Nuclear Engineering
ALLOWABLE MARGIN/TOLERANCE CONTROL FORM

Calculation: IP3-CALC-SWS-03023 (Existing) Rev. 0

Margin Rev. No. (Obtain from DC) 0A

Modification No. N/A Rev. ____

Affected Component: Insp. pt. on line # 1093 - CB9A

Attribute: min wall thickness

Tolerance Value*: 0.11 in

Current Change: 0.11 in

Cumulative Change: 0

Remarks: New inspection point @ node 75, page 14/25

From computer output:

$S_{NOR} = 1324$ psi $\quad \frac{1324}{15,000}(.365) = .032$ in

$S_{UPS} = 1753$ psi $\quad \frac{1753}{1.2(15,000)}(.365) = .036$ in

$S_{EMG} = 1967$ psi $\quad \frac{1967}{1.8(15,000)}(.365) = .027$ in

$0.3\,(t_{nom}) = 0.11$ in $\quad t_a = .036$ in (does not govern)

$\therefore\ t_{min} = 0.11$ in $\quad t_{req} = 0.135$ in

*: The allowable variation from a specified or true value.

Reviewed by: M Lakis Date: 8/19/99

Approved by: Richard H Drake Date: 8/19/99

SUPERVISOR

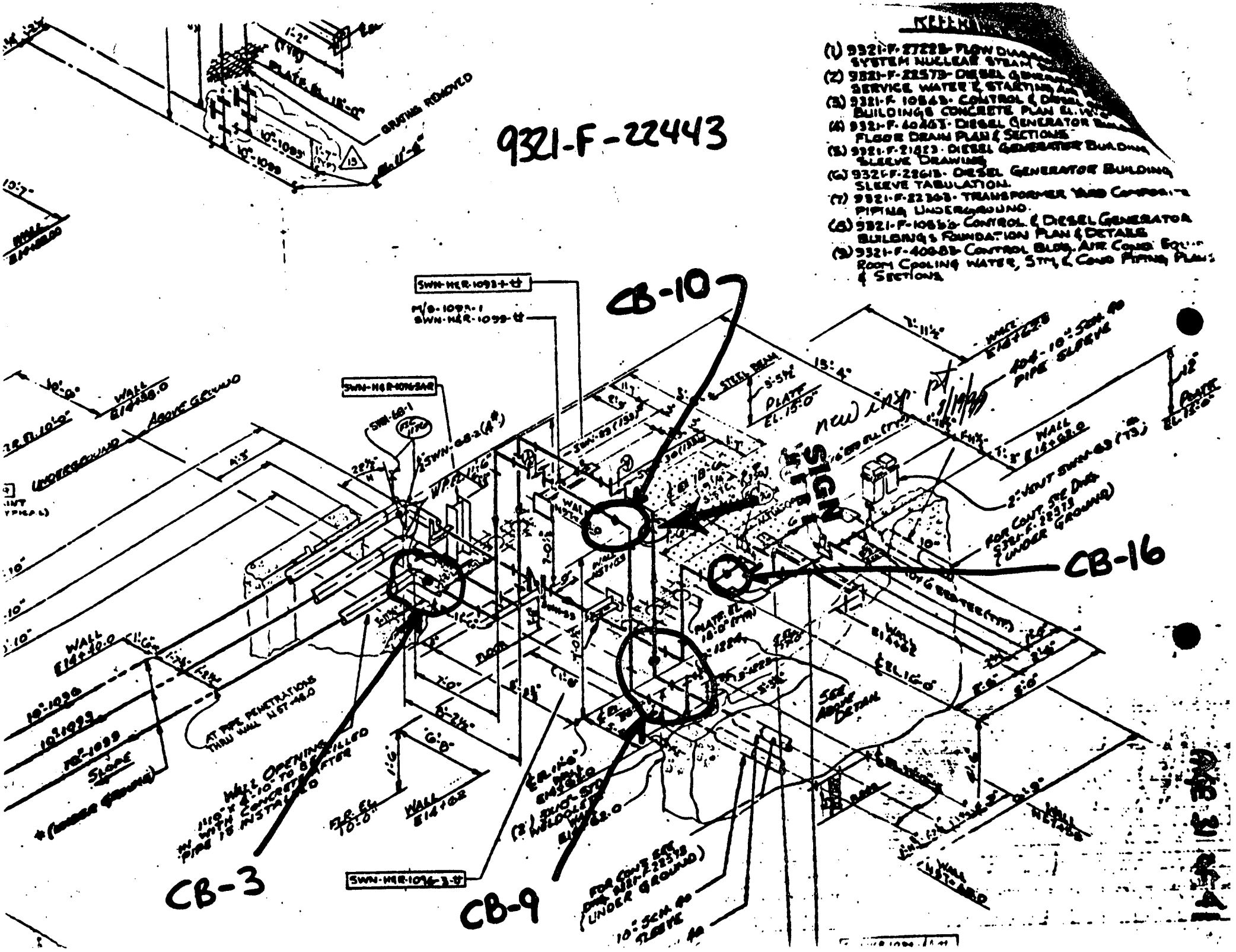
9909210202 990915
PDR ADOCK 05000286
P PDR

TABLE 3
Required Pipe Wall Thickness for Projected 2 Year Service

ID No.	Line No.	t_{nom}	Node No	S_h	t_p	S_P	S_{DW}	S_{OBE}	S_{NOR}	S_{UPS}	S_{EMG}	t_a	t_{min}	t_{req}	Ref
CB 3	10"-#1099	0.365	15	15000	0.054	1100			1636	1792	1869	0.040	0.110	0.135	10
CB 9	10"-#1093	0.365	95	15000	0.054	1100			1199	1593	1788	0.032	0.110	0.135	11
CB10	10"-#1099	0.365	70	15000	0.054	1100			2018	2278	2408	0.049	0.110	0.135	10
CB 11	6"-#1101	0.280	enveloped	15000	0.034	890	471	443	1361	1804	2026	0.028	0.084	0.103	13
CB 12	6"-#1094	0.280	enveloped	15000	0.034	890	471	443	1361	1804	2026	0.028	0.084	0.103	13
CB 13	4"-#1093	0.237	enveloped	15700	0.022	710	133	173	843	1016	1103	0.013	0.071	0.087	13
CB 14	6"-#1093	0.280	enveloped	15000	0.034	890	471	443	1361	1804	2026	0.028	0.084	0.103	13
CB 15	3"-#1231	0.216	7, 10, 12	15000	0.017	498	83	166	581	747	830	0.009	0.065	0.080	14
CB 16	6"-#1096	0.280	85	15000	0.034	890			1256	1293	1311	0.023	0.084	0.103	12
CB9A	10"-1093	0.365	75	15000	0.054	1100			1324	1753	1967	0.036	0.110	0.135	11

Rev. 0A
UL 8/19/99
RSD 8/19/99

DER 99-1677


9321-F-22443
REFERENCE
(1) 9321-F-27228- FLOW DIAGRAM SYSTEM NUCLEAR STEAM
(2) 9321-F-22573- DIESEL GENERATOR SERVICE WATER & STARTING AIR
(3) 9321-F-10543- CONTROL & DIESEL BUILDINGS CONCRETE PLAN EL.
(4) 9321-F-40463- DIESEL GENERATOR BUILDING FLOOR DRAIN PLAN & SECTIONS
(5) 9321-F-21823- DIESEL GENERATOR BUILDING SLEEVE DRAWING
(6) 9321-F-22613- DIESEL GENERATOR BUILDING SLEEVE TABULATION.
(7) 9321-F-22363- TRANSFORMER YARD COMPOSITE PIPING UNDERGROUND.
(8) 9321-F-10553- CONTROL & DIESEL GENERATOR BUILDINGS FOUNDATION PLAN & DETAILS
(9) 9321-F-40683- CONTROL BLDG. AIR COND. EQUIP. ROOM COOLING WATER, STM. & COND PIPING PLANS & SECTIONS
CB-10
CB-16
CB-3
CB-9
SWN-HER-1093-1-tt
SWN-HER-1096-3-tt
SWN-HER-1096-SAR
GRATING REMOVED
PLATE EL. 15'-0"
STEEL BEAM
PLATE EL. 15'-0"
WALL E14+38.0
ABOVE GROUND
UNDERGROUND
WALL E14+40.0
AT PIPE PENETRATIONS THRU WALL N57+48.0
SLOPE
WALL OPENING 1'-10" x 4'-10" TO BE FILLED IN WITH CONCRETE AFTER PIPE IS INSTALLED
FLR. EL. 10'-0"
WALL E14+62
FLOOR
SEE ABOVE DETAIL
FOR CONT. SEE DWG. 9321-F-22573 (UNDER GROUND)
10" SCH. 40 SLEEVE
404-10" SCH. 40 PIPE SLEEVE
2" VENT SWN-63 (TS)
FOR CONT. SEE DWG. 9321-F-22573 (UNDER GROUND)
new insp. pt.
SIGN

DER NO. 99-01677

All final calculations are to be prepared in accordance with the appropriate methods specified in the Design and Modification Control Manuals. Attach all final calculations to the Operability Determination package.

UT REPORT 99UT081 SHOWS 1/2" SECTION OF WALL BELOW THE 30% nominal wall. THIS WILL BE treated as a through wall in accordance with GL 90-05 and IP3-CALC-SWS-01596. CALCULATION IP3-CALC-SWS-03023 REV 0A shows FOR THE STRESS LEVELS AT THIS LOCATION THE MINIMUM ACCEPTABLE WALL THICKNESS IS 0.11" (30%).

FOR THE STRESS LEVELS THE MAXIMUM CIRCUMFERENTIAL THROUGH WALL FLAW PER FIGURE 6. OF IP3-CALC-SWS-01596 FOR 2000 psi IS 3" LONG. THIS IS MORE THAN THE 1/2" TO 3/4" Measured FLAW.

∴ PIPE IS STRUCTURALLY ACCEPTABLE AND WILL BE REPAIRED NEXT OUTAGE.

S. GUARNACCIA	8-20-99	747
Preparer (print & initial)	Date	Time
RICHARD DRAKE RJD	8/20/99	0800
Reviewer (print & initial)	Date	Time
JP DeRoy	8-20-99	0800
Approver (print & initial)	Date	Time

