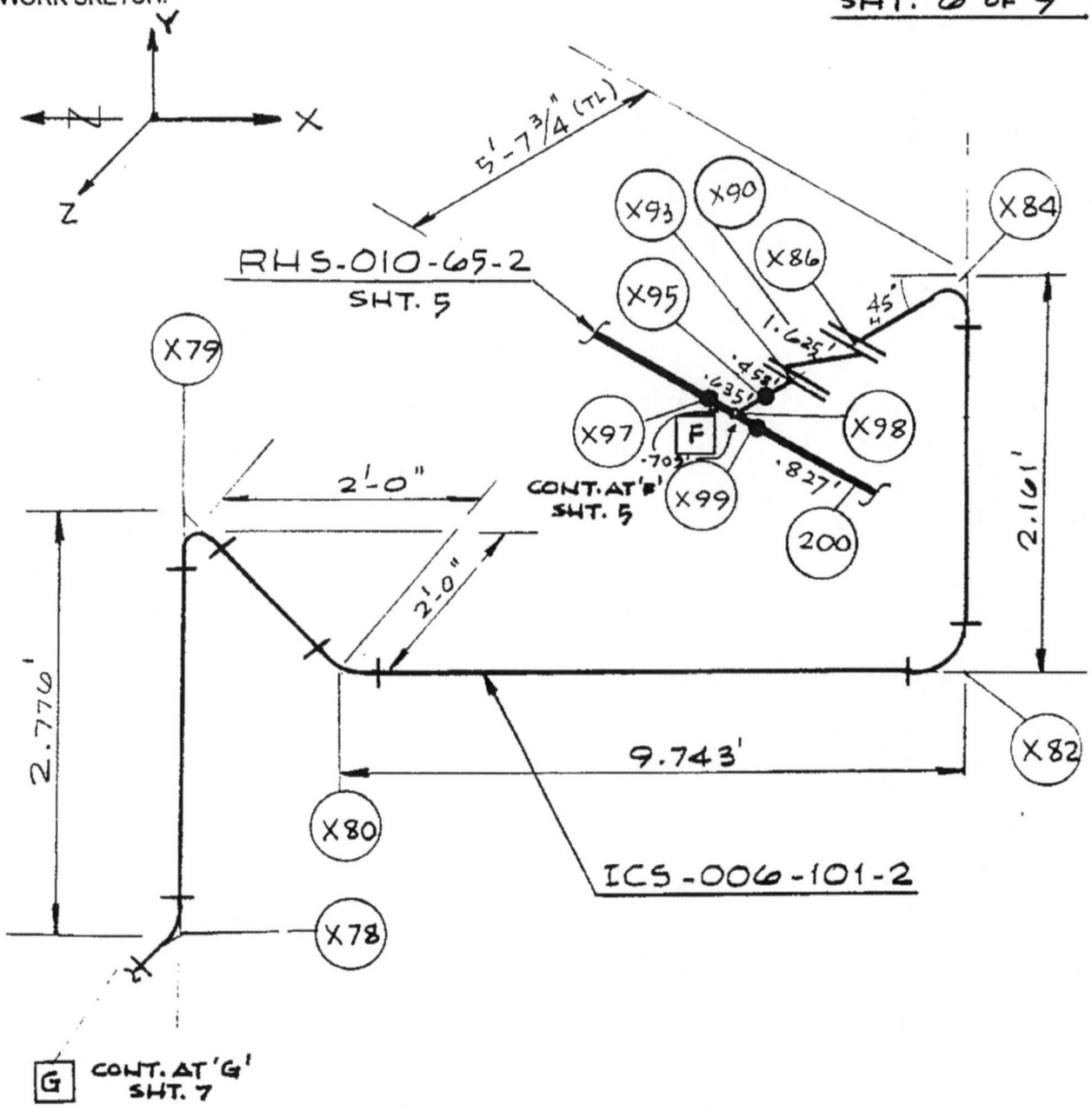

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WORK SKETCH:

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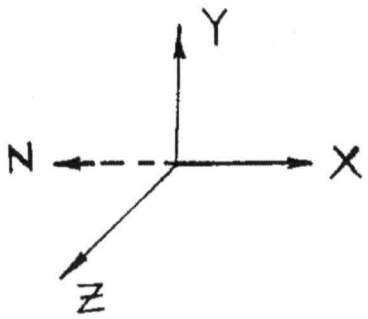
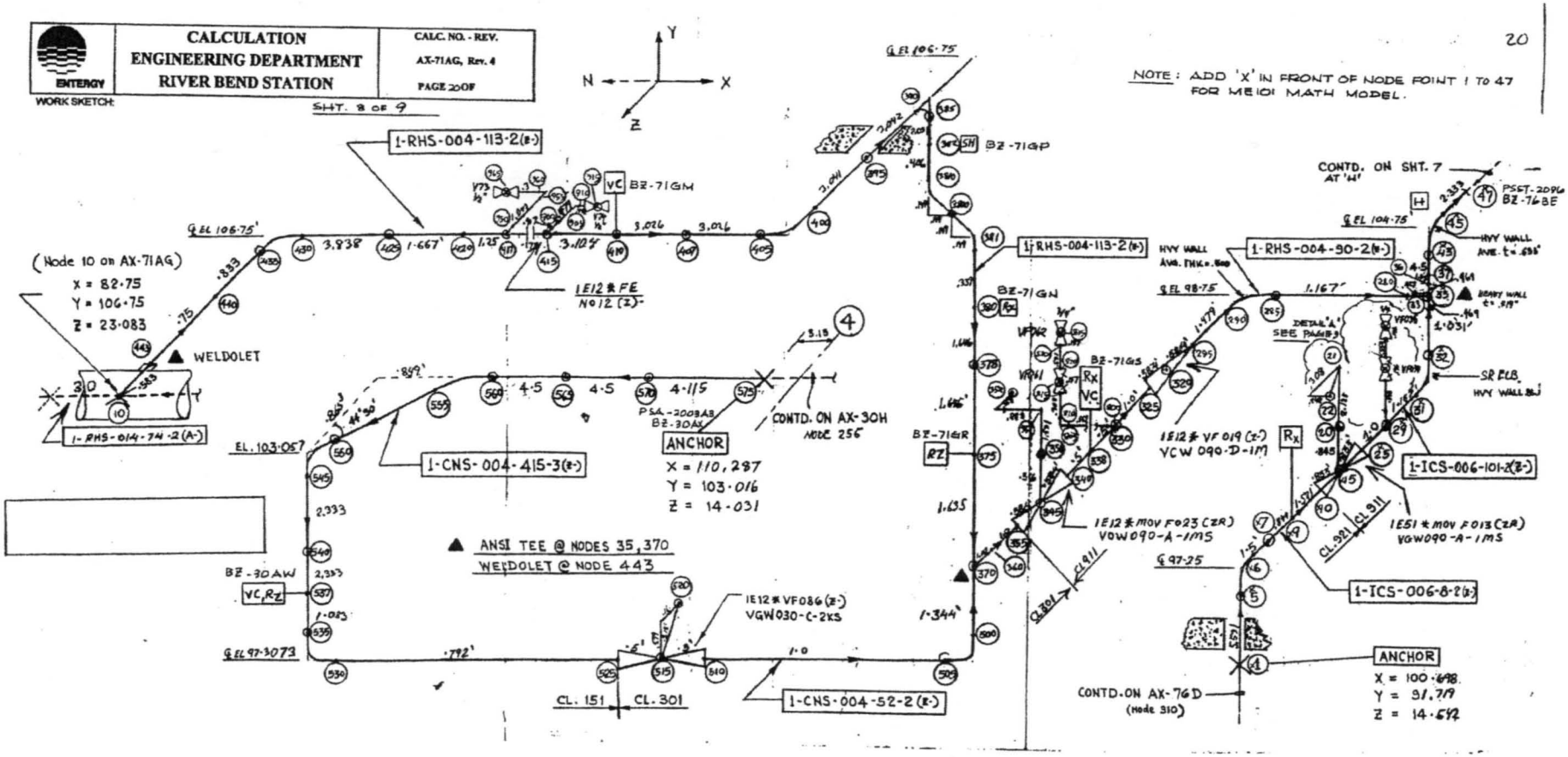


DIRECTION COSINE OF SKEW SUPPORTS

NODE	Y_X	Y_Y	Y_Z
47 RSK	-	.9973	-.0729
48 SSK	-.9976	-	.0690
71 SSK	.9848	-	.1736
~~100 RSK~~	~~-.1194~~	~~.9928~~	=

NOTE: ALL SNUBBERS ··· PSA-3

NOTE: ADD 'X' IN FRONT OF NODE POINT FOR MEIOI MATH MODEL



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WORKSKETCH

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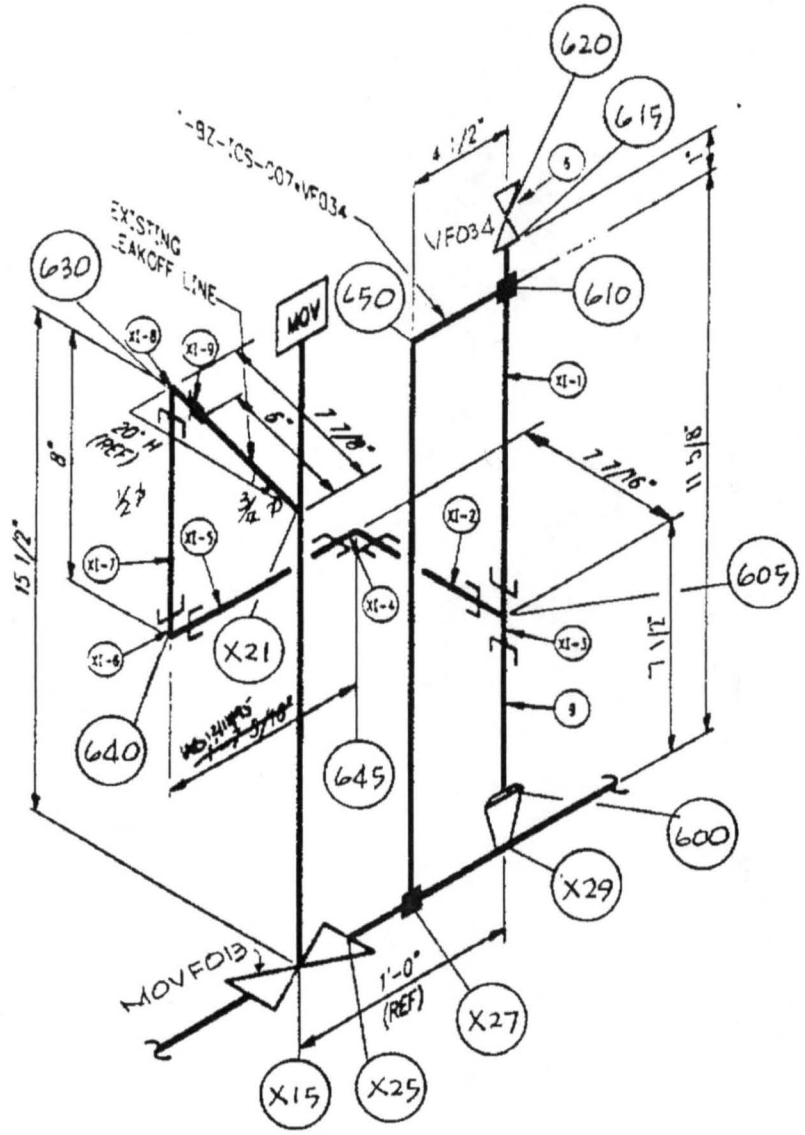

DETAIL "A"
(SHT. 8)

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BASIC ANALYTICAL DATA

ITEM	COMPONENT IDENTIFICATION	NOM PIPE SIZE (IN)	NOM WALL THKN (IN)	SWEC CLASS / MATERIAL AND GRADE	DESIGN CONDITIONS TEMP (F)	DESIGN CONDITIONS PRESS (PSI)	MAXIMUM OPERATING TEMP (F)	MAXIMUM OPERATING PRESS (PSI)	ALLOWABLE STRESS (KSI) SC	SH	SA	WEIGHTS (LBS)/FT PIPE	FLUID	INSU	TOTAL
1	RHS-014-74-2	14.	.375	301 / SA106GRB	358	500	298	425	15.	15.	22.5	54.6	59.7	4.61	118.91
2	RHS-014-75-2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
3	RHS-010-66-2	10.75	.365	↓	480	500	298	425				40.5	34.1	3.37	77.97
4	RHS-010-65-2	↓	.843	921 / SA106GRB	450	1525	1215	1348				89.2	28.0	4.79	121.99
5	CNS-004-57-3	4.5	.237	151 / SA106GRB	120	135	100	80				10.79	5.51	–	16.30
6	3/4" SCH 160	1.05	.218	911/921 / SA106GRB	450	1885	300	1348				1.94	.128	–	2.068
7	3/4" SCH 80	1.05	.154	301 / SA106GRB	358	500	298	425				1.47	.188	–	1.658
8	ICS-006-101-2	6.625	.432	911 / SA106GRB	450	1525	300	1348				28.57	11.29	–	39.86
9	ICS-006-8-2	↓	.562	921 / SA106GRB	170		170	1190				36.42	10.29	–	46.69
10	RHS-004-90-2	4.5	.337	911 / SA106GRB	358		300	1215				14.98	4.98	–	19.96
11	RHS-004-113-2	↓	.237	301 / SA106GRB	↓	500	↓	425				10.79	5.51	–	16.3
12	CNS-004-52-2	↓	↓	↓	↓	↓	↓	283				10.79	5.51	1.63	17.93
13	CNS-004-115-3	↓	↓	151 / SA106GRB	120	135	100	115				10.79	5.51	–	16.3
14	1/2" SCH 80	.840	.147	301 / SA106GRB	358	500	300	425	↓	↓	↓	1.09	.101	–	1.19

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BASIC ANALYTICAL DATA

ITEM	COMPONENT IDENTIFICATION	NOM PIPE SIZE (IN)	NOM WALL THKN (IN)	SWEC CLASS	MATERIAL AND GRADE	DESIGN CONDITIONS TEMP (F)	DESIGN CONDITIONS PRESS (PSI)	MAXIMUM OPERATING TEMP (F)	MAXIMUM OPERATING PRESS (PSI)	ALLOWABLE STRESS (KSI) SC	SH	SA	WEIGHTS (LBS) PIPE	FLUID	INSU	TOTAL
15	ELBOWS NP X31-X32	6.625	.808	911	SA 106 GRB	575	1525	300	1348	15.	15.	22.5				58.74
16	X43-X45		.633													56.29
17	X49-X50		.639													50.39
18	X59-X60		.620													49.64
19	X73-X75		.598													48.53

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VALVE DATA

NODE NO.	NOMINAL SIZE(IN)	VALVE NO.	S&W DESCRIPTION NO.	TYPE	S&W FILE NO.	VALVE LENGTH (FT.)	VALVE WEIGHT (LB.)	OPER. WT. (LB.)
80	10	1E12*HOVF053A	VOW-090-E-2TS	Motor or GLOBE	12210-228-212-047-083E	2.83	1900	1100
182	10	1E12*VF050A	VOW-090-D-2T	CHECK	12210-228-211-049-001E	2.256	1850	—
304	4	1E12*VF063A	VGW-030-C-2KS	GATE	12210-228-211-049-007K	1.0	350	—
200	3/4	1RHS*V112	VOS-150-G-2	GLOBE	12210-228-213-058-011L	.334	10	—
200		1RHS*V113						—
90		1E12*VF058A	VOS-150-G-2					—
90		1E12*VF059A						—
31		1RHS*V129	VOS-060-B-2		12210-228-213-058-008T	.327	6	—
128	1/2"	RHS*V51	VOS060-B-2		228-213-053-008T			
128	1/2"	RHS*V52	"		"			
50	1 1/2" x 2"	1E12*RV025A			247-521-207-0268	—	45.0	—
X90	6"			CHECK			430	—

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VALVE DATA

NODE NO.	NOMINAL SIZE(IN)	VALVE NO.	S&W DESCRIPTION NO.	TYPE	S&W FILE NO.	VALVE LENGTH (FT.)	VALVE WEIGHT (LB.)	OPER. WT. (LB.)
~~720/722~~	6	VGW090-A-1Y5C	1E51*MOVF013	GATE	228.212-047-003G	1.666	750	360
~~1350/1370~~	~~6~~	~~VCW090-D-1M5A~~	~~1E61*AOVF065~~	~~CHECK~~	~~228.218-062-008F~~	~~1.166~~	~~307~~	~~123~~
350/852	4	VGW090-A-1M5Q	1E12*MOVF023	GLOBE	228.212-047-084C	1.166	325	210
320	4	VCW090-D-1M	1E12*VF019	CHECK	228.211-049-002F	1.166	145	—
520	4	VGW080-C-2K5	1E12*VF086	GATE	228.211-049-007K	1.0	—	350
~~725~~	~~3/4"~~	~~V05150-G-2~~	~~1E51*VF084~~	~~GLOBE~~	~~228.213-058-011L~~	~~.334~~	~~10~~	
~~745~~	~~3/4~~	~~V0W150-G-2~~	~~1E51*VF085~~	~~GLOBE~~	~~228.213-058-011L~~	~~.334~~	~~10~~	~~—~~
610	3/4	V0W150-G-2M	1E51*VF034		228.213-058-014G	.292	10	—
625	3/4	V0W150-G-2M	1E51*VF035			.292	10	—
~~1220~~	~~3/4~~	~~V0W150-G-2M~~	~~1E51*V802~~			~~.3125~~	~~10~~	~~—~~
~~1820~~	~~3/4~~	~~V0W150-G-2M~~	~~1E51*V100~~			~~.333~~	~~10~~	~~—~~
815	3/4	V0W150-G-2M	1E12*VF061			.3125	10	—
830	3/4	V0W150-G-2M	1E12*VF062			.3125	10	—
915	1/2	V05060-B-2	1RH5*V74		228.213-058-008I	.25	6	—
965	1/2	V05060-B-2	1RH5*V73		228.213-058-008I	.266	6	—

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO. 12210	DIVISION & GROUP EM/NP(T)	CALCULATION NO. 12210-AX-71AG	OPTIONAL TASK CODE N/A	PAGE 26

REV. 4

REF.

