Procedure No.	Procedure Title	Revision/ Field Change N	o. Date	
		reru onange n	o. Date	
C-ADMIN-100	Management Interface for Waterford #3 PSI	Rev. 0	12/27/82	
C-ADMIN-101	Field Document Control	Rev. 0	1/20/82	
		F.C. 1	1/28/82	
		F.C. 2	2/19/82	
		Rev. 1	3/01/83	
C-ADMIN-102	Notification of Reportable Indications for Waterford #3	Rev. 0	1/20/82	20
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		Rev. 1	3/01/83	- 클 :
VC-QA-101	Site Quality Assurance for Waterford #3 Preservice Inspection	Rev. 0	1/20/82	Kichmond
	이 같은 것 같은 것 같은 것 같은 것도 것 같은 것 같은 것 같은 것 같	.F.C. 1	5/05/82	
		Rev. 1	3/01/83	
VC-QA-102	Procedural Noncomformance	Rev. 0	1/20/82	\$
		F.C. 1	1/28/82	1
		Rev. 1	3/01/83	
VC-QA-103	Generation and Control of Procedures for Waterford #3 PSI	Rev. 0	1/20/82	
	한 것 같은 것은 것 같은 것 같은 것 같은 것이 같은 것 같은 것 같은	F.C. 1	1/28/82	
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		Rev. 1	3/01/83	
ISI-1.1	System Verification and Marking for Waterford #3 PSI	Rev. 0	1/20/82	
		F.C. 1	7/01/82	
		F.C. 2	10/21/82	
		Rev. 1	3/01/83	Page 1
ISI-1.2	Preservice Inspection Documentation	Rev. 0	1/27/82	Page
		F.C. 1	1/28/82	0
		F.C. 2	8/10/82	
		F.C. 3	9/15/82	Of
		Rev. 1	3/01/83	
ISI-2.1	Ultrasonic Equipment Calibration Confirmation	Rev. 0	2/10/82	ļω
		F.C. 1	12/15/82	
		Rev. 1	3/01/83	
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Procedure No.	Procedure Title	Revision/ Field Change No.	Date	
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ISI-2.2	Manual Ultrasonic Examination of Full Penetration	Rev. 0	2/10/82	
	Circumferential and Longitudinal Ferritic Butt Welds	F.C. 1	4/01/82	1 7
	Gifedinterentiat and hongreadinar vertitie batt nords	F.C. 2	7/06/82	
		Rev. 1	3/01/83	wije v
cr. 2. 2	Manual Ultrasonic Examination of Circumferential and	Rev. 0	2/10/82	
SI-2.3	Longitudinal Butt Welds in Clad Ferritic Vessels and	F.C. 1	4/01/82	24
	Class 1 Loop Piping			1 2 2
	orado i noop i iping	F.C. 2	5/11/82	77
		Rev. 1	3/01/83	of Richmond
ISI-2.4	Ultrasonic Examination of Studs and Bolts	Rev. 0	2/10/82	106
		F.C. 1	8/05/82	1 3 2
		F.C. 2	12/16/82	
		Rev. 1	3/01/83	
ISI-2.5	Ultrasonic Thickness Measurement	"ev. 0	2/10/82	
		F.C. 1	16/14/82	
		Rev. 1	3/01/83	
ISI-2.6	Manual Ultrasonic Examination of Steam Generator Stay	Rev. 0	5/26/82	
151-2.0	Cylinder Welds	Rev. 1	7/15/82	
	Cylinder welds	Rev. 1 Rev. 2	8/23/82	
		F.C. 1 Rev. 3	10/18/82	1. 1. 1.
		Rev. 5	3/01/83	
ISI-2.7	Manual Ultrasonic Examination of Full Penetration	Rev. 0	2/10/82	
	Circumferential and Longitudinal Austenitic Butt Welds	F.C. 1	3/08/82	X
		F.C. 2	4/01/82	S
		F.C. 3	6/16/82	P
		F.C. 4	10/14/82	Page
		Rev. 1	3/01/83	e 2
ISI-2.8	Manual Ultrasonic Examination of Circumferential Butt	Rev. 0	2/15/82	MASTER LIST OF Page <u>2</u> of
	Welds Between Clad Ferritic Piping and Austenitic Safe Ends		4/29/82	w
	and the second second and manufactory party made	F.C. 1	6/18/82	PR
		F.C. 2	7/14/82	00
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rocedure No.	Procedure Title	Revision/ Field Change No	Date
SI-3.1	Liquid Penetrant Examination Using the Color-Contrast	Rev. 0	1/08/82
	Solvent Removable Technique	F.C. 1	1/28/82
		F.C. 2	2/04/82
		F.C. 3	7/16/82
		F.C. 4	9/13/82
		Rev. 1	3/01/83
SI-4.1	Magnetic Particle Examination of Bolting Utilizing the Dry Continuous Method	Rev. O	2/10/82
51-4.2	Magnetic Particle Examination of Bolting by Continuous Method Utilizing Wet, Fluorescent Medium	Rev. O	2/10/82
\$1-4.3	Magnetic Particle Examination of Welds Utilizing the Dry,	Rev. 0	2/10/82
	Continuous Method	F.C. 1	7/16/82
		Rev. 1	3/01/83
SI 4.4	Magnetic Particle Examination of Welds by Continuous	Rev. 0	2/11/82
	Method Utilizing Wet, Fluorescent Medium	Rev. 1	4/29/82
	그는 것 같은 것 같은 것 같은 것을 위해야 한 것 귀에운 것이 지 않는 것 같이 것 같이 많이 했다.	F.C. 1	7/16/82
		Rev. 2	3/01/83
1-5.1	VT-1 Visual Examination	Rev. 0	6/25/82

MASTER LIST OF PROCEDURES

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Virginia er Richma	Corp.		(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
Procedure Title:	Management Int Waterford #3 P		EBASCO SERVICES INCORPORATED QUALITY ASSUBANCE
Procedure No.:	VC-ADMIN-100		ENGINEERING This Decument Is:
Plant Site:	Waterford No.	3	Aeviewed With Comments as Noted; Incorporate Comments, and Resubmit; Proceed With Order. Rejected; Revies and Resubmit NOTE:
Customer:	Louisiana Powe Ebasco Service	er and Light es, Inc Agent	whous of this document, with de whous comments, is for general conformance wish the applicable specifications only and in no way relieves the manufacturer or con- tractor from full responsibility for delivery of all materials, equip-
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1.0 Purpose

The purpose of this procedure is to establish administrative guidelines for Virginia Corporation of Richmond (VCR) site supervision and management to interface with Ebasco site management, Ebasco corporate management, Louisiana Power and Light, site authorized inspector, and other regulatory personnel that may become involved.

2.0 Scope

The scope of this procedure is applicable to the preservice inspection program, Waterford #3, and will encompass all administrative activities from contract signing to final report. Technically, the examination of class I and class II nuclear piping systems will be in accordance with Ebasco Services, Inc. project identification #1564-1001, ammended as per Aug. 26, 1981, joint meeting between the Nuclear Regulatory Commission, Ebasco Services, Inc., Louisiana Power and Light, and VCR. Contractually, the procedure recognizes the instructions and guidelines set forth in contract #NY-403685 between Ebasco Services, Inc. and The Virginia Corporation of Richmond.

3.0 References

- 3.1 Contract: NY-403685
- 3.2 ASME Boiler and Pressure Vessel Code, Section XI 1977, addenda through summer, 1978
- 10CFR-50 3.3
- VCR Quality Assurance Manual 3.4
- VCR Quality Assurance Procedures and NDE Procedures for 3.5 Waterford Preservice Inspection
- VCR Program Plan and Schedule 3.6

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4.0 Responsibilities

- 4.1 It will be the responsibility of the VCR site supervisor to report all contract activities to the Ebasco PSI construction coordinator. He will interface only with this individual. He will interface with Louisiana Power and Light, the authorized inspector, regulatory bodies, or other departments of Ebasco, only when requested to do so by the Ebasco PSI construction coordinator. When such requests are made, he will endeavor to assist in every manner possible to resolve any question concerning the preservice examination or necessary repairs.
- 4.2 It will be the responsibility of the site supervisor to present personnel certifications and equipment certifications to the Ebasco construction coordinator immediately upon their arrival at the job site.
- 4.3 He will make all weld report data available to the coordinator on a daily basis.
- 4.4 He will report immediately any field changes to ISI NDE procedures or Q.A. procedures to the coordinator.
- 4.5 The site supervisor will report immediately all reportable indications concerning the NDE examinations, non-conformance with any procedure, and any suspicion of minimum wall violation, to the coordinator. It will be his responsibility to resolve, or assist in resolving, any of the above as expeditiously as possible.
- 4.6 The site supervisor will report all deviations in geometry or weld identification on the initial program isometrics. He will obtain the approval of the coordinator before making permanent changes to the geometry or weld numbers. He will also obtain approval before making necessary additions or deletions to the isometrics. Once data collection has started, it will be the responsibility of the site supervisor to assure that no weld numbers are changed (refer to VCR procedure ISI 1.1).

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- 4.7 The site supervisor will assist Ebasco in all Q.A. or technical audit of his contract activities.
- 4.8 The site supervisor will refer all technical questions promptly to the Ebasco PSI construction coordinator and VCR management.
- 4.9 It will be a responsibility of the site supervisor to present his schedule of examination sufficiently in advance, and in sufficient detail, to enable the coordinator to arrange the necessary support system for an uninterrupted flow of work.
- 4.10 In all cases involving incomplete examination, it will be the responsibility of the site supervisor to supply the coordinator with a comprehensive report of existing conditions in order that a relief request may be filed through proper channels.
- 5.0 Responsibilities VCR Management
 - 5.1 It will be the responsibility of management to assure that the joint contract for preservice examination is completed in a competent, professional manner and that a final report is submitted in accordance with contract requirements. In accordance with contract obligations, management will develop NDE procedures, QA procedures, a program plan and schedule that will satisfy the governing codes and contract commitments.
 - 5.2 Management will assume the responsibility for timely site audits to assure that our commitment is being fulfilled.
 - 5.3 Management will instruct the VCR Quality Assurance Manager to conduct sufficient site audits of the program to assure that the quality of the work performed meets the intent and letter of the VCR Quality Assurance Manual and the specific Waterford QA procedures.

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5.4	Management will limit commun to the following: (1) Ebasco Technical Section (2) Ebasco Site Coordinator (3) Ebasco Contracts Section All telephone conversations if requested.	on (corporate) r (through site manag on (corporate and sit	;er) :e)
5.5	It will be the responsibilit technical questions from the advise the site supervisor a	e site with Mr. B. Ba	
5.6	Management is responsible for concerning the resolution of during the preservice inspec-	f any problem that ma ction and with Louisi	y arise
5.7	and Light or the regulatory It will be the responsibilit correspondence and invoice a forth in the contract.	ty of management to d	

•	Virginia C el Ristanues	orp.		(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
	Procedure Title:	Field Documenta	tion Control	EBASCO SERVICES INCORPORATED QUALITY ASSURANCE ENCIMPERIO
	Procedure No.:	VC-ADMIN-101		This Document is: Reviewed Without Comments Reviewed With Comments as Noted: Incorporate Comments, and
	Plant Site:	Waterford No. 3		Relected: Revise and Resubmit. NOTE: Review of this document, with or with- out comments, is for general conformance with the applicable specifications mety
	Customer: Louisiana Power and Light Ebasco Services Corporation - Agent			ent and in no was prices the manufactored or contractor from full responsibilities for delivery of all materials, mant, services and documentation a strict accordance/with the Purchase Crier. BY: An Clarkfult
	Approved for Use Virginia Corporation:	iman >	2. Dercine	DATE: 7.1.8.33
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1.0 Purpose

- 1.1 The intent of this procedure is to establish a workable system for the control of documentation pertaining to field administration of the preservice inspection, Waterford No. 3.
- 1.2 The procedure addresses document control of NDE procedures, QA procedures, administrative procedures, non-conformance reports, program plan, examination data reports, personnel certification, reportable indications, job correspondence, equipment certification, and site audits.

2.0 References

- 2.1 VCR ISI Procedures Waterford
- 2.2 VCR QA Procedures Waterford
- 2.3 VCR Admin. Procedures Waterford
- 2.4 ANSI N-45.2
- 2.5 VCR Program Plan Waterford
- 2.6 VCR QA Manual, VC-QA-100, Rev. 4, dated 12/7/81

3.0 Responsibility

- 3.1 The Virginia Corporation of Richmond (VCR) field supervisor will be responsible for the implementation of this procedure.
- 4.0 Control of NDE Procedures Documentation
 - 4.1 Procedure documentation will comprise a master file of procedures, an active file of procedures, and an inactive file of procedures.
 - 4.1A The master file will be the latest revision of all NDE procedures, with field changes attached. The master file will also include a master log of procedure revision, and a master log of field change.

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4.1B The active file will be comprised of those procedures issued to Level II examiners. The procedures will reflect latest revisions and field changes. The active file will be checked for accuracy against the master file and controlled in accordance with item 5.0 of VC-QA-103. Accuracy checks will be on a scheduled weekly basis as well as with the issuance of a new procedure, revision, or field change.

4.1C The inactive file will be comprised of procedures rendered inactive by revision. The procedures affected by field changes, and superseded by a revision, will be transferred to the inactive file with field changes attached. All procedures shall be marked or stamped "VOID" when transferred to the inactive file.

- Control of Site Quality Assurance Procedures Documentation 5.1 Procedure documentation will comprise a master file of procedures, an active file of procedures, and an inactive file.
 - 5.1A The master file will be the latest revision of all QA procedures, with field changes attached. The master file will also include a master log of procedure revision, and a master log of field changes.
 - 5.1B The active file will be a working list of procedures issued to Level II examiners (VT-2 and VT-3). The procedures will reflect latest revisions and field changes. The active file will be checked for accuracy against the master file when a new procedure, revision or field change is issued. The file will also be checked against the master on a scheduled weekly basis.

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5.1C The inactive file will include procedures made obsolete by revision. The procedures affected by field changes and superseded by a revision will be transferred to the inactive file with field changes attached. All procedures shall be marked or stamped "VOID" when transferred to the inactive file.

6.0 Control of Administrative Procedure Documentation

- 6.1 Procedure documentation will include a master file, active file, and an inactive file.
 - 6.1A The master file will include latest revisions of all administrative procedures. A master log will be maintained of procedure revisions and field changes.
 - 6.1B The active file will contain administrative procedures used by site supervision. Accuracy of the active file will be compared to the master file.
 - 6.1C When a procedure has been rendered inactive by revision, it will be filed in the inactive section. All procedures shall be marked or stamped "VOID" when transferred to the inactive file.
- 7.0 Program Plan Documentation Control
 - 7.1 The program plan will be handled in a similar manner as procedures. The documentation will include a master of each zone, an active file of each zone, and an inactive file.
 - 7.1A The master file of each zone will reflect the latest revisions and/or field changes. A master log will be maintained of revisions and field changes.

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- 7.18 The active file will be the respective zone examination sheets and isometrics. The master file will serve as an accuracy check. The final zone drawings will become part of the PSI final report.
- 7.1C The inactive file will comprise zone information rendered obsolete by revision. All zone information shall be marked or stamped "VOID" when transferred to the inactive file.

8.0 Control of Examination Data Documentation

8.1 Examination data sheets will be reviewed and cleared by the VCR supervisor. Examination sheets will be filed daily in a "hold" file for review. After review by the VCR supervisor, a copy will be forwarded to the Ebasco PSI construction coordinator and the Louisiana Power and Light PSI coordinator. The examination information will be entered on the VCR zone examination control log. The data sheet will then be filed under the proper zone in the VCR "data sheet complete" file. This file will be available to the ANI for review at all times.

9.0 Control of Reportable Indication Documentation

- 9.1 When an examination report indication record is submitted on a point of examination, the record will be reviewed by the VCR supervisor. A copy will then be forwarded to the Ebasco PSI construction coordinator and the Louisiana Power and Light PSI coordinator. The site supervisor will file the original with the examination data sheet and place a copy in the VCR "Reportable Indications Active" file.
- 9.2 When the owner has decided on disposition, the VCR site supervisor will take appropriate action as directed by the Ebasco PSI construction coordinator. If disposition

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Date: 3/1/83 Page 5 of 6

involves repair, a re-examination sheet will be issued. If repair and examination result in a disposition, the indication record will be removed from the active to a "Reportable Indication Inactive" file.

- 9.3 Should the owner decide that disposition is passive, upon proper notification from the owner the VCR supervisor will remove the indication record from the active file and place it in the "Reportable Indications Inactive" file. When notification is received from the owner regarding passive disposition, the owner's statement will be attached to the original indication record and will become a permanent record of the preservice examination.
- 10.0 Control of Personnel Certification Documentation
 - 10.1 Certification of personnel will be controlled by a master file.
 - 10.1A The master file will include certification on VCR personnel that may be assigned to the inspection. All changes in level of certification will be forwarded to the site and entered in the master file.

11.0 Control of Equipment and Materials Certification Documentation 11.1 The certification of equipment will include a master file, active file, and inactive file.

- 11.1A The master file will contain certification of VCR equipment likely to be employed in the inspection.
- 11.1B The active file will include all equipment currently used in the inspection program.
- 11.1C The inactive file will comprise equipment transferred from the job for any reason. The file will also contain terminated certification.

Th	e Vir	ginia Corporation	Proc. No. <u>VC-ADMIN-101</u> Rev. 1 Date: <u>3/1/83</u> Page 6 of 6	
12.0	Control 12.1	of Documentation of Non-Confo All non-conformance reports w file, arranged in chronologic number.	ill be contained in a single	
13.0	Control 13.1	of Documentation of Site Audi Records of site audits and co under separate cover in chron	rrective action will be filed	
14.0	Control	of Job Correspondence		

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- 14.1 All correspondence pertaining to the preservice inspection emanating from Richmond management will be filed under separate cover in chronological order.
- 14.2 All correspondence emanating from Ebasco or Louisiana Power and Light will be filed under separate cover.

Virginia of Richman			(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
Procedure Title:	Notification of Waterford No. 3	Reportable Ind	EBASCO SERVICES lications founcomponated QUALITY ASSUPANCE ENGINEERING
Procedure No.:	VC-ADMIN-102		This Document is: Reviewed Without Comments Reviewed With Comments as Note
Plant Site:	Waterford No. 3		Resubmit: Proceed with order. Rejected: Revise and Resubmit. NOTE: Review of this document, with or with out comments, is for general conformant
Customer:	Louisiana Power Ebasco Services		and in no way relieves the manufactur or contractor from full responsibilito f delivery of all materials, sman
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The	e Oi	irginia Corporation of Richmond	Proc. No. VC-ADMIN-102 Rev. 1 Date: 3/1/83 Page 1 of 2
1.0	Purpo	ose	
	1.1	To establish a written proceed disposition of reportable inc Waterford #3.	dure for the reporting and dications, preservice inspection,
2.0	Refer	ences	
	2.1	VCR ISI Procedures - Waterfor	rd
	2.2	VCR QA Procedures - Waterford	1
	2.3	VCR Administration Procedures	s - Waterford
	2.4	ASME Section XI, Boiler and P 1978	Pressure Vessel Code, Summer,
	2.5	VCR Program Plan - Waterford	
	2.6	Ebasco Administrative Procedu	are ASP-IV-81
3.0	Respon	nsibility	
	The re	esponsibility for reporting, doc	umenting, and disposition
	at own	ner's discretion, of reportable	indications will rest solely
	with t	the VCR site supervisor.	
.0	Report	ting .	
	4.1	When reportable indications a	re encountered du ing the
		preservice inspection, the VC	R site supervisor will review
		the examination report data sl	heet and the examination report
		indication sheet before any ac	ction is taken.
	4.2	After the information on the a	above documents has been verified,
		the original data sheet and in	ndication sheet will be filed
		under the proper zone in the V	VCR master data file. A copy of
		the indication sheet will be i	forwarded to the Ebasco PSI
		construction coordinator and t	the Louisiana Power and Light
		PSI coordinator within twenty-	-four hours. A copy of the
		indication sheet will be place	ed in the VCR "Reportable
		Indications Acitve" file.	성영이는 사람이 많이 많은 것이야 한 것이 같아. 생각

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Disposition

- 5.1 Method of disposition will be the responsibility of the owner.
- 5.2 Should disposition involve repair, re-examination will be accomplished at the direction of the Ebasco PSI construction coordinator when repair is completed. A re-examination report data sheet will be filed in the VCR master data file. When disposition has been verified, the indication sheet will be removed from the active file and placed in the "Reportable Indications Inactive" file.
- 5.3 When the owner's decision on disposition is passive (no repair), the owner's statement will be attached to the original indication sheet and returned to the master data file. and thus will become a part of the preservice examination record. The indication sheet copy will then be removed from the "Reportable Indications Active" file and placed in the inactive file.

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Procedure Title:	Site Quality . Preservice In	Assurance for Waterf spection	EBASCO SERVICES INCORPORATED QUALITY
Procedure No.:	VC-QA-101		This, Document is:
Plant Site:	Waterford No.	3	Reviewed Without Comments Reviewed With Comments as Noted incomovate Comments, and Resubmit: Proceed with order. Rejected: Revise and Resubmit.
Customer:	Louisiana Pow Ebasco Servic	er and Light es Corporation - Age	Review of this document, with or with out comments, is for general conformant with the applicable specifications onl and in mo way refieres the manufacture or contractor from full responsibility for
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Date: 3/1/83 Page 1 of 5

1.0 Purpose

To insure that the site activities of the Virginia Corporation of Richmond (herein after referred to as VCR) comply with quality requirements as set forth by the VCR Quality Assurance Manual and contract requirements of contract #NY-403685 between Ebasco Services Corporation and VCR.

2.0 Scope

- 2.1 To insure that site activities comply with procedures generated for Waterford No. 3 preservice inspection.
- 2.2 To insure that site activities comply with the VCR Quality Assurance Manual.
- 2.3 To insure that personnel, materials, and equipment used at the Waterford site are properly certified and qualified.

3.0 References

- 3.1 The VCR Quality Assurance Manual, VC-QA-100, Rev. 3.
- 3.2 Waterford #3 NDE Procedures
- 3.3 Waterford #3 QA Procedures
- 3.4 Waterford #3 Administrative Procedures

4.0 General

4.1 . In the case of conflicts which arise between the VCR Quality Assurance Manual (reference 3.1) and the Waterford procedures (references 3.2, 3.3, and 3.4), the Waterford Site Procedures shall take precedence over the QA Manual.

5.0 Responsibilities

- It shall be the responsibility of the VCR site job supervisor 5.1 to implement the site Quality Control program in accordance with the requirements of references 3.1, 3.2, 3.3, and 3.4.
- 5.2 It shall be the responsibility of an NDE Level III to approve all technical reports requiring Level III sign-off at the Waterford site. In addition, he shall assure that all technical reports are signed by an NDE Level III as required.

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- 5.3 It shall be the responsibility of the corporate Quality Assurance Manager to visit the site monthly, at a minimum, during VCR work progress to insure the program compliance with quality assurance requirements. The corporate Quality Assurance Manager may designate this responsibility to one who has been appropriately trained and who does not have responsibility in the area being audited.
 5.4 It shall be the responsibility of Ebasco Services, Inc. to provide adequate storage facilities for records, equipment, and materials.
 - It shall be the VCR site supervisor's responsibility to insure that records, equipment and material are properly stored.
- 5.5 It shall be the responsibility of Ebasco Services, Inc. to maintain a duplicate storage of quality records pertaining to the preservice inspection.
- 5.6 It shall be the responsibility of the VCR site supervisor to insure that the dual storage system is complete through timely checks in accordance with reference 3.4.
- 5.7 It shall be the responsibility of the VCR site supervisor to receipt inspect and complete a controlled material log sheet for all materials or equipment shipped from the Richmond office to the field office.
 - 5.7.1 Equipment and/or materials shall be checked for shipping damages.
 - 5.7.2 Equipment and/or materials shall be checked to insure that certification sheets are complete and not out of date.
 - 5.7.3 Any non-conforming equipment and/or materials shall be removed from the jobsite.

6.0 Frequency of Site Audits

6.1 The frequency of site audits shall be adequate to detect quality related problems promptly. Site audits shall occur at the initiation of inspection activities, at monthly intervals during the inspection program, and at the completion of the inspection program. Follow-up

 audits of deficient items or are s shall be performed to verify implementation of corrective action in a timely manner. 7.0 Quality Assurance Activities 7.1 During the jobsite visit, a sufficient sample of the job activities shall be reviewed in accordance with a prepared audit check list which details the specific elements to be audited in order to insure compliance with the procedures referenced in paragraph 3.0. 7.2 Job activities to be sampled should be (but are not limited to): 7.2.1 Weld centerline marking 7.2.2 Weld identification 7.2.3 Personnel, material, and equipment certifications 7.2.4 Examination reports 7.2.5 Field changes 7.2.6 Nonconformance reports and dispositions 7.2.7 Procedure implementation (personnel performance) 7.3 Any discrepancies noted shall be reported in an exit interview. The exit interview will confirm that the audit team has: a. been correctly informed b. correctly interpreted communication c. interviewed appropriate personnel. d. examined the significant documents. e. clearly stated the findings. 8.1 Results of the site visits shall be reported on forms 	The		nia Corporation Richmond	Proc. No. <u>VC-QA-101</u> Rev. 1 Date: <u>3/1/83</u> Page <u>3</u> of <u>5</u>
 7.0 Quality Assurance Activities 7.1 During the jobsite visit, a sufficient sample of the job activities shall be reviewed in accordance with a prepared audit check list which details the specific elements to be audited in order to insure compliance with the procedures referenced in paragraph 3.0. 7.2 Job activities to be sampled should be (but are not limited to): 7.2 Job activities to be sampled should be (but are not limited to): 7.3 Weld centerline marking 7.4 Weld centerline marking 7.5 Held changes 7.6 Nonconformance reports and dispositions 7.7 Procedure implementation (personnel performance) 7.3 Any discrepancies noted shall be reported in an exit interview. The exit interview will confirm that the audit team has: be no correctly informed correctly interpreted communication e interviewed appropriate personnel. e interviewed appropriate personnel. 8.4 Reports 			to verify implementation o	
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	8.0			shall be reported on forms

similar to Figure 1. The report shall identify the areas or items audited, the identification of the audit

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team member(s), reflect the conditions as found during the audit, and any specific deficiencies that have been observed. The report shall be signed by the audit team leader. The report shall require a date by which a written response is required, outlining the actions taken to correct the deficiency, actions taken to preclude recurrence, and date by which full compliance was or will be achieved. The report shall be transmitted to the appropriate level of management being audited.

8.2 There shall be a follow-up audit to verify that corrective actions have been implemented for those instances when the observed discrepancies were of a serious nature. At the discretion of the audit team leader, submittal of documentation such as procedures, instructions, and corrective action reports may satisfy the reaudit requirement. Deficiencies in implementing effective corrective action shall be brought to the attention of The Virginia Corporation president by letter. Continued deficiencies, or failure to implement effective corrective action, shall be considered a significant condition adverse to quality, and forwarded to The Virginia Corporation president by letter.

8.3 All significant conditions adverse to quality shall be resolved by the president with a thirty calendar days of his notification will be by letter to both parties involved. Procedural nonconformances shall be reported in accordance with VC-QA-102.

8.4 Copies of all Q.A. documentation will be provided to Ebasco Q.A., L.P.&L. Q.A., and L.P.&L. PSI coordinator.

The Virginia Corporation of Richmond	Proc. No. <u>VC-QA-101</u> Rev. 1 Date: <u>3/1/83</u> Page <u>5</u> of <u>5</u>
QUALITY ASSURANCE SITE	AUDIT REPORT
Facility Audited:	Dates of Visit: From To
Personnel Contacted:	
Procedural Reference:	
Extent and Depth of Audit:	
Summary of General Impressions:	
Corrective Action Recommended:	
Closure or Rejection of Audit Findings (sho	w NCR No.):
Signed:	Date:
Copies:	
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Virginia ef Richmer	Corp.		(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
Procedure Title:	Procedural Nonc	onformance	
•			EBASCO SERVICES INCORPORATED
Procedure No.:	VC-QA-102		QUALITY ASSUMANCE ENGINEERDIG
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	and the second		and Resubmit.
Customer:	Louisiana Power Ebasco Services	and Light Corporation - Age	Review of this document, with or with out comments is for general conformant
Approved for Use Virginia Corporation:	Thomas is	, munson	delivery of an material, a shear services and documentation in stri accordance with the Purchase Order.
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1.0 Purpose

- 1.1 This procedure covers the actions required of The Virginia Corporation of Richmond (herein after referred to as VCR) should any question regarding procedural nonconformance arise during the field operations of Waterford #3 PSI.
- 1.2 It is not the intent of this procedure to delineate the processing of NDE reports stating rejectable or questionable indications as detailed in Ebasco procedure ASP-IV-81.

2.0 References

- 2.1 Ebasco procedure ASP-III-7, "Corrective Action".
- 2.2 Ebasco Nonconformance Report, form 6009 11/5/77.

3.0 Initiation

- 3.1 Questions of nonconformance may be raised by VCR examiners, VCR field supervisor or Level III examiner, the customer, the authorized inspector, regulatory personnel, or other designated responsible authorities.
- 3.2 Upon an apparent nonconformance, procedural work shall terminate immediately to the extent deemed necessary by the VCR supervisor.