Original filed in Operations Log Book Copy sent to ORG by Responsible Department

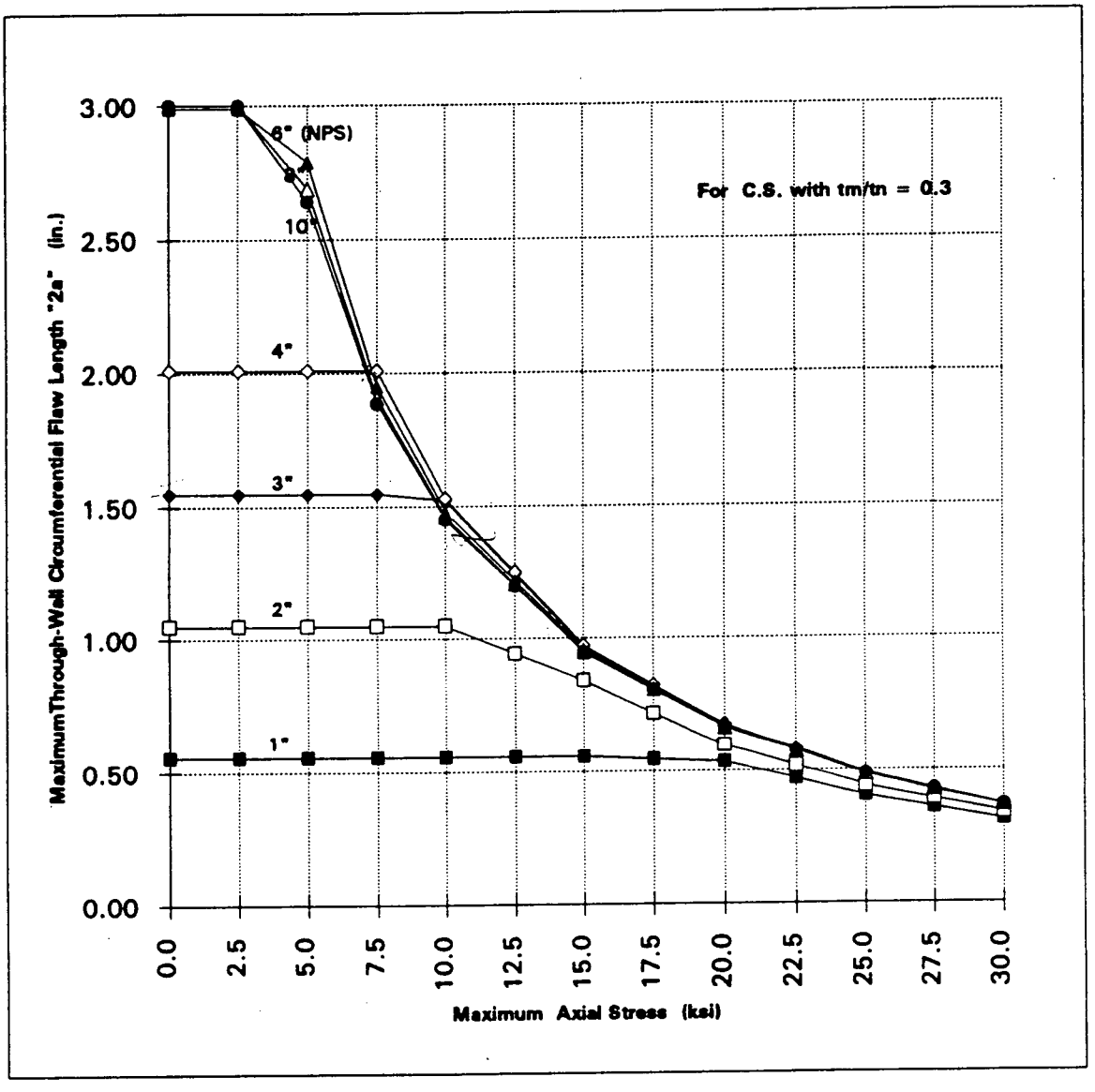


Figure 6 : Maximum Through-Wall Circumferential Flaws for C. S. SW Lines (NPS : 1" to 10")

Nuclear Engineering
CALCULATION CONTROL SHEET

Nuclear Plant: IP3 [x] JAF [ ] PAGE 1 OF 2

CALC. NO. IP3-CALC-SWS-03023 REV. 0
CALCULATION IS: PRELIMINARY: _____ FINAL: X

	NAME	SIGNATURE	DATE
PREPARER:	Mara Lakis	M Lakis	8/10/99 & 8/17/99
CHECKER:	Kai Lo	Kai Lo	8/10/99 & 8/17/99
(DESIGN) VERIFIED:/NA	Zarif Rafik KAI LO	Z. Rafik /KL	8-17-99/8/17/99
APPROVED:	Richard Drake	Richard Drake	8/19/99

ORIGINATOR: NYPA [x] OR OTHER [ ]
SYSTEM NO./NAME: F44-0150 / Service Water System
TITLE: Minimum Wall Thickness at R10 Inspection Locations

QA CATEGORY: I DISCIPLINE: Civil/Str STRUCTURE: Piping

MODIFICATION NO./TASK NO. WR 98-05100 DBD REF. NO. 304 & 310

PROBLEM/OBJECTIVE/METHOD
To calculate minimum wall thickness and required wall thickness for projected service at the R10 inspection locations

DESIGN BASIS/ASSUMPTIONS
IP3 FSAR and IP3-DBD-310

SUMMARY/CONCLUSIONS
See Tables 1 through 4 in body of calculation

ACTS #99-43819 issued to D. Pennino to track & replace branch line in R11

THIS CALC SUPERSEDES OR VOIDS CALC. NO. None

DISTRIBUTION: C = CONTROLLED I = INFO

NAME	DEPT	LOC	C	I
D. Pennino	IDSE	ADM 45-3-H		x
R. S. Drake	IDEM	24-A		x

Nuclear Engineering
CALCULATION CONTROL SHEET

COMPONENTS

MAJOR EQUIPMENT	PIPE NO.	VALVE NO.	SUPT. NO.	INST. NO.	PENE. NO.
	408,409,406				
	11a,11b,11c,				
	11d,11e,12a,				
	12b,12c,12d,				
	405,411,407,				
	671,672,1099				
	1093,1101,				
	1094,1231				
	1096,1081-86				
	712,1219				
	FCU 31-35 3" Supply & 3" Return lines				

RELATED DOCUMENTS

1. NRC Generic Letter 89-13

REFERENCES

1. References listed in body of calculation, page 9
2. ANSI B31.1 - 1967
3. Teledyne Engineering Services TR - 7366 - 4

RELATED DRAWINGS

1. 9321-F-53533	15. 9321-F-26913
2. 9321-F-53543	16. 9321-F-22443
3. 9321-F-53523	17. M-SWN-SK-041
4. 9321-F-27023	18. 9321-F-23423
5. 9321-F-55113	19. 9321-F-22443
6. 9321-F-55163	20. 9321-F-22423
7. 9321-F-55123	21. 9321-F-70020
8. 9321-F-27003	22. 9321-F-27033
9. 9321-F-26903	23. 9321-F-20973
10. INRN-1020-22	24. 9321-F-70053
11. 9321-F-26923	
12. 9321-F-27483	
13. INRN-1020-21	
14. 9321-F-26903	

SECURITY: (Y/N) N COMPUTER PRINTOUT: (Y/N) Y

ATTACHMENT 1

DESIGN VERIFICATION COVERSHEET

Verification of:

Document Title: Minimum Wall Thickness at R10 Inspection Locations

Document Number: IP3-CALC-SWS-03023 **Rev:** 0

Subject: **Minimum Wall Thickness at R10 Inspection Location**

Modification/Task Number (if applicable): **WR98-05100**

QA Category: **I**

Review Required	Discipline	Review Complete (initials of reviewer)
	ELECTRICAL	
	MECHANICAL	
	INSTRUMENT & CONTROL	
✓	CIVIL/ STRUCTURAL	8/17/99
	FIRE PROTECTION	

K. Lo (FOR computer output ONLY

CALCULATION VERIFICATION CHECKLIST

IDENTIFICATION:

Document Title: _Minimum Wall Thickness at R10 Inspection locations _____
(print title)

Doc. Number: IP3-CALC-SWS-03023 Rev: 0

QA Category: __I_____

Selected Verifier: Zarif Rafla / IDEM / 2122
(print name, department, phone ext.)

DISCIPLINE:

❑ ELEC ❑ I&C
❑ MECH ❑ Fire Protection
✓ C/S
❑ Other_____

METHOD OF VERIFICATION: ✓ Design Review ❑ Alternate Calculations ❑ Qualification Test

#	Design Verification Questionnaire All questions shall be explained in the space provided.	Where Found
1.	Was the correct QA category assigned to the calculation? ✓ Yes ❑ No	Page No: Cover page OR Paragraph No: _____

Verifier Comments: QA Cat. I requirements shown on the cover page

Resolution:

		Where Found
2.	Were the objectives, method and purpose of the calculation completely and clearly stated? • Purpose: Why the calculation is necessary (problem statement) • Objective: What we are trying to demonstrate • Method: How we intend to achieve the objective(s) ✓ Yes ❑ No	Page No: 2, 3, and 4 OR Paragraph No: _____

Verifier Comments: The Calculation clearly identify the purpose, objective, and the method used for analysis

Resolution:

CALCULATION VERIFICATION CHECKLIST

3. Were design inputs completely and correctly selected, consistent with the design bases, applied appropriately and the corresponding source of information referenced?

Design inputs shall be provided in sufficient detail to permit the calculation to be carried out in a correct manner and to provide a consistent basis for making design decisions, accomplishing design verification measures and evaluating the calculation.

Design inputs include design bases, plant operational conditions, performance requirements, regulatory requirements and commitments, codes, standards, field data, etc. All information used as design shall have been reviewed and approved by the responsible design organization and applicable to IP3.

All inputs need to be retrievable or excerpts of documents used shall be attached.

✓ Yes ❑ No

Where Found

Page No: 2, 3, and 4

OR

Paragraph No: _____

Verifier Comments: Design inputs is accurate for the described problem.

Resolution:

4. Were assumptions (e.g., temperature, pressure, flow, weight, size, location, clearances, current, voltage, cable lengths, maintenance and test equipment, environmental qualifications, plant operational condition, etc.) documented, adequately justified and/or verified?

Assumptions that require verification following the issuance of the calculation need to be tracked via the ACTS system. The calculation needs to include a statement of the risk involved with implementation of the results prior to verifying the assumptions.

Based on the risk involved, the calculation may or may not be approved for use.

❑ Yes ❑ No ✓N/A

Where Found

Page No: _____

OR

Paragraph No: _____

Verifier Comments: No assumption used. The calculation used existing design documents and B31.1 Code requirements.

Resolution:

CALCULATION VERIFICATION CHECKLIST

5. Were applicable codes, standards and regulatory requirements, as committed to in the IP3 license (FSAR, Technical Specifications, NRC Commitments), properly considered? **{Reference 7.1.1}**

✓ Yes ❑ No ❑ N/A

Where Found

Page No: _Page 2 of the cover sheet_____

OR

Paragraph No: _____

Verifier Comments: See Related documents and references

Resolution:

6. For a calculation that utilized software applications, was the computer output reviewed and verified, and was the software application properly verified and validated in accordance with CMM-5.1?

Software that is used for word processing does not need to be verified or validated.

✓ Yes ❑ No ❑ N/A

Where Found

Page No: All attachments_____

OR

Paragraph No: _____

Verifier Comments: All computer runs are attached and checked as required.

Resolution:

7. Was operational experiences or impact on plant operations and maintenance addressed?

❑ Yes ❑ No ✓ N/A

Where Found

Page No: _____

OR

Paragraph No: _____

Verifier Comments: Calculation is performed to check existing conditions. No new design is issued for this calculation.

Resolution:

CALCULATION VERIFICATION CHECKLIST

8. For calculation revisions, was the scope of the revision properly and completely described? Were the design inputs and references reviewed to ensure that they are still applicable? Was the impact of the revision on documentation that references the calculation considered?

ACTS Items should have been generated to track any necessary updates to other documents.

❑ Yes ❑ No ✓ N/A

Where Found

Page No: _____

OR

Paragraph No: _____

Verifier Comments:

Resolution:

9. Were interactions with other calculations, including those of other disciplines, considered?

If the calculation involves multiple disciplines, was an interdisciplinary review conducted? ACTS items should have been generated to track any necessary updates to other documents. Changes required to documents used as input need to be completed prior to issuance of this calculation.

❑ Yes ❑ No ✓ N/A

Where Found

Page No: _____

OR

Paragraph No: _____

Verifier Comments:

Resolution:

10. Was the methodology appropriate to meet the objective and was it properly applied?

✓ Yes ❑ No

Where Found

Page No: _2,3 , and 4_____

OR

Paragraph No: _____

Verifier Comments: Method used in this analysis is appropriate for design conditions.

Resolution:

CALCULATION VERIFICATION CHECKLIST

11. Was the conclusion of the calculation clearly stated, did it correspond directly with the objectives, and are the results reasonable based on the inputs?

✓ Yes ❑ No

Where Found

Page No: _5 through 8_____

OR

Paragraph No: _____

Verifier Comments: Minimum wall thickness for each pipe is shown on appropriate page.

Resolution:

12. Considering the objective and purpose, was the acceptance criteria for the calculation results acceptable?

✓ Yes ❑ No

Where Found

Page No: 2 through 8_____

OR

Paragraph No: _____

Verifier Comments: This calculation is performed to find the minimum pipe wall thickness. The acceptance, or rejection will depend on field measurements. Each case will be evaluated separately for acceptance or rejection.

Resolution:

13. Were appropriate follow up actions identified if the results of the calculation require changes to equipment, design, other calculation(s), Surveillance Test Procedures, Operating Procedures, Maintenance Procedures, FSAR, DBD, etc.?