8 & 12a & 23

CALCULATION OF THE EQUIVALENT SECTION FOR VALVE YOKE (1E12*MOV-FOSA)

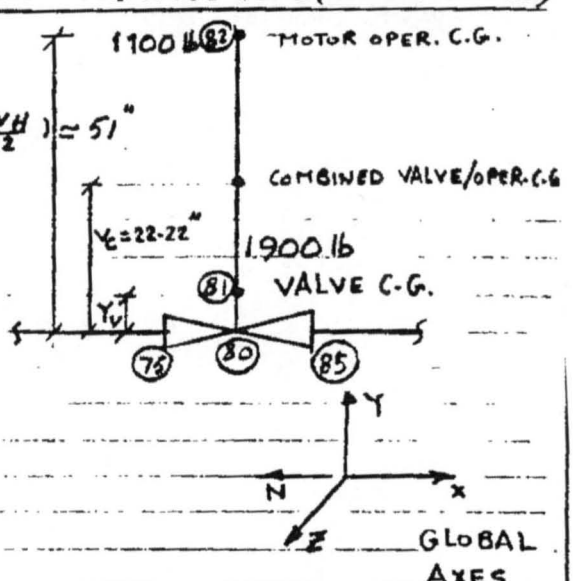
VALVE SIZE = 10"

VALVE WT. = 2350#

MOTOR OPER. WT. = 1100#

VALVE C.G. $Y_V = \frac{(2350+1100)\times 22.22 - 1100\times 51}{2350}$

$= 8.75"$



$\therefore \ell$ = DISTANCE 81-82

$= 51 - 8.75 = 42.25"$

MOMENT OF INERTIA FOR YOKE (FREQUENCY = 72 HZ) $= \frac{1}{3}\left(2\pi f \ell \sqrt{\frac{wL}{Eg}}\right)^2$

$= \frac{1}{3}\left(2\pi \times 72 \times 42.25 \sqrt{\frac{1100\times 42.25}{27.9\times 10^6 \times 386}}\right)^2$

$= 525.0 \text{ in}^4$

$I_x = I_z = \frac{\pi}{64}(D_o^4 - D_i^4)$

$\therefore 525.0 = \frac{\pi}{64}(10.75^4 - D_i^4)$

$\therefore D_i = 7.18$ IN

$\therefore$ THICKNESS OF EQUIVALENT SECTION OF PIPE O.D. 10.75"

$= t_{EQ} = \frac{10.75 - 7.18}{2} = 1.785"$ IN.

NOTE: FROM REF # 23, OPER. WT (INCLUDING PART OF YOKE) = 1300#

& VALVE WT. = 2200#

BY ENG. JUDGEMENT, THIS WILL HAVE INSIGNIFICANT EFFECT ON THE ANALYSIS CONSIDERING THAT THE DISTANCE TO C.G. of OPER + PART OF YOKE SHOULD DECREASE DUE TO EFFECT OF YOKE WT.

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

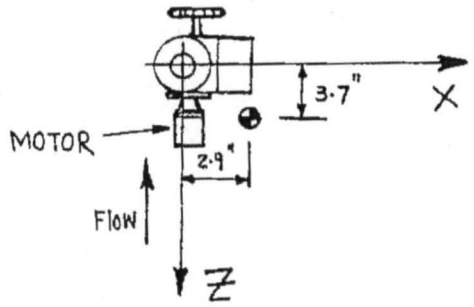
CALCULATION IDENTIFICATION NUMBER				27
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE ___
12210	E.M./Pipe Stress	AX-71AG REV. 4		

VALVE C.G. (Ref. &)

① MOV F013 (NODE X15)

VALVE ONLY :- - - - - - - - - - - - Y = 10.14" = .845'

OPERATOR ONLY :



X = 2.9" = .242'

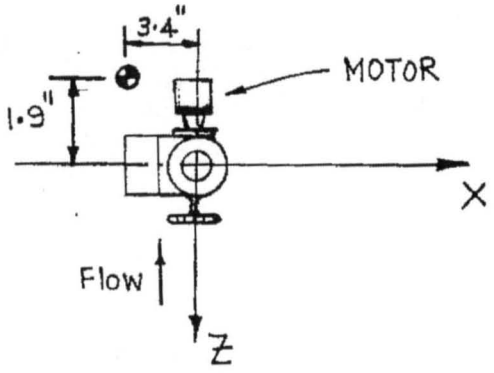
Y = (5.2" + 30.437") - 10.14"
= 25.497" = 2.125'

Z = 3.7" = .308'

② MOV F023 (NODE 345)

VALVE ONLY : - - - - - - - - - Y = $6\frac{3}{16}$" = .516'

OPERATOR ONLY



X = -3.4" = -.283'

Y = (6.0 + 18.562) - $6\frac{3}{16}$"
= 18.375" = 1.531'

Z = -1.9" = -.158'

CONCENTRATED WEIGHTS

ITEM	COMPONENT DESCRIPTION	WEIGHT (LBS)	NODE POINT
1	VALVE BODY, 1E51*MOVF013	690	X20
2	VALVE OPERATOR, 1E51-MOVF013	420	X22
3	VALVE, 1E51*VF034	10	610
8	VALVE, 1E12*VF019	145	320
9	VALVE, 1E12*VF061	10	815
10	VALVE, 1E12*VF062	10	835
11	VALVE BODY, 1E12*MOVF023	280	350
12	VALVE OPERATOR, 1E12*MOVF023	255	352
13	SUPPORT COMPONENT WT.	10	382
14	SUPPORT COMPONENT WT.	66	410
15	FLANGE WEIGHT	30	415
16	FLANGE WEIGHT	30	417
17	VALVE, 1E12*VF086	350	520
18	1E12-FEV014A(A-)	450	128
19	Valve Operator 1E12*MOVF053A	1100	82
20	Valve Weight 1E12*MOVF053A	1900	80
21	1E12*VF050A	1850	182
22	Check Valve	430	X98
23	1E12*VF063A	350	304

ENTERGY

CALCULATION
ENGINEERING DEPARTMENT
RIVER BEND STATION

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RELATIVE THERMAL ANCHOR DISPLACEMENTS

SUPPORT PT. NO.	SUPPORT TYPE	LOCATION	THER MODE	SUPPORT ATTACHMENT ELEVATION (ft)	ΔX(in)	ΔY(in)	ΔZ(in)
215	ASSUMED ANCHOR	AUX. BLDG.	1-8	121'-6 5/8"	1.631	.100	.092
			2		-.160	.009	-.007

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 30 OF

RELATIVE SEISMIC ANCHOR DISPLACEMENTS

SUPPORT PT: NO.	SUPPORT TYPE	LOCATION	SUPPORT ATTACHMENT ELEVATION (ft)	ΔX (in)	ΔY (in)	ΔZ (in)
5 *	ANCHOR	AUX. BLDG.	106'-9"	.27	.124	.240
53 *	RX, RZ		99'-5"	.25	—	.23
116 *	VC, RZ		104'-11 9/16"	—	.124	.235
146 *	VC, RX		106'-7"	.265	.124	—
166 *	RX, RZ		108'-4 5/8"	.270	—	.240
169 *	RX, RZ		123'-0 5/8"	.325	—	.275
176 *	VC		124'-7 3/8"	—	.1245	—
215 **	ASSUMED ANCHOR		121'-6 5/8"	.690	.240	.295
124 *	RZ		104'-6"	—	—	.235
130 *	ANCHOR		88'-11 3/4"	.21	.1235	.205
310 *	ANCHOR		106'-9"	.27	.124	.240

REF: PX-334

** Reference for the seismic anchor movements: Absolute/displacements of the Auxiliary Building. All restraints have Auxiliary Building displacement except the fictitious anchor for the feedwater line (node 215) which has Reactor Building and orbital motion relative to Auxiliary Building restraints.

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				31
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV.4	OPTIONAL TASK CODE	PAGE

REF.

DESIGN INPUT (CONT'D)

RELATIVE SEISMIC ANCHOR AND/OR SUPPORT DISPLACEMENTS

~~(* SEE CALCULATION ON THE FOLLOWING PAGE(S) 55-61 .)~~

NODE NO.	SUPT. TYPE	BUILDING (STRUCTURE)	SUPPORT ATTACHMENT ELEVATION (FT)	DISPLACEMENTS * (IN) DX	DY	DZ	REMARKS
X1	ANCHOR	AUX. BLDG.	91.719	0.2550	0.1800	0.2370	
X9	R_X		97.25	0.2750	------	------	
X47	RSKEW		104.75	------	0.1810	0.2680	
X48	SSKEW		104.75	0.3070	------	0.2680	
X52	S_Z		104.75	------	------	0.2680	
X61	R_Z		106.0	------	------	0.2720	
X71	SSKEW		118.167	0.3620	------	0.3030	
X76	VC		119.75	------	0.1810	------	
~~80~~	~~R_Z~~		~~120.75~~			~~0.3100~~	
100	RSKEW		122.526	0.3800	0.1810	------	
121	R_Z		122.526	------	------	0.3130	
122	VC		122.526	------	0.1810	------	
141	VC, R_Z		122.526	------	0.1810	0.3130	
220	VC, R_Z	SHIELD BLDG.	122.60	------	0.4110	0.8530	
~~285~~	ANCHOR	STEEL CONT.	122.76	0.9870	0.4390	0.8690	

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 32
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV.4	OPTIONAL TASK CODE	

REF.

DESIGN INPUT (CONT'D)

RELATIVE SEISMIC ANCHOR AND/OR SUPPORT DISPLACEMENTS

~~(* SEE CALCULATION ON THE FOLLOWING PAGE(S) 55-61 .)~~

NODE NO.	SUPT. TYPE	BUILDING (STRUCTURE)	SUPPORT ATTACHMENT ELEVATION (FT)	DISPLACEMENTS * (IN) DX	DY	DZ	REMARKS
~~260~~	~~ANCHOR~~	~~DRYWELL~~	~~123.17~~	~~1.0460~~	~~0.4780~~	~~0.9310~~	
338	R_X, V_C	AUX. BLDG.	98.75	0.2800	0.1800	------	
375	R_Z		100.385	------	------	0.2570	
380	R_X		103.677	0.3020	------	------	
382	S_H		104.72	------	0.1810	------	
410	V_C		106.75	------	0.1810	------	
445	ANCHOR		106.75	0.3150	0.1810	0.2740	
537	V_C, R_Z		98.39	------	0.1800	0.2520	
575	ANCHOR	▼	103.016	0.3000	0.1800	0.2640	

Basic Analytical Data
Thermal Modes:

ICS and RHS is injecting - or not injecting - while FWS is hot or old, i.e, while feedwater connection node 215 has either the static displacement, for feedwater hot or cold. Injection at 122 deg F bounds "no injection" at 120 deg F.

Modes 1-9 represent the different flow conditions. Modes 6-9 were not analyzed. They can be considered bounded by modes 1-5.

Region	Mode (Temperature °F)									
	1	2	3	4	5	6	7	8	9	Piping Line No.
1	122	40	40	298	185	122	40	122	122	RHS-014-74-2
2	122	40	40	298	40	122	40	122	122	RHS--010-66-2
3	122	40	40	298	40	122	40	122	122	RHS-010-65-2
4	425	40	425	298	425	122	40	170	170	RHS-010-65-2 (AFTER CK)
5	425	40	425	298	425	122	40	170	170	ICS-006-101-2 (AFTER CK)
6	122	40	40	122	40	122	40	170	170	ICS-006-101/7-2, RHS-004-90-2
7	122	40	40	122	40	122	40	170	170	ICS-006-8-2
8	122	40	40	122	40	122	122	122	122	RHS-004-113-2, CNS-004-52-2
9	122	40	40	100	40	122	100	100	122	CNS-004-415-3
10	122	40	40	298	185	122	40	122	122	RHS-014-75-2
11	122	40	40	298	40	122	40	122	122	CNS-004-58-2
12	122	40	40	100	185	122	40	122	122	CNS-004-57-3
.	425	40	425	425	425	425	425	425	70	Feedwater Line Temp

DYNAMIC LOADS
FLUID TRANSIENT FILE NAMES:

FROM	TO	FILE NAME
678	1178	/home3/ywu90/px1037/frcic.29
1180	1680	/home3/ywu90/px1037/frcic.30
1682	2182	/home3/ywu90/px1037/frcic.31
2184	2684	/home3/ywu90/px1037/frcic.32
2686	3186	/home3/ywu90/px1037/frcic.33
3188	3688	/home3/ywu90/px1037/frcic.34
3690	4190	/home3/ywu90/px1037/frcic.35
4192	4692	/home3/ywu90/px1037/frcic.36
4694	5194	/home3/ywu90/px1037/frcic.37
5196	5696	/home3/ywu90/px1037/frcic.38
5698	6198	/home3/ywu90/px1037/frcic.39
6200	6700	/home3/ywu90/px1037/frcic.40
6702	7202	/home3/ywu90/px1037/frcic.41
7204	7704	/home3/ywu90/px1037/frcic.42
7706	8206	/home3/ywu90/px1037/frcic.43
8222	8721	/home3/riverbend/ft/px1015/p1015f04.017
8723	9222	/home3/riverbend/ft/px1015/p1015f04.018
9224	9723	/home3/riverbend/ft/px1015/p1015f04.019
9725	10224	/home3/riverbend/ft/px1015/p1015f04.020
10226	10725	/home3/riverbend/ft/px1015/p1015f04.021
10727	11226	/home3/riverbend/ft/px1015/p1015f04.022
11228	11727	/home3/riverbend/ft/px1015/p1015f04.023

DYNAMIC LOADS
FILE NAMES

Uniform ARS method is used. All supports except the fictitious anchor at node 215 are in the Auxiliary Building; therefore, the seismic ARS for the elevation range from highest to the lowest Auxiliary Building attachments are input. Node 215 transmits the Reactor Building ARS of Drywell and Shield Building to the piping model. The feedwater penetration Z-3A is attached to these structures at EL. 121.85'. For the seismic ARS, a structural point above and below have to be input; for the hydrodynamic ARS, the structural model has a node at the penetration elevation.

TABLE 1

Structural Attachment	Elevation (FT)	Curve Number	
		OBE	SSE
Auxiliary Building	70	auxbon01.ace	auxbsn02.ace
Auxiliary Building	95	auxbon03.ace	auxbsn04.ace
Auxiliary Building	114	auxbon05.ace	auxbsn06.ace
Auxiliary Building	141	auxbon07.ace	auxbsn08.ace
Drywell	114	rbdwon41.ace	rbdwsn42.ace
Drywell	133	rbdwon43.ace	rbdwsn44.ace
Shield Building	112.67	rbsbon03.ace	rbsbsn04.ace
Shield Building	133	rbsbon05.ace	rbsbsn06.ace

TABLE 2

Structural Attachment	Elevation (ft)	Curve Number			
		SRV1V	SRV16V	CHCO	PS
Drywell	121	*	rbdwan43.ace	rbdwcn43.ace	rbdwpn43.ace
Shield Building	121	rbsbtn03.ace	rbsban03.ace	rbsbcn03.ace	rbsbpn03.ace

* BOUNDED BY SRV16V CASE

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 36 OF

MAXIMUM STRESS LEVELS

ASME SECT. III, CLASSES 2 & 3

DESIGN CONDITION	LEVEL	LOCATION OF MAXIMUM END	LOCATION OF MAXIMUM ELEMENT	MAXIMUM COMPUTED STRESS (PSI)	ALLOWABLE STRESS (PSI)	COMPUTED / ALLOWABLE
SUSTAINED LOADS EQN. 8		X25	X27 X25	7166	SH 15000	.478
OCCASIONAL LOADS EQN. 9	B	X35	X35 280	15674	1.2 SH 18000	.871
OCCASIONAL LOADS EQN. 9	C	303	302 303	20692	1.8 SH 27000	.766
OCCASIONAL LOADS EQN. 9	D	303	302 303	21011	2.4 SH 36000	.584
THERMAL EXPANSION EQN. 10		505	21$ M 505	22098	SA 22500	.982

Based on industry practice the regions which are isolated from the Reactor Building by at least 3 equivalent dynamic restraints in each direction can be considered unaffected by the Reactor Building response spectra. These regions experience only OBE and SSE ARS, and not hydrodynamic ARS. The boundaries of the RB affected region are beyond nodes (or exclude boundary nodes) 116, X1, and X338. Therefore, the stresses in these regions can be corrected to exclude the hydrodynamic loading. The maximum stresses for level C and D were not corrected, since they are within the allowables.

FUNCTIONAL CAPABILITY EVALUATION:

The maximum stress level for Equation 9 emergency condition and Equation 9 faulted condition are below the Equation 9 Normal/Upset allowable, and OD/t is less than 50 for piping associated with this calculation. Therefore, the piping system ensures the functional capability. No further detail evaluation is required.

PIPE BREAK LOCATIONS

The only applicable region is from the feedwater connection at node 215 upstream to the first check valve in the RHR line, the RCIC line and the RWCU line (not modelled) i.e., nodes 185-215 and X93-X98.

Conclusion:

Besides the mandatory new break at node X93 (the interface of High Energy and Moderate Energy piping - see calculation no: 228.850-CBC-2024 REV.0), no new High Energy breaks need be postulated. The stresses in the High Energy region are well below the allowbles.

ENTERGY

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ENGINEERING DEPARTMENT
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VALVE IDENTIFICATION NUMBER: 1E12*MOVF053A									
Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP 82			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP 81			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBEI	0.162	0.131	0.238	0.094	0.13	0.237	2	2	2
SSEI	0.323	0.259	0.475	0.187	0.259	0.486	2	2	2
SRV1V	1.137	0.783	1.277	0.617	0.781	0.347	3.5	3.5	3.5
SRV16V	1.563	1.112	1.759	0.858	1.11	0.545	4	4	4
CHUG/CO	0.411	0.153	0.224	0.198	0.151	0.307			
PS	0.115	0.086	0.103	0.058	0.086	0.034	4	4	4
FT	0.093	0.083	0.151	0.094	0.083	0.087	4	4	4
UPSET	1.57412261	1.12276177	1.78143931	0.86823729	1.12066453	0.6006355	6	6	6
FAULTED	1.65071742	1.15495584	1.84192372	0.90508176	1.15276667	0.79689334	7.21110255	7.21110255	7.21110255

Valve Spec No: 228.212-047-083E

LEGEND:

UPSET = SRSS(OBEI,FT,SRVMAX)
FAULTED = SRSS(SSEI, FT, SRVMAX.,MAX(CHCO, PS))

VALVE IDENTIFICATION NUMBER: 1E12*VF019									
Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP 320			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBEI				0.159	0.161	0.119	2	2	2
SSEI				0.315	0.32	0.236	2	2	2
SRV1V				1.306	1.636	0.958	3.5	3.5	3.5
SRV16V				1.717	1.921	1.127	4	4	4
CHUG/CO				1.086	1.37	0.884			
PS				0.148	0.188	0.114	4	4	4
FT				1.377	1.849	0.6	4	4	4
UPSET	0	0	0	2.20669413	2.67113515	1.28229872	6	6	6
FAULTED	0	0	0	2.47443711	3.01468771	1.5707581	7.21110255	7.21110255	7.21110255

Valve Spec No: 228.211

VALVE IDENTIFICATION NUMBER: 1E12*VF063A									
Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP 304			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP 315			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBEI	0.4	0.112	0.342	0.4	0.117	0.402	2	2	2
SSEI	0.792	0.224	0.68	0.793	0.233	0.797	2	2	2
SRV1V	2.337	0.773	2.125	2.338	0.85	2.357	3.5	3.5	3.5
SRV16V	3.739	1.046	3.088	3.741	1.116	3.546	4	4	4
CHUG/CO	0.159	0.328	1.132	0.16	0.421	0.376			
PS	0.196	0.086	0.169	0.196	0.093	0.198	4	4	4
FT	0.257	0.092	0.264	0.257	0.088	0.324	4	4	4
UPSET	3.76910732	1.05599432	3.11807697	3.77109135	1.12556164	3.58339169	6	6	6
FAULTED	3.83560295	1.12264865	3.36886687	3.83775911	1.21849497	3.66819806	7.21110255	7.21110255	7.21110255