4.0 Reporting

- 4.1 The VCR supervisor will make a decision as to whether the apparent nonconformance is major or minor.
- 4.2 Major nonconformance
 - 4.2.1 A major nonconformance is defined as a deviation from the established procedure that affects or detracts from the quality or completeness of the examination. Repeated minor nonconformances may be considered a major nonconformance.

nonconformance (Fig the customer, and a Manager, or his des 4.2.3 Each major nonconfor shall be given a se in the nonconforman shall be recorded a	t of the apparent major gure 1) shall be made to the VCR Quality Assurance signee, by the VCR supervisor. ormance report (Figure 1) equential number, and logged nce report file. This number
nonconformance (Fig the customer, and a Manager, or his des 4.2.3 Each major nonconfor shall be given a se in the nonconforman shall be recorded a	gure 1) shall be made to the VCR Quality Assurance signee, by the VCR supervisor. ormance report (Figure 1) equential number, and logged
shall be given a so in the nonconforman shall be recorded of	equential number, and logged
report .	under item one (1) of the
4.2.4 For major nonconfororor his designee, si(2) through nine (rmances, the VCR supervisor, hall complete items two 9) of the report, fully conforming condition.
Minor nonconformance	
	ance is defined as any t does not meet the aph 4.2.1.
nonconformance (Fi the VCR Quality As	t of the apparent minor gure 2) shall be made to surance Manager by the VCR
4.3.3 Each minor nonconf	ormance report (Figure 2) sequential number, and logged ance report file.
sition - major nonconformance	
When a major nonconformance will be forwarded promptly t supervisor for further proce	to the EBASCO Q.A. site
	criteria of paragr 4.3.2 An immediate repor nonconformance (Fi the VCR Quality As supervisor. 4.3.3 Each minor nonconf shall be given a s in the nonconformance When a major nonconformance will be forwarded promptly t

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- 5.2 The nonconformance report shall then be evaluated by Ebasco, Louisiana Power and Light and their authorized inspector. The report will also be evaluated promptly by the VCR Q.A. Manager.
- 5.3 When items thirteen and fifteen are completed, the Ebasco Q.A. site supervisor shall indicate whether corrective action and/or verification of disposition are required, by checking the blocks of the form for items fourteen (14) and sixteen (16). He shall then transmit the yellow and pink copies of the nonconformance report to the VCR supervisor for further processing.
- 5.4 If corrective action and verification of disposition is required of VCR, the VCR field supervisor shall insure that corrective action and verification of disposition is accomplished within twenty working days. It will be the responsibility of the VCR Q.A. Manager to insure that disposition is accomplished by the VCR supervisor. If this cannot be accomplished within twenty working days, the VCR field supervisor shall transmit a request for extension to the Ebasco contract administrator.
- 5.5 The VCR field supervisor, or his designee, shall document corrective action (item 14) and verification of disposition (item 17) on the nonconformance report form, and transmit the pink copy of the form to the Ebasco Q.A. site supervisor. A copy of the corrective action shall be forwarded to the VCR Q.A. Manager and the Louisiana Power and Light PSI coordinator. The yellow copy shall be retained by VCR for permanent record filing.
- 6.0 Disposition minor nonconformance
 - 6.1 Determination shall be made of the legitimacy and extent of the nonconformance.

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6.2 The disposition of a minor nonconformance shall be evaluated by the VCR field supervisor and the VCR Quality Assurance Manager, as applicable.

- 6.3 Corrective action resulting from the evaluation shall be initiated by the VCR Field Supervisor, and reviewed by the VCR Quality Assurance Manager to ensure that follow-up action will be taken.
- 6.4 The resulting disposition shall be documented (Figure 2), and signed by the VCR Field Supervisor, and approved by the VCR Quality Assurance Manager.
- 6.5 The nonconformance and corrective actions taken shall be reviewed by the VCR Quality Assurance Manager for the identification of conditions adverse to quality. If actions need to be taken to prevent recurrence, these actions shall be reported on the appropriate nonconformance report.

6009-11/5-77	QUALITY ASSURANCE		Distribution: White - PQAE or Site QA Supervis
PORT NO.(1)			Yellow - Organization recommendin disposition
NSTRUCTIONS: (See book of	(a)		Pink - Initiator of NCR
LIENT OR PROJECT (2)	rorm [,]	DRAW	ING HO./SPEC NO. (3)
UPPLIER, CONSTRUCTION OC O			
OFFLIER, CONSTRUCTION QC O	R CONTRACTOR (4)	0. NO. (5)	
ESCRIPTION OF COMPONENT, P	PART OR SYSTEM (6)		
I. DESCRIPTION OF NONCO	ONFORMANCE ⁽⁷⁾ (Items Involved Submit Sketch	d, Specification, Code or Stan if Applicable)	adard to Which Items Do Not Comply,
		<u>.</u>	
		-715	
AME AND SIGNATURE OF PERSO	REPORTING NONCONFORMANCE	anter repropriet in	DATE (9)
		112142	
II. RECOMMENDED DISPOSIT	TION (10) (Submit Sketch V ROA	icome	
	- (SIV)	MUL	
	012		
	- Or		
AME AND SIGNATURE OF PERSON	RECOMMENDING DISPOSITION (11)	TITLE/COMPANY	DATE (12)
I. EVALUATION OF DISPOS	TION BY EBASCO, REASON FO	DR DISPOSITION (13)	
V. CORRECTIVE ACTION	Required Not	Required	
V.18 ENGINEERING	QUALITY ASSURANCE	CONSTRUCTION	OTHER
AME (SIGNATURE)	NAME (SIGNATURE)	NAME (SIGNATURE)	NAME (SIGNATURE)
ATE	DATE	DATE	DATE
ACCEPTED REJECTED	ACCEPTED REJECTED	ACCEPTED REJECT	hand have been
I. VERIFICATION OF DISPO		ED OT REQU	IRED (16)
71.87	SIGNATURE		0.115
17) BY EBASCO VENDOR QA OR QA ENGINEERING	FIGURE 1	TITLE	DATE

INSTRUCTIONS

To Be Completed By:

Item (1)	- Ebasco Quality Assurance Engineering.
Items (2) through (9)	- Person initiating Nonconformance Report, eg, Ebasco Vendor QA Representative, Ebasco QA Engineering, etc.
Items (10), (11) and (12)	- Supplier, Ebasco Construction Quality Control or other authorized responsible personnel.
Item (13)	 Personnel designated by QA Engineering as indicated in the appropriate box in Part V.1 Ebasco Quality Assurance Engineering.
ltsm (14)	- Ebasco Quality Assurance Engineering.
Item (15)	- Responsible engineer of the department designated by QA Engineering in the appropriate box.
Item (16)	- QA Engineering after completion of Part III.
Item (17)	- Ebasco Vendor QA Representative when NCR is generated in Supplier's facility, or QA Engineering when generated at the construction site or engineering offices.

NOTE: Completed form to be incorporated into Ebasco QA Records.

Virginia Co	orp.	MINOR NONCONFORMANCE REPORT # Page of
Minor Nonconformance Re Date: Description of Minor No		
Disposition/Corrective	Action:	MFZ.
Verification of Disposi VCR Field Supervisor VCR Quality Assurance M	_1/11	Date:
Action to Prevent Recur Required	rance: Not Required_	
QC:		

Virginia	Corp.		(804) 266-8741 P. O. Bex 9474 5809 Lakeside Ave. Richmond, Virginia 23228
Procedure Title:		Control of Procedu Preservice Inspec	
Procedure No.:	VC-QA-103		This Document is:
Plant Site:	Waterford No. 3		Reviewed Without Comments Reviewed With Conscients as Noted: Incorporate Communis, and Resubmit: Proceed with order. Reincted: Revise and Resubmit.
Customer:	Louisiana Power Ebasco Services	and Light Corporation - Age	Review of this document, with or with- out comments, is or pereral confurmance with the anoticable specifications only and in no way relieves the manifacture or contractor from fully remanchillion for
Approved for Use Virginia Corporation:	Thomas B	Wunson	BY: Athe Cannor way
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The Virginia Corporation of Richmond

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1.0 Purpose

To provide a system for the preparation, review, approval, issue, and control of nondestructive examination procedures, administrative procedures, and site quality assurance procedures generated by The Virginia Corporation of Richmond (herein after referred to as VCR) for the Waterford #3 PSI.

2.0 References

- 2.1 VCR OA Manual, VC-QA-100, Rev. 4, dated 12/7/81.
- 2.2 Ebasco procedure ASP-IV-81.

3.0 Definitions

- 3.1 NDE Procedures -
 - Documents which establish administrative and technical requirements for conducting nondestructive examinations.
- 3.2 Administrative Procedures -Documents which establish management control over site activities and establish necessary interfaces with the customer.
- 3.3 Site Quality Assurance Procedures -Documents which establish policies to ensure adequate control of quality during the conduct of field activities.

4.0 Preparation, Review and Approval of Procedures

4.1 Preparation

The originator shall be a member of the appropriate department; i.e., NDE department for NDE procedures, QA department for site Q.A. procedures, or VCR management for administrative procedures.

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4.2 Review

The procedure shall be reviewed by a member of the appropriate department; i.e., a Level III shall review NDE procedures, the QA Manager, or his designate, shall review QA procedures, and VCR management shall review administrative procedures. The procedure shall then undergo an additional review by the Quality Assurance Manager or his designate. All VCR comments shall be resolved prior to the final reviewer's signature being placed on the procedure cover sheet (Figure 1).

4.3

5.0

Final procedure

When all review has been completed, the procedure shall be issued and controlled as designated in paragraph 5.0.

Issue and Control of Procedures

- 5.1 Initial procedure prepared for customer review, upon the completion of all steps in paragraph 4.0, shall be marked "Draft" and shall be designated Revision A. Each draft revision, upon receipt of customer comments, will be given a sequential alphabetical designation.
- 5.2 Each draft revision will be required to complete all steps in paragraph 4.0.
- 5.3 Upon customer acceptance, the procedure will be given the designation "Revision O", and will not be marked "Draft". All subsequent revisions will be given a sequential numerical designation.
- 5.4 The procedure will then undergo a final review for completeness, and will be signed on the cover sheet in the block "Approved for use - Virginia Corporation", by a responsible VCR official.

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- Three copies of the procedure, (one controlled and two 5.5 uncontrolled), will be transmitted to the Ebasco Site Manager in accordance with Reference 2.2, for Louisiana Power & Light approval in the appropriate block on the cover sheet marked "Approved for Use, Customer:". Ebasco will also document acceptance of the procedure by stamping the cover sheet.
- Ebasco will retain one controlled copy and one uncontrolled 5.6 copy, and transmit the approved uncontrolled copy to VCR for internal controlled distribution.
- 5.7 All NDE field test procedures will be controlled on the job site by the VCR Field Supervisor. All field test procedures, before being used for examination, will be reviewed for proper revision and completeness, and will then be stamped "Approved for Field Use". No procedure will be used for NDE examination without this stamp.
- Prior to examination, each Level II technician at the 5.8 job site will be issued a controlled copy of the applicable field test procedures. A log will be maintained of the procedure copy number, and to whom issued. Any revisions to the procedures, or field change, will be immediately inserted into all applicable procedures and so recorded in the log. Upon leaving the job site, the technicians shall return all controlled procedures to the VCR field supervisor.

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6.0 Field Changes

- 6.1 Procedures may be revised in the field to reflect practical considerations. The field change may be originated by the VCR Field Supervisor or Level III. The field change must be approved by a VCR level III, VCR QA Manager or his designate, an authorized Louisiana Power and Light representative, and reviewed by an authorized Ebasco representative. Field changes shall be documented on VCR Field Change Form (Figure 2), and Continuation Sheet (Figure 3), if necessary, and shall be attached to the procedure. The procedure will be marked to reflect the paragraph affected by the field change. The field change will be controlled yer paragraph 5.8.
- 6.2 A controlled copy of the procedure and field change shall be transmitted to the Ebasco Site Manager. At no time shall there be more than five field changes to an individual procedure. All field changes must be incorporated into the final issue of the procedure.

7.0 Revisions

7.1 The initiation, review, and approval for revisions of procedures shall be the same as for the original issue. Revisions may include field changes made to the previous issue, as specific circumstances dictate.

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Scope

This document describes the method and procedures for performing system walk downs and zone drawing verifications, marking of weld centerlines for examination start points and scan directions, and marking of weld identification numbers on circumferential, longitudinal, and branch connection welds in order to ensure that the PSI program be conducted in accordance with the requirements of Section XI of the ASME Boiler and Pressure Vessel Code.

2.0 Purpose

- 2.1 To ensure uniformity of the manner in which system walk down and zone drawing verification are performed.
- .2.2 To ensure uniformity of the manner in which weld centerlines are marked so their locations can be used as an identifiable datum point.
- 2.3 To ensure uniformity of the manner in which weld identification numbers are marked.

3.0 References

- 3.1 1977 Edition of ASME Boiler and Pressure Vessel Code, Section XI, with addenda through summer, 1978, Article III-4300, Appendix III.
- 3.2 VCR Program Plan Waterford #3.
- Virginia Corporation Quality Assurance Manual, VC-QA-100, Rev. 4, 12/7/81.
- 3.4 The Virginia Corporation of Richmond Procedure ISI 1.2, Preservice Inspection Documentation (latest revision)

4.0 Personnel Qualifications

4.1 Personnel shall have the ability to identify and to locate vessel components and piping systems through the use of construction, assembly or zone drawings of the preservice inspection plan.

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5.0 Equipment and Material Requirements

- 5.1 Low stress stamps and/or vibratool shall be used to permanently identify each weld and weld centerline.
- 5.2 Stamps shall be supplied with certifications from the manufacturer stating that the stamps are manufactured in accordance with ASME, Section III requirements.

6.0 Initial Conditions

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- 6.1 Surface conditioning shall be done prior to marking weld identification numbers and weld centerlines.
- 6.2 Surface condition shall be acceptable for the appropriate NDE method for that specific weld as defined in the preservice inspection plan.

Instructions for System Walk Down and Zone Drawing Verification

- 7.1 Each zone drawing shall be walked down completely.
- 7.2 During system walk downs the following items shall be verified.
 - 7.2.1 Zone drawing configuration.
 - 7.2.2 Location of all welds on the piping system including butt welds, socket welds, branch connections and welded attachments.
 - 7.2.3 Pipe diameter.
 - 7.2.4 Valve numbers.

7.2.5 Wall and floor penetrations.

- 7.2.6 Surface condition of all welds with respect to subsequent nondestructive examinations.
- 7.3 Any variation of the items in paragraph 7.2 on the zone drawing shall be marked in "red" on the zone drawing.
- 7.4 Upon completion of the system walk down and zone drawing verification, a current zone drawing will be generated.
- 7.5 Upon completion of the current zone drawing, a final system walk down and zone drawing verification will be performed by another technician and any necessary changes will be made.

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- 7.6 Upon completion of the final system walk down and zone drawing verification, an approved zone drawing shall be generated and stamped "Approved for Field Use", and initialed and dated by the field supervisor.
- 7.7 Any subsequent changes shall be brought to the attention of the field supervisor and he shall make the appropriate changes on the zone drawings.
 - 7.7.1 Once data has been generated on a specific zone drawing and a weld is added, the weld shall be designated the next highest number in the weld number sequence.
 - 7.7.2 Any welds that have been cut out and replaced by another spool piece shall be designated a "900" series number, starting with "900" for that particular zone drawing, and continuing with that number sequence for subsequent weld cutouts only. (Reference figure 1).
 - 7.7.3 All lines designated for hydrostatic testing only shall be designated a "600" series number, following the weld I.D. number (Reference figure 2).
- 7.8 All longitudinal welds in piping systems shall be designated an Alpha letter "L" after the numerical designation.

7.8.1 When more than one longitudinal weld exists on a spool piece, valve, or fitting, the first longitudinal weld in the clockwise direction from the weld centerline mark "V" stamp, when looking in the direction of zone drawing flow, shall be designated an Alpha letter "A" after the "L" designation. The second longitudinal weld in a piping system shall

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be designated an Alpha letter "B" after the "L" designation, etc. (Note: If there is a longitudinal weld in the same location as the "V" stamp mark, the first weld in the clockwise direction from this weld shall be designated the "LA" designation.) 7.8.2 When longitudinal seam welds in class 2 piping require examination 2.5T from the circumferential weld, these longitudinal welds shall be designated the number of the intersecting circumferential weld after the Alpha designation on that particular end of the longitudinal weld. (Reference Figure 3.) 7.8.3 For longitudinal welds in tees with two (2) short seams in the radius of the tee and one (1) long seam, the short scam on the end with the lower weld identification number shall be designated a "LA" designation. The short seam on the end with the higher weld identification number shall be designated a "LB" designation and the long seam shall be

designated a "LC" designation. (Reference figure 4.)

7.9 Upon completion of the preservice inspection, final zone drawings will be generated as necessary and included in the final report.

8.0 Instructions for Marking Weld Centerlines

8.1 Weld centerlines shall be marked with a low stress "V" stamp with the intersecting point on the centerline of the weld pointing in the clockwise direction when looking in the direction of the zone drawing flow. The zone drawing flow is in the direction of the weld number sequence from lower numbers to higher numbers.

8.2 The locations of centerline marks shall be established in accordance with the following rules.

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- 8.2.1 For horizontal pipelines (Reference Figure 5), the centerline mark shall be located at the intersection of the weld centerline and the top centerline of the pipe.
- 8.2.2 For vertical pipelines (Reference Figure 5), the centerline mark shall be located at the intersection of the weld centerline and the centerline through the outside radius of the first elbow or bend in the direction of the lower weld identification number on the zone drawing.
- 8.2.3 In a vertical run, where there is no elbow in the direction of the lower weld ID number, use an extension of the center line of the outside radius of the elbow in the direction of the higher ID number.
- 8.2.4 For vertical pipelines where no elbows or bends are involved.
 - 8.2.4.1 For vertical runs up from a tee or branch connection, the centerline mark shall be at the intersection of the top centerline of the horizontal pipeline through the radius of the tee or branch connection on the side of the lower weld identification number on the zone drawing. (Reference Figure 6.)

2 For vertical runs down from a tee or branch connection, the centerline mark shall be at the intersection of the bottom centerline of the horizontal pipeline through the radius of the tee or branch connection on the side of the lower weld identification number on the zone drawing. (Reference Figure 7.)

8.2.4.2

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- 8.2.4.3 For any case not covered by 8.2.4.1 or 8.2.4.2, choose the most convenient location.
- 8.2.5 For saddle welds (sweepolet, weldolet, etc.), the centerline mark shall be the same as Par. 8.2.4.1 for vertical pipelines branching up and Par. 8.2.4.2 for vertical pipelines branching down from a tee or branch connection.
- 8.2.6 For longitudinal welds in piping, elbows, tees, etc., the centerline mark shall be at the intersecting point of the circumferential and longitudinal weld centerlines on the lower weld identification number end of the longitudinal weld and pointing in the direction of the zone drawing flow (Reference Figure 8.)
- 8.3 In the event that an error is stamped on the weld a "C" will be stamped over the error, and the correct stamp and centerline will be marked.
- 8.4

The methods used for locating actual weld centerline shall be as follows.

- 8.4.1 For welds that are not ground flush, measure the distance across the weld (edge to edge) and determine mid-point.
- 8.4.2 For stainless steel welds that have not been solution annealed or heat treated, measure the distance across the weld (edge to edge) and determine mid-point.
- 8.4.3 For carbon steel and stainless steel welds that have been solution annealed or heat treated, and there are no magnetic properties, measurements shall be taken from geometric changes on the surface. When edges of the weld are located, measure the distance from edge to edge of the weld and determine the mid-point.

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8.4.4 For welds that are ground smooth, with the weld geometry in question, it may be necessary to etch in order to clearly define the weld configuration. If this becomes necessary, etching shall be the responsibility of Ebasco.

9.0 Instructions for Marking Weld Identification Numbers

9.1 All welds shall be verified by the "Approved for Field Use" zone drawings prior to marking any weld identification numbers.

9.2 Locations of weld identification numbers shall be established in accordance with the following rules.

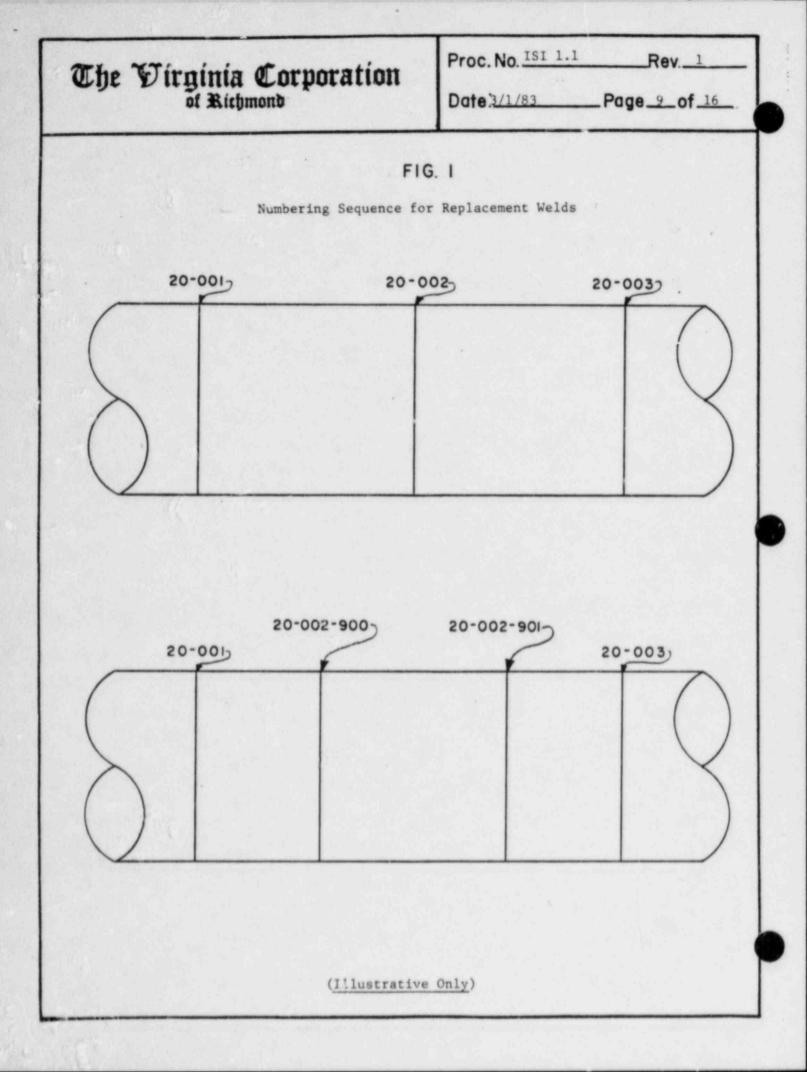
- 9.2.1 The centerline of each weld shall be marked prior to marking its identification number.
- 9.2.2 All weld identification numbers shall be located close to the centerline mark in the circumferential direction.
- 9.2.3 Where practical, all weld identification numbers shall be located on the side of the weld in the direction of the lower weld identification number.
- 9.2.4 All weld identification numbers shall be located, when possible, at a minimum of 1.5" from the toe of the weld so that there will be no interference with subsequent visual or surface examinations.
- 9.2.5 At no time shall the weld identification number be marked on the weld material or on the weld fusion zone.
- 9.3 In the event that an error in the weld identification number is made, or the wrong weld identification number is stamped, all wrong numbers shall be "X" stamped and the correct numbers marked.

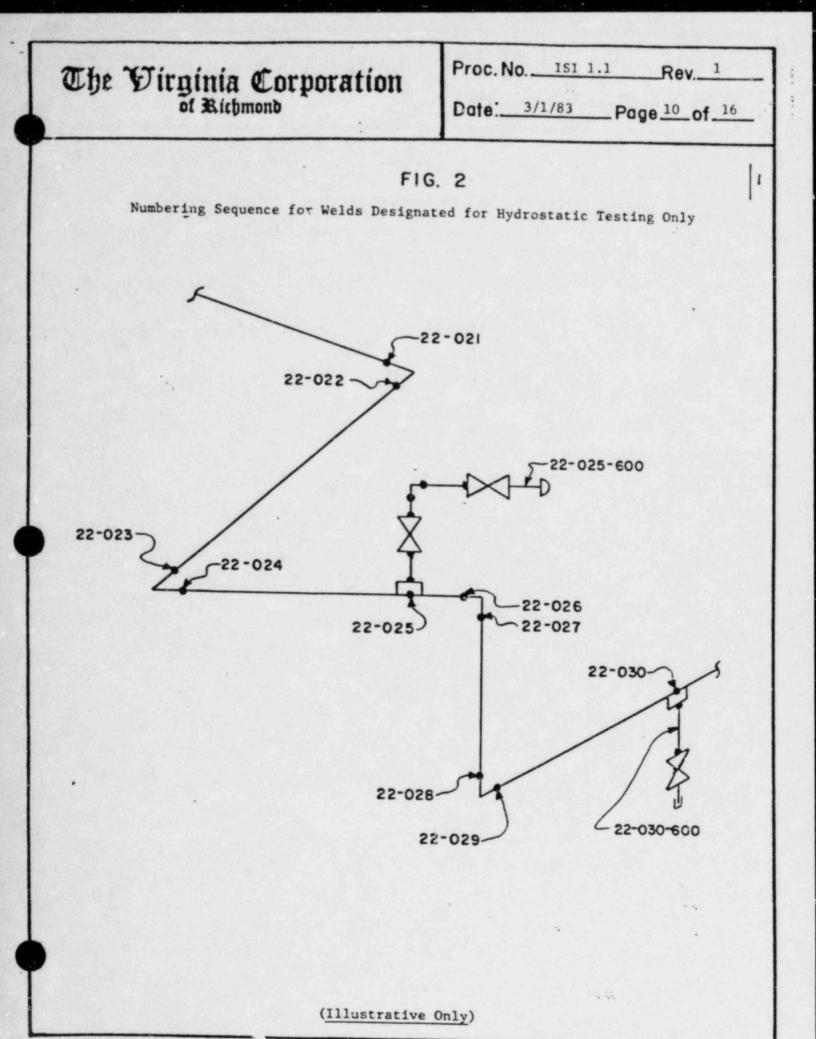
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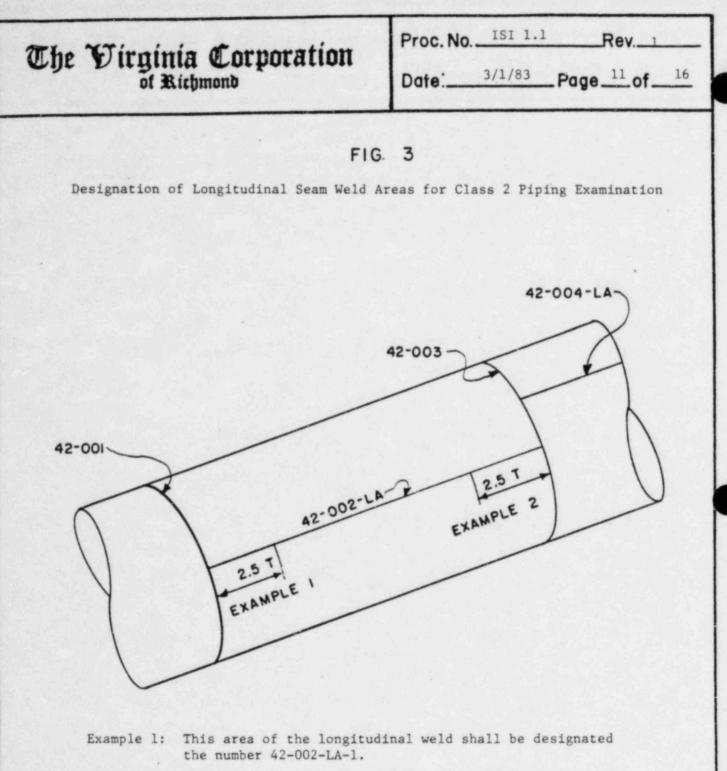
9.4 A final system walkdown will be performed upon completion of the preservice inspection at Waterford 3. In the event that an error has been made on the weld centerline location, no corrective action is required. If the weld centerline or weld identification number can not be located, the field supervisor shall be notified and he shall schedule restamping and reexamination.