✓ Yes ❑ No ❑ N/A

Where Found

Page No: _Cover Page _____

OR

Paragraph No: _____

Verifier Comments: ACT # 99-43819 is issued for the required tracking and replacement of the branch line during R 11

Resolution:

CALCULATION VERIFICATION CHECKLIST

14. Was a DER initiated if the calculation results indicate the existence of a condition adverse to quality in accordance with AP-8?

❑ Yes ❑ No ✓ N/A

Where Found

Page No: _____

OR

Paragraph No: _____

Verifier Comments:

Resolution:

15. Have all additional verifier's concerns such as procedural adherence, clarity, neatness, proper use of references, impact on engineering programs, etc. been addressed?

❑ Yes ❑ No ✓ N/A

Where Found

Page No: _____

OR

Paragraph No: _____

Verifier Comments:

Resolution:

All comments for "NO" answers have been resolved satisfactorily. The calculation was verified to be adequate for the given design inputs.

Kai Lo 8/17/99 (FOR COMPUTER OUTPUTS ONLY)

Design Verification Complete: Zarif Rafla / / 8-17-99
(print name, signature, date)

Contents Page No.

1. Introduction 2

2. Evaluation of Minimum Wall Thickness 3

3. Required Wall Thickness for Projected Service 4

4. Results 4

5. References 8a

Required Pipe Wall Thickness for Projected 2 Year Service

Table 1 (PAB Inspection Locations)..... 5

Table 2 (VC Inspection Locations)..... 6

Table 3 (CB Inspection Locations)..... 7

Table 4 (IS, YD, & TB Inspection Locations)..... 8

Attachments

Computer Output for CB-3 & CB-10

Computer Output for CB-9

Computer Output for CB-16

Computer Output for YD-1

1. Introduction

The purpose of this calculation is to evaluate minimum pipe wall thicknesses at the 76 locations scheduled to be inspected during R10 refueling outage. These selected locations for the R10 RT examinations are indicated in Reference 19.

The minimum wall calculation is based on the stress at the locations and the code requirement, except as noted. The calculation of the required pipe wall for a projected service is dependent upon the erosion/corrosion rate, the projected service duration and the minimum pipe wall thickness. The methodology and formulation of the calculations as provided in Section 2 and 3 use the method of performing pipe wall thinning evaluations of Reference 20.

2. Evaluation of Minimum Pipe Wall Thickness

2.1 Seismic Class 1 SW Piping Design Data (Ref. 17)

P (Design Pressure) =		150 psi
T (Design Temperature) =		160°F (max.)
NPS [1]	1" – 10"	Sch. 40
	12" – 24"	t_{nom} = 0.375 wall

Pipe Material	Sh (Allowable Stress at 160°F)	(Ref. 17)
Carbon Steel		
A53 SML Gr B, Cement lined	15 ksi	
A106 SML Gr B, Cement lined	15 ksi	
Stainless Steel		
A312 SML TP 304	18.75 ksi	(Ref. 17)
A213 SML TP 316	18.75 ksi	(Ref. 17)
A312 SML PT 316L	15.7 ksi	(Ref. 17)
B677 Welded TP 904L	17.1 ksi	(Ref. 17)

2.2 Minimum Thickness required for Hoop Stress: (t_p)

$t_p = P*D/(2*(Sh + .4*P) + A$ (Ref. 17)

Where D = Outside diameter of pipe
A = Erosion/corrosion tolerance, (A = O is assumed for this calculation)

2.3 Minimum Thickness required for Axial Stress: (t_a)

S (axial stress) = Sp + Sb (Ref. 17)

Where Sp : Axial stress due to pressure = $PD/4t_{nom}$,
Sb : Bending stress due to dead weight (dw) or seismic loads

Notes:
[1] NPS = Nominal Pipe Size; t_{nom} = Pipe Nominal Thickness

a) For IP3 Seismic Class 1 Piping except FCU Service Water Piping, axial stresses for various conditions shall satisfy the stress limits as follows:

S_{NOR} (Normal condition) = Sp + Sdw <= Sh (Ref. 17)
S_{UPS} (Upset condition) = Sp + Sdw + Sobe <= 1.2 Sh
S_{EMG} (Emergency condition) = Sp + Sdw + Sdbe <= 1.8 Sh

Where Sdw, Sobe and Sdbe are bending stresses for dead weight, operation basis earthquake (obe) and design basis earthquake (dbe).

b) For IP3 FCU Service Water Piping, axial stresses for various conditions shall satisfy the stress limits as follows:

(Ref. 21)

Operational Condition	Load Combination	Stress Allowable
Normal (S_{NOR})	P + DW	S_h
Upset 1 (S_{UPS1})	P + DW + OBE	$1.2S_h$
Upset 2 (S_{UPS2})	P + DW + WHT	$1.2S_h$
Upset 3 (S_{UPS3})	P + DW + WHL	$1.2S_h$
Emergency (S_{EMG})	P + DW + DBE	$1.8S_h$

Where: DW = Dead Weight
P = Design Pressure
OBE = Operational Basis Earthquake
DBE = Design Basis Earthquake
WHT = Column closure waterhammer resulting from simulated LOOP event (Ref. 21)
WHL = Column closure waterhammer resulting from LOOP events (return piping only)

t_a = Maximum (S_{NOR}/Sh, S_{UPS}/1.2 Sh, S_{EMG}/1.8Sh) *t_{nom} (Ref. 17)

2.4 Total Minimum Required Pipe Wall Thickness: (t_{min})

t_{min} = Maximum (t_p, t_a, 0.3*t_{nom})

Where 30% of t_{nom} is the lower bound for repair.

ML 8/10/99

3. Required Pipe Wall Thickness for Project Service (t_{req})

For a pipe wall thinning due to erosion/corrosion, the required pipe wall thickness for the projected service shall include the erosion/corrosion during the projected service duration. It can be expressed as follows:

$$t_{req} \geq t_{min} + \text{E/C Rate} * N$$

Where N = projected service years after inspection,
E/C Rate can be estimated as $(1.125 * t_{nom} - t_{meas}) / Y$ (Ref. 21)
t_{meas} = measured wall thickness of inspection
Y = total service years before inspection

The measured wall thickness for the projected service shall be larger than the required wall thickness, i.e., $t_{meas} \geq t_{req}$. Let $t_{meas} = t_{req}$ and substitute into the above formulas, we can obtain the minimum t_{req} as follows:

$$t_{req} \geq (t_{min} + 1.125 * t_{nom} * N/Y)/(1 + N/Y)$$

4. Results

Based on the equations in previous sections and the maximum stresses at points of inspection, the minimum wall thickness, t_{min}, and the required thickness for two years service, t_{req}, are calculated and listed in Table 1 (PAB locations), Table 2 (VC locations), Table 3 (CB locations) and Table 4 (IS, YD, and TB locations).

TABLE 1

Required Pipe Wall Thickness for Projected 2 Year Service

ID No.	Line No.	t_{nom}	Node No.	S_h	t_p	S_p	S_{DW}	S_{OBE}	S_{NOR}	S_{UPS}	S_{EMG}	t_a	t_{min}	t_{req}	Ref.
PAB 7	18" - #408	0.375	151/153	15000	0.090	1800	1600	4689	3400	8089	10433.5	0.169	0.169	0.190	3
PAB 8	18" - #409	0.375	525	15000	0.09	1800	1600	3052	3400	6452	7978	0.134	0.134	0.158	4
PAB 9	18" - #409	0.375	545	15000	0.090	1800	1600	5144	3400	8543	11116	0.178	0.178	0.198	4
PAB 10	18" - #406	0.375	621	15000	0.090	1800	550	1807	2350	4157	5060.5	0.087	0.113	0.138	2
PAB 14	18" - #406	0.375	335	15000	0.090	1800	811	4766	2611	7377	9760	0.154	0.154	0.176	2
PAB 20	10" - #11e	0.365	9/11	15000	0.055	1100	900	770	2000	2770	3155	0.056	0.110	0.135	3
PAB 21	10" - #406	0.365	838	15000	0.055	1100	382	911	1482	2393	2848.5	0.049	0.110	0.135	2
PAB 22	10" - #11c	0.365	502	15000	0.055	1100	550	1104	1650	2754	3306	0.056	0.110	0.135	3
PAB 23	24" - #405	0.375	640/650	15000	0.120	2400			3185	3472	3612	0.080	0.120	0.145	5
PAB 24	18" - #411	0.375	253	15000	0.090	1800	407	1043	2207	3250	3771.5	0.068	0.113	0.138	1
PAB 25	18" - #407	0.375	280/281	15000	0.090	1800	1067	3451	2867	6318	8043.5	0.132	0.132	0.156	1
PAB 26	24" - #409	0.375	330	15000	0.120	2400	1350	3967	3750	7717	9700.5	0.161	0.161	0.183	4
PAB 27	2 ~~10~~" - #11e	0.154		15000	0.055	1100		(2" SWN-42-5 inlet line)					0.135	0.138	6
PAB 28	10" - #11c	0.365	61/63	15000	0.055	1100	550	1365	1650	3015	3697.5	0.061	0.110	0.135	3
PAB 29	10" - #12d	0.365	114/115	15000	0.055	1100	620	3957	1720	5677	7655.5	0.115	0.115	0.140	2
PAB 30	18" - #407	0.375	419	15000	0.090	1800	174	485	1974	2459	2701.5	0.051	0.113	0.138	1
PAB 31	14" - #408	0.375	43	15000	0.071	1400	1210	2294	2610	4904	6051	0.102	0.113	0.138	3
PAB 32	10" - #11b	0.365	83/85	15000	0.055	1100	370	3106	1470	4576	6129	0.093	0.110	0.135	3
PAB 33	20" - #411	0.375	320/319	15000	0.101	2000	369	1880	2369	4249	5189	0.089	0.113	0.138	1

