TIC

ARKANSAS POWER & LIGHT COMPANY
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August 24, 1979

1-089-12
2-098-14

Mr. K. V. Seyfrit, Director
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Subject: Arkansas Nuclear One-Units 1 & 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF -6
IE Bulletin No. 79-17
(File: 1510.1 and 2-1510.1)

Gentlemen:

Attached is our written report as required by item 5 of the subject bulletin. This report addresses the results of our review of safety-related stainless steel piping systems as required by item 1 of the bulletin. Responses to the remaining items will be submitted as required.

Very truly yours,

David C. Trimble
Manager, Licensing

DCT/ERG/ew

Attachments

1397 048

cc: Mr. Darrell G. Eisenhut
Acting Director
Division of Operating Reactors
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Mr. W. D. Johnson
U. S. Nuclear Regulatory Commission
P. O. Box 2090
Russellville, AR 72801

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RESPONSE TO ITEM 1(a)

ANO-1

Only one hydrotest has been completed in relation to Inservice Inspection (ISI). This was a test of the High Pressure Injection System in April of 1979. Visual and volumetric exams of identified systems which were performed per ISI are delineated in Attachment A1. The procedures used are ISI-120, ISI-300 and ISI-350 and are included as Attachments B1-1, B1-2, and B1-3, respectively. Of all exams done on the identified systems during the ISI program, no repairable indications were noted; therefore, no corrective actions have been taken.

ANO-2

No Inservice Inspections have been performed as this unit is not in commercial operation. The sampling plan is being developed at this time. The procedures used for the base line are included as Attachments B2-1 and B2-2.

RESPONSE TO ITEM 1(b)

ANO - 1 & 2

Primary water radiochemistry controls at ANO are to maintain technical specification limits on B, Cl^-, F^- and dissolved O_2. The limits are maximum allowable concentrations of dissolved O_2, Cl^- and F^- in the Reactor Coolant System (RCS), and are the same for both ANO-1 and ANO-2. (See ANO-1 Tech. Spec. 3.1.5 and ANO-2 Tech. Spec. 3.4.7.) The limits for other systems tested are extrapolations of these. Boron concentration tests are done as required by Tech. Specs. and when needed for other specific procedures, such as during Physics Testing. pH tests are done as required and reflect Boric acid concentration changes due to power excursions, etc.

There are no specific Tech. Spec. requirements for Cl^-, F^-, and dissolved O_2 levels in the systems addressed by IE Bulletin 79-17. However, the decay heat system is tested for pH, B, C^- and F^- three times per week when in operation and the BWST (RWST) is tested for pH, B, Cl^-, F^-, and suspended solids weekly. The ECCS and spent fuel systems are tested monthly for Boron and the makeup system is tested for Boron during startup. No chemistry tests are done on the containment spray system.

A review of water chemistry logs shows that Cl^- levels have exceeded the Tech. Spec. limits about a dozen times in the past three years for all systems tested (RCS, decay heat, and BWST/RWST) and have typically remained below 0.01 ppm. The concentrations did not approach transient limits of between 0.2 and 0.3 ppm. The dissolved O_2 concentrations were tested less frequently, but typically remained less than 0.002 ppm.

There have been no design changes to maintain chemistry in the systems mentioned. There are not specific requirements concerning periodic flushing and recirculation procedures for stagnant systems, however, pump recirculation flowpaths are flushed during Section XI, IWP testing. The core flood lines are purged of air (by "burping") after each refueling.

RESPONSE TO ITEM 1(c)

ANO-1

Preservice exams on the Low Pressure Injection, High Pressure Injection and Core Flood systems were completed by December of 1973 in accordance with Section XI, 1971 Edition, Summer 73 Addenda. UT and PT exam procedures were written by personnel qualified to the requirements of SNT-TC-1A level II and were reviewed and approved by personnel qualified to Level III. These NDE procedures conform to the requirements of ASME Section XI and referenced parts of Section III.

ANO-2

Attachment C2 provides a description of preservice NDE procedures and includes the applicable ASME Code edition addenda used.

The Arkansas Power and Light Company, Arkansas Nuclear One, Unit No. 2 Inservice Inspection Program is based upon meeting the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, 1971 Edition through the Summer of 1971 Addenda to the maximum extent possible. Class 1 and 2 piping examinations will be conducted to meet 1975 Winter Addenda Appendix III requirements. Item IS-231 of the Code requires the preparation of written procedures necessary for the conduct of non-destructive examinations associated with the program. Accordingly, written procedures have been prepared for the conduct of volumetric examinations. The procedures have been approved by the customer (AP&L), the inservice inspection contractor (C-E/Aii), and the inspection agency (Factory Mutual).

Volumetric examinations are performed predominantly using ultrasonic methods; some examinations will be by radiographic techniques. The procedures prepared for these examinations comply with the 1971 Edition of Section XI requirements. However, since the issuance of this edition of the Code, significant advancements in the state-of-the-art of ultrasonic examination have been achieved. The ASME recognized the worthiness of these advancements when it issued the Summer 1973 Addenda to Section XI incorporating many of the improvements for the examination of Category A components.

In keeping with Arkansas Power and Light's desire to perform the best examination possible by employing the most current accepted techniques, the ultrasonic procedures include as many of the requirements of the Summer 1973 Addenda to Section XI as practical. The most notable areas are:

1. Use of Code acceptable calibration standards

2. Use of 0°, 45° and 60° ultrasonic transducers

3. Increased direction of angle beam testing

4. Increased volume of metal to be examined

5. Increased calibration requirements

6. Increased frequency of recalibration

7. Controlled scan speed and transducer overlap of successive scans

While the Summer of 1973 Addenda is specific to Category A components, the requirements and intent of the Code have been included in the procedures for the remainder of the Class 1 components. Current Code activity is proving this to be a valid assumption.

All procedures will be retained by Arkansas Power and Light and will be retained for use on subsequent inservice examinations. Revisions to any procedure deemed necessary due to experience gained by utilization or Code changes, will be made and recorded using acceptable quality assurance practices.

RESPONSE TO ITEM 1(d)

ANO-1

Sections of piping in the Reactor Building Spray and Decay Heat Removal Systems have been replaced with 304L stainless steel or with type 304 if material documentation shows

carbon content to be less than 0.065 wt. percent. Reference LER's 50-31/74-11, 75-7, and 76-25.

ANO-2

There has been no experience of cracking in identified systems of Unit 2.

ATTACHMENT A1

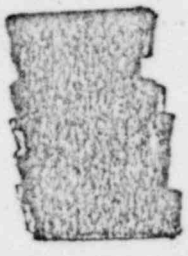
PGM 8834-02 B&W CONSTRUCTION CO. - INSERVICE INSPECTION SYSTEM DATE - 03/19/79 TIME - 1157 PAGE - 16

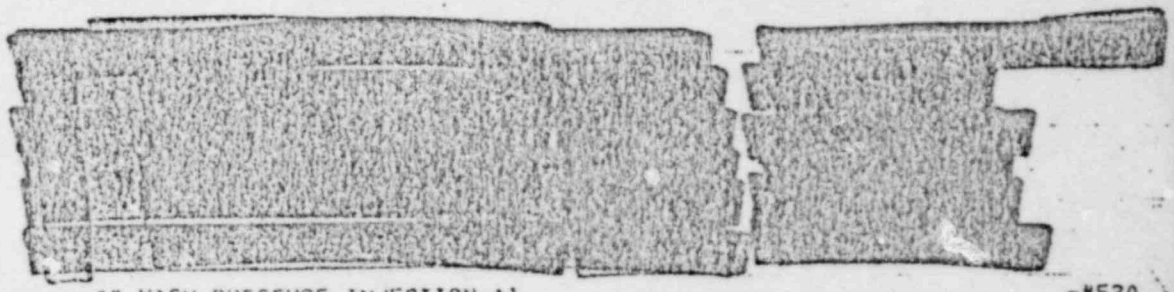
TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - PIPING PRESSURE BOUNDARY

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------	
			** DECAY HEAT REMOVAL	-#200
B4.1.69	X	100	NOZ S/E TO PIPE	ID# DH-1S
B4.1.70	X	100	NOZ S/E TO PIPE	ID# DH-1S
B4.1.77	X		** HIGH PRESSURE INJECTION A1	-#520
B4.1.78	X	100	NOZ S/E TO PIPE	ID# 47 TO 46
		100	NOZ S/E TO PIPE	ID# 47 TO 46
			** HIGH PRESSURE INJECTION A2	-#540
B4.1.79	X	100	NOZ S/E TO PIPE	ID# 47 TO 46
B4.1.80	X	100	NOZ S/E TO PIPE	ID# 47 TO 46
			** HIGH PRESSURE INJECTION B1	-#570
B4.1.81	X	100	NOZ S/E TO PIPE	ID# 47 TO 46
B4.1.82	X	100	NOZ S/E TO PIPE	ID# 47 TO 46
			** HIGH PRESSURE INJECTION B2	-#590
B4.1.83	X	100	NOZ S/E TO PIPE	ID# 47 TO 46





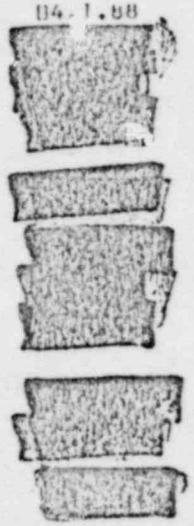
PGM 88.34-02 B&W CONSTRUCTION CO. - INSERVICE INSPECTION SYSTEM DATE - 03/19/79 TIME - 1157 PAGE - 17

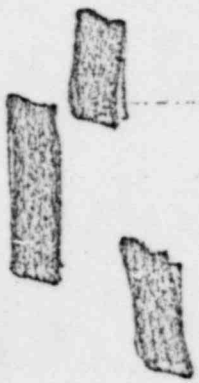
TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

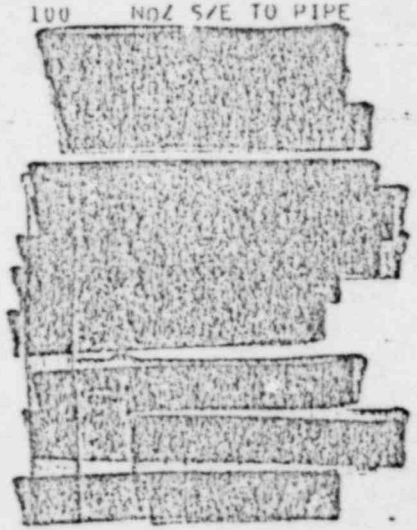
UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - PIPING PRESSURE BOUNDARY

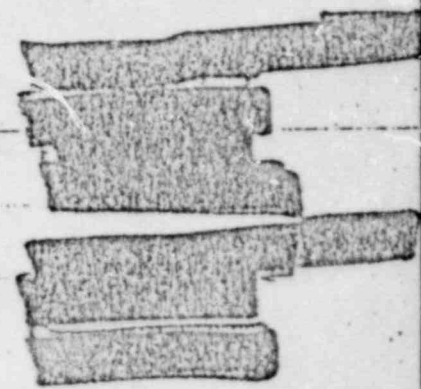
CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------	
			** HIGH PRESSURE INJECTION B2	-#590
B4.1.84	X	100	NOZ S/E TO PIPE	ID# 47 TO 46
			** CORE FLOOD A	-#400
B4.1.85	X	100	NOZ S/E TO PIPE	ID# 17 TO 89
B4.1.86	X	100	NOZ S/E TO PIPE	ID# 17 TO 89
			** CORE FLOOD B	-#450
B4.1.87	X	100	NOZ S/E TO PIPE	ID# 17 TO 89
B4.1.88	X	100	NOZ S/E TO PIPE	ID# 17 TO 89









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TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

COMPONENT - PIPING PRESSURE BOUNDARY

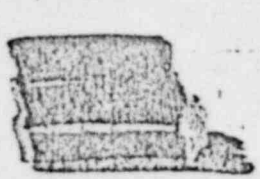
---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	% SCHED	----------REMARKS----------	
B4.5.44			X								100	** CORE FLOOD A PIPE TO ELBOW	-#400 ID# CFA-16
B4.5.45			X								100	VALVE DH-14A TO PIPE	ID# CFA-12
B4.5.46			X								100	TEE TO REDUCER	ID# CFA-8
B4.5.47			X								100	PIPE TO TEE	ID# CFA-6
B4.5.48			X								100	ELBOW TO PIPE	ID# CFA-5
B4.5.49	X										100	** CORE FLOOD B PIPE TO ELBOW	-#450 ID# CFB-17

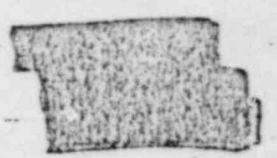
TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE.- 03/09/79
CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

COMPONENT - PIPING PRESSURE BOUNDARY

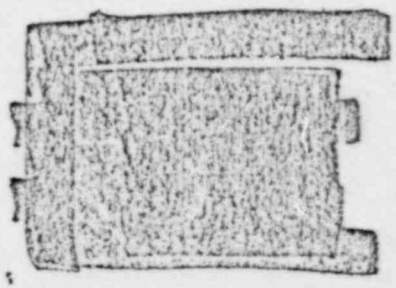
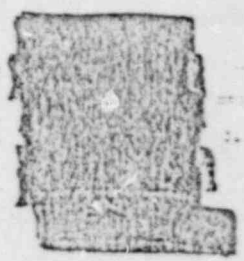
---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------
			* CORE FLOOD B -#450
B4.5.50	X	100	ELBOW TO PIPE ID# CFB-16
B4.5.51	X	100	REDUCER TO TEE ID# CFB-11
B4.5.52	X	100	VALVE CF-1B TO ELBOW ID# CFB-1
B4.5.53	X	100	PIPE TO ELBOW ID# CFB-5




			** DECAY HEAT REMOVAL -#200
B4.5.57	X	100	PIPE TO VALVE CV-1410 ID# DH-1
B4.5.58	X	100	ELBOW TO PIPE ID# DH-4
B4.5.59	X	100	PIPE TO ELBOW ID# DH-7
B4.5.60	X	100	ELBOW TO ELBOW ID# DH-11
	X		




TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
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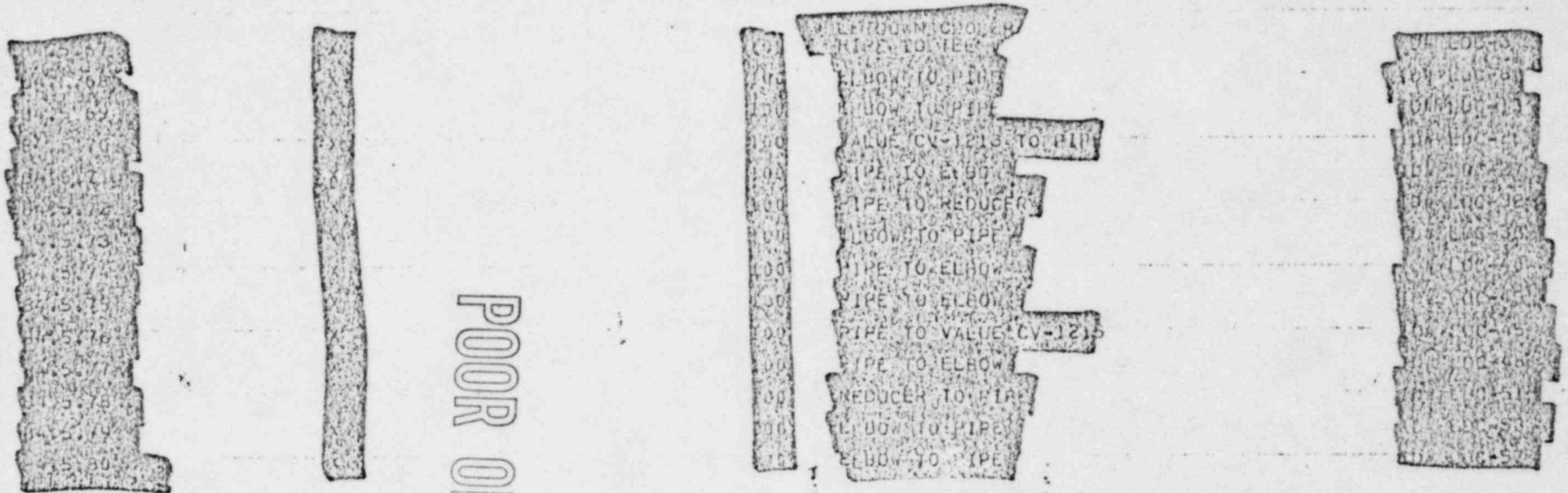
CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	% SCHED	----------REMARKS----------
B4.5.81			X									-#600
B4.5.82	X											
B4.5.83	X											
B4.5.84	X											
B4.5.85	X											



**	HIGH PRESSURE INJECTION A1		-#520
100	VALVE CV-1219 TO PIPE	ID# HPI-A1-1	
100	ELBOW TO PIPE	ID# HPI-A1-4	
100	PIPE TO ELBOW	ID# HPI-A1-7	
100	ELBOW TO PIPE	ID# HPI-A1-11	
100	ELBOW TO PIPE	ID# HPI-A1-15	

TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

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---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	% SCHED	----------REMARKS----------	
												** HIGH PRESSURE INJECTION A1	-#520
B4.5.86	X										100	PIPE TO ELBOW	ID# HPI-A1-18
B4.5.87	X										100	PIPE TO ELBOW	ID# HPI-A1-22
B4.5.88	X										100	ELBOW TO PIPE	ID# HPI-A1-25
B4.5.89	X										100	PIPE TO PIPE	ID# HPI-A1-29
B4.5.90	X										100	ELBOW TO PIPE	ID# HPI-A1-37
B4.5.91	X										100	VALVE MU-45C TO PIPE	ID# HPI-A1-42
												** HIGH PRESSURE INJECTION A2	-#540
B4.5.94		X									100	ELBOW TO PIPE	ID# HPI-A2-11
B4.5.95		X									100	ELBOW TO PIPE	ID# HPI-A2-15
B4.5.96		X									100	ELBOW TO PIPE	ID# HPI-A2-19
B4.5.98		X									100	ELBOW TO PIPE	ID# HPI-A2-23
B4.5.99		X									100	ELBOW TO PIPE	ID# HPI-A2-25
B4.5.100		X									100	ELBOW TO PIPE	ID# HPI-A2-27
B4.5.101		X									100	PIPE TO PIPE	ID# HPI-A2-32
B4.5.102		X									100	VALVE MU-34D TO ELBOW	ID# HPI-A2-36
B4.5.103			X								100	PIPE TO VALVE MU-45D	ID# HPI-A2-41
B4.5.104			X								100	ELBOW TO PIPE	ID# HPI-A2-45
												** HIGH PRESSURE INJECTION B1	-#570
B4.5.105			X								100	PIPE TO ELBOW	ID# HPI-B1-5

TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - PIPING PRESSURE BOUNDARY

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------	
			** HIGH PRESSURE INJECTION B1	-#570
		100	PIPE TO ELBOW	ID# HPI-B1-8
B4.5.106	X	100	PIPE TO ELBOW	ID# HPI-B1-13
B4.5.107	X	100	ELBOW TO PIPE	ID# HPI-B1-18
B4.5.108	X	100	PIPE TO ELBOW	ID# HPI-B1-26
B4.5.109	X	100	ELBOW TO PIPE	ID# HPI-B1-31
B4.5.110	X	100	PIPE TO ELBOW	ID# HPI-B1-33
B4.5.111	X	100	PIPE TO ELBOW	ID# HPI-B1-36
B4.5.112	X	100	PIPE TO ELBOW	ID# HPI-B1-46
B4.5.113	X	100	PIPE TO VALVE MU-45A	ID# HPI-B1-48
B4.5.114	X	100	VALVE MU-45A TO PIPE	ID# HPI-B1-49
B4.5.115	X	100	PIPE TO PIPE	ID# HPI-B1-50
B4.5.116	X	100	ELBOW TO PIPE	ID# HPI-B1-52
B4.5.117	X		** HIGH PRESSURE INJECTION B2	-#590
B4.5.118	X	100	ELBOW TO PIPE	ID# HPI-B2-4
B4.5.119	X	100	PIPE TO ELBOW	ID# HPI-B2-7
B4.5.120	X	100	PIPE TO ELBOW	ID# HPI-B2-15
B4.5.121	X	100	PIPE TO ELBOW	ID# HPI-B2-19
B4.5.122	X	100	PIPE TO ELBOW	ID# HPI-B2-25
B4.5.123	X	100	PIPE TO PIPE	ID# HPI-B2-29
B4.5.124	X	100	PIPE TO ELBOW	ID# HPI-B2-32

PGM 8834-02 B&W CONSTRUCTION CO. - INSERVICE INSPECTION SYSTEM DATE - 03/19/79 TIME - 1157 PAGE - 25

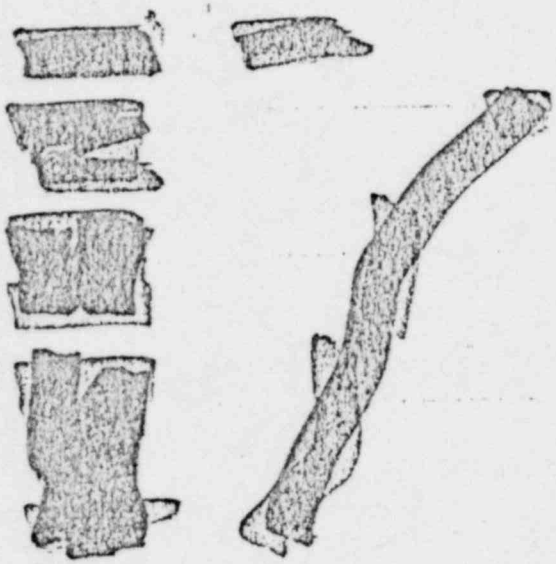
TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

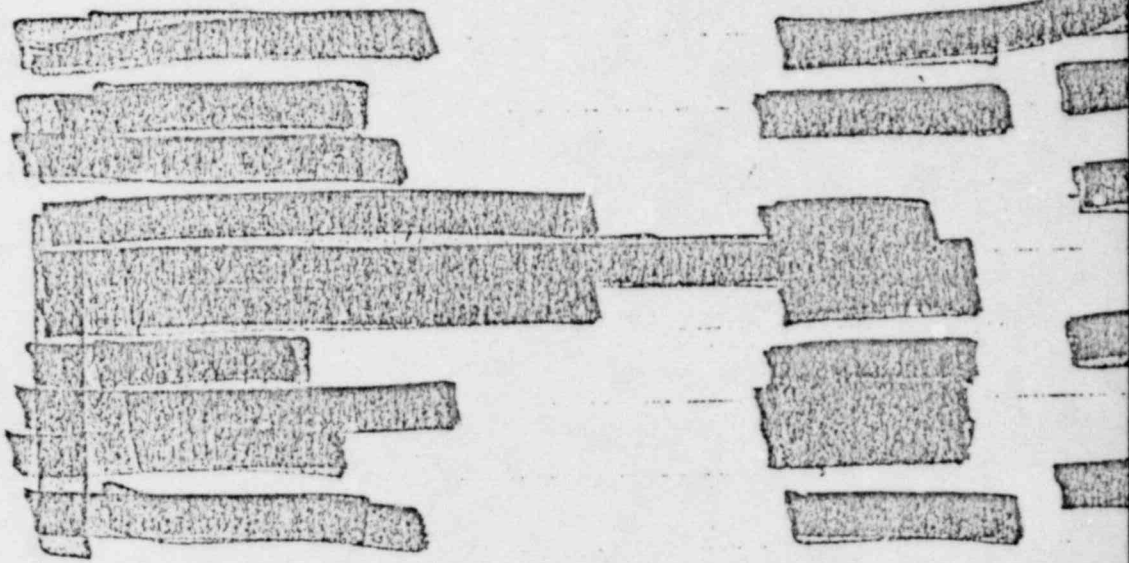
UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - PIPING PRESSURE BOUNDARY