Valve Spec No: 228.211-049-007K

VALVE IDENTIFICATION NUMBER: 1E12*VF050A									
Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP 182			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBEI				0.119	0.102	0.121	2	2	2
SSEI				0.236	0.204	0.239	2	2	2
SRV1V				0.735	0.797	0.574	3.5	3.5	3.5
SRV16V				0.965	1.072	0.885	4	4	4
CHUG/CO				0.212	0.489	0.168			
PS				0.081	0.097	0.065	4	4	4
FT				0.963	1.462	1.19	4	4	4
UPSET	0	0	0	1.36848639	1.81577311	1.48794019	6	6	6
FAULTED	0	0	0	1.3997264	1.88874694	1.51151249	7.21110255	7.21110255	7.21110255

Valve Spec No: 228.211-049-001E

ENTERGY

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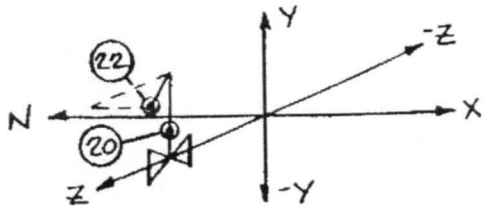
VALVE IDENTIFICATION NUMBER: 1E51*MOVF013

Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP X22			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP X20			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBE1	0.254	0.145	0.208	0.133	0.153	0.159	2	2	2
SSE1	0.503	0.287	0.413	0.264	0.302	0.314	2	2	2
SRV1V	1.633	0.995	1.24	0.874	1.082	0.797	3.5	3.5	3.5
SRV16V	2.262	1.28	1.73	1.149	1.361	1.041	4	4	4
CHUG/CO	0.351	0.37	0.691	0.765	0.406	0.307			
PS	0.168	0.105	0.149	0.096	0.114	0.08	4	4	4
FT	1.055	1.257	1.456	0.705	1.259	0.908	4	4	4
UPSET	2.50882144	1.79985388	2.27070474	1.35459034	1.86032551	1.3904769	6	6	6
FAULTED	2.57019046	1.85410841	2.40018458	1.57230627	1.92183298	1.44947922	7.21110255	7.21110255	7.21110255

Valve Spec No: 228.212



VALVE IDENTIFICATION NUMBER: 1E51*MOVF023									
Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP 352			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP 350			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBEI	0.367	0.179	0.306	0.128	0.154	0.126	2	2	2
SSEI	0.726	0.356	0.607	0.254	0.306	0.249	2	2	2
SRV1V	1.695	1.506	2.139	0.945	1.026	0.962	3.5	3.5	3.5
SRV16V	3.052	2.115	3.167	1.312	1.529	1.16	4	4	4
CHUG/CO	0.505	1.115	1.091	0.889	0.55	0.842			
PS	0.18	0.187	0.254	0.102	0.126	0.112	4	4	4
FT	0.772	1.254	1.01	0.985	0.764	0.617	4	4	4
UPSET	3.16944427	2.4653158	3.33820685	1.64558591	1.71617394	1.31991098	6	6	6
FAULTED	3.26998303	2.72317866	3.55087581	1.88319038	1.82144805	1.58027023	7.21110255	7.21110255	7.21110255

ENTERGY

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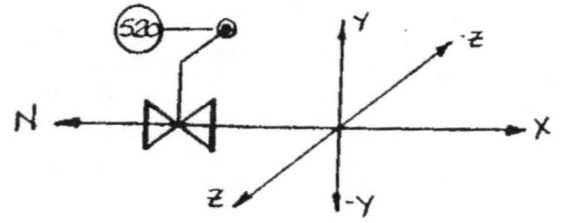
VALVE IDENTIFICATION NUMBER: 1E12*VF086									
Loading Case	Acceleration in Global Coordinate System at C.G. of operator (g) NP			Acceleration in Global Coordinate System at C.G of Valve Body (g) NP 520			Acceptable Acceleration (g)		
	Ax	Ay	Az	Ax	Ay	Az	Ax	Ay	Az
OBEI				0.228	0.148	0.131	2	2	2
SSEI				0.451	0.294	0.261	2	2	2
SRV1V				0.963	0.927	1.07	3.5	3.5	3.5
SRV16V				1.308	1.436	1.581	4	4	4
CHUG/CO				0.528	0.72	0.797			
PS				0.086	0.115	0.155	4	4	4
FT				0.489	0.572	0.918	4	4	4
UPSET	0	0	0	1.41490954	1.55279876	1.83287916	6	6	6
FAULTED	0	0	0	1.5595416	1.73035141	2.01137142	7.21110255	7.21110255	7.21110255

Valve Spec No: 228.211



ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 46 OF

FLANGE QUALIFICATION

LINE NO. RHS-014-75-2

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE A)

Based On: EMTR-605-0 (REF # 5)

Node Point No. 128

ASME III Class 2 and 3

FLANGE TYPE: R.F. WELDING NECK SIZE: 14"

FLANGE MATERIAL: SA-105

BOLTING MATERIAL: SA-193 GR. B7 NO. OF BOLTS: 20

S = 25000 psi ≥20,000 psi (A)

S_y = 31200 psi

C = 20.25 in.

A_b = .763X20=15.26 $in.^2$

D_f = 16.25 in.

F_s = S_y/ 36000 = .867 ≤ 1.0 (A)

F_{sc} = F_s.C = 17.56 in.

S: Minimum allowable value of stress for bolting material at 100°F from table I-7.3, subsection NA, ASME III (psi)

Sy: Yield strength of flange material at the design temperature from table I-2.2, I-7.1 subsection NA, ASME III (psi)

C: Diameter of bolt circle. (in.)

A_b: Total cross-sectional area of the bolts at the root of the threads. ($in.^2$)

D_f: Outside diameter of raised face of flange. (in.)

(A) = ACCEPTABLE (X) = UNACCEPTABLE

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 47 OF

FLANGE QUALIFICATION

LINE NO. RHS-014-75-2 NP: 128

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE B)

Based On: EMTR-605-0 (REF #5)

a. Design, Normal and Upset Conditions
a-1 Deadweight and Thermal

Local Moments / LOADS	M_x (ft-lb)	My (ft-lb)	M_z (ft-lb)
DEADWEIGHT	-657	-699	3203
THERMAL **	1152	1156	2689
STEADY STATE **	—	—	—
TOTAL (A) *	+495	699	5892

1. Bending moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(699)^2 + (5892)^2} = 5933.$ ft lb

2. Torsional moment $= M_x = 495.$ ft lb

3. Allowable moment $= \frac{3125.}{12} F_{sc} \cdot A_b$ ∴

$= \frac{3125}{12} \times 17.56 \times 15.26 = 69783$ ft lb

$$M_{fs} \leq \frac{3125}{12} \frac{(S_y)}{36000} C A_b \quad (A)$$

M_{fs}: The maximum of 1 or 2 = 5933. Ft.lb

* Total (A) is the maximum of the (deadweight + steady state) or (deadweight + thermal + steady state) algebraic combination.

** Maximum components from all Thermal cases input.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 48 OF

FLANGE QUALIFICATION

LINE NO. RHS-014-75-2 NP: 128

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE C)

Based On: EMTR-605-0 (REF # 5)

a-2 Deadweight, Thermal and Dynamic Loads

Local Moments / LOADS	M_x (ft-lb)	M_y (ft-lb)	M_z (ft-lb)
TOTAL (A)	+ 495	699	5892
N+U Dynamic **	337	611	1100
OBEA	261	445	237
TOTAL (B) *	1093	1755	7229

4. Bending Moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(1755)^2 + (7229)^2} = 7439$ ft-lb

5. Torsional moment $= M_x$ $= 1093$ ft-lb

6. Allowable moment $= \frac{6250}{12} F_{sc} A_b$

$= \frac{6250}{12} \times 17.56 \times 15.26 = 139565$ ft-lb

$$M_{fd} \leq \frac{6250}{12} \frac{(Sy)\ C}{36000} A_b \qquad (A)$$

M_{fd}: the maximum of 4 or 5. = 7439 ft-LB

* Absolute combination of A, N+U dynamic and OBEA

** Maximum value of all dynamic load combinations for normal and upset condition (i.e., OBE, SRV, Fluid Transient, etc)

NOTE: SRV, FT DOES NOT APPLY, SINCE ISOLATED FROM RB.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 49 OF

FLANGE QUALIFICATION

LINE NO. RHS-014-75-2 NP: 128

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE D)

Based On: EMTR-605-0 (REF # 5)

b. Emergency Condition

b-1 Deadweight, Thermal and Dynamic Loads

Local Moments / LOADS	M_x (ft-lb)	M_y (ft-lb)	M_z (ft-lb)
TOTAL (A)	495	699	5892
EMERGENCY DYNAMIC **	337	611	1100
TOTAL (C) *	832	1310	6992

7. Bending moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(1310)^2 + (6992)^2} = 7114$ ft-lb

8. Torsional Moment $= M_x = 832$ ft-lb

9. Operating pressure $= Po = 500 psi \leq 1.5P = 1.5 \times 500 = 750$ psi

10. Allowable moment $= (11250\, A_b - \frac{(\pi)}{16} D_f^2\, P_e)\, F_{sc}/12$

$= (11250 \times 15.26 - \frac{\pi}{16} \times 16.25^2 \times 500) \times \frac{17.56}{12} = 213282$ FT-LB

$$M_{fd} \leq (11250\, A_b - \frac{(\pi)}{16} D_f^2\, P_E)\, \frac{C}{12}\, \frac{(Sy)}{36000} \qquad (A)$$

Po: Maximum operating pressure during emergency condition (psi)= 500 psi

P: Design pressure (psi) = 500 psi

P_E: Emergency condition pressure concurrent with Mfd (psi) = 500 psi

M_{fd}: The maximum of 7 or 8 = 7114 ft-lb

* Absolute combination of A and emergency dynamic
** Maximum value of all dynamic load combinations for emergency condition

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 50 OF

FLANGE QUALIFICATION

LINE NO. RHS-014-75-2 NP: 128

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE E)

Based On: EMTR-605-0 (REF# 5)

c. Faulted Condition

c-1 Deadweight, Thermal and Dynamic Loads

LOADS \ Local Moments	M_x (ft-lb	M_y (ft-lb)	M_z (ft-lb)
TOTAL (A)	495	699	5892
FAULTED DYNAMIC **	662	1191	2102
TOTAL (D) *	1157	1890	7994

11. Bending moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(1890)^2 + (7994)^2} = 8214$ ft-lb

12. Torsional Moment $= M_x = 1157$ ft-lb

13. Operating pressure = Po = 500 psi ≤ 2.0 P = 2 x 500 = 1000 psi

14. Allowable moment $= (11250\ A_b - \frac{(\pi)}{16}\ D_f^2\ P_f)\ F_{sc}/12$

$= (11250 \times 15.26 - \frac{\pi}{16} \times 16.25^2 \times 500) \times \frac{17.56}{12} = 213282$ FT-LB

$$M_{fd} \leq (11250\ A_b - \frac{(\pi)}{16}\ D_f^2\ P_f)\ \frac{C}{12}\ \frac{(Sy)}{36000} \quad (A)$$

Po: Maximum operating pressure during faulted condition (psi) = 500 psi

P: Design pressure (psi) = 500 psi

P_f: Faulted condition pressure concurrent with Mfd (psi) = 500 psi

M_{fd}: The maximum of 11 or 12 = 8214 Ft-LBs

* Absolute combination of A and faulted dynamic

** Maximum value of all dynamic load combinations for faulted condition

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 51 OF

FLANGE QUALIFICATION

LINE NO. 1-RHS-004-13-2

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE A)

Based On: EMTR-605-0

Node Point No. MAX. OF 415/417

ASME III Class 2 and 3

FLANGE TYPE: WELDING NECK SIZE: 4"

FLANGE MATERIAL: SA-105

BOLTING MATERIAL: SA-193, GR. B7 NO. OF BOLTS: 8 @ 3/4" DIA.

S = 25000 psi ≥20,000 psi (A)

S_y = 36000 psi

C = 7.88 in.

A_b = 2.416 in.^{2}

D_f = 6.19 in.

F_s = S_y / 36000 = 1.0 ≤ 1.0 (A)

F_{sc} = F_s.C = 7.88 IN.

S: Minimum allowable value of stress for bolting material at 100°F from table I-7.3, subsection NA, ASME III (psi)

Sy: Yield strength of flange material at the design temperature from table I-2.2, I-7.1 subsection NA, ASME III (psi)

C: Diameter of bolt circle. (in.)

A_b: Total cross-sectional area of the bolts at the root of the threads. (in)^2

D_f: Outside diameter of raised face of flange. (in.)

(A) = ACCEPTABLE (X) = UNACCEPTABLE

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 52 OF

FLANGE QUALIFICATION

LINE NO. RHS-004-113-2 NP: 415/417

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE B)

Based On: EMTR-605-0 (REF # 5)

a. Design, Normal and Upset Conditions
a-1 Deadweight and Thermal

Local Moments / LOADS	M_x (ft-lb)	My (ft-lb)	M_z (ft-lb)
DEADWEIGHT	- 47	5	29
THERMAL **	- 91	50	155
STEADY STATE **	—	—	—
TOTAL (A) *	- 138	55	184

1. Bending moment = $\sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(55)^2 + (184)^2} = 192.$ ft lb

2. Torsional moment = M_x $= 138.$ ft lb

3. Allowable moment = $\frac{3125.}{12} F_{sc} \cdot A_b$

$= \frac{3125}{12} \times 17.56 \times 15.26 = 69783$ ft lb

$$M_{fs} \leq \frac{3125}{12} \frac{(S_y)}{36000} C A_b \quad (A)$$

M_{fs}: The maximum of 1 or 2 = 192. ft.lb

* Total (A) is the maximum of the (deadweight + steady state) or (deadweight + thermal + steady state) algebraic combination.

** Maximum components from all Thermal cases input.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 53 OF

FLANGE QUALIFICATION

LINE NO. RHS-004-113-2 NP: 415/417

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE C)

Based On: EMTR-605-0 (REF# 5)

s-2 Deadweight, Thermal and Dynamic Loads

Local Moments / LOADS	M_x (ft-lb)	M_y (ft-lb)	M_z (ft-lb)
TOTAL (A)	-138	55	184
N+U Dynamic **	36	210	153
OBEA	72	56	172
TOTAL (B) *	246	321	509

4. Bending Moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(321)^2 + (509)^2} = 602$ ft-lb

5. Torsional moment $= M_x = 246$ ft-lb

6. Allowable moment $= \frac{6250}{12} F_{sc} A_b$

$= \frac{6250}{12} \times 17.56 \times 15.26 = 139565$ ft-lb

$$M_{fd} \leq \frac{6250}{12} \frac{(Sy)\ C}{36000} A_b$$ (A)

M_{fd}: the maximum of 4 or 5. = 602 Ft-LB

* Absolute combination of A, N+U dynamic and OBEA

** Maximum value of all dynamic load combinations for normal and upset condition (i.e., OBE, SRV, Fluid Transient, etc)

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 54 OF

FLANGE QUALIFICATION

LINE NO. RHS-004-113-2 NP: 415/417

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE D)

Based On: EMTR-605-0 (REF # 30)

b. Emergency Condition

b-1 Deadweight, Thermal and Dynamic Loads

Local Moments / LOADS	M_x (ft-lb)	M_y (ft-lb)	M_z (ft-lb)
TOTAL (A)	138	55	184
EMERGENCY DYNAMIC (OBE1, OCCE) **	36	210	153
TOTAL (C) *	174	265	337

7. Bending moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(265)^2 + (337)^2} = 429$ ft-lb

8. Torsional Moment $= M_x = 174$ ft-lb

9. Operating pressure $= Po = 500 psi \leq 1.5P = 1.5 \times 500 = 750$ psi

10. Allowable moment $= (11250\, A_b - \frac{(\pi)}{16} D_f^2\, P_e)\, F_{sc}/12$

$= (11250 \times 15.26 - \frac{\pi}{16} \times 16.25^2 \times 500) \times \frac{17.56}{12} = 213282$ FT-LB

$$M_{fd} \leq (11250\, A_b - \frac{(\pi)}{16} D_f^2\, P_E)\, \frac{C}{12}\, \frac{(Sy)}{36000} \quad (A)$$

Po: Maximum operating pressure during emergency condition (psi)= 500 psi

P: Design pressure (psi) = 500 psi

P_E: Emergency condition pressure concurrent with Mfd (psi) = 500 psi

M_{fd}: The maximum of 7 or 8 = 174 ft-lb

* Absolute combination of A and emergency dynamic
** Maximum value of all dynamic load combinations for emergency condition

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 55OF

FLANGE QUALIFICATION

LINE NO. RHS-004-113-2 NP: 415/417

SUBJECT: QUALIFICATION OF FLANGED JOINTS (TABLE E)

Based On: EMTR-605-0 (REF#)

c. Faulted Condition

c-1 Deadweight, Thermal and Dynamic Loads

LOADS \ Local Moments	M_x (ft-lb	M_y (ft-lb)	M_z (ft-lb)
TOTAL (A)	138	55	184
FAULTED DYNAMIC **	54	326	236
TOTAL (D) *	192	381	420

11. Bending moment $= \sqrt{(M_y)^2 + (M_z)^2}$

$= \sqrt{(381)^2 + (420)^2} = 567$ ft-lb

12. Torsional Moment $= M_x = 192$ ft-lb

13. Operating pressure = Po = 500 psi $\leq 2.0\ P = 2 \times 500 = 1000$ psi

14. Allowable moment $= (11250\ A_b - \frac{(\pi)}{16}\ D_f^2\ P_f)\ F_{sc}/12$

$= (11250 \times 15.26 - \frac{\pi}{16} \times 16.25^2 \times 500) \times \frac{17.56}{12} = 213282$ FT-LB

$$M_{fd} \leq (11250\ A_b - \frac{(\pi)}{16}\ D_f^2\ P_f)\ \frac{C}{12}\ \frac{(Sy)}{36800} \quad (A)$$

Po: Maximum operating pressure during faulted condition (psi) = 500 psi

P: Design pressure (psi) = 500 psi

P_f: Faulted condition pressure concurrent with Mfd (psi) = 500 psi

M_{fd}: The maximum of 11 or 12 = 567 ft-lbs

* Absolute combination of A and faulted dynamic

** Maximum value of all dynamic load combinations for faulted condition

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-71AG, Rev. 4 PAGE 56 OF

VENT & DRAIN QUALIFICATION:

The following Vents & Drains are qualified generically by Calculation PX-SB-316:

Valve No:

- RHS*V1229
- RHS*V112 and V113
- RHS*V51
- RHS&V52
- ICS*VF084 & VF085
- ICS*VF061 & VF062
- ICS*VF073
- ICS*VF074

The following Vents & Drains are qualified with tie-back support:

Valve No:

- ICS*VF034
- 1E12*VF058A & VF059A
- RHS*V112 & V113

SLEEVE CLEARANCES

Piping displacements due to reanalysis of Rev. 4 have not changed significantly; either they have decreased at certain locations or increased insignificantly at some locations. The thermal load cases and Seismic Anchor Movement load case movements are not altered, and this analysis has used N411 damping values, which reduces the dynamic displacements. The original values from previous revisions are still applicable.