TABLE 2

Required Pipe Wall Thickness for Projected 2 Year Service

ID No.	Line No.	Node No.	t_{nom}	S_h	t_p	S_{NOR}	S_{UPS1}	S_{UPS2}	S_{UPS3}	S_{UPS}	S_{EMG}	t_a	t_{min}	t_{req}	Ref
VC-8	10"-#11b	640/650	0.365	15	0.05	1.32	6.9	2.16	0	6.9	8.3	0.14	0.140	0.162	7
VC-22	10"-#11c	421/425	0.365	15	0.05	1.33	4.08	4.53	0	4.53	4.03	0.092	0.110	0.135	7
VC-23	10"-#12c	109/110	0.365	15	0.05	1.24	5.51	4.49	5.59	5.59	6.25	0.113	0.113	0.138	7
VC-36	10"-#12c	39/41	0.365	15	0.05	2.32	7.57	6.17	6.72	7.57	9.21	0.154	0.154	0.175	7
VC-37	10"-#12b	70/80	0.365	15	0.05	2.18	9.1	9	7.89	9.1	8.55	0.185	0.185	0.203	7
VC-38	2"-#671		0.154	15	0.01	2.9				12	16.5	0.103	0.103	0.109	8
VC-39	10"-#12e	122/123	0.365	15	0.05	1.58	4.74	4.89	15.82	15.82	4.41	0.321	0.321	0.328	7
VC-40	10"-#11b	820	0.365	15	0.05	2.71	7.47	6.78	0	7.47	7.96	0.151	0.151	0.173	7
VC-41	10"-#12a	1380	0.365	15	0.05	1.21	11.01	3.13	3.13	11.01	10.69	0.223	0.223	0.239	7
VC-42	2"-#672		0.154	15	0.01	2.9				12	16.5	0.103	0.103	0.109	8
VC-43	10"-#12b	780	0.365	15	0.05	1.18	1.18	1.18	1.18	1.18	1.18	0.029	0.110	0.135	7
VC-44	10"-#12d	160	0.365	15	0.05	1.82	9.26	8.14	10.23	10.23	8.18	0.207	0.207	0.224	7
VC-45	10"-#11c	138	0.365	15	0.05	2.28	8.72	5.79	0	8.72	7.95	0.177	0.177	0.196	7
VC-46	10"-#11a	1310	0.365	15	0.05	2.01	9.11	5.91	0	9.11	8.38	0.185	0.185	0.204	7
VC-47	10"-#12a	1280	0.365	15	0.05	2.32	6.53	5.29	9.98	9.98	6.83	0.202	0.202	0.220	7
VC-48	10"-#12e	87/90	0.365	15	0.05	1.41	7.36	7.61	5.45	7.61	6.3	0.154	0.154	0.176	7
VC-49	10"-#11e	90	0.365	15	0.05	1.43	7.02	5.48	0	7.02	6.63	0.142	0.142	0.165	7
VC-50	10"-#12d	15	0.365	15	0.05	1.49	7.49	5.8	10.57	10.57	6.96	0.214	0.214	0.231	7
VC-51	10"-#11d	15	0.365	15	0.05	1.99	10.17	7.83	0	10.17	9.84	0.206	0.206	0.223	7
VC-52	10"-#11c	140	0.365	15	0.05	2.3	8.62	8.94	0	8.94	7.9	0.181	0.181	0.200	~~8~~ 7
VC-31-1	12b-A	7060	0.216	17.1	0.015	0.74	2.83	1.01	4.9	4.9	2.96	0.052	0.065	0.080	7
VC-32-2	11d-E	290	0.216	17.1	0.015	1.19	4.04	3.78	0	4.04	4.09	0.043	0.065	0.080	7
VC-32-3	12d-C	490	0.216	17.1	0.015	1.13	3.28	1.45	5.76	5.76	3.94	0.061	0.065	0.080	7
VC-32-4	12d-B	390	0.216	17.1	0.015	1.32	4.72	3.59	7.53	7.53	4.35	0.079	0.079	0.093	7
VC-32-5	12d-F	335	0.216	17.1	0.015	1.98	6.62	3.27	6.38	6.62	6.54	0.07	0.070	0.084	7
VC-33-1	12a-A	3560	0.216	17.1	0.015	1.07	2.87	1.98	1.93	2.87	2.98	0.03	0.065	0.080	7
VC-34-1	12c-E	545	0.216	17.1	0.015	1.02	1.4	1.71	1.56	1.71	1.47	0.018	0.065	0.080	7
VC-35-1	12e-A	290	0.216	17.1	0.015	0.91	3.59	1.31	8.37	8.37	4.09	0.088	0.088	0.101	7
VC-31-7	11a-F	3790	0.216	17.1	0.015	0.7	8.03	3.78	0	8.03	7.34	0.085	0.085	0.098	7
VC-31-8	12b-B	6050	0.216	17.1	0.015	0.78	2.96	1.25	4.35	4.35	3.13	0.046	0.065	0.080	7
VC-32-7	11d-G	490	0.216	17.1	0.015	1.23	4.23	1.78	0	4.23	4.23	0.045	0.065	0.080	7
VC-32-8	12d-E	245	0.216	17.1	0.015	1.93	6.06	4.44	17.42	17.42	5.99	0.183	0.183	0.188	7
VC-33-7	11b-A	10110	0.216	17.1	0.015	1.7	5.36	3.06	0	5.36	6.6	0.056	0.065	0.080	7
VC-33-8	12a-F	3040	0.216	17.1	0.015	0.93	7.4	2.92	2.83	7.4	7.94	0.078	0.078	0.092	7
VC-34-7	11c-D	1120	0.216	17.1	0.015	0.91	1.65	2.12	0	2.12	1.69	0.022	0.065	0.080	7
VC-34-8	12c-C	381	0.216	17.1	0.015	1.89	3.33	3.01	4.18	4.18	3.57	0.044	0.065	0.080	7
VC-35-7	11e-B	350	0.216	17.1	0.015	0.8	4.21	2.5	0	4.21	5.37	0.044	0.065	0.080	7
VC-35-8	12e-B	390	0.216	17.1	0.015	0.83	2.91	1.29	6.5	6.5	3.25	0.068	0.068	0.083	7
VC52	1" branch line (CS/SS coupling)		t_{nom} = 0.133									0.102	0.102	0.069	

TABLE 3
Required Pipe Wall Thickness for Projected 2 Year Service

ID No.	Line No.	t_{nom}	Node No	S_h	t_p	S_P	S_{DW}	S_{OBE}	S_{NOR}	S_{UPS}	S_{EMG}	t_a	t_{min}	t_{req}	Ref
CB 3	10"-#1099	0.365	15	15000	0.054	1100			1636	1792	1869	0.040	0.110	0.135	10
CB 9	10"-#1093	0.365	95	15000	0.054	1100			1199	1593	1788	0.032	0.110	0.135	11
CB10	10"-#1099	0.365	70	15000	0.054	1100			2018	2278	2408	0.049	0.110	0.135	10
CB 11	6"-#1101	0.280	enveloped	15000	0.034	890	471	443	1361	1804	2026	0.028	0.084	0.103	13
CB 12	6"-#1094	0.280	enveloped	15000	0.034	890	471	443	1361	1804	2026	0.028	0.084	0.103	13
CB 13	4"-#1093	0.237	enveloped	15700	0.022	710	133	173	843	1016	1103	0.013	0.071	0.087	13
CB 14	6"-#1093	0.280	enveloped	15000	0.034	890	471	443	1361	1804	2026	0.028	0.084	0.103	13
CB 15	3"-#1231	0.216	7, 10, 12	15000	0.017	498	83	166	581	747	830	0.009	0.065	0.080	14
CB 16	6"-#1096	0.280	85	15000	0.034	890			1256	1293	1311	0.023	0.084	0.103	12

TABLE 4

Required Pipe Wall Thickness for Projected 2 Year Service

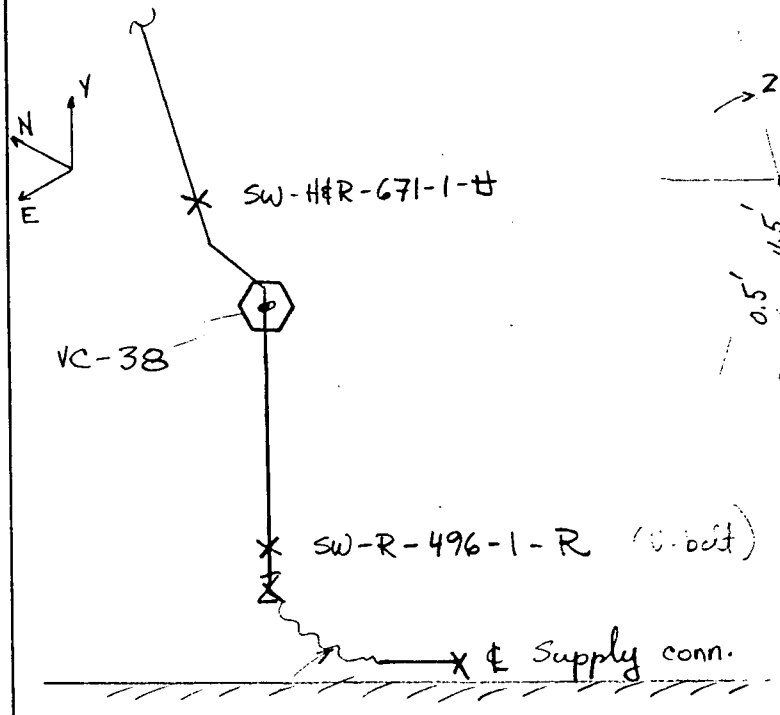
ID No.	Line No	t_{nom}	S_h	t_p	S_p	S_{dw}	S_{obe}	S_{NOR}	S_{UPS}	S_{EMG}	t_a	t_{min}	t_{req}	Ref
IS-2	14"-#1085	0.375	15000	0.071	1400	510	829	1910	2739	3153.5	0.057	0.113	0.138	15
IS-3	14"-#1083	0.375	15000	0.071	1400	246	399	1646	2045	2244.5	0.043	0.113	0.138	15
IS-7	14"-#1081	0.375	15000	0.071	1400	616	998	2016	3014	3513	0.063	0.113	0.138	15
IS-8	14"-#1082	0.375	15000	0.071	1400	510	829	1910	2739	3153.5	0.057	0.113	0.138	15
IS-9	14"-#1086	0.375	15000	0.071	1400	1700	2755	3100	5855	7232.5	0.122	0.122	0.147	15
IS-10	14"-#1084	0.375	15000	0.071	1400	48	78	1448	1526	1565	0.036	0.113	0.138	15
YD-1	24"-#712	0.375	15000	0.12	2400			3019	4770	5141	0.099	0.120	0.145	16
YD-2	16"-#1219	0.375	15000	0.079	1600	1500	9000	3100	12100	16600	0.252	0.252	0.266	17
YD-3	24"-#409	0.375	15000	0.12	2400	1350	6150	3750	9900	12975	0.206	0.206	0.224	6
TB-1	N/A	0.065	17100	0.0016	220	1500	2955	1720	4675	6152.5	0.015	0.020	0.024	18

IS-9 3"- branch line (on lines #1081 - #1086) 0.065 (pgs 16a 16b 16c)

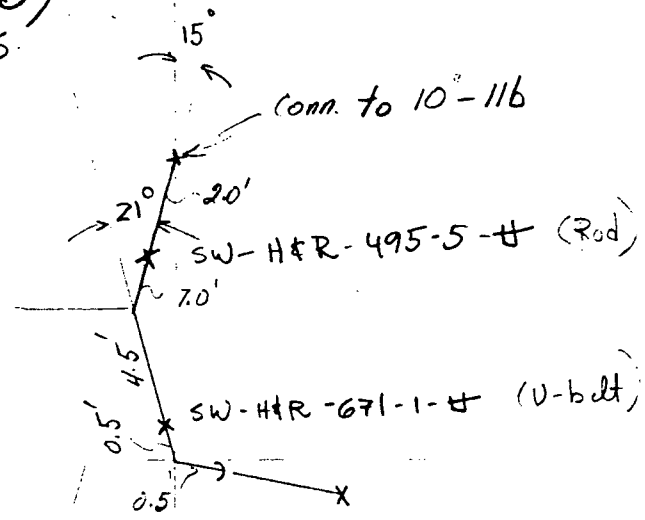
5. References

1. UE&C Calc. 6604.343-C-SW-005
2. UE&C Prob. 440 SWS Lines 12A – 12E & 406 (Outside Containment)
3. UE&C Prob. 417 ('79 analysis)
4. UE&C Prob. 418 ('79 analysis)
5. IP3-CALC-AC-00054, Rev. 1
6. ASME Section VIII, Div. 1, Table UNF-23.3
7. ALTRAN Tech Rpt #97124-TR-01, Rev. 1 of Vol. 2 & Rev. 3 of Vol. 1
   ALTRAN Tech Rpt #97124-TR-02, Rev. 0
8. Pages 9 & 10 Stress calculation for inspection points VC-38 & VC-42
9. Pages 11 & 12 Stress calculation for inspection point VC-52
10. Page 13 Stress calculation for inspection points CB-3 & CB-10
11. Page 14 Stress calculation for inspection point CB-9
12. Page 15 Stress calculation for inspection point CB-16
13. UE&C Calc. 6604.003
14. UE&C Calc. 6604-C-SWS-051 (10/29/94 with ECN)
15. Pages 16 – 22 Stress calculation for inspection points IS-1 through IS-10
16. Pages 23 & 24 Stress calculation for inspection point YD-1
17. IP3-CALC-SWS-01596, Rev. 1
18. Page 25 Stress calculation for inspection point TB-1
19. Memo: IP-DSE-98-227MC, dated 3/9/99
20. NYPA Eng. Std. CES-7, Rev. 2
21. IP3-CALC-SWS-02419, Rev. 1

Line #671 (Ref: 9321-F-27483)
mat: 904L S.S.