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	SCHED	----------REMARKS----------
			** HIGH PRESSURE INJECTION B2
B4.5.125	X	100	PIPE TO ELBOW ID# HPI-B2-37
B4.5.126	X	100	PIPE TO VALVE MU-34B ID# HPI-B2-41
B4.5.127	X	100	ELBOW TO PIPE ID# HPI-B2-42A
B4.5.128	X	100	ELBOW TO PIPE ID# HPI-B2-45
B4.5.129	X	100	VALVE MU-45B TO PIPE ID# HPI-B2-47
B4.5.130	X	100	ELBOW TO PIPE ID# HPI-B2-49

-#590





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TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

COMPONENT - PIPING PRESSURE BOUNDARY

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	% SCHED	----------REMARKS----------
B4.11.19											100	A SIDE CORE FLOOD DRAIN TO VAL DH-1004 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.20						X					100	A SIDE CORE FLOOD DRAIN TO VAL CF-1004 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.21						X					100	LPI B TO A CROSSOVER DRAIN TO VAL DH-1038 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.22						X					100	B SIDE CORE FLOOD DRAIN TO VAL DH-1002 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.23						X					100	B SIDE CORE FLOOD DRAIN TO VAL CF-1002 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.24	X					X					100	IAI HPI INST LINE TO VALVE MU-1025B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.25	X					X					100	IAI HPI VENT LINE TO VALVE MU-1002 TO BE PERFORMED BY AP&L AT HYDRO TEST

PGM 8834-02 B&W CONSTRUCTION CO. - INSERVICE INSPECTION SYSTEM DATE - 03/19/79 TIME - 1157 PAGE - 34

TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT
CONTRACT - 192-034-0 - 8 DATE - 03/09/79
COMPONENT - PIPING PR BOUNDARY

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------
B4.11.26	X X	100	1A1 HPI INST LINE TO VALVE MU-1049B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.27	X X	100	1A2 HPI INST LINE TO VALVE MU-1026B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.28	X X	100	1A2 HPI VENT LINE TO VALVE MU-1073B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.29	X X	100	1A2 HPI INST LINE TO VALVE MU-1220B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.30	X	100	1B1 HPI INST LINE TO VALVE MU-1034B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.31	X	100	1B1 HPI VENT LINE TO VALVE MU-1004 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.32	X	100	1B1 HPI INST LINE TO VALVE MU-1065B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.33	X	100	1B2 HPI INST LINE TO VALVE MU-1035B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.34	X	100	1B2 HPI VENT LINE TO VALVE MU-1006 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.35	X	100	1B2 HPI INST LINE TO VALVE MU-1226B TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.36	X	100	DECAY HEAT DRAIN LINE TO VALVE DH-1008 TO BE PERFORMED BY AP&L AT HYDRO TEST
B4.11.37	X	100	DECAY HEAT INST LINE TO VALVE DH-1410B TO BE PERFORMED BY AP&L AT HYDRO TEST

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TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - AUGMENTED INSPECTION

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10
X0.6.1		X				X				
X0.6.2		X				X				
X0.6.3				X		X				
X0.6.4				X		X				
X0.6.5			X		X					
X0.6.6			X		X					
X0.6.7				X	X					
X0.6.8				X	X					
X0.6.9				X	X					
X0.6.10				X	X					
X0.6.11				X	X					
X0.6.12				X	X					
X0.6.13				X						
X0.6.14		X								
X0.6.15				X						

SCHED	REMARKS		
100	RB SPRAY-TEE TO PIPE	A LOOP	ID# 69G
100	RB SPRAY-PIPE TO ELBOW	A LOOP	ID# 69H
100	RB SPRAY-VAL TO PIPE	A LOOP	ID# HCB-6-29
100	RB SPRAY-PIPE TO VAL	A LOOP	ID# HCB-6-28
100	RB SPRAY-VAL TO PIPE	B LOOP	ID# HCB-6-1A
100	RB SPRAY-PIPE TO ELBOW	B LOOP	ID# 26E
100	RB SPRAY-ELBOW TO PIPE	B LOOP	ID# 26C
100	RB SPRAY-TREPAN #26	B LOOP	ID# T #26
100	RB SPRAY-PIPE TO PIPE	B LOOP	ID# HCB-6-1C
100	RB SPRAY-PIPE TO ELBOW	B LOOP	ID# 26B
100	RB SPRAY-ELBOW TO PIPE	B LOOP	ID# 26A
100	RB SPRAY-PIPE TO PIPE	B LOOP	ID# HCB-6-32
100	DHR-TEE TO PIPE	A LOOP	ID# 125B
100	DHR-PIPE TO VAL	A LOOP	ID# 125A
100	DHR-ELBOW TO PIPE	A LOOP	ID# 50A

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TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - AUGMENTED INSPECTION

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	% SCHED	----------REMARKS----------		
X0.6.16			X								100	DHR-PIPE TO PIPE	A LOOP	ID# GCB-1-20A
X0.6.17			X								100	DHR-PIPE TO ELBOW	A LOOP	ID# GCB-1-20
X0.6.18			X								100	DHR-ELBOW TO PIPE	A LOOP	ID# 49D
X0.6.19			X								100	DHR-PIPE TO ELBOW	A LOOP	ID# 49C
X0.6.20			X								100	DHR-ELBOW TO PIPE	A LOOP	ID# 49B
X0.6.21		X									100	DHR-PIPE TO ELBOW	A LOOP	ID# 49A
X0.6.22			X								100	DHR-ELBOW TO PIPE	A LOOP	ID# GCB-1-19
X0.6.23		X									100	DHR-PIPE TO PIPE	A LOOP	ID# GCB-1-18A
X0.6.24			X								100	DHR-PIPE TO PIPE	A LOOP	ID# GCB-1-48C
X0.6.25			X								100	DHR-PIPE TO PIPE	A LOOP	ID# GCB-1-46C
X0.6.26		X									100	DHR-PIPE TO ELBOW	A LOOP	ID# 48B
X0.6.27		X									100	DHR-ELBOW TO PIPE	A LOOP	ID# 48C
X0.6.28		X									100	DHR-PIPE TO RED	A LOOP	ID# GCB-1-17
X0.6.29		X									100	DHR-FLANGE TO PIPE	A LOOP	ID# 32A
X0.6.30		X									100	DHR-PIPE TO TEE	A LOOP	ID# GCB-1-3
X0.6.31			X								100	DHR-TEE TO PIPE	A LOOP	ID# 30B
X0.6.32		X									100	DHR-PIPE TO ELBOW	A LOOP	ID# 30A
X0.6.33		X									100	DHR-ELBOW TO PIPE	A LOOP	ID# GCB-1-4
X0.6.34				X							100	DHR-PIPE TO PIPE	A LOOP	ID# GCB-1-4A
X0.6.35				X							100	DHR-PIPE TO ELBOW	A LOOP	ID# GCB-1-6
X0.6.36				X							100	DHR-VAL TO PIPE	B LOOP	ID# GCB-1-38

TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

COMPONENT - AUGMENTED INSPECTION

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------		
X0.6.37	X	100	DHR-PIPE TO TEE	B LOOP	ID# GCB-1-38A
X0.6.38	X	100	DHR-VAL TO PIPE	B LOOP	ID# GCB-1-40
X0.6.39	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 54C
X0.6.40	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 54B
X0.6.41	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# GCB-1-12
X0.6.42	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 55A
X0.6.43	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 55B
X0.6.44	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# GCB-1-13
X0.6.45	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 56A
X0.6.46	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# GCB-1-15A
X0.6.47	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 57A
X0.6.48	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 57B
X0.6.49	X	100	DHR-PIPE TO REDUCER	B LOOP	ID# 57C
X0.6.50	X	100	DHR-TEE TO PIPE	B LOOP	ID# 127B
X0.6.51	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# GCB-1-42
X0.6.52	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 127RA
X0.6.53	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 127RB
X0.6.54	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# GCB-1-43
X0.6.55	X	100	DHR-PIPE TO VAL	B LOOP	ID# 127A
X0.6.56	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 126C
X0.6.57	X	100	DHR-PIPE TO TEE	B LOOP	ID# 126B

TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - AUGMENTED INSPECTION

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------		
X0.6.58	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 44K
X0.6.59	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 44H
X0.6.60	X	100	DHR-TEE TO PIPE	B LOOP	ID# GCB-1-27G
X0.6.61	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 43D
X0.6.62	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 43C
X0.6.63	X	100	DHR-TREPAN #4	B LOOP	ID# T #4
X0.6.64	X	100	DHR-PIPE TO FLANGE	B LOOP	ID# 43A
X0.6.65	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# GCB-3-4
X0.6.66	X	100	DHR-TREPAN #37A	B LOOP	ID# T #37A
X0.6.67	X	100	DHR-TREPAN #37B	B LOOP	ID# T #37B
X0.6.68	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# GCB-3-5
X0.6.69	X	100	DHR-FLANGE TO PIPE	B LOOP	ID# 42G
X0.6.70	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 42F
X0.6.71	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 42E
X0.6.72	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 42C
X0.6.73	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 42B
X0.6.74	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 42A
X0.6.75	X	100	DHR-TEE TO PIPE	B LOOP	ID# GCB-1-28
X0.6.76	X	100	DHR-PIPE TO PIPE	B LOOP	ID# GCB-1-28D
X0.6.77	X	100	DHR-PIPE TO PIPE	B LOOP	ID# GCB-1-28E
X0.6.78	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 39B

TEN YEAR INSERVICE INSPECTION SCHEDULE
(FIGURE B1.1. TO FIGURE)

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-006 REV - 8 DATE - 03/09/79
COMPONENT - AUGMENTED INSPECTION

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------		
X0.6.79	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# 39C
X0.6.80	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 39D
X0.6.81	X	100	DHR-ELBOW TO PIPE	B LOOP	ID# GCB-1-28A
X0.6.82	X	100	DHR-PIPE TO ELBOW	B LOOP	ID# 38A

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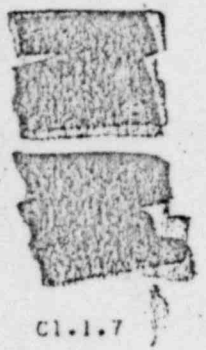
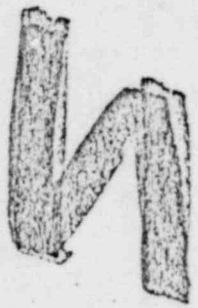
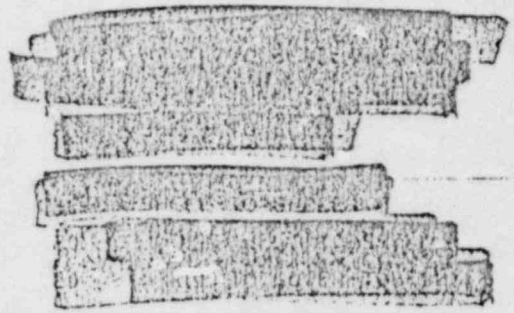
TEN YEAR INSERVICE INSPECTION SCHEDULE

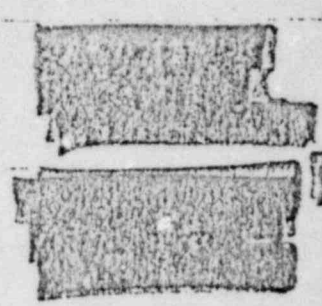
UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79
COMPONENT - PRESSURE VESSELS

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - , RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	SCHED	----------REMARKS----------
												
C1.1.7				X								
C1.1.8						X						
C1.2.1				X								
C1.2.2						X						
C1.2.3				X								
C1.2.4						X						
C1.3.1				X								







20	** DECAY HEAT REMOVAL COOLER E35A SHELL TO FLANGE		-#040
20	** DECAY HEAT REMOVAL COOLER E35B SHELL TO HEAD		-#090
100	** STEAM GENERATOR A STEAM OUTLET NOZZLE TO SHELL X-Y AXES	ID# MK 14 TO 3	-#030
100	** STEAM GENERATOR B STEAM OUTLET NOZZLE TO SHELL W-X AXES	ID# MK 14 TO 3	-#080
100	** DECAY HEAT REMOVAL COOLER E35A 18" INLET NOZZLE TO SHELL		-#040
100	** DECAY HEAT REMOVAL COOLER E35B 12" OUTLET NOZZLE TO SHELL (SOUTH)		-#090
100	** STEAM GENERATOR A FW HEADER BRACKETS TO SHELL 4 SETS OF BRACKETS		-#030

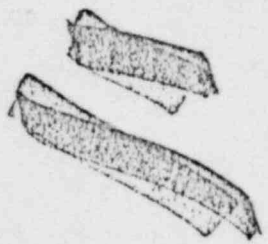
TEN YEAR INSERVICE INSPECTION SCHEDULE

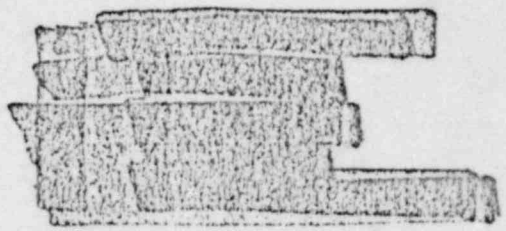
UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

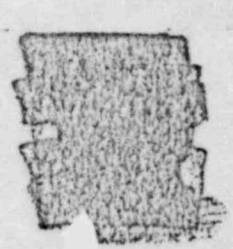
COMPONENT - PIPING

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------
			
C2.1.42	X		
C2.1.43	X		
C2.1.44	X		
C2.1.45	X		
C2.1.46	X		
C2.1.47	X		
C2.1.48	X		
C2.1.49	X		
C2.1.50	X		
C2.1.51	X		
C2.1.52			
C2.1.53			





	** DECAY HEAT REMOVAL TO PUMPS	-#925
100	PIPE TO 30 ELL	ID# DHR-7
100	30 ELL TO PIPE	ID# DHR-8
100	ELL TO PIPE	ID# DHR-14
100	PIPE TO PENE 27	ID# DHR-15
100	VAL CV-1404 TO PIPE	ID# DHR-17
100	TEE TO PIPE	ID# DHR-21
100	PIPE TO ELL	ID# DHR-31
100	ELL TO PIPE	ID# DHR-39
100	ELL TO PIPE	ID# DHR-43
100	RED TO VAL BW-88	ID# DHR-49
	** LOW PRESSURE INJECTION A	-#935
0	TEE TO PIPE EXAMINE UNDER X0.6.13	ID# LPI-A41
0	PIPE TO ELL EXAMINE UNDER X0.6.17	ID# LPI-A6



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TEN YEAR INSERVICE INSPECTION SCHEDULE

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79
COMPONENT - PIPING

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	SCHED	REMARKS	
				-#935
C2.1.54	X		LOW PRESSURE INJECTION A	
C2.1.55	X	100	RED TO INLET NOZ	ID# LPI-A15
C2.1.56	X	100	PIPE TO TEE	ID# LPI-A20
C2.1.57	X	100	PIPE TO TEE	ID# LPI-A24
C2.1.58		100	ELL TO PIPE	ID# LPI-A33
		0	FLANGE TO PIPE EXAMINE UNDER X0.6.29	ID# LPI-A54
C2.1.59	X	100	ELL TO PIPE	ID# LPI-A59
C2.1.60	X	100	PIPE TO VAL DH-8A	ID# LPI-A65
C2.1.61		0	PIPE TO ELL EXAMINE UNDER X0.6.32	ID# LPI-A75
C2.1.62		0	PIPE TO ELL EXAMINE UNDER X0.6.35	ID# LPI-A77
				-#985
C2.1.63		0	LOW PRESSURE INJECTION B VAL DH-2B TO PIPE EXAMINE UNDER X0.6.36	ID# LPI-B2
C2.1.64		0	PIPE TO ELL EXAMINE UNDER X0.6.47	ID# LPI-B14
C2.1.65	X	100	NOZ TO RED	ID# LPI-B18
C2.1.66		0	PIPE TO ELL EXAMINE UNDER X0.6.59	ID# LPI-B21
C2.1.67	X	100	PIPE TO TEE	ID# LPI-B27
C2.1.68	X	100	PIPE TO VAL CV-1429	ID# LPI-B34
C2.1.69	X	100	PIPE TO 45 ELL	ID# LPI-B45

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TEN YEAR INSERVICE INSPECTION SCHEDULE

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79
COMPONENT - PIPING

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE,ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------	
			** LOW PRESSURE INJECTION B	-#985
C2.1.70		0	PIPE TO ELL EXAMINE UNDER X0.6.61	ID# LPI-B55
C2.1.71		0	ELL TO PIPE EXAMINE UNDER X0.6.71	ID# LPI-B58
C2.1.72	X	100	TEE TO PIPE	ID# LPI-B63
C2.1.73	X	100	ELL TO PIPE	ID# LPI-B69
C2.1.74	X	100	PIPE TO ELL	ID# LPI-B74
C2.1.75		0	PIPE TO 45 ELL EXAMINE UNDER X0.6.78	ID# LPI-B80
			** LOW PRESSURE INJECTION A	-#935
C2.1.76	X	100	ELL TO PIPE	ID# LPI-A88
C2.1.77	X	100	ELL TO PIPE	ID# LPI-A114
C2.1.78	X	100	PIPE TO ELL	ID# LPI-A98
C2.1.79	X	100	PIPE TO ELL	ID# LPI-A108
			** LOW PRESSURE INJECTION B	-#985
C2.1.80	X	100	PENE 36 TO PIPE	ID# LPI-B88
C2.1.81	X	100	PIPE TO TEE	ID# LPI-B95
C2.1.82	X	100	PIPE TO ELL	ID# LPI-B97
C2.1.83	X	100	ELL TO PIPE	ID# LPI-B104

TEN YEAR INSERVICE INSPECTION SCHEDULE

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79
COMPONENT - PIPING

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1	2	3	4	5	6	7	8	9	10	SCHED	----------REMARKS----------
												-#900
C2.2.9		X										
C2.2.10		X										
C2.2.11			X									
C2.2.12			X									
C2.2.13			X									
C2.2.14			X									
C2.2.15			X									
												-#925
C2.2.16				X								** DECAY HEAT REMOVAL TO PUMPS
C2.2.17				X							100	TEE LONG SEAMS ID# DHR-7L
C2.2.18	X										100	ELL LONG SEAMS ID# DHR-13L
C2.2.19				X							100	TEE LONG SEAMS ID# DHR-20L
C2.2.20				X							100	ELL LONG SEAMS ID# DHR-31L
											100	ELL LONG SEAMS ID# DHR-38L
											100	ELL LONG SEAMS ID# DHR-42L
											100	RED LONG SEAMS ID# DHR-48L
												-#935
												** LOW PRESSURE INJECTION A
											100	RED TEE LONG SEAMS ID# LPI-A41L
											100	ELL LONG SEAMS ID# LPI-A6L
											100	RED LONG SEAMS ID# LPI-A14L
											100	TEE LONG SEAMS ID# LPI-A24L
											100	ELL LONG SEAMS ID# LPI-A33L

TEN YEAR INSERVICE INSPECTION SCHEDULE

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79
COMPONENT - PIPING

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------	
			** LOW PRESSURE INJECTION A	-#9
C2.2.21	X	100	ELL LONG SEAMS	ID# LPI-A58L
C2.2.22	X	100	ELL LONG SEAMS	ID# LPI-A75L
C2.2.23	X	100	ELL LONG SEAMS	ID# LPI-A77L
			** LOW PRESSURE INJECTION B	-#9
C2.2.24	X	100	ELL LONG SEAMS	ID# LPI-B14L
C2.2.25	X	100	RED LONG SEAMS	ID# LPI-B18L
C2.2.26	X	100	ELL LONG SEAMS	ID# LPI-B21L
C2.2.27	X	100	TEE LONG SEAMS	ID# LPI-B27L
C2.2.28	X	100	ELL LONG SEAMS	ID# LPI-B45L
C2.2.29	X	100	ELL LONG SEAMS	ID# LPI-B55L
C2.2.30	X	100	ELL LONG SEAMS	ID# LPI-B58L
C2.2.31	X	100	TEE LONG SEAMS	ID# LPI-B63L
C2.2.32	X	100	ELL LONG SEAMS	ID# LPI-B68L
C2.2.33	X	100	ELL LONG SEAMS	ID# LPI-B74L
C2.2.34	X	100	ELL LONG SEAMS	ID# LPI-B80L
			** LOW PRESSURE INJECTION A	-#9
C2.2.35	X	100	ELL LONG SEAMS	ID# LPI-A87L
C2.2.36	X	100	ELL LONG SEAMS	ID# LPI-A114L
C2.2.37	X	100	ELL LONG SEAMS	ID# LPI-A98L
C2.2.38	X	100	ELL LONG SEAMS	ID# LPI-A108L

PGM 8834-02 B&W CONSTRUCTION CO. - INSERVICE INSPECTION SYSTEM DATE - 03/16/79 TIME - 1814 PAGE - 10

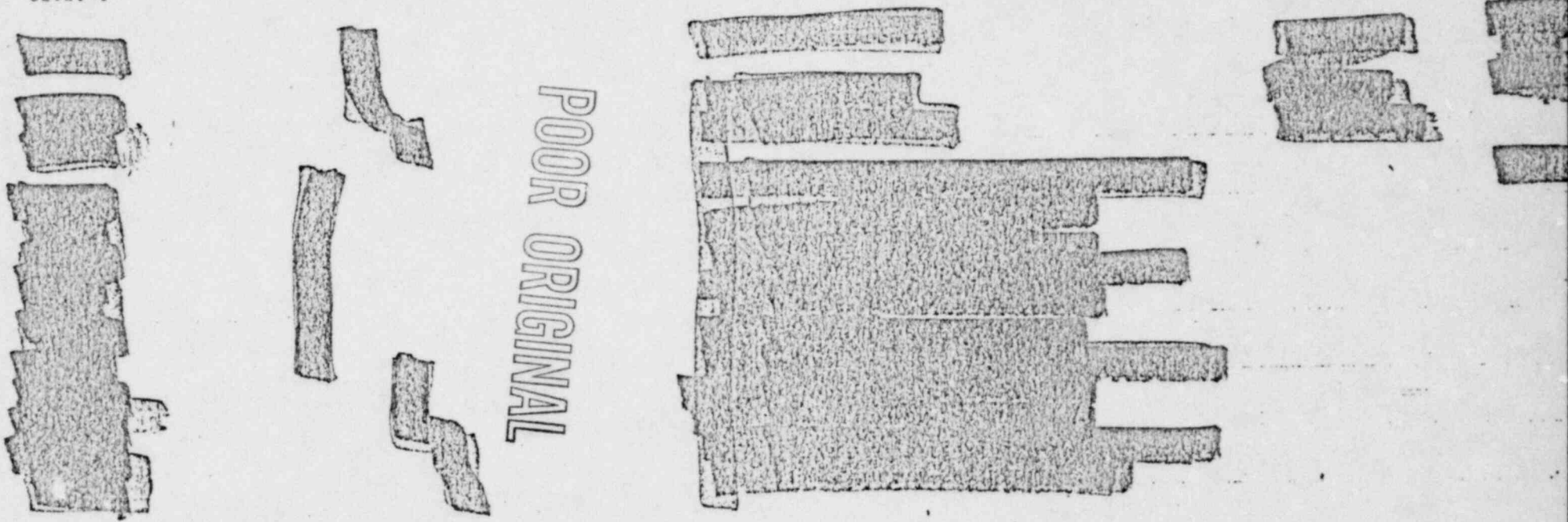
TEN YEAR INSERVICE INSPECTION SCHEDULE

UNIT - ARKANSAS UNIT 1
CONTRACT - 192-034-010 REV - 1 DATE - 03/12/79

CUSTOMER - ARKANSAS POWER & LIGHT
LOCATION - RUSSELLVILLE, ARKANSAS

COMPONENT - PIPING

---FIGURE----	EXAMINATION SCHEDULED AT OUTAGE SHOWN 1 2 3 4 5 6 7 8 9 10	% SCHED	----------REMARKS----------
			** LOW PRESSURE INJECTION B
C2.2.39	X	100	TEE LONG SEAMS ID# LPI-B96L
C2.2.40	X	100	ELL LONG SEAMS ID# LPI-B97L
C2.2.41	X	100	ELL LONG SEAMS ID# LPI-B104L



BABCOCK & WILCOX
B&W Construction Company
INSERVICE INSPECTION PROCEDURE

SUBJECT ULTRASONIC EXAMINATION OF CLASS 1&2 PIPING WELDS JOINING SIMILAR & DISSIMILAR MATERIALS	ISI-120, REV. 7

1. SCOPE: This examination procedure shall govern the ultrasonic examination of similar and dissimilar metal Class 1&2 piping welds ranging in thickness from 0.1 to 6 inches. Circumferential, longitudinal, attachment, hanger, support, nozzle, etc. weld seams in piping are covered by this procedure. This procedure is in accordance with the requirements of Section XI of the ASME Code.