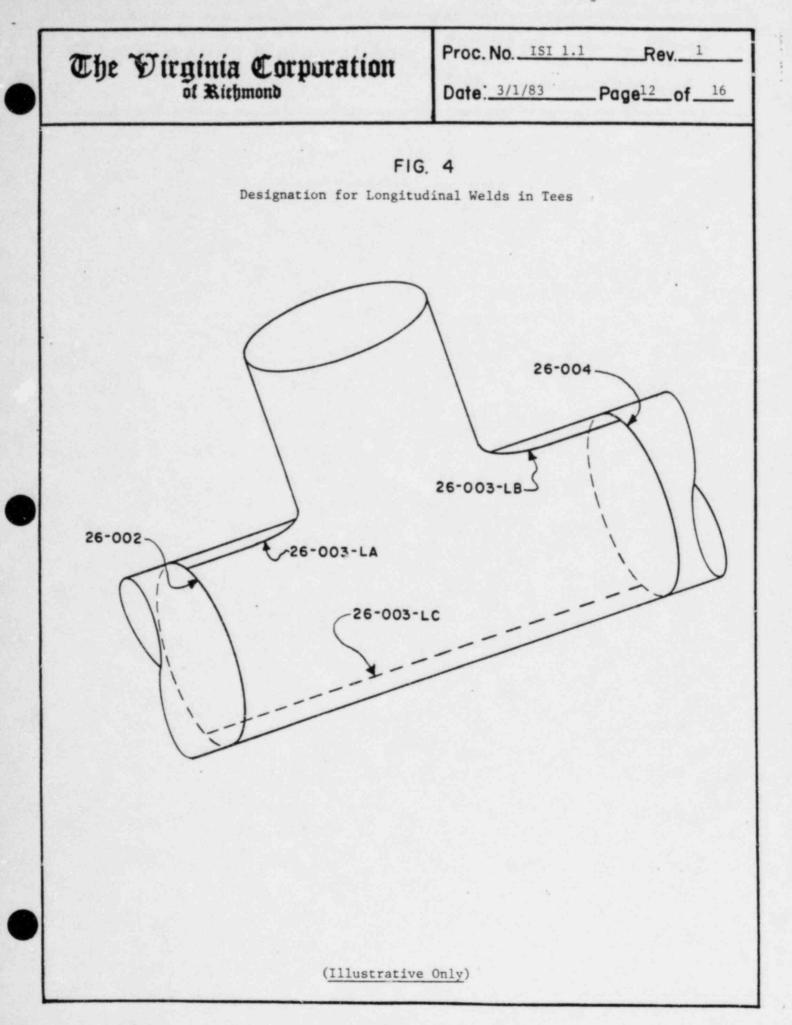


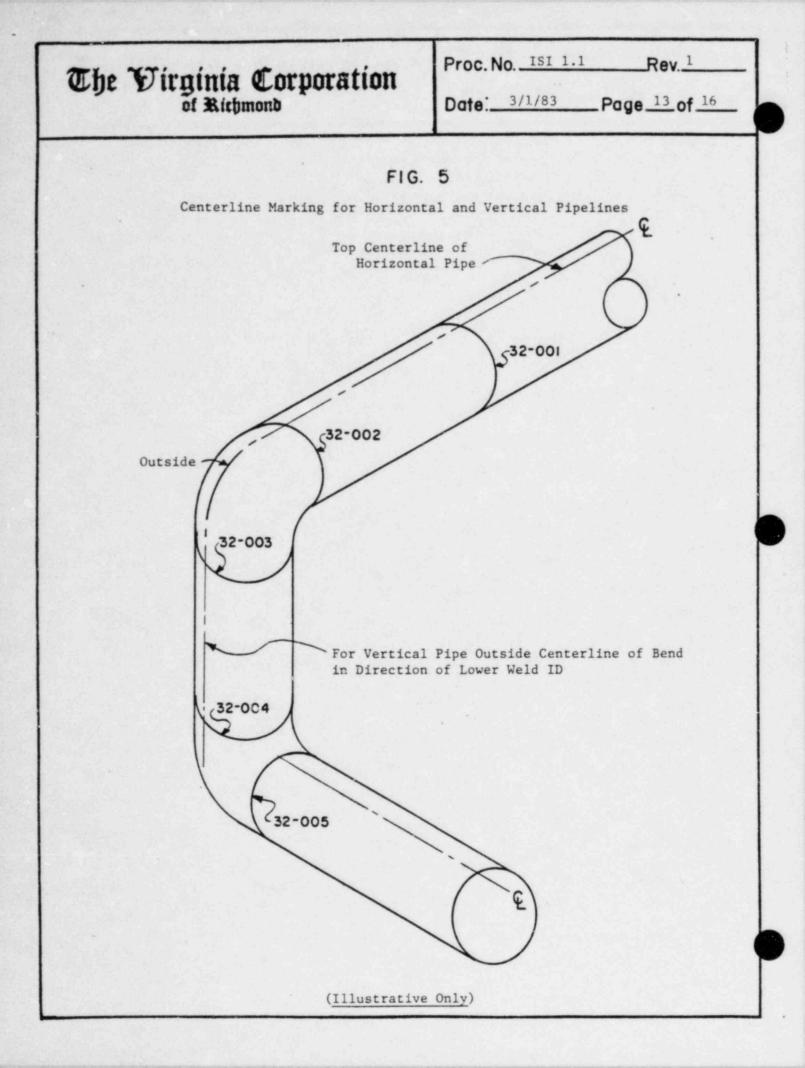
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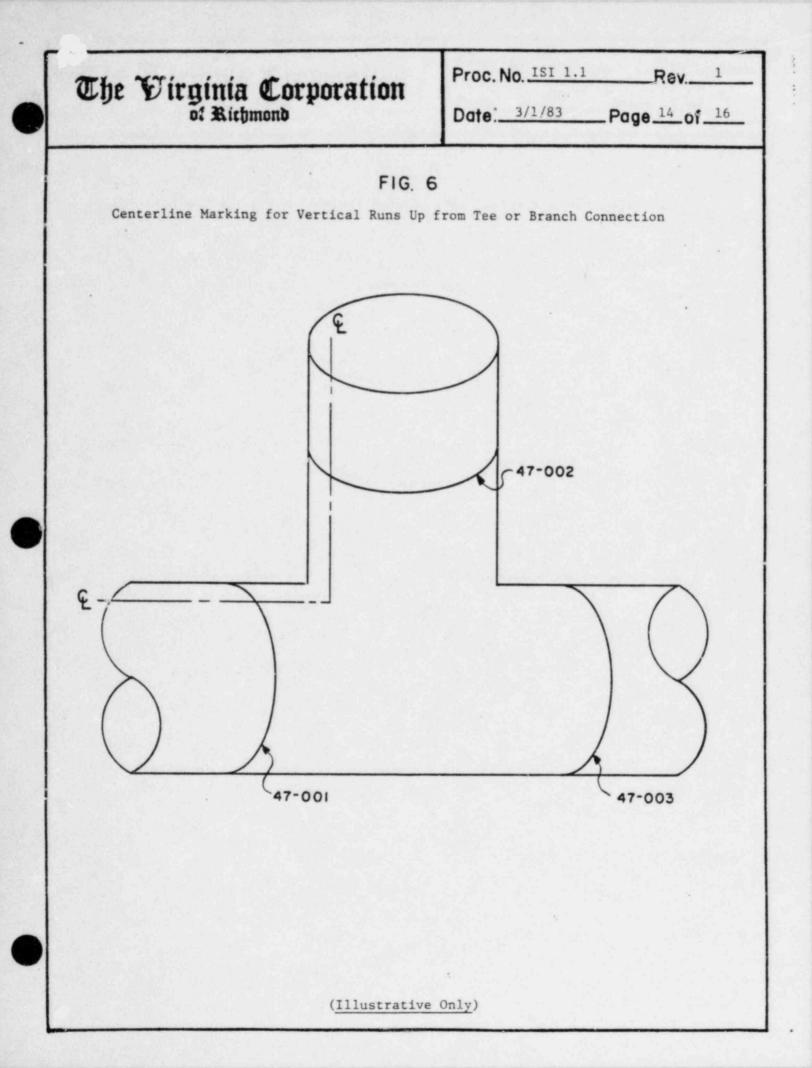
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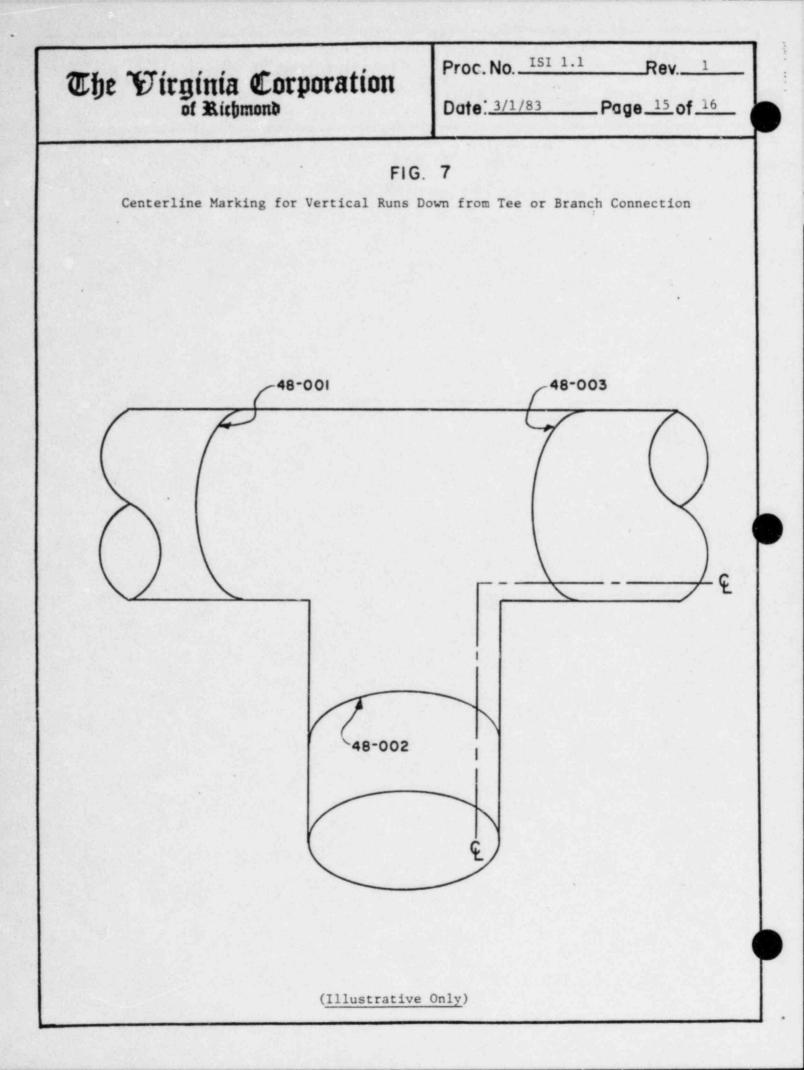


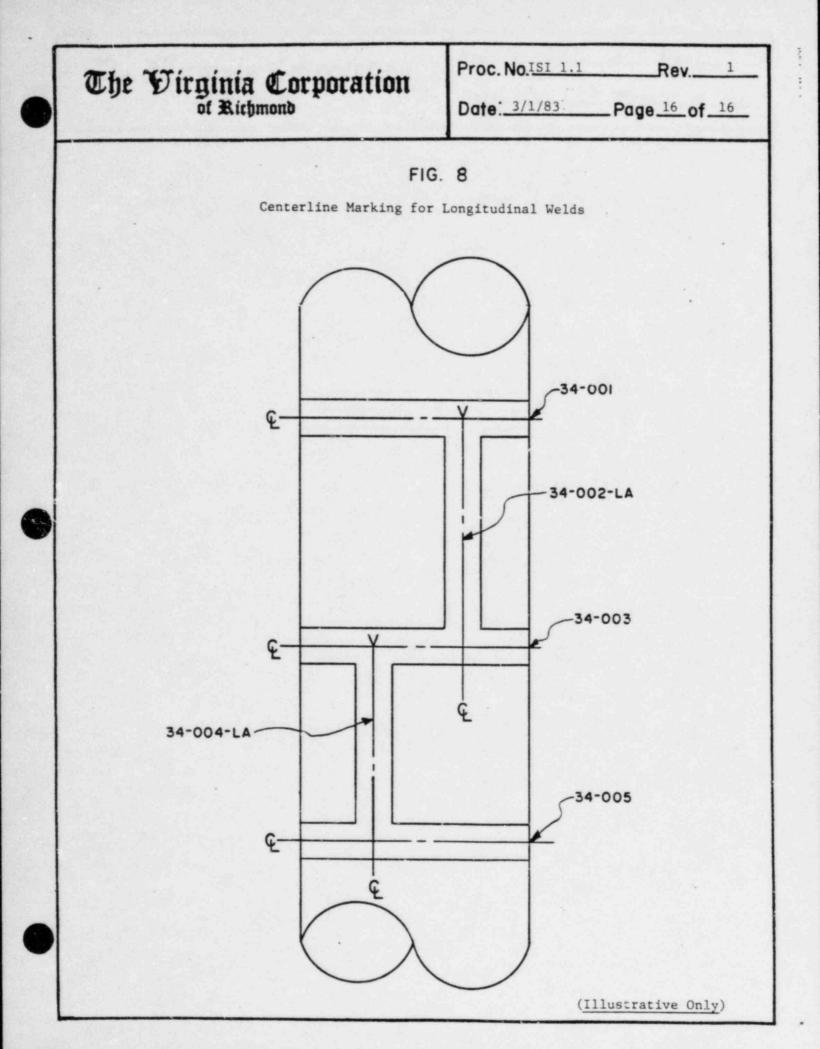
Example 2: This area of the longitudinal weld shall be designated the number 42-002-LA-3.











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1.1 This document describes the methods, procedures, and special requirements for documenting and reporting the performance of nonmechanized, nondestructive preservice examination conducted in accordance with the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. 2.0 References 2.1 The Virginia Corporation of Richmond Procedure ISI 1.1, System Verification and Marking. 2.2 The Virginia Corporation of Richmond Program Plan -Waterford #3. 2.3 The Virginia Corporation of Richmond ISI Procedures -Waterford #3. 2.4 The Virginia Corporation of Richmond Quality Assurance Procedures - Waterford #3. 2.5 The Virginia Corporation of Richmond Administrative Procedures - Waterford #3. 2.6 ASME Boiler and Pressure Vessel Code, Section XI, 1977 Edition, with addenda through Summer 1978. 3.0 General Requirements 3.1 The type of examinations that are to be performed on all welds and/or areas of systems and components shall be fully defined in the Preservice Inspection Program Plan. 3.2 Included in the Preservice Inspection Program Plan are zone drawings which define the examination areas and locations in the various piping systems and components. 3.3 All examinations shall be conducted in accordance with approved written procedures. The specific procedure to be utilized for each weld or item shall be defined in the Pre-

service Inspection Program Plan.

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4.0 Datum Points

4.1 The "V" stamp mark on the weld shall be the zero datum point (start point) and indicates scan direction 7. The weld centerline "V" stamp mark locations are to be established in accordance with the requirements of the Virginia Corporation of Richmond procedure referenced in paragraph 2.1.

5.0 Data Recording

- 5.1 The locations of all reportable indications noted during the performance of nondestructive examination shall be recorded with reference to datum points established in accordance with paragraph 4.0. of this document.
- 5.2 All measurements between a datum point and an indication shall be referenced to scan directions used for ultrasonic examinations.
- 5.3 The surfaces and scan directions for the performance of ultrasonic examination of circumferential welds in piping systems and horizontal vessels shall be in accordance with the following rules (reference figure 1).
 - 5.3.1 Surface five shall be the side of the weld in the direction of the lower weld identification number.
 - Surface two shall be the side of the weld in the 5.3.2 direction of the higher weld identification number.
 - 5.3.3 Scan direction five shall be from surface five looking in the direction of surface two.
 - 5.3.4 Scan direction two shall be from surface two looking in the direction of surface five.
 - 5.3.5 Scan direction seven shall be clockwise from the datum point when looking in scan direction five.
 - 5.3.6 Scan direction eight shall be counterclockwise from the datum point when looking in scan direction five.

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- 5.4 The surface and scan directions for longitudinal welds in piping systems and horizontal vessels shall be in accordance with the following rules (reference figure 2).
 - 5.4.1 For longitudinal welds, rotate the scan pattern 90° counterclockwise when looking in the five direction as defined in paragraph 5.3.3
- 5.5 The surfaces and scan directions for circumferential welds in vertical vessels shall be in accordance with the following rules (reference figure 3).
 - 5.5.1 Scan direction five shall be in the down direction when looking from the top of the vessel toward the bottom of the vessel.
 - 5.5.2 Scan direction two shall be in the up direction when looking from the top of the vessel toward the bottom of the vessel.
 - 5.5.3 Scan direction seven shall be in the clockwise direction when looking from the top of the vessel toward the bottom of the vessel.
 - 5.5.4 Scan direction eight shall be in the counterclockwise direction when looking from the top of the vessel toward the bottom of the vessel.
- 5.6 The surfaces and scan directions for longitudinal welds in vertical vessels shall be in accordance with the following rules (reference figure 4).
 - 5.6.1 For longitudinal welds, rotate the scan pattern 90° counterclockwise when looking in scan direction five as defined in paragraph 5.5.1.
- 5.7 The location of all reportable indications noted during the performance of nondestructive examinations shall be recorded in accordance with the following rules:
 - 5.7.1 The length and location of all indications parallel to the weld shall be recorded by the distance along the **axis** of the weld from the datum points to each end of the indication in the seven scan direction.

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5.7.4 The depth, width and location of all indications transverse to the weld shall be recorded by the distance along the axis of the weld from the datum point to each side of the indication.

6.0 Data Reporting

- 6.1 All information with respect to the performance of nondestructive examinations shall be reported on the appropriate form, and completed in accordance with the appropriate information sheet (see paragraph 6.4 for appropriate form numbers.)
- 6.2 Any information blocks that do not need to be filled out for the specific examination shall be marked not applicable, "N/A".
- 6.3 White-out or other correction fluid shall not be used on final data sheets. Any errors shall be marked through with a single line and initialled by the examiner. Additional corrections may be made by the Virginia Corporation

The Virginia Corporation of Richmond

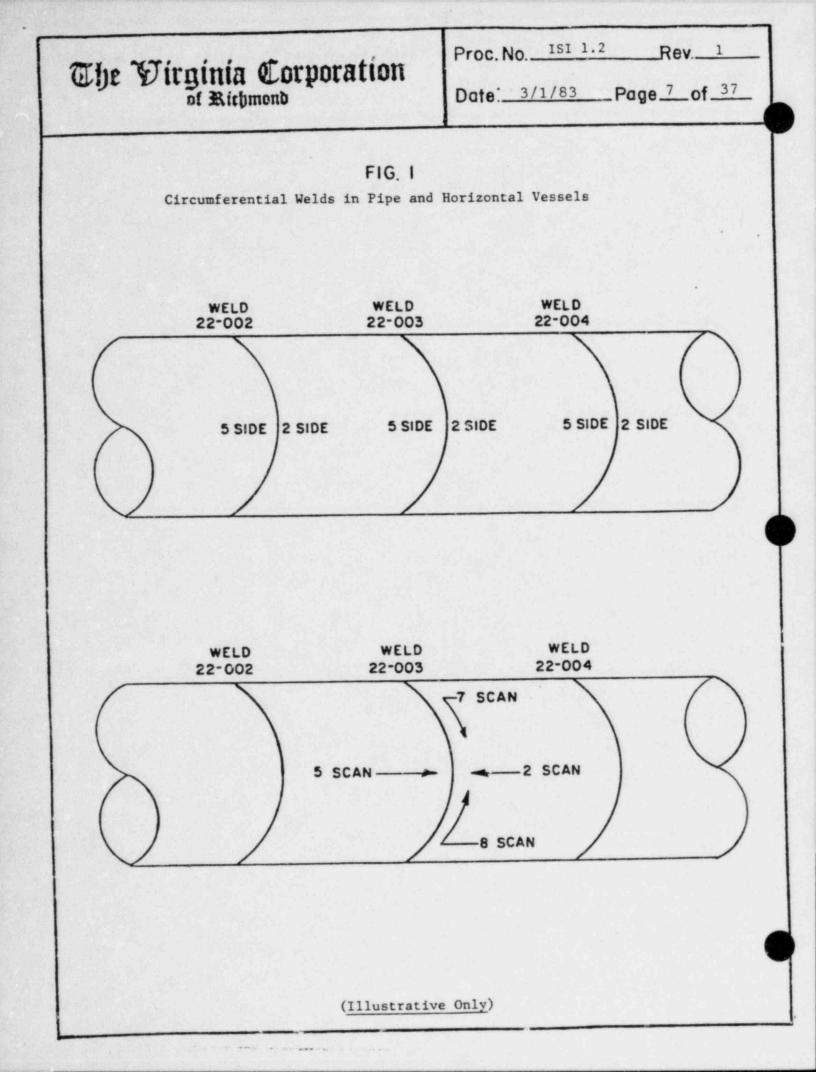
6.

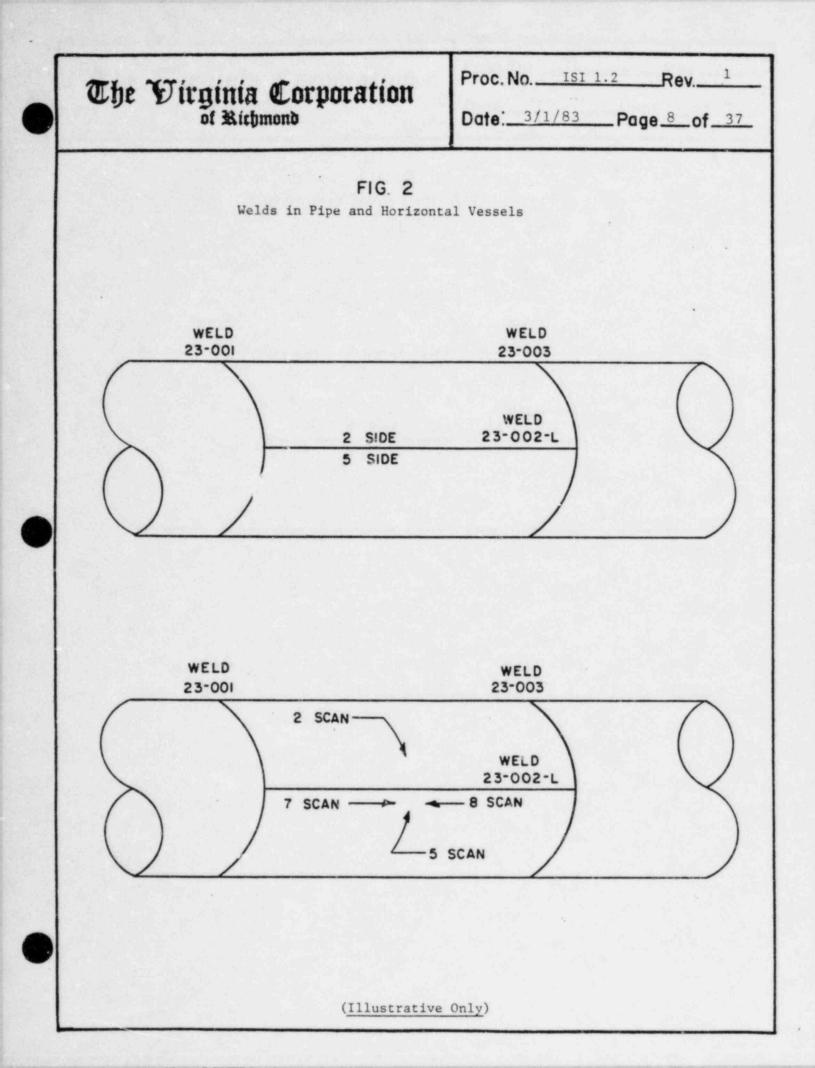
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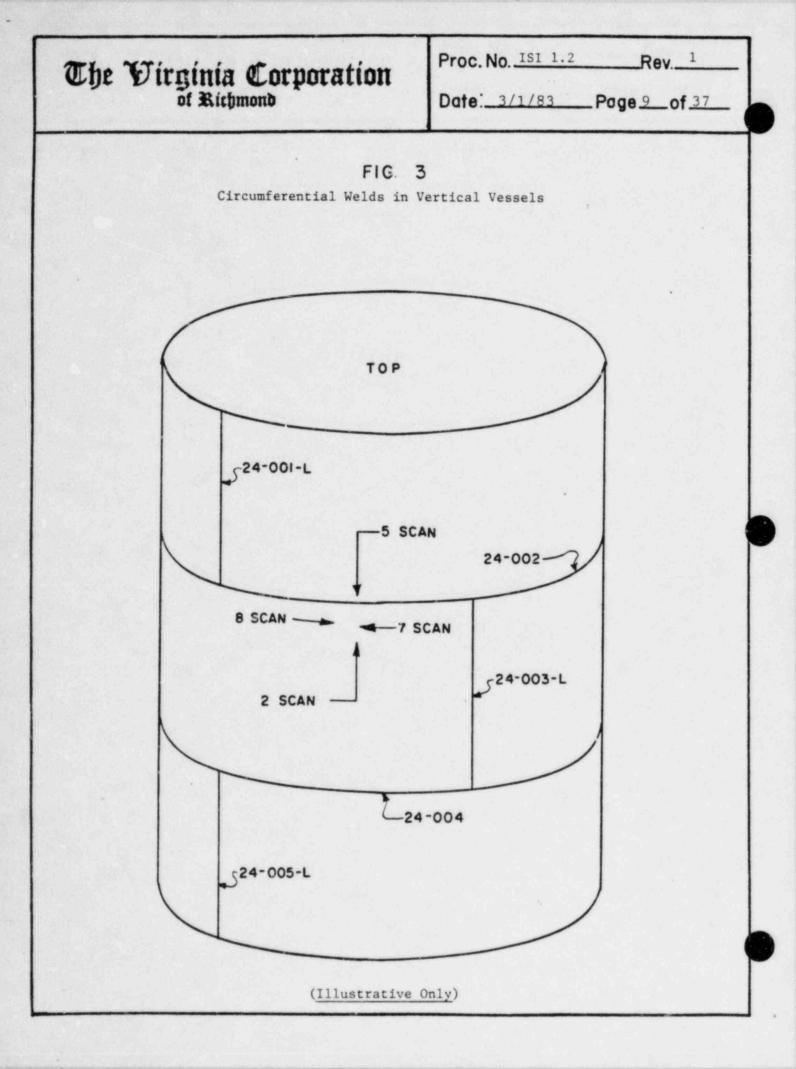
Date: 3/1/83 Page 5 of 37

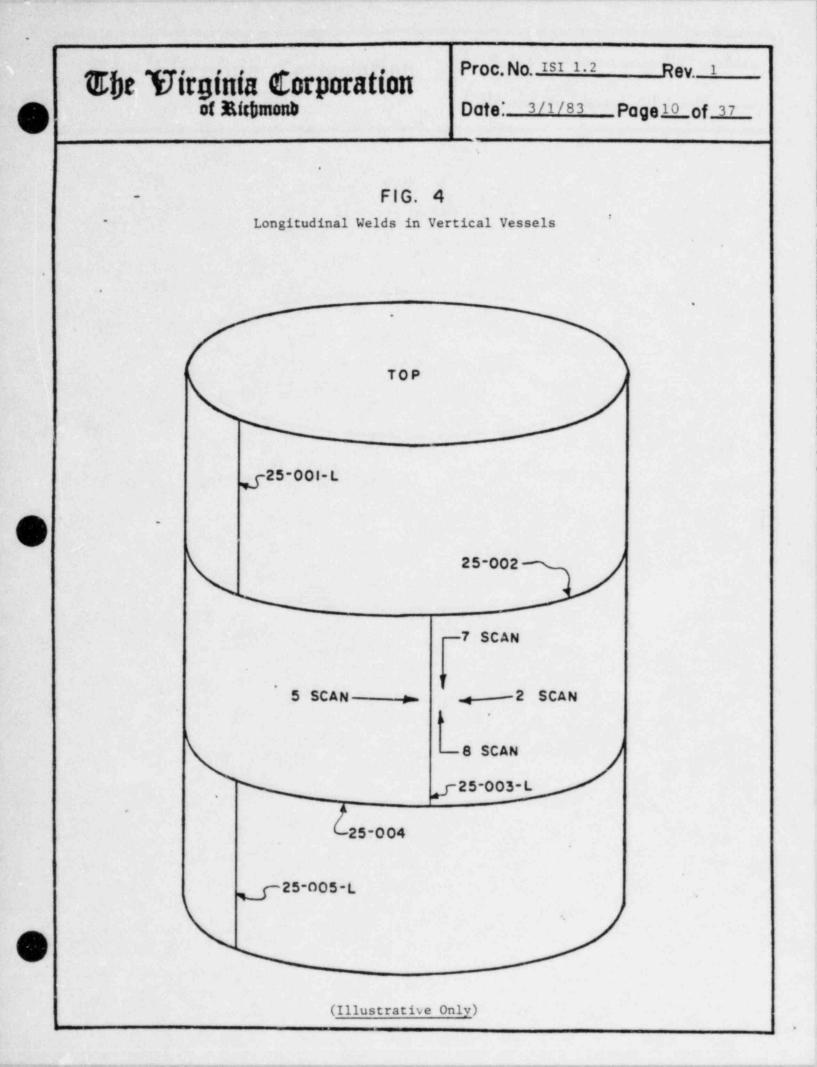
Site Sun	
	ervisor as long as the change does not directly
affect t	he test results. This change shall be initialle
by the V	irginia Corporation Site Supervisor and the
Authoriz	ed Nuclear Inservice Inspector.
Form num	bers (see attachments for completion requirement
100 Seri	es - Ultrasonic Data Reports
UT-101	UT Examination Report
UT-101a	UT Examination Report Continuation Sheet
UT-102	UT Examination Report Indication Record
UT-103	UT Data Sheet for Studs and Bolts
UT-104	UT Indication Record for Studs and Bolts
UT-105	UT Data Sheet for Thickness Measurement
UT-105a	UT Data Sheet for Thickness Measurement -
	Continuation Sheet
UT-106	UT Data Sheet for Reactor Coolant Pump Flywheel
UT-107	UT Indication Record for Reactor Coolant Pump
UT-107	UT Indication Record for Reactor Coolant Pump Flywheel
UT-107	
	Flywheel
<u>200 Seri</u>	Flywheel es - Liquid Penetrant Data Reports
<u>200 Seri</u> PT-201	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report
<u>200 Seri</u> PT-201 PT-202	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record
<u>200 Seri</u> PT-201 PT-202 PT-203	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record
200 Seri PT-201 PT-202 PT-203 300 Seri	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record
200 Seri PT-201 PT-202 PT-203 300 Seri	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record <u>es - Magnetic Particle Data Reports</u>
200 Seri PT-201 PT-202 PT-203 300 Seri MT-301	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record <u>es - Magnetic Particle Data Reports</u> Magnetic Particle Examination Report
200 Seri PT-201 PT-202 PT-203 300 Seri MT-301 MT-302	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record <u>es - Magnetic Particle Data Reports</u> Magnetic Particle Examination Report Magnetic Particle Weld Indication Record
200 Seri PT-201 PT-202 PT-203 300 Seri MT-301 MT-302 MT-303	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record <u>es - Magnetic Particle Data Reports</u> Magnetic Particle Examination Report Magnetic Particle Weld Indication Record
200 Seri PT-201 PT-202 PT-203 300 Seri MT-301 MT-302 MT-303	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record <u>es - Magnetic Particle Data Reports</u> Magnetic Particle Examination Report Magnetic Particle Weld Indication Record Magnetic Particle Indication Record Magnetic Particle Indication Record
200 Seri PT-201 PT-202 PT-203 300 Seri MT-301 MT-302 MT-303 400 Seri VT-401	Flywheel <u>es - Liquid Penetrant Data Reports</u> Liquid Penetrant Examination Report Liquid Penetrant Weld Indication Record Liquid Penetrant Indication Record <u>es - Magnetic Particle Data Reports</u> Magnetic Particle Examination Report Magnetic Particle Weld Indication Record Magnetic Particle Indication Record Magnetic Particle Indication Record

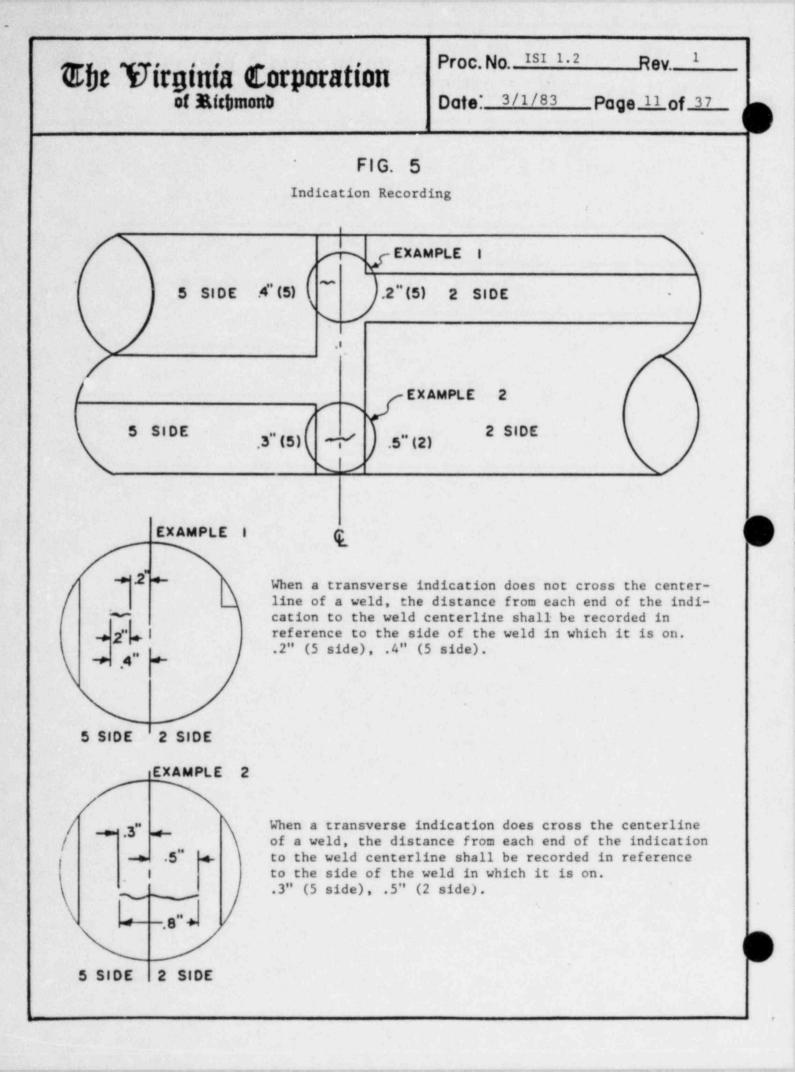
The Virginia Corporation of Richmond	Proc. No Rev Date: Page _6_ of7
<u>600 Series - Eddy Current</u> ET-601 Eddy Current Cal	<u>Examination Data Reports</u> ibration Sheet - "Thickness"











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Rev 1

ULTRASONIC EXAMINATION REPORT

(Form UT 101)

Block No. Information Required 1. Customer name 2. Plant name 3. Plant unit number Unit loop or zone identity (whichever is applicable) 4. 5. Sketch or Iso. number Examination procedure number and appropriate revision 6. and field change numbers 7. Examination surface (i.e. I.D., O.D.) 8. Operator's signature and level certifying the examinations have been performed in accordance with the referenced procedure and field changes 9. Signature of VCR site supervisor, after reviewing data sheet ! 10. Date of examination 11. Identity of component or system 12. Size of pipe, diameter and schedule 13. Weld type (i.e. butt, fillet) Calibration block identification number 14. 15. Couplant manufacturer, type, batch number 16. Search unit serial number 17. Search unit size 18. search unit frequency 19. Search unit angle as determined from IIW block 20. Instrument manufacturer 21. Instrument serial number 22. UT instrument reject control setting when calibrated. If any change between 0°, 45° or 60° calibration, an additional ultrasonic examination data form shall be completed. UT instrument damping control setting when calibrated. 23. If any change between 0°, 45° or 60° calibration, an additional ultrasonic examination data form shall be completed. 24. UT instrument frequency control setting 25. Model of UT instrument 26. UT instrument rep. rate control setting when calibrated. If any change between 0°, 45° or 60° calibration, an additional ultrasonic examination data form shall be completed. UT instrument filter control setting when calibrated. 27. If any change between 0°, 45° or 60° calibration, an additional ultrasonic examination data form shall be completed. 28. Search unit cable length.