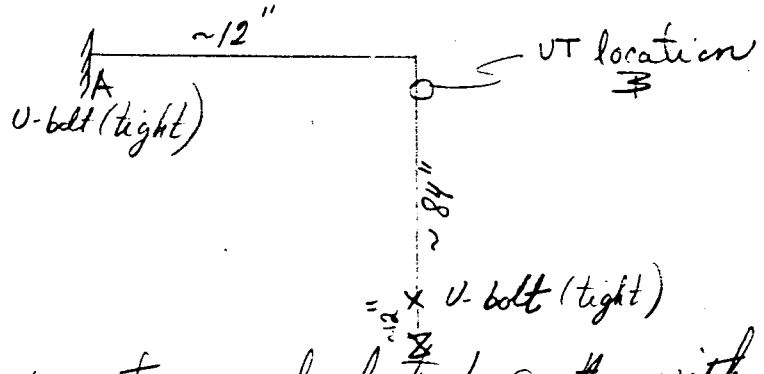
Flexible conn.



Plan view

Assumptions:

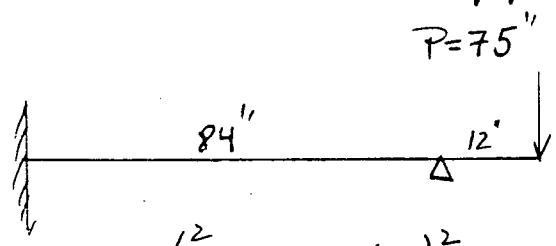
1. Lines #671 & #672 may be enveloped by the same model (VC-38 & VC-42 @ same location)



2. Max stress calculated @ A with SIF=2.1 is used @ B

g_{horiz} DBE $= 1.4$ g_{vert} DBE $= 0.93$ Cont. Bldg. 81' elev

$\omega \approx 5\#/ft$ 2" Sch 40 pipe $P = 25 + 50 = 75\#$ flex value



$a = 12$ $l = 96$
$b = 84$

$$M_1 = \frac{\omega l^2}{8} = \frac{5(84)^2}{12(8)} = 368 \text{ in-lbs}$$

$$M_2 = \frac{Pl}{2} = \frac{75(12)}{2} = 450 \text{ in-lbs}$$

$$M_{total} = 368 + 450 = 818 \text{ in-lbs}$$

$$S = 0.561 \text{ in}^3$$

$$S_{dwt} = \frac{818}{0.561} \approx 1{,}458 \text{ psi} \quad \text{use SIF} = 2.1$$

$$\therefore S_{Dwt} = 1458(0.75)(2.1) \approx 2296 \text{ psi}$$

OBE seismic factor $= \left[(1.4)^2 + (1.4)^2\right]^{1/2} = 1.98(2) = 3.96$

$$S_{OBE} = 2296(3.96) = 9092 \text{ psi}$$

$$S_{DBE} = 9092(1.5) = 13{,}638 \text{ psi}$$

$$S_P = \frac{PD_o}{4t} = \frac{15(2.375)}{4(0.154)} = 600 \text{ psi}$$

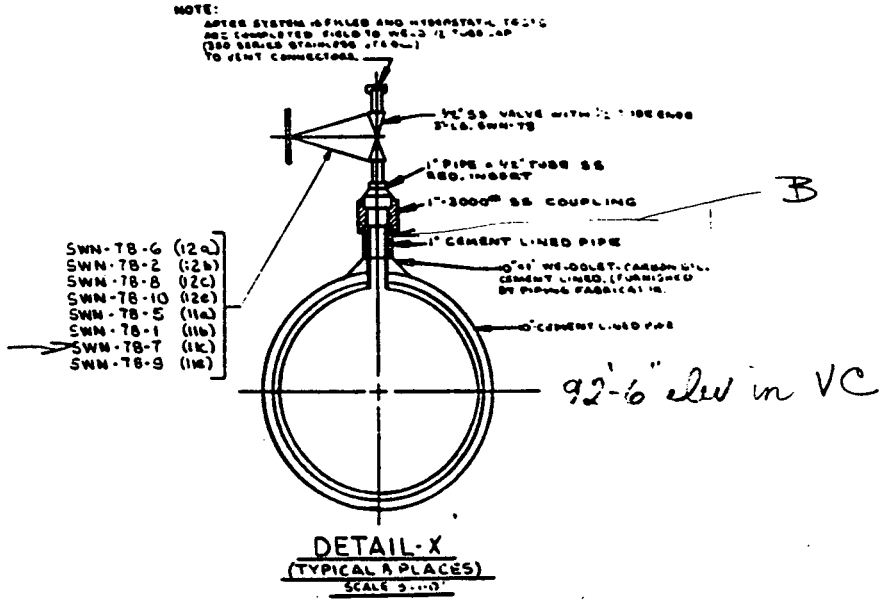
$$S_{NOR} = 2296 + 600 = 2896 \text{ psi}$$

$$S_{UPS} = 2896 + 9092 = 11{,}988 \text{ psi}$$

$$S_{EMG} = 2896 + 13{,}638 = 16{,}534 \text{ psi}$$

very conservative

VC-52



Ref: INRN-1020-2

Calc. stress @ point B (dis-similar metal weld)

component	wt (lbs)	
valve	6.0	
1" pipe (6in)	1.28	(pipe + water + cement lining) (2.05 + 0.51) lbs/ft
1/2" std cap	0.10	
reducer	0.30	
coupling	0.50	
1/2" tubing (6in)	0.15	
Total	8.33	use total wt = 10 lbs

estimate total length ≈ 2 ft

calculate stress by calc. moment @ B $= 10(2)\left(\frac{2}{3}\right) = 13.3$ ft-lb

S for 1" Sch 40 pipe $= 0.133\ in^3$

$\therefore S_{Dwt} = \frac{13.3(12)}{.133} = 1{,}200$ psi $\quad S_p = \frac{PD_o}{4t} = \frac{150(1.315)}{4(.133)} = 375$ psi

VC - 106' elev $\quad g_{horiz}^{OBE} = 2.50 \quad g_{vert}^{OBE} = 1.67$

$$\text{seismic factor} = \left[(2.5^2 + 2.5^2)\right]^{1/2} (2)_{MMF} = 7.07$$

$SIF = 2.1$

$$S = 1200(0.75)(2.1) = 1890 \text{ psi} \quad (g = 1.0)$$

$$S_{OBE} = 1890(7.07) = 13{,}363 \text{ psi}$$

$$S_{DBE} = 1.5(13{,}363) = 20{,}044 \text{ psi}$$

$S_{DWT} = 0$ (negl., since eccentricity of value is small)

$$S_{NOR} = S_P + S_{DWT} = 375 \text{ psi}$$

$$S_{UPS} = S_{NOR} + S_{OBE} = 375 + 13{,}363 = 13{,}738 \text{ psi}$$

$$S_{EMG} = S_{NOR} + S_{DBE} = 375 + 20044 = 20{,}419 \text{ psi}$$

$t_{nom} = 1.315$ in

$$t_P = \frac{PD}{2[S_h + .4P]} = 0.01 \text{ in}$$

NewYorkPower Authority

Calculation No. IP3-CHC-SWS-03023

Project IP3

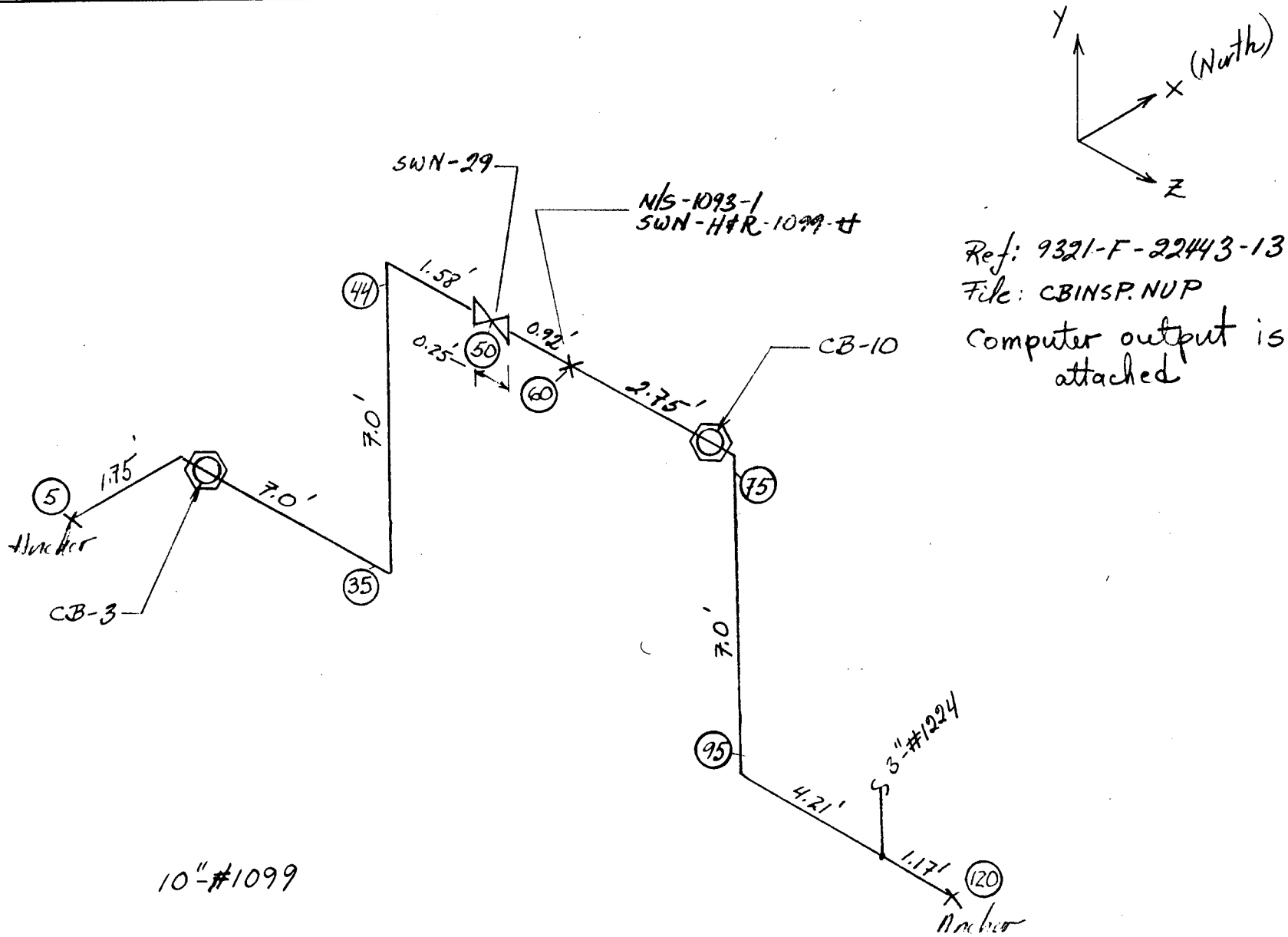
Subject Min. Wall Thickness @ PID Inspections (CB-3 & CB-10)

Revision 0

Page 13 of 25 attached comp. anal.