2. SURFACE PREPARATION: The examination surface shall be free of dirt, loose scale, machining or grinding particles, weld splatter, or other loose foreign material. Surface preparation shall be performed on an area which includes the weld and the area for two times the thickness on both sides of the weld.

3. OPERATOR QUALIFICATIONS:

   3.1 Operator: The operator performing the examination shall be qualified to Level II in accordance with B&W Construction Company Quality Control Administrative Procedure 9A-169. The Level II shall be responsible for and shall accept the results of the examination.

   3.2 Assistant: The assistant shall be qualified to at least Level I in accordance with B&W Construction Company Quality Control Administrative Procedure 9A-169. The Level I shall not independently evaluate or accept the results of the examination.

4. EQUIPMENT:

   4.1 UT Scope: A pulse-echo type ultrasonic flaw detection instrument shall be used. The instrument shall be equipped with a stepped gain control calibrated in units of 2dB or less.

   4.2 Search Units: (All reference to MHz shall be nominal frequency.)

      4.2.1 Straight Beam: Either ceramic, lithium sulfate, or barium titanate 2.25 MHz single element or a 2.25 or 5.0 MHz dual element search unit shall be used. The element shall have an effective area from .049 to 1.0 square inches inclusive. If grain structure is such that 2.25 MHz cannot penetrate, a 1.0 MHz search unit of the types listed above may be used.

Other search units may be used upon approval of the B&W Construction Company Level III.

4.2.1.1 Size*of search units shall be selected according to the following table:

Nominal Test Piece Thickness	Nominal Search Unit Size
1" or Less	1/4" Dia.
.50" to 4.0"	1/2" Dia.
2.0" to 6.0"	3/4" & greater Dia.

4.2.2 Angle Beam: Either ceramic, lithium sulfate, or barium titanate, 2.25 MHz, or 3.5 MHz; 45 degree(-2 degrees) angle beam single element search unit shall be used. The element shall have an effective area from .049 to 1.0 square inches inclusive. Other angles may be used to evaluate indications, or where wall thickness or geometric configuration impedes the effective use of 45 degree angle beam for examination. If grain structure is such that 2.25 MHz cannot penetrate, a 1.0 MHz search unit may be used. Other search units may be used upon approval of the B&W Construction Company Level III. Where wall thickness is 0.5 inches and less, a nominal frequency of 5 MHz may be used.

4.2.2.1 Size* of search units shall be selected according to the following table:

Nominal Test Piece Thickness	Nominal Search Unit Size
1" or Less	1/4"x1/4"; 1/4" Dia.
.50" to 4.0"	1/2"x1/2"; 1/2" Dia.
2.0" to 6"	1"x1"; 1" Dia.

*Smaller search units than those specified for each range may be used.

4.2.2.2 Exit Point: A standard steel IIW block will be used before examinations are performed each day to verify and mark the exit point on the transducer shoe.

4.2.2.3 Beam Angle: After the exit point has been determined, the angle shall be checked with the IIW block to confirm that the transducer meets angle ranges specified in 4.2.2.

4.3 Couplant: A suitable liquid, semi-liquid, or paste couplant medium, such as water, oil, gylcerin, grease, or Hamikleer shall be applied to the examination surface. Each batch of materials used on stainless steels or nickel base alloys shall have been tested for residual amounts of total halogen and total sulfur in accordance with ISI-60. The total residual amount of halogens and sulfur shall not exceed the requirements of ISI-60. The couplant identification or batch number shall be recorded on the data sheet.

5. CALIBRATION BLOCK:

5.1 Material: The block shall be fabricated from a component prolongation where possible. If it is not possible to fabricate the block from material taken from the component, it shall be fabricated from a material similar to the component. When the examination is to be performed from only one side of the joint, the calibration block shall be determined by the material where the search unit is applied. If the weld contains dissimilar materials (stainless steels and/or nickel base alloys with carbon steel) the calibration block may be stainless steel or the nickel base alloy.

5.2 Size: The length of the calibration block shall be determined by the angle of the search unit and the Vee path that will be used. A minimum length of 6T is desirable.

5.2.1 Thickness:

5.2.1.1 Prior to the W'75 Code:[1] The thickness of the block shall be as allowed in Figure 1 for the material thickness examined. Where two or more component thicknesses are joined, the block shall be selected to cover the largest thickness.

5.2.1.2 W'75 Code and Later: The thickness of the block shall be the same nominal dimension as the pipe being examined. Where two or more component thicknesses are joined, the block

[1]Winter 1975 Code Addenda to Section XI, throughout this procedure

shall be selected to cover the thickness where the search unit is applied.

5.3 Calibration Block Reflectors:

5.3.1 Holes:

5.3.1.1 Prior to the W'75 Code: The calibration holes shall be drilled parallel to the contact surface for flat blocks. For curved blocks, longitudinal holes shall be drilled parallel to the contact surface and circumferential holes, when used, shall be drilled parallel to a tangent to the contact surface. The diameter and depth of these holes shall conform to those stated in Figure 1 for the block thickness.

5.3.1.2 W'75 Code and Later: Side drilled holes may be placed in the calibration block at 1/4 and 3/4 T with a depth of 1-1/2 inch minimum. The holes shall be located so they will not interfere with the notches. Hole diameters shall be as stated in Table III for the block thickness.

5.3.2 Notches:

5.3.2.1 Prior to the W'75 Code: The calibration block doesn't require the use of notches.

5.3.2.2 W'75 Code and Later: The calibration block shall contain ID and OD circumferential and longitudinal notches with their sides perpendicular to the surface. The notches shall have a length of 1.0 inch minimum, a width no greater than 1/4 inch and a depth as shown in Table II for ferritic and austenitic materials.

5.4 Configuration:

5.4.1 Prior to the W'75 Code:

5.4.1.1 Flat Block: For the examination of circumferential or longitudinal welds on piping with contact curvatures greater than 20 inch diameter,

a flat block or blocks of essentially the same curvature as the part to be examined may be used.

5.4.1.2 Curved Blocks: For examination of circumferential or longitudinal welds on piping with contact curvatures equal to or less than 20 inch diameter, a curved block shall be used. A single curved basic calibration block may be used to calibrate for contact surfaces in the curvature range from 9/10 to 1-1/2 times the calibration block diameter.

5.4.2 W'75 Code and Later: The calibration block shall be of the same nominal diameter as the component being examined.

5.5 Block Temperature:

5.5.1 W'75 Code and Later: The temperature of the calibration block and the component shall be within 25 degrees F (14 degrees C) of each other.

6. CALIBRATION:

6.1 Straight Beam for Laminar Defects:

6.1.1 Prior to the W'75 Code: Examination of the base metal shall be performed on the component for the detection of laminar type discontinuities that may interfere with the angle beam examination.

6.1.2 W'75 Code and Later: If the component has previously received a laminar type examination, the laminar examination does not apply.

6.1.3 Range: The sweep range calibration shall be performed using an IIW block or the calibration block. The maximum thickness should appear at no greater than 80% of the full screen sweep.

6.1.4 Back Wall Amplitude Calibration: The search unit shall be coupled to the examination material to produce a minimum 50% to a maximum 80% full screen back reflection from the opposite side of a defect free area of the part to be examined.

If calibration from the opposite side of the component is not possible or unreliable, calibration shall be established using the calibration block. The calibration block back reflection shall be set at a minimum of 50% and maximum 80%.

6.2 Straight Beam for Area of Interest:

6.2.1 Prior to the W'75 Code: Examination of the Area of Interest with a straight beam shall be performed.

6.2.2 W'75 Code and Later: The straight beam examination of the Area of Interest does not apply.

6.2.3 Range: The sweep range calibration may be performed using a IIW block or the calibration block itself. The back reflection of the part to be examined should appear on the screen at no greater than 80% of the full screen sweep.

6.2.4 Distance-Amplitude Correction:

6.2.4.1 Position the transducer for the maximum response from the hole which gives the highest amplitude. Adjust the sensitivity control to provide an 80% of full screen indication from the hole. Mark the peak of the indication on the screen.

6.2.4.2 Position the search unit for maximum response from each of the remaining holes and mark the peak of each on the screen.

6.2.4.3 Connect the screen marks and extend through the thickness to provide the distance-amplitude curve. If only one hole is available, this is the primary reference level for the thickness range.

6.3 Angle Beam Calibration:

6.3.1 Range: The sweep range calibration shall be performed using an IIW block, or the calibration block. The sweep range should be set to cover the range thickness to be examined. The maximum thickness should appear at no greater than 80% of full screen sweep.

6.3.2 Distance Amplitude Correction Prior to the W'75 Code:

Normally the reject control shall be in the off position; but due to the grain boundary noise, it may be necessary to use reject to obtain a screen presentation with the maximum signal to noise ratio.

6.3.2.1 Position the search unit for maximum response from the hole which gives the highest amplitude. Adjust the sensitivity control to provide an 80% of full screen signal from that hole with the reject control in the off position. Mark the peak of the signal on the screen.

6.3.2.1.1 If necessary, increase the reject control. A signal to noise ratio of 10 to 1 or better is preferable, but a signal to noise ratio as low as 4 to 1 is acceptable. Record the drop in signal, as a percentage of full screen, in a note on the calibration sheet. Recheck the range and make any fine adjustments. Reposition the search unit to obtain the highest response and increase the sensitivity control until the signal is at 80% of full screen height. Mark the peak of the signal on the screen.

6.3.2.2 Position the search unit for maximum response from each of the remaining holes and mark the peak of each on the screen.

6.3.2.3 Connect the screen marks and extend through the thickness to be examined.

6.3.3 60° Angle Beam Calibration: When required the following shall be used to establish the sweep range and distance amplitude correction curve (DAC).

6.3.3.1 Sweep range calibration shall be performed using known measured holes in the calibration block. The sweep range should be set to cover the range of thickness for the volume not examined by the 45° angle beam examination.

6.3.3.2 DAC calibration shall start with a calibration hole located at a depth just short of the starting depth of the volume not examined by the 45° angle beam examination and shall extend to cover the volume not examined by the 45° angle beam.

6.3.4 Distance-Amplitude Correction W'75 Code and Later:

Position the search unit for maximum response from the ID notch. Adjust the amplitude to 80% full screen height and mark its peak on the screen. Without changing the instrument controls, obtain a reflection from the 1V (OD notch) and 1-1/2V path and mark their peak on the screen. Connect these points to form a distance-amplitude curve (DAC). This curve is the primary reference level. If the 1-1/2 Vee path notch cannot be obtained, extrapolate the curve to the nearest 1/4T.

6.3.4.1 When the 1V path notch calibration technique as outlined in 6.3.3 cannot be performed, the examination shall be done using the 1/2 Vee path technique.

Calibration shall be accomplished using side drilled holes to construct the DAC curve only. After the curve has been constructed, position the search unit so it reflects the ID notch and adjust its amplitude to the DAC curve. This is the primary reference level.

6.4 With the above mentioned techniques, some variables may be encountered, such as weld preparation, weld crown width, etc.

These variables may be eliminated by:

1. Reducing the dimension of the wedge edge to beam exit point.

2. Reducing search unit size.

3. Increasing beam angle.

6.5 Calibration Confirmation: Sweep range and DAC curve shall be verified:

A. At the beginning of each day of examination.
B. At least every four hours of examination.
C. With every change of examination personnel.
D. At the finish of examinations for each thickness range.
E. If the operator suspects any malfunction of the UT system.
F. After change in search units, shoes, couplants, cables, ultrasonic instruments, or any other parts of the examination system.
G. In the event of any power loss.

The original and final calibration must be performed on the basic calibration block. Intermediate calibration checks may be performed on a calibration block simulator. If a calibration block simulator is used, it shall be able to produce known amplitude and sweep readings. The simulator-produced amplitude and sweep reading shall be recorded on the calibration sheet at initial calibration and each calibration check. If multiple DAC curves are used for different types of examinations, the calibration block simulator shall be used for each type.

6.6 Calibration Changes: If any point on the distance-amplitude correction (DAC) curve has changed by more than 20% of its amplitude or 10% on the sweep range, all data sheets since the previously successful calibration check shall be marked void. A new calibration shall be made and recorded and the void examination area shall be reexamined.

7. SCANNING REQUIREMENTS:

7.1 Base Metal Outside the Area of Interest: This area shall include all the base metal through which the angle beam(s) will pass. For example, when examining with a 45 degree angle beam with a 1/2 Vee path calibration,the typical extent of scanning is 1T added to each side of the area of interest. The extent of a 60 degree, 1/2 Vee path scan should be 1.8T added to each side of the area of interest.

7.2 Area of Interest: The area of interest is the volume to be examined and shall include the weld, any weld metal previously applied to either side of the weld, and the base metal in both directions for a distance of one wall thickness for Codes prior to Winter 1975; or the base metal in both directions for a distance of 1/2 wall thickness or one inch whichever is the lesser for Winter 1975 and later Codes.

Scanning with a 60° angle beam is required only when the volume to be examined cannot be fully covered with a 45° angle beam due to wall thickness or geometric conditions.

7.2.1 Application:

7.2.1.1 Prior to the W'75 Code: The area of interest shall be examined by a straight beam and from four directions by one angle beam. Direct the angle beam normal to the weld from both sides and parallel to the weld in both directions. The beams shall pass through all of the weld material on each of the scans where practicable.

For nozzle welds, the beam shall be directed normal to the weld and 45 degrees to the longitudinal axis of the weld.

7.2.1.2 W'75 Code and Later: The area of interest shall be examined from two directions with a full Vee path or four directions with a 1/2 Vee path calibration. Direct the angle beam normal to the weld from one side and parallel to the weld in one direction with a full Vee path calibration. With a 1/2 Vee path calibration, direct the angle beam normal to the weld from both sides and parallel to the weld in two directions.

7.2.2 For longitudinal welds adjacent to circumferential welds examined during inservice inspections, the are of interest on the longitudinal weld shall include the full 12-inch space between the layout marks closest to the circumferential weld, plus any shorter section of the layout ending on the circumferential weld.

7.3 Movement Rate: The rate of search unit movement shall not exceed 6 in./sec., unless calibration is verified at scanning speed.

7.4 Search Unit Coverage: Each pass of the search unit shall overlap a minimum of 10% of the transducer active element dimension perpendicular to the direction of scan.

7.5 Scanning Sensitivity: Scanning shall be performed after increasing the gain a minimum of 6dB above the reference level. Six dB would increase the signal amplitude by a factor of two making the primary reference curve a 50% DAC curve. Recording of peak indications requires that the signal amplitude be adjusted to the DAC curve using the dB control. True signal amplitude shall be obtained from the following chart using the observed change in the dB control.

dB	%DAC	%DAC	dB
0	100	100	0
-1	112	90	+1
-2	125	80	+2
-3	141	70	+3
-4	159	63	+4
-5	178	56	+5
-6	200	50	+6
-7	224	45	+7
-8	251	40	+8
-9	282	36	+9
-10	316	32	+10
-11	355	28	+11
-12	400	25	+12
-13	447	22	+13
-14	501	20	+14
-15	562	18	+15
-16	631	16	+16
-17	708	14	+17
-18	794	13	+18
-19	891	11	+19
-20	1000	10	+20

8. RECORDING STANDARDS:

8.1 Definitions:

8.1.1 Damps on Surface with Screen Correlation: The terminology used here is to describe the kind of dampable indication, on the surface, whose location on the screen presentation is at the 8/8 node location. This is the only type of dampable indication that does not require TWD information.

8.1.2 Damps on Surface with No Screen Correlation: This refers to an indication that damps on the surface, but whose screen presentation displays it at a location other than the 8/8 node location. The point at which the indication damps should be recorded, but the indication should be treated as an indication that does not damp. (See Figure 5.)

8.1.3 Traveling Indication: An indication, due to its orientation in the area of interest, that causes a screen presentation in which the signal changes depth as the transducer moves over the dimensions of the indication shall be called traveling indication. be advised that this type of indication may be the result of the configuration of the examination area. The examiner should use discretion and evaluate the possibility of this type of condition existing. In cases where it does exist, the condition should be stated in a note.

8.1.4 One - Depth Indication: A single depth indication does not travel in depth and maintains a constant depth throughout the area of interest. When characterizing 360° intermittent, 360° continuous, and separate indications, the depth of the one-depth indication can fluctuate. The amount of fluctuation will depend on the thickness of the part to which the transducer has been applied:

a. For part thicknesses up to and inclusive of one inch, the amount of fluctuation shall be ±10% of the part thickness.

b. For parts over one inch in thickness, up to and inclusive of ten inches, the amount of fluctuation shall be ±.100 of an inch.

8.1.5 360° Intermittent Indication:

A. A one-depth indication that fluctuates above and below 50% DAC, with no limitation on the amount of fluctuation, for the entire length of the weld.

B. A traveling indication that also fluctuates above and below 50% can be characterized as a 360° intermittent indication with one stipulation.

The indication must be maintained on the screen at all times, with no less than a 2.1 signal/noise ratio. The examiner may adjust the sensitivity of the instrument to compensate for the changes in attenuation of the material and/or the changes in the physical dimensions of the indication to locate this condition along the length of the weld.

8.1.6 360° Continuous Indication: Any indication of a one-depth nature or a traveling depth nature, that fluctuates in amplitude above 50% DAC for the entire length of the weld.

8.1.7 Separate Indication: Any indication that does not meet the above characteristics. An indication that does not have the same depth as any other indication. A traveling indication that does not travel meeting the amplitude requirements of a 360 INT & 360 CON indication shall be characterized as a separate indication. When in doubt as to the characterization of a given indication, record it also as a separate indication.

8.2 Base Metal Outside the Area of Interest (All Codes):

8.2.1 Back Wall Method: All indications which exceed 50% of the resultant back reflection shall be investigated with the search unit in a position which produces the maximum amplitude.

8.2.1.1 If the maximum amplitude equals or exceeds 100% of the resultant back reflection, the following shall be recorded:

A. Amplitude: The maximum height as a percentage of the resultant back reflection. The amplitude shall be recorded to the nearest 10 percent increment.

B. Depth: The distance from the examination surface as read on the CRT.

C. Size: The 100 to 100% length and width of the indication.

D. Location: The search unit distance from the weld centerline and the nearest reference point. These measurements shall be taken at the point of maximum amplitude.

8.2.2 Calibration Block Method: If the part geometry does not produce a back reflection, evaluation shall be done to the calibration standard.

Indications which exceed 100% of the original back reflection from the calibration standard and cannot be contained in a 2 inch diameter circle shall be recorded as in Paragraph 8.2.1.1 B, C, and D. The amplitude shall be recorded as a percentage of the calibration standard back reflection.

8.2.3 If a base material condition exists which is recordable, the angle beam examination shall be performed from both the inside and outside surfaces wherever possible. If the opposite side is not accessible, these areas shall be recorded on the data sheet and the inspection preformed on a best effort basis.

8.3 Angle or Straight Beam (From DAC) Indications within Area of Interest:

8.3.1 All Codes: All indications which produce a response greater than 20% of DAC reference level shall be investigated to the extent that the operator can determine the shape, identity, and location of all such reflectors.

8.3.2 Prior to W'75 Code:

8.3.2.1 If the maximum amplitude exceeds 50% of the DAC reference calibration, the following shall be recorded on the data sheet:

A. Amplitude: Record the amplitude, to the nearest 10 percent increment, of the maximum signal (Highest Peak) in the appropriate block. In the case of recording 360° intermittent and 360° continuous indications, it is also necessary to record the range of amplitudes and the number of peaks, over 100% DAC, as a note.

B. Depth: When recording the depth, no matter what type of indication is involved, always record the depth at the max signal (Highest Peak) in the block provided. Note that, when recording traveling indications, it is also necessary to record the range of depths as a note to assist in characterizing the indication.

C. Length: The 100/100% length and the 50/50% length are to be recorded on each indication. Where 360° intermittent or 360° continuous indications are involved the length recorded shall be the entire length of the weld. When recording straight beam indications, it is also necessary to record the width of the indications.

D. Distance: To properly document the location of the inidcation, it is necessary that the distance from surface one or two and distance from position "A" or "B" should be recorded. This information should be taken from the location of the max signal (Highest Peak). For traveling indications, the range of distances from the opposite surface should also be recorded as a note. It is not necessary to record the distance "A" or "B" when documenting 360° intermittent or 360° continuous indications.

E. Through Wall Dimension (TWD): The TWD is measured by obtaining the minimum and maximum sweep readings (depth in inches) for which the indication signal reduces to 100% DAC. The TWD may not necessarily be measured in line with the highest indicated amplitude depth, nor do the minimum and maximum amplitude have to occur on the same scan line. The TWD is the difference between the minimum and maximum depths. An example of TWD measurements is given in Figure 4.

On separate, 360° continuous, and 360° intermittent indications that meet the requirement of an "INDICATION THAT DAMPS ON THE SURFACE WITH SCREEN CORRELATION," TWD information is not necessary. On indications 100% of DAC and below, there is no need to record TWD information.

F. Damps: All indications should state whether or not they damp.

G. Recording of 60° angle beam indications are required only in the volume that has not been covered with a 45° angle beam.

9. REPORTING STANDARDS:

9.1 Prior to W'75 Code: All indications detected in the area of interest which produce signal amplitudes greater than the DAC reference calibration curve and that have a linear dimension equal to or exceeding that given in Table I shall be recorded and reported individually and an evaluation made to the acceptance standards involved in the original construction.

TABLE 1

Material Thickness Range (Inches)	Linear Dimension
0 thru 3/4	1/4 inch
Over 3/4 thru 2-1/4	1/3 of thickness
Over 2-1/4	3/4 inch

9.1.1 Where discontinuities are interpreted to be cracks or incomplete penetration, they are unacceptable regardless of discontinuity size or signal amplitude.

9.1.2 If there is any doubt regarding the proper interpretation of ultrasonic indications in the area of interest, such doubt may be resolved by radiography.

9.2 W'75 Code and Later: All indications detected in the area of interest which produce signal amplitudes greater than 100% of the DAC reference calibration curve shall be reported individually and an evaluation made in accordance with Table IWB-3514.2 and IWB-3514.3 of ASME Section XI, Winter '75 Addenda.

9.3 Any area where limited or no examination was performed shall be recorded and reported.

10. RECORD OF EXAMINATION RESULTS: A copy of the examination data (Figure 3) shall be provided to the customer with the following information:

A. Contract Number
B. Examination Personnel by Name and/or ID Number
C. Instrument by ID Number
D. Method of Test
E. Couplant by Batch or ID Number
F. Calibration Sheet
G. Weld Identification and Location
H. Type, Size, and Frequency of Search Unit by ID Number
I. Ultrasonic Wave Mode
J. Calibration Block Number
K. Chart of Results
L. Procedure Number and Revision
M. Dates of Examination
N. Examination Surface
O. Layout of Weld Seams as Detailed in ISI-360, ISI-361 ISI-362 or BLI-36
P. The Number(s) of any Field Change Authorization(s) that affect(s) this Procedure.