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 58
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
12210	EM/NP(T)	AX-71AG-	N/A	

REV. 4

AX-NODE NO. 129

PIPE MVTS. IN SLEEVE PENETRATIONS

LOAD CASE DESCRIPTION	CASE NO.	NUPIPE OUTPUT PIPE DEFLECTION DIR.	NUPIPE OUTPUT PIPE DEFLECTION MVT	NUPIPE INPUT PENETRATION MVT	SUM OF RELATIVE MOVEMENTS
DEADWEIGHT	5	X	.007	—	.007
		Z	-.007	—	-.007
THERMAL (N-U)					
THERMAL (MAX)	9	X	.112	—	.112
		Z	-.007	—	-.007
THERMAL (MIN)	8	X	-.014	—	-.014
		Z	.001	—	.001
BUILDING SETTLEMENT 1	*				
BUILDING SETTLEMENT 2	—				
OBEA	18	X	± .230	± .235	± .005
		Z	± .217	± .220	± .003
SSEA (2OBEA)		X	± .460	± .470	± .010
		Z	± .434	± .440	± .006
OBEI	12	X	± .009	—	± .009
		Z	± .005	—	± .005
SSEI	13	X	± .016	—	± .016
		Z	± .009	—	± .009
DYNAMIC OCCU	20	X	± .008	—	± .008
		Z	± .010	—	± .010
DYNAMIC OCCE	21	X	± .008	—	± .008
		Z	± .010	—	± .010
DYNAMIC OCCF	27	X	± .008	—	± .008
		Z	± .010	—	± .010

TOTAL RELATIVE MOVEMENTS = | DWT ± THER. ± BLDG. SETTLEMENT | ± OBEA ± DYNAMIC (OCCU / OCCB)

OR = | DWT ± THER ± BLDG. SETTLEMENT | ± SSEA ± DYNAMIC (OCCF)

* INSIGNIFICANT (SEE P. #2)

NOTES: 1. THE SIGN OF THE TOTAL RELATIVE MOVEMENTS MUST BE THE SIGN OF THE MAXIMUM COMBINATION OF DWT., THERMAL AND BLDG. SETTLEMENT.

2. THE MAXIMUM OF EITHER EQUATION SHOWN ABOVE IS RECORDED ON THE NEXT PAGE TO BE COMPARED WITH THE SLEEVE CLEARANCE.

STONE & WEBSTER ENGINEERING CORPORATION

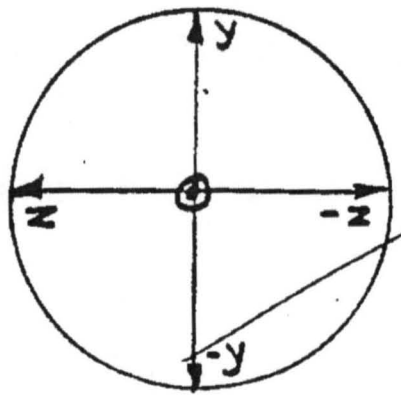
CALCULATION SHEET

A 5010 66

CALCULATION IDENTIFICATION NUMBER				PAGE 59
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
12210	EM/NP(T)	AX-71AG	N/A	

AX - NODE NO. 129 REV. 4

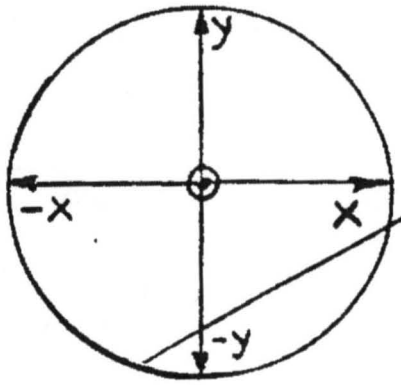
SLEEVE CLEARANCE LOOKING NORTH



TOTAL RELATIVE MOVEMENTS

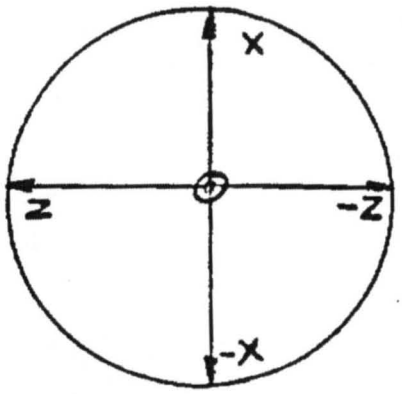
N/A

SLEEVE CLEARANCE LOOKING EAST



N/A

SLEEVE CLEARANCE LOOKING UP FACING NORTH



-Z =	3 3/16" = 3.1875"	→	.030"
Z =	4 5/16" = 4.3125"	→	.010"
X =	4 7/16" = 4.4375"	→	.137"
-X =	3 1/4" = 3.25"	→	.025"

∴ SLEEVE CLEARANCE IS ACCEPTABLE

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				60
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE ___
12210	EM/NP(T)	AX-71AG-	N/A	

REV. 4

AX-NODE NO. BETWEEN NODE NO. 120 & 131

PIPE MVTS. IN SLEEVE PENETRATIONS

LOAD CASE DESCRIPTION	CASE NO.	NUPIPE OUTPUT PIPE DEFLECTION DIR.	NUPIPE OUTPUT PIPE DEFLECTION MVT	NUPIPE INPUT PENETRATION MVT	SUM OF RELATIVE MOVEMENTS
DEADWEIGHT	5	Y	-.013/-.002	—	-.013 / -.002
		Z	0.00 / .004	—	0.00 / .004
THERMAL (N-U)					
THERMAL (MAX)	9	Y	.037	—	.037
		Z	.110	—	.110
THERMAL (MIN)	10	Y	-.024	—	-.024
		Z	-.113	—	-.113
BUILDING SETTLEMENT 1	*				
BUILDING SETTLEMENT 2	—				
OBEA	18	Y	± .128	.124	± .004
		Z	± .241	.235	± .006
SSEA (2OBEA)		Y	± .256	.248	± .008
		Z	± .482	.470	± .012
OBEI	12	Y	± .014	—	± .014
		Z	± .013	—	± .013
SSEI	13	Y	± .023	—	± .023
		Z	± .022	—	± .022
DYNAMIC OCCU	20	Y	± .016	—	± .016
		Z	± .018	—	± .018
DYNAMIC OCCE	21	Y	± .016	—	± .016
		Z	± .018	—	± .018
DYNAMIC OCCF	27	Y	± .024	—	± .024
		Z	± .025	—	± .025

TOTAL RELATIVE MOVEMENTS $= \left| DWT \pm THER. \pm \text{BLDG. SETTLEMENT} \right| \pm OBEA \pm (\text{DYNAMIC OCCU / OCCB})$

OR $= \left| DWT \pm THER \pm \text{BLDG. SETTLEMENT} \right| \pm SSEA \pm (\text{DYNAMIC OCCF})$

* INSIGNIFICANT (SEE P#2)

NOTES: 1. THE SIGN OF THE TOTAL RELATIVE MOVEMENTS MUST BE THE SIGN OF THE MAXIMUM COMBINATION OF DWT., THERMAL AND BLDG. SETTLEMENT.

2. THE MAXIMUN OF EITHER EQUATION SHOWN ABOVE IS RECORDED ON THE NEXT PAGE TO BE COMPARED WITH THE SLEEVE CLEARANCE.

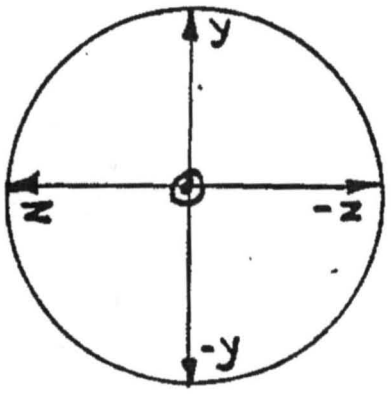
STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 61
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
12210	EM/NP(T)	AX-71AG REV.4	N/A	

AX - NODE NO. BETWEEN NODE NO. 120 & 131

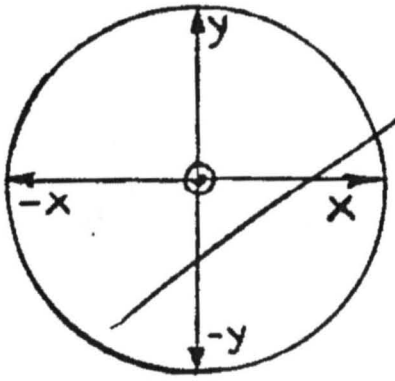
SLEEVE CLEARANCE LOOKING NORTH



				TOTAL RELATIVE MOVEMENTS
-z =	2 15/16"	= 2.9375"	>	.150
z =	4 7/16"	= 4.4375"	>	.151
y =	4 3/16"	= 4.1875"	>	.067
-y =	3 3/8"	= 3.375"	>	.069

∴ SLEEVE CLEARANCES ARE ACCEPTABLE

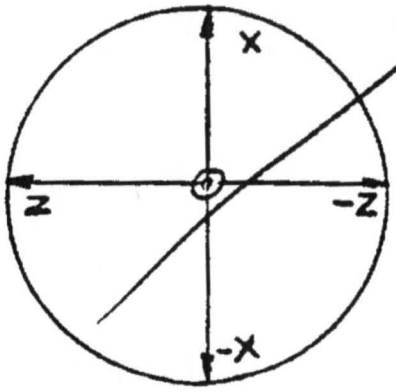
SLEEVE CLEARANCE LOOKING EAST



x =		=		
-x =		=		
y =		=		
-y =		=		

N/A

SLEEVE CLEARANCE LOOKING UP FACING NORTH



-z =		=		
z =		=		
x =		=		
-x =		=		

N/A

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				62
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV.4	OPTIONAL TASK CODE	PAGE____

REF.

SLEEVE CLEARANCE EVALUATION

NODE 5

Load Case Description	Case No.	NUPIPE Output: Pipe Deflection Dir.	NUPIPE Output: Pipe Deflection Movement	NUPIPE Input: Penetration Movement	Sum of Relative Movements
Deadweight	31	X	.005	–	.005
		Z	-.012	–	-.012
Thermal (N+U)	20	X	-.003	0	-.003
		Z	.004	0	.004
Thermal (Max.)	26	X	-.007	0	-.007
		Z	-.013	0	-.013
Thermal (Min.)	23	X	-.001	0	-.001
		Z	0	0	0
Building Settlement 1	M-CLASS 2 RUN	X	0	0	0
		Z	0	0	0
Building Settlement 2	20-CLASS 2 RUN	X	0	0	0
		Z	0	0	0
OBEA	37	X	.268	.255	.013
		Z	.249	.237	.012
SSEA (2*OBEA)		X			.026
		Z			.024
OBEI	40	X	.009	–	.009
		Z	.024	–	.024
SSEI	41	X	.017	–	.017
		Z	.042	–	.042
Dynamic OCCU	45	X	.072	–	.072
		Z	.126	–	.126
Dynamic OCCE	35	X	.074	–	.074
		Z	.126	–	.126
Dynamic OCCF	36	X	.075	–	.075
		Z	.131	–	.131

Total Relative Movements = | DWT + Ther. + Building Settlement | + OBEA + Dyanmic (OCCU/OCCE)

Or

= | DWT + Ther. + Building Settlement | + SSEA + Dyanmic (OCCF)

Notes: 1. The sign of the total relative movements must be the sign of the maximum combination of Deadweight, Thermal and Building Settlement.

2. The maximum of either equation shown above is recorded on the next page to be compared with the sleeve clearance.

X = |.005 -.001 +0| + .026 + .075 = .105"
Z = |-.012 -.013 +0| + .024 + .131 = .180"

STONE & WEBSTER ENGINEERING CORPORATION

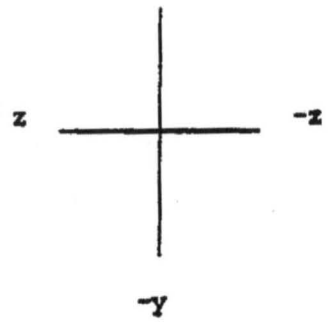
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 63
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV. 4	OPTIONAL TASK CODE	

REF.

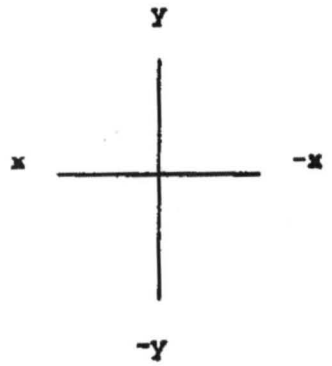
SLEEVE CLEARANCE EVALUATION

Sleeve Clearance Looking North



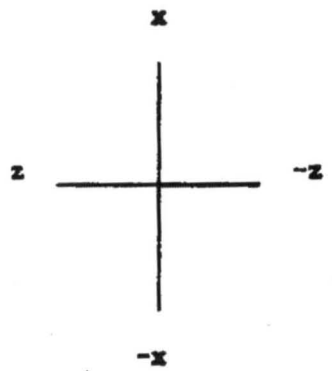
				Total Relative Movements
-z	=		=	-
z	=		=	-
y	=		=	-
-y	=		=	-

Sleeve Clearance Looking East



-x	=		=	-
x	=		=	-
y	=		=	-
-y	=		=	-

Sleeve Clearance Looking Up Facing North NODE 5



		MIN.			
-z	=	1½"	= 1.5" -	.180"	
z	=	1½"	= 1.5" -	.180"	∴ OK
x	=	2 3/8"	= 2.375" -	.105"	
-x	=	2 5/8"	= 2.375" -	.105"	

Conclusion : ∴ OK

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				64
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71 AG REV.4	OPTIONAL TASK CODE	PAGE____

REF.

SLEEVE CLEARANCE EVALUATION

NODE 71

Load Case Description	Case No.	NUPIPE Output: Pipe Deflection Dir.	NUPIPE Output: Pipe Deflection Movement	NUPIPE Input: Penetration Movement	Sum of Relative Movements
Deadweight	31	X	0	—	0
		Z	-.002	—	-.002
Thermal (N+U)	20	X	.285	0	.285
		Z	.044	0	.044
Thermal (Max.)	26	X	.767	0	.767
		Z	.207	0	.207
Thermal (Min.)	23	X	.064	0	.064
		Z	-.002	0	-.002
Building Settlement 1	19-CLASS 2 RUN	X	.019	0	.019
		Z	-.001	0	-.001
Building Settlement 2	20-CLASS 2 RUN	X	-.008	0	-.008
		Z	0	0	0
OBEA	37	X	.370	.362	.008
		Z	.307	.303	.004
SSEA (2*OBEA)		X			.016
		Z			.008
OBEI	40	X	.003	—	.003
		Z	.005	—	.005
SSEI	41	X	.006	—	.006
		Z	.010	—	.010
Dynamic OCCU	45	X	.058	—	.058
		Z	.108	—	.108
Dynamic OCCE	35	X	.058	—	.058
		Z	.108	—	.108
Dynamic OCCF	36	X	.058	—	.058
		Z	.109	—	.109

Total Relative Movements = | DWT + Ther. + Building Settlement | + OBEA + Dyanmic (OCCU/OCCE)

Or

= | DWT + Ther. + Building Settlement | + SSEA + Dyanmic (OCCF)

Notes: 1. The sign of the total relative movements must be the sign of the maximum combination of Deadweight, Thermal and Building Settlement.

2. The maximum of either equation shown above is recorded on the next page to be compared with the sleeve clearance.

$X = |0 + .767 + .019| + .016 + .058 = .860"$

$Z = |-.002 + .207 - .001| + .008 + .109 = .321"$

STONE & WEBSTER ENGINEERING CORPORATION

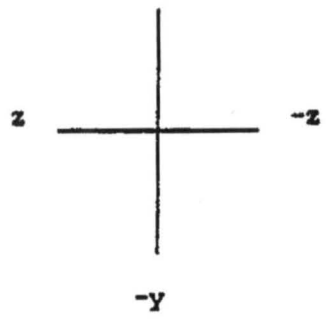
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 65
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71 AG REV.4	OPTIONAL TASK CODE	

REF.

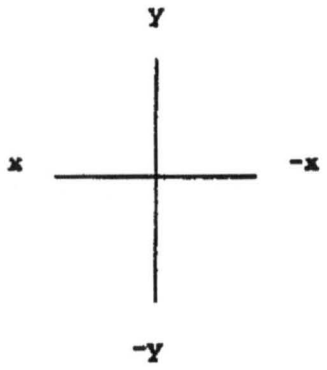
SLEEVE CLEARANCE EVALUATION

Sleeve Clearance Looking North



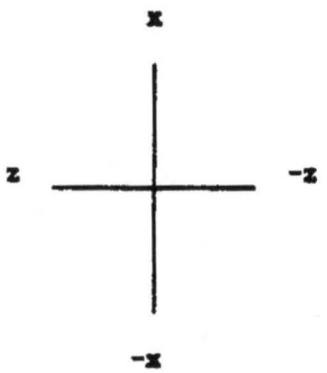
			Total Relative Movements
-z	=	=	-
z	=	=	-
y	=	=	-
-y	=	=	-

Sleeve Clearance Looking East



-x	=	=	-
x	=	=	-
y	=	=	-
-y	=	=	-

Sleeve Clearance Looking Up Facing North NODE 71



		MIN. FOR EACH DIRECTION.		
-z	=	2 3/8"	= 2.375" -	.321"
z	=	2 3/8"	= 2.375" -	.321"
x	=	1 7/8"	= 1.875" -	.860"
-x	=	1 7/8"	= 1.875" -	.860"

Conclusion : ∴ OK

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				66
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV.4	OPTIONAL TASK. CODE	PAGE

REF.

SLEEVE CLEARANCE EVALUATION

NODE 100

Load Case Description	Case No.	NUPIPE Output: Pipe Deflection Dir.	NUPIPE Output: Pipe Deflection Movement	NUPIPE Input: Penetration Movement	Sum of Relative Movements
Deadweight	31	Y	-.014	—	-.014
		Z	-.002	—	-.002
Thermal (N+U)	20	Y	.054	0	.054
		Z	.003	0	.003
Thermal (Max.)	26	Y	.118	0	.118
		Z	.003	0	.003
Thermal (Min.)	23	Y	.015	0	.015
		Z	.002	0	.002
Building Settlement 1	19-CLASS 2 RUN	Y	.004	0	.004
		Z	.0	0	0
Building Settlement 2	20-CLASS 2 RUN	Y	-.272	-.270	-.002
		Z	0	0	0
OBEA	37	Y	.195	.181	.014
		Z	.314	.313	.001
SSEA (2*OBEA)		Y			.028
		Z			.002
OBEI	40	Y	.004	—	.004
		Z	.007	—	.007
SSEI	41	Y	.008	—	.008
		Z	.013	—	.013
Dynamic OCCU	45	Y	.050		.050
		Z	.075		.075
Dynamic OCCE	35	Y	.050	—	.050
		Z	.075	—	.075
Dynamic OCCF	36	Y	.051	—	.051
		Z	.076	—	.076

$$\text{Total Relative Movements} = \left| \text{DWT} + \text{Ther.} + \text{Building Settlement} \right| + \text{OBEA} + \text{Dyanmic (OCCU/OCCE)}$$

Or

$$= \left| \text{DWT} + \text{Ther.} + \text{Building Settlement} \right| + \text{SSEA} + \text{Dyanmic (OCCF)}$$

Notes: 1. The sign of the total relative movements must be the sign of the maximum combination of Deadweight, Thermal and Building Settlement.