Computed by MK Date 8/10/99

Checked by MK Date 8/10/99



Ref: 9321-F-22443-13

File: CBINSP.NUP

Computer output is attached

NewYorkPower Authority

Calculation No. IP3-CALC-SWS-03023

Project IP3

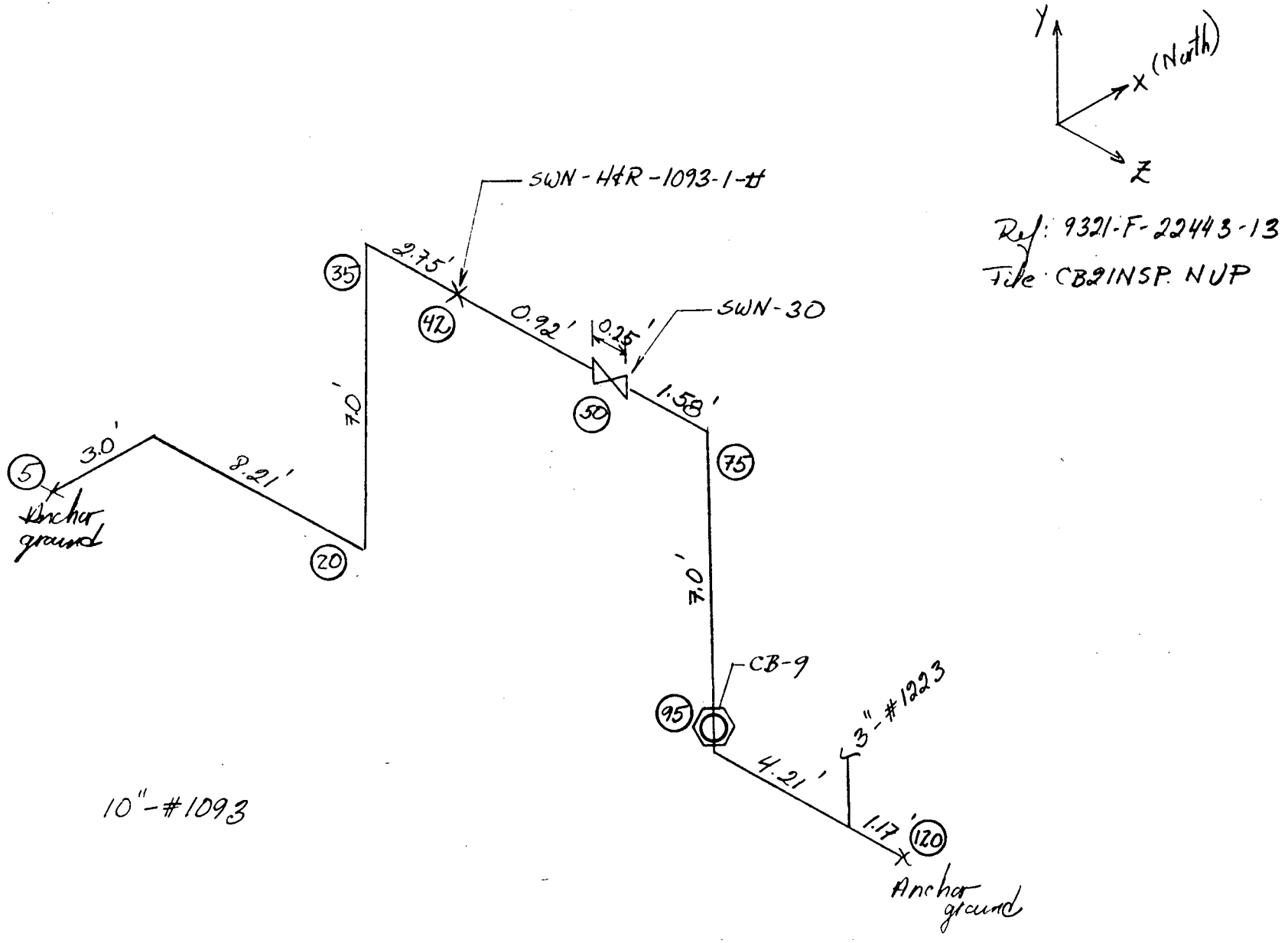
Subject Min. Wall Thickness @ R10 Insp. Loc. (CB-9)

Revision 0

Page 14 of 25 & attached comp. anal.

Computed by UL Date 8/10/99

Checked by KL Date 8/10/99



Recycled paper

NewYorkPower Authority

Calculation No. IP3-CALC-SWS-03023

Project IP3

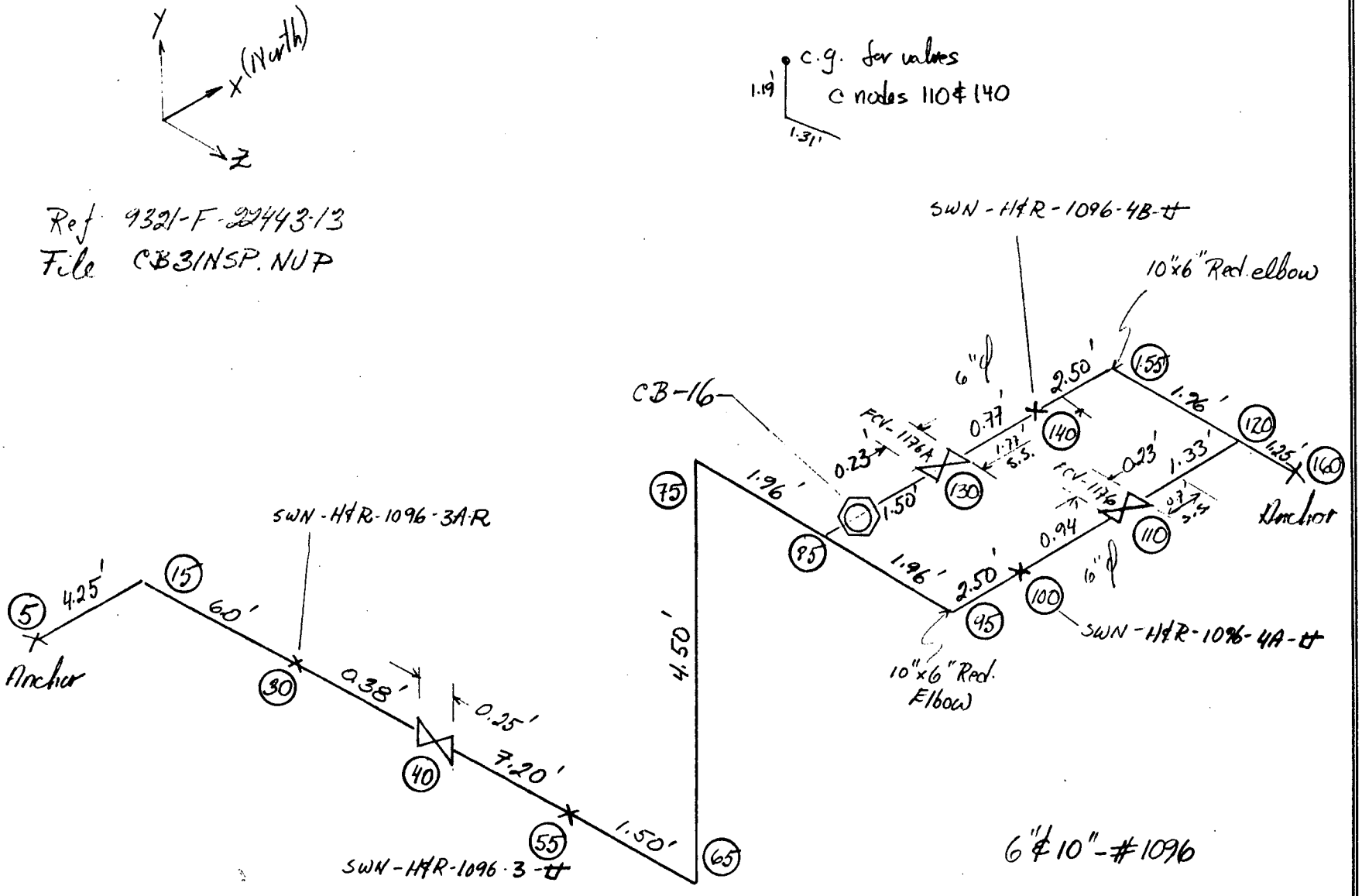
Subject Min. Wall Thickness @ R10 Insp. Loc. (CB-16)

Revision 0

Page 15 of 25 & Attached comp. anal.

Computed by [illegible] Date 8/10/99

Checked by KL Date 8/10/99



Misc. calc:

Cement lining weight, t = 5/16"

O.D. = 10.75 Sch 40 } pipe
I.D. = 10.02

O.D. cem lining = 10.02

I.D. = 10.02 - 2(5/16) = 9.395

Area = 0.785 (OD² - ID²) = 9.526 in²

Vol / ft length = Al = 9.526(12) = 114.31 in³

Density of cement = 0.0833 #/in³

wt = Vol × density = 114.31(.0833) = 9.52 lbs

O.D. = 6.625 Sch 40 } pipe
I.D. = 6.065

O.D. cem lining = 6.065

I.D. = 6.065 - 2(5/16) = 5.44

Area = 0.785 (OD² - ID²) = 5.65 in²

Vol / ft length = Al = 5.65(12) = 67.74 in³

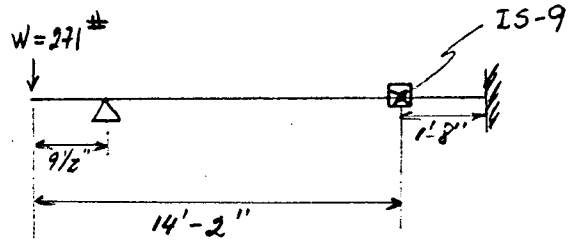
Density of cement = 0.0833 #/in³

wt = Vol × density = 67.74 (.0833) = 8.64 lbs

PIPE MATERIAL AND PROPERTIES

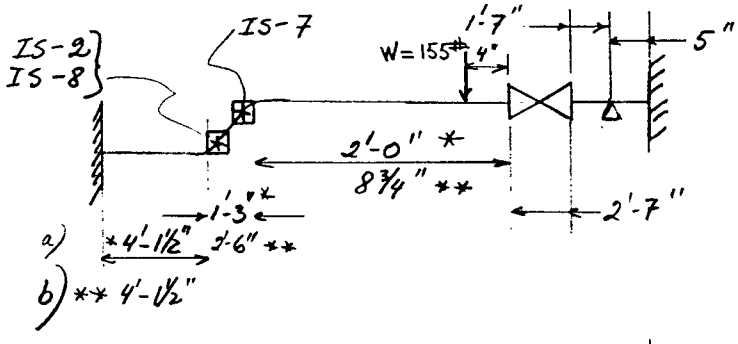
Line Designation Spec 1321-05-248-35 Rev. 1	1093	1096		1099	
Material	153 SS				
Pipe O.D. (in)	10.75	10.75	6.625	10.75	
Schedule	40	40	40	40	
thickness (in)	0.365	0.365	0.280	0.365	
Wt. of Pipe (#/ft)	40.50	40.50	18.97	40.50	
Wt. of Fluid (#/ft)	34.10	34.10	12.51	34.10	
Wt. of Insul (#/ft)	—	—	—	—	
Cement lining	9.52	9.52	8.64	9.52	
Total:	84.12	84.12	40.12	84.12	
Design Conditions IP3-LIST-MULT-C1177, Rev 0					
Temperature (°F)	160	160	160	160	
Pressure (psi)	150	150	150	150	
Operating Conditions					
Temperature (°F)	85	120	120	85	
Pressure (psi)	150	150	150	150	
Linear Th exp (in/ft)	0.0069	0.0069	0.0069	0.0069	@ 160°F
Mean exp (10^{-6} in/in/°F)	—	—	—	—	(Design Temp)
Modulus of Elasticity					
Ec (10^{-6} psi)	27.9	27.9	27.9	27.9	
Eh (10^{-6} psi)	27.9	27.9	27.9	27.9	
Allowable Stress					
Sc (psi)	15,000				
Sh (psi)	15,000				
Isometric (ref)	22443	22443	22443		

Case I : Line #1086



$W = [82 - 2(230)]\frac{1}{2} = 271^{\#}$
cap. it flgs

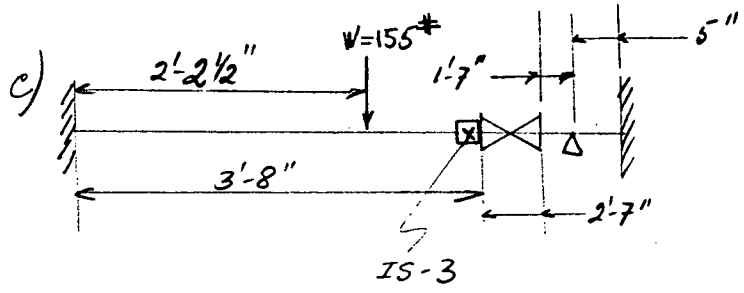
Case II : lines # 1085, 1083, 1082, and 1081