TABLE II

SURFACE NOTCH DEPTHS FOR
ULTRASONIC CALIBRATION

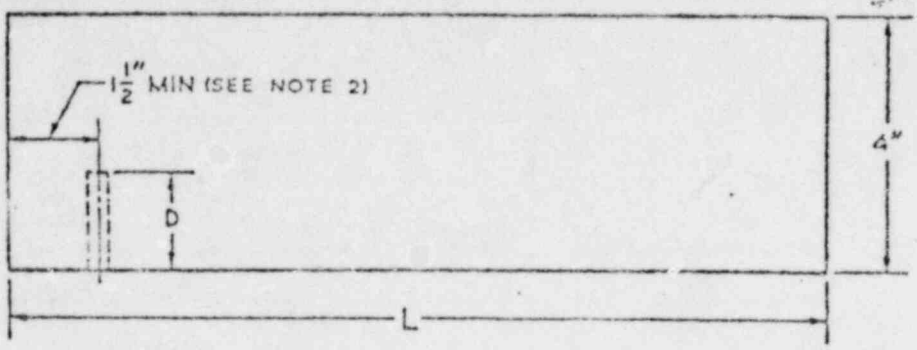
Nominal Pipe Wall Thickness (t) inches	Materials	Notch Depth (d) as a Percent of t
Less than 0.312	Ferritic	10.0 + 0.005 in./-0.010 in.
0.312 to 6.0	Ferritic	10.4 minus 0.9t + 10%/-20%
Less than 0.312	Austenitic	10% of t + 10%/-20%
0.312 to 6.0	Austenitic	10% of t + 10%/-20%

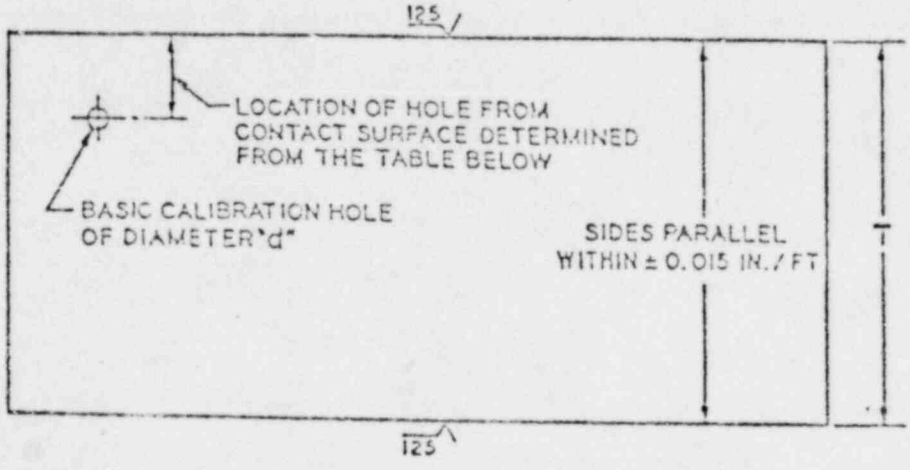
TABLE III

CALIBRATION BLOCK HOLE DIAMETERS

Material Thickness (t) inches	Hole Diameter (d) inches
Up to 1 inclusive	3/32
Over 1 thru 2	1/8
Over 2 thru 4	3/16
Over 4 thru 6	1/4

SUBJECT ULTRASONIC EXAMINATION OF CLASS 1&2 PIPING WELDS JOINING SIMILAR & DISSIMILAR MATERIALS	ISI-120, REV. 7





L = Length of block determined by the angle of search unit and the vee-path used
T = Thickness of basic calibration block (see table below)
D = Depth of side-drilled hole (see table below)
d = Diameter of side-drilled hole (see table below)
t = Nominal production material thickness

Nominal Production Material Thickness (*t*) in.	Basic Calibration Block Thickness (*T*), in.	Hole Location	Hole Diameter (*d*), in.	Minimum Hole Depth (*D*), in.
Up to 1 incl.	¾ or *t**	½ *T*	3/32	1½
Over 1 thru 2	1½ or *t*	¼ *T*	⅛	1½
Over 2 thru 4	3 or *t*	¼ *T*	5/32	1½
Over 4 thru 6	5 or *t*	¼ *T*	¼	1½
Over 6 thru 8	7 or *t*	¼ *T*	5/16	1½
Over 8 thru 10	9 or *t*	¼ *T*	⅜	1½
Over 10	*t*	¼ *T*	See Note 1	1½

Note 1–For each increase in thickness of 2 in., or a fraction thereof, the hole diameter shall increase 1/16 in.

Note 2–For block sizes over 3 in. in thickness (*T*), the distance from the hole to the end of the block shall be ½*T* min. to prevent coincident reflections from the hole and the corner in the ¾ th vee-path position. Blocks fabricated with a 1½-in. minimum dimension need not be modified if the corner and hole indications can be easily resolved.

*± 0.25 inch per Code Case 1705.

Figure 1

Basic Calibration Blocks

SUBJECT ULTRASONIC EXAMINATION OF CLASS 1&2 PIPING WELDS JOINING SIMILAR & DISSIMILAR MATERIALS	ISI-120, REV. 7

BWCC 3817-1 BABCOCK & WILCOX B&W CONSTRUCTION COMPANY

CALIBRATION SHEET SHEET NO: _____ DATE: _____ TIME: _____ HR

CUSTOMER: | CONTRACT NO.: | COMPONENT:

EXAMINER: | ID#: | LEVEL: | COUPLANT:

EXAMINER: | ID#: | LEVEL: | COUPLANT ID#:

INSTRUMENT
ID#: *
LINEARITY CHECK ☐ YES ☐ NO
REJECT: _____ %
MAT'L. CAL.: _____
DELAY: _____
PULSE ENERGY: _____
COARSE GAIN IN DB: _____
FINE GAIN IN DB: _____
FINE GAIN: _____ %
SCREEN RANGE: _____
SCREEN DEPTH: _____ IN.
☐ TSR ☐ NORMAL } OPERATION
FREQUENCY: _____ MHZ
☐ NORMAL ☐ RF } DISPLAY
REP. RATE: _____
ZERO CONTROL: _____ °
RESOLUTION: _____
A _____ B _____ C _____ } DOC
A _____ B _____ C _____ } GATE
☐ NORMAL ☐ FIRST ECHO } ECHO START

CALIBRATION BLOCK
ID#: _____
LENGTH _____ IN.
OD _____ IN.
THICKNESS _____ IN.
* TEMP _____ °F

CRYSTAL
ID# _____
TYPE _____
FREQ. _____ MHZ
SIZE _____ IN.
ACTUAL ∠ _____ °

CALIBRATION BLOCK SIMULATOR
SERIAL NO. _____ SCREEN RANGE _____ IN.
SIGNAL AMP _____ % SCREEN DEPTH _____ IN.
COURSE GAIN DB _____ FINE GAIN DB _____
* TEMP _____ °F

SYSTEM CALIBRATION
ANGLE ____

REFLECTOR	AMPLITUDE % OF FULL SCREEN	SCREEN READING IN INCHES
/8 NODE	%	IN.
/8 NODE	%	IN.
/8 NODE	%	IN.
/8 NODE	%	IN.
/8 NODE	%	IN.
/8 NODE	%	IN.
TOP NOTCH	%	IN.
OPPOSITE NOTCH	%	IN.
BKR @ ___°	%	IN.
BKR @ ___°	%	IN.

SEARCH UNIT CABLE

TYPE	LENGTH

* THERMOMETER _____
* REQUIRED SUMMER 73 ± 5 FOR VESSELS
REQUIRED WINTER 75 ± 5 FOR PIPING

FIGURE NO(S) EXAMINED

CALIBRATION CONFIRMATION

TIME		HRS		HRS		HRS		HRS		HRS		HRS
BLOCK SIM.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
BACK REFL.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
/8 NODE	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
/8 NODE	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
/8 NODE	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
TOP NOTCH	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
OPPOSITE NOTCH	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.
INITIALS												

* BKR @ (BACK REFLECTION FROM CAL. BLOCK) * BKR P (BACK REFLECTION FROM PART)

REVIEWED BY _____ LEVEL _____ DATE REVIEWED _____

Figure 2
Typical Calibration Sheet

BABCOCK & WILCOX
B&W Construction Company
INSERVICE INSPECTION PROCEDURE

SUBJECT ULTRASONIC EXAMINATION OF CLASS 1&2 PIPING WELDS JOINING SIMILAR & DISSIMILAR MATERIALS	ISI-120, REV. 7

PAGE 3618 BABCOCK & WILCOX B&W CONSTRUCTION COMPANY

VOLUMETRIC TEST DATA Form 100

CUSTOMER:		CONTRACT NO.:		COMPONENT:		
DESCRIPTION:						
ID#:	PROCEDURE:		MATERIAL:	THICKNESS: IN.	TEST SURFACE:	
NO. POSITIONS:	DISTANCE: IN.	21 REFERENCE:	CAL. SHEET:	CAL. SHEET:	CAL. SHEET:	
BEAM DIRECTION ___LONG ___SHEAR	LIMITED EXAM ☐NO ☐YES (IF SO WHY)		ANGLE:	ANGLE:	ANGLE:	
EXAMINER:	ID#:	LEVEL:	TIME START: HR.	TIME START: HR.	TIME START: HR.	
EXAMINER:	ID#:	LEVEL:	TIME STOP: HR.	TIME STOP: HR.	TIME STOP: HR.	
NOTES:			PART TEMP: ____ °F	PART TEMP: ____ °F	PART TEMP: ____ °F	
			DATE:	DATE:	DATE:	
			CAL. BLOCK:	2D INFORMATION ONLY		
			DRW. #:	WELD HEIGHT ____ WELD WIDTH ____		
			PCAIS:	SURFACE ONE TO SURFACE TWO		
				BM / HAZ / ℄ WELD / HAZ / BM		

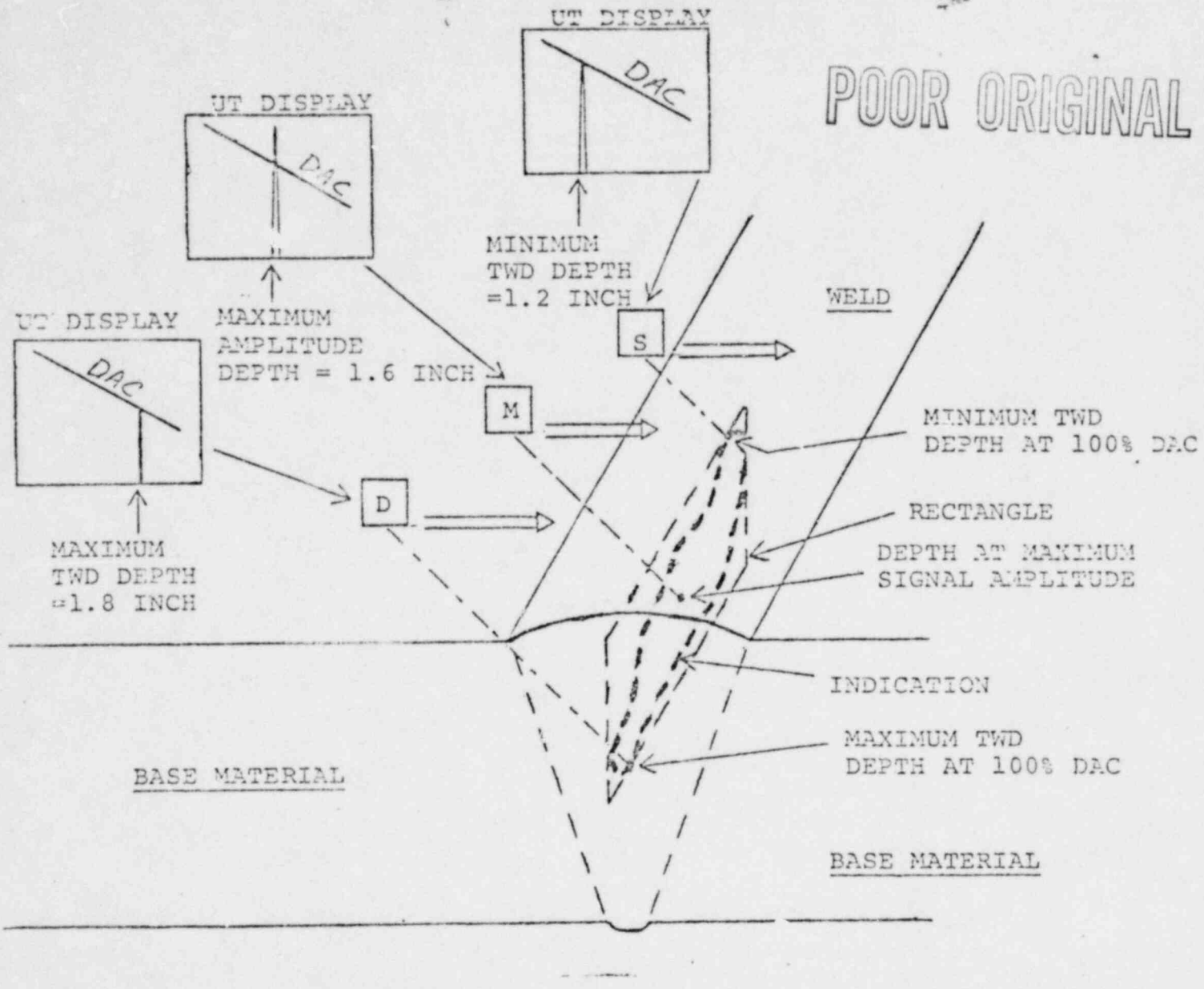
IND. NO.	A / B POSITION OF PART ITEM	ANGLE (DEG)	SURFACE	BEAM DIRECTION	STATUS	LAM: MAG. PART. LOCAT.	LAM: DEPTH (IN.)	LENGTH/WIDTH: 20%	LENGTH/WIDTH: 50% OR MRA	LENGTH/WIDTH: 100%	(INCHES): CRYSTAL A	(INCHES): CRYSTAL B	(INCHES): DISTANCE FROM 1	(INCHES): DISTANCE FROM 2	THROUGH WALL DIMENSION: MINIMUM: DEPTH	MINIMUM: POSITION IN. 1	MINIMUM: POSITION IN. 2	MAXIMUM: DEPTH	MAXIMUM: POSITION IN. 1	MAXIMUM: POSITION IN. 2	DATES	REMARKS
								LENGTH			A	B	1	2		A	B		A	B		

REVIEWED BY: LEVEL: DATE REVIEWED: FIGURE NO.:

PAGE 1 OF ____

* ANGLE - 0 DEG. - 45 DEG. - 60 DEG. - OTHER
IND. NO'S. - 0 TO 1 - 200 TO 399 - 400 TO 599 - 600 TO 799

Figure 3
Typical Data Sheet



= Beam direction and scan path
= Angle beam path in base material and weld
= Circumscribed rectangle
= Typical indication source
M = Transducer position for maximum signal amplitude
S = Transducer position for minimum TWD path
D = Transducer position for maximum TWD path
TWD = 1.8 inch - 1.2 inch = 0.6 inch

1397 096

Figure 4

TWD Example

SUBJECT ULTRASONIC EXAMINATION OF CLASS 1&2 PIPING WELDS JOINING SIMILAR & DISSIMILAR MATERIALS	ISI-120, REV.7

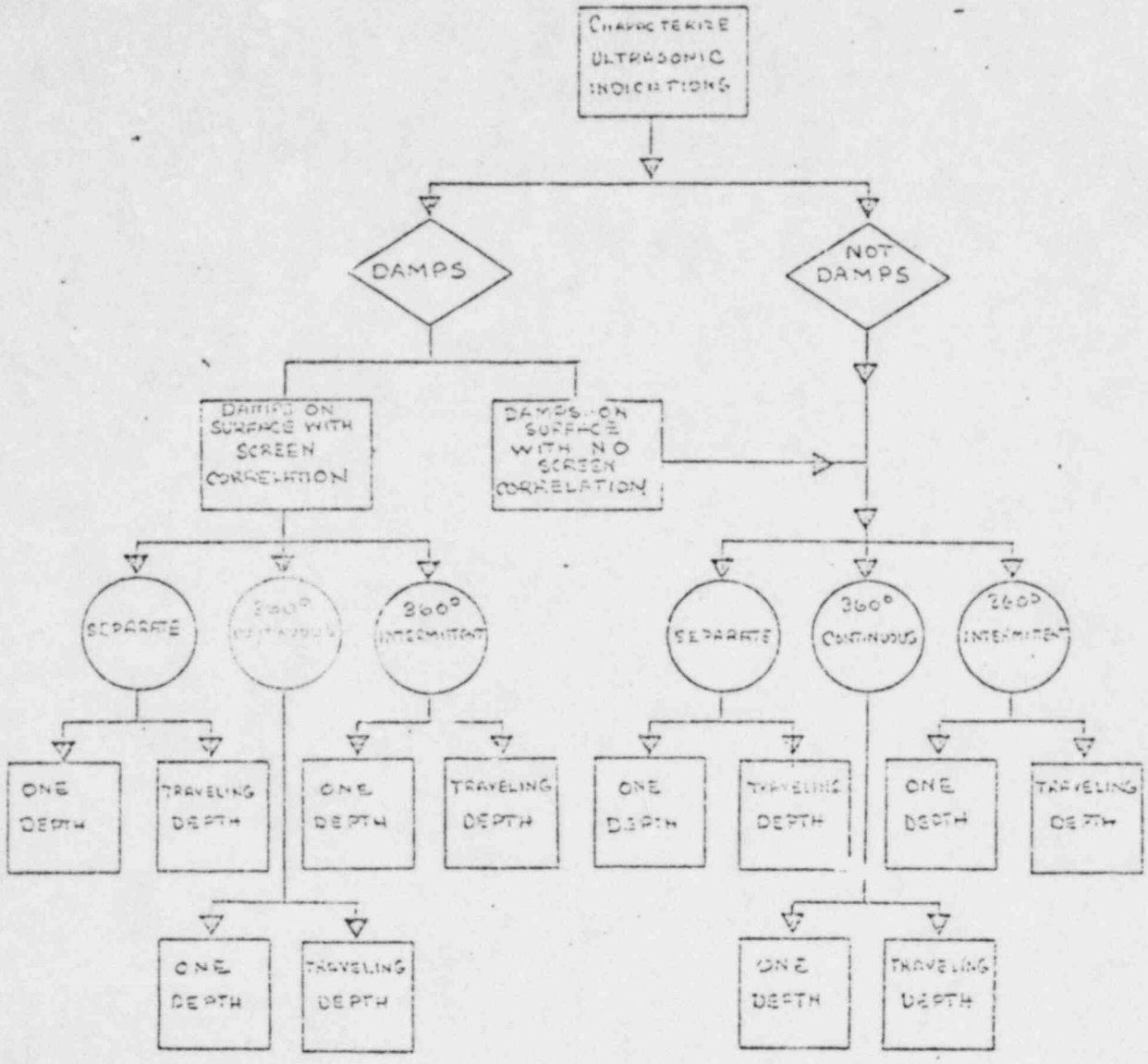


Figure 5
Typical Characterization Sequence

ATTACHMENT B1-2

BABCOCK & WILCOX

B&W Construction Company

INSERVICE INSPECTION PROCEDURE

SUBJECT	
RADIOGRAPHIC EXAMINATION OF WELDS AND BASE MATERIALS	ISI-300, REV. 8

1. SCOPE: This procedure outlines the requirements for radiographic examination of Class 1 and Class 2 welds and base materials (ferritic and austenitic steels, nickel base alloys, and combinations thereof) as required in ASME Boiler and Pressure Vessel Code, Section XI, 1974 Edition, with Addenda thru Summer 1975.

2. PERSONNEL QUALIFICATION: The personnel performing radiographic examination or evaluation shall be qualified to the requirements of Q. C. Administrative Procedure 9A-170. The examination can be performed by a Level I technician; however, all interpretation of results shall be performed by a Level II or III technician.

3. AREA OF INTEREST: For Class 1 and Class 2 pressure boundary welds, the area subject to examination shall include the weld, heat affected zone, and an area of base material on both sides of the weld extending one wall thickness from the edge of the weld.

4. SURFACE PREPARATION: The weld ripples and surface irregularities on both the inside (where accessible) and outside shall be removed by any mechanical process to such a degree that the resulting radiographic image due to these irregularities cannot mask or be confused with the image of any discontinuity.

5. WELD LAYOUT: Location markers shall be placed on the base material 1-T (one wall thickness) from the edge of the weld. Orientation shall be as specified by BLI-36, ISI-360, ISI-361, or ISI-362. When permitted, location markers shall be permanently located by light center punch marks. The starting position shall be steel stamped using round bottom, low stress stamps. When this type of permanent marking is prohibited, other methods shall be used such as sketches of the layouts which shall be maintained with the radiographs. The image of at least two location markers shall appear on each film.

6. EQUIPMENT: The radiographic equipment shall consist of gamma ray emitters (Cobalt 60 or Iridium 192) with suitable intensities to provide the desired radiographs.

6.1 IR-192: For material thickness 0.15 inches to 3.5 inches.

Typical IR-192 Emitters

Strength	Size	Focal Spot
100 Curies	0.100 x 0.100 Cylindrical	0.141
50 Curies	0.100 x 0.040 Cylindrical	0.108

6.2 CO-60: For material thickness greater than 1.5".

Typical CO-60 Emitters

Strength	Size	Focal Spot
50 Curies	0.125 Sphere	0.125
5 Curies	0.060 Sphere	0.060

7. FILM: Radiographs shall be made using film of Type 1 or Type 2 as listed in Table 1.

7.1 Number of Films: All radiographic exposures shall be made using at least two films per cassette.

7.2 Intensifying Screens: Lead intensifying screens with a minimum thickness of 0.010 inches shall be employed inside the cassette on both sides of the film. The lead shall be in intimate contact with the film. Additional lead sheets may be used on the back of the cassette for protection against scattered radiation. Chemically coated intensifying screens shall not be used.

As a check on backscattered radiation, a lead symbol "B" with minimum dimensions of 1/2 in. in height and 1/16 in. in thickness shall be attached to the back of the film holder. If the image of the "B" appears on the radiograph, protection from backscatter is insufficient and the radiograph shall be considered unacceptable.

7.3 Identification: Radiograph identification shall include contract number, component, part or weld seam, date, and B&W Construction Company. This information shall appear on each film.

7.4 Processing: All film shall be processed in such a manner to be free from mechanical, chemical, or other blemishes that could interfere with proper interpretation of the radiograph.

7.5 Density:

7.5.1 Density Limitations: The film density through the radiographic image of the body of the appropriate penetrameter and the area of interest shall be 2.0 minimum for single film viewing. For composite viewing of double film exposure, the minimum density shall be 2.6. Each radiograph of a composite set shall have a minimum density of 1.3. The maximum density shall be 3.8 for either single.

or composite viewing.

7.5.2 Monitoring Density Limitations: Densities shall be measured using a calibrated densitometer. The densitometer shall be calibrated daily, prior to checking radiographic density on a single radiograph or series of radiographs. The densitometer shall be calibrated using a certified density strip traceable to a national standard.

7.6 Geometrical Unsharpness: Radiographs shall have a maximum geometrical unsharpness of 0.020 inch for material thicknesses up to 2 inches, 0.030 inch for material thicknesses over 2 inches and thru 4 inches, and 0.040 inch for material thickness greater than 4 inches. Geometrical unsharpness (Ug) equals the focal spot size (F) times the thickness (T) over the object to source distance (D),

$$Ug = \frac{(F)\ (T)}{D}$$

where:

F = Focal spot in inches, i.e., the maximum effective dimension of the radiation source in the plane of the distance D from the weld.

D = Distance in inches from source of radiation to the weld or other object being radiographed.

T = Thickness in inches of the weld or other object being radiographed, assuming the film is against the weld or object; otherwise, it shall be the thickness plus the space between the film and the weld or object.

8. PENETRAMETERS:

8.1 Sensitivity: The images of the penetrameter identification numbers, the penetrameter outline, and the essential hole are indicators of image quality on the radiograph and must appear clearly on the radiograph.

8.2 Type: Penetrameters shall be fabricated in accordance with ASME SE-142 and be of material that is radiographically similar to or radiographically less dense than the material to be examined.

8.3 Identification: Penetrameters shall be identified by permanently attached lead numbers which indicate the thickness of the penetrameter in thousandths of an inch and shall be further identified by having its principal alloy marked thereon.