2. The maximum of either equation shown above is recorded on the next page to be compared with the sleeve clearance.

$Y = |-.014 + .118 + .004| + .028 + .051 = .187"$

$Z = |-.002 + .003 + 0| + .002 + .076 = .079"$

STONE & WEBSTER ENGINEERING CORPORATION

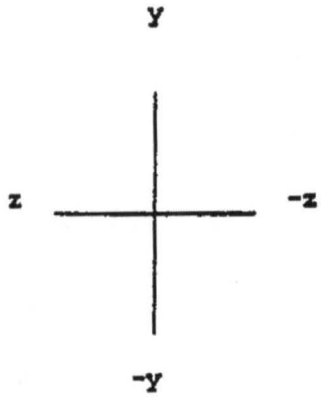
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				67
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV.4	OPTIONAL TASK CODE	PAGE

REF.

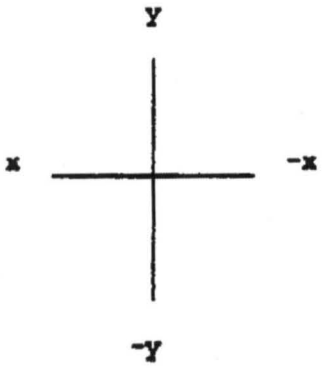
SLEEVE CLEARANCE EVALUATION

Sleeve Clearance Looking North NODE 100



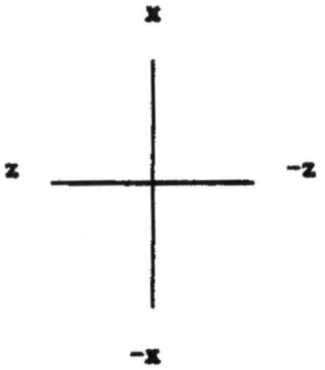
		MIN.		Total Relative Movements	
-z	=	1 5/8"	= 1.625" -	.079"	OK
z	=	1 5/8"	= 1.625" -	.079"	
y	=	1 13/16"	= 1.812" -	.187"	
-y	=	1 13/16"	= 1.812" -	.187"	

Sleeve Clearance Looking East



-x	=		= -		
x	=		= -		
y	=		= -		
-y	=		= -		

Sleeve Clearance Looking Up Facing North



-z	=		= -		
z	=		= -		
x	=		= -		
-x	=		= -		

Conclusion : ∴ OK

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				68
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV. 4	OPTIONAL TASK CODE	PAGE

REF.

SLEEVE CLEARANCE EVALUATION

NODE 395

Load Case Description	Case No.	NUPIPE Output: Pipe Deflection Dir.	NUPIPE Output: Pipe Deflection Movement	NUPIPE Input: Penetration Movement	Sum of Relative Movements
Deadweight	31	X	.010	—	.010
		Y	-.031	—	-.031
Thermal (N+U)	20	X	.078	0	.078
		Y	.004	0	.004
Thermal (Max.)	26	X	.212	0	.212
		Y	.088	0	.088
Thermal (Min.)	23	X	.035	0	.035
		Y	-.015	0	-.015
Building Settlement 1	19-CLASS 2 RUN	X	0	0	0
		Y	-.001	0	-.001
Building Settlement 2	20-CLASS 2 RUN	X	0	0	0
		Y	-.270	-.270	0
OBEA	37	X	.314	.315	-.001
		Y	-.180	.181	-.001
SSEA (2*OBEA)		X			-.002
		Y			-.002
OBEI	40	X	.020	—	.020
		Y	.062	—	.062
SSEI	41	X	.033	—	.033
		Y	.099	—	.099
Dynamic OCCU	45	X	.112	—	.112
		Y	.216	—	.216
Dynamic OCCE	35	X	.112	—	.112
		Y	.216	—	.216
Dynamic OCCF	36	X	.115	—	.115
		Y	.229	—	.229

Total Relative Movements = | DWT + Ther. + Settlement + Building | + OBEA + (OCCU/OCCE) + Dyanmic

Or

= | DWT + Ther. + Settlement + Building | + SSEA + (OCCF) + Dyanmic

Notes: 1. The sign of the total relative movements must be the sign of the maximum combination of Deadweight, Thermal and Building Settlement.

2. The maximum of either equation shown above is recorded on the next page to be compared with the sleeve clearance.

$X = |.010 + .212 + 0| + .002 + .115 = .339"$

$Y = |-.031 + .088 + 0| + .002 + .229 = .288"$

STONE & WEBSTER ENGINEERING CORPORATION

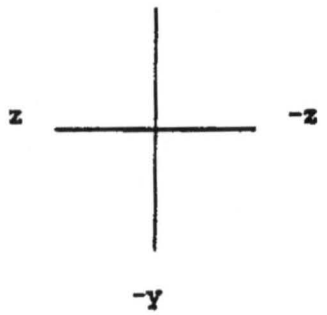
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 69
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-71AG REV. 4	OPTIONAL TASK CODE	

REF.

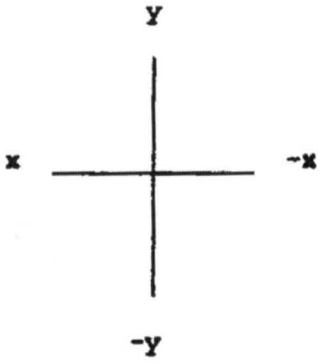
SLEEVE CLEARANCE EVALUATION

Sleeve Clearance Looking North



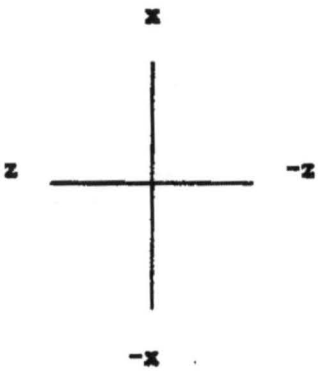
			Total Relative Movements
-z =		=	-
z =		=	-
y =		=	-
-y =		=	-

Sleeve Clearance Looking East NODE 395



	MIN.		
-x =	3¼"	= 3.25" -	.339"
x =	3¼"	= 3.25" -	.339"
y =	3"	= 3.0" -	.288"
-y =	3"	= 3.0" -	.288"

Sleeve Clearance Looking Up Facing North



-z =		=	-
z =		=	-
x =		=	-
-x =		=	-

Conclusion :

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. ATTACHMENT NO.: PAGE 70 OF

CALCULATION CHECKLIST

YES	NO	N/A	FORMAT	EDP-AA-20 SECTION
x			Cover Page completed.	6.4.1
x			Table of Contents completed (as required).	6.4.2
x			Revision History Sheet completed (as required).	6.4.3
		x	Revisions are identified with revision lines in right margin.	6.4.3
x			Applicable Documents Page completed.	6.4.4
		x	Definitions established (as required).	6.4.5
x			Calculation/revision/addendum/page numbers are identified correctly.	6.4.10
			CONTENTS	
x			Previous calculation for the required analysis exists.	6.3
x			Calculation is appropriately titled for the intended scope.	6.4.1-2
x			Purpose and scope are clearly and adequately established.	6.4.1-7, 7.1
x			Safety classification is correct for the identified scope.	6.4.1-6
x			Topics/documents/equipment for cross-reference/retrieval are identified.	6.4.1-11
x			Calculation is clear and comprehensible.	6.1
x			Applicable codes, standards, etc. are identified.	6.4.4-1
x			RBS references are identified.	6.4.4-2
x			Affected documents are identified	6.4.4-3
x			Inputs and sources are identified, appropriate, and correct.	7.2.2-1
x			Assumptions are identified and appropriate.	7.2.2-2
		x	Inputs derived from field walkdown have been witnessed/verified	7.2.2-5
x			Engineering judgments are identified and appropriate.	7.2.2-6
x			Calculation methodology is identified and supported by technical bases.	7.2.3
x			Conclusion is appropriate and is justified by calculation.	7.3
		x	Confirmations are identified and indicated as required on Cover Page.	7.5.7
		x	Directions for Confirmations are included.	7.5.7-3
x			Calculation data is appropriately included, attached, or referenced.	7.4
x			Programs and software are identified and have been verified and validated.	8.0
x			Methods/calculations use to check results are identified and included.	
x			Results are accurate and in accordance with the established methodology.	
		x	Certification by Professional Engineer is required.	11.7
			VENDOR CALCULATIONS	
		x	Calculation is performed in accordance with EDP-AA-25.	10.2
		x	Calculation content and format are acceptable.	10.2
		x	Vendor, preparer, reviewer, and approver are clearly identified.	10.3
x			Design verification review has been completed (as applicable).	

Preparer (Signature/KCN or SSN/Date): Rajni R Patel (OSC1) 6/18/97

Reviewer (Signature/KCN or SSN/Date): Lothar Kuhn (1105) 6/18/97

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. B ATTACHMENT NO.: PAGE 71 OF

REVIEWER'S CHECKLIST

Item	Calc Page	Comments	Response/Resolution

Comments Provided By			Comments Resolved By			Resolution Accepted		
Lothar Kuhn	(1105)	6/18/97						
Reviewer	KCN	Date	Preparer	KCN	Date	Reviewer	KCN	Date

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. 4 ATTACHMENT NO.: PAGE 72 OF

Design Verification Record

Document No. AX-71AG, Rev. 4

METHOD

Verification methods to be used:

X **Design Review**

_____ **Qualification Testing**

_____ **Alternate Calculations**

DOCUMENT(S) REVIEWED: (Attach Additional Sheet(s), if needed)

Document No.	Revision	Document Title
AX-71AG	4	Pipe Stress Analysis for ICS Injection (added through EWS system per EMR 96-0069.

SUMMARY OF REVIEW: (Attach Additional Sheet(s), if needed)

Acceptable as is.

Design Verification Completed By Lothar Kuhn (1105) Date 6/18/97

Comments Resolution Accepted By _____ Date _____

Engineering Supervisor Rajesh Gupta Date 11-20-97

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-71AG, Rev. 4A
ATTACHMENT NO.: (as required)
JBI NO.: G13.10.2.2
PAGE 1 OF 6

Title: Pipe Stress Analysis For ICS Function Added Through FWS System Per MR96-0069

CALCULATION STATUS: ☐ APPROVED ■ PENDING ON IMPLEMENTATION OF MR 96-0069 ☐ CANCELED ☐ PENDING ON CONFIRMATIONS

SYSTEM NO.: 107/FWS | MARK NO.: RHS-010-065-2

CLASSIFICATION: ■ SAFETY RELATED NON-SAFETY RELATED: ☐ QAPA ☐ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

To qualify the welding tee due to a reduction in the wall thickness which was required for final fit up during construction.

CONCLUSION:

The piping remains within the code allowables.

SOFTWARE USED FOR CALCULATION: ☐ YES ■ NO SDDF #: _____
Manufacturer: _____ Name_____ Version/Release No. ___

KEYWORDS:

FWS, ICS

Licensing/Design Basis Impact
■ Addressed in DCA No. MR 96-0069
☐ Licensing/Design Basis Impact Checklist included
☐ None - Reason: _____

REVIEW & APPROVAL

B. Lanka 4-15-99	Tarika Tarabia 5/3/99	Rajesh Gupta 5-3-99
Brian Lanka, KCN 1311	(Signature/Date)	(Signature/Date)
Preparer	☐ Reviewer (Non-Safety)	Supervisor
	☒ Design Verification Reviewer	(Printed Name, KCN, or SSN)
	(Printed Name, KCN, or SSN)	RAJESH GUPTA, 1059

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. 4A ATTACHMENT NO.: (as required) JBI NO.: G13.10.2.2 PAGE 2

REVISION HISTORY

Revision No.	Paragraph No.	Description of Change
4A		To qualify the welding tee due to a reduction in the wall thickness during final fit up during construction.

ENTERGY

CALCULATION
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-71AG, Rev. 4A
ATTACHMENT NO.: (as required)
JBI NO.: G13.10.2.2
PAGE 3

REFERENCE DOCUMENTATION

I. Control Document Cross References (Page four of NORMS): Other Calculations, Procedures, Drawings, etc. Identify how documents are affected.

			EFFECT (Check One)			
DOC. NO.(Control Xrefs)	**REV. NO.**	**TYPE**	Supplemented	Superseded	Voided	Reference Only
1. AX-71AG	4	CALCSW	X			

II. Record Cross References (Page five of NORMS): RBS change documents, ERs, MRs, Calculation Addenda, etc. Identify how documents are affected.

			EFFECT (Check One)			
RECORD NO. (Rec Xref)	**REV NO**	**TYPE**	Supplemented	Superseded	Voided	Reference Only
1. MR96-0069	0	MR				X

III. Miscellaneous References (Misc Ref): Applicable codes, standards, & references (non-RBS):

1. ASME B &PV Code, 1974 Edition.
2. NAVCO Piping Datalog, 10th Edition.

ENTERGY

CALCULATION WORK SHEET
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-71AG, Rev. 4A
ATTACHMENT NO.: (as required)
JBI NO.: G13.10.2.2
PAGE 4

Calculation:

During installation of the 10" welding tee (sch 160) at node point X98, the ends had to be machined to schedule 120 to allow proper fit up to pipe line RHS-010-065-2 (Sch 120).

This tee was modeled and designed as a sch. 160 tee. The ME101 analysis (Ref. I.1) considered the tee to be schedule 160. For the tee to be welded to the pipe, the ends had to be machined to sch 120. This calculation will qualify the tee stress as if it was schedule 120, which is conservative. Since only the thickness of the end of the tee is reduced, the change in weight will be negligible.

Design Input:

Properties are per Ref. III.2.

Pipe Size	Schedule	Thickness	r – mean radius
10"	120	0.843"	4.9535"
10"	160	1.125"	4.8125"

Pipe Stress

The reduction in wall thickness affects mechanical stress and pressure stress. Pressure stress is calculated by P D / 4 t and mechanical stress is calculated by i M / z

By changing the thickness from 1.125" to 0.843" the pressure stress will increase 1.125 / 0.843 or 33%. The mechanical stress is calculated by i M / Z. Per NC-3652.4, $Z = \pi r^2 t$. Where r is the mean radius. Thus

$Z\ 120 = \pi (4.9535)^2 (0.843) = 65.0\ in^3$

$Z\ 160 = \pi (4.8125)^2 (1.125) = 81.9\ in^3$

Thus, the section modulus will change by 81.9 / 65 or 26%. The change in thickness will also affect the SIF for a welding tee. Per Ref. III.1, $SIF = 0.9 / (4.4\ t / r)^{.667}$ Thus

$SIF\ 120 = 0.9 / (4.4 * 0.843 / 4.9535)^{.667} = 1.09$
$SIF\ 160 = 0.9 / (4.4 * 1.125 / 4.8125)^{.667} = 0.88 = 1.00$ Since the SIF can not be less than 1.00.

Thus the mechanical stress will increase by 1.09 * 1.26 = 1.37. This value envelops the pressure stress term and will conservatively be used to increase the equation stresses. Existing stresses per Ref. I.1.

Equation	Node	Existing Stress (Psi)	New Stress (1.37 * Existing Stress)	Allowable	Margin
Equation 8	X99-X97	4209	5766	15000	0.38
Equation 9B	X99-X97	6185	8473	18000	0.47
Equation 9C	X99-X97	6196	8489	27000	0.31
Equation 9D	X99-X97	6241	8550	36000	0.24
Equation 10	X99-X97	5269	7219	22500	0.32
High Energy Eq 9B + 10	Not Applicable per Ref. I.1				

∴ Pipe stresses are within their allowables.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. 4A ATTACHMENT NO.: (as required) JBI NO.: G13.10.2.2 PAGE 5

CALCULATION CHECKLIST

YES	NO	N/A	FORMAT	EDP-AA-20 SECTION
X			Cover Page completed.	6.4.1
		X	Table of Contents completed (as required).	6.4.2
X			Revision History Sheet completed (as required).	6.4.3
		X	Revisions are identified with revision lines in right margin.	6.4.3
X			Applicable Documents Page completed.	6.4.4
		X	Definitions established (as required).	6.4.5
X			Calculation/revision/addendum/page numbers are identified correctly.	6.4.10
			CONTENTS	
X			Previous calculation for the required analysis exists.	6.3
X			Calculation is appropriately titled for the intended scope.	6.4.1-2
X			Purpose and scope are clearly and adequately established.	6.4.1-7, 7.1
X			Safety classification is correct for the identified scope.	6.4.1-6
X			Topics/documents/equipment for cross-reference/retrieval are identified.	6.4.1-11
X			Calculation is clear and comprehensible.	6.1
X			Applicable codes, standards, etc. are identified.	6.4.4-1
X			RBS references are identified.	6.4.4-2
X			Affected documents are identified	6.4.4-3
X			Inputs and sources are identified, appropriate, and correct.	7.2.2-1
X			Assumptions are identified and appropriate.	7.2.2-2
		X	Inputs derived from field walkdown have been witnessed/verified	7.2.2-5
X			Engineering judgments are identified and appropriate.	7.2.2-6
X			Calculation methodology is identified and supported by technical bases.	7.2.3
X			Conclusion is appropriate and is justified by calculation.	7.3
		X	Confirmations are identified and indicated as required on Cover Page.	7.5.7
		X	Directions for Confirmations are included.	7.5.7-3
X			Calculation data is appropriately included, attached, or referenced.	7.4
		X	Programs and software are identified and have been verified and validated.	8.0
		X	Methods/calculations use to check results are identified and included.	
X			Results are accurate and in accordance with the established methodology.	
		X	Certification by Professional Engineer is required.	11.7
			VENDOR CALCULATIONS	
		X	Calculation is performed in accordance with EDP-AA-20.	10.2
		X	Calculation content and format are acceptable.	10.2
		X	Vendor, preparer, reviewer, and approver are clearly identified.	10.2
		X	Design verification review has been completed (as applicable).	

Preparer (Signature/KCN or SSN/Date): B-11 4-15-99 (1311)

Reviewer (Signature/KCN or SSN/Date): Camilo Cuadra 5/3/99 (0969)

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-71AG, Rev. 4A ATTACHMENT NO.: (as required) JBI NO.: G13.10.2.2 PAGE 6

Design Verification Record

Document No. AX-71AG, Rev. 4A

METHOD

Verification methods to be used:

X **Design Review**

_____ **Qualification Testing**

_____ **Alternate Calculations**

DOCUMENT(S) REVIEWED: (Attach Additional Sheet(s), if needed)

Document No.	Revision	Document Title
AX-71AG,	4A	

SUMMARY OF REVIEW: (Attach Additional Sheet(s), if needed)

Acceptable as is.

Design Verification Completed By Tanik Tandra (0969) Date 5/3/99

Comments Resolution Accepted By _____ Date _____

Engineering Supervisor Rajesh Gupta / 5-3-99 / KCN 1059 Date 5-3-99

ENTERGY

Record Revision Notice

Department DE	Document No. AX-71AG Rev 4A		Page 1 of 2
JBIX No.	6-22-99 04/15/99 Revision/Date	13033740 FileNet Location	(ASG Use Only) 3/19/99 AS99-0820 Batch/Transmittal - Item No.