The Virgin	ia Corporation	Proc. No. <u>ISI 1.2</u> Date: <u>3/1/83</u>	Rev. 1 Page 13 of 37						
	ULTRASONIC EXAMINAT (Form UT 101) o								
Block No.	Information Required								
29.	If any change betwee	setting when calibra en 0°, 45° and 60° ca sonic examination dat	libration,						
30.	Indicate if continuation sheet(s) have been utilized for recording weld examination data.								
31.	Indicate if any field changes are applicable to the procedure utilized for the performance of the examination. If none, enter none.								
32.		eference reflector lo							
33., 35., 39.		ude from reference re	flector						
34., 36., 40.	The location of the	reference reflector l axis of the CRT scr							
37., 41.	When required by pro- from the search unit point on the block of the location of the the search unit is p reference response.	ocedure, enter the di t sound exit point to surface, vertically a reference reflector, positioned for the ma	the bove when ximum						
38., 42.	When required by procedure, enter the distance from the search unit sound exit point to the point on the block surface, vertically above the location of the reference reflector, when the search unit is positioned to obtain a response of 50% of that from the reference response.								
43.	used to establish DA								
44.	calibration checks.	calibration and subs							
45.	reflectors required	ns and amplitudes of for the examination, be represented on th ic instrument.	and complete						
46.	Enter additional comments or sketches, if necessary, to aid in the interpretation of the examination. If additional comments or sketches are not necessary, "not applicable" (N/A) shall be written in the blank.								

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Virginia Corp.			Customer 1 Procedure 6 7 Component/Piping System 11			Plant Unit 3				Loop/2	onelso		ng No.					
		Proce				Exam Surface 7		e Examiner/Lev 8			VCR Supervisor 9				Date 10			
9	Compo	Pipe Size Weld				d Type 13				peBatch No								
Continuat	ion Sheet	Attache	d		T	ransduc	er	0°	4	5.	60°			nstru	nent			
Yes No 30				Contraction of the second second	/N		16	1	Street, and the local division of the local	16	Mfgr.		20	Model		25		
Field Changes: Yes No 31 If Yes, Number					ize	T	17	1		17	S/N	sector and the sector was not set of the sector of the	21	RepRa		26		
				F	requenc	y I	18	1		18	Reject	The subscription of the local division of the local division of the local division of the local division of the	2	Filte	r	27		
					eam Ang		19	1	Sold Street Stre	19	Damp	And in case of the local division of the loc	3	Coax	_	28		
Calib	ration 0	0		2 & 5	Scan			7	8 3			Freq.	2	4	Video		29	
alibration				Soun						Sound En				Calibration Checks				
leflector	Signal		Signal		Poin	oint To:		nal		Poin	t To:)°		5°		60°	
ocation		Sweep	Amp.	Sweep	Scribe Line	50% DAC	Ап	np. 1	Sweep	Scrib Line		In	Out	In	Out	In	Out	
32	33	34	35	36	37	38	39	_	40		42		1		4		-	
36	33	57	35	1.26	5/	36		+	40	41		1	1		7		1	
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												<u> </u>						
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		8- 6- 4- 2-	DAC 45			10 ⁻ 8- 6. 4- 2-	8 6 45 4			Additional Comments/Sketch 46								
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ULTRASONIC EXAMINATION REPORT - CONTINUATION SHEET

(Form UT 101a)

Β.	10	C	k	No	
-	-	-	-	-	-

1.	Customer name
2.	Plant name
3.	Plant unit number
4.	Unit loop or zone identity (whichever is applicable)
5.	Sketch or Iso. number
6.	Examination procedure number and appropriate
	revision anf field change numbers
7.	Examination surface (i.e. I.D., O.D.)
8.	Operator's signature and level certifying the
	examinations have been performed in accordance
	with the referenced procedure and field changes
9.	Signature of VCR site supervisor, after reviewing data sheet
10.	Date of examination
11.	Identity of component or system
12.	Size of pipe, diameter and schedule
13.	Weld type (i.e. butt, fillet)
14.	Calibration block identification number
15.	Couplant manufacturer, type, batch number
16.	The identity (as given on the referenced Iso.) of the weld being examined.
17.	Indicate that the required straight beam examination of the area to be examined has been performed,
	partially performed or not performed. (i.e. Yes, Par., No)
18., 19., 20.	Indicate here that the required angle beam
	examinations have been performed, partially
	performed or not performed. (i.e. Yes, Par., No)
21.	Indicate here that the required calibrated
	straight beam examination has been performed,
	partially performed, or not performed. (i.e. Yes, Par., No)
22.	Enter any limitations preventing the performance
	of the required examinations such as obstructions
	due to pipe supports, valves, etc. Indicate
	approximate extent of limitation.
23.	Indicate the condition of the base mccal adjacent
	to the weld. (i.e. smooth, as cast, hand ground, etc.)
24.	Indicate the condition of the weld surfaces.
	(i.e. as welded, ground flat)

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Rev. 1

ULTRASONIC EXAMINATION REPORT - CONTINUATION SHEET

(Form UT 101a) cont'd

Block No.

Information Required

25.

OI

Indicate the results of the examination by inserting "NI", "NRI" or "RI" in accordance with the referenced procedure in block No. 6.

26.

Indicate the results of the visual examination performed prior to the ultrasonic examination. The results shall be reported by inserting the notation "Sat." for satisfactory, or "Unsat." for unsatisfactory results. If "Unsat" results are recorded, a Visual Examination Indication Record, Form VT 402, shall be completed.

27.

Indicate any information necessary to explain unusual examination problems. The presence of any geometric reflectors, as determined by the reference procedure, shall be noted here with an explanation of approximate extent. (i.e. root geometry 100% DAC 360°)

~				Ultr	asonia	Exar	nination R	eport -	- Cont	inuation S	Sheet	Page	of	
The			Custo	mer	1	Plant	2		Unit 3	Loop/ Zone	Iso/Drawing	No.		
M	irgini	a Cor	p.	1.4	6		7		ner/Lev 8	el	VCR Super	visor 9	Date 10	
				Compon	ent/Pi	ping Sy 11	stem	Pipe Size W		Weld Type 13	Cal. Block	k Couplant: Type & Ba 15		
	Base Metal	Statement of the Address of the Addr	And in case of the local division of the loc		0				Base		Examinat			
000004400	Scan	2	2	1 4 8	0	Inspe	ction Limit	ations	Metal	Weld	UT	Visual	Remarks	
	17	18	19	20	21	-	22		23	24	25	26	27	
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		Virgini of Rich Base Metal Scan	Virginia Cor of Richmond Base Metal Scan 2	Base Metal Scan Scan Din 5	The Custor Virginia Corp. Proced Of Richmond Compon Base Scan Direction Scan 2 5 7 & 8	The Customer Virginia Corp. Procedure 01 Richmond 6 Component/Pin 6 Base 6 Metal Scan Direction Scan 2 5 7 & 8 0	The Customer 1 Virginia Corp. of Richmond Procedure E: Component/Piping Sy 11 Base Metal Scan Direction 11 Scan 2 5 7 & 8 0 Inspe	CustomerPlantVirginia Corp.CustomerPlantVirginia Corp.CustomerPlantProcedureExam Surface67Component/Piping System11Base Metal ScanScan Direction SInspection Limit	The Customer Plant 2 Virginia Corp. of Richmond Procedure Exam Surface Exami Component/Piping System Pipe S 12 Base Metal Scan Direction Inspection Limitations	The Customer Plant 2 Virginia Corp. of Richmond Procedure Exam Surface Examiner/Lev 6 7 8 Component/Piping System Pipe Size 12 Base Scan Direction Inspection Limitations Surfac Scan 2 5 7 & 8 Inspection Limitations	The Customer Plant 2 Unit 3 1 Virginia Corp. of Richmond Customer 1 Plant 2 Unit 3 1 Virginia Corp. of Richmond Component/Piping System Exam Surface Examiner/Level Component/Piping System Pipe Size Weld Type 11 12 13 Base Metal Scan Direction Inspection Limitations Surface Condition Base Metal Weld Weld	Virginia Corp. of Richmond Procedure Exam Surface 7 Examiner/Level 8 VCR Super Component/Piping System Pipe Size Weld Type Cal. Block 11 12 13 14 Base Scan Direction Inspection Limitations Surface Condition Examination 0 1 1 1 1 1 1	The Customer Plant Plant Q Unit Goop/Zone Iso/Drawing Virginia Corp. of Richmond Procedure Exam Surface Examiner/Level VCR Supervisor 0 6 7 8 VCR Supervisor 0 0 0 Procedure Exam Surface Examiner/Level VCR Supervisor 0 0 0 11 12 13 14 14 12 13 14 14 14 14 14 12 5 7 & 8 0 Inspection Limitations Base Metal Weld UT Visual	

The	Virginia	Corporation
	of Rich	

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ULTRASONIC EXAMINATION REPORT INDICATION RECORD (Form UT 102)

Block No.	Information Required
1.	Customer name
2.	Plant name
3.	Plant unit number
4.	Unit loop or zone identity (whichever is applicable)
5.	Examination procedure number, including appropriate
	revisions and field change numbers
6.	Operator's signature and level certifying the
	examinations have been performed in accordance with
	the referenced procedure and field changes.
7.	Signature of VCR site supervisor, after reviewing data sheet
8.	Date of examination
9.	Identity of component or system
10.	Sketch or isometric number
11.	Calibration block identification number
12.	The identity (as given on the referenced Iso.) of
	the weld being examined
13.	If more than one indication is found in any given
	weld, each indication shall be given a number, i.e.
	(Ind. 1, 150°-155°), (Ind. 2, 170°-175°).
14.	Record the maximum signal response from the indication
	either as a percentage of DAC (i.e. 90% DAC) or
	in terms of the attenuation required to reduce the
	signal amplitude to the DAC level, (i.e. 100% DAC
	& [-8dB]).
15	Measure and record the distance from the reference
1.5.	
	datum point or weld c to the nearest end of the
	indication at the point where the signal has reduced
16.	to 50% of maximum response.
10.	Similarly, measure and record the distance from
	the datum point or weld 4 , , but from the furthest end of the indication.
17.	Measure and record the distance from the sound entry
	point to the referenced datum point or weld ¢ at
	the minimum depth location
18.	Measure and record the sound path distance (sweep
	reading) to the half amplitude point of the reflector
	nearest to the surface.
19.	Measure and record the distance from the sound entry
	point to the referenced datum point or weld 4 at
	the maximum depth location
20.	Measure and record the sound path distance to the
	half amplitude point of the reflector farthest from
	the surface (i.e. maximum depth)
	ene burrace (fret maximum depen)

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ULTRASONIC EXAMINATION REPORT INDICATION RECORD

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(Form UT 102) cont'd

Information Required
Record the search unit refracted angle in the material as calculated on the IIW block
Indicate the direction that the search unit is pointing when recording the indication (i.e. 2,5,7, 8)
Measure and record the thickness of the base metal on the 2 side of the weld.
Measure and record the thickness of the weld at or near the centerline of the weld
Measure and record the thickness of the base metal on the 5 side of the weld
Record any information necessary to help characterize the indication





						Ultrasonic Examination Report Customer Plant								Indication Record				
Virginia Corp.					1				2			Unit 3	Loop / Zone 4					
1	Y	1	of Richmo	corp.		and the second se	5		iner/Le	6		VCR	Super	7	Date 8			
66	-				Comp	onent/Pi	ping Sys 9	stem	ISO	Drawin	1g No. 10			Cal. Standard	No./Thickness			
Veld No.		Max.% DAC		ation gth To	S.U.	m Depth Sweep Reading	S.U.	n Depth Sweep Reading	Beam Angle	Beam Dir.	Base Mo Thick 2 Sid	ness	Weld Thick		Remarks			
12	13	14	15	16	17	18	19	20	21	22	23		24	25	26			
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		_																
	-																	
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UL	TRASONIC DATA SHEET		
	(Form UT-	103)	1
Block No.	Informatio	n Required	

lock No	Information Required
1.	Customer name
2.	Plant name
3.	Unit number
4.	
4.	Unit loop or zone ide.tity (whichever is applicable)
5.	Examination procedure number, including appropriate
	revisions and field change numbers
6.	Operator's signature and level, certifying the
	examinations have been performed in accordance
	with the reference procedure and field change
7.	Date of examination
8.	Identity of component or system
9.	Sketch or Iso. number
10.	VCR supervisor signature after reviewing data
	sheets
11.	Calibration block identification number
12., 13., & 14.	Check appropriate surface used for calibration
15.	Transducer serial number
16.	Transducer size
17.	Transducer frequency
18.	
19.	Transducer beam angle
20.	Transducer wave mode (longitudinal or shear)
	Ultrasonic instrument manufacturer
21.	Ultrasonic instrument serial number
22.	Ultrasonic instrument reject control setting when
	calibrated
23.	Ultrasonic instrument damping control setting when
	calibrated
24.	Ultrasonic instrument frequency control setting
	when calibrated
25.	Ultrasonic instrument video setting when cali-
	brated
26.	Ultrasonic instrument model identification
27.	Ultrasonic instrument rep. rate control setting
	when calibrated
28.	Ultrasonic instrument filter control setting when
	calibrated
29.	Douplart type and batch number
30.Coa	Coaxial cable length and type of connector (i.e.,
	BNC to BNC, BNC to MD, etc.)
31., 32., 33.,	
& 34.	Enter signal amplitude from reference reflector
	as a percentage of FSH

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The Virginia Q of Richmo	Corporation nd	Proc. No Rev. 1 Date: Page 19 of 37
ULTR	ASONIC DATA SHEET	FOR STUDS AND BOLTS
	(Form UT-10	3) cont'd.
35. & 36.	Total of all cali used to establish	brated gain control settings
37., 38., 39.,	coco co cocabilsi	and curve
& 40.	The location of t along the horizon sweep location)	he reference reflector signal tal axis of the CRT screen (i.e.,
41.	Signal to noise r	atio between the threaded area notch reflector at the refer-
42.		al calibration and subsequent
43.		aterial being tested
44. & 45.	andicate the resu	lts of the examination in accord- erenced procedure in block no. 5
46.	Indicates any unu	sual examination problems
47. & 48.		lts of the visual examination the ultrasonic examination

The Virginia Corp. or RICHMOND						ASONIC FO TUDS &	R				
Customer	1		Plant	Plant 2			3		Loop/Zone 4		
Procedure 5			Examiner	/Level	6			Dote	7		
Component/Pip		ISO Drav	ving No. 9		VCR Sup	ervisor	10	7			
CALIBRATIC	N BLOC	ĸ	TRANSDUCE		1	L	NSTRU				
Cal. Block No.	11		S/N 14	and a second second	.Manu.	20		Model	26		
CALIBRATIO	N SURFAC	E	Size 16	and the second second second second	S/N	21		Rep Rate	27		
Flat End	12		Freq 17		Reject	22		Filter	28		
Groved End			Beom Angle		Damp	23		Couplant	29		
Other:	14		Wave Mode	19	Freq	24		Batch No.	1999 B. C.		
			second	Sheor D	THE OWNER WHEN THE PARTY NAMED	25		Coax	30		
DAC Point	"B "	32	%FSH				Swee	p Position_	38		
DAC Point DAC Point		<u>33</u> 34	%FSH	RE	F DB	36	_ Swee	p Position_	39		
	"D"	34	%FSH	RE	F DB	.36 Calibrati	_ Swee	ep Position_ ep Position_	39 40		
DAC Point	"D"	34	%FSH	RE	F DB		_ Swee	ep Position_ ep Position_ cks 42	39 40		
DAC Point	"D"	34	%FSH	RE	IN IN		Sweet	ep Position_ ep Position_ cks 42 T T	39 40		
DAC Point	"D"	34	%FSH 41 -		IN IN IN	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T	39 40		
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DAC Point Signal To No ITEM NO.	"D" bise Ratio	34	%FSH 	MINATION	IN IN IN RESUL	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T T	39 40 2 18 UAL UKBAT		
DAC Point Signal To No	"D" bise Ratio	34	%FSH 	MINATION	IN IN IN N RESUL	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T T	39 40 2		
DAC Point Signal To No ITEM NO.	"D" bise Ratio	34	%FSH 	MINATION	IN IN IN RESUL	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T T	39 40 2 18 UAL UKBAT		
DAC Point Signal To No ITEM NO.	"D" bise Ratio	34	%FSH 	MINATION	IN IN IN RESUL	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T T	39 40 2 18 UAL UKBAT		
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DAC Point Signal To No ITEM NO.	"D" bise Ratio	34	%FSH 	MINATION	IN IN IN RESUL	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T T	39 40 2 18 UAL UKBAT		
DAC Point Signal To No ITEM NO.	"D" bise Ratio	34	%FSH 	MINATION	IN IN IN RESUL	Calibrati	Sweet	ep Position_ ep Position_ cks 42 T T T	39 40 2 18 UAL UKBAT		

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tion	Proc. No		Rev

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ULTRASONIC INDICATION RECORD FOR STUDS AND BOLTS

(Form UT 104)

Block No.

1.	Customer name
2.	Plant name
3.	Unit number
4.	Unit lcop or zone identity (whichever is applicable)
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level certifying the
	examinations have been performed in accordance with the reference procedure and field change
7.	Date of examination
8.	Identity of component or system
9.	Sketch or Iso, number
10.	Signature of VCR site supervisor, after reviewing data sheet
11.	Record maximum indication signal amplitude
12.	Record indication depth from examination surface
13.	Enter indication location from one end, indication radial and/or circumferential location, and length of indication
14.	Indicate by the use of a sketch, the approximate location of indication.

Virginia C of Richmon		Ultrasonic Indication Record for Studs & Boits				
ustomer 1	Plant 2	Unit 3	Loop /Zone			
Procedure 5	Examiner/Level 6	出去。 出版	Date 7			
Component/Piping System	Iso/Drawing No. 9	VCR Supervise	or 10			
	pproximate location of ind	ication.				
		ication.				
		ication.				
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ndicate by sketch below an		ication.				
		ication.				
		ication.				
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The	Virginia Corporation	Proc. No	ISI 1.	2
eye	Virginia Corporation of Richmond	Date:3		

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ULTRASONIC DATA SHEET FOR THICKNESS MEASUREMENT

(Form UT 105)

Block No.	Information Required
1.	Customer name
2.	Plant name
3.	Unit number
4.	Unit loop or zone number (whichever is applicable)
5.	Identity of component or system
6.	Operator's signature and level, certifying that the examinations have been performed in accordance with the reference procedure and field change
7.	Date of examination
8.	Examination procedure number, including appropriate revisions and field change numbers
9.	Sketch or Iso. number
10.	Signature of VCR site supervisor after reviewing data sheet
11.	Indicate if there is a continuation sheet attached or not
12.	Instrument manufacturer
13.	Model of UT instrument
14.	Instrument serial number
15.	UT instrument reject control setting when calibrated
16.	UT instrument damping control setting when calibrated
17.	UT instrument frequency control setting
18.	UT instrument rep. rate control setting when calibrated
19.	UT instrument filter control setting when calibrated
20.	UT instrument video setting when calibrated
21.	Couplant manufacturer, type, batch number
22.	Transducer manufacturer
23.	Transducer size
24.	Transducer frequency
25.	Transducer serial number
26.	Length and type of coaxial connector
27.	Reference gain setting
28.	Enter calibration block thickness when using only one thickness to calibrate. Enter thinner calibration block thickness
29.	when using more than one material thickness for calibration Enter only thicker calibration block thickness when using two calibration thicknesses
30.	Enter calibrated range of instrument in inches
31.	Enter times of initial, verification and final calibrations
32.	The identity (as given on the reference iso.) of the weld being examined
33.	All thickness readings recorded shall be referenced to the actual location of the reading by means of a sketch or sketches on the report form

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The Virginia Corporation of Richmond

Block No.

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ULTRASONIC DATA SHEET FOR THICKNESS MEASUREMENT (Form UT 105)

34.	Enter thickness reading taken directly on the weld
35.	Enter thickness reading taken on the scan 2 side
36.	Enter thickness reading taken on the scan 5 side
37.	Use this space for drawing sketches to identify measuring points

Custome	r	1	P	lant	2	Un		3 Loop/Zone			
Compone	ent/Pipi	ing System	E	xaminer/Le				Date			
Procedu	ure	5	Iso/Drawi	ine No IV	CR Superv		1		7		
	8 150/Drav				10			Yes 11	et Attache		
		1		Equi	pment						
	Inst	rument			Transduce	r	1	Calibra	tion		
Mfgr.		12		Mfgr.	Siz	e	10-1	Block			
Model		13		2	2	23		Block	28		
s/N 14				Freq.					30		
Refect		15		1	24	4	AND DESCRIPTION OF		And States and States and States		
Damp.		16		Serial No		-		alibration	Checks		
Freq.		17			25	,		31			
Rep. Ra	ite	18		Coax. Cab	le 7/						
Filter Video		19			26						
Couplar		20 21		Cain	27						
Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Examinat Reading Scan 5	ion Resul Weld Number	Mcas. Point	Reading Weld	Reading Scan 2	Reading Scan 5		
					1			bean 2	Jocan 5		
32	33	34	35	36	32	33	34	35	36		
Sketch/	Identif	ication		37	<u>1</u>	<u> </u>			<u> </u>		

The V	irginia Corporation of Richmond	Proc. No Rev1 Date: Page 23 of 37
	ULTRASONIC DATA SHEET FOR TH	HICKNESS MEASUREMENT
	(Form UT 10	05a)
lock No.	Information Re	equired
1.	Customer name	행동 영상 전에 가지 않는 것 같아요. 이 것 같아요. 이 것
2.	Plant name	생활 수 있는 것 같은 것 같은 것 같은 것 같이 있는 것 같이 있다.
3.	Unit number	
4.	Unit loop or zone (which	ever is applicable)
5.	Identity of component or	
6.	Operator's signature and	level certifying that the examinations cordance with the reference procedure
7.	Date of examination	
8.		mber, including appropriate revisions
9.	Sketch or Iso. number	
10.	Signature of VCE site sup	pervisor after reviewing data sheet
11.	Enter identity (as given being examined	on the reference Iso.) of the weld
12.		ecorded shall be referenced to the eading by means of sketch or sketches
13.	Enter thickness reading t	aken directly on the weld
14.	Enter thickness reading t	
15.	Enter thickness reading t	
16.		ng sketches to identify measuring points

Custom	er	-		P1.	ant		Contin	it	Page of			
Component/Piping System Examiner						2		3		2009/	4	
Procedu	5					6		Date		7		
		8		1150	b/Drawing	^{NO.} 9		R Supervi	Lsor	10		
					Examinat	ion Resul	ts					
Weld Number	Meas. Point	Reading Weld	Readin Scan 2		Reading Scan 5	Weld Number	Meas. Point	Reading Weld		ding n 2	Reading Scan 5	
11	12	13	14		15	11	12	13	1.	4	15	
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Sketch	Identi	fication					1	1	1		1	
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The Virginia Corporation of Richmond

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UT DATA SHEET FOR REACTOR COOLANT PUMP FLYWHEEL

(Form UT-106)

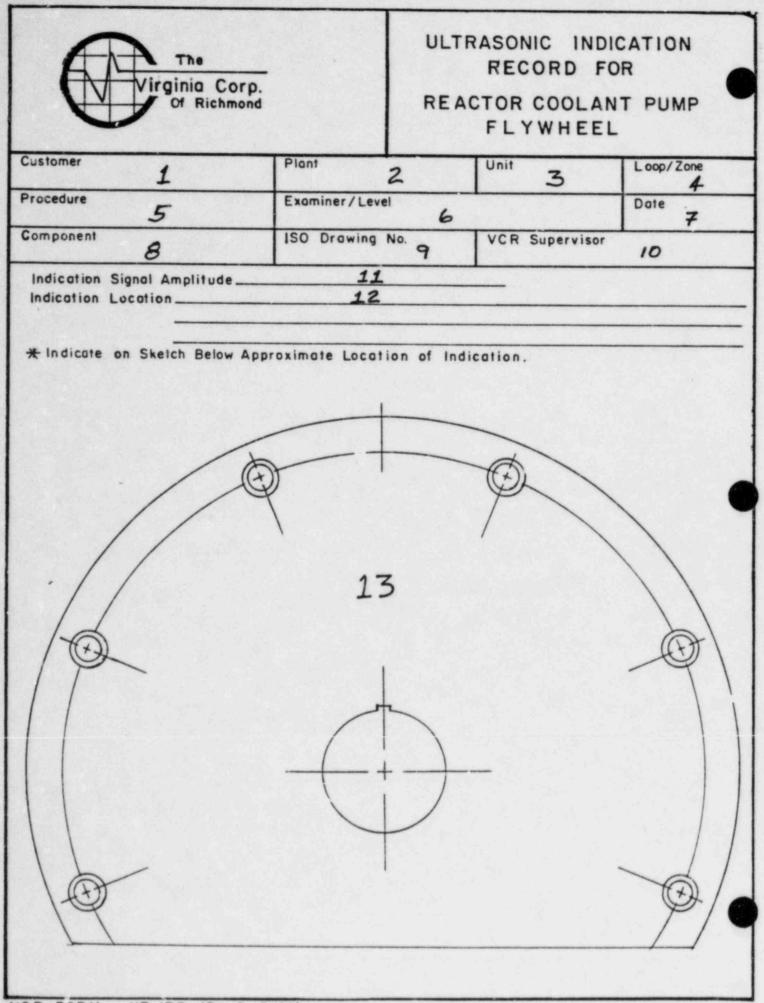
Block No.