8.4 Selection of Penetrameters:

8.4.1 Single-Wall Viewing: Except as permitted in 8.4.2, radiographic examination of circumferential butt welds shall be performed with single-wall viewing only. The radiation may pass through one or both walls. Where the source is located outside the cylinder, a minimum of four exposures separated by 90° shall be required for single-wall viewing. When the radiation must pass through two walls of cylinder, the penetrameter given in Table 3 shall be used.

8.4.2 Double-Wall Viewing: Welds joining items with an outside diameter of 3-1/2 in. or less may be radiographed using a technique in which radiation passes through two walls, and the weld in both walls is viewed for acceptance on the same film. The penetrameter shall be placed on the source side. The radiation beam may be offset from the plane of the weld centerline at an angle sufficient to separate the images of the source-side and film-side portions of the weld so there is no overlap of the areas to be interpreted, in which case a minimum of two exposures taken at 90° to each other shall be made for each weld joint. As an alternate, the weld may be radiographed with the radiation beam positioned so the images of both walls are superimposed, in which case at least three exposures shall be made at 60° to each other. Penetrameters shall be selected from Table 3.

8.4.3 Film-Side Penetrameter: If the radiation passes through one wall and inaccessibility prevents source-side placement of the penetrameter, a film-side penetrameter shall be used from Table 2. When the radiation must pass through two walls of a cylinder, the penetrameter given in Table 3 may be used.

8.4.4 Thickness of Penetrameter: For any material thickness range, a thinner penetrameter than listed for

that range may be used provided all other requirements for radiography are met. For welds joining equal thickness material, the penetrameter is based on the nominal single-wall thickness. For unequal wall thickness material, penetrameters are based on the thinnest and thickest nominal wall dimensions. Backing rings or strips are not to be considered as part of the weld or reinforcement thickness in penetrameter selection.

8.5 Placement:

8.5.1 For welds joining equal thickness material, a set of two identical penetrameters per radiograph, one shimmed and one unshimmed, shall be exposed simultaneously with the weld. The shim shall be made of material radiographically similar to the

weld and shall be such that the total thickness under one penetrameter is essentially the same as the total weld thickness. The shim size shall exceed the penetrameter by 1/8 inch on three sides. For welds joining unequal thickness material, two sets of penetrameters, one placed on the thicker section and one placed on the thinner section, will be required.

8.5.2 When the source is placed on the axis of a weld joint as shown in Figure 4, and the complete circumference is radiographed with a single exposure, at least three sets of uniformly spaced penetrameters shall be required. However, the sets must conform to the thickness requirements of the material which is being examined, i.e., unequal nominal wall thicknesses will require penetrameters for each thickness.

8.5.3 Penetrameters shall be placed on the base metal adjacent to the area of interest. In instances where the weld metal is not radiographically similar to the base material or base material geometry is restrictive, the penetrameters shall be placed over the weld metal adjacent to the area of interest.

8.5.4 When placement of a source side penetrameter is impractical, the penetrameter may be placed on the film side with a lead letter "F" at least as high as the penetrameter identification number adjacent to each penetrameter used.

8.6 Qualified Density Range: The minimum and maximum qualified density of the radiograph in the area of interest is established as described below:

8.6.1 The density of the penetrameters shall be established using a densitometer. The density shall be taken through the body of the penetrameter.

8.6.2 Using the density chart in Figure 7, the lightest penetrameter is used to obtain the minimum(-15%) qualified density(minimum acceptable density). The darkest penetrameter is used to obtain the maximum (+30%) qualified density(maximum acceptable density).

8.6.3 All densities in the area of interest that fall between the minimum and maximum density range established in 8.6.1 and 8.6.2 above shall be considered acceptable.

8.6.4 Densities in the area of interest that do not fall within the minimum and maximum density range established in 8.6.1 and 8.6.2 above shall be considered unacceptable. The radiograph shall be retaken using additional penetrameters as required to qualify these exceptional areas. The steps in 8.6.1 through 8.6.3 shall be repeated to establish the new qualified density range.

8.6.5 The penetrameters used to establish the qualified density range shall meet the requirements of 8.1 and 7.5.1 above.

8.6.6 If the penetrameter image does not show on one radiograph in double film technique but does show in composite viewing, interpretation shall be permitted only by double film viewing.

9. RADIATION SAFETY: The "Radiation Safety Manual for Radiographic Operations" describes the Radiation Safety Program of the B&W Construction Company. This manual includes operating procedures for the radiographic equipment used and the administrative procedures for radiation safety. A copy is assigned to each radiographer and shall be available at the job site.

9.1 The self reading dosimeter shall be read before and after each source exposure.

10. EXPOSURE CONDITIONS:

10.1 Weld Joints in Tubular Products Having an Outside Diameter of 3-1/2 Inches or Less:

Weld joints in this category shall be radiographed using Iridium 192 by the techniques shown in Figures 1 or 5.

When using the Figure 1 technique, the penetrameter shall be placed on the source side. The angle of the radiation beam shall be approximately 20 degrees. In all cases this angle shall be sufficient to separate the images of the source side and film side of the weld so that there is no overlap of the areas to be interpreted. A minimum of two exposures taken at 90 degrees around the pipe shall be made for each weld joint.

When using the Figure 5 technique, the weld is radiographed with the radiation beam positioned so that the image of the weld adjacent to the film is shown on the radiograph. In this case, at least four exposures shall be made at 90 degrees around the pipe with the penetrameter on the film side.

10.2 Weld Joints in Tubular Products Having an Outside Diameter in Excess of 3-1/2 Inches, and 0.15" to 1.5" Thickness: Weld joints in this category shall be radiographed using IR-192 by any of the techniques shown in Figures 2 through 5 within the limits of geometrical unsharpness. Where the source is located outside of the pipe, a minimum of four exposures, separated by 90 degrees around the pipe, shall be required.

10.3 Weld Joints Greater than 1.5" Thick: These weld joints may be radiographed using IR-192 or CO-60 by any of the techniques shown in Figures 2 through 5. On circumferential welds, a minimum of four exposures, separated by 90 degrees around the pipe, shall be required.

10.4 The exposure technique number (See Figures 1 thru 5) used for the radiograph shall be recorded under "REMARKS" on the Radiographic Inspection Report.

11. EVALUATION: A radiographic inspection report as shown in Figure 6 shall be completed for each weld examined.

11.1 Discontinuities detected in the examination area shall be entered on the report form as reportable (requires further evaluation) if the indication displays any of the following characteristics:

(a) Any type of crack or zone of incomplete fusion or penetration;

(b) Any other elongated indication which has a length greater than:

(1) 1/4 in. for T up to 3/4 in., inclusive;
(2) 1/3t for T from 3/4 in. to 2-1/4 in., inclusive;
(3) 3/4 in. for T over 2-1/4 in; where T is the thickness of the thinner portion of the weld;

(c) Any group of indications in line that have an aggregate length greater than T in a length of 12T except where the distance between any successive indications exceeds 6L, where L is the longest indication in the group;

(d) Porosity in excess of that shown as acceptable in Appendix VI of ASME III.

11.2 Discontinuities which do not exceed the limits of Paragraph 11.1 shall be entered on the report form as recordable (not requiring further evaluation).

11.3 Any area where best effort inspection was performed due to configuration shall be recorded and reported.

12. RECORD OF EXAMINATION RESULTS: A copy of the examination data (Figure 6) shall be provided to the customer with the following information:

A. Customer and Contract Number.
B. Name, ID Number and Certification Level of all examination personnel including reviewer and evaluator.
C. Date of examination.
D. Component description.
E. Weld identification.
F. Material type, thickness and OD (where applicable).
G. Procedure number and revision including field charge numbers, where applicable.
H. Location of #1 reference position, distance between location markers, and other weld layout data as detailed in ISI-360, ISI-361, ISI-362, or BLI-36.
I. Source type, strength, and focal spot size.
J. Film type, size, and brand name as detailed in Table 1. Indicate type of processing.
K. Number of films in cassette.
L. Penetrameter size, serial number, and location during exposure.
M. Type and thickness of intensifying screens as detailed in Section 7.2.
N. Shim thickness.
O. Geometric unsharpness.
P. Dates of review and evaluation.
Q. Method of film viewing (single film and/or superimposed).
R. Exposure conditions including technique number (see Figures 1 through 5), source to film distance, exposure time and weld to film distance where necessary.
S. Chart of results as detailed in Section 11.

TABLE 1

TYPE 1	TYPE 2
Dupont Cronex NDT 45	Dupont Cronex NDT 65
Dupont Cronex NDT 55	Dupont Cronex NDT 75
Dupont Cronex NDT 65	GAF 800
GAF 200	Kodak AA
GAF 400	Kodak T
Kodak M	

TABLE 2

THICKNESS, PENETRAMETER DESIGNATIONS, AND ESSENTIAL HOLES

Single-Wall Material Thickness Range, in.	Penetrameter			
	Source Side		Film Side	
	Designation	Essential Hole	Designation	Essential Hole
Up to 1/4, incl.	5	4T	5	4T
Over 1/4 thru 3/8	7	4T	7	4T
Over 3/8 thru 1/2	10	4T	10	4T
Over 1/2 thru 5/8	12	4T	12	4T
Over 5/8 thru 3/4	15	4T	12	4T
Over 3/4 thru 7/8	17	4T	15	4T
Over 7/8 thru 1	20	2T	15	2T
Over 1 thru 1-1/4	25	2T	17	2T
Over 1-1/4 thru 1-1/2	30	2T	20	2T
Over 1-1/2 thru 2	35	2T	25	2T
Over 2 thru 2-1/2	40	2T	30	2T
Over 2-1/2 thru 3	45	2T	35	2T
Over 3 thru 4	50	2T	40	2T
Over 4 thru 6	60	2T	45	2T
Over 6 thru 8	80	2T	50	2T
Over 8 thru 10	100	2T	60	2T
Over 10 thru 12	120	2T	80	2T
Over 12 thru 16	160	2T	100	2T
Over 16 thru 20	200	2T	120	2T

1327 107

TABLE 3

THICKNESS, PENETRAMETER DESIGNATIONS, AND ESSENTIAL HOLES

Single-Wall Material Thickness Range, in.	Penetrameter Film or Source Side Designation	Penetrameter Film or Source Side Essential Hole
0 thru 0.375	10	4T
Over 0.375 thru 0.625	12	4T
Over 0.625 thru 0.875	15	4T
Over 0.875 thru 1.00	17	4T
Over 1.00 thru 1.50	25	2T
Over 1.50 thru 2.50	30	2T
Over 2.50 thru 3.00	35	2T
Over 3.00 thru 4.00	40	2T
Over 4.00 thru 6.00	50	2T

SUBJECT	RADIOGRAPHIC EXAMINATION OF WELDS AND BASE MATERIALS	ISI-300, REV. 8

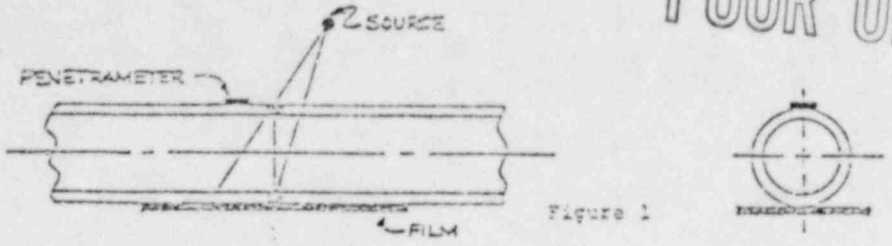


Figure 1

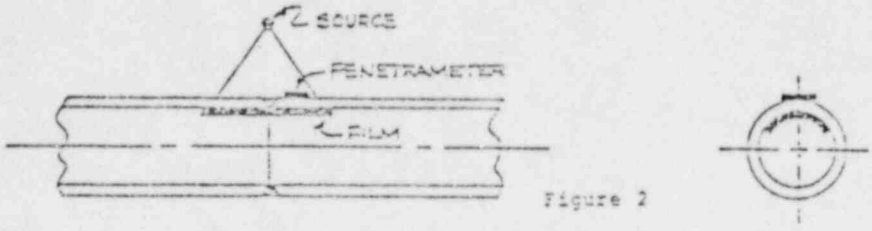


Figure 2

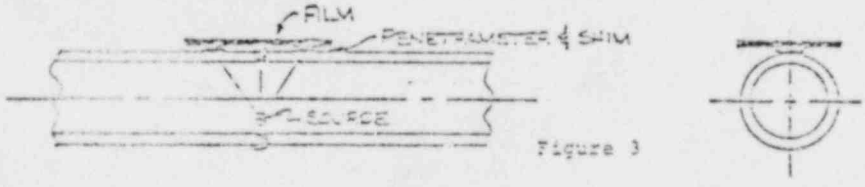


Figure 3

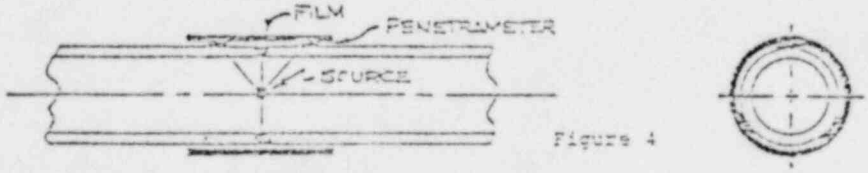


Figure 4

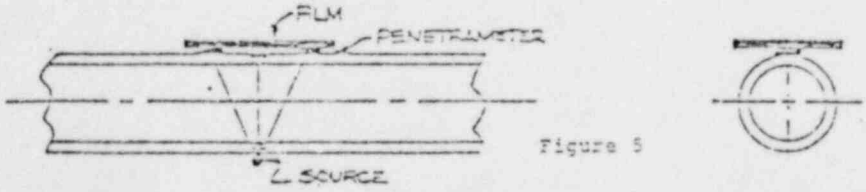


Figure 5

Figures 1 thru 5
Radiographic Exposure Techniques

BABCOCK & WILCOX
B&W Construction Company
INSERVICE INSPECTION PROCEDURE

SUBJECT	
RADIOGRAPHIC EXAMINATION OF WELDS AND BASE MATERIALS	ISI-300, REV. 6

BABCOCK & WILCOX
B&W CONSTRUCTION COMPANY

Form 500 RADIOGRAPHIC INSPECTION DATA DATE:

Customer: Contract No: Component:

Weld I.D.# Procedure: Material(s): Thickness in. O.D. in.

No. Positions: Distance: in. #1 Reference:

EXPOSURE
☐ Single Wall ☐ Ellipse Source to Film Distance:
☐ Double Wall ☐ Panoramic Exposure Time:

SOURCE
☐ IR 192 ☐ CO 60 ☐ _____
Curies: Size:
Focal Spot :

Shim Size: Ug:

Examiner: ID#: Level:

Examiner: ID#: Level:

FILM
Make : Size:
Film Process
☐ Manual ☐ Automatic

PENETRAMETER (s)
Size:
☐ Source Side ☐ Film Side

POSITION A	POSITION B	No Apparent Indication	Recordable	Reportable	Slag	Porosity	Crack	Lack of Penetration	Lack of Fusion	Undercut	Surface	Tungsten	Root Concave	Root Convex	Length (Reportable)	REMARKS

Reviewer: ID# Level Date
Evaluator: ID# Level Date
Figure No:

1397 110

Figure 6
Typical Radiographic Inspection Report

Penetrameter Density	Area of Interest Minimum	Area of Interest Maximum
	-15	+30
1.30 *	1.30 *	1.69
1.35	1.30 *	1.76
1.40	1.30 *	1.82
1.45	1.30 *	1.89
1.50	1.30 *	1.95
1.55	1.32	2.02
1.60	1.36	2.08
1.65	1.40	2.15
1.70	1.44	2.21
1.75	1.49	2.28
1.80	1.53	2.34
1.85	1.57	2.41
1.90	1.61	2.47
1.95	1.66	2.54
2.00	1.70	2.60
2.05	1.74	2.67
2.10	1.78	2.73
2.15	1.83	2.80
2.20	1.87	2.86
2.25	1.91	2.93
2.30	1.95	2.99
2.35	2.00	3.06
2.40	2.04	3.12
2.45	2.08	3.19
2.50	2.12	3.25
2.55	2.17	3.32
2.60	2.21	3.38
2.65	2.25	3.45
2.70	2.29	3.51
2.75	2.34	3.58
2.80	2.38	3.64
2.85	2.42	3.71
2.90	2.46	3.77
2.95	2.51	** 3.80
3.00	2.55	** 3.80
3.05	2.59	** 3.80
3.10	2.63	** 3.80
3.15	2.68	** 3.80
3.20	2.72	** 3.80

Figure 7
Typical Radiographic Density Chart

Penetrameter Density	Minimum	Maximum
3.25	2.76	** 3.80
3.30	2.80	** 3.80
3.35	2.85	** 3.80
3.40	2.89	** 3.80
3.45	2.93	** 3.80
3.50	2.97	** 3.80
3.55	3.02	** 3.80
3.60	3.06	** 3.80
3.65	3.10	** 3.80
3.70	3.14	** 3.80
3.75	3.19	** 3.80
3.80	3.23	** 3.80

*Minimum allowable density.
**Maximum allowable density.

NOTE: Round off penetrameter density to the nearest five hundredths.

For Example:

Reading	Rounds To
1.31	1.30
1.32	1.30
2.33	2.35
2.34	2.35
3.76	3.75
3.77	3.75
3.78	3.80
3.79	3.80

Figure 7
Typical Radiographic Density Chart
(Continued)

SUBJECT	
VISUAL EXAMINATION OF WELDS AND SURFACE CONDITIONS	ISI-350, REV. 8

1. SCOPE: This procedure shall govern the visual examination as outlined in ASME Boiler and Pressure Vessel Code, Section XI, to provide a report of the general condition of the surfaces and welds of the system components.

2. OPERATOR QUALIFICATIONS: The visual examiner shall be qualified to at least Level II in accordance with B&W Construction Company Quality Control Administrative Procedure:

   2.1 9A-167 or 9A-168 for examinations governed by Section XI Code Editions and addenda thru Summer 1975;

   2.2 9A-172 for examinations governed by Section XI Code Editions and addenda later than Summer 1975.

3. EQUIPMENT:

   3.1 In Air or other Gaseous Atmosphere Visual aids, such as a magnifying glass, mirrors, telescopes, borescopes, and other remote devices, may be used provided that the operator can resolve a black line 1/32 of an inch wide (maximum) on an eighteen percent neutral gray card placed on or near the surface to be examined. (Figure 1).

   3.2 In Water or other Liquid Media: Visual aids, such as underwater television cameras, may be used provided that the operator can resolve a scribe line 1/32 of an inch wide (maximum) on a surface similar in appearance to that being examined.

4. SURFACE CONDITION: The examination surface shall be free of dirt, scale, machining or grinding particles, weld spatter, grease, or other foreign matter that might interfere with the examination.

   Whenever neccesary, surface conditioning shall be accomplished by a mechanical process such as machining, grinding, or belt sanding to provide a suitable surface finish.

5. LIGHTING: The lighting shall illuminate the area to be examined at right and oblique angles. This lighting can be accomplished using normal lighting, portable light cords, flashlights, underwater spot or flood lights, etc..

Reflections from the piece being examined must not interfere with the visual examination. The lighting level shall be bright enough to resolve the 1/32 inch black line of Paragraph 3.1 or the 1/32 inch scribe line of Paragraph 3.2, depending upon the examination conditions.

6. RECORDING: Any area where a visual examination reveals surface imperfections such as scratches, wear, cracks, arc strikes, undercuts, deep gouges, corrosion, erosion, misalignment, movement, leakage, etc. shall be reported on the data sheet. (Figure 2).

6.1 Photography shall be utilized in areas that might be of a questionable nature at a later date. Photographs shall have a 6 inch scale shown on the picture. A card shall be included in the area photographed, which shall display identification information for the component or weld.

6.2 Charts shall be made on areas of visual indications other than those listed in Paragraph 6.1.

6.3 The visual indications noted in Paragraphs 6.1 and 6.2 shall have at least the following information:

6.3.1 Dimension from axis.

6.3.2 Dimension from flange, nozzle, elevation line, or other known fixed objects.

6.3.3 Type of indication: scratch, wear, crack, gouge, arc strikes, undercuts, misalignment, movement, leakage, boric acid residue, etc.

6.3.4 Charts shall show the length,width, and average depth of the indication when it can be obtained.

6.3.5 When remote visual examinations are performed using an automated positioning device, the location and dimensions of indications shall be obtained using the position display readouts of the positioning device. If no position display readouts are available the location of the indication shall be recorded relative to known physical locations on the part, and the dimensions of the indication shall be estimated based on known surface irregularties.

SUBJECT	
VISUAL EXAMINATION OF WELDS AND SURFACE CONDITIONS	ISI-350, REV. 8

7. EVALUATION OF DEFECTS:

7.1 Pronounced visual indications may be evaluated by the naked eye.

7.2 On visual indications that are not pronounced, other means of NDE may be incorporated to aid the visual examination.

7.3 Evaluation of visual indications shall be made at a distance no greater than 24 inches from the area of interest and at an angle no less than 30 degrees with the surface to be examined.

7.4 Other visual aids may be used to evaluate indications that are seen by the naked eye provided they meet the requirements set forth in Paragraph 3.

7.5 During a system hydrostatic, leakage, functional, inservice, or pressure test, all applicable welds shall be examined for evidence of leaking.

(a) The examination, which may be conducted without the removal of insulation, shall be performed by inspecting(1) the exposed surfaces of and joints in component insulation to locate evidence of leakage, (2) the floor areas (or equipment) directly underneath components for evidence of accumulated leakage that may drip from components,and (3) other areas to which such leakage may be channelled.

(b) Examination of insulation joints along vertical surfaces of vessels, wall, and piping need not be performed provided the lowest terminal ends of vertical surfaces are examined, and the insulation design is such that any leakages originating along the vertical surfaces can accumulate and leak from the insulation joint at the lowest elevation.

(c) Examination of insulation joints along horizontal surfaces of components shall be conducted at each insulation joint except where accessibility is limited by structural members or other components. In the latter cases, either the insulation shall be removed to permit component examination, or provisions shall be included to channel potential leakages to areas accessible for examination.

(d) At locations where leakages are normally expected and collected (e.g., valve stems, pump seals)the examination shall verify that the leakage collection system is operative.

(e) During the examination, particular attention shall be given to the insulated areas of components constructed of ferritic steels to detect evidence of boric acid residues whose source derives from borated reactor coolant and which may have accumulated during the service period preceding the examination. In the event boric acid residues are detected, the insulation shall be removed from the components to the extent necessary to permit visual examination of the surfaces wetted by reactor coolant leakage in order to detect evidence of corrosion.

7.6 After reactor operation, any discoloration or white residue indicating boric acid buildup shall be indicative of leaking. Any such residue shall be examined in relation to surrounding components which may have leaks. These components shall be examined visually for leaks. If a definite source(s) is (are) not found, an appropriate dye penetrant procedure shall be used for examining suspected areas of cracking.

7.7 Any indications found during the preoperational examination shall be recorded, but these data shall only be used as references for comparison during subsequent postoperational examinations.

7.8 Any indications found during postoperational examinations shall be compared to the data recorded during previous examinations. Any changes shall be reported.

8. RECORDS: A copy of the examination results with the following information shall be maintained and made available to the Customer: (Figure 2)

A. Contract number
B. Examination personnel by name and/or ID number
C. Method of tests
D. Chart of results
E. Date(s) of examination
F. Procedure number and revision
G. The number(s) of any Field Change Authorization(s) that affect(s) this procedure.