Revision Description

Change the status of the calculation from Pending to Approved.

Reason For Revision

MR96-0069 was implemented during RF-08.

Approvals:

Originator [signature] KCN: 1389 Date 6/22/99

Section Supervisor [signature] KCN 0658 Date 6/24/99

page 2 of 2

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-71AG, Rev. 4A
ATTACHMENT NO.: (as required)
JBI NO.: G13.10.2.2
PAGE 1 OF 6

Title: Pipe Stress Analysis For ICS Function Added Through FWS System Per MR96-0069

CALCULATION STATUS: 6/22/99 1389 ☐ APPROVED ~~■ PENDING ON IMPL~~EMENTATION OF MR 96-0069 ☐ CANCELED
☐ PENDING ON CONFIRMATIONS

SYSTEM NO.: 107/FWS | MARK NO.: RHS-010-065-2

CLASSIFICATION: ■ SAFETY RELATED NON-SAFETY RELATED: ☐ QAPA ☐ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

To qualify the welding tee due to a reduction in the wall thickness which was required for final fit up during construction.

CONCLUSION:

The piping remains within the code allowables.

SOFTWARE USED FOR CALCULATION: ☐ YES ■ NO SDDF #: _____
Manufacturer: _____ Name_____ Version/Release No. ____

KEYWORDS:

FWS, ICS

Licensing/Design Basis Impact
■ Addressed in DCA No. MR 96-0069
☐ Licensing/Design Basis Impact Checklist included
☐ None - Reason: _____

REVIEW & APPROVAL

B. Lanka 4-15-99	Camilo Tarazona 5/3/99	Rajesh Gupta 5-3-99
Brian Lanka, KCN 1311	(Signature/Date)	(Signature/Date)
Preparer	☐ Reviewer (Non-Safety)	Supervisor
	☒ Design Verification Reviewer	(Printed Name, KCN, or SSN)
	(Printed Name, KCN, or SSN)	RAJESH GUPTA, 1059

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - AX-76A Rev. 3E
ATTACHMENT NO.:
JBI NO.: G13.10.2.2
PAGE 1 OF 9

TITLE:
Stress Analysis for ICS Piping in the Reactor Building per MR 96-0069

SUPERSEDES: N/A
SUPPLEMENTS: AX-76A Rev. 3

CALCULATION STATUS: ☐ APPROVED ■ PENDING ☐ CANCELED

SYSTEM NO.: 209 | **MARK NO.:**

CLASSIFICATION: ■ SAFETY RELATED | **NON-SAFETY RELATED:** ☐ QAPA ☐ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

To document the changes implemented by MR 96-0069. This MR re-routes the RCIC injection from the reactor vessel head to the feedwater nozzle. As a result of this changes, line ICS-006-6-1 is removed and ICS-006-57-1 is downgraded to ASME class 2 and abandoned in place.

CONCLUSION:

The changes implemented by MR 96-0069 are acceptable. The removal of line ICS-006-6-1 reduces the loads on the RPV head nozzle and the Drywell Bellows Penetration DRB*Z130. Likewise, the abandonment of ICS-006-57-2 greatly reduces the stress acting on the piping and the support loads acting on penetration DRB*Z130, penetration KJB*Z19, and pipe supports. Therefore, the piping systems analyzed by this calculation remain within the allowables of the ASME Section III Code .

SOFTWARE USED FOR CALCULATION: ☐ YES ☐ NO SDDF #: N/A
Manufacturer: _____ Name _____ Version/Release No. ____

CONFIRMATIONS REQUIRED: ☐ YES ■ NO | **CONFIRMATION COMPLETE:** ☐ YES ☐ NO ☐ N/A

KEYWORDS:

ICS, MR 96-0069, RCIC

REVIEW & APPROVAL

Preparer	Reviewer	Supervisor
Camilo Cuadra 6-15-97	Rajni K Patel (O&I) 6/16/97	Rajesh Gupta 11-19-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
Camilo Cuadra, KCN 0969	☐ Reviewer (Non-Safety) ☒ Design Verification Reviewer (Printed Name, KCN, or SSN)	(Printed Name, KCN, or SSN) RAJESH GUPTA, 1059

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76A Rev. 3E ATTACHMENT NO.: JBI NO.: PAGE 2 OF

Pipe Stress Analysis for ICS in the Reactor Building per MR 96-0069

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Total Pages: 9

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Pipe Stress Analysis for ICS in the Reactor Building per MR 96-0069

REVISION HISTORY

Revision No.	Paragraph No.	Description of Change
3A	All	Per MR 96-0069, the piping is rerouted through the RHR system. As a result of this change, the piping in this calculation is either removed or abandoned in place.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76A Rev. 3E ATTACHMENT NO.: JBI NO.: PAGE 4 OF

Pipe Stress Analysis for ICS in the Reactor Building per MR 96-0069

APPLICABLE DOCUMENTS

I. APPLICABLE CODES, STANDARDS, & REFERENCES (NON-RBS):

1. ASME Boiler & Pressure Vessel Code, Section III, Division 1, 1974 Edition

II. RBS REFERENCES:

1. MR 96-0069

III. AFFECTED DOCUMENTS:

DOC. NO.	REV. NO.	DOCUMENT TITLE	AFFECT (Superseded, Revised, Initiated, etc.)	CHANGE DOC.
Z-76-3009A	0	Pipe Support Calculation	VOID	MR 96-0069
Z-76-3009A	0A	Pipe Support Calculation	VOID	MR 96-0069
Z-76-3012A	0	Pipe Support Calculation	VOID	MR 96-0069
Z-76-3012A	0A	Pipe Support Calculation	VOID	MR 96-0069
Z-76-3023A	0	Pipe Support Calculation	VOID	MR 96-0069
Z-76-3023A	0A	Pipe Support Calculation	VOID	MR 96-0069
12210-N-SR-140	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-143	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-153	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-144	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-145	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-146	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-147	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-148	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-149	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-150	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-151	1A	Support Stress Report	REVISED	MR 96-0069
12210-N-SR-155	1A	Support Stress Report	REVISED	MR 96-0069
AX-002H	3C	Pipe Stress Calculation	GENERATED	MR 96-0069

ENTERGY

CALCULATION WORK SHEET
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
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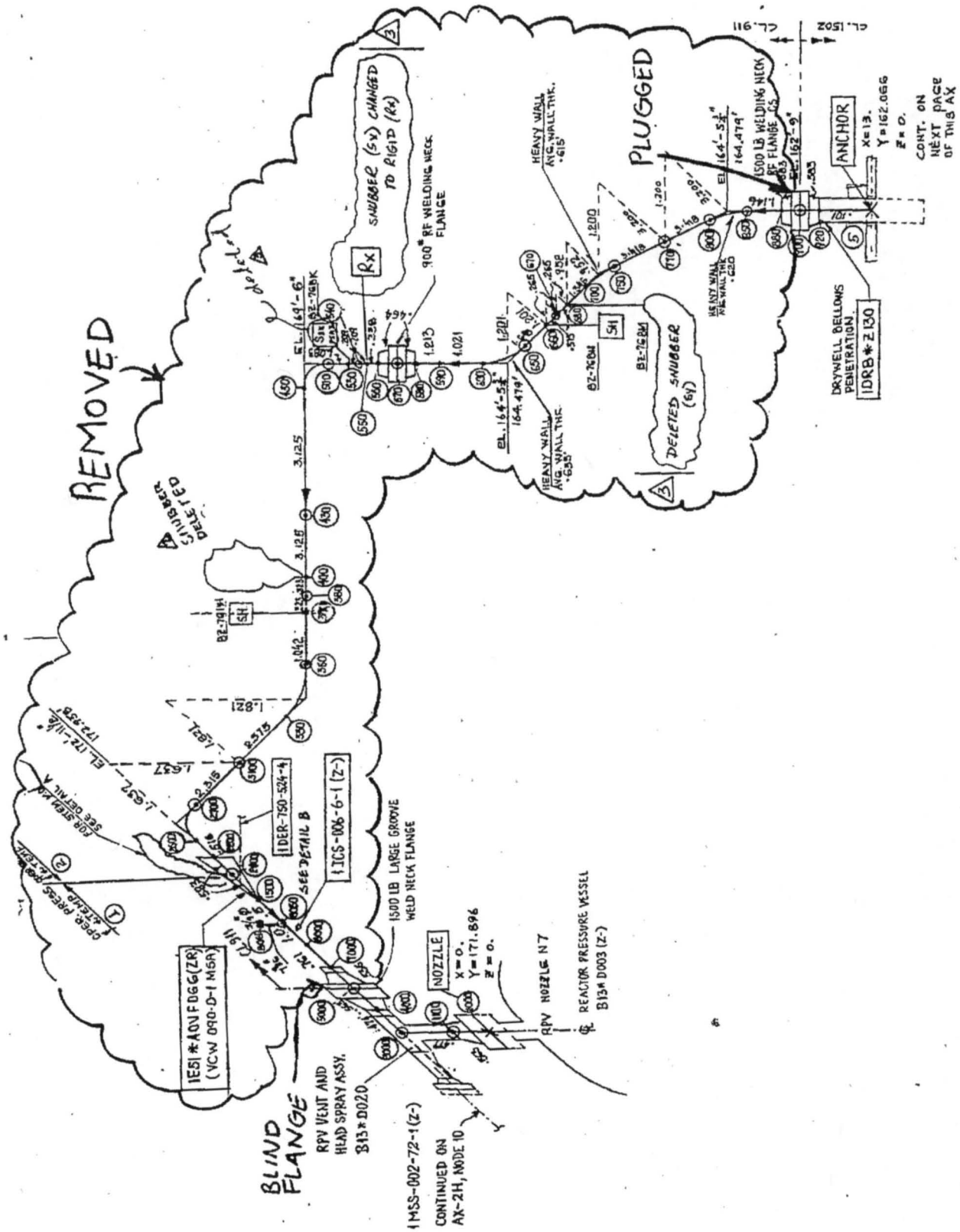
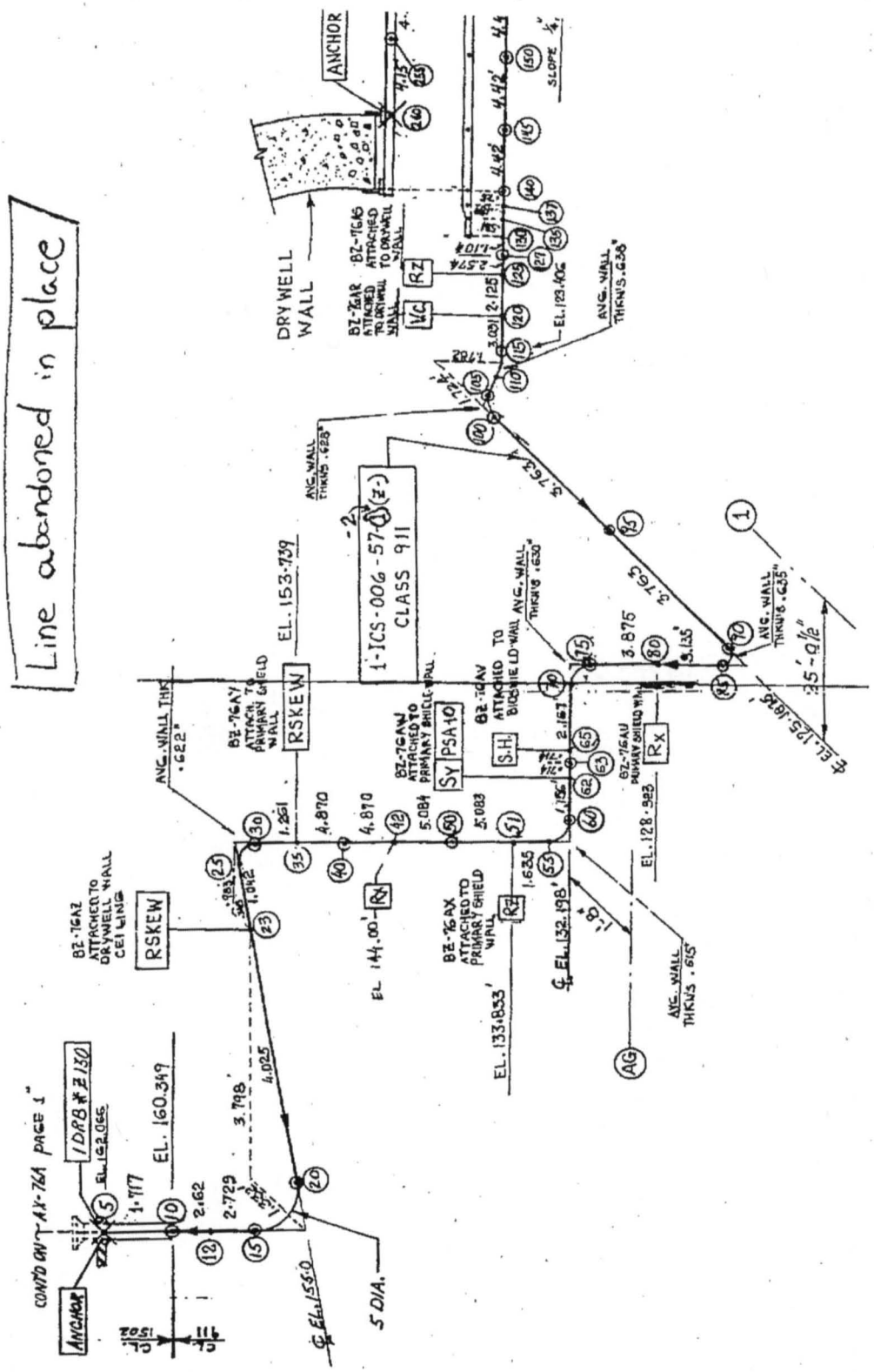


ENTERGY	CALCULATION WORK SHEET ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76A Rev. 3E ATTACHMENT NO.: JBI NO.: PAGE 6 OF



ENTERGY

CALCULATION WORK SHEET
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
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CALCULATION DETAILS

MR 96-0069 re-outes the RCIC Injection Point from the Reactor Head Spray connection to the A Loop of Feedwater via RHR piping. As a result of this change, pipe line ICS-006-6-1 (Z-) is removed from the RPV vent and head spray assembly to the drywell bellows penetration DRB*Z130. The flange at the RPV assembly is replaced by a blind flange, and the flange at DRB*Z130 replaced by plug as shown in the isometrics. Pipe supports associated with this pipe are removed. See isometrics. The remaining line ICS-006-57-2 (Z-) from DRB*Z130 to penetration 1KJB*Z19 is abandoned in place.

The abandoned pipe, ICS-006-57-1(Z-), will be empty and capped at both ends which results in a considerable reduction in dead weight and nullification of the thermal and fluid transient loads. Therefore, the structural integrities of the piping, the pipe supports, and the penetrations are assured. The pipe supports associated with this line are downgraded to Class 2.

Removal of ICS-006-6-1 (Z-) eliminates the loads on one side of the RPV vent and head spray assembly. Line MSS-002-72-1(Z-) connected to the other side of the assembly is not affected by MR 96-0069. Thus, RPV nozzle N7 is now solely qualified in AX-2H. Since the total load acting on the nozzle is reduced, the nozzle remains qualified.

The following table lists the pipe supports affected by this MR:

Support No.	Change
ICS*PSSH-3009-A1	Removed
ICS*PSSH-3023-A1	Removed
ICS*PSSP-3012-A1	Removed
ICS-PSR-3013-A2	Downgraded to class 2
ICS-PSR-3014-A2	Downgraded to class 2
ICS-PSSH-3017-A2	Downgraded to class 2
ICS-PSSP-3018-A2	Downgraded to class 2
ICS-PSST-3016-A2	Downgraded to class 2
ICS-PSST-3019-A2	Downgraded to class 2
ICS-PSST-3020-A2	Downgraded to class 2
ICS-PSST-3021-A2	Downgraded to class 2
ICS-PSST-3027-A2	Downgraded to class 2

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76A Rev. 3E ATTACHMENT NO.: JBI NO.: PAGE 8 OF

CALCULATION CHECKLIST

YES	NO	N/A	FORMAT	EDP-AA-20 SECTION
X			Cover Page completed.	6.4.1
X			Table of Contents completed (as required).	6.4.2
X			Revision History Sheet completed (as required).	6.4.3
		X	Revisions are identified with revision lines in right margin.	6.4.3
X			Applicable Documents Page completed.	6.4.4
		X	Definitions established (as required).	6.4.5
X			Calculation/revision/addendum/page numbers are identified correctly.	6.4.10
			CONTENTS	
X			Previous calculation for the required analysis exists.	6.3
X			Calculation is appropriately titled for the intended scope.	6.4.1-2
X			Purpose and scope are clearly and adequately established.	6.4.1-7, 7.1
X			Safety classification is correct for the identified scope.	6.4.1-6
X			Topics/documents/equipment for cross-reference/retrieval are identified.	6.4.1-11
X			Calculation is clear and comprehensible.	6.1
		X	Applicable codes, standards, etc. are identified.	6.4.4-1
X			RBS references are identified.	6.4.4-2
X			Affected documents are identified	6.4.4-3
X			Inputs and sources are identified, appropriate, and correct.	7.2.2-1
X			Assumptions are identified and appropriate.	7.2.2-2
		X	Inputs derived from field walkdown have been witnessed/verified	7.2.2-5
		X	Engineering judgments are identified and appropriate.	7.2.2-6
X			Calculation methodology is identified and supported by technical bases.	7.2.3
X			Conclusion is appropriate and is justified by calculation.	7.3
		X	Confirmations are identified and indicated as required on Cover Page.	7.5.7
		X	Directions for Confirmations are included.	7.5.7-3
		X	Calculation data is appropriately included, attached, or referenced.	7.4
		X	Programs and software are identified and have been verified and validated.	8.0
		X	Methods/calculations use to check results are identified and included.	
X			Results are accurate and in accordance with the established methodology.	
			Certification by Professional Engineer is required.	11.7
			VENDOR CALCULATIONS	
			Calculation is performed in accordance with EDP-AA-25.	10.2
			Calculation content and format are acceptable.	10.2
			Vendor, preparer, reviewer, and approver are clearly identified.	10.3
X			Design verification review has been completed (as applicable).	

Preparer (Signature/KCN or SSN/Date):
Camilo Cuadra (0969) 6-12-97

Reviewer (Signature/KCN or SSN/Date):
Rajni R Patel (0561) 6-12-97

(LAST)

ENTERGY	ATTACHMENT I Page 1 of 2	ES-P-002-00
	Typical Design Verification Record	

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Document Number AX-76A Revision 3E

METHOD

Verification methods to be used:

X	Design Review
	Qualification Testing
	Alternate Calculations

DOCUMENT(S) REVIEWED: (Attach Additional Sheet(s), if needed)

Document Number	Revision	Document Title
AX-76A	3E	Pipe Stress Analysis for ICS in the Reactor Bldg. per MR 96-0069

SUMMARY OF REVIEW: (Attach Additional Sheet(s), if needed)

Design Verification Completed By Rajan R Patel (0861) Date: 6/16/97

Comment Resolutions Accepted By _____ Date: _____

Engineering Supervisor Rajesh Gupta (1059) Date: 11-19-97

ENTERGY

Record Revision Notice

ENGMSYS Department	AX-076A - ADDE Document No.		Page 1 of 2
G13.10.2.2 JBIX No.	3E/11/19/97 Revision/Date	11665084 FileNet Location	(ASG Use Only) 510056 ASG98-0558 Batch/Transmittal - Item No.