	2011년 1월 11일 11일 11일 11일 11일 11일 11일 11일 11일
1.	Customer name
2.	Plant name
3.	Plant unit number
4.	"nit loop or zone identity (whichever is appli-
	cable)
5.	Identity of component
6.	Operator's signature and level certifying the
	examinations have been performed in accordance
	with the referenced procedure and field changes
7.	Date of examination
8.	Examination procedure number and appropriate
	revision and field change numbers
9.	Sketch or iso. number
10.	Signature of VCR supervisor after reviewing data
11.	Transducer serial number
12.	Transducer serial number
13.	Transducer frequency
14.	Transducer angle
15.	Transducer wave mode (longitudinal or shear)
16.	Instrument manufacturer
17.	Instrument serial number
18.	UT instrument reject control setting when cali-
	brated
19.	UT instrument damping control setting when cali-
	brated
20.	UT instrument frequency control setting when
	calibrated
21.	UT instrument video setting when calibrated
22.	Model of UT instrument
23.	UT instrument rep. rate control setting when
	calibrated
24.	UT instrument filter control setting when cali-
	brated
25.	Coax cable length and type of connector (i.e.,
23.	BNC to BNC. BNC to MD, etc.)
26.	
	Couplant type and batch number
27.	The time of initial calibration and subsequent
	calibration checks
28.	Enter signal amplitude from near hole as a per-
	centage of FSH

The Virgini	a Corporation	Proc. No Rev. 1 Date: Page 25_ of
	UT DATA SHI REACTOR COOLANT I	
	(Form UT-106) (cont'd.
29.	Enter signal amp centage of FSH	litude from far hole as a per-
30.		ibrated gain control settings
31. & 32.	The location of	the near and far hole reflector e horizontal axis of the CRT
33.	Pump number being	g examined
34. & 35. 36.	Results of the ex Indicate any unus	xamination sual examination problems

		he inia C	orp.			CTOR (FOR	A SHEET	
Customer	1		Plont	:	2	Unit	3	Loop/Zone	7
Component	5		Exomine	r/Leve	6			Date 7	
Procedure	8		ISO Dray	wing N		VCR SU	pervisor	10	
TRANSD	UCER		1	NSTR	UMENT		Colib	ration Checks	27
S/N	11	Monu,	16		Model	22			61
Size	12	S/N	17		RepRote	23	In	Out	
Freq	13	Reject	18		Filter	24	In	Out	
Beam Angle	14	Domp	19		Coax	25	In	Out	
Wove: long	15	Freq	20		Couplant	26			
long []	shear 🗌	Video	21		Batch No	20	In	Out	
			С	ALIBR	RATION				
Near Hole.	28		_%FSH		Sweep Posi	tion	31		
Far Hole_	29		_%FSH					And a second	-
Ref. Goin_	-		dB		Sweep Post				-
FLYWHEE	L		EXAN	and the second se	ION RES	ULTS			
DESIGNAT			NRI	RI	1	COMI	MENTS		
	33		34	35			71		
			1 JT	32			36		
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The Virgi	nia Corporation Richmond	Proc. No Rev1 Date: J/1/83 Page _26 of _37			
	UT INDICATION R REACTOR COOLANT				
	(Form UT	-107)			
Block No.	Informati	on Required			
1. 2. 3. 4. 5. 6.	cable) Examination proce revisions and fie Operator's signat examination was p	identity (whichever is appli- dure number and appropriate ld changes ure and level certifying the erformed in accordance with			
7. 8. 9. 10. 11. 12. 13.	Date the examinat Identity of compo Sketch or iso. nu Signature of VCR Amplitude of the Location of the i	mber supervisor after reviewing data indication			



Th	e Virgin	tia Corporation Richmond	Proc. No Rev Date: 3/1/83 Page 27 of 37
		LIQUID PENETRANT EXA	MINATION REPORT
		(Form PT	201)
Blo	ock No.	Information R	Required
	1. 2. 3. 4.	Customer name Plant name Unit number	
	5.	Examination proced revisions and fiel	identity (whichever is applicable) dure number, including appropriate d change numbers
	6.	examinations have	are and level certifying the been performed in accordance e procedure and field change
	7.	Date of examinatio	m
	8.	Identity of compon	ent or system
	9. 10.	Sketch or Iso. num Signature of VCR s sheet	ber te supervisor, after reviewing data
	11.	Manufacturer of fam	mily grouping
	12. 13.	Material designation	on, i.e. Spoccheck, Dubl-check batch no. for penetrant, i.e.
	14.	Material type and 1 D-100/21J674	batch no. for developer, i.e.
	15.	DR-60/60H425	batch number for remover, i.e.
	16.	Iso., if applicable	ation (as given on the reference e) of the weld or item being examined
		o the examination	tions affecting the performance
	18.	a check in "NRI" i are found, or a che indications are for	of the examination by inserting f no reportable indications eck in "RI" if reportable und. If the "RI" block is a form PT 202 for indication
	19.	Indicate here the reamination in accord of ISI 5.1. The reaction shall be recorded h satisfactory ("Sat ("Unsat.") block, w "unsat." is checked	results of performing an ordance with the requirements esults of the visual examination by inserting a check in .") or unsatisfactory whichever is applicable. If d, complete a Visual Examination form VT 402 or VT 403

	Virginia C of Richmon	orp.			juid Pe ninatior			(
Customer	4	Plant 2		Unit	3	L	oop/Zor	ne
rocedure	5	Examiner/Level				Date	7	
component/Pip:	ing System	ISO Drawing No		VCR	Supervis	or		
	8	1	9				0	
	Manufacturer	Туре	Batch	No.				
Penetrant	11	12	13		_			
Developer	-11	12	14					
Remover	11	12	15					
Weld/Item						sults	And the second law lines are under	esults
Number		Comments			NEI	RI	SAT.	UNSA
16		17			18	18	19	19
					_			
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								-

Form PT-201

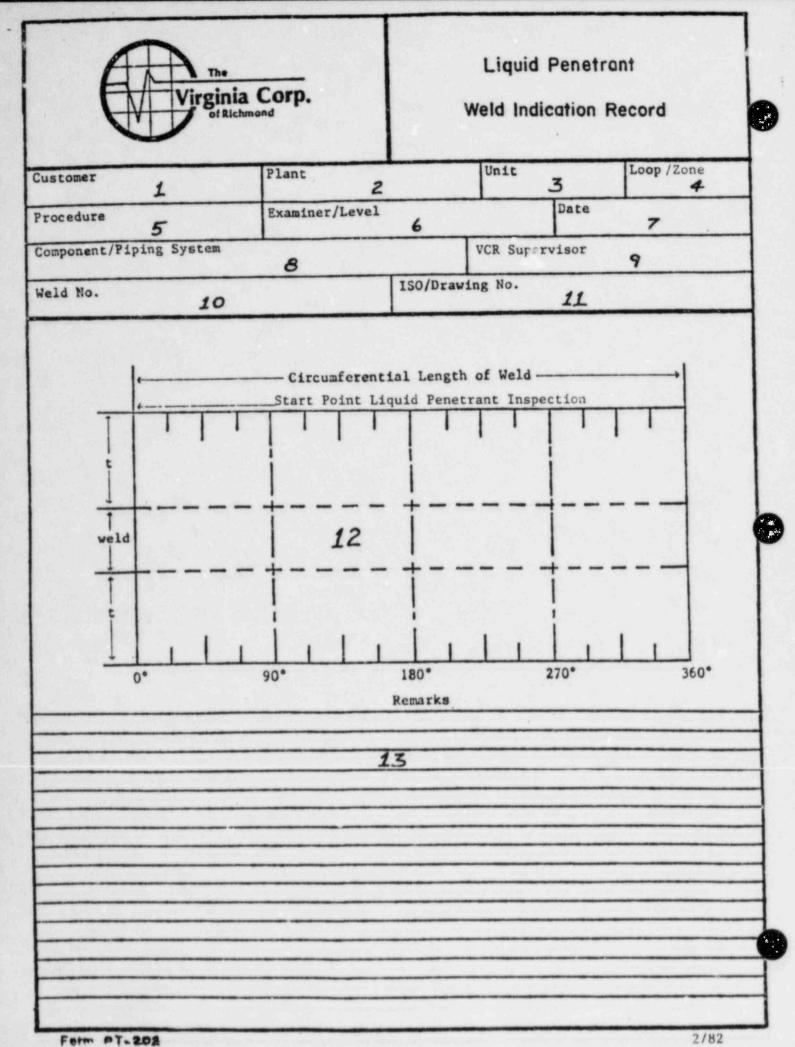
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The Virginia Corporation of Richmond	Date: 3/1/83	Page. 28 of 37

LIQUID PENETRANT WELD INDICATION RECORD

(Form PT-202)

llock No.	Information Required
1.	Customer name
2.	Plant name
2.	Unit number
4.	Unit loop or zone identity (whichever is applicable)
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level certifying the examinations
	have been performed in accordance with the reference procedure and field change
7.	Date of examination
8.	Identity of component or system
9.	Signature of VCR site supervisor, after reviewing data sheet
10.	The identity (as given on the reference drawing) of the weld to be examined
11.	Sketch or Iso. number
12.	Draw approximate size and location of indication in relation to weld
13.	Identify any conditions relating to the indication(s) drawn in space 12



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LIQUID PENETRANT INDICATION RECORD

(Form PT-203)

Block No.

1.	Customer name
2.	Plant name
3.	Unit number
4. 5.	Unit loop or zone number
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level, certifying that the examination has been performed in accordance with the referenced procedure and field change
7.	Date of examination
8. 9.	Identity of component or system
9.	Signature of VCR site supervisor after reviewing data sheet
10.	Enter identity of the item being examined
11.	Sketch or Iso. number (if applicable)
12.	Use this area to sketch the location and dimensions of the indication
13.	Use this area for any comments pertinent to the examination

	Virginia Co	orp.		Liquid		
Customer	1	Plant 2		Unit	3	Loop/ Zone
procedure 5		Examiner/Level	6		Date	7
Component/Pip:	ing System	8		VCR Supe	rvisor	9
Item No.	10		ISO/Dra	wing No.	1	1
		11	2			
Comments:		1	2			

The Virgi	nia Corporation Richmond	Proc. No. <u>ISI 1.2</u> <u>Rev. 1</u> Date: <u>3/1/83</u> Page <u>30 of 37</u>
	MAGNETIC PARTICLE EXAN	MINATION REPORT
	(Form MT 1	301)
Block No.	Information Re	equired
1.	Customer name	
2.	Plant name	
3.	Unit number	
4.	Unit loop or zone :	identity (whichever is applicable)
5.		ure number, including appropriate .
	revisisons and fiel	
6.	Operator's signatur	re and level certifying the
		been performed in accordance
	with the reference	procedure and field change.
7.	Signature of VCR si	ite supervisor, after reviewing data
	sheet	
8.	Date of examination	n
9.	Identify of compone	ent or system
10.	Sketch or Iso. num	
11.	Condition of surface	ce, (i.e. smooth, as cast,
	etc.)	
12.	Enter, or check in	the appropriate blank, the
	type of particles	being used for the examination
13.	The manufacturer of	f the particles being used
14.		being used, i.e. 8A
15.	Batch number of mag	gnetic particles
16.	Type of magnetizin;	g current being used for
	examination	
17.		f the magnetizing unit
18.	. Type or model of m	agnetizing unit being used
	for the examination	
19.		of the magnetizing unit
20.		blank when using continuous
	or residual magnet	
21.		er the amount of amperage used
		turns in the coil used during
	examination	
22.		ter the tip spacing in inches
	and the amperage u	
23.		er the pole spacing in inches
24.		iven in the referenced Iso., if
		weld or item being examined
25.		tions affecting the performance
		s. Describe any reportable
		entify any separate sheet or
	photograph utilize	d to record indications.

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The Virginia Corporation of Richmond

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MAGNETIC PARTICLE EXAMINATION REPORT

(Form MT 301)

Block No.

Information Required

26.

27.

Enter the results of the examination by inserting a check in "NRI" if no reportable indications are found, in "RI" if reportable indications are found. If the "RI" block is checked, complete a form MT-302 for indication record.

Indicate here the results of performing an examination in accorance with the requirements of ISI 5.1. The results of the visual examination shall be recorded by inserting a check in the satisfactory ("Sat.") or unsatisfactory ("Unsat.") block, whichever is applicable. If "Unsat." is checked, complete a Visual Examination Indication Record, form VT 402 or VT 403

	Virgin	ia Corp.						Partic on Repo		
Customer 1		Plant	2	2	Un	it	3	L	oop /Zor	ne 4
Procedure 5		Examiner/Lev	vel 6	1	VCR Sup	ervis	or 7		Date	-
Component /Piping	System	9		150 Dray	ing No.		Sur	face Co	ndition 11	
Type of Particles Wet Dry	s 12 Visible	Flouresc		13	r	Type 14	2		Number	
Current 16 AC DC HW	Mac	thine Mfr. 17		Type/	Model 18		Seri	al No.		
Magnetization 20 Continuous Residual	Coil 21	Amps. No. Turns	Prods 22	_Spacing Amps.	Yoke 23	Spa	acing			
Weld / Item		Com	ments				MT Re NRI	sults	VT Re: Sat	Unsa
24			25			-	26	26	27	27
and the second se		the second se	and the second s	NAME OF TAXABLE PARTY AND DESCRIPTION OF TAXABLE PARTY.	And the second state of the second state				The second secon	-

Form MT-301

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MAGNETIC PARTICLE WELD INDICATION RECORD

(Form MT 302)

Block No.

1.	Customer name
2.	Plant name
3.	Unit number
2. 3. 4.	Unit loop or zone identity (whichever is applicable)
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level certifying that the examinations have been performed in accordance with the referenced procedure and field change
7.	Date of examinations
7. 8. 9.	Identity of component or system
9.	Signature of VCR site supervisor, after reviewing data sheet
10.	The identity (as given on the reference Iso.) of the weld being examined
11.	Sketch or Iso number
12.	Draw approximate size and location of indication in relation to weld
13.	Identify any conditions relating to the indication(s) drawn in space 12.

Customer	1	Plant 2	Unit	3 Loop/Zone
Procedure	5	Examiner/Level 6		Date 7
Component/Pip		8	VCR Superv	visor 9
Weld No.	10	ISO/D	rawing No.	11
t weld t t 0	· · · ·			
		Remarks		
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MAGNETIC PARTICLE INDICATION RECORD

(Form MT-303)

Block No.

1.	Customer name
2.	Plant name
3.	Unit number
4.	Unit loop or zone number
5.	Examination procedure number, including appropriate revisions and field change number
6.	Operator's signature and level, certifying that the examination has been performed in accordance with the reference procedure and field change
7.	Date of examination
8.	Identity of component or system
9.	Signature of VCR site supervisor, after reviewing data sheet
10.	Enter identity of the weld being examined
11.	Sketch or Iso. number (if applicable)
12.	Use this area to sketch the location and dimensions of the indication
13.	Use this area for any comments pertinent to the examination

Virginia Corp. of Richmond			Magnetic Particle Indication Record			
Customer	1	Plant 2		Unit	3	Loop/Zone
Procedure	5	Examiner/Level	6		Date	7
Component/Pipin	ng System	8		VCR Supe	rvisor	9
Item No.	10		ISO/ Drav	ving No.	11	
Comments:		12				
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The Virgi	inia Corporation Richmond	Proc. No. 1SI 1.2 Date: 3/1/83	Rev. 1 Page <u>34</u> of <u>37</u>				
	VISUAL EXAMINATI	ON REPORT					
	(Form VT 4	01)					
lock No.	Information Re	quired					
1.	Customer name						
2.	Plant name						
3.	Unit number						
4.	Unit loop or zone identity (whichever is applicable)						
5.		Examination procedure number, including appropriate					
6.		revisions and field change numbers					
0.	Operator's signature and level certifying that the						
	examinations have been performed in accordance with the referenced procedure and field change.						
7.	Date of examination	re and riero change.					
8.	Identity of component or system						
9.	Sketch or Iso. number						
10.	Signature of VCR site supervisor, after reviewing data sheet						
11.	The identity (as given on the referenced Iso., if applicable) of the weld or item being examined						
12., 13.	Enter the results of the examinations by inserting a check in "NRI" if no reportable indications are noted, and "RI" if indications are found.						
14.	Identify any condition of the examinations. or identify any separa to record indications.	s affecting the perfo Describe any reportab te sheet or photograp	le indications				
15.	Identify any visual ai examination of each it	ds utilized to aid in	the				

B

		The firginia (Corp.	Visual Examination Report for Category VT-1			
Customer	;	1	Plant 2	2	Unit 3	Loop/Zone 4	
Procedur	re	5	Examiner/Level	6		Date 7	
Componer	nt/Pipin	ng System	ISO Drawing No.	the second s	VCR Superviso	^{or} 10	
Weld/ Ttem	Exam I NRI	RI	Comme	nts		lisual Aids	
11	13	13	14			15	
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The Virginia Corporation of Richmond

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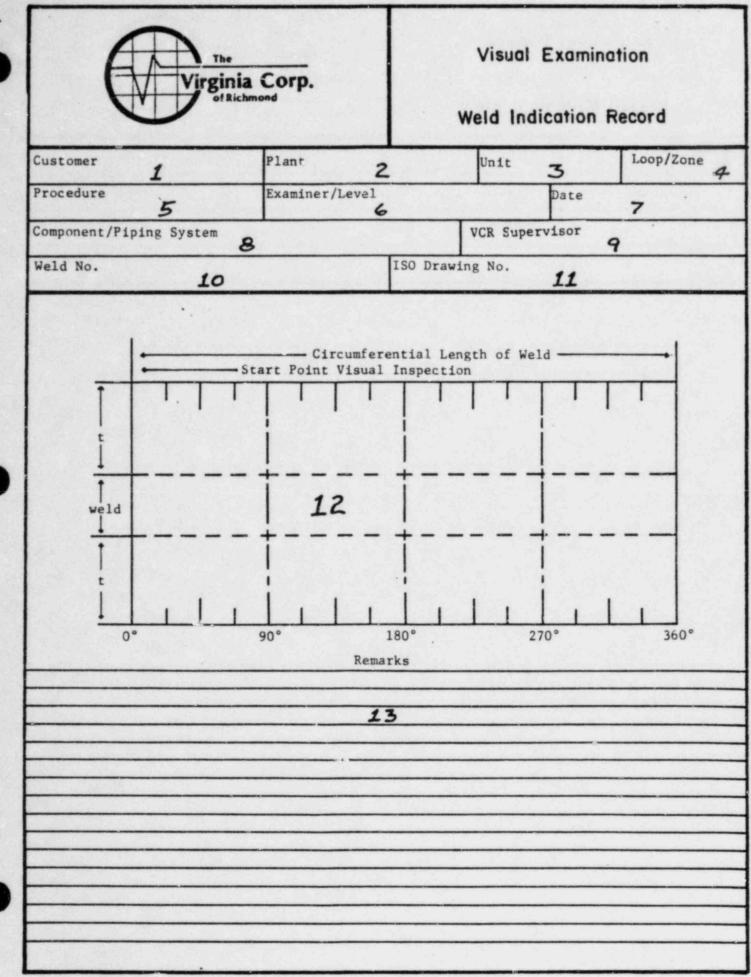
VISUAL EXAMINATION WELD INDICATION RECORD

(Form VT 402)

-					
H 1	10	-	L#	- NI -	
D 1	. U	1	σ.	No	2 4
-	1.17	-		-	

Information Required

1.	Customer name
2.	Plant name
3.	Unit number
4.	Unit loop or zone identity (whichever is applicable)
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level certifying the examinations have been performed in accordance with the reference procedure and field change
7.	Date of examination
8.	Identity of component or system
9.	Signature of VCR site supervisor, after reviewing data sheet
10.	The identity (as given on the referenced Iso) of the weld being examined
11.	Sketch or Iso. number
12.	Draw approximate size and location of indication in relation to weld
13.	Identify any conditions relating to the indication(s) drawn in space 12.



Form VT-402

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Block No.

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VISUAL EXAMINATION INDICATION RECORD

(Form UT-403)

Information Required

1.	Customer name
2. 3.	Plant name
3.	Unit number
4. 5.	Unit loop or zone number
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level, certifying that the examination has been performed in accordance with the referenced procedure and field change.
7.	Date of examination
7. 8.	Identity of component or system
9.	Signature of VCR site supervisor after reviewing date sheet
10.	Enter identity of the item being examined
11.	Sketch or Iso. number
12.	Use this area to sketch the location and dimensions of the indication
13.	Use this space for comments pertinent to the examination

Virginia	Corp.			Examir tion Re	
Customer 1	Plant 2		Unit	3	Loop/Zone 4
Procedure 5	Examiner/Leve	¹ 6		Date	7
Component/ Piping System	8		VCR Supe	ervisor	9
Item No. 10		ISO/Dr	awing No.	11	
	12				
omments:	13				

VT-403

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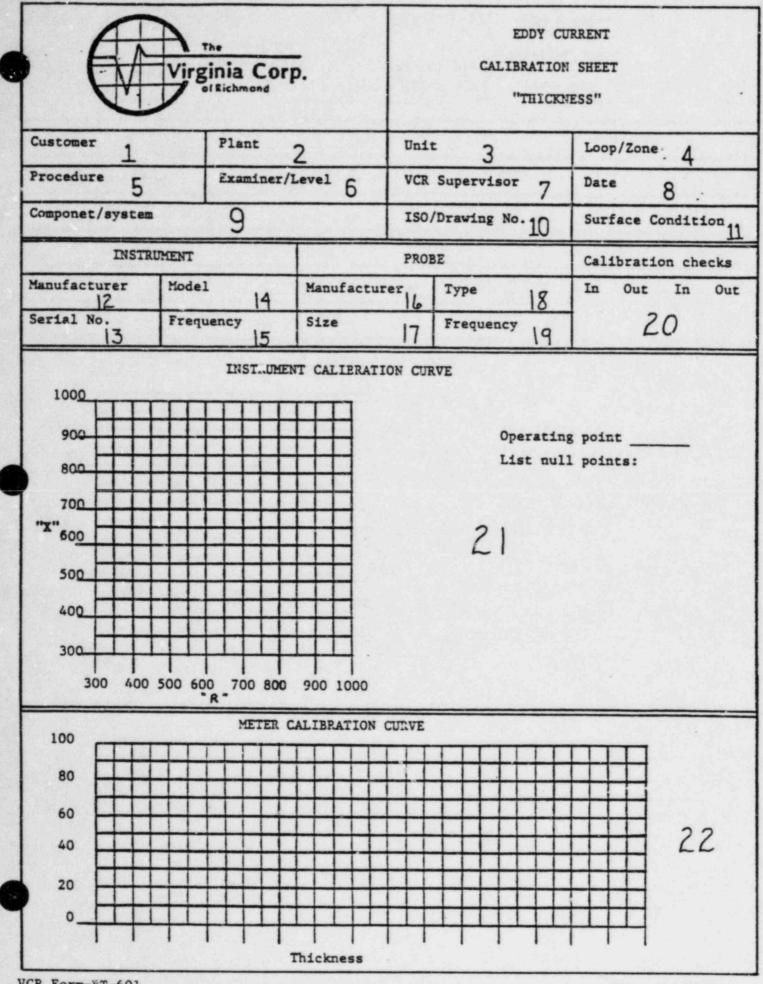
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EDDY CURRENT CALIBRATION SHEET - "THICKNESS"

(Form ET-601)

Block No.	Information Required
1.	Customer name
2. 3.	Plant name
3.	Unit number
4.	Unit loop or zone identity (whichever is appli- cable)
5.	Examination procedure number including appro- priate revisions and field changes
6.	Operator's signature and level certifying the examination has been performed in accordance with the referenced procedure and field changes
7.	Signature of VCR supervisor after reviewing data sheets
8.	Date the examination was p formed
9.	Identity of the component o. system
10.	Sketch or iso. number
11.	Surface condition of the material to be examined
12.	Instrument manufacturer
13.	Instrument serial number
14.	Instrument model
15.	Instrument frequency
16.	Probe manufacturer
17.	Frobe size
18.	Probe type
19.	Probe frequency
20.	The time of initial calibration and subsequent calibration checks
21.	Plot a meter reading to thickness conversion curve according to the procedure referenced above (block 5)
22.	Plot a meter calibration curve according to the

procedure reference above (block 5)



VCR Form-ET-601

(Rev. 0, 9/82)

Procedure Title: ULTRASONIC EQUIPMENT CALIBRATION CONFIRMATION Procedure Title: ULTRASONIC EQUIPMENT CALIBRATION CONFIRMATION Procedure No.: ISI 2.1 Procedure No.: ISI 2.1 Procedure No.: ISI 2.1 Plant Site: Waterford No. 3 Customer: Louisiana Power and Light Ebasco Services, Inc Agent Approved for Use Virginia Corporation: Homes Of Munice Approved for Use Customer: Date: 2/10/82 Rev. Date: 2/10/82 Reviewed by: Immes of Munice Reviewed by: I	. Virginia of Ricks	Corp.		(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
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1.1 This procedure is applicable to, and describes, the requirements for ultrasonic equipment qualification. This procedure is written in compliance with the ASME code, Section XI, and conforms with the addition and addenda in paragraph 2.1.

2.0 References

Scope

- 2.1 1977 Edition of ASME Boiler an | Pressure Vessel Code, Section XI, with addenda through summer, 1978.
- 2.2 The Virginia Corporation Written Practice for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3, 3/16/81.
- 2.3 The Virginia Corporation procedure ISI-1.2, Preservice Inspection Documentation Rev. (latest revision).
- 2.4 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Qualifications

3.1 Personnel performing equipment qualifications to this procedure shall be qualified and certified to at least Level I in accordance with the document specified in paragraph 2.2.

4.0 General Requirements

4.1 The instrument calibration confirmation (paragraph 6.1 and 6.2) required by this procedure shall be performed on each instrument prior to use at the Waterford 3 site, and shall not remain in effect for a period exceeding three months.

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5.0 Equipment and Material Requirements

- 5.1 Ultrasonic flaw detection instruments shall be of the A scan, pulse echo type equipped with a stepped gain control in units of 2dB or less.
- 5.2 Search units used shall be certified by the manufacturer as to the essential properties, such as the realtime waveform and spectrum analysis of the waveform. The central operating frequency shall be stated and/or displayed and shall be within ± .5 MHZ of its stated frequency. The beam angles shall be within ± 2° of nominal, as verified in paragraph 7.1.
- 5.3 Any basic calibration block may be used which satisfies the requirements of 6.0
- 5.4 Linearity verifications shall be performed with the reject "off" or minimum; "pulse length" (damping) and "filter" controls shall be adjusted for optimum results.

6.0 Instrument Qualification Method

6.1 Screen height

Linearity:

To verify the ability of the ultrasonic instrument to meet the linearity requirement of III-3110 of Section XI, position an angle beam search unit as shown in Figure 1 so that echoes can be observed from any two reflectors in a calibration block. Adjust the search unit position to give a 2 to 1 ratio of amplitudes between the two echoes, with the larger set at 80% of full screen height. Without moving the search unit, adjust sensitivity (gain) to successively set the larger echo from 100% to 20% of FSH, in 10% increments

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and read and record the amplitude of the smaller echo at each setting on the form provided in Figure 2. The settings and readings shall be estimated to the nearest 1% of full screen. Alternatively, a straight beam search unit may be used on any calibration block that will provide the signal differences.

- 6.2
- Amplitude control
 - Linearity:

To verify the accuracy of the amplitude control in the ultrasonic instrument, as required in III-3120 of Section XI, position a search unit so that an echo from one reflector in a calibration block is peaked on the screen. With the increases and decreases in attenuation shown in the following table, the echo amplitude shall be read and recorded in the form provided in Figure 2. Convenient reflectors from any calibration block may be used with angle or straight beam search units. The settings and readings shall be estimated to the nearest 1% of full screen.

Indication Set at % of Full Screen	dB Control Change
80%	-6dB
80%	-12dB
40%	+6 dB
20%	+12dB

Note:

 Minus denotes decrease in amplitude; plus denotes increase

7.0 Search Unit Qualification

7.1 Beam exit point and angle determination: An IIW, type 1, ultrasonic test block shall be used to verify the beam exit point and beam angle.

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Beam Exit Point: (refer to Figure 3) Position the search unit on surface D, scanning the quadrant. Move the search unit back and forth about the focal point until the echo from the quadrant is peaked on the screen (instrument gain and/or range may have to be adjusted to provide an echo within the screen presentation).

Mark the beam exit point on the search unit.

7.1.2 Beam Angle (refer to Figure 3) Position the search unit on surface c or d depending on the anticipated wedge angle (surface c is for wedge angles less than 65°, surface d is for angles greater than 60°). Move the search unit back and forth until the echo from the 2" hole is peaked in the screen (instrument gain and/or range may have to be adjusted to provide an echo within the screen presentation). Read the angle on the IIW block at the beam exit point, and record on the examination report.

- 7.2 Beam spreau:
 - 7.2.1

Beam spread measurement shall be performed, when required by referencing ultrasonic examination procedures, on the same calibration block used to calibrate the instrument system for examination.

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7.2.2 After the instrument is calibrated for angle beam examination, position the angle beam search unit to obtain the maximum response from the ½T hole. Move the unit toward the hole until the response from the ½T hole reaches 50% of DAC, as the DAC was constructed on the examination procedure. This can be accomplished by either constructing a 50% DAC curve or by increasing gain by 6dB, and reducing the signal amplitude to the DAC level. Record the distance from the beam point to the hole location.

7.2.3 Repeat 7.2.2, moving the unit away from the hole.
7.2.4 Repeat 7.2.2 and 7.2.3 on the ¹/₂T and 3/4T holes.

Recording, Evaluation and Reports

8.0

- 8.1 Screen height linearity and amplitude control linearity shall be reported on the form illustrated in Figure 2.
- 8.2 Screen height linearity shall be acceptable if the recorded echoes are 50% of the larger amplitude within ±5% of full screen height over at least 80% of full range (0 to 100% FSH).
- 8.3 Amplitude control linearity must be within the limits specified below:

Indication Set at % of Full Screen	dB Control Change	Indication Limits, <u>% of Full Screen</u>
80%	-6dB	32 - 48%
80%	-12dB	16 - 24%
40%	+6dB	64 - 96%
20%	+12dB	64 - 96%

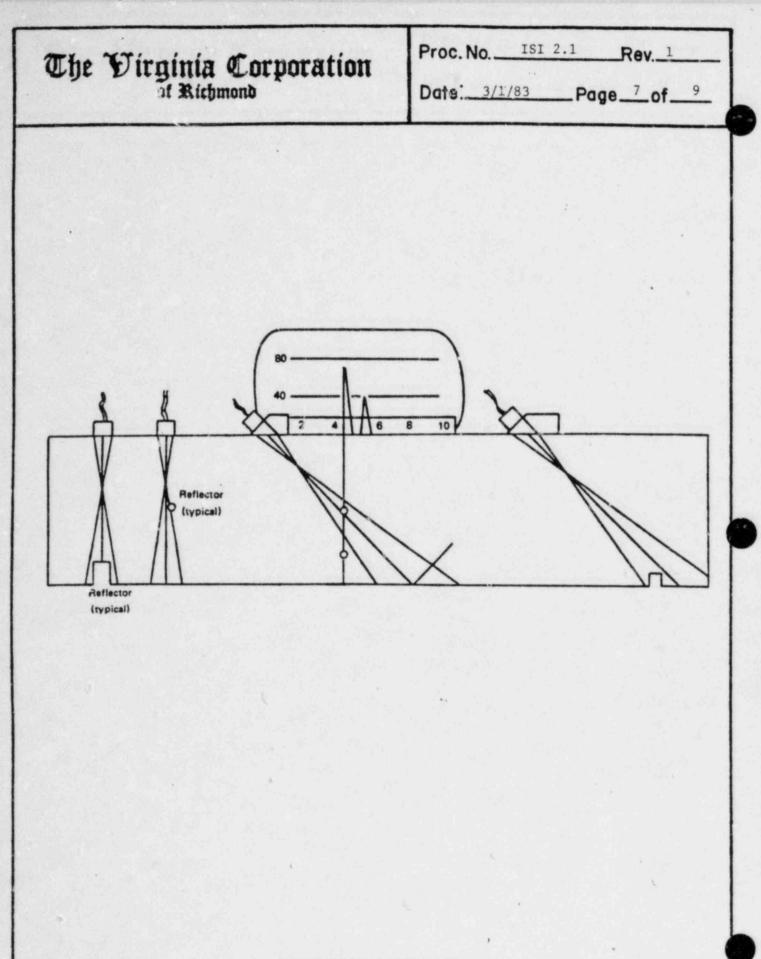
Note:

(1) Minus denotes decrease in amplitude; plus denotes increase

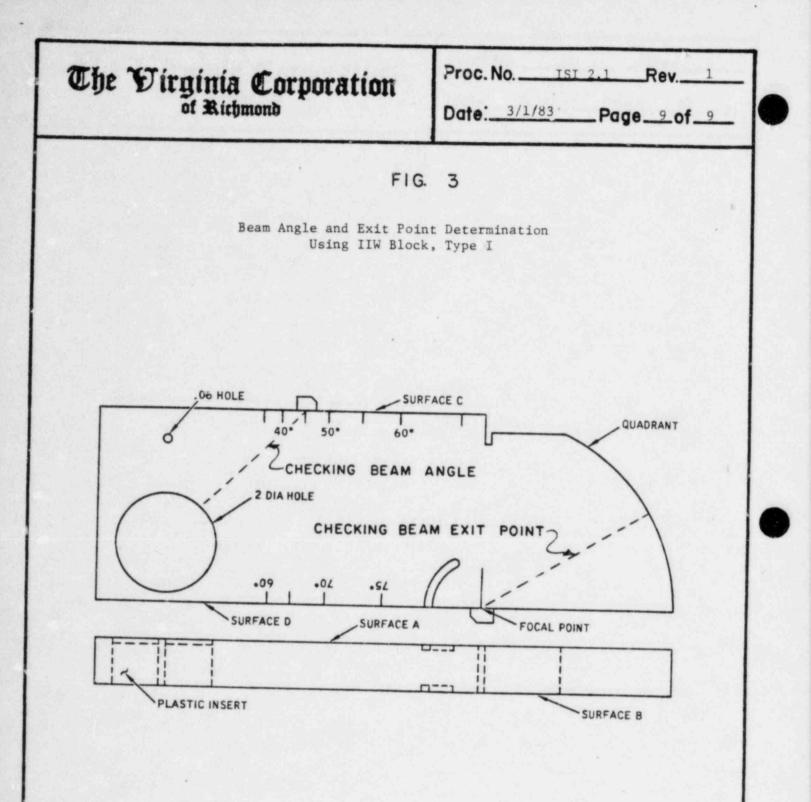
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8.4	Beam exit point shall be mar	ked on the search unit.	
8.5	Beam angle shall be within ±		

reported on the examination report.