SUBJECT VISUAL EXAMINATION OF WELDS AND SURFACE CONDITIONS	ISI-350, REV. 8

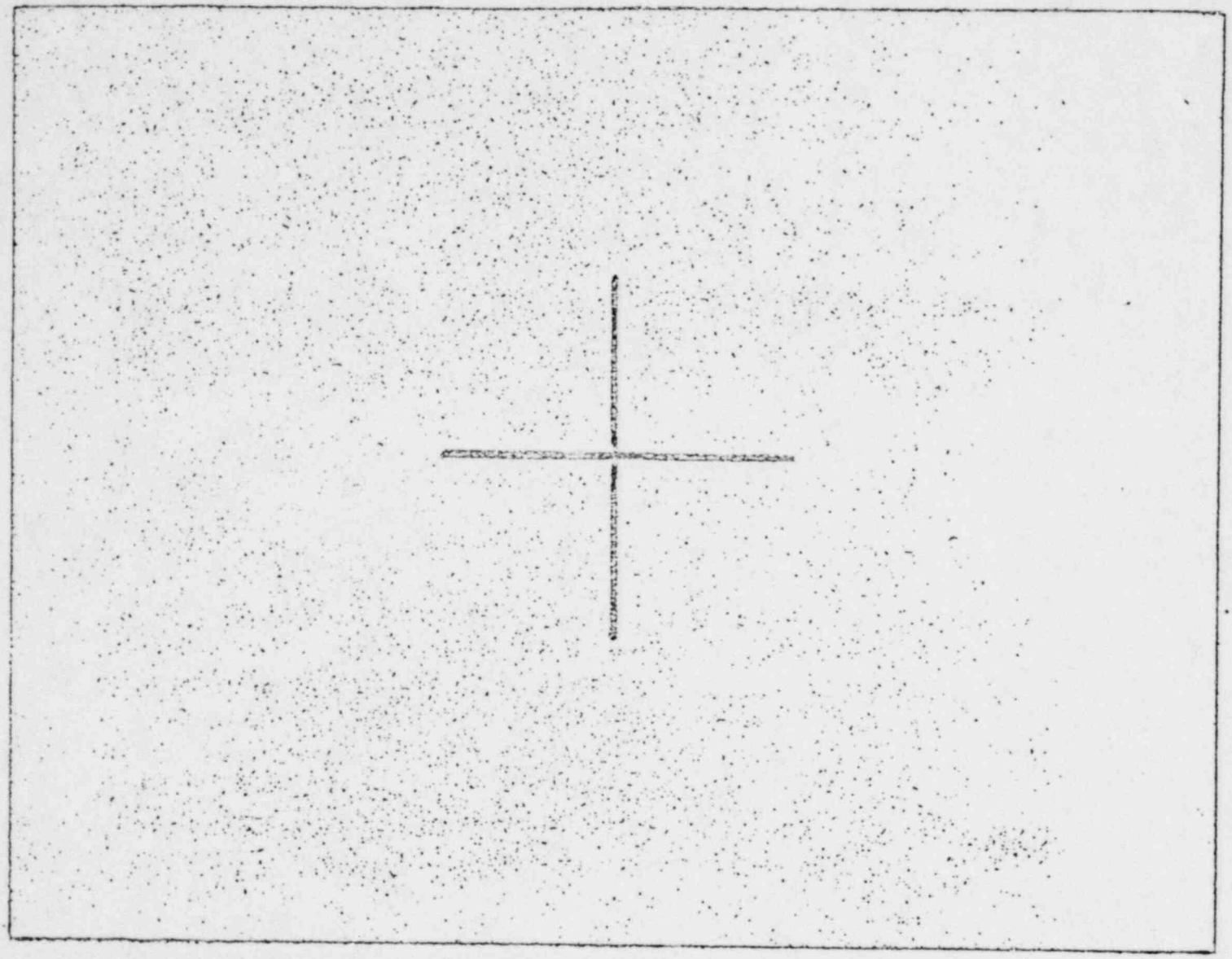


FIGURE 1
Neutral Gray Card Example

BABCOCK & WILCOX
B&W Construction Company
INSERVICE INSPECTION PROCEDURE

SUBJECT	
VISUAL EXAMINATION OF WELDS AND SURFACE CONDITIONS	ISI-350, REV. 8

FORM 200 — VISUAL/SURFACE DATA — BABCOCK & WILCOX B&W CONSTRUCTION COMPANY

CUSTOMER:	CONTRACT NO.			COMPONENT:
DESCRIPTION:				
ID #:	PROCEDURE:	MATERIAL:	THICKNESS: IN.	SURFACE:
TEST METHOD:	NO. POSITIONS:	DISTANCE: IN.	#1 REF.:	DATES:
EXAMINERS:	ID#:	LEVEL:		F.C.A.(S):
EXAMINERS:	ID#:	LEVEL:		

MAGNETIC PARTICLE (ONLY)
PARTICLE
☐WET ☐DRY COLOR_____
☐VISIBLE ☐FLUORESCENT
INSTRUMENT
METHOD_____CURRENT_____
MACHINE:_____

DYE PENETRANT (ONLY)
CLEANER_____
PENETRANT_____
DEVELOPER_____
METHOD
☐VISIBLE
☐FLUORESCENT

NOTES:

IND. NO. *	PART ITEM OR POSITION A	PART ITEM OR POSITION B	STATUS	SIZE (INCHES)	DISTANCE FROM (INCHES) A	DISTANCE FROM (INCHES) B	DISTANCE FROM (INCHES) 1	DISTANCE FROM (INCHES) 2	SURFACE	REMARKS

REVIEWED BY: LEVEL: DATE REVIEWED FIGURE NO.:

* METHOD - (VIS) - P.T. - M.T. - OTHER
IND. NO'S. - 0 TO 199 - 200 TO 399 - 400 TO 599 - 600 TO 799

PAGE 1 OF _____

Figure 2

Typical Visual Data Sheet

ATTACHMENT B2-1

CLASS I AND II

AUSTENITIC PIPING AND CEDM

UPPER PRESSURE HOUSING WELDS

ARKANSAS POWER AND LIGHT

NUCLEAR ONE, UNIT 2

1307 119

Daniel H. Nagga Jr 1/16/76
Signature Date

Signature Date

Approved By:

A.I./N.E.S. SNT-TC-1A Level III
Signature Date

C-E SNT-TC-1A Level III 4/21/76
Signature Date

AUTHORIZED INSPECTOR J. Maguder Insp. Spec 8-25-76

NUCLEAR ENERGY SERVICES, INC.

RECORD OF REVISIONS

Rev. No.	Date	Description	Reason	Originator	C-E	Aff	Auth. Insp.
01	7/16/76	Para. 5.2: UT-numbers added to items 5.2 (6) through 5.2 (16), one item deleted, and items renumbered	Calibration standards defined and numbered	I.I.Gerstein	RPK	PSB	JAM
		Para 7.2.2: Added "... when add specifically for Inservice Inspection."	Simplification of Datum Point requirements.				
		Para. 7.2.3: Added "...mark specifically for Inservice Inspection..."	Simplification of Datum Point requirements.				
		Para. 7.2.4: Added "...when a reportable indication is recorded."	Simplification of Datum Point requirements.				
		Para. 14.2: Second sentence added.	Clarification of responsibility				
		Figures 2,3,4 and 5: UT-numbers added to Ref. Std. columns	Calibration standards defined and numbered.				

RECORD OF REVISIONS

REV. NO.	DATE	DESCRIPTION	REASON	ORIGINATOR	C-E	NES	AUTH. INSP.
02	12-6-6	Para. 5.2 and Fig. 3: Added Ref. Stds. UT-25, 26,33 to List	Complete Ref. Std. Listing	G. Perkins G.R.Perkins			
		Fig. 4: Changed .034" notch depth to .035"; changed .025" notch depth to .028".	Conform to Ref. Std. AS-Builts	G. Perkins G.R.Perkins			
		Para. 1.2 (1): Added "...and piping longitudinal welds..."	Include Exam of Long. Seams	G. Perkins G.R.Perkins			
		Para. 12.2.1 (1) Added "If this is not possible, the calibration must be extended to included the third half vee".	Clarification of Calibration Procedures	G. Perkins G.R.Perkins			
		Para. 12.2.1 (1) Changed to read: "Select a search unit of such angle and size that the root of the weld to be examined will be within the 1/2 vee path".	Clarification of Calibration Procedures	G. Perkins G.R.Perkins			
		Para. 8.2: Changed to read"...Techniques applied in 2 directions toward and 2 directions parallel with the weld. One direction toward and one direction parallel is permissable using full vee techniques on flush ground welds.					

RECORD OF REVISIONS

Revision Number	Date	Description	Reason	Originator	C-E	AI/ NES
03	10/28/ 77	Pg.3, Para.1.2, delete "both straight beam and" per [illegible]	Angle beam examination (only) required by [illegible] of Section XI	G.R.Perkins		

CLASS I AND II AUSTENITIC PIPING AND
CEDM UPPER PRESSURE HOUSING WELDS

1.0 SCOPE

1.1 This procedure meets the intent of the ASME Boiler and Pressure Vessel Code, Section XI, Inservice Inspection of Nuclear Reactor Coolant Systems, Summer of 1973 Addenda, to the extent outlined in the Program Plan Book.

1.2 This procedure covers angle beam methods, using manual pulse-echo ultrasonic techniques for the examination of Class I and II Austenitic Piping, as follows:

(1) Pipe-to-pipe, pipe-to-fitting, pipe-or-elbow-to-safe-end circumferential welds, and piping longitudinal welds shown in Figures 2 & 3.

(2) CEDM upper pressue housing tube circumferential welds shown in Figures 1 and 2.

2.0 REFERENCES

2.1 Reference Documents

The following documents form a part of this examination procedure:

(1) ASME Boiler and Pressure Vessel Code, Section XI, 1971 Edition and the Summer of 1973 Addenda.

(2) ASNT Recommended Practice, SNT-TC-1A. Supplement C, Third Edition (1971).

(3) ConAm Procedure for Certifying Inspection Personnel, CUP-1 Revision 2, October 1975.

2.2 APPLICABLE DRAWINGS

The following drawings form a part of this procedure:

(1) CE Assembly Drawing No. E-235-224- Detail C.

(2) CE Assembly Drawing No. E-235-225- Detail B.

(3) Bechtel Drawing No. 6600-M-2087.

(4) CE Drawing No. CND-E-3329.

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2.3 OPERATIONAL MANUALS

The operational manual(s) for the particular ultrasonic instrument used shall form a part of this procedure.

3.0 PERSONNEL CERTIFICATION

3.1 Personnel Certification Requirements

3.1.1 Each person performing ultrasonic examination governed by this procedure shall be certified in accordance with the following:

(1) ASNT Recommended Practice, SNT-TC-1A, Supplement C, Third Edition (1971).

(2) ConAm Inspection, Inc., Procedure for Certifying Ultrasonic Test Personnel CUTP-1, Revision 2, October 1975.

(3) ASME Boiler and Pressure Vessel Code, Section XI.

3.1.2 Examination crews shall have one or more members as necessary. At least one member of each crew shall have a minimum qualification of Level II in accordance with the above-referenced documents. The remaining member(s) shall have a minimum qualification of Level II or Level I Trainee.

3.2 Personnel Records

3.2.1 Records of personnel qualification shall be maintained by Examination Contractor.

3.2.2 A copy of the Examiner's certification, and a current eye test as required by SNT-TC-1A shall be filed with each permanent examination record, with a copy submitted to the Plant Owner or his Agent, prior to performing examinations per this procedure.

4.0 PROCEDURE REQUIREMENTS

4.1 The austenitic piping weld thicknesses and configurations are shown in Figures 1, 2 and 3.

4.2 Automatic defect alarm and recording equipment is not used when performing manual UT examination in accordance with this procedure.

4.3 Search units, wedges, shoes, or saddles used in performance of examination in accordance with this procedure are outlined in paragraph 5.0 of this procedure.

4.4 Rotating, revolving scanning mechanisms are not used when performing

manual ultrasonic examination in accordance with this procedure.

4.5 Examinations performed in accordance with this procedure shall be performed on welds in their complete condition.

4.6 The piping and fittings covered by this procedure are constructed of wrought austenitic stainless steel.

4.7 The volumetric examinations shall be performed from the OD surfaces of the piping.

4.8 The surface finish and couplant used when performing examination according to this procedure are specified in paragraph 6.0.

4.9 The volumetric examinations shall be performed using ultrasonic pulse-echo techniques, with angles as follows:

(1) 45° angle beam perpendicular to the weld axis and parallel with the weld axis where possible.

(2) Other beam angles (i.e. 60°, 70°, etc) when they facilitate examination or evaluation.

4.10 The nominal examination frequencies shall be 2.25 MHz for all examinations. During preoperational examination, other pulse frequencies shall be used only if such variables as material attenuation, grain structure, etc., necessitate their use to achieve penetration or resolution. This information shall be recorded on the data sheets.

4.11 The examination shall be performed using manual search units and/or scan fixtures.

4.12 Description of calibration method and method of correlation of indications with defects are specified in paragraphs 12.0 and 14.0 of this procedure.

5.0 EQUIPMENT REQUIREMENTS

5.1 Examination Contractor's Equipment

The following test equipment or its equivalent shall be provided by the Examination Contractor for examinations specified in this procedure.

(1) Pulse-echo ultrasonic instrument (AI Model UJ, UM 775 or other)

(2) Scan Fixture, 45° (No. 85C134, 57A8407, or other)

(3) Scan Fixture, 60° (No. 85C155, 57A8417, or other)

(4) Scan Fixture, 70° (No. 57A8408, or other)

(5) Search Units, 1/2" x 1", 2.25 MHz (No. J1225, or other)

(6) Search Units, 45°, 60° or 70° - ½" x ½", 2.25 MHz

(7) Search Unit, 45°, 60° or 70° - ¾" x ¾", 2.25 MHz

(8) Search Unit, 1/4", 3/8", or 1/2" Dia 2.25 MHz, 5 MHz, or 10 MHz Ceramic

(9) Couplant

The Plant Owner or his Agent shall provide the following service facilities and equipment as required:

(1) Scaffolding

(2) Water, Air and Electricity

(3) Temporary Lighting

(4) Crane or lifting Devices

(5) 2" Sch. 160 Reference Standard No. UT-27

(6) 3" Sch. 160 " " No. UT-28

(7) 4" Sch. 120 " " No. UT-29

(8) 6" Sch. 120 " " No. UT-41

(9) 12" Sch. 140 " " No. UT-31

(10) 14" Sch. 140 " " No. UT-32

(11) 8" Sch. 120 " " No. UT-30

(12) 8" Sch.160 " " No.UT-25

(13) 14" Sch.20 " " No. UT-46

(14) 12" Sch. 20 " " No. UT-45

(15) 10" Sch. 20 " " No. UT-44

(16) 8" Sch. 20 " " No. UT-43

(17) 6" Sch. 20 " " No. UT-42

(18) 12" Sch. 160 " " No. UT-53

(19) 18" Sch. 40, Reference Standard No. UT-26

(20) Radiation Monitoring Equipment

(21) Radiation Shielding

(22) Test Surface Preparation (cleaning and finishing)

(23) Drawings of each Examination Area

(24) Post Examination Cleanup of Test Area

6.0 SURFACE PREPARATION AND COUPLANT

6.1 Surface Preparation

6.1.1 All examination surfaces should be clean and free of dirt, weld spatter, etc., or any other condition which would interfere with the examination or impair proper transmission of the sound beam.

6.1.2 Irregularity of surface contour to be contacted by the search unit should not exceed 1/8" in any 2" of surface travel. Weld crown and edges should blend smoothly into adjacent base material.

6.2 Liquid Couplant

6.2.1 The ultrasonic couplant shall be Trim Regular, Trim HD (Master Chemical Corporation, Perrysburg, Ohio), or any other couplant whose chemistry has been approved.

6.2.2 The couplant shall be supplied in clean polyethylene containers of sufficient quantity to facilitate the examination.

6.2.3 The couplant shall be pumped from the container to the search unit scan fixtures through clear tygon flexible tubing or shall be applied manually with a brush or other suitable device.

6.2.4 Where required, the Examiner shall be responsible for removing couplant from the examination surface at the conclusion of the examination.

7.0 WELD IDENTIFICATION, INCLUDING DATUM POINT

7.1 Weld Identification

Each weld shall be located and identified per the appropriate maps, located in the Program Plan Book.

7.2 Datum Point

7.2.1 The Examiner shall permanently mark, or verify, that there has been marked, a reference datum point on each weld from which all

examination data and reported indications shall be referenced.

7.2.2 Datum points shall be marked by the use of low stress stamps or vibratooling and shall not be deeper the 1/64" when added specifically for Inservice Inspection.

7.2.3 The datum point marked specifically for Inservice Inspection for all pipe welds in horizontal lines shall be located on the top of the pipe at weld centerline.

7.2.4 The datum point for all pipe welds in vertical lines shall be at the most visible portion of the pipe at weld centerline.

7.2.5 Each weld datum point along with respective weld reference points and divisions shall be shown on each examination report when a reportable indication is recorded.

8.0 EXAMINATION COVERAGE

8.1 The intent of this procedure is to provide maximum examination coverage to insure weld integrity. Each weld shall be scanned with minimum 25% overlap of the transducer width (diameter) for each scan pass. The scan rate shall not exceed 6" per second.

8.2 Each weld shall be ultrasonically examined where part geometry and access permit using angle beam techniques applied in two directions toward and two directions parallel with the weld. One direction toward and one direction parallel is permissable using full vee techniques on flush ground welds.

8.3 Where the examination surface or other conditions (weld, contour, access, etc.) do not permit a meaningful ultrasonic examination to be performed, the Examiner shall record the area of non-examination and the particular interfering condition in the space provided on the Weld Scan Data Sheet.

9.0 CALIBRATION

9.1 Basic instrument calibration shall be performed using appropriate reference standards, search units and instrumentation immediately prior to the examination of the piping welds.

9.2 Instrument calibration checks shall be performed at the beginning of each day of examination in accordance with Section 11.0 of this procedure.

9.3 Examination system calibration checks shall be performed at least at the beginning and the completion of each 4-hour period of examination and/or at the change of examination personnel, equipment, search units, coupler shoes,etc., and at the completion of the examination of each similar series of welds in accordance with Section 12.2 of this procedure.

10.0 CALIBRATION PROCEDURE

10.1 Reference Standards

10.1.1 The reference standards designated in 5.2 (5 thru 19) shall be used for basic instrument calibration and establishing reference sensitivity levels for examination of the piping welds See Figures 4 and 5.

10.1.2 Spot thickness checks of the components may be made prior to preservice examinations to ensure that the proper reference standard is used.

10.1.3 The number of reference standards shall be recorded on each Calibration Data Sheet. Figure 7 is an example of the Calibration Data Sheet to be used with this procedure.

10.1.4 Calibration Data Sheets shall be numbered 154-1, 154-2, 154-3, etc., at the time of calibration and shall be signed by the Examiner(s) upon completion.

10.1.5 The temperature of the reference standard shall be within 25°F of the component temperature.

10.2 Reference Sensitivity Level

10.2.1 The reference sensitivity level shall be the distance-amplitude curve initially obtained directly from the reference standard and shall be the sensitivity level used for evaluating and recording all indications.

10.2.2 During actual weld scanning, the reference sensitivity levels shall be increased a minimum of 2X (6dB).

10.3 Calibration Response

10.3.1 Calibration response shall be checked at the primary reference sensitivity level.

10.3.2 Signal response obtained during calibration check shall be within ±20% of that established during basic system calibration.

10.3.3 If any point on the DAC curve has changed by more than 20% or 2 dB of its amplitude, the Examiner shall:

(1) Mark all weld data sheets since previous calibration void.

(2) Recalibrate examination system.

(3) Re-examine voided areas.

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10.3.4 If any point on the DAC curve has moved horizontally more than 5% of the sweep line from its original settings, the Examiner shall:

(1) Correct the sweep calibration and note it on the Calibration Data Sheet.

(2) Void any data sheets made since the previous calibration which have recorded indications and re-examine those areas.

11.0 INSTRUMENT LINEARITY VERIFICATION

11.1 Amplitude Linearity

11.1.1 The linearity of the ultrasonic instrument shall be checked as follows:

(1) Position an angle beam search unit on the reference standard so that indications from both the 1/2T and 3/4 T holes are visible (other reflectors which provide the ratio of 2:1 required in (2) may be substituted).

(2) Manipulate search unit to establish a 2:1 ratio of amplitudes between the two indications with the largest at 80% FSH.

(3) Without moving search unit, adjust sensitivity to run the higher response from approximately 100% to 20% FSH in 2 dB steps (10% if fine control available)

(4) Read and record the relative amplitudes of the two indications to the nearest 1%.

(5) If the smaller indication does not fall within 5% FSH of 50% of the larger indication, the instrument shall not be used for examinations until corrected.

11.2 Amplitude Control Linearity

11.2.1 The linearity of the instrument gain (attenuation) control shall be checked as follows:

(1) Position an angle beam search unit on the reference standard to obtain an 80% FSH indication from the 1/2T hole or other suitable reflector.

(2) Using amplitude control, decrease signal amplitude by 6 dB and by 12 dB to obtain nominal 40% FSH and 20% FSH signals. Read and record actual signal amplitudes to closest 1%.

(3) Obtain a 40% FSH indication from the reflector and increase amplitude with the amplitude control by 6 dB to obtain a nominal 80% signal. Read and record as in (2).

(4) Obtain a 20% FSH indication from the reflector and increase amplitude with the amplitude control by 12 dB to obtain a nominal 80% FSH signal. Read and record as in (2).

(5) If the indications obtained in (2), (3), and (4) are not within ± 20% of nominal, the instrument shall not be used for examination until corrected.

12.0 ANGLE BEAM CALIBRATION PROCEDURES

12.1 Full Vee Calibration

12.1.1 Full vee path calibration shall be the preferred method of examination and shall be accomplished as shown in Figure 6 and as follows:

(1) Whenever possible select a search unit of such angle and size that the root of the weld to be examined will be seen by the first 1/2 vee path. If this is not possible, the calibration must be extended to include the third half vee.

(2) Obtain maximized indications from the appropriate notches and adjust sweep settings to place the indications at convenient locations on the instrument screen.

(3) Maximize the signal from the first notch in the vee path and set its amplitude to 80% FSH.

(4) Without changing sensitivity settings, maximize successive notch indications and mark their peak amplitudes on the CRT screen, and on the Calibration Data Sheet.

(5) Draw a line connecting the peak amplitude points to form a DAC. This is the primary reference level.

(6) Record all sensitivity settings and required calibration data on the Calibration Data Sheet and sign upon completion.

(7) Repeat steps (1) through (6) for each diameter and thickness combination as required.

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12.2 1/2 Vee Calibration

12.2.1 ½ vee calibration shall be used if conditions prevent the use of full vee and shall be accomplished as shown in Figure 6 and as follows:

(1) Select a search unit of such angle and size that the root of the weld to be examined will be within the 1/2 vee path.

(2) Obtain maximized indications from side drilled holes within the ½ vee path and adjust sweep settings to place the indications at convenient locations on the instrument screen.

(3) Set the highest amplitude signal at 80% FSH and mark its amplitude and position on the CRT screen.

(4) Without changing the sensitivity mark the position and maximized signal amplitude from the other hole(s) in the ½ vee path on the CRT screen

(5) Draw a line connecting the peak amplitude points to form a DAC. Extend the line to cover the complete ½ vee path.

(6) Obtain a maximized signal from the appropriate surface notch and adjust the sensitivity to bring this amplitude to the level of the DAC. This is the primary reference level.

(7) Record all sensitivity settings and required calibration data on the Calibration Data Sheet and sign upon completion.

(8) Repeat steps (1) through (7) for each diameter and thickness combination as required.

12.3 Angle Beam Calibration Check

Angle beam calibration check as required by Section 9.3 shall be performed as follows:

(1) Adjust the sensitivity control settings to those recorded for the calibrated reference sensitivity. See Section 12.1 and 12.2.

(2) Reposition search unit at each respective calibration reflector and observe signal response amplitudes.

(3) See Section 10.3 for signal response requirements during calibration check.

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13.0 ANGLE BEAM EXAMINATION PROCEDURES

13.1 Angle Beam Examinations

13.1.1 All angle beam examinations shall be performed at a scanning sensitivity level a minimum of 2X (6dB) greater than the calibrated reference sensitivity level.

13.1.2 The search unit shall be swivelled as it is moved along the tooth scan pattern to ensure a minimum of 25% overlap of the transducer width (diameter).