Valve wt = 1379#

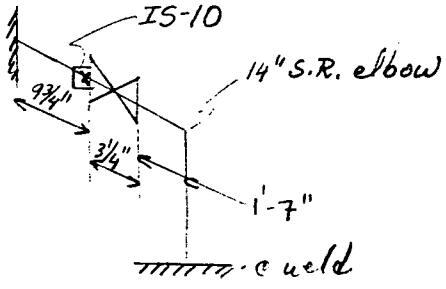
* lines #1082 & 1085

** line # 1081



line # 1083 & 1084

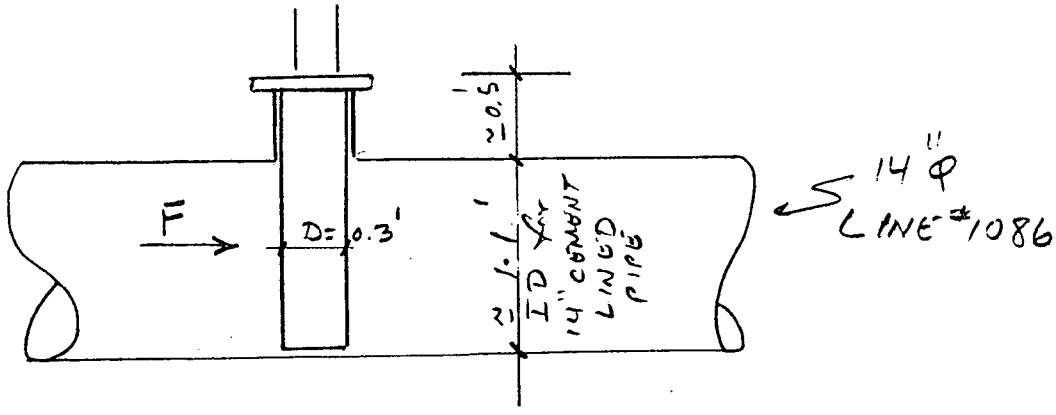
Case III line # 1084



Valve wt = 478#

REFERENCE: QA Report 99 R140

Applicable to branches on lines #1081 - #1086



$A = \pi D \times L = \pi \times 0.3 \times \frac{1.1}{2} = \frac{1.04}{2}$ FT^2

(very conservative)

Assume the flow = 6000 gpm (Max SW Flow)
(very conservative)

$V = \frac{Q}{A_{pipe}} = \frac{6000 \times 4}{\pi \times (1.1)^2 \times 60} \times 0.1337 = 14.1$ ft/sec

Velocity head $= \frac{V^2}{2g} = \frac{14.1^2}{2 \times 32.2} = 3.1$ ft

Velocity pressure $= \frac{3.1}{2.3106} = 1.34$ psi

Force $= 1.34 \times 144 \times \frac{1.04}{2} = 100$ lb

Moment @ weld location $= 100 \times \frac{1.1}{2} = 55$ FT.lb

$= 660$ #.lb

$$S_{weld} = \pi r^2 \qquad r = \frac{3.5}{2} \text{ in}$$

$$= \pi \left(\frac{3.5}{2}\right)^2 = 9.62 \text{ in}^3 / \text{in width}$$

$$(t_1)_{req'd} = \frac{660}{15{,}000 \times 9.62} \times \frac{1}{0.707} = 0.0065 \text{ in}$$

for water flow

ADD'L weld for pressure

$$15{,}000 \times \pi \times 3.5 \times 0.707\, t_2 = \frac{150 \times 3.5}{t_2 \times 4}$$

$$t_2 = \sqrt{\frac{150 \times 3.5}{4 \times 15{,}000 \times \pi \times 3.5 \times 0.707}}$$

$$= 0.0335 \text{ in}$$

$$t_{Total} = 0.0335 + 0.0065 = 0.04 \text{ in}$$

Seismic weld requirements

Assume all attachment weight = 100 lb
using 3g for accelaration (very conservative)

Moment = $100 \times 3 \times \frac{1.1}{2} = 165$ ft. lb = 1,980 ft. lb

$$t_s = \frac{1980}{15{,}000 \times 9.62} \times \frac{1}{0.707} = 0.0194 \text{ in}$$

(Note: weld stresses can be increased by $\frac{1}{3}$ for seismic, however it is not used)

$$t_{Total} = 0.04 + 0.0194 = 0.0594 \text{ in}$$

Weld or pipe (conservative) < 0.1049 in measured

3" ϕ sch. 40 $t_{nom} = 0.216$ in

t_{min} (ESM-CES-7 Engineering Standard) $= 0.3 \times 0.216$
$= 0.0648$ in

$t_{measured} > 0.3\, t_{nom}$ ok

Corrosion/erosion rate = $(0.216 \times 1.125 - 0.1049)\frac{1}{20} = 0.0069$ in

Number of years available = $\frac{0.1049 - 0.0648}{0.0069} = 5.8$ years Max

For 15 years, $\frac{15}{20} = .75 \times 5.8 = 4.35$ years

Intake Structure 15'-0" ELEV

$g_{horiz\ OBE} = 0.69$ $g_{vert\ OBE} = 0.46$

$g_{horiz\ DBE} = 1.04$ $g_{vert\ DBE} = 0.69$

distr wt = wt pipe + wt water + wt cement lining

14" Sch 40 pipe

O.D. = 14.00
I.D. = 13.25 $t = 0.375$ } Assume 5/16" thick cement lining
I.D. = 13.25 - 2(5/16) = 12.625

Area = $0.785(OD^2 - ID^2) = 12.70$

Vol/ft length = $Al = 12.70(12) = 152.3$

Density of cement = $0.0833\ \#/in^3$

Wt = Vol × density = 152.3(0.0833) = 12.68 lbs

∴ dist wt = 54.6 + 59.7 + 12.68 = 127.0 #/ft
= 10.58 #/in

seismic factor$_{OBE}$ = $\left[(0.69)^2 + (0.69)^2 + (0.46)^2\right]^{1/2} = 1.08$

seismic factor$_{DBE}$ = $\left[(1.04)^2 + (1.04)^2 + (0.69)^2\right]^{1/2} = 1.62$

use MMF = 1.50

Recycled paper

Case I: (Beam fixed @ one end, supported @ other)

Assumptions: 1. ignore overhang w/wt = 271#, since overhang is short
2. calc max moment, although not at inspection location

$$M_{max} = \frac{wl^2}{8} = \frac{10.58\,lbs}{in} \times \frac{[15(12)]^2\,in^2}{8} = 42{,}849\ in\text{-}lbs$$

$$S = 53.2\ in^3$$

$$S_{Dwt} = \frac{42{,}849}{53.2} = 806\ psi$$

$$S_{OBE} = \frac{42{,}849(1.08)(1.5)}{53.2} = 1305\ psi$$

$$S_{DBE} = \frac{42{,}849(1.62)(1.5)}{53.2} = 1958\ psi$$

use SIF = 2.81 for weldolet $\quad i = 0.9/h^{2/3} \quad h = \frac{3.3\,t_{nom}}{R_{mean}}$

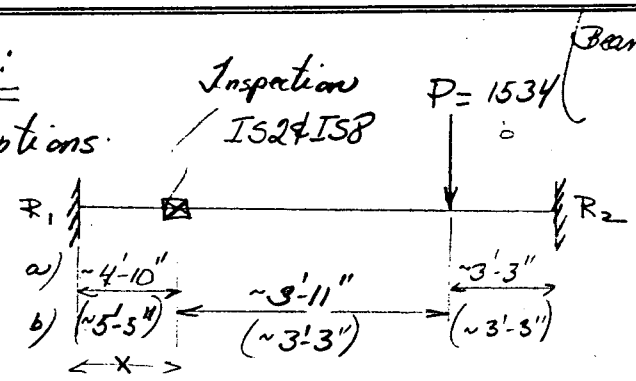
$$\therefore\ S_{Dwt} = 0.75(2.81)(806) = 1700\ psi$$

$$S_{OBE} = 0.75(2.81)(1305) = 2755\ psi$$

$$S_{DBE} = 0.75(2.81)(1958) = 4130\ psi$$

Case II:

Assumptions:



$l = 144$ in
$a = 105$
$b = 39$
$f = 58$

a) $M_x = R_1 x - \frac{P a b^2}{l^2}$

$R_1 = \frac{P b^2}{l^3}(3a + b) = \frac{1534(39)^2}{144^3}\left[3(105) + 39\right] = 277$ lbs

$M_{x\,\text{conc. ld}} = 277(58) - \frac{1534(105)(39)^2}{144^2} = 4251$ in-lbs

$M_{x\,\text{distr. ld}} = \frac{w}{12}(6lf - l^2 - 6x^2) = \frac{10.58}{12}\left[6(144)(58) - 144^2 - 6(58)^2\right]$

$= 8105$ in-lbs

$M_{x\,\text{total}} = 4251 + 8105 = 12{,}356$ in-lbs

$S_{Dwt} = \frac{12{,}356}{53.2} = 232$ psi

$S_{OBE} = \frac{12{,}356(1.08)(1.5)}{53.2} = 377$ psi

$S_{DBE} = \frac{12{,}356(1.62)(1.5)}{53.2} = 564$ psi

$SIF_{45^\circ\,\text{elbow}} = 2.93$ std elbow (Ref. CES-7, Rev. 2)

$\therefore S_{Dwt} = 0.75(2.93)232 = 510$ psi

$S_{OBE} = 0.75(2.93)377 = 829$ psi

$S_{DBE} = 829(1.5) = 1243$ psi

IS-7

$l = 144$
$a = 105$
$b = 39$
$x = 64$

II.b) $R_1 = \frac{1534(39)^2}{(144)^3}\left[3(105)+39\right] = 280$ lbs

$M_{x\,\text{conc. ld}} = 280(64) - \frac{1534(105)(39)^2}{(144)^2} = 6106$ in-lbs

$M_{x\,\text{distr ld}} = \frac{10.58}{12}\left[6(144)(64)-(144)^2-6(64)^2\right] = 8803$ in-lbs

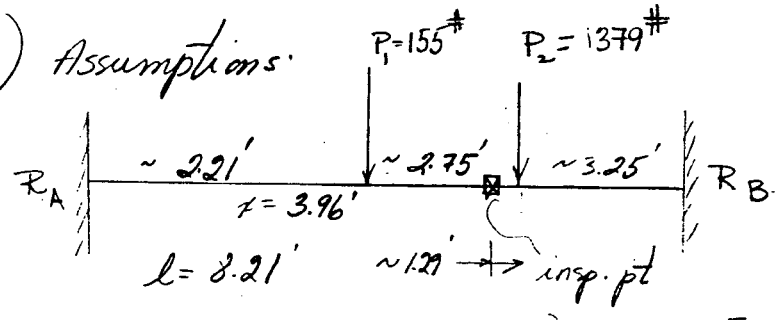
$M_{x\,\text{total}} = 6106 + 8803 = 14{,}909$ in-lbs

$S_{DWT} = \frac{14{,}909}{53.2}(0.75)(2.93) = 616$ psi

$S_{OBE} = \frac{14909}{53.2}(1.08)(1.5)(0.75)(2.93) = 998$ psi

$S_{DBE} = 1.5\,S_{OBE} = 1497$ psi

II.c) Assumptions:



$M_{x\,\text{distr. ld}} = \frac{w}{12}\left(6lx - l^2 - 6x^2\right) = \frac{10.58}{12}\left[6(98.5)(44)-(98.5)^2-6(44)^2\right] = 4131$ in.

for $P_1 = 155$ $a = 72$ $b = 26.5$ $x = 54.4$

$R_{B(P_1)} = \frac{P_1 b^2}{l^3}(3a+b) = \frac{155(26.5)^2}{(98.5)^3}\left[26.5+3(72)\right] = 28$ lbs