8.6 Beam spread shall be reported on the examination report.



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Amplitude	Change	Amplitude	Limits
80% FSH	-6DB		32 - 48
802 FSH	-12DB		16 - 24
40% FSH	+6DB		64 - 96
20% FSH	+12DB		64 - 96
Note: Minus deno	otes decrease in amplitude	; plus denotes	increase.
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1.1

Scope

This procedure is applicable to, and describes, the requirements for manual ultrasonic examination of full penetration circumferential and longitudinal ferritic butt welds and adjacent base metal in piping having a nominal wall thickness of 0.2 inches to 6.0 inches, and ferritic vessels with a wall thickness of 2.0 inches and less, that are formed by extrusions, castings, forgings, or rolled plate. Material to be examined includes similar metal welds in carbon or low alloy steels. This procedure is written in compliance with the ASME Code, Section XI, Appendix III.

2.0 References

- 2.1 1977 edition of ASME Boiler and Pressure Vessel Code, Section XI, with addenda through summer, 1978.
- 2.2 The Virginia Corporation Written Practice for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3, dated 3/6/81.
- 2.3 The Virginia Corporation procedure ISI 1.2, Preservice Inspection Documentation (latest revision).
- 2.4 The Virginia Corporation procedure ISI 2.1, Ultrasonic Equipment Calibration Confirmation (latest revision).
- 2.5 The Preservice Inspection Program Plan.
- 2.6 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Qualifications

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with the document referenced in paragraph 2.2. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

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4.0 General Requirements

4.1

- The area to be examined and contacted by the search unit shall be checked to ensure that it is free of dirt, loose scale, machining or grinding particles, weld splatter, or other loose foreign matter that would impair the free movement of the search unit or affect the examination. If such conditions are detected, they will be rectified prior to conducting the examination.
- 4.2 The identity and location of welds to be examined shall be as specified in paragraph 2.5.
- 4.3 The examinations conducted in accordance with this procedure shall be done from the O.D. surface using contact methods.
- 4.4 Calibration shall be performed from the side of the calibration block which corresponds to the O.D. surface of the component. The calibration/examination surface shall be noted on the report.
- 4.5 Examinations shall consist of nominal 45 degree angle beam shear wave techniques applied in two directions parallel and two directions perpendicular to the weld axis, except where restricted by part geometry or access. A zero degree longitudinal beam shall be applied to all areas through which the angle beams must pass.

5.0 Equipment and Material Requirements

5.1 Ultrasonic flaw detection instruments shall be of the Ascan pulse echo type equipped with a stepped gain control calibrated in units of 2 dB or less, and shall be qualified to the requirements of reference 2.4 prior to use at the Waterford 3 site. Qualifications may be valid for a period not to exceed three months.

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- 5.2 Search units shall be selected in accordance with figure 1. Transducers used shall be certified by the manufacturer as to serial number, size, and central frequency. Search units shall be capable of providing the applicable calibrations as required in paragraph 6.0
- 5.3 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used for preservice examinations.
- 5.4 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.
 5.5 Calibration Blocks
 - 5.5.1 The basic calibration blocks shall be made from material of the same nominal diameter and nominal wall thickness or pipe schedule as the pipe to be examined.
 - 5.5.2 The finish on the surfaces of the calibration blocks shall be representative of the surface finishes of the piping.
 - 5.5.3 Design of the calibration blocks and reflectors shall be essentially as depicted in Figures 2 through 5. Additional reflectors may be installed provided they do not interfere with establishing the primary reference.

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5.6 Wedges used to produce shear wave for angle beam examination shall be within ±2° of the manufacturer's designated angle as required by reference 2.4.

6.0 Calibration

- 6.1 Prior to conducting examinations, the complete system to be utilized shall be calibrated on the applicable calibration block. The system shall include the ultrasonic unit (and battery pack, if applicable), cable or cables, search unit, couplant, and any other apparatus, instrument or circuit employed between the instrument and the calibration block surface. Once calibration has been established, any change to any part of the system, including the operator, will require at least a verification of the calibration, which shall be documented.
 - 6.1.1 The search unit shall be selected in accordance with Figure 1.
 - 6.1.2 The calibration block shall be identified and selected from reference 2.5.
 - 6.1.3 The temperature difference between the examination surface and basic calibration block surface shall not exceed 25° F.
 - 6.1.4 The maximum calibration indications shall be obtained with the sound beam oriented essentially perpendicular to the axis of the calibration reflector. The center line of the search unit shall be at least 3/4 in. (19 mm) from the nearest side of the block or pipe. (Rotation of the beam into a corner formed by the reflector and the side of the block may produce a higher amplitude signal at a longer beam path; this beam path shall not be used for calibration.)

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- 6.1.5 Calibration shall be performed from the surface of the calibration block which corresponds to the component surface to be examined.
- 6.2 Straight Beam Calibration for Weld Metal and HAZ
 - 6.2.1 Position the search unit for the maximum response from the ½T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ½T hole is positioned at 2.0 on the graticule.
 - 6.2.2 Position the search unit for the maximum response from the 3/4T hole. Using the sweep range control, adjust the sweep position so that the leading edge of the response from the 3/4T hole is positioned at 6.0 on the graticule.
 - 6.2.3 Repeat steps 6.2.1 and 6.2.2 until no further adjustment is necessary.

Note: Other sweep positions may be used when necessary to obtain a broader sweep range for piping systems with varying thickness.

- 6.2.4 Position the search unit for the maximum response from the hole giving the highest signal amplitude. Adjust the sensitivity control to 80% of full screen height (FSH). Mark the peak of the indication on the screen.
- 6.2.5 Position the search unit for the maximum response from the remaining hole(s). Without changing the sensitivity control, mark the peak of the indication(s) on the screen.
- 6.2.6 Connect the screen marks and extrapolate through the thickness (½T on each end) to provide a smooth DAC curve. This shall be the primary reference level.
- 6.2.7 The use of delay line transducers and/or dual transducers for evaluation of indications in the near zone is permitted if applied in accordance with the requirements of paragraph 6.1.

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	6.3	Angle Beam Calib			
				he 1/4T and 3/4T	
			hape of the DA	to establish C curve in the	
		6.3.1.	.1 Positio	n the search u	nit for the
			maximum	response from	the ½T hole.
			Using t	he sweep delay	control, adjust
			the swe	ep position so	that the leading
			edge of	the response	from the ½T
			hole is	positioned at	2.0 on the
			graticu	le.	
		6.3.1.	2 · Positio	on the search u	nit for the
			maximum	response from	the 3/4T hole.
			Using t	he sweep range	control, adjust
			the swe	ep position so	that the leading
			edge of	the response	from the 3/4T
			hole is	positioned at	6.0 on the
			graticu	le.	
		6.3.1.	.3 Repeat	steps 6.3.1.1	and 6.3.1.2
			until n	o further adju	stment is
			necessa	ry.	
		6.3.1.	.4 Positio	on the search u	nit for the maximum
			respons	e from the hold	e giving the highest
			signal	amplitude. Ad	just the sensitivity
		*	control	to 80% of ful:	l screen height (FSH).
			Mark th	e peak of the	indication on the
			screen.		
		6.3.1.	.5 Positio	n the search un	nit for the maximum
			respons	e from the rema	aining hole(s).
			Without	changing the	sensitivity control,
			mark th	e peak of the :	indication(s) on
			the scr	een.	

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6.3.1.6 Connect the screen marks and extrapolate through the thickness (¹/₂T on each end) to provide a smooth DAC curve. This shall be the primary reference level.
6.3.1.7 The sensitivity shall then be established from the I.D. surface notch by setting the signal response amplitude from the I.D. notch at the level of the DAC curve.

6.4 Angle Beam Calibration for Full Node Examination

6.4.1 The response from the I.D. and O.D. notches shall be used to establish the slope, shape, and sensitivity of the DAC curve in the following manner:

- 6.4.1.1 Position the search unit for the maximum response from the I.D. notch. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the I.D. notch is positioned at 4.0 on the graticule.
- 6.4.1.2 Position the search unit for the maximum response from the 0.D. notch. Using the sweep range control, adjust the sweep position so that the leading edge of the response from the 0.D. notch is positioned at 8.0 on the graticule.
- 6.4.1.3 Repeat steps 6.4.1.1 and 6.4.1.2 until no further adjustment is necessary.
- 6.4.1.4 Position the search unit for the maximum response from the I.D. notch. Adjust the sensitivity control to

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	SH. Mark the peak of the
	on on the screen. the search unit for the
maximum r	response from the O.D. notch.
Without o	changing the sensitivity
control,	mark the peak of the
indicatio	on on the screen.
6.4.1.6 Connect t	the screen marks and extrapolate
the DAC a	at either end for a distance

reference level.

6.5 Angle Beam Calibration for 1¹/₂ Node Examination

6.5.1 The response from the I.D. and O.D. notches shall be used to establish the slope, shape, and sensitivity of the DAC curve in the following manner:

of 1/2T. This shall be the primary

6.5.1.1 Position the search unit for the maximum response from the I.D. notch. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the I.D. notch is positioned at 3.0 on the graticule.

> Position the search unit for the maximum response from the 0.D. notch. Using the sweep range control, adjust the sweep position so that the leading edge of the response from the 0.D. notch is positioned at 6.0 on the graticule.

6.5.1.3 Repeat steps 6.5.1.1 and 6.5.1.2 until no further adjustment is necessary.

6.5.1.2

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6.5.1.4	Position the search unit for the maximum response from the I.D. notch $(1\frac{1}{2} \text{ node})$. Check that the leading edge is at
6.5.1.5	approximately 9.0 on the graticule. Position the search unit for the maximum response from the I.D. notch (1/2 node). Adjust the sensitivity control to 80% FSH. Mark the peak of the indication
6.5.1.6	on the screen. Position the search unit for the maximum response from the O.D. notch
6.5.1.7	<pre>(1 node). Without changing the sensitivity control, mark the peak of the indication on the screen. Position the search unit for the</pre>
	maximum response from the I.D. notch (1 ¹ / ₂ node). Without changing the sensitivity control, mark the peak of the indication on the screen.
6.5.1.8	Connect the screen marks and extrapolate the DAC at either end for a distance of 1/2T. This shall be the primary reference level.
variables such as weld or physical interference	t beam or angle beam techniques, preparation, weld crown width, ce may be encountered. These nated by one or more of the

following:

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	6.6.1	Reducing the dimension of the wedge edge-to-
		beam entry point.
	6.6.2	Reducing search unit size
	6.6.3	Increasing beam angle
	6.6.4	Increasing the metal path by at least an additional $\frac{1}{2}$ node.
	6.6.5	Additional surface preparation
6.7	Calibra	tion Verification
	6.7.1	A system calibration check, which is the
		verification of the instrument sensitivity and
		sweep range calibration, shall be performed at
		the beginning of each day of examinations and
		at the end of each examination category, or every
		four hours, whichever is less, and with any change
		in examination personnel.
	6.7.2	A decrease in sensitivity of 20% or 2 dB shall
		require recalibration and re-examination of all
		items examined sin e the previous acceptable
		calibration check. All data taken since the
		last calibration check shall be marked void.
	6.7.3	An increase in sensitivity of 20% or 2 dB shall
		require recalibration, re-examination, and data
		correction of all indications reported since
		the previous acceptable calibration or check.
	6.7.4	If any point on the DAC curve has moved on the
		sweep line more than 10% of the sweep division
		reading, correct the sweep range calibration
		and note the correction in the examination record.
		If recordable reflectors are noted on the
		data sheets, those data sheets shall be voided,
		a new calibration shall be recorded, and the
		voided examination areas shall be re-examined.
		Contraction of Gas Shart De re-Examined

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7.0	Examina							
	.7.1		Bean Examination for					
		7.1.1	Prior to performing					
			the base material th					
			will pass (reference					
			completely scanned w		-			
			unit to det.ct lamin					
			affect the interpret		ne resul	ts of t	he	
			angle beam examinati					
		7.1.2	The sensitivity of t					
			at a location free o					
			initial back reflect					
			the plate will be 80	percent of	f full s	çreen h	eight.	
		7.1.3	Areas containing lan	ninar indica	ations t	hat may		
			affect angle beam ex	aminations	shall b	e noted	•	
			All areas giving ind	lications ed	qual to	or grea	ter	
			than the remaining b	ack reflect	tion sha	ll be r	ecorded	
			on the data sheet.	Also, recon	rd all a	reas wh	ere	
			one or more disconti	nuities pro	oduce a	continu	ous	
			loss of back reflect	ion accompa	anied by	contin	uous	
			indication oin the s	ame plane.				
		7.1.4	Alternatively, the b	ase metal e	examinat	ion may		
			be conducted concurr	ently and a	at the s	ame cal	ibration	
			as described in para	graph 6.2,	provide	d that		
			the scan sensitivity	(2 x refer	rence) i	s at le	ast	
			as sensitive as that	required :	in parag	raph 7.	1.2.	

7.2 Straight Beam Examination for Weld Metal and HAZ

7.2.1

If the angle beam examination is restricted to a full node or 1¹/₂ node examination from one side of the weld, a calibrated straight beam examination shall be performed, providing the weld crown is flat enough to make satisfactory transducer contact.

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	7.2.2	The area to be examined sh and the adjacent base mate side of the weld to the es	erial on the restricted
		geometric configuration (shall overlap at least ter	
	7.2.3	Calibration shall be as in 6.2	가지 않아 있는 것을 물건을 다 다 가지 않는 것을 수 없을 것
7.3	Angle Be	am - Reflectors Parallel to	the Weld
	7.3.1	The primary scan for refle weld shall be 1/2 node from	ectors parallel to the
	7.3.2	Full node or l_2^1 node shall it is impossible to examin with a $\frac{l_2}{2}$ node examination the weld.	ne the required material
	7.3.3	The area of interest shall and the required amount of side of the weld (reference	f base metal on each
	7.3.4	The scan pattern shall sta area to be examined with a unit transmitting an angle to the weld axis. The sea towards and away from the calibrated beam passes the	art at one edge of the the ultrasonic search e beam perpendicular arch unit shall be moved weld such that the
		of the weld and base metal Concurrent with this scan,	l to be examined. , the search unit shall 15 ⁰ left and progressively

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the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure. The examination shall be accomplished from both sides of the weld. For welds where scanning access is not available from both sides, the L.P.& L. P.S.I. coordinator will be notified.

7.3.5 Calibration for ½ node, full node, or 1½ node examination shall be accomplished according to paragraph 6.3, 6.4, or 6.5.

7.4 Angle Beam - Reflectors Transverse to the Weld

7.4.1 The angle beam examination for reflectors transverse to the weld (examination directions 7 and 8) shall be performed on the weld crown and adjacent base material as necessary to examine the weld root by ½ node in two directions along the weld. When the weld crown configuration prohibits a ½ node examination, a full node examination shall be performed with the search unit adjacent to the weld crown, and highlighted in the data report.

7.4.2 The search unit shall be placed on one edge of the inspection area directing the angle beam into the material parallel to the weld axis. From this position the search unit

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shall be moved parallel to the weld and indexed toward the opposite side of the weld such that the next scan will cover at least 10 percent of the area covered by the previous adjacent scan. Parallel scans shall be repeated in this manner until the opposite side of the weld and base metal is reached and examined. Alternately, the search unit may be swiveled 15° right and 15° left and progressively indexed along the length of the weld such that the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass.

7.4.3 The weld and the required amount of adjacent base metal is to be fully examined by one of the techniques described in paragraph 7.4.2.

7.4.4 Calibration for ½ node, full node, or 1½ node examination shall be accomplished according to paragraph 6.3, 6.4, or 6.5.

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- 7.5 Extent of Examination
 - The volume subject to examination and extent 7.5.1 of scan length shall be in accordance with Figures 6 and 7.
 - Butt welded branch connection welds shall be 7.5.2 examined by scanning both transverse and parallel to the weld according to paragraph 7.3 and 7.4. The examination volumes are shown in Figure 9.
 - Longitudinal welds adjacent to circumferential 7.5.3 welds shall be examined by scanning both transverse and parallel to the weld according to paragraphs 7.3 and 7.4.
- 7.6 Examinations utilizing more than one DAC curve shall be examined once at the higher sensitivity, and evaluated at the applicable sensitivity.
- Rate of search unit movement shall not exceed 6" per second. 7.7
- Scanning sensitivity shall be at least twice (+6 dB) the 7.8 calibration or reference sensitivity.

Evaluation and Recording of Indications 8.0

> All indications 20% of the primary reference DAC or greater 8.1 shall be investigated to determine the shape, identity, location, and type of indication. Additionally, all indications, regardless of amplitude, which the examiner judges to be potentially indicative of a crack or lack of fusion shall be investigated to determine the shape, identity, location, and type of indication. Any indication categorized as a flaw shall be 8.1.1

recorded and reported in accordance with the requirements of reference 2.3.

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8.1.2 Any indication resulting from the metallurgical structure within the material shall be considered when assessing the effectiveness of the examination. Restrictions or variations to the examination due to the metallurgical structure shall be reported.

- 8.1.3 Geometric indications that are equal to or greater than 50% of the primary reference DAC shall be acknowledged by recording their length and location.
- 8.2 Any indication which is equal to or greater than 50% of the primary reference DAC shall be evaluated to the extent necessary to determine the size, shape, identity, and location of the reflector. Indications shall be reported in accordance with the requirements of reference 2.3.

8.3 Welds that did not receive a complete examination according to pragraph 7.0 shall have the partial examination noted on the data sheet as follows:

- 8.3.1 The extent of the examination performed shall be noted.
- 8.3.2 If the volum scric examination was performed from one side of the weld only, it shall be noted and an entry made indicating what steps were taken to ensure that the required area on the far side of the weld was examined.
- 8.3.3 The reason(s) that a specific examination was impractical shall be noted. For example, support or component restricts access, fitting prevents adequate ultrasonic coupling on one side, component to component weld prevents ultrasonic examination, etc.

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- Investigation and reporting of indications shall be performed 8.4 at the reference sensitivity. Other frequencies, sizes, or beam angles may be used as an aid in evaluating or interpreting examination results.
- Documentation of Examination 9.0
 - 9.1 All data relative to the examinations and reportable indications shall be reported in accordance with reference 2.3, and on forms similar to those shown in Figures 10, 11, and 12.

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Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

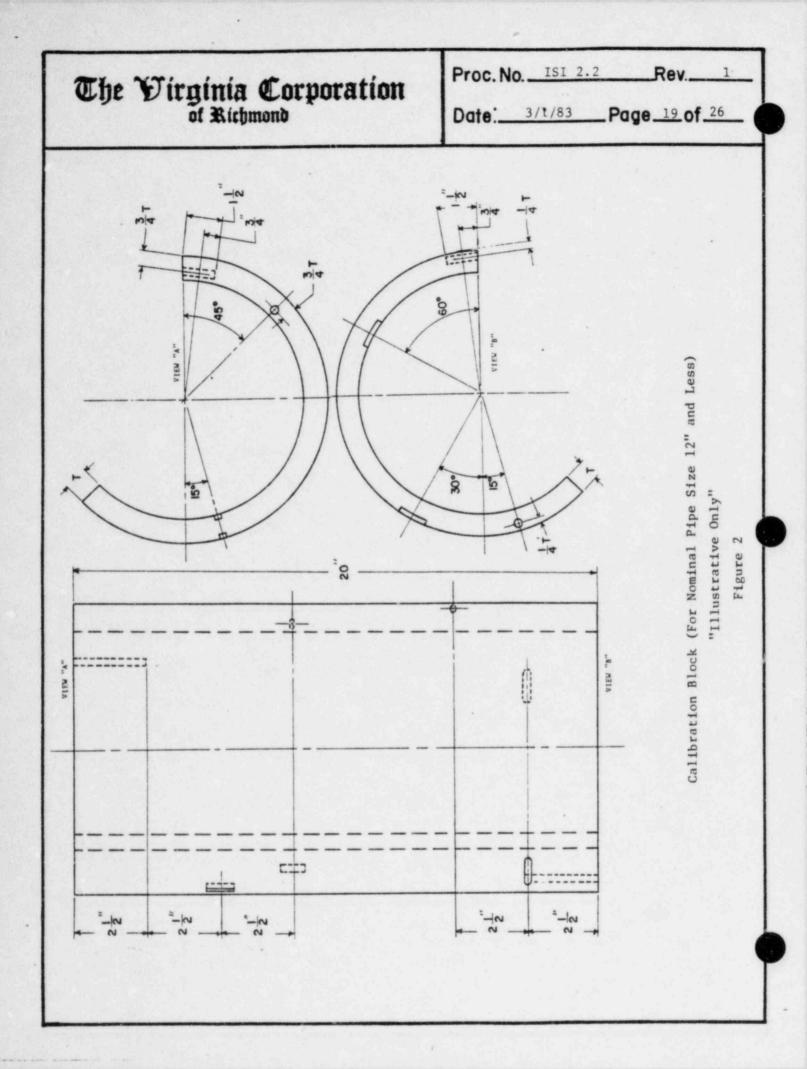
Angle Beam Examination*

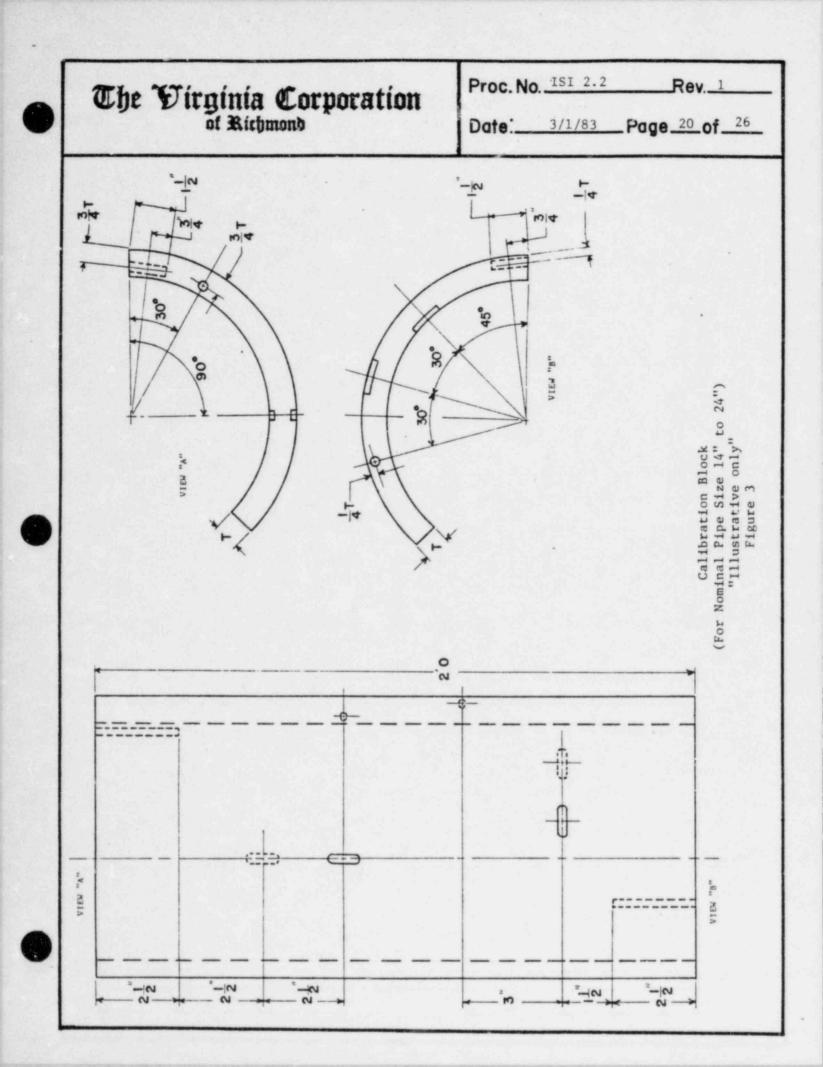
Nominal	Transducer		
Material Thickness	Maximum Size	Nominal Frequency	Nominal Angle
.250" to .400"	1/4" dia. or 1/4" x 1/4"	2.25 MHZ	45°
.400" to 1.000"	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	45°
1.000" to 1.200"	3/4" dia. or 3/4" x 3/4"	2.25 MHZ	45°
1.200" and greater	1" dia. or 1" x 1"	2.25 MHZ	45°

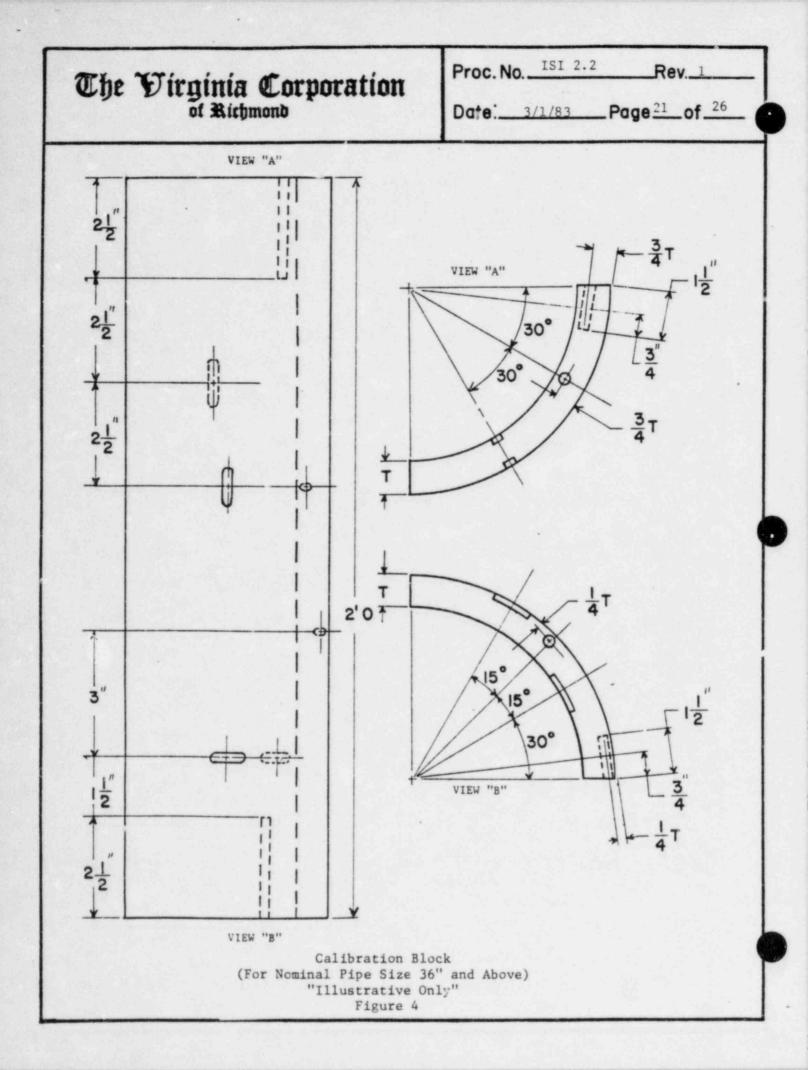
Straight Beam Examination*

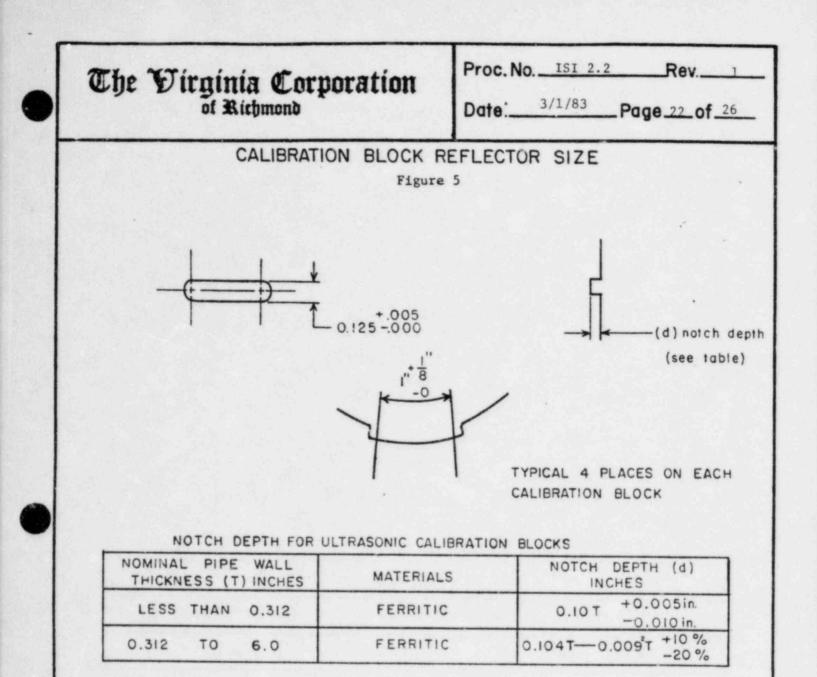
Nominal Pipe	Transducer			
Diameter	Maximum Size	Nominal Frequency		
less than 12" dia.	1/2" dia. or 1/2" x 1/2"	2.25 MHZ		
12" dia. and greater	1" dia. or 1" x 1"	2.25 MHZ		

* Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.