Revision Description

Change calculation / addendum status from pending to approved.

Reason For Revision

MR 96-0069 has been installed.

Approvals:

Melissa L. Litherland 1240 — 6/23/99

Originator — Date

Section Supervisor — 0658 — 6/23/99

Date

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. -
AX-76A Rev. 3E
ATTACHMENT NO.:
JBI NO.: G13.10.2.2
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TITLE:
Stress Analysis for ICS Piping in the Reactor Building per MR 96-0069

SUPERSEDES: N/A
SUPPLEMENTS: AX-76A Rev. 3

CALCULATION STATUS: ☒ APPROVED ■ PENDING mm 6/23/99 ☐ CANCELED

SYSTEM NO.: 209 | MARK NO.:

CLASSIFICATION: ■ SAFETY RELATED | NON-SAFETY RELATED: ☐ QAPA ☐ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

To document the changes implemented by MR 96-0069. This MR re-routes the RCIC injection from the reactor vessel head to the feedwater nozzle. As a result of this changes, line ICS-006-6-1 is removed and ICS-006-57-1 is downgraded to ASME class 2 and abandoned in place.

CONCLUSION:

The changes implemented by MR 96-0069 are acceptable. The removal of line ICS-006-6-1 reduces the loads on the RPV head nozzle and the Drywell Bellows Penetration DRB*Z130. Likewise, the abandonment of ICS-006-57-2 greatly reduces the stress acting on the piping and the support loads acting on penetration DRB*Z130, penetration KJB*Z19, and pipe supports. Therefore, the piping systems analyzed by this calculation remain within the allowables of the ASME Section III Code.

SOFTWARE USED FOR CALCULATION: ☐ YES ☐ NO SDDF #: N/A
Manufacturer: _____ Name _____ Version/Release No. ____

CONFIRMATIONS REQUIRED: ☐ YES ■ NO | CONFIRMATION COMPLETE: ☐ YES ☐ NO ☐ N/A

KEYWORDS:

ICS, MR 96-0069, RCIC

REVIEW & APPROVAL

Camilo Cuadra 6-15-97	Rajesh R Patel (O&I) 6/16/97	Rajesh Gupta 11-19-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
Preparer	☐ Reviewer (Non-Safety)	Supervisor
Camilo Cuadra, KCN 0969	☒ Design Verification Reviewer	(Printed Name, KCN, or SSN)
	(Printed Name, KCN, or SSN)	RAJESH GUPTA, 1059

ENTERGY

CALCULATION COVER PAGE
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-76B, Rev. 1H
ATTACHMENT NO.:
347
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TITLE: Pipe Stress Analysis for ICS-006-7-2 (abandoned in place) in the Auxiliary Building per MR 96-0069

SUPERSEDES: AX-76B R/1 incl addenda ~~B~~ (C.N.)

SUPPLEMENTS: 6/11/98 1223

CALCULATION STATUS: ☐ APPROVED ☒ PENDING ☐ CANCELED

SYSTEM NO.: 204, 209 | **MARK NO.:**

CLASSIFICATION: ☒ SAFETY RELATED | **NON-SAFETY RELATED:** ☐ QAPA ☒ NON-QAPA

PURPOSE / SCOPE / OBJECTIVE:

MR 96-0069 reroutes the RCIC Injection line from its original connection to the RPV Head to the FWS system through a short portion of the RHS piping RHS-010-65-2. The objective of this revision is to evaluate the abandoned pipe ICS-006-7-2 (downgraded from Class 1 to 2) in place. This piping has no function and it is not removed due to ALARA purpose. The piping is cut near an elbow as shown on isometric. The piping is to be evaluated for the applicable dynamic load cases only to meet Class 2 requirements. The supports, penetration, valves, and other piping components do not need evaluation because they are qualified with thermal, fluid transients, and all dynamic load cases in the previous revisions.

RECEIVED
JUN 12 1998
SDC

CONCLUSION:

This analysis demonstrates that the piping system is within acceptable design limits of ASME Section III Code for changes implemented by MR 96-0069.

SOFTWARE USED FOR CALCULATION: ☒ YES ☐ NO **SDDF #:** 6229.400-100-001A

Manufacturer: Bechtel **Name** ME101 **Version/Release No.** N4

CONFIRMATIONS REQUIRED: ☐ YES ☒ NO | **CONFIRMATION COMPLETE:** ☐ YES ☐ NO ☒ N/A

KEYWORDS: *pipe, stress calculation, MR 96-0069*

REVIEW & APPROVAL

Preparer	Reviewer / Design Verification Reviewer	Supervisor
Rajni R Patel 6/18/97	Camilo Cuadra 6/18/97	Rajesh Gupta 11-19-97
(Signature/Date)	(Signature/Date)	(Signature/Date)
(Printed Name, KCN, or SSN)	☐ Reviewer (Non-Safety)	
Rajni R. Patel (0861)	~~☒~~ Design Verification Reviewer	Rajesh Gupta (1059)
	Camilo Cuadra (0969)	

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. REV. ADDENDUM AX-76B, Rev. 1H ATTACHMENT NO.: PAGE 2 OF

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ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76B, Rev. 1H ATTACHMENT NO.: PAGE 3 OF

REVISION HISTORY

Revision No.	Paragraph No.	Description of Change
2	All	ICS function is added to FWS System through RHR per MR 96-0069. Rev 2 of this calculation qualifies the abandoned pipe ICS-006-7-2 from penetration Z-19 to NP 87-88 (downgraded from Class 1 to Class 2). All design input and results are documented in their appropriate section.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76B, Rev. 1H ATTACHMENT NO.: PAGE 4 OF

APPLICABLE DOCUMENTS

I. APPLICABLE CODES, STANDARDS, & REFERENCES (NON-RBS):

1. ASME Boiler and Pressure Vessel Code, Section III, 1974 edition with addenda through Summer 1974.
2. ME101 Version N4 Pipe Stress Analysis Computer Program.
3. Piping Design and Engineering by ITT Grinnel Industrial Piping, Inc. Fifth Edition.

II. RBS REFERENCES:

1. EDS-ME-014, "Pipe Stress Analysis and Pipe Support Design Standard".
2. Specification No. 228.000, Rev. 1H "Piping Engineering and Design".
3. Design Criteria No. 228.010, "Pipe Stress and Pipe Support Design Criteria" dated 6-25-84.
4. CHOC-EMTR 605-0, "Procedure for Qualification of Flanged Joints for ASME III, Class 1, 2, and 3 Piping Systems"
5. Environmental Design Criteria S&W Document No. 215.150, Rev. 1H, Dated July 6, 1986.
6. Calculation G13.18.1.5*08, Rev. 1, "Peak Spread ARS for Seismic Events Including Curves with N-411-1 Damping".
7. CHOC-EMDM-81-08, "Valve Modeling Procedure" dated December 11, 9181
8. LEM-34, "Frequencies and Acceptable Accelerations for Valve Qualification"
9. Calculation RBI-EQ-416, "Valve Modeling and Acceptable Accelerations"
10. Line Designation Table Change Notice - LDTCN No.: 97-ICS-01
11. PICL Change No.: AP-76-01
12. CHOC-EMTR-601, "Design and Installation of Seismic Small Bore Piping, Instrumentation Tubing & Supports for River Bend", dated Sept. 1980
13. Calculation 12210 NP(C)-PX-SB-316-0, "Pipe Stress Calc. for Vent, Drain & Instrument Connections", dated 1/7/83.
15. Calculation PX-334, Rev. 1H, "1/2 SSE Structural Seismic Displacements Data and Input Procedure for Piping Analysis" dated July 18, 1984,
16. Calculation PX-462, Rev. 0, "Structural Displacements Due to Thermal Expansion" dated April 9, 1976,
17. DEM-1900, "Stress Analysis of Large Bore Piping and Pipe Supports for Jet Impingement Loads", dated 12-17-84
18. CHOC-EMDM-82-20, "Stress Intensification Factors for Reduced Outlet Branch Connections", dated 11-12-82.

ENTERGY

CALCULATION
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-76B, Rev. 1H
ATTACHMENT NO.:
PAGE 5 OF

APPLICABLE DOCUMENTS

II. RBS REFERENCES:

19. DEM-P-4335, IOC from G. Martino/K. Basu to D. Christodoulou/D. Bhargava, "Model of Valve 1E51*AOVF065," dated 11-19-84.

20. AX-76B including all addendums

III. AFFECTED DOCUMENTS:

DOC. NO.	REV. NO.	DOCUMENT TITLE	AFFECT (Superseded, Revised, Initiated, etc.)	CHANGE DOC.
SR122	0A	Pipe Support Stress Report	Revised	MR 96-0069
SR126	0A	Pipe Support Stress Report	Revised	MR 96-0069
SR127	0A	Pipe Support Stress Report	Revised	MR 96-0069
SR128	0A	Pipe Support Stress Report	Revised	MR 96-0069
SR132	0A	Pipe Support Stress Report	Revised	MR 96-0069

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 6 OF

OBJECTIVE

MR 96-0069 reroutes the RCIC Injection Line from its original connection to the RPV Head to the FWS system through a short portion of the RHS piping RHS-010-65-2. Since some of the original ICS-006-7-1 piping beyond the diversion point is left in place and has been downgraded to ASME Class 2. The objective of Revision 2 of this calculation is to evaluate the abandoned piping ICS-006-7-2 from containment penetration Z-19 to the capped near elbow after the horizontal restraint PSST-2071A1 (BZ-76AN) at NP 90 as shown on isometric.

The ICS piping was originally analyzed for thermal, fluid transients, dynamic and hydrodynamic load cases because it was connected to the containment penetration Z-19. The abandoned pipe in place is not functional; therefore, there is no water weight, and fluid transients associated with this piping. Only dynamic and hydrodynamic load cases are applicable to demonstrate the structural integrity of piping is maintained for this piping.

There are no support configuration change. Supports are qualified while the piping is operational. Since the piping is not going to experience any thermal, fluid transient loads, the original support design is adequate and no further analysis is required.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 7 OF

METHOD OF ANALYSIS

ME101

The abandoned piping in place is unsupported at free end; however, the support configuration is adequate to provide supports to maintain the structural integrity of piping during seismic and LOCA events. To demonstrate the piping system is within the ASME code requirements, the piping was analyzed by ME101, Version N4 using only the dynamic and hydrodynamic load cases.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 8 OF

CONCLUSION

The completed analysis shows that the stresses and reactions on the subject piping are within acceptable limits in accordance with the requirements of the ASME Section III Code.

Functional capability evaluation is not performed because the piping is abandoned in place and is not functional.

Stresses on vents, drains, and test connections are within acceptable limits per calculation PX-SB-316.

Sleeve clearances are adequate.

Penetration Z-19 loads are reduced due to deletion of thermal and fluid transients load cases. Therefore, the previous revision loads are still valid and are acceptable. New analysis is not required.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 9 OF

NOTES

1. The Coordinate system for all data expressed in the global system is defined as follows:

   (-X) Is plant "called north" per piping drawing

   (Y) Is vertical "up"

   (Z) According to right hand rule

   The local system for straight piping members is defined as follows:

   (X) Is along the axis of the pipe, positive in the direction of coding.

   (Y) In the plane of the local X-Axis and the global +Y-Axis unless the local X-Axis is aligned with the global Y-Axis; then the local Y-Axis will be parallel to the global X-Axis.

   (Z) According to right hand rule.

2. Forces and moments on restraints, supports, and equipment are those imposed by the piping systems (i.e., actions, not reactions).

3. Unless otherwise noted, forces and moments reported at an inline anchor represent the total forces and moments acting upon that anchor considering contributions from piping on all sides of that anchor. Reactions reported on terminal anchors are due to piping shown in this report only. For total reactions, values must be combined with those from continuation summaries.

4. Unless otherwise indicated, stresses at intersections have assumed an unreinforced branch Connection.

5. Intersection reinforcement requirements indicated in this AX are based on mechanical loads only. No pressure reinforcement has been calculated or considered. The piping fabricator shall perform these calculations, as well as area reinforcement requirements, and shall utilize the larger of the indicated pressure or mechanical reinforcement for fabrication.

6. Piping support loads may be found in Attachment B pipe support summary.

7. For lines requiring seismic analysis, the reactions reported are cyclic in character, and reactions must be considered as acting in either the positive or negative direction.

8. The valve 1E51*A0VF065 operator weight reduction of 40 lb per Rev. 1B was neglected in this revision.

9. Abbreviations
   R.H----------Rod Hanger
   S.H----------Spring Hanger
   V. C.----------Vertical Restraint
   RX----------X-Restraint
   RZ----------Z-Restraint
   RSKew----------Skewed Restraint
   SX----------X-Snubber
   SY----------Y-Snubber
   SZ----------Z-Snubber
   SSKew----------Skewed Snubber
   El-------- ----------Elevation
   Rdcr----- ---------Reducer
   S.R. Elb----------Short Radius Elbow

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 10 OF

ASSUMPTIONS

None

ENTERGY

CALCULATION
ENGINEERING DEPARTMENT
RIVER BEND STATION

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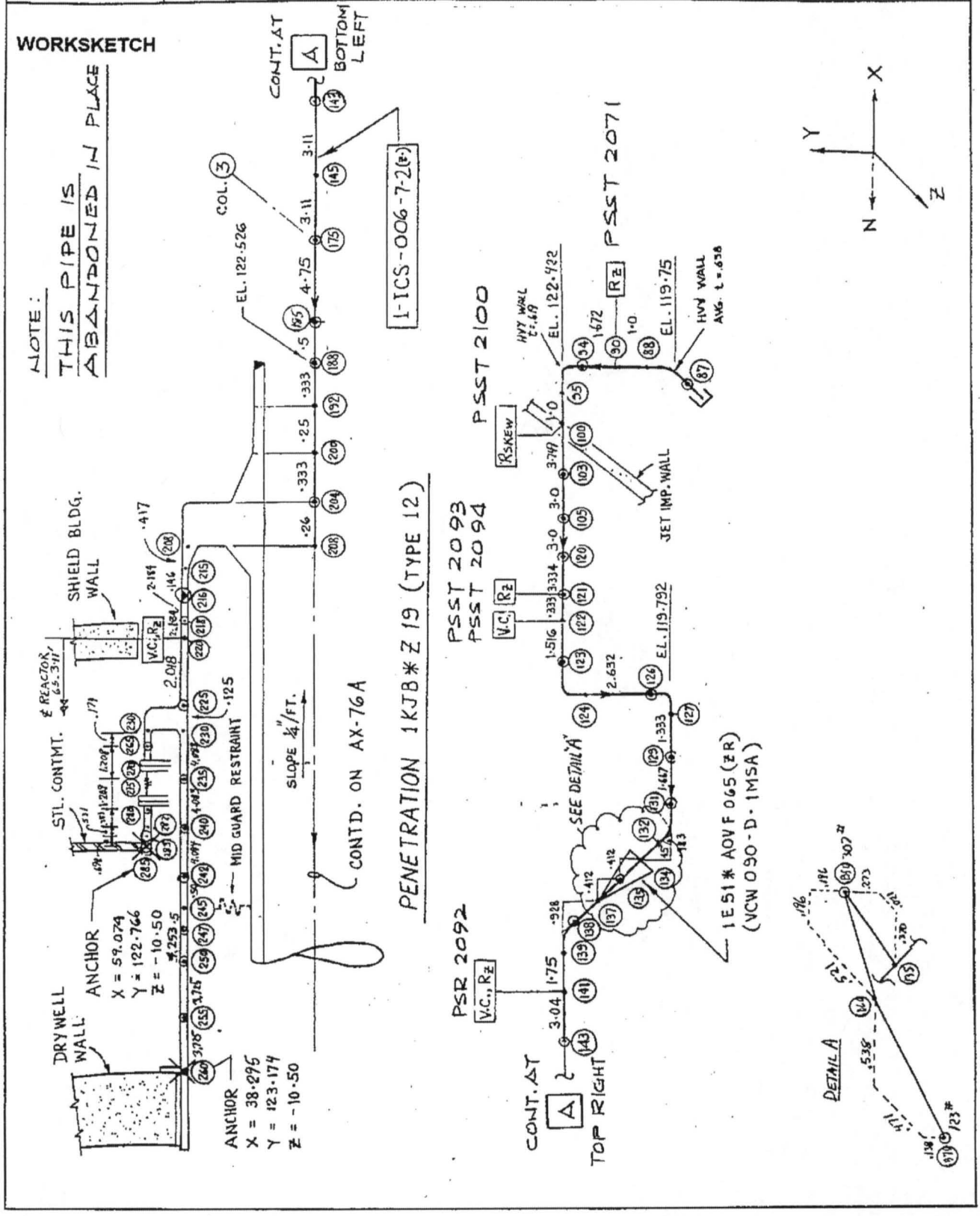

ENTERGY

CALCULATION
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV.
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BASIC ANALYTICAL DATA

LINE NUMBER	CLASS	MATERIAL	E COLD (10^6PSI)	ALLOWABLE STRESS Sh(PSI)	OUTSIDE DIA (IN.)	WALL THKNS (IN.)	INSUL THKNS (IN.)	E HOT (10^6PSI)	COEFF OF EXPN. IN./FT.	WT. TOTAL LB./FT
1-ICS 006-7-2	911	SA106 Gr.B	27.9	15000	6.625	.432	0	27.4	.0182	28.57
PENETRATION NODES	—	—	—	—	—	—	—	—	—	—
188-200	—	SA508 CL1	29.9	17500	6.625	.432	0	29.0	.0182	28.57
200-204	—	"	"	"	7.625	.932	"	"	"	66.62
204-208	—	"	"	"	24.0	9.1195	"	"	"	1460.62
208-215	—	"	"	"	"	1.843	"	27.82	.0038	436.13
215-225 230-260	—	SA333 Gr.6	27.9	15000	"	1.218	"	"	"	296.36
225-230	—	SA508 CL1	29.9	17500	30.0	4.218	"	"	"	1161.46
230-282	—	"	"	"	"	.375	"	"	"	118.65
282-283	—	SA508 CL1	29.9	17500	32.125	1.438	0	27.82	.0038	471.29
283-285	—	"	"	"	34.25	2.5	0	"	"	847.74
3/4" LINE	911 921	SA106 Gr.B	27.9	15000	1.05	.154	0	27.4 27.75	.0182 .0076	1.66
1/2" LINE	201	"	"	"	.840	.147	0	27.4	.0182	1.19
ELBOWS ~~31-32~~	911	~~"~~	~~"~~	~~"~~	~~6.625~~	~~.808~~	~~0~~	~~"~~	~~"~~	~~58.74~~
~~43-45~~	~~"~~	~~"~~	~~"~~	~~"~~	~~"~~	~~.633~~	~~0~~	~~"~~	~~"~~	~~50.29~~
~~49-60~~	~~"~~	~~"~~	~~"~~	~~"~~	~~"~~	~~.635~~	~~0~~	~~"~~	~~"~~	~~50.39~~
~~59-60~~	~~"~~	~~"~~	~~"~~	~~"~~	~~"~~	~~.620~~	~~0~~	~~"~~	~~"~~	~~49.64~~
~~73-75~~	~~"~~	~~"~~	~~"~~	~~"~~	~~"~~	~~.598~~	~~0~~	~~"~~	~~"~~	~~48.53~~
94-95 87-88	"	"	"	"	"	.638	0	"	"	39.24

NOTE: PIPING IS NON-FUNCTIONAL, THEREFORE, PRES & TEMP. ARE NOT CONSIDERED.