13.1.3 See Table I and Figures 2 and 3 for scan path distances and sequences of weld examinations.

13.1.4 Continue scanning sequences until all welds have been examined using angles and directions shown as required. Examinations shall not be considered complete until all recordable indications have been evaluated.

14.0 EVALUATION CRITERIA

14.1 Recording of Indications

14.1.1 [illegible]cations showing a signal amplitude response equal to or greater than the reference response shall be recorded on the appropriate data sheet at the time of weld examination and prior to removing equipment from the examination area.

14.1.2 Each recorded indication shall be identified as to depth, length signal amplitude, and location relative to the weld datum point.

(1) Indications from all piping welds shall be reported in inches upstream or downstream of the weld centerline and in inches CW or CCW from the weld datum point when looking with direction of flow.

(2) Indications shall be reported in inches above or below the weld centerline from CEDM pressure housing welds and in inches CW or CCW from the weld datum point when looking down on the closure head.

14.2 Evaluation of Indications

Evaluation of all indications shall be made at the reference sensitivity and in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Summer of 1973 Addenda, IS-311. Evaluation and interpretations of indications will be made by a Level II or Level III examiner. Results of this evaluation shall be reported to the Plant Owner or his Agent in accordance with the requirements of the ASME Boiler and

Pressure Vessel Code, Section XI-IS-622 as defined in Program Plan Book.

15.0 EXAMINATION RECORDS

15.1 Certification of Records

The Examiner shall complete and sign the appropriate Weld Scan Data Sheet(s) immediately upon the completion of each weld examination.

15.2 Filing of Records

The Examiner shall be responsible for submitting to the Plant Owner, or his Agent, all documentation of an examination including the following certification of personnel qualifications with a current eye test report in accordance with SNT-TC-1A.

16.0 EXAMINER'S CRITIQUE

16.1 Procedure Corrections and Additions

All procedure corrections and/or additions required during the pre-operational and/or service examinations shall be made in accordance with Combustion Engineering Document No. 00000-NLE-056, "Program Controls Procedure for Inservice Inspection."

16.2 Critique Report

Upon completion of the examination of all piping welds, the Examiner shall submit a written report to the Plant Owner or his Agent listing pertinent information for future examinations such as procedure additions, corrections, and revisions or unique problems or actions to be taken.

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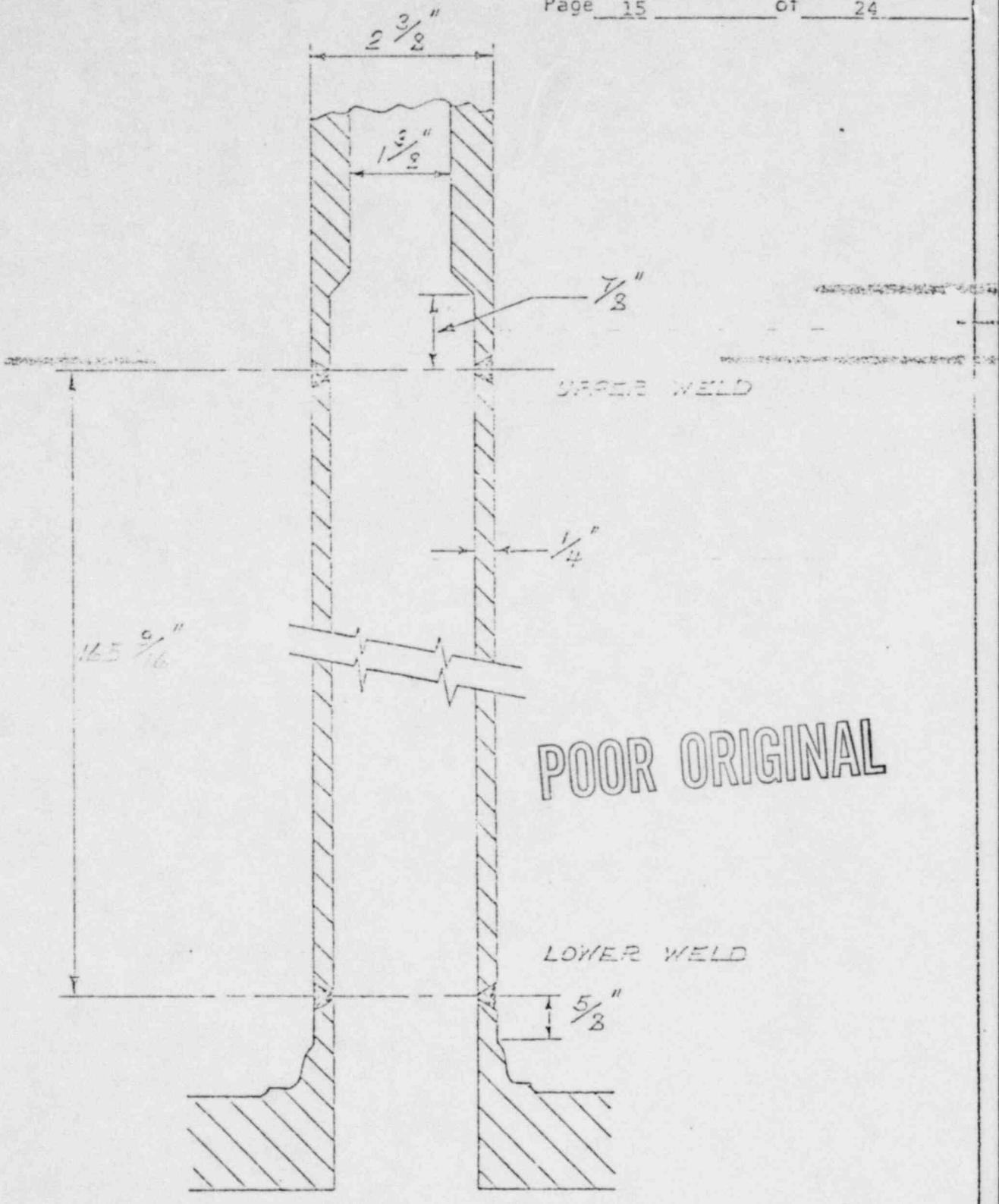
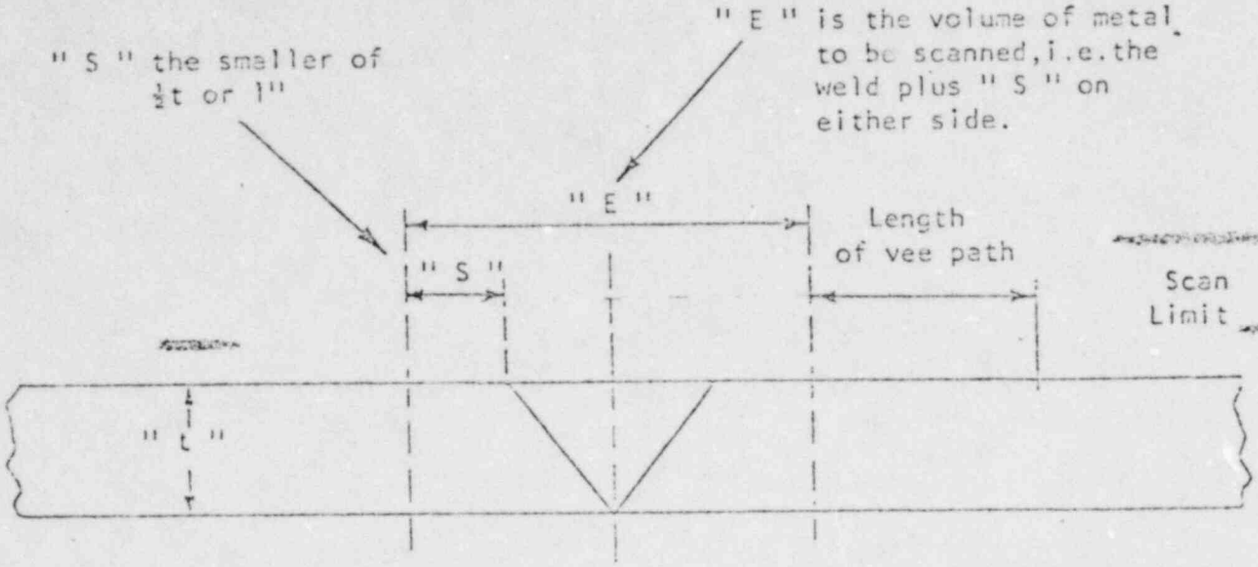


FIGURE 1. CEDM UPPER PRESSURE HOUSING ASSEMBLY (ORIENTATION ONLY)



Perpendicular scan paths should extend beyond the outer edge of " S " by the length of the vee path used.

Parallel scan paths should cover as much of " E " as possible.

NOMINAL PIPE DIA.	PIPE SCHEDULE	" t "	" S "	REF. STD.	
2"	160	.344"	.172"	UT-27	
6"	20	.25"	.125"	UT-42	
8"	20	.25"	.125"	UT-43	
10"	20	.25"	.125"	UT-44	
12"	20	.25"	.125"	UT-45	
14"	20	.312"	.156"	UT-46	

FIGURE 2. ULTRASONIC EXAMINATION OF t=3/16" thru 3/8" PIPE

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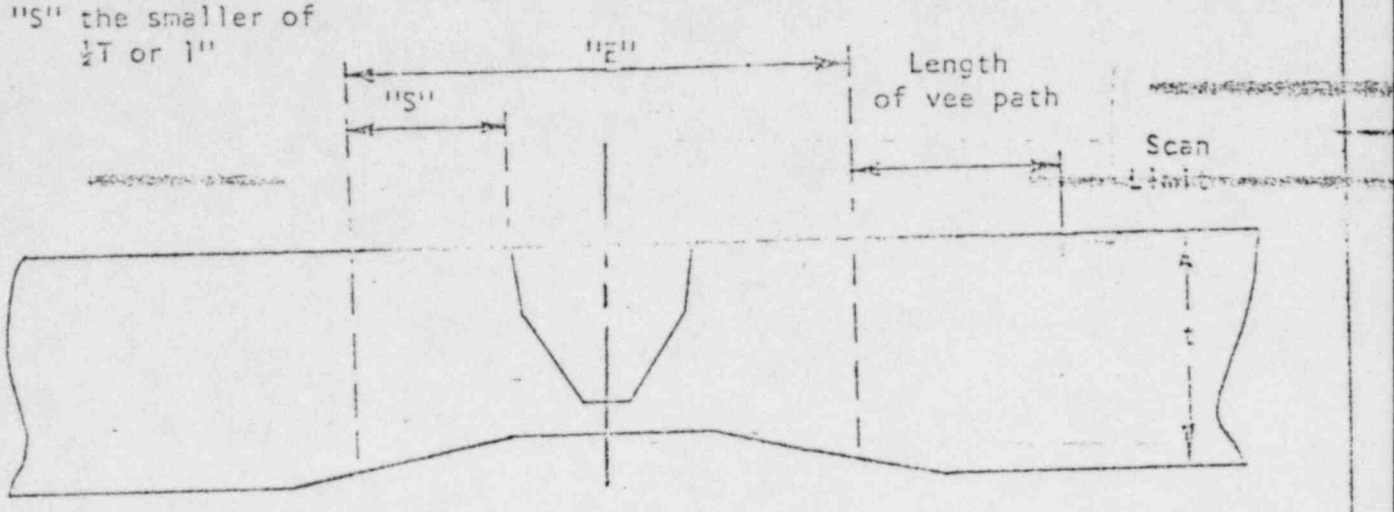
"E" is the volume of metal to be scanned, i.e. the weld plus "S" on either side.

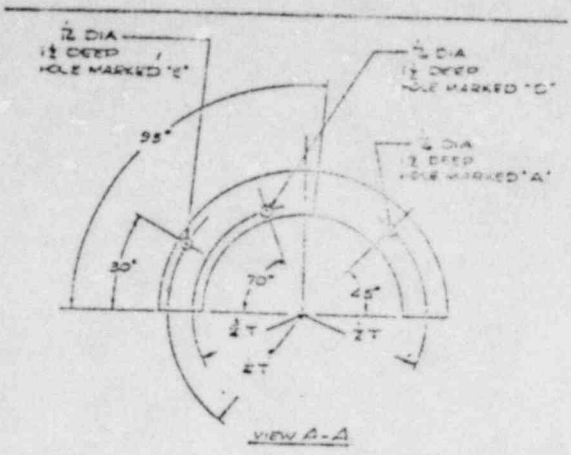


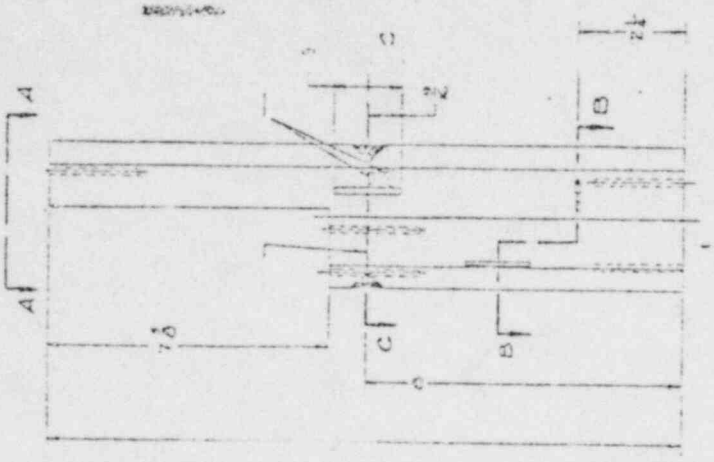
Perpindicular scan paths should extend beyond the outer edge of "S" by the length of the vee path used.

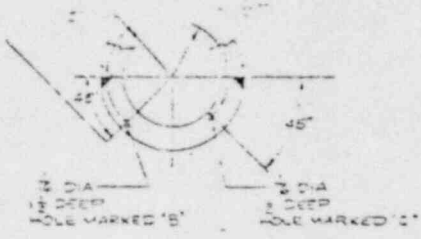
Parallel scan paths should cover as much of "E" as possible.

NOMINAL PIPE PIPE DIA.	PIPE SCHED.	t	"S"	REF. STD.	
3"	160	.438"	.219"	UT-28	
4"	120	.438"	.219"	UT-29	
6"	120	.562"	.281"	UT-41	
8"	120	.719"	.359"	UT-30	
8"	160	.906"	.453"	UT-25	(RHX)
12"	140	1.125"	.562"	UT-31	
14"	140	1.250"	.625"	UT-32	
12"	160	1.312	.656"	UT-53	(RHX)
18"	40	.562	.281"	UT-26	(L.D.HX)

FIGURE 3. ULTRASONIC EXAMINATION OF PIPE WITH WALL GREATER THAN .375"







Typical Cal. Std. Design

REF. STD. NO.	PIPE DIA.	SCHED.	WALL (t)	HOLE DIA.	HOLE DEPTH	NOTCH DEPTH	
UT- 27	2"	160	.344"	3/32"	$\frac{1}{4}T, \frac{1}{2}T, \frac{3}{4}T$	.035"	
UT- 28	3"	160	.438"	1/16"	$\frac{1}{4}T, \frac{1}{2}T, \frac{3}{4}T$	.044"	
UT- 29	4"	120	.438"	1/16"	$\frac{1}{4}T, \frac{1}{2}T, \frac{3}{4}T$	.044"	
UT- 42	6"	40S	.28"	1/16"	$\frac{1}{4}T, \frac{1}{2}T, \frac{3}{4}T$	.028"	
UT- 41	6"	120	.562"	3/32"	$\frac{1}{4}T, \frac{1}{2}T, \frac{3}{4}T$	.056	

FIGURE 4 - ULTRASONIC REF. STDS. For 6" and UNDER PIPE

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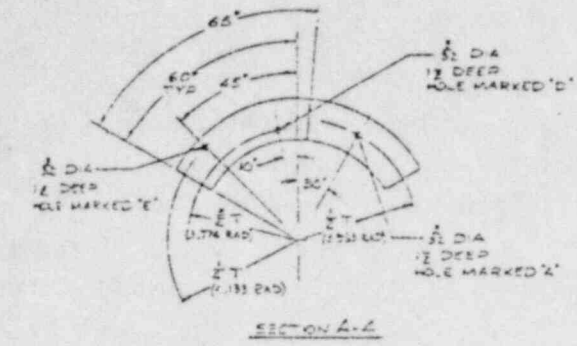

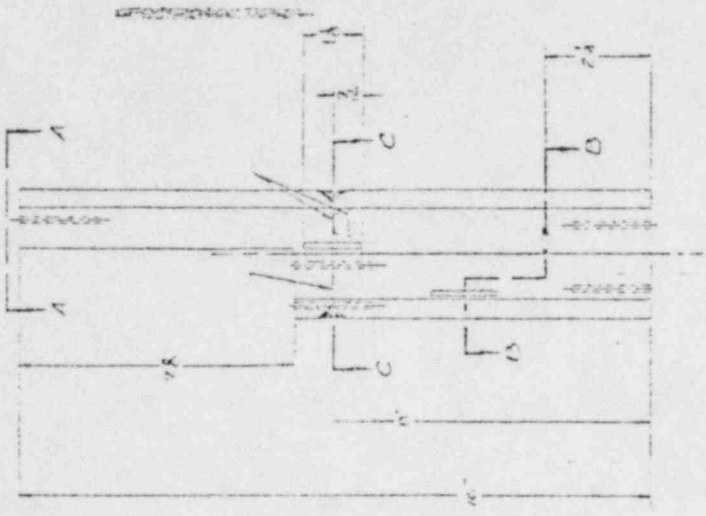

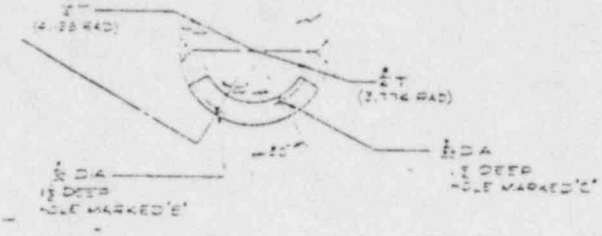

Typical Cal. Std. Design

REF. STD. NO.	PIPE DIA.	SCHED.	WALL (t)	HOLE DIA.	HOLE DEPTH	NOTC. DEPTH	
UT-43	8"	20	.25"	1/16"	¼T, ½T, 3/4T	.025	
UT-30	8"	120	.719"		¼T, ½T, 3/4T	.072	
UT-44	10"	20	.25"	1/16"	¼T, ½T, 3/4T	.025	
UT-45	12"	20	.25"	1/16"	¼T, ½T, 3/4T	.025	
UT-31	12"	140	1.125"	1/8"	¼T, ½T, 3/4T	.110	
UT-46	14"	20	.312"	1/16"	¼T, ½T, 3/4T	.032	
UT-32	14"	140	1.250"	1/8"	¼T, ½T, 3/4T	.110	
UT-26	18"	40	.562"	3/32"	¼T, ½T, 3/4T	.056	
UT-53	12"	160	1.312"	1/8"	¼T, ½T, 3/4T	.131	
UT-25	8"	160	.906"	3/32"	¼T, ½T, 3/4T	.090	

FIGURE 5 - ULTRASONIC REF. STDS. for 8" and OVER PIPE

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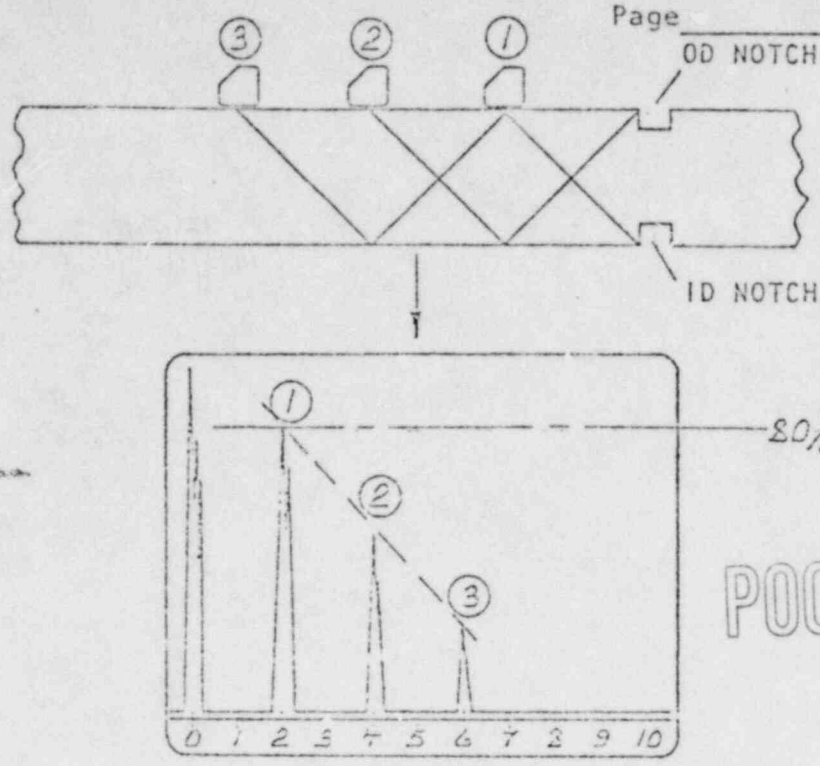
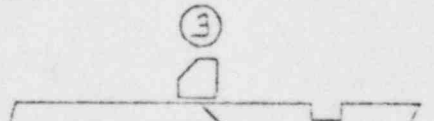
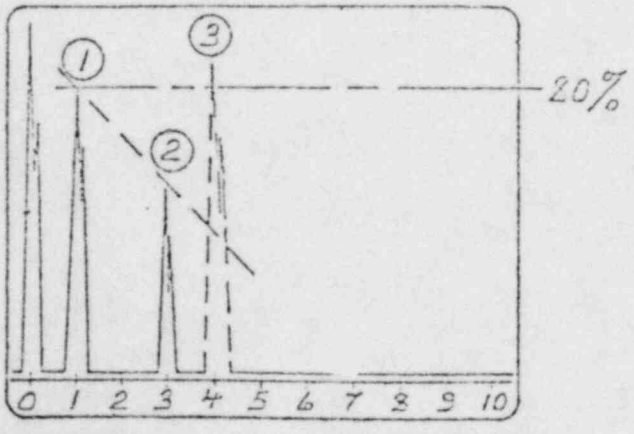
I. FULL VEE PATH CALIBRATION
ILLUSTRATIVE EXAMPLE

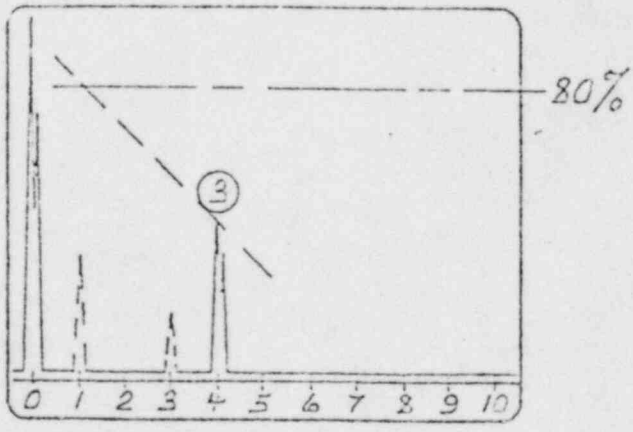


II. 1/2 VEE PATH CALIBRATION - ILLUSTRATIVE EXAMPLE





INITIAL SET-UP OF HOLES AND NOTCH



FINAL SENSITIVITY ADJUSTMENT FROM NOTCH

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FIGURE 6 - ULTRASONIC EXAMINATION OF PIPING - CALIBRATION TECHNIQUES.