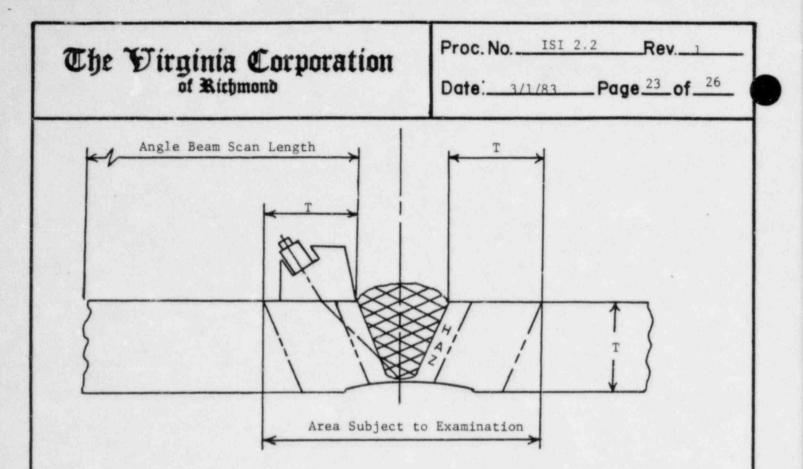






HOLE DIAMETERS FOR ULTRASONIC CALIBRATION BLOCKS

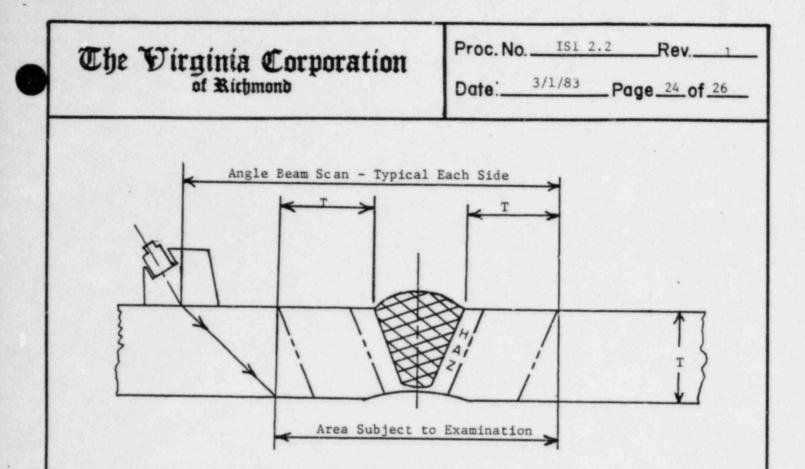
ATERIAL	THICKNESS	(T) INCHES	HOLE DIAMETER (INCHES)
UP TO	I" INCLUSIV	E	<u>3</u> " 32
OVER	I" THRU	2"	<u> </u>
OVER	2" THRU	4"	3" T6
OVER	4" THRU	6"	$\frac{1^n}{4}$



Angle beam scan length as shown above, shall be as follows:

Material Thickness	Minimum Scan Length 45°
.200 to .400	1.25"
.400 to 1.000	3.00"
1.000 to 1.200	4.00"
1.200 to 1.500	5.00"
1.500 and Greater	1.1 x 3T

Full Node Examination Figure 6



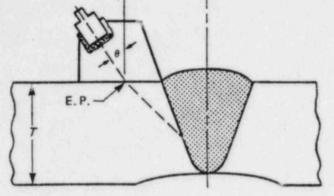
For angle beam scan length as shown above, add the following from each side of the weld fusion line.

Material	Minimum Scan
Thickness	Length 45°
.200" to .400"	1.00"
.400" to 1.000"	2.25"
1.000" to 1.200"	2.75"
1.200" to 1.500"	3.25"
1.500" and Greater	1.2 x 2T

Half Node Examination

Figure 7

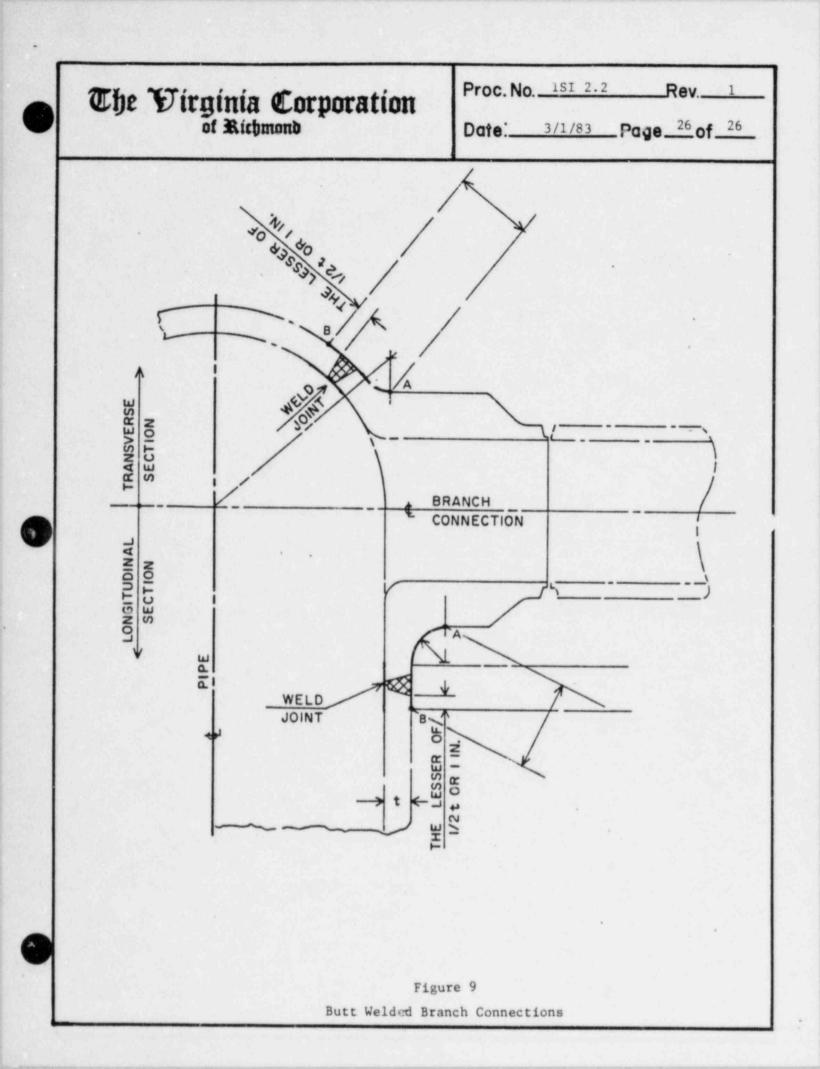
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The beam path shall be increased by at least one-half vee if dimension "A" is greater than:

0.93 T for = 43° to 45° 1.6 1 for = 58° to 60° 2.5 T for = 68° to 70°

> Weld Coverage Figure 8



	The		Custo	mer				Plan	•		U	nit	Loop/Zo	onelso	/Drawin	ng No.		
EVE	Virginia	Corp.	Proce	dure		Ex	am Sur	face	Exa	miner	/Level		VCR Su	pervis	or .		Date	
Y	-		Compo	nent/Pi	ping	Sys	tem		Pip	e Siz	e Wel	d Type	Cal. B	lock #		lant:	Batch	No
Continuat	lon Sheet	Attache	1			-			0°	T	5.	(0)					Daten	110.4
Yes		lo				S/N	ansduc	er	0.	4	2	60*	Mfer.	T	nstrum	Mode		
	and the second second		-			Siz		-		-			S/N			RepRa		
Field Chang Yes N	ges:					Fre	equenc	v					Reject			Filte		
If Yes, Num	the second secon						am Ang						Damp			Coax	_	
	ration 0	0		2 & 5	Scan	1 .			7	8 8	Scan		Freq.			Video		
alibration							Entry					Entry		Ca	librat	ion Che	cks	0°
eflector	Signal		Signal				To:	Sig				t To:	0			Out	In	Out
ocation	Amp.	Sweep	Amp.	Sweep	Scri			Am	p. [5	ween		e 50% DAC	In	Out	In	Out	In	Out
		++			Lin	ne	DAC	-	A	tE	Line	DAC						1
		++				-+	tr	571	-111	1	P							
					F	-	117	14,	71	H	5							
				16	51	Z	IN	MI		7								
				110	R	II	INU		71									
					5	T	W	P										
				1	P)	4	-											
					<u> </u>													
																		+
ef. dB								1							L	101	<u> </u>	I
0		DAC	10				DAC	10				DAC	Additi	onal C	omment	s/Sketa	2h	
8			8					8										
Contraction of the																		
6			6					6					1					
4			4					4										
1. 1. 1. 1.																		
2			2					2-					1					
		1.1																
2 1	6	8 10	0		6	8	10	0	2	4	6	8 16						•

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	0)					12.0	0
	-		Figur	e 11	Ultr	asonic	Examina	tion Re	eport	- Cont	inuatio	n S	heet	Page	of
A		1 The			Custon	ner		Plant			Unit	L	.oop/ Zone	Iso/Drawing	No.
E		virginia	Cor	p.	Proced	ure	Exam S	urface	Exami	ner/Lev	el	-	VCR Superv	visor	Date
V	1	GIRICH	mond		Compon	ent/Pip	ping System		Pipe S	ize	Weld Ty	pe	Cal. Block	Couplant: T	ype & Batch
Weld		Base Metal	Se	an Di	rection	_			·	Surfac Base	e Condit	ion		Lon Results	
No.		Scan	2	5	7 & 8	0	Inspection	Limita	ations	Metal	Wel	d	UT	Visual	Remarks
									•						
										1					
									- +7	15				1	
							ar	5.11	0)1	1E	1	_			
						- (DIVI	1A	15	1		_			
			_				Din	Jur							
_							5/0					_			
												-			
												-			
											_				

Indication Record	Loop / Zone	te	No./Thickness	Remarks	
Indicatio	Unit	visor Date	Cal. Standard No./	Base Metal Thickness 5 Side	_
	-	VCR Supervisor	No.	Base Metal Thickness Weld 2 Side Thick	
n Report	Plant	Examiner/Level	ISO Drawing	Beam Beam Angle Dir.	-
c Examination		Exami	ng System	Maximum Depth S.U. Sweep Pos. Reading	
Ultrasonic	Customer	Procedure	Component/Piping	Minimum Depth M S.U. Sweep Pos. Reading	
Figure 12	The	Irginia Corp.		Indication Length From To	
()	Ind Max.2 No. DAC	
	-	-		Weld No.	

Virginia			(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
Frocedure Title:	MANUAL ULTRASONIC LONGITUDINAL BUTT CLASS 1 LOOP PIPIN	WELDS IN CLAD FE	IRCUMFERENTIAL AND RRITIC VESSELS AND EBASCO SERVICES INCORPORATED
Procedure No.:	ISI 2.3		QUALITY ASSURANCE EMCHEDRING
Plant Site:	Waterford No. 3		This Document is: Reviewed Without Comments Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order. Rejected: Revise
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1.0 Scope

of Richmond

1.1 This procedure is applicable to, and describes, the requirements for manual ultasonic examination of full penetration circumferential and longitudinal butt welds in Class 1 and Class 2 clad ferritic vessels with wall thicknesses greater than 2 inches and in primary coolant piping. This procedure is written in compliance with the ASME Code, Section XI, and ASME Code, Section V, Article 4.

2.0 References

- 2.1 1977 edition of ASME Boiler and Pressur Vessel Code, Section XI, with addenda through summer, 1978.
- 2.2 The Virginia Corporation Written Practice for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3, dated 3/6/81.
- 2.3 The Virginia Corporation procedure ISI 1.2, Preservice Inspection Documentation (latest revision).
- 2.4 The Virginia Corporation procedure ISI 2.1, Ultrasonic Calibration Confirmation (latest revision).
- 2.5 The Preservice Inspection Program Plan.
- 2.6 1977 Edition of ASME Boiler and Pressure Vessel Code, Section V, with addenda through summer, 1978.
- 2.7 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Qualifications

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with the document referenced in paragraph 2.2. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

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4.0 General Requirements

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- 4.1 The area to be examined and contacted by the search unit shall be checked to ensure that it is free of dirt, loose scale, machining or grinding particles, weld splatter, or other foreign matter that would impair the free movement of the search unit or affect the examination. If such conditions are detected, they will be rectified prior to conducting the examination.
- The identity and location of welds to be examined shall be as 4.2 specified in reference 2.5.
- 4.3 The examinations conducted in accordance with this procedure shall be done from the O.D. surface unless specified by the Ebasco PSI construction coordinator that I.D. examinations be performed. All examinations shall be performed using the contact method.
- 4.4 Calibration shall be performed from the side of the calibration block which corresponds to the examination surface of the component. The calibration/examination surface shall be noted on the report.
- 4.5 Examinations shall consist of nominal 45° and 60° angle beam shear wave techniques applied in two directions parallel and two directions perpendicular to the weld axis, except where restricted by part geometry or access. A 0° longitudinal beam shall be applied to all areas through which the angle beams must pass. Other angles may be used provided the measured difference between the angles is at least 10 degrees.

5.0 Equipment and Material Requirements

5.1 Ultrasonic flaw detection instruments shall be of the A-scan pulse echo type, equipped with a stepped gain control calibrated in units of 2 dB or less, and shall be qualified to the requirements of reference 2.4 prior to use at the Waterford 3 site. Calibration may be valid for a period not to exceed three months.

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5.2 Search units shall be selected in accordance with figure 1. Transducers used shall be certified by the manufacturer as to serial number, size, and central frequency. Search units shall be capable of providing the applicable calibrations as required in paragraph 6.0.

5.3 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used for preservice examinations.

5.4 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.

- 5.5 Calibration Blocks
 - 5.5.1 Design of the calibration blocks and reflectors shall be essentially as depicted in Figure 2, and shall comply with the requirements of reference 2.6. Exceptions shall be noted in the final report.
 - 5.5.2 Where possible, the material from which the block is fabricated shall be from one of the following:
 - (a) nozzle drop out from the component
 - (b) a component prolongation
 - (c) material of the same material specification, product form, and heat treatment as the materials being joined.

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5.5.3	The finish on the surfaces of the block .
	shall be representative of the surface
	finishes of the component.
5.5.4	Additional reflectors may be installed;
	these reflectors shall not interfere
	with establishing the primary reference.
5.5.5	Figure 2 shows calibration block configuration
	with hole size and location. Each weld
	on the component or piping system shall be
	represented by a calibration block having
	a thickness which meets the requirements
	of Figure 2. The calibration block
	thickness must be within one inch (plus
	or minus) of the component or piping weld
	thickness. Where the calibration block
	thickness, plus or minus one inch, spans
	two of the weld thickness ranges shown
	in Figure 2, the block's use shall be
	acceptable in the range of plus or minus
	one inch of the block's thickness. For
	example, a four-inch calibration block
	shall be acceptable for weld thicknesses
	of three inches to five inches. The
	holes shall be in accordance with the
	thickness of the block. Where two or
•	more base metal thicknesses are involved,
	the calibration block thickness is
	determined from the average thickness of
	the weld.

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5.5.6 The basic calibration block shall be curved for welds in materials with diameters 20 in. (508 mm) and less. A single curved basic calibration block may be used to calibrate the examination on surfaces in the range of curvature from 0.9 to 1.5 times the basic calibration block diameter.
5.5.7 For examination of welds in materials where the diameter is greater than 20 in. (508 mm), a block of essentially the same curvature, or, alternately, a flat basic calibration block, shall be used.

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6.0 Calibration

- 6.1 Instrument calibration for screen height linearity, amplitude control linearity, and beam spread measurement shall be performed prior to use at the Waterford 3 plant site and every three months thereafter in accordance with reference 2.4.
 6.2 Straight Beam Calibration for Weld Metal and HAZ
 - 6.2.1 The search unit shall be selected in accordance with Figure 1.
 - 6.2.2 The calibration block shall be identified and selected from reference 2.5.
 - 6.2.3 The temperature between the examination surface and basic calibration block surface shall not exceed 25° F.

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6.2.4	Calibration 6.2.4.1	Verification A calibration check, which is the verification of the instrument sensitivity and sweep range calibration, shall be performed at the beginning and end of each shift of examinations and at the end of each examination category, or every four hours, whichever is less, and with
	6.2.4.2	any change in examination personnel. A decrease in sensitivity of 20% or 2dB shall require recalibration and re- examination of all items examined since the previous acceptable calibration or
	6.2.4.3	check.

6.2.4.4

reported since the previous acceptable calibration or check.

If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be reexamined.

The instrument sweep range and a distance amplitude curve (DAC) shall be established utilizing the response from the applicable basic calibration holes in accordance with paragraphs 6.4 and 6.5.

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.3 5	Straight	Beam Calibr	ation for Base Metal
6	6.3.1	The sensit	ivity of the instrument shall be adjusted
		at a locat	ion free of indications so that the first
		back refle	ction from the far side of the plate will
		be 80 perc	ent of full screen neight (FSH). The
		sensitivit	y as adjusted above shall be continuously
		monitored	during the examination. The base
		metal stra	ight beam examination may be
		conducted	concurrently and at the same
		sensitivit	y as the straight beam examination
		described	in paragraph 6.4.2.
.4 5	Straight	Beam Calibr	ation for Weld Metal and HAZ
6	6.4.1	Sweep Rang	e Calibration
		6.4.1.1	Position the search unit on the calibratio
			block and obtain the maximum response from
			the 1/4T side drilled hole. Adjust the
			left edge of this indication to line 2 on
			the screen with the delay control.
		6.4.1.2	Position the search unit for the maximum
			response from the 3/4T hole. Adjust the
			left edge of this indication to line 6 on
			the screen with the range control.
		6.4.1.3	Repeat delay and range control adjustments
			until the 1/4T and 3/4T hole reflections
			start at sweep lines 2 and 6.
6	6.4.2	Distance A	mplitude Correction
		6.4.2.1	Position the search unit for maximum
			response from the hole which gives the
			highest amplitude.
		6.4.2.2	Adjust the sensitivity control to provide
			an 80% of full screen indication from that
			hole. Mark the peak of the indication on
			the screen with a grease pencil or other
			suitable marker.
		6.4.2.2	Adjust the sensitivity control to p an 80% of full screen indication fr hole. Mark the peak of the indicat the screen with a grease pencil or

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- 6.4.2.3 Position the search unit for maximum response from each of the remaining calibration holes.
- 6.4.2.4 Mark the peaks of these indications on the screen.
- 6.4.2.5 Connect the screen marks and extend through the thickness to provide the distance amplitude curve for the side drilled holes. This is the primary reference level.
- Angle Beam Calibration

6.5.1 Sweep Range Calibration

- 6.5.1.1 . Position the search unit for the maximum response from the 1/4T side drilled hole. Adjust the left edge of this indication to line 2 on the screen with the delay control.
- 6.5.1.2 Position the search unit for the maximum response from the 3/4T hole. Adjust the left edge of this indication to line 6 on the screen with the range control. 6.5.1.3 Repeat delay and range control adjustments until the 1/4T and 3/4T hole reflections start at sweep lines 2 and 6 respectively.
- 6.5.1.4 Position the search unit for maximum response from the square notch on the opposite surface. The indication will appear near sweep line 8.

6.5.1.5 Two divisions on the sweep equals 1/4T. 6.5.2 Distance-Amplitude Correction

> 6.5.2.1 Calibration from the clad side

> > (a) Position the search unit for maximum response from the hole which gives the highest amplitude.

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6.5.2.1, continued

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- (b) Adjust the sensitivity control to provide an 80% FSH response from the hole. Mark the peak of the indication on the screen.
- (c) Position the search unit for maximum response from each of the remaining holes.
- (d) Mark the peak of these indications on the screen.
- (e) Position the search unit for maximum amplitude from the 3/4T hole indication after the beam has bounced from the opposite surface. The indication should appear near sweep line 10. Mark the peak on the screen for the 5/4T position.
- (f) Connect the screen marks for the side drilled holes to provide the distance amplitude curve. This is the primary reference level.

6.5.2.2 Calibration from the unclad side

- (a) From the clad side of the block, determine the dB change in amplitude between the 3/4T and 5/4T positions.
- (b) From the unclad side, perform calibrations as noted in 6.5.2.1 (a) through (d).
- (c) To determine the amplitude for the 5/4T hole, position the search unit for maximum amplitude from the 3/4T hole. Decrease the signal amplitude by the number of dB determined in (a).

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- 6.5.2.2
- (c) continued

Mark the height of this signal amplitude at sweep line 10 (5/4T).

(d) Connect the screen marks to provide the distance-amplitude curve. This is the primary reference level. This will permit evaluation of indications down to the clad surface (near sweep line 8).

) Examination

7.1 Straight Beam Examination for Base Metal

7.1.1 Prior to performing angle beam examinations, the base material through which the angle beam will pass (reference Fig. 3) shall be completely scanned with a straight beam search unit to detect reflectors which might affect the interpretation of the results of the angle beam examination.

7.1.2 Calibration shall be as indicated in paragraph 6.3.

- 7.1.3 Scans shall overlap at least ten percent.
- 7.1.4 Alternatively, the base metal examination may be conducted concurrently and at the same calibration as described in paragraph 6.4, provided that the scan sensitivity (2 x reference) is at least as sensitive as that required in paragraph 6.3.
- 7.2 Straight Beam Examination for Weld Metal and HAZ

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- 7.2.1 The examination for planar reflectors shall be performed on the entire volume of weld and adjacent base material in accordance with Figure 3.
- 7.2.2 Calibration shall be as indicated in paragraph 6.4.

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	7.2.3	Penetration shall be verified by obtaining a
		reflection from an opposite surface of the
		material being examined when the two surfaces
		are parallel.
	7.2.4	Scans shall overlap at least ten percent.
	7.2.5	Alternatively, the weld metal and HAZ examination
		may include the examination detailed in paragraph
		7.1, provided that the scan sensitivity (2 x
		reference) is at least as sensitive as that
		required by paragraph 7.1.2.
7.3	Angle Be	eam Examination for Reflectors Parallel to the Weld
	7.3.1	The primary scan for reflectors parallel to
		the weld shall be 1/2 node from both sides
		of the weld.
	7.3.2	If it is impossible to examine the required
		material with a 1/2 node examination from both
		sides of the weld, the reasons for the partial
		examination shall be documented in accordance
		with paragraph 9.4.
	7.3.3	The area of interest shall be the weld and HAZ,
		and the required amount of base metal on each
		side of the weld (reference Figure 3).
	7.3.4	Calibration shall be as indicated in paragraph
		6.5.
	7.3.5	The scan pattern shall start at one edge of the area to
		be examined with the ultrasonic search unit transmitting
		an angle beam perpendicular to the weld axis. The
		search unit shall be moved towards and away from the
		weld such that the calibrated beam passes through the
		whole area of the weld and base metal to be examined.
		Concurrent with this scan, the search unit shall be
		swiveled 15° right and 15° left and progressively
		indexed along the length of the weld such that the
		whole scan pattern follows a "saw-tooth" pattern.

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7.3.5, continued

The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure. When practical, the examination shall be accomplished from both sides of the weld except where restricted by part geometry or access.

7.4 Angle Beam Examination for Reflectors Transverse to the Weld

- 7.4.1 The angle beam examination for reflectors transverse to the weld shall be performed on the weld crown and adjacent base material as necessary to examine the weld root by 1/2 node in two directions along the weld.
- 7.4.2 If it is impossible to examine the required material with a 1/2 node examination from both sides of the weld, the reasons for the partial examination shall be documented in accordance with paragraph 9.4, and reported to the L.P.& L. P.S.I. coordinator.
- 7.4.3 The area of interest shall be the weld and HAZ, and the required amount of base metal on each side of the weld (reference Figure 3).

7.4.4 Calibration shall be as indicated in paragraph 6.5.
7.4.5 The search unit shall be placed at 5T on one edge of the inspection area directing the angle beam into the material parallel to the weld axis. From this position the search unit shall be moved parallel to the weld and indexed toward the opposite side of the weld such that the next scan will cover at least 10 percent of the area covered by the previous adjacent scan. Parallel scans shall be repeated in this manner until the opposite side of the weld and base metal is reached and examined. The

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7.4.5, continued

search unit shall be swiveled 15° right and 15° left and progressively indexed along the length of the weld such that the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure, except where restricted by part geometry or access.

- 7.5 Scanning shall be performed at a gain setting of at least 2 times the reference level (6 dB increase in amplitude). Recording of indications shall be carried out with the gain control set at the reference level.
- 7.6 Rate of search unit movement shall not exceed 6in./sec. (153 mm/sec.).
- 8.0 Evaluation and Recording of Straight Beam Examination for Laminar Reflectors
 8.1 All areas giving indications equal to or greater than the back reflection shall be recorded.
 - 8.2 All areas where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications in the same plane shall be recorded.
 - 8.3 The following data shall be recorded for laminar reflectors:
 - 8.3.1 Sweep reading of laminar reflectors from the surface.
 - 8.3.2 Position from the reference marking.
 - 8.3.3 Location parallel to the reference marking for each search unit position, giving the recordable extent of the indication as the laminar area is scanned on parallel scan paths.

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8.4 Where laminar reflectors interfere with the scanning of examination volumes for planar reflectors, the angle beam examination technique shall be modified to examine the maximum feasible volume, within the specified examination volume, and the description of the volume excluded by the lamination shall be noted on the data sheet.

Evaluation and Recording of Straight Beam and Angle Beam Indications in the Weld and Heat Affected Zone

9.1 All indications 20% of the rimary reference DAC or greater shall be investigated to determine the shape, identity, location, and type of indication. Additionally, all indications, regardless of amplitude, which the examiner judges to be potentially indicative of a crack or lack of fusion shall be investigated to determine the shape, identity, location, and type of indication.

> 9.1.1 Any indication categorized as a flaw shall be recorded and reported in accordance with the requirements of reference 2.3.

Any indication resulting from the metallurgical structure 9.1.2 within the material shall be considered when assessing the effectiveness of the examination. Restrictions or variations to the examination due to the metallurgical structure shall be reported. Additional search unit angles may be used during evaluation as an aid in interpretation.

Clad interface and back wall reflections need not be 9.1.3 recorded.

9.1.4 Geometric indications that are equal to or greater than 50% of the primary reference DAC shall be acknowledged by recording their length and location.

9.0

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- 9.2 Any indication which is equal to, or greater than, 50% of the primary reference DAC shall be evaluated to the extent necessary to determine the size, shape, identity, and location of the reflector. Indications shall be recorded in accordance with paragraph 9.3 and reported in accordance with the requirements of reference 2.3.
- 9.3
- Data required when indications are equal to, or greater than, 50% of DAC:
 - 9.3.1 All search unit position and location dimensions shall be recorded to the nearest tenth of an inch.
 - 9.3.2 Maximum percent of DAC, sweep reading of indication, search unit position, location along the length of the weld, and beam direction.

9.3.3 Through-Wall Dimensions:

- 9.3.3.1 For reflectors 50 to 100% DAC, the minimum and maximum sweep readings and their position and location along the length of the reflector for 50% DAC when approaching and moving away from the reflector's maximum signal direction.
- 9.3.3.2 For reflectors exceeding 100% DAC, minimum and maximum sweep readings and their position and location along the length of the reflector for 50% of the maximum amplitude when approaching and moving away from the reflector's maximum signal direction.

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9.3.4 Length Dimension

9.3.4.1

The length of the reflector shall be obtained by recording the position and location along the length of weld as determined by 50% of DAC for each end of the reflector.

9.4

Welds that did not receive a complete examination according to paragraph 7.0 shall have the partial examination noted on the data sheet as follows:

9.4.1 The extent of the examination performed shall be noted.

9.4.2 If the volumetric examination was performed from one side of the weld only, it shall be noted and an entry made indicating what steps were taken to ensure that the required area on the far side of the weld was examined.

9.4.3 The reason(s) that a specific examination was impractical shall be noted. For example, support or component restricts access, fitting prevents adequate ultrasonic coupling on one side, component to component weld prevents ultrasonic examination, etc.

9.5 Investigation and reporting of indications shall be performed at the reference sensitivity.

10.0 Documentation of Examination

10.1 All data relative to the examination and reportable indications shall be reported in accordance with reference 2.3, and on forms similar to those shown in Figures 4, 5, and 6.

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Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

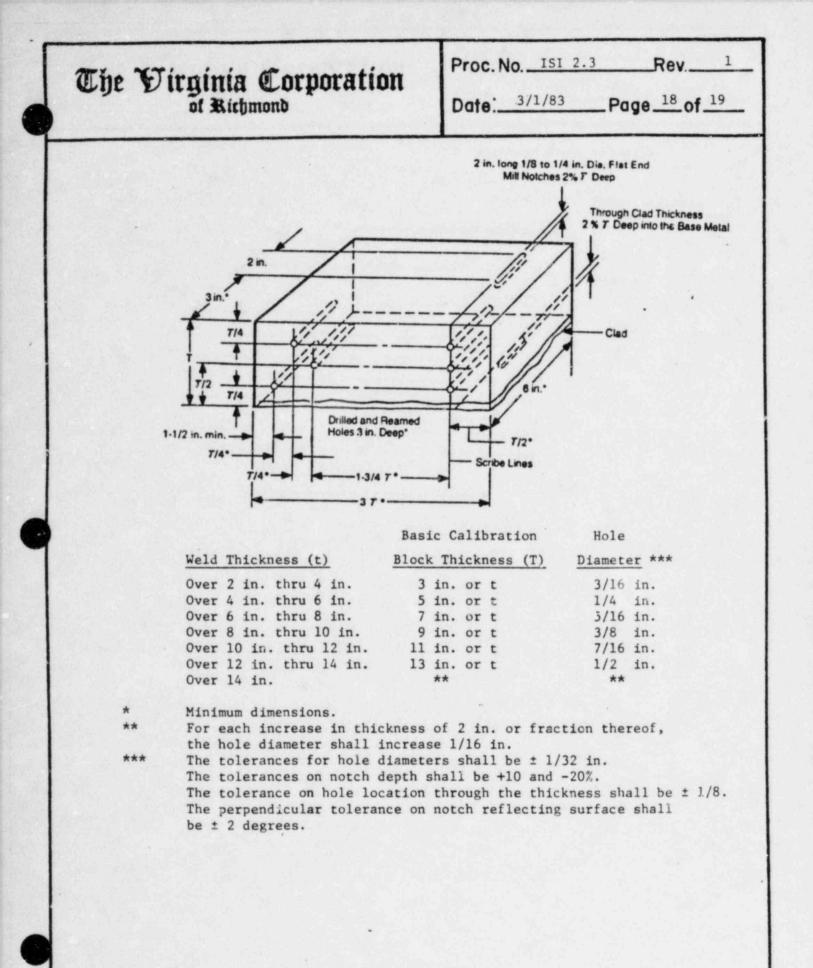
Angle Beam Examination*

Nominal	Trans	sducer			
Material Thickness	Maximum Size	Nominal Frequency	Nominal Angles		
.250" to .400"	1/4" dia. or 1/4" x 1/4"	2.25 MHZ	45°	600	
.400" to 1,000"	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	45 ⁰	600	
1.000" to 1.200"	3/4" dia. or 3/4" x 3/4"	2.25 MHZ	45°	600	
1.200" and greater	1-1/8" dia. or 1" x 1"	2.25 MHZ	45°	60 ⁰	

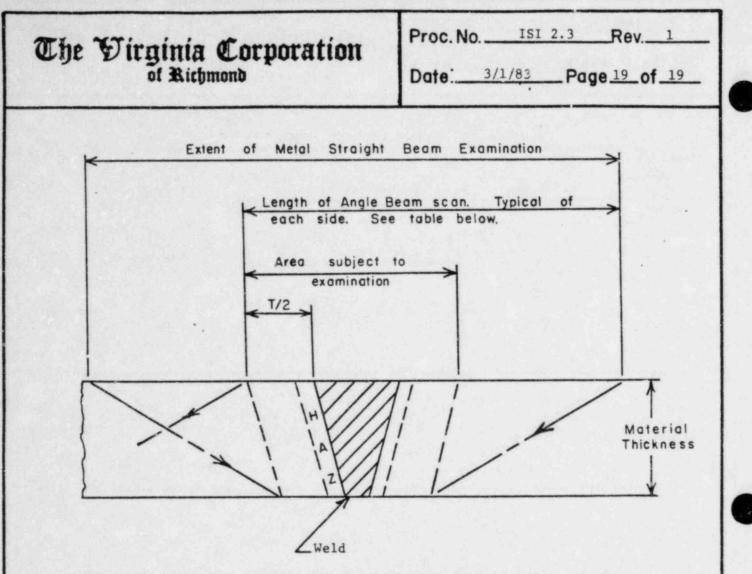
Straight Beam Examination*

Nominal Pipe	Transducer									
Diameter	Maximum Size	Nominal Frequency								
less than 12" dia.	1/2" dia. or 1/2" x 1/2"	2.25 MHZ								
12" dia. and greater	1-1/8" dia. or 1" x 1"	2.25 MHZ								

*Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.