$M_{x(P_1)} = R_B x - \frac{P_1 a b^2}{l^2} = 28(54.4) - \frac{155(72)(26.5)^2}{(98.5)^2} = 716$ in-lbs

for $P_2 = 1379$ $a = 59$ $b = 39$ $x = 44$

$R_{A(P_2)} = \frac{1379(39)^2}{(98.5)^3}\left[3(59.5)+39\right] = 480$ lbs

$M_{x(P_2)} = 480(44) - \frac{1379(59.5)(39)^2}{(98.5)^2} = 8257$ in-lbs

II c) continued

$M_{x_{total}} = 4131 + 716 + 8257 = 13{,}104$ in-lbs

$$S_{DWT} = \frac{13{,}104}{53.2} = 246 \text{ psi}$$

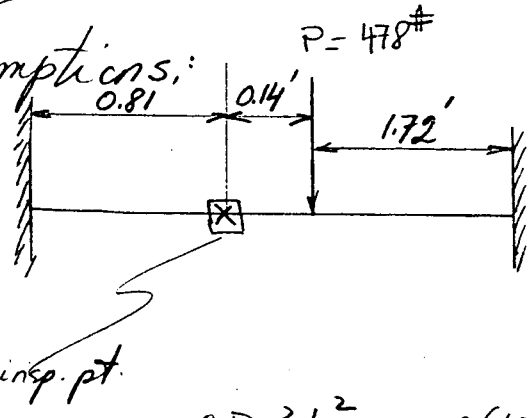
$$S_{OBE} = 246(1.08)(1.5) = 399 \text{ psi}$$

$$S_{DBE} = 1.5(399) = 598 \text{ psi}$$

Case III

Assumptions:

1)



2) assume insp. pt is @ location of P

$a = 0.95 \times 12 = 11.5$ in

$b = 1.72 \times 12 = 20.6$ in

$l = 32.1$ in

$$M_{conc\ ld} = \frac{2Pa^2b^2}{l^3} = \frac{2(478)(11.5)^2(20.6)^2}{(32.1)^3} = 1623 \text{ in-lbs}$$

$$M_{x\,distr\ ld} = \frac{w}{12}(6lx - l^2 - 6x^2) = \frac{10.58}{12}\left[6(32.1)(11.5) - (32.1)^2 - 6(11.5)^2\right]$$
$(x = 11.5$ in$)$

$$= 345 \text{ in-lbs}$$

$$M_{max} = \frac{wl^2}{12} = \frac{10.58(32.1)^2}{12} = 908 \text{ in-lbs}$$
(at ends)

Case III (continued)

use M_{max} to envelope assumptions

$\therefore M_{total} = 1623 + 908 = 2531$ in-lbs

$S_{DWT} = \frac{2531}{53.2} = 48$ psi

$S_{OBE} = 48(1.08)(1.5) = 78$ psi

$S_{DBE} = 1.5(78) = 117$ psi

Recycled paper

NewYorkPower Authority

Calculation No. IP3-CALC-SWS-03023

Project IP3

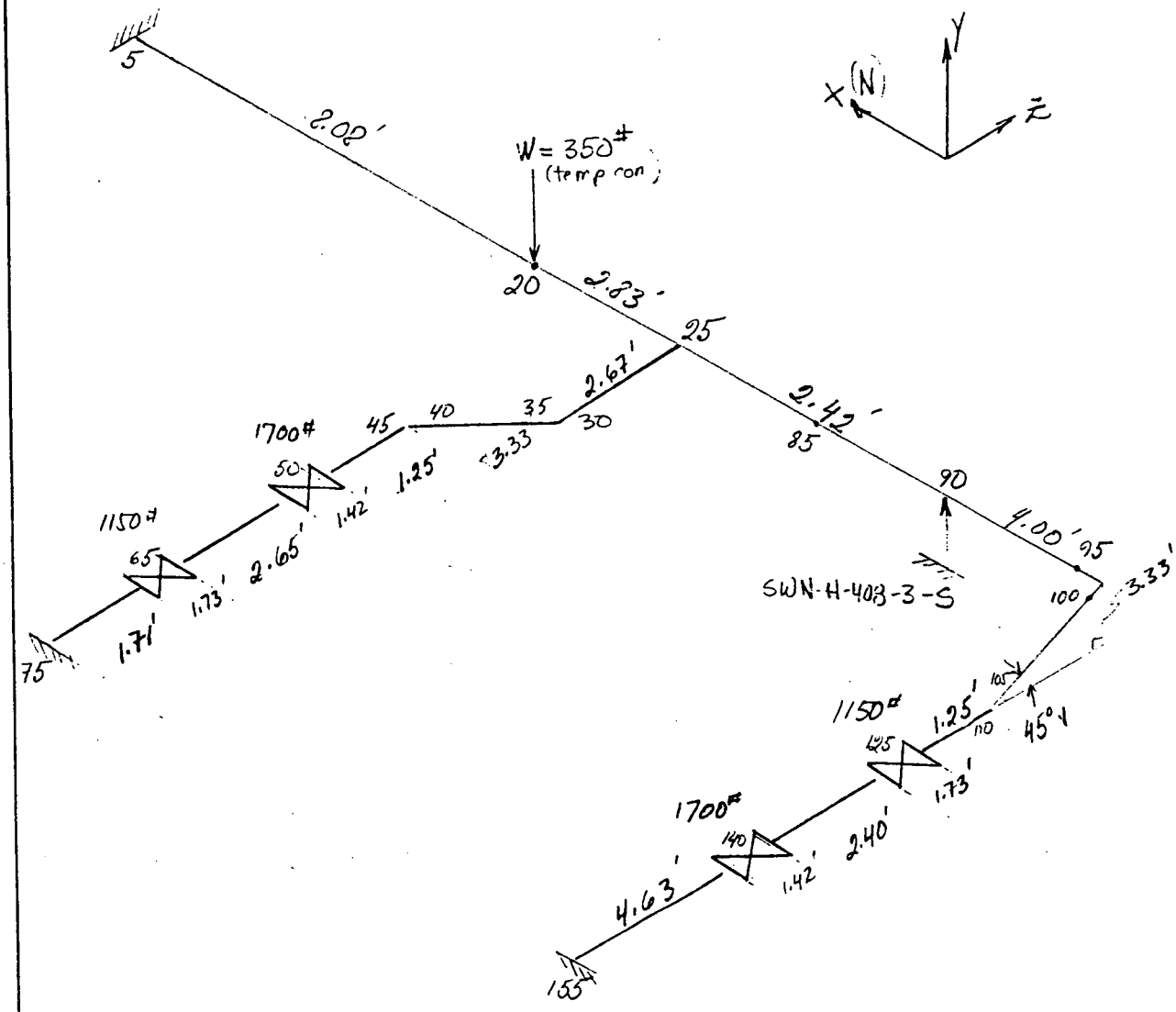
Subject Min. Wall Thickness @ R10 Insp. Loc. (YD-1)

Revision 0

Page 23 of 25

Computed by MZ Date 8/10/99

Checked by KL Date 8/10/99



PIPE MATERIAL AND PROPERTIES

Line Designation	712				
Material	C.S.				
Pipe O.D. (in)	24				
Schedule	20				
thickness (in)	0.375				
Wt. of Pipe (#/ft)	94.6				
Wt. of Fluid (#/ft)	183.8				
~~Wt. of Insul~~ (#/ft) Cement lining	22.5		OD = 23.25 ID = 22.625 in for cement lining 5/16" thick		
Total	301. —		area = $0.785(OD^2 - ID^2) = 22.5 in^2$		
Design Conditions			vol/ft length = Al = 22.5 (12) = 270 in^3		
			density of cement = 0.0833 #/in^3		
Temperature (°F)	160		wt = Vol x density = 270(.0833) = 22.5 lbs		
Pressure (psi)	150				
Operating Conditions					
Temperature (°F)	85				
Pressure (psi)	65				
Linear Th exp (in/ft)	0.0069				
Mean exp (10^{-6} in/in/°F)					
Modulus of Elasticity					
Ec (10^{-6} psi)	27.9				
Eh (10^{-6} psi)	27.76				
Allowable Stress					
Sc (psi)	15000				
Sh (psi)	15000				

TB-1 (Ref. 9321-F-70053) 3/8" s.s. tubing in tube track

$S_{Dwt} = 1500$ psi Ref: ESM: CES-7, page 6/18

$$S_P = \frac{P_o D}{4t} = \frac{150(0.375)}{4(0.065)} = 220 \text{ psi}$$

Seismic factor: use C.B. 15 elev; $g_{horiz\ OBE} = 0.63$ $g_{vert\ OBE} = 0.42$

$$S_{OBE} = (0.63^2 + 0.63^2 + 0.42^2)^{1/2}(1500)(2)_{MMF} = 2955 \text{ psi}$$

$$t_p = \frac{F D_o}{2[S_h + .4P]} + A \qquad A = 0$$

$$= \frac{150(0.375)}{2[17{,}100 + .4(150)]} = 0.0016 \text{ in}$$

Indian Point 3
Nuclear Power Plant
P.O. Box 215
Buchanan, New York 10511
914 736.8000

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NewYorkPower Authority

TO: Document Control Desk - NRC CONTROL COPY NO.: 25

FROM: EMERGENCY PLANNING DATE: 8/99

SUBJECT: DISTRIBUTION OF THE INDIAN POINT #3 EMERGENCY PLAN REVISIONS

The enclosed revisions are for your controlled copy of the IP-3 Emergency Plan. Please discard old sheets, insert new sheets, initial/date this transmittal, and return it to the **IP-3 Documents Department**. If you have any questions regarding these changes, call Emergency Planning (x8404).

Thank you.

VOLUME II - EMERGENCY RESPONSE ACTIVATION - IMPLEMENTING PROCEDURES

OLD:		NEW:	
Table of Contents	6/99	Table of Contents	8/99
IP-2103	Rev. 3	IP-2103	Rev. 4
IP-2302	Rev. 5	IP-2302	Rev. 6
EP Forms Index	6/99	EP Forms Index	8/99

*** Remove the forms for EP-Forms 1A and 1B in the forms section**

VOLUME III - EMERGENCY PLAN IMPLEMENTING PROCEDURES

Table of Contents	6/99	Table of Contents	8/99
IP-1001	Rev. 15	IP-1001	Rev. 16

I acknowledge the receipt of these revisions to the IP-3 Emergency Plan.

(Signature) (Date)

INDIAN POINT 3

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2	SPOERRY D	TRAINING	IP3
3	RES DEPARTMENT MANAGER	RES	45-4-A
4	DECKER V	REFERENCE LIBRARY	#48
8	PUBLIC RELATIONS MANAGER	PUBLIC RELATIONS	46-2-C
9	PUBLIC RELATIONS MANAGER	PUBLIC RELATIONS	46-2-C
10	SHIFT MANAGER	DOCUMENT CONTROL	IP3
11	CONTROL ROOM	DOCUMENT CONTROL	IP3
12	COMPUTER SERVICES MANAGER	COMPUTER SERVICES	IP3
13	I&C MANAGER	I&C	45-2-A
14	EOF	E-PLAN	EOF
15	EOF	E-PLAN	EOF
16	GROSJEAN A	APPRISAL & COMPLIANCE	WPO/14A
17	GROSJEAN A	APPRISAL & COMPLIANCE	WPO/14A
18	PATRICK C	PUBLIC RELATIONS	WPO/11L
19	WPO DOCUMENT CONTROL	NUCLEAR ENG. LIBRARY	WPO/10-A
22	RESIDENT INSPECTOR	US NRC	IP3
23	MCNAMARA N	NRC	OFFSITE
24	MCNAMARA N	NRC	OFFSITE
25	DOCUMENT CONTROL DESK	NRC	OFFSITE
27	LEWIS P - VOLUME #1 ONLY	INPO	OFFSITE
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37	HP WATCH OFFICE	HP - R. DESCHAMPS - RES	45-4-A
38	SECURITY COMMAND POST	SECURITY	IP3
39	SECONDARY ALARM (SAS)	SECURITY	IP3
40	SECURITY MANAGER	SECURITY	IP3
41	SIMULATOR	TRAINING	IP3
42	CONTROL ROOM	DOCUMENT CONTROL	IP3
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107	QA MANAGER	QA	TRL #2A
128	O.R.G. DEPT. MANAGER	O.R.G. DEPARTMENT	46-2-B
158	SYSTEM ENGINEERING MGR.	SYSTEM ENGINEERING	45-3-H
211	D&A MANAGER	DESIGN ENGINEERING	IP3
308	HUGHES J IP-1011 ONLY	E-PLAN	CON ED
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