CALIBRATION DATA SHEET NO. ____
MANUAL EXAMINATION

EXAMINATION AREA _____

TRANSDUCER IDENTIFICATION

STYLE OR TYPE NO. _____
SIZE _____
FREQUENCY _____
SERIAL NO. _____
ANGLE & MODE _____
BEAM DIRECTION (= or ⊥ to weld) _____
SCAN FIXTURE _____
CABLE LENGTH & TYPE _____

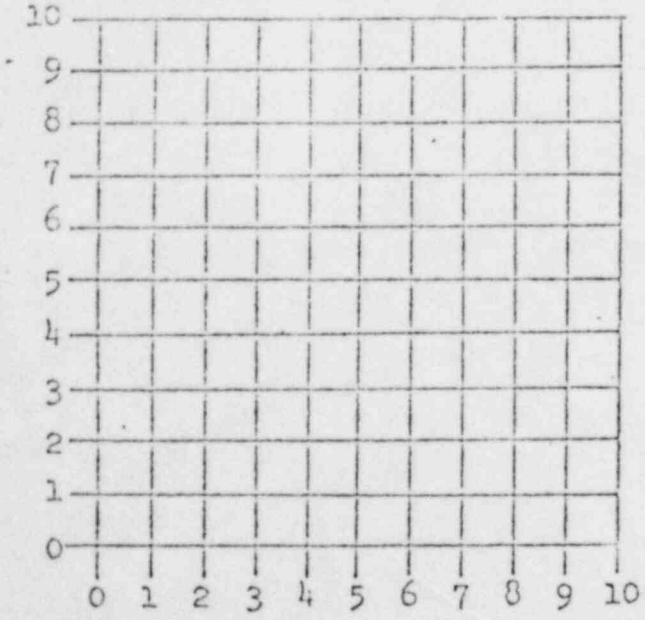
CALIBRATION BLOCK

ID NO. _____
SIZE _____
EXAMINATION SURFACE _____

Reflector	Depth In.	Amp. %	Atten. dB

TEMPERATURE = Ref. Std. _____
Component _____

DAC PLOT



ULTRASONIC INSTRUMENT

MODEL NO. _____
SERIAL NO. _____

CONTROL SETTINGS

PULSE LENGTH _____
FREQUENCY _____
dB GAIN _____
SWEEP LENGTH _____
SWEEP DELAY _____
VIDEO FILTER _____
REJECT _____
COUPLANT _____

INSTRUMENT LINEARITY CALIBRATION

Amplitude High	Low	High	Low
1.		5.	
2.		6.	
3.		7.	
4.		8.	

AMPLITUDE CONTROL LINEARITY

Initial	Δ dB	Result	Limit
80	-6		32% - 48%
80	-12		16% - 24%
40	+6		64% - 96%
20	+12		64% - 96%

EXAMINER(S) (Signature Required)

1. _____ SNT-TC-1A Level
2. _____ SNT-TC-1A Level

DATE: _____ TIME: _____

FIGURE 7

Reviewed by: _____

WELD SCAN DATA SHEET

Procedure No.: NIP 154
Subject: AUSTENITIC PIPE
Issue Date: 6-18-76
Revision No.: 3 Date: 10/28/77
Page 22 of 24

1. Calibration Data Sheet No. _____
2. Examination Angle _____
3. Area of Examination _____
4. Examination Surface _____
5. Initial Calibration Time _____

Weld, Item or Part No.	Scan Completion				No Reportable Indications	Reportable Indications	Supplement Attached	Comments: Reason for Incompleted Scans
	0° Base Metal	0° WHAT	Normal to Weld Centerline	Parallel to Weld Centerline				

POOR ORIGINAL

Calibration Checks

Instrument		Examination System	
Time	Date	Time	Date

Additional Sheets Attached:
Continuation _____ Supplements _____

Examiner(s):
1. _____ SNT-TC-1A Level _____
2. _____ SNT-TC-1A Level _____
Date: _____

FIGURE 8

NUCLEAR ENERGY SERVICES, INC.

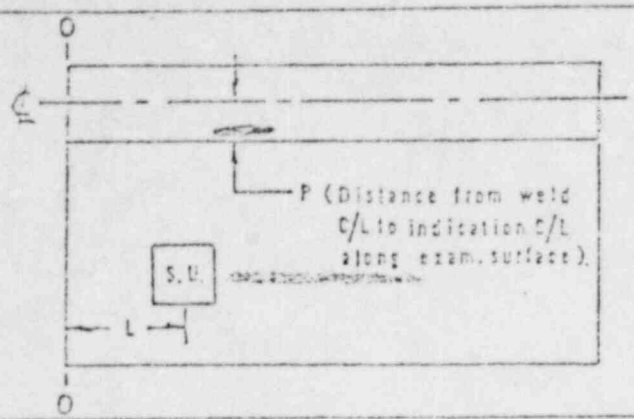
WELD SCAN DATA SHEET

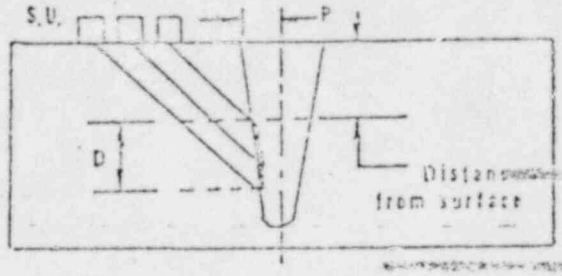
SUPPLEMENT B

Procedure No.: NIP 154
Subject: AUSTENITIC PIPE
Issue Date: 6-18-76
Revision No.: 3 Date: 10/28/77
Page 23 of 24

Weld No. _____ Sheet _____ of _____

Calibration Data Sheet No. _____ EXAM. ANGLE _____





Note: Location increments are not to exceed allowable scan increments.

Ind. No.	BEAM DIR.	L Location	Max % DAC	Dist. From Surface	P	Ref. Forward Dist. From Surface	P	Ref. Back Dist. From Surface	P	Depth (D) Inches	% T

COMMENTS:

Examiner(s):

1. _____ SNT-TC-1A Level _____

2. _____ SNT-TC-1A Level _____

Date: _____

NUCLEAR ENERGY SERVICES, INC.

TABLE I

WELD IDENTIFICATION

NUCLEAR COMPONENTS

Weld No.	Description	Ref. Block	Reference Figures	Notes
GENERAL NOTE:				
	WELDS SPECIFIED IN THIS PROCEDURE MAY BE LOCATED AND IDENTIFIED BY REFERENCE TO THE PROGRAM PLAN BOOK, ZONES			

ATTACHMENT B2-2

VISUAL EXAMINATION PROCEDURE

FOR

INSERVICE INSPECTION

Prepared By: Irwin Gerstein Date: 10/20/75
I. I. Gerstein

Approval: Date: 10/20/75
SNT-TC-1A, Level III
Combustion Engineering, Inc.

Approval: Date: 10/28/75
SNT-TC-1A, Level III
Automation Industries, Inc.

RECORD OF REVISIONS

Revision Number	Date	Description	Reason	Originator	Approvals C-E	

INDEX

VISUAL EXAMINATION PROCEDURE

1.0 SCOPE

1.1 Intent

1.1.1 This procedure shall be followed whenever visual examination of nuclear reactor systems or components is to be performed as required by ASME Boiler and Pressure Vessel Code, Section XI, Inservice Inspection of Nuclear Reactor Coolant Systems, 1971 Edition to and including Summer 1973 Addenda, or as required for Class 3 systems. Later Edition of Section XI. Examinations may be performed with the naked eye or may include visual aids such as telescopes, borescopes, periscopes, fiber optics or T.V. cameras. This procedure does not include those visual methods which are aided by magnetic particle or liquid penetrant means since these are considered surface examinations under the provisions of Section XI.

1.2 Types of Examination

1.2.1 This document shall apply to the following types of visual examinations:

1.2.1.1 Weld Visual Examination

1.2.1.2 Support Member Visual Examination

1.2.1.3 Valve Visual Examination

1.2.1.4 Pump Visual Examination

1.2.1.5 Fastener Visual Examination

1.2.1.6 Cladding Visual Examination

1.2.1.7 Visual Examination During Hydrotest

1.3 Time of Examination

1.3.1 This procedure shall govern preoperational (baseline) examinations, inservice examinations and examinations after repairs of piping systems and components as required by the ASME Boiler and Pressure Vessel Code, Section XI.

2.0 REFERENCES

2.1 Reference Documents

2.1.1 The following documents form a part of this examination procedure:

(1) ASME Boiler and Pressure Vessel Code, Section XI, 1971 Edition to and including Summer 1973 Addenda and 1974 Edition.

(2) Procedure CVIP-1 for Certifying Visual Weld Inspection Personnel, Revision 2, November 30, 1973; and CVEP-PSIS, Procedure for Certifying Visual Examination Personnel for Preservice/Inservice Examinations, Revision 0, January 1, 1973.

(3) Procedure No. 00000-NLE-040, Standard Operating Procedure for Certifying Visual Examination Personnel for Preservice/Inservice Examinations, Revision 2, dated December 6, 1974.

3.0 PROCEDURE CERTIFICATION

3.1 The examination procedures described in this document comply with Section XI of the ASME Boiler and Pressure Vessel Code, 1971 Edition and 1974 Edition.

4.0 PERSONNEL CERTIFICATION

4.1 Personnel Certification Requirements

4.1.1 Each person performing visual examinations governed by this procedure shall be certified as qualified in accordance with Procedure Nos. CVIP-1, and CVEP-PSIS, or 00000-NLE-040.

4.1.2 Each person performing examinations shall have a minimum qualification Level II in accordance with the requirements of CVIP-1, and CVEP-PSIS, or 00000-NLE-040.

4.2 Personnel Records

4.2.1 Records of personnel qualification shall be maintained by the Examination Contractor.

4.2.2 A copy of each examiner's certification and a current eye test shall be filed with the permanent examination record, with a copy to the Plant Owner, or his agent, prior to performing examinations as per this procedure.

5.0 EXAMINATION REQUIREMENTS

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5.1 Surface Preparation

5.1.1 Visual examinations which require clean surfaces for valid interpretation of results shall be cleaned using demineralized water or acetone and clean lint-free rags or other method approved by the Plant Owner or his agent.

5.2 Examination Area Identification

5.2.1 Each examination area shall be located or identified on the appropriate weld map, isometric or system boundary diagram.

5.3 Examination Coverage

5.3.1 The intent of this procedure is to provide maximum examination coverage of Class 1 and Class 2 systems in areas identified in Tables IS-251 and ISC-251 of Section XI of the ASME Boiler and Pressure Vessel Code and Class 3 systems as described in Subsection IWD of the 1974 Edition of Section XI.

6.0 EQUIPMENT REQUIREMENTS

6.1 Examination Contractor's Equipment

6.1.1 The following test equipment or its equivalent may be required due to lack of access or personnel hazards and shall be provided and/or operated by the Examination Contractor for examinations:

(1) Borescope

(2) Fiber Optics Device

(3) Closed-Circuit Television System

(4) Telescope

(5) Low-Power Magnifying Lens

(6) Microscope

(7) Mirror

(8) Portable Light Source(s)

(9) Camera

6.1.2 A light source shall be used and shall be sufficient to obtain good definition and contrast at the surface of the object being examined. Color of the light source may be white (incandescent) or any other which will produce the desire definition and contrast. In all cases, light position, direction and distance shall be adjusted to the best angle for viewing the component being examined. Where feasible, it shall be moved

to various positions during the examination so that the light will fall on the component from a number of directions to improve the interpretation of conditions which may be present. In addition, the level of illumination shall be adjusted by changing the distance or the intensity so that the best visual contrast is obtained.

6.1.3 Resolution shall be tested by placing an 18 percent neutral gray color card or plate containing a black line 1/32 inch in width in the area to be examined or a replica of that area. Resolution is considered adequate if this line can be resolved from this background. Where remote equipment is used, similar resolution tests shall apply.

6.2 Plant Owner's Equipment

6.2.1 The plant owner or his agent shall provide the following service facilities and equipment as required:

(1) Scaffolding -- temporary or permanent

(2) Water, air and electricity (110 volts, 50-60 Hz)

(3) Temporary lighting

(4) Crane or lifting devices

(5) Radiation monitoring equipment

(6) Radiation shielding

(7) Anti-contamination clothing

(8) Personnel decontamination facilities

(9) Test surface preparation

(10) Post-examination cleanup of test area

(11) Decontamination of the test area where required

7.0 EXAMINATION PROCEDURES

7.1 General Requirements

7.1.1 Direct visual examination may be performed when access is sufficient to place the eye within 24 inches of the surface

to be examined and at an angle no less than 30 degrees with the surface to be examined. Mirrors may be used to improve the angle of vision.

7.1.2 The visual examination is employed to provide a report on the general condition of the part, component or surface to be examined, including but not limited to such conditions as scratches, wear, cracks, structural distress, corrosion or erosion on the surfaces or misalignment or movement of the part or component or evidence of leakage.

7.1.3 Remote visual examination may be substituted for direct visual examination in areas where access is restricted. Remote visual examination may include visual aids such as but not limited to telescopes, periscopes, borescopes, fiber optics or T.V. cameras and monitoring systems with or without attachments for permanent recording.

7.1.4 Indications found shall be noted on the appropriate examination data sheet.

7.2 Weld Visual Examination

7.2.1 Ensure that the examination surface is clean enough to allow examination of the weld.

7.2.2 Examine the weld surface for evidence of leakage, cracks and other symptoms of structural distress.

7.2.3 Report findings on the Visual Examination Data Sheet.

7.3 Support Member Visual Examination

7.3.1 This section defines the requirements for visual examination of nuclear reactor piping system support members. The purpose of the examination is to provide a check that operation of the system has not damaged, misaligned or otherwise adversely affected the support member. The Plant Owner or his agent shall remove insulation as necessary to facilitate examination.

7.3.2 Observe the condition of the insulation around the hanger for evidence of distress or dented or abraided insulation due to extraordinary movment of the pipe relative to the hanger.

7.3.3 Observe and record the hanger setting (if of that type) and note any abnormal condition. This includes constant and variable spring-type hangers, snubbers and shock absorbers.

7.3.4 Observe all bolting and pinned connections for missing or bent parts or other damaged conditions.

7.3.5 Observe support weldments for cracks, misalignment or other evidence of distress.

7.3.6 On uninsulated piping, observe and report wear, rubbing and/or scratch marks which might indicate relative motion.

7.3.7 Report all findings on the Support Member Data Sheet.

7.4 Valve Visual Examination

7.4.1 The purpose of this section is to provide the examiner with necessary guidelines to visually examine the various valves included within the system boundary in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI. Provisions for valve internal inspection have been included if the Plant Owner or his agent deems it necessary to disassemble the valve. The Plant Owner or his agent shall remove insulation as necessary to facilitate examination.

7.4.2 External Examination

(1) Observe the condition of the valve insulation prior to removal for evidence of distress caused by leakage. Leakage will be indicated by a white residue in the area. Dented insulation or abrasion will indicate that the valve in the hot condition might be touching stationary objects.

(2) Examine the service connections to the valve operator (if applicable) for signs of distress.

(3) Examine the exposed portion of the valve stem (if applicable) for evidence of galling.

(4) Examine the valve packing gland (if applicable) and note any deficiencies.

7.4.3 Internal Examination

The following parts should be examined for mechanical damage such as galling and breakage: (not all the following parts are applicable to all valves)

(1) Stem

(2) Disc

(3) Seat

(4) Packing

(5) Internal pilot valve

(6) Rings

(7) Stem-to-disc connection

The following areas should be examined for evidence of metallurgical damage such as erosion and cracking:

(1) Valve bowl

(2) Seat

(3) Disc

(4) Stem

Report findings on the Visual Examination Data Sheet.

7.5 Pump Visual Examination

7.5.1 The purpose of this procedure is to provide the examiner with the necessary guidelines to visually examine the pumps to assure the owner-operator that no damage has occurred which can be considered detrimental to the pump's function. Provisions for pump internal inspection have been included if the plant owner or his agent deem it necessary to disassemble the pump. The plant owner or his agent shall remove insulation as necessary to facilitate examination.

7.5.2 External Examination

(1) Examine the external surfaces of the pump, motor and insulation for evidence of leakage (white residue), external damage and loose or broken service connections.

(2) Report observations on the Visual Examination Data Sheet.

7.5.3 Internal Examination

(1) Examine the pump bowl for evidence of erosion, cracking, galling (caused by close clearance between rotating or reciprocating and stationary parts), mechanical damage, or other abnormal conditions.

(2) Examine the pump impeller or piston for erosion, cracking, galling or other abnormal conditions.

(3) Record observations on the Visual Examination Data Sheet.

7.6 Fastener Visual Examination

7.6.1 Examine all surfaces, especially the thread root area (if applicable), for evidence of cracking, galling, mechanical damage or other abnormal conditions.

7.6.2 Record observations on the Visual Examination Data Sheet.

7.7 Cladding Visual Examination

7.7.1 Examine the clad surface for evidence of cracking, mechanical damage or other abnormal conditions.

7.7.2 Record observations on the Visual Examination Data Sheet.

7.8 Visual Examination During Hydrotest

7.8.1 This examination shall be performed at that time when the system boundary is subjected to a hydrostatic test prior to each plant startup following a refueling outage or at or near the end of each inspection interval. For Class 1 systems, the system shall be at test pressure for a minimum of four (4) hours prior to examination. For Class 2 and Class 3 systems, no waiting time is required.

7.8.2 The external surfaces of all accessible areas of the components and piping within the reactor coolant pressure boundary shall be directly or remotely examined for evidence of uncontrolled coolant leakage from the system. The examination may be conducted without the removal of insulation when the external surfaces of the insulation joints are accessible for visual examination.

7.8.3 The examination, which may be conducted without the removal of insulation, shall be performed by inspecting (1) the exposed surfaces of and joints in component insulation to locate evidence of reactor coolant leakage and (2) the floor areas (or equipment) directly underneath components for evidence of accumulated leakage which might drip from components.

7.8.3.1 When evidence of leakage is found, then the following steps shall be taken:

(a) The specific location of the leak shall be determined by the removal of any insulation which interferes with the determination of the leakage

(b) The leakage source, when determined, shall be identified and its specific location defined by:

(1) marking the area on the leaking component, using a suitable marking device, and/or

(2) documenting its location on the data sheet using supplementary sketches, if necessary, by measured distances from convienent, adjacent reference locations such as welds, components, etc.

7.8.4 Examination of insulation joints along vertical surfaces of vessel walls and piping need not be performed provided the lowest terminal ends of vertical surfaces are examined, and the insulation design is such that any leakages originating along the vertical surfaces can accumulate and leak from the insulation joint at the lowest elevation.

7.8.5 Examination of insulation joints along horizontal surfaces of components shall be conducted at each insulation joint except where accessibility is limited by structural members or other components. In the latter cases, either the insulation shall be removed to permit component examination, or provisions shall be included to channel potential leakages to areas accessible for examination.

7.8.6 At locations where reactor coolant leakages are normally expected and collected (e.g., valve stem, pump seals), the examination shall verify that the leakage collection system is operative.

7.8.7 During the examination, particular attention shall be given to the insulated areas of components constructed of ferritic steels to detect evidence of boric acid residues whose source derives from borated reactor coolant, and which might have accumulated during the service period preceding the inspection.

7.8.8 Record all instances when evidence of leakage is found on the Hydrotest Examination Data Sheet.

8.0 EVALUATION CRITERIA

8.1 Recording of Indications

8.1.1 All visible indications shall be reported and detailed on the appropriate data sheet (see Appendix of Forms) and shall contain the following information:

(1) Date of examination

(2) Identification and signature of examiner

(3) Identification of item examined

(4) Examination results

(5) Special equipment used

(6) Photographs may be used to assist in evaluation

(7) The location of indications shall be described with respect to a convenient datum point on the object being examined.

(8) Other information as required

8.2 Evaluation of Indications

8.2.1 All indications shall be evaluated in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI.

8.2.2 Results of this evaluation shall be reported to the Plant Owner or his agent in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, as defined in the Program Plan Book.

9.0 EXAMINATION RECORDS

9.1 Certification of Records

9.1.1 The examiner shall complete and sign the appropriate data sheet(s) immediately upon completion of each examination.

9.2 Filing of Records

9.2.1 The examiner shall be responsible for submitting to the Plant Owner or his agent a complete set of examination records including certification of personnel qualifications with current eye test in accordance with Section 4.2.2.

9.2.2 Permanent records shall be maintained by the owner-operator for the life of the component.

10.0 EXAMINER'S CRITIQUE

10.1 Procedure Corrections and Additions

10.1.1 All procedure corrections and/or additions required during the preoperational inservice and/or repair examinations shall be made in accordance with Combustion Engineering Document 00000-NLE-056, Revision 1, "Program Controls Procedure for Inservice Inspection."

10.2 Critique Report

10.2.1 Upon completion of the examination of all items, the examiner shall submit a written report to the Plant Owner, or his agent, listing pertinent information for future examinations such as procedure additions, corrections and revisions or unique problems or action to be taken.

11.0 APPENDIX OF FORMS

11.1 Form 1 -- Visual Examination Data Sheet

11.2 Form 2 -- Support Member Examination Data Sheet

11.3 Form 3 -- Hydro test Examination Data Sheet

VISUAL EXAMINATION DATA SHEET

Plant Name: _____
Identification of Item Examined: _____
Examiner's Name: _____
Examiner's Qualification-Level: _____

Photograph Identification:
Roll # _____ Frame # _____
Inspector's Signature: _____
Signature: _____
Date: _____

Finding	Yes	No	N/A	Location and Other Information (Additional Comments on Reverse Side)
Cracks				
Evidence of Leakage				
Symptoms of Structural Distress				
Dented or Abrased Insulation				
Valve o Pump Service Connections				
Valve Stem				
Valve Packing Gland				
Galling				
Breakage				
Disc				
Seat				
Packing				
Internal Pilot Valve				
Rings				
Stem to Disc Connection				

VISUAL EXAMINATION DATA SHEET

Plant Name: _____
Identification of Item Examined: _____
Examiner's Name: _____
Examiner's Qualification Level: _____

Photograph Identification:
Roll # _____ Frame # _____
Inspector's Signature: _____
Signature: _____
Date: _____

Finding	Yes	No	N/A	Location and Other Information (Additional Comments on Reverse Side)
Valve or Pump Bowl				
Piston or Impeller				
Erosion				
Thread Root Area				
Scratches				
Pits				
Gouges				
Grind Marks				
Arc Strikes				
Wear				
Misalignment				
Movement				
Corrosion				
Other				

Attachment C2

EXAMINATION PROCEDURES

The Arkansas Power and Light, Arkansas Nuclear One, Unit No. 2 Preoperational Inspection Program is based upon meeting the requirements of Section XI of the ASME Boiler and Pressure Vessel Code, 1971 Edition through the Summer of 1973 Addenda, to the maximum extent possible. Class 1 and 2 piping examinations were conducted to meet 1975 Winter Addenda Appendix III requirements. Item IS-231 of the Code requires the preparation of written procedures necessary for the performance of the nondestructive examinations associated with the program. Accordingly, written procedures have been prepared. The procedures have been approved by the customer (AP&L), the inservice inspection contractor (C-E/Aii), and the inspection agency (Factory Mutual).

Volumetric examinations are performed using ultrasonic methods, although some examinations may utilize radiographic techniques. The procedures prepared for these examinations were written to comply with the 1971 Edition of Section XI requirements. However, since the issuance of this edition, significant advancements in the start-of-the-art of ultrasonic examination have been achieved. ASME recognized the value of these advancements in the Summer 1973 Addenda to Section XI, which incorporated many improvements for the examination of Category A components.

In keeping with Arkansas Power and Light's desire to perform the best examination possible by employing the most current accepted techniques, the ultrasonic procedures include as many of the requirements of the Summer 1973 Addenda to Section XI as practicable. The most notable areas are:

1. Use of Code acceptable calibration standards
2. Use of 0°, 45° and 60° ultrasonic transducers
3. Increased direction of angle beam testing
4. Increased volume of metal to be examined
5. Increased calibration requirements
6. Increased frequency of recalibration
7. Controlled scan speed and transducer overlap of successive scans

While the Summer of 1973 Addenda is specific to Category A components, the requirements and intent of the Code have been included in the procedures for the remainder of the Class 1 components. Recent Code activity has proven this to be a valid assumption.

All procedures will be retained by Arkansas Power and Light for use on subsequent inservice examinations. Revisions to any procedure deemed necessary due to experience gained by utilization or Code changes, will be made and recorded using acceptable quality assurance practices.