2/4

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

▲5010.85

CALCULATION IDENTIFICATION NUMBER

J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO. REV.	OPTIONAL TASK CODE	PAGE
12210	EM/NP(C)	12210-AX-765	REV. 14	13 ~~36~~

PS 6-12-85

VALVE DATA

NODE NO.	NOMINAL SIZE(IN)	VALVE NO.	S&W DESCRIPTION NO.	TYPE	S&W FILE NO.	VALVE LENGTH (FT.)	VALVE WEIGHT (LB.)	OPER. WT. (LB.)
~~20/22~~	~~6~~	~~VGW090-A-1Y6C~~	~~1E51*MOVF013~~	~~GATE~~	~~228.212-047-003G~~	~~1.666~~	~~750~~	~~360~~
~~1350/1370~~ BSO	6	VCW090-D-1M5A	1E51*AOVF065	CHECK	228.218-062-003F	1.166	307	123
~~350/352~~	4	VOW090-A-1M5Q	1E12*MOVF023	GLOBE	228.212-047-084C	1.166	325	~~210~~
320	4	VCW090-D-1M	1E12*VF019	CHECK	228.211-049-002F	1.166	145	—
520	4	VGW030-C-2K5	1E12*VF086	GATE	228.211-049-007K	1.0	—	350
N/A 725	3/4"	VOS150-G-2	1CS*VF084	~~GLOBE~~	228.213-058-011L	.334	10	—
745	3/4	VOW150-G-2	1CS*VF085	GLOBE	228.213-058-011L	.334	10	—
2010	3/4	VOW150-G-2M	1E51*VF034		228.213-058-014G	.292	10	—
~~2040~~	3/4	VOW150-G-2M	1E51*VF035			.292	10	—
~~1220~~	3/4	VOW150-G-2M	1CS*V302			.3125	10	—
~~1820~~	3/4	VOW150-G-2M	1CS*V100			.333	10	—
~~3325~~	~~3/4~~	~~VOW150-G-2M~~	~~1E12*VF061~~			~~.3125~~	~~10~~	—
N/A 3345	3/4	VOW150-G-2M	1E12*VF062			.3125	10	—
4020	1/2	VOS060-B-2	1RHS*V74		228.213-058-008E	.25	6	—
~~4120~~	~~1/2~~	~~VOS060-B-2~~	~~1RHS*V73~~		228.213-058-008E	.266	6	—

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 14 OF

CONCENTRATED WEIGHTS:

Component Description	Weight in lb	Node No
Valve Body 1E51*AOVF065	307.	B50
Valve Operator 1E51*AOVFO65	123.	B70
Small Bore Support Weight	40.	188

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-76B REV. 1H	OPTIONAL TASK CODE	PAGE 15

REF.

DESIGN INPUT (CONT'D)

RELATIVE SEISMIC ANCHOR AND/OR SUPPORT DISPLACEMENTS

~~(* SEE CALCULATION ON THE FOLLOWING PAGE(S) 55-61 .)~~

NODE NO.	SUPT. TYPE	BUILDING (STRUCTURE)	SUPPORT ATTACHMENT ELEVATION (FT)	DISPLACEMENTS * (IN) DX	DY	DZ	REMARKS
1	ANCHOR	AUX. BLDG.	91.719	0.2550	0.1800	0.2370	
9	R_X		97.25	0.2750	------	------	
47	RSKEW		104.75	------	0.1810	0.2680	
48	SSKEW		104.75	0.3070	------	0.2680	N/A
52	S_Z		104.75	------	------	0.2680	
61	R_Z		106.0	------	------	0.2720	
71	SSKEW		118.167	0.3620	------	0.3030	
76	V_C		119.75	------	0.1810	------	
90	R_Z		120.75	------	------	0.3100	
100	RSKEW		122.526	0.3800	0.1810	------	
121	R_Z		122.526	------	------	0.3130	
122	V_C		122.526	------	0.1810	------	
141	V_C, R_Z		122.526	------	0.1810	0.3130	
220	V_C, R_Z	SHIELD BLDG.	122.60	------	0.4110	0.8530	
285	ANCHOR	STEEL CONT.	122.76	0.9870	0.4390	0.8690	

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 16
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-76B REV. 1	OPTIONAL TASK CODE	

REF.

DESIGN INPUT (CONT'D)

RELATIVE SEISMIC ANCHOR AND/OR SUPPORT DISPLACEMENTS

~~(* SEE CALCULATION ON THE FOLLOWING PAGE(S) 55-61 .)~~

NODE NO.	SUPT. TYPE	BUILDING (STRUCTURE)	SUPPORT ATTACHMENT ELEVATION (FT)	DISPLACEMENTS * (IN) DX	DY	DZ	REMARKS
260	ANCHOR	DRYWELL	123.17	1.0460	0.4780	0.9310	
338	Rx, Vc	AUX. BLDG.	98.75	0.2800	0.1800	------	
375	Rz		100.385	------	------	0.2570	
380	Rx		103.677	0.3020	------	------	
382	SH		104.78	------	0.1810	------	N/A
410	Vc		106.75	------	0.1810	------	
445	ANCHOR		106.75	0.3150	0.1810	0.2740	
537	Vc, Rz		98.39	------	0.1800	0.2520	
575	ANCHOR		103.016	0.3000	0.1800	0.2610	

Dynamic Loads
File Names

TABLE 1

Structural Attachment	Elevation (FT)	Curve Number	
		OBE	SSE
Auxiliary Building	114	auxbon05.ace	auxbsn06.ace
Auxiliary Building	141	auxbon07.ace	auxbsn08.ace
Drywell	114	rbdwon43.ace	rbdwsn44.ace
Drywell	133	rbdwon45.ace	rbdwsn46.ace
Shield Building	112.67	rbsbon03.ace	rbsbsn04.ace
Shield Building	133	rbsbon05.ace	rbsbsn06.ace

TABLE 2

Structural Attachment	Elevation (ft)	Curve Number			
		SRV1V	SRV16V	CHCO	PS
Drywell	121	rbdwtn43.ace	rbdwan43.ace	rbdwcn43.ace	rbdwpn43.ace
Drywell	128	rbdwtn45.ace	rbdwan45.ace	rbdwcn45.ace	rbdwpn45.ace
Shield Building	121	rbsbtn03.ace	rbsban03.ace	rbsbcn03.ace	rbsbpn03.ace
Shield Building	128	rbsbtn05.ace	rbsban05.ace	rbsbcn05.ace	rbsbpn05.ace

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 18 OF

MAXIMUM STRESS LEVELS

PIPING STRESS SUMMARY CHECK AND COVER SHEET RB/562367 (BG4043) 06/11/97 BG4043

ASME SECT. III, CLASSES 2 & 3

PROJECT

JOB NO. 22497 PLANT DESIGN GROUP

SYSTEM RIVER BEND RCIC SYSTEM PART NOT IN OPERATION

CALC NO AX-76B ISO NO REV NO

DESIGN CONDITION	LEVEL	LOCATION OF MAXIMUM END	ELEMENT	MAXIMUM COMPUTED STRESS (PSI)	ALLOWABLE STRESS (PSI)	COMPUTED / ALLOWABLE
SUSTAINED LOADS		134	132	776	SH	.052
EQN. 8			134		15000	
OCCASIONAL LOADS	B	134	132	3511	1.2 SH	.195
EQN. 9			134		18000	
OCCASIONAL LOADS	C	134	132	3793	1.8 SH	.140
EQN. 9			134		27000	
OCCASIONAL LOADS	D	134	132	3830	2.4 SH	.106
EQN. 9			134		36000	
THERMAL EXPANSION		200	192	10114	SA	.450
EQN. 10			200		22500	

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 19 OF

FUNCTIONAL CAPABILITY EVALUATION:

This abandoned pipe ICS-006-7-2 is not performing any function per MR 96-0069; therefore, functional capability evaluation is not required.

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 20 OF

VALVE ACCELERATIONS

Valve 1E51*AOV065 is abandoned in place and is not performing any function; therefore, it is not active. Valve accelerations from this analysis are reduced due to the use of N411 damping values for all dynamic and hydrodynamic load cases. Furthermore, the fluid transients are not applicable to this piping anymore. The valve accelerations from the previous revision are provided for information only.

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

Ref: Valve Identification No. 1E51*AOVF065 AX Node Pt. 1350/1370

Valve Spec. No. 228.218

Loading Case	Acceleration in Global Coordinate System at 'C.G.' of Operator (g) NODE B60 ~~NODE 1370~~			Acceleration in Global Coordinate System at 'C.G.' of Valve Body/~~at Combined 'C.G. of Valve & Operator~~ (g) NP B50 ~~NODE 1350~~			Acceptable Acceleration (g) ~~See Ref. 8, 23, 24, 26~~		
	a_x	a_y	a_z	a_x	a_y	a_z	a_x	a_y	a_z
OBEI	.412	.610	.452	.187	.323	.241	2.0	2.0	2.0
SSEI	.795	1.175	.871	.360	.620	.463	3.0	3.0	3.0
SRV_{max} (SYMMETRIC-16v)	3.777	6.638	4.013	2.455	3.570	2.613	3.5	3.5	3.5
Chugg /CO	2.441	4.572	2.476	1.974	2.351	1.732	3.0	3.0	3.0
pool swell	.315	.532	.347	.306	.292	.206	4.0	4.0	4.0
AP N/A									
Fluid Transient N/A	~~1.846~~	~~4.715~~	~~2.984~~	~~4.342~~	~~2.674~~	~~2.326~~	~~4.0~~	~~4.0~~	~~4.0~~
TOTAL COMBINED -UPSET	4.224	Δ 8.165	Δ 5.021	4.991	4.472	3.507	5.0	5.0	5.0
TOTAL COMBINED - FAULTED	4.926	Δ 9.412	5.648	5.376	5.080	3.931	6.1	6.1	6.1

~~SEE PAGE 40 FOR VALVE ORIENTATION.~~

~~Δ EXCEEDS ALLOWABLES.~~ CONFIRMATION REQUIRED PENDING APPROVAL OF VALVE QUALIFICATION GROUP

▲5019.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO. 12210	DIVISION & GROUP EM/NP(C)	CALCULATION NO. 12210-AX-76B	OPTIONAL TASK CODE REV. 1H	PAGE 21

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 22 OF

VENT & DRAIN QUALIFICATION:

The following Vent & Drain is qualified with generic calculation PX-SB-316.

Valve No:
ICS*VF302
ICS*VF100

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. AX-76B, Rev. 1H PAGE 23 OF

SLEEVE CLEARANCES

Piping displacements due to reanalysis of Revision 2 have not changed significantly, most of them have decreased due to the deletion of thermal and fluid transients load cases, which are not applicable anymore. The Seismic Anchor Movement load case movements are not altered, and this analysis has used N411 damping values, which reduces the dynamic displacements.

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

884

CALCULATION IDENTIFICATION NUMBER				PS-67248 24
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-76B R/1H	OPTIONAL TASK CODE	PAGE 205

REF.

SLEEVE CLEARANCE EVALUATION

NODE 100

Load Case Description	Case No.	NUPIPE Output: Pipe Deflection Dir.	NUPIPE Output: Pipe Deflection Movement	NUPIPE Input: Penetration Movement	Sum of Relative Movements
Deadweight	31	Y	-.014	—	-.014
		Z	-.002	—	-.002
Thermal (N+U)	20	Y	.054	0	.054
		Z	.003	0	.003
Thermal (Max.)	26	Y	.118	0	.118
		Z	.003	0	.003
Thermal (Min.)	23	Y	.015	0	.015
		Z	.002	0	.002
Building Settlement 1	19-CLASS 2 RUN	Y	.004	0	.004
		Z	.0	0	0
Building Settlement 2	20-CLASS 2 RUN	Y	-.272	-.270	-.002
		Z	0	0	0
OBEA	37	Y	.195	.181	.014
		Z	.314	.313	.001
SSEA (2*OBEA)		Y			.028
		Z			.002
OBEI	40	Y	.004	—	.004
		Z	.007	—	.007
SSEI	41	Y	.008	—	.008
		Z	.013	—	.013
Dynamic OCCU	45	Y	.050		.050
		Z	.075		.075
Dynamic OCCE	35	Y	.050	—	.050
		Z	.075	—	.075
Dynamic OCCF	36	Y	.051	—	.051
		Z	.076	—	.076

Total Relative Movements = | + DWT + Ther. + Building Settlement | + OBEA + Dyanmic (OCCU/OCCE)

Or

= | + DWT + Ther. + Building Settlement | + SSEA + Dyanmic (OCCF)

Notes: 1. The sign of the total relative movements must be the sign of the maximum combination of Deadweight, Thermal and Building Settlement.

2. The maximum of either equation shown above is recorded on the next page to be compared with the sleeve clearance.

$Y = |-.014 + .118 + .004| + .028 + .051 = .187"$
$Z = |-.002 + .003 + 0| + .002 + .076 = .079"$

STONE & WEBSTER ENGINEERING CORPORATION

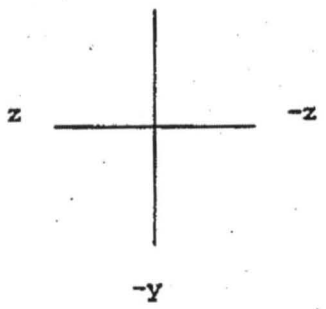
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				P.S. 7334 25 6598 PAGE 206
JO. OR WO. NO. 12210	DIVISION & GROUP NP(C)	CALCULATION NO. AX-76B R/1H	OPTIONAL TASK CODE	

REF.

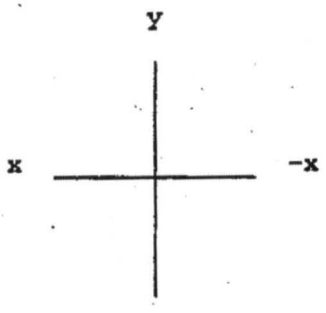
SLEEVE CLEARANCE EVALUATION

Sleeve Clearance Looking North NODE 100



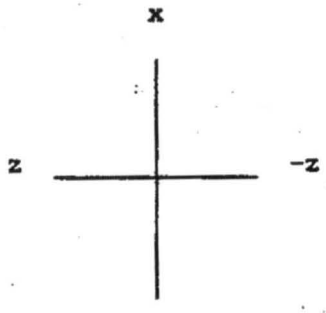
		MIN.		Total Relative Movements	
-z	=	1 5/8"	= 1.625" -	.079"	
z	=	1 5/8"	= 1.625" -	.079"	ok
y	=	1 13/16"	= 1.812" -	.187"	
-y	=	1 13/16"	= 1.812" -	.187"	

Sleeve Clearance Looking East



-x	=		= -		
x	=		= -		
y	=		= -		
-y	=		= -		

Sleeve Clearance Looking Up Facing North



-z	=		= -		
z	=		= -		
x	=		= -		
-x	=		= -		

Conclusion : ∴ OK

ENTERGY

CALCULATION
ENGINEERING DEPARTMENT
RIVER BEND STATION

CALC. NO. - REV. ADDENDUM
AX-76B, Rev. 1H
ATTACHMENT NO.:

PAGE 26 OF

REVIEWER'S CHECKLIST

Item	Calc Page	Comments	Response/Resolution
		None	

Comments Provided By			Comments Resolved By			Resolution Accepted		
Reviewer	KCN	Date	Preparer	KCN	Date	Reviewer	KCN	Date
[signature]	0968	6/18/97						

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76B, Rev. 1H ATTACHMENT NO.: PAGE 27 OF

CALCULATION CHECKLIST

YES	NO	N/A	FORMAT	EDP-AA-20 SECTION
x			Cover Page completed.	6.4.1
		x	Table of Contents completed (as required).	6.4.2
x			Revision History Sheet completed (as required).	6.4.3
		x	Revisions are identified with revision lines in right margin.	6.4.3
x			Applicable Documents Page completed.	6.4.4
		x	Definitions established (as required).	6.4.5
x			Calculation/revision/addendum/page numbers are identified correctly.	6.4.10
			CONTENTS	
x			Previous calculation for the required analysis exists.	6.3
x			Calculation is appropriately titled for the intended scope.	6.4.1-2
x			Purpose and scope are clearly and adequately established.	6.4.1-7, 7.1
x			Safety classification is correct for the identified scope.	6.4.1-6
x			Topics/documents/equipment for cross-reference/retrieval are identified.	6.4.1-11
x			Calculation is clear and comprehensible.	6.1
x			Applicable codes, standards, etc. are identified.	6.4.4-1
x			RBS references are identified.	6.4.4-2
x			Affected documents are identified	6.4.4-3
x			Inputs and sources are identified, appropriate, and correct.	7.2.2-1
x			Assumptions are identified and appropriate.	7.2.2-2
		x	Inputs derived from field walkdown have been witnessed/verified	7.2.2-5
x			Engineering judgments are identified and appropriate.	7.2.2-6
x			Calculation methodology is identified and supported by technical bases.	7.2.3
x			Conclusion is appropriate and is justified by calculation.	7.3
		x	Confirmations are identified and indicated as required on Cover Page.	7.5.7
		x	Directions for Confirmations are included.	7.5.7-3
x			Calculation data is appropriately included, attached, or referenced.	7.4
		x	Programs and software are identified and have been verified and validated.	8.0
x			Methods/calculations use to check results are identified and included.	
x			Results are accurate and in accordance with the established methodology.	
		x	Certification by Professional Engineer is required.	11.7
			VENDOR CALCULATIONS	
		x	Calculation is performed in accordance with EDP-AA-25.	10.2
		x	Calculation content and format are acceptable.	10.2
		x	Vendor, preparer, reviewer, and approver are clearly identified.	10.3
x			Design verification review has been completed (as applicable).	

Preparer (Signature/KCN or SSN/Date): Rajni R Patel (0861) 6/18/97

Reviewer (Signature/KCN or SSN/Date): Carla Carden (0969) 6/18/97

ENTERGY	CALCULATION ENGINEERING DEPARTMENT RIVER BEND STATION	CALC. NO. - REV. ADDENDUM AX-76B, Rev. 1H ATTACHMENT NO.: PAGE 28 OF

Design Verification Record

Document No. AX-76B, Rev. 1H

METHOD

Verification methods to be used:

X **Design Review**

_____ **Qualification Testing**

_____ **Alternate Calculations**

DOCUMENT(S) REVIEWED: (Attach Additional Sheet(s), if needed)

Document No.	Revision	Document Title
AX-76B	1H	Pipe Stress Analysis for ICS-006-7-2

SUMMARY OF REVIEW: (Attach Additional Sheet(s), if needed)

Acceptable as is.

Design Verification Completed By Carl Tucker Date 6-18-97

Comments Resolution Accepted By N/A Date _____

Engineering Supervisor Rajesh Gupta Date 11-19-97

TABLE 1