"ILLUSTRATIVE ONLY" Typical Calibration Block Figure 2



For angle beam scan length, add the following from each side of the weld fusion line.

Material		
Thickness	<u>45°</u>	<u>60°</u>
2.5"	3.75	5.75
3"	4.5	6.75
3.5"	5.25	8.0
4"	6.0	9.0
4.5" 5"	6.75	10.0
5"	7.5	11.0
5.5"	8.25	12.5
6"	9.0	13.5
6.5"	9.75	14.5
7" and Greater	T + T/2	1.73T + T/2

Straight beam scan length shall be in accordance with the 60° angle beam scan length.

Extent of Examination

Figure 3

-		Figure 4					Ultr	ason	ic Ex	amin	nation	Repor					
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			EBASCO SERVICES INCORPORATED
Procedure No.:	ISI 2.4		QUASIFY ASSURANCE ENGINEERING
Plant Site:	Waterford No. 3		THIS DOCUMENT 13: Reviewed Without Comments Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order. Rejected: Revise and Resubmit.
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- 1.0 Scope
 - 1.1 This procedure is applicable to, and describes, the requirements for manual ultrasonic examination of studs and bolts. This procedure complies with ASME Code, Section XI.

2.0 References

- 2.1 1977 Edition of ASME Boiler and Pressure Vessel Ccde, Section XI, with addenda thru summer, 1978.
- 2.2 1977 Edition of ASME Boiler and Pressure Vessel Code, Section V, with addenda thru summer, 1978.
- 2.3 The Virginia Corporation Written Practice for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3 dated 3/6/81.
- 2.4 The Virginia Corporation procedure ISI 1.2, Preservice Inspection Documentation (latest revision).
- 2.5 The Virginia Corporation procedure ISI 2.1, Ultrasonic Equipment Calibration Confirmation (latest revision).
- 2.6 The Preservice Inspection Program Plan.
- 2.7 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Qualifications

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with the document referenced in paragraph 2.3. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

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4.0

General Requirements

- 4.1 Surfaces from which the examination is to be conducted shall be checked to ensure that they are free of all foreign matter, pits, nicks, or dents, etc., that would adversely affect or limit the examination. If such conditions are detected, they will be rectified prior to conducting the examination.
- 4.2 The identity and location of studs and bolts to be examined
 - shall be as specified in the Preservice Inspection Plan.
- 4.3 The scanning rate shall not exceed 6 in./sec.
- Equipment and Material Requirements 5.0
 - 5.1 Ultrasonic flaw detection instruments shall be of the Ascan pulse echo type equipped with a stepped gain control calibrated in units of 2 dB or less, and shall be qualified to the requirements of ISI 2.5 prior to use at the Waterford 3 site. Qualifications may be valid for a period not to exceed three wonths.
 - 5.2 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used for preservice examinations.
 - 5.3 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.

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- 5.4 The transducer element shall not exceed 3/4" diameter and shall have a nominal frequency of 2.25 MHZ. Transducers used shall be certified by the manufacturer as to serial number, size, and central frequency. Plastic shoes may be used to improve ultrasonic coupling to the test part. Transducers shall be capable of providing the applicable calibrations as required in paragraph 6.0.
- 5.5 Calibration Blocks
 - 5.5.1 Calibration for studs and bolts shall be established on a test bar of the same nominal composition and diameter as the stud or bolt to be examined. The design is to be essentially as depicted in Figure 2.

6.0 Calibration

- 6.1 Prior to conducting examinations, the complete system to be utilized shall be calibrated on the applicable calibration block. The system shall include the ultrasonic unit (and battery pack, if applicable), cable or cables, search unit, couplant, and any other apparatus, instrument or circuit employed between the instrument and the calibration block surface. Once calibration has been established, any change to any part of the system, including the operator, will require at least a verification of the calibration which shall be documented.
 - 6.1.1 The transducer shall be selected according to paragraph 5.4.
 - 6.1.2 The calibration block shall be identified and selected from reference 2.6 for the particular item to be examined. Calibration shall be established by using a calibration block similar to the one illustrated in Figure 2. The calibration block shall be a minimum of $\frac{1}{2}$ the length of the stud or bolt to be examined.

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	6.1.3		fference between the examination calibration block surface shall
6.2	Sweep r	ange calibration	
	6.2.1	Position the transo	ducer on the calibration block reflection from notch "A" of
	6.2.2		flector, adjust the delay and that the notch reflector is at
	6.2.3	Position the first	back reflection at sweep posi-
	6.2.4	Repeat delay and ra	ange control adjustments until
			is now set for 100% coverage
6.3	Distanc	e amplitude correcti	
0.5	6.3.1		ducer over notch "A".
		Adjust the sensitiv	vity control to provide an 80% (FSH) indication from notch
		screen with a greas	k of the indication on the se pencil or other suitable correspond to DAC point "A"
	6.3.3	on the data sheet. Position the transp	ducer over notch position "B"
		of Figure 2.	
	6.3.4	peak of this indica	ne sensitivity control, mark the ation on the screen. This will point "B" on the data sheet.
	6.3.5	Connect the screen "A" through the end provide a smooth DA	marks and extrapolate point d of the calibration block to AC curve. Record the reference
			et for DAC point "A". This is nee level for the first half

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- 6.3.6 With the transducer over notch "B", adjust the sensitivity to bring the notch reflection to 80% FSH. This shall be DAC position "C" on the data sheet.
- 6.3.7 Position the transducer over notch "C" of Figure 2. Peak the reflector for maximum screen height without changing the sensitivity level from DAC point "C". Mark this amplitude on the screen as DAC point "D".
- 6.3.8 Connect DAC points "C" and "D" and extrapolate through the back reflection producing a smooth DAC curve. Record the sensitivity on the data sheet for DAC point "C". This is the primary reference level for the second half of the stud length.
- 6.4 Calibration verification
 - 6.4.1 A calibration check, which is the verification of the instrument sensitivity and sweep range calibration, shall be performed at the beginning of each day of examinations and at the end of each examination category, or every four hours, whichever is less, and with any change in examination personnel.
 - 6.4.2 A decrease in sensitivity of 20% or 2 dB shall require recalibration and re-examination of all items examined since the previous acceptable calibration or check.
 - 6.4.3 An increase in sensitivity of 20% or 2dB shall require recalibration, re-examination, and data correction of all indications reported since the previous acceptable calibration or check.
 - 6.4.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading,

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correct the sweep range calibration and note the correction in the examination record. If the recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be re-examined.

7.0 Examination

- 7.1 Studs and bolts shall be examined from both ends when possible. If installed, studs or bolts may be examined from one end providing one end is inaccessable and the geometry and surface condition of the exposed end is conducive to a meaningful examination. If an examination cannot be performed or only partially performed, the reason(s) shall be noted on the data sheet.
- 7.2 Scanning shall be accomplished in concentric circular patterns or along the radius lines with at least a 10 percent scan overlap, such that the entire end surface is scanned. A short saw-tooth scan pattern may be used to improve discrimination of reflections from threaded areas.
- 7.3 Reflections from threaded areas shall be carefully observed to detect and investigate possible indications emanating from these sections.
- 7.4 Scanning sensitivity shall be twice (+6 dB) the calibration sensitivity.

8.0 Evaluation and recording of indications

- 8.1 All non-geometric indications from threaded areas shall be evaluated and reported. All other indications exceeding 20 percent of the DAC shall be investigated to determine maximum response, location, and probable cause.
- 8.2 Indications that are 50% of DAC or more shall be evaluated and recorded on the ultrasonic indication report to the

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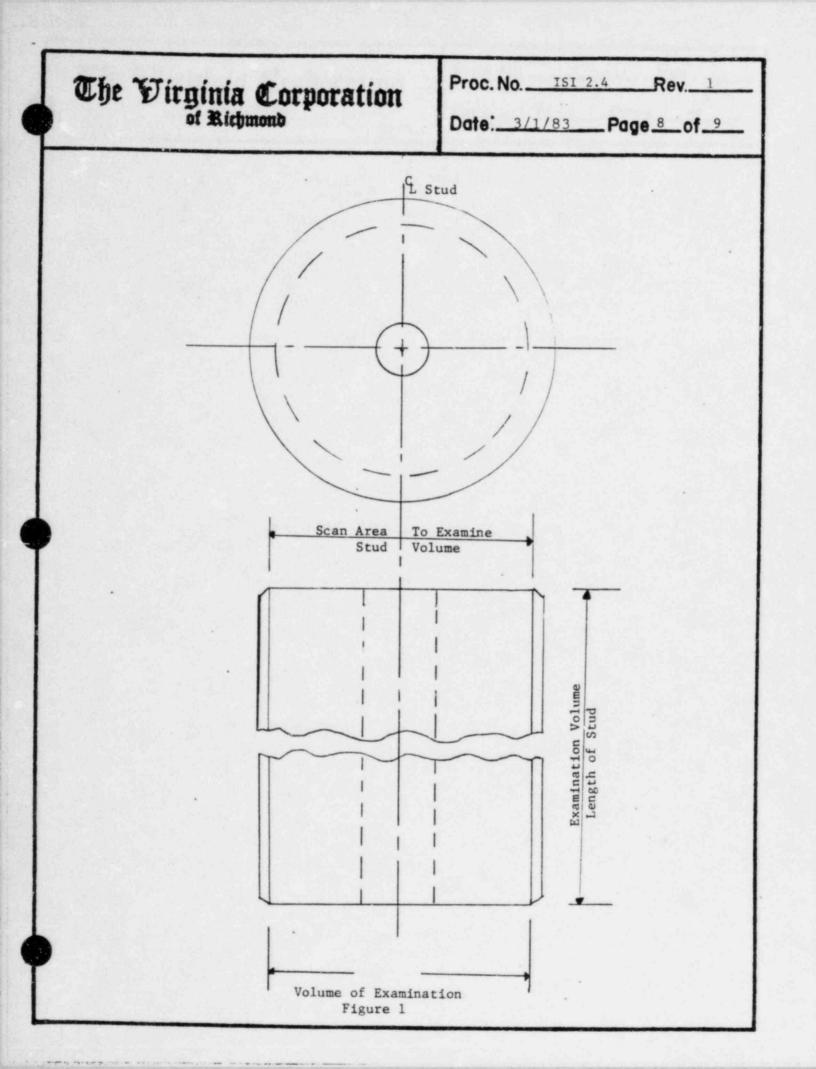
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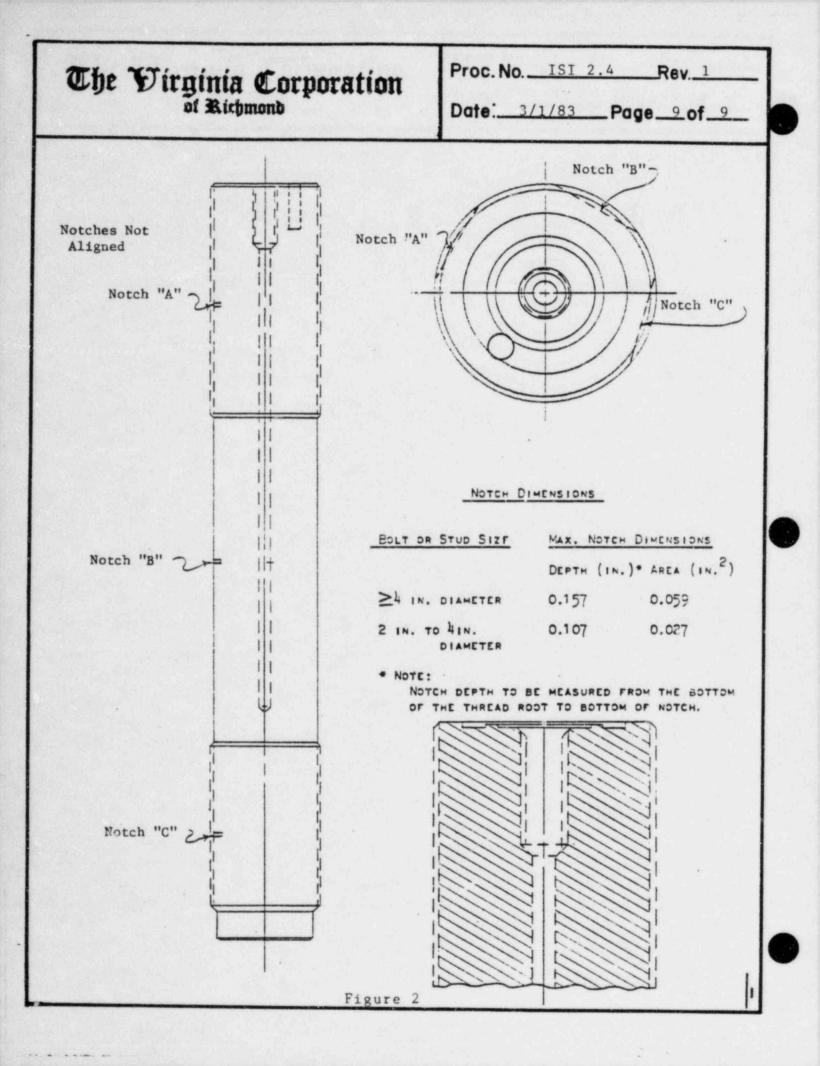
extent that shape, orientation, location, and possible identity of the indication producing area can be assessed. The extremities of the discontinuity shall be defined as the points where the signal amplitude drops to 50% of the calibrated DAC line or 50% of the peak signal, whichever is less.

- 8.3
- Indications judged to be caused by beam redirection and/or wave mode conversion shall be verified by use of another transducer size and/or frequency that has been calibrated in accordance with 6.1 through 6.4.5 and noted on the report. Signals resulting from the thread surfaces or other designed geometry need not be reported.
- 8.4 In the event that reportable indications are detected on items that are not permanently identified with a unique designation, the item shall be securely tagged or positively identified.

9.0 Documentation of examination

> All data relative to the examination and reportable indi-9.1 cations shall be reported in accordance with reference 2.4 and on forms similar to those shown in Figures 3 and 4.





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1.1 This procedure is applicable to, and describes, the requirements for manual ultrasonic thickness measurement of weld material and adjacent base metal in piping systems by the pulseecho method. This procedure is written in compliance with the ASME Code, Section V, Article 5, and is applicable to the edition and addenda in paragraph 2.0.

2.0 References

Scope

- 2.1 Section V, Article 5, ASME Boiler and Pressure Vessel Code, 1977 edition with addenda through summer, 1978
- 2.2 The Virginia Corporation Written Procedure for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3, dated 3/6/81.
- 2.3 The Virginia Corporation Procedure ISI-1.2, Preservice Inspection Documentation (latest revision).
- 2.4 The Virginia Corporation Procedure ISI 2.1, Ultrasonic Equipment Calibration Confirmation (latest revision).
- 2.5 The Virginia Corporation Procedure VC-OA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).
- 3.0 Personnel Qualifications
 - 3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with reference 2.2. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

4.0 General Requirements

4.1 The area to be examined and contacted by the search unit shall be checked to ensure that it is free of dirt, loose scale, machining or grinding particles, weld splatter, or other loose foreign matter that would impair the free movement of the search unit or affect the examination.

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If such conditions are detected, they will be rectified prior to conducting the examination.

- 4.2 The identity and location of welds to be measured for thickness shall be as directed by the Ebasco PSI construction coordinator.
- 5.0 Equipment and Material Requirements
 - 5.1 Ultrasonic flaw detection instruments shall be of the Ascan pulse echo type equipped with a stepped gain control calibrated in units of 2 dB or less, and shall be qualified to the requirements of reference 2.4 prior to use at the Waterford 3 site. Calibration confirmation may be valid for a period not to exceed three months.

5.2 Search Units

- 5.2.1 Search units shall be certified by the manufacturer as to essential properties, including serial number, size and center frequency.
- 5.2.2 Search units shall be either single element or dual element.

5.2.3 Search unit sizes shall range from '4" diameter to 1" diameter and frequency of 1 MHZ to 5 MHZ.

- 5.3 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used.
- 5.4 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.

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5.5 Calibration Blocks

- 5.5.1 Calibration blocks, where possible, shall be the same material and product form as the material to be measured.
- 5.5.2 Alternately, step wedges or IIW blocks may be used.

6.0 Calibration

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- 6.1 Prior to conducting examinations, the complete system to be utilized shall be calibrated on the applicable calibration block. The system shall include the ultrasonic unit (and battery pack, if applicable), cable or cables, search unit, couplant, and any other apparatus, instrument or circuit employed between the instrument and the calibration block surface. Once calibration has been established, any change to any part of the system, including the operator, will require at least a verification of the calibration.
- 6.2 Calibration When More Than One Material Thickness is Used (Preferred Method)
 - 6.2.1 When more than one material thickness is used for calibration the thickness of the material to be examined shall be between the thickness of the thin and thick sections of the calibration material.

6.2.2 Select appropriate instrument, transducer and couplant for the required examination.

6.2.3 Select appropriate frequency and range control settings.

^{5.5.3} The finishes on the surface of the calibration block(s) shall be representative of the surface finishes of the piping to be measured.

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		6.2.4	calibration material delay, adjust the sw first back reflectio	r on the thinner section of and, by using the sweep weep position so that the on signal is at the appropriate esired screen range.
		6.2.5	calibration material range control, adjus the first back refle	on the thicker section of and, by using the sweep at the sweep position so that ection signal is at the appropriate esired screen range.
		6.2.6	Continue steps 6.2.4 adjustment is necess	and 6.2.5 until no further sary.
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		6.3.1		instrument, transducer, and
		6.3.2	Select the appropria settings.	te frequency and range control
		6.3.3	Place the transducer and, by using the sw so that the first ba	on the calibration material weep delay, adjust the sweep ack reflection signal is at sicule for the desired screen
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6.4	Calibra 6.4.1	tion Verification A calibration check of sweep range cal at the beginning of measurements cover	ibration, shall be f each set of thick	performed kness
	6.4.2	block(s), and with personnel. If any point in the		
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off more than 2% of full screen, a new calibration shall be recorded, and all readings taken since the last successful calibration or recalibration shall be re-done. All data sheets completed since the last valid calibration shall be voided.

7.0 Examination

- 7.1 Following calibration to paragraph 6.2 or paragraph 6.3, measurements shall be taken on the designated weld and/or adjacent base metal.
- 7.2 Measurements shall be taken, as a minimum, at 12 o'clock, 2 o'clock, 4 o'clock, 6 o'clock, 8 o'clock, and 10 o'clock. Additional readings shall be taken as designated by the Ebasco PSI construction coordinator.
- 7.3 Thickness determination is accomplished by placing the transducer on the point to be measured and obtaining a back reflection. The gain shall be adjusted so that the same high frequency node is breaking the baseline as in the calibration.
- 7.4

4 Thickness is then read directly off the screen in inches and shall be read to the nearest 1% of full screen sweep.

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- 8.0 Recording of Thickness Readings
 - 8.1 All thickness readings shall be recorded and shall be referenced to the actual location of the reading on the report form. Any thickness readings on other than normal part configuration shall be recorded with an additional sketch or sketches to identify locations.
 - 8.2 Measurements shall be read to 1% of full screen (i.e., for a one inch screen, readings shall be to the nearest .010").
- 9.0 Documentation of Examination
 - 9.1 All data relative to the examination shall be reported in accordance with reference 2.3 and on forms similar to those shown in figurs 1 and 2.

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2.0 References

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- 2.1 1977 edition of ASME Boiler and Pressure Vessel Code, Section XI, with addenda through summer, 1978.
- 2.2 The Virginia Corporation Written Practice for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3, dated 3/6/81.
- 2.3 The Virginia Corporation procedure ISI 1.2, Preservice Inspection Documentation (latest revision).
- 2.4 The Virginia Corporation procedure ISI 2.1, Ultrasonic Calibration Confirmation (latest revision).
- 2.5 The Waterford Unit 3 Preservice Inspection Program Plan.
- 2.6 1977 Edition of ASME Boiler and Pressure Vessel Code. ^c ion V, with addenda through summer, 1978.
- 2.7 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Qualifications

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with the document referenced in paragraph 2.2. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level 1-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

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4.0	General 4.1	checked to ensure that it is free or grinding particles, weld spla would impair the free movement of	tacted by the search unit shall be see of dirt, loose scale, machining atter, or other foreign matter that of the search unit or affect the s are detected, they will be rectified
	4.2	prior to conducting the examinat The identity of welds to be exam reference 2.5.	
	4.3		of welds to be examined shall be and 7.
	4.4		corance with this procedure shall -clad) surface using contact methods.
	4.5	block which corresponds to the I generator stay cylinder. The ca	from the side of the calibration (.D. (non-clad) surface of the steam alibration/examination surface shall
	4.6	wave techniques applied in two d perpendicular to the weld axis e or access. Where other pairs of difference between the angles sh	ainal 45° and 60° angle beam shear directions parallel, and two directions except where restricted by part geometry angles are used, the measured hall be at least 10 degrees. A 0° ded to all areas through which the
5.0	Equipmen	nt and Material Requirements	
	5.1	echo type, equipped with a stepp of 2dB or less, and shall be qua	aments shall be of the A-scan pulse bed gain control, calibrated in units alified to the requirements of reference and 3 site. Calibration may be valid a months.

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- 5.2 Search units shall be selected in accordance with figure 1. Transducers used shall be certified by the manufacturer as to serial number, size, and central frequency. Search units shall be capable of providing the applicable calibrations as required in paragraph 6.0.
- 5.3 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used for preservice examinations.
- 5.4 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.
 5.5 Calibration Blocks
 - .5 Calibration Blocks
 - 5.5.1 Design of the calibration blocks and reflectors shall be essentially as depicted in Figure 2, and shall comply with the requirements of reference 2.6. Exceptions shall be noted in the final report.
 - 5.5.2 Where possible, the material from which the block is fabricated shall be from one of the following:
 - (a) nozzle drop out from the component
 - (b) a component prolongation
 - (c) material of the same material specification, product form, and heat treatment as the materials being joined.

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5.5.3	The finish on the surfaces of the block
	shall be representative of the surface
	fi shes of the component.
5.5.4	Additional reflectors may be installed;
	these reflectors shall not interfere
	with establishing the primary reference.
5.5.5	Figure 2 shows calibration block configuration
	with hole size and location. Each weld
	on the component or piping system shall be
	represented by a calibration block having
	a thickness which meets the requirements
	of Figure 2. The calibration block
	thickness must be within one inch (plus
	or minus) of the component thickness.
	Where the calibration block thickness,
	plus or minus one inch, spans two of the
	weld thickness ranges shown in Figure 2,
	the block's use shall be acceptable in
	the range of plus or minus one inch of
	the block's thickness. For example,
	a four-inch calibration block shall be
	acceptable for weld thicknesses of three
	inches to five inches. The holes shall be
	in accordance with the thickness of the
	block. Where two or more base metal
	thicknesses are involved, the calibration
	block thickness is determined from the
	average thickness of the weld.

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5.5.6 The basic calibration block shall be curved for welds in materials with diameters 20 in. (508 mm) and less. A single curved basic calibration block may be used to calibrate the examination on surfaces in the range of curvature from 0.9 to 1.5 times the basic calibration block diameter.

5.5.7 For examination of welds in materials where the diameter is greater than 20 in. (508 mm), a block of essentially the same curvature, or, alternately, a flat basic calibration block, shall be used.

6.0 Calibration

6.1 Instrument calibration for screen height linearity, amplitude control linearity, and beam spread measurement shall be performed prior to use at the Waterford 3 plant site and every three months thereafter, as a minimum, in accordance with reference 2.4.
6.2 Straight Beam Calibration for Weld Metal and HAZ

6.2.1 The search unit shall be selected in accordance with Figure 1.

- 6.2.2 The calibration block shall be idencified and selected from reference 2.5.
- 6.2.3 The temperature between the examination surface and basic calibration block surface shall not exceed 25^o F.

 6.2.4 Calibration Verification 6.2.4.1 A calibration check, which is the verification of the instrument sensitivity and sweep range calibration, shall be performed at the beginning and end of each shift of examinations and at the end of each examination category, or every four hours, whichever is less, and with any change in examination personnel. 6.2.4.2 A decrease in sensitivity of 20% or 2dB shall require recalibration and reexamination of all items examination or check. 6.2.4.3 An increase in sensitivity of 20% or 2dB shall require recalibration or check. 6.2.4.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination sensa shall be re-examination)	The Virginia of Richard		Dil Proc. No. ISI 2.6 Rev. Date: <u>3/1/83</u> Page 6 o	3 f_24
 of each examination category, or every four hours, whichever is less, and with any change in examination personnel. 6.2.4.2 A decrease in sensitivity of 20% or 2dB shall require recalibration and re-examination of all items examined since the previous acceptable calibration or check. 6.2.4.3 An increase in sensitivity of 20% or 2dB shall require recalibration, re-examination, and data correction of all indications reported since the previous acceptable calibration or check. 6.2.4.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be re- 		6.2.4	6.2.4.1	calibration check, which is the erification of the instrument ensitivity and sweep range calibration, hall be performed at the beginning and	end
 6.2.4.3 An increase in sensitivity of 20% or 2dB shall require recalibration, re-examination, and data correction of all indications reported since the previous acceptable calibration or check. 6.2.4.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be re- 			6.2.4.2 A	f each examination category, or every our hours, whichever is less, and with ny change in examination personnel. decrease in sensitivity of 20% or 2dB hall require recalibration and re- xamination of all items examined since	end
6.2.4.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be re-			6.2.4.3 A s a	n increase in sensitivity of 20% or 2dB hall require recalibration, re-examinat nd data correction of all indications eported since the previous acceptable	
examined			6.2.4.4 I c s f f f f t c v v	f any point on the DAC curve has moved in the sweep line more than 10% of the weep division reading, correct the swee ange calibration and note the correction in the examination record. If recordabl effectors are noted on the data sheets, hose data sheets shall be voided, a new alibration shall be recorded, and the oided examination areas shall be re-	1

The instrument sweep range and a distance amplitude curve (DAC) shall be established utilizing the response from the applicable basic calibration holes in accordance with paragraphs 6.4 and 0.5.

6.2.5

The Virginia Corporation of Richmond Proc. No. ISI 2.6 Rev. 3 Date: ______ Page_7_ of _24 Straight Beam Calibration for Base Metal 6.3 6.3.1 The sensitivity of the instrument shall be adjusted at a location free of indications so that the first back reflection from the far side of the plate will be 80 percent of full screen height (FSH). The sensitivity as adjusted above shall be continuously monitored during the examination. The base metal straight beam examination may be conducted concurrently and at the same sensitivity as the straight beam examination described in paragraph 6.4.2 6.4 Straight Beam Calibration for Weld Metal and HAZ 6.4.1 Sweep Range Calibration 6.4.1.1 Position the search unit on the calibration block and obtain the maximum response from the XT side-drilled hole. Adjust the left edge of this indication to line 2 on the screen with the delay control. 6.4.1.2 Position the search unit for the maximum response from the 3/4T hole. Adjust the left edge of this indication to line 6 on the screen with the range control. 6.4.1.3 Repeat delay and range control adjustments until the %T and 3/4T hole reflections start at sweep lines 2 and 6. Note: Other sweep positions may be used for 3 material with varying thickness. 6.4.2 Distance Amplitude Correction 6.4.2.1 Position the search unit for maximum response from the hole which gives the highest amplitude.

6.4.2.2 Adjust the sensitivity control to provide an 80% of full screen indication from that hole. Mark the peak of the indication on the screen with a grease pencil or other suitable marker.

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	from 6.4.2.4 Mark scre	
	the	ect the screen marks and extend through thickness to provide the distance amplitude e for the side-drilled holes. This is primary reference level.
6.5 Augle Be	am Calibration	primary reference level.
6.5.1	Sweep Range Ca	libration
	from Jeft the	tion the search unit for the maximum response the ½T side-drilled hole. Adjust the edge of this indication to line 2 on screen with the delay control.
	from of t	tion the search unit for the maximum response the 3/4T hole. Adjust the left edge his indication to line 6 on the screen the range control.
	unti. at su Note	at delay and range control adjustments 1 the ½T and 3/4T hole reflections start weep lines 2 and 6 respectively. : Other sweep positions may be used for rial with varying thickness.
	from	tion the search unit for maximum response the square notch on the opposite surface. indication will appear near sweep line
	6.5.1.5 Two (divisions on the sweep equals ½T.

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6.5.2 Distance-Amplitude Correction

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6.5.2.1 Calibration from the clad side

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- (a) Position the search unit for maximum response from the hole which gives the highest amplitude.
- (b) Adjust the sensitivity control to provide an 80% FSH response from the hole. Mark the peak of the indication on the screen.
- (c) Position the search unit for maximum response from each of the remaining holes.
- (d) Mark the peak of these indications on the screen.
- (e) Position the search unit for maximum amplitude from the 3/4T hole indication after the beam has bounced from the opposite surface. The indication should appear near sweep line 10. Mark the peak on the screen for the 5/4T position.
- (f) Connect the screen marks for the sidedrilled holes to provide the distance amplitude curve. This is the primary reference level.
- 6.5.2.2 Calibration From the Unclad Side
 - (a) From the clad side of the block, determine the dB change in amplitude between the 3/4T and 5/4T positions.
 - (b) From the unclad side, perform calibrations as noted in 6.5.2.1 (a) through (d).

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- (c) To determine the amplitude for the 5/4T hole, position the search unit for maximum amplitude from the 3/4T hole. Decrease the signal amplitude by the number of dB determined in (a). Mark the height of this signal amplitude at sweep line 10 (5/4T).
- (d) Connect the screen marks to provide the distance-amplitude curve. This is the primary reference level. This will permit evaluation of indications down to the clad surface (near sweep line 8).

6.5.2.3 Calibration for Unclad Areas (Ref. Fig. 4)

- (a) Position the search unit for the maximum response from the hole giving the highest signal amplitude. Adjust the sensitivity control to 80% of full screen height (FSH). Mark the peak of the indication on the screen.
- (b) Position the search unit for the maximum response from the remaining hole(s). Without changing the sensitivity control, mark the peak of the indication(s) on the screen.

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(c) Connect the screen marks and extrapolate through the thickness (½T on each side) to provide a smooth DAC curve. This shall be the primary reference level.
(d) The sensitivity shall then be established

from the O.D. surface notch by setting the signal response amplitude from the O.D. notch at the level of the DAC curve.

7.0 Examination

- 7.1 Straight Beam Examination of Base Metal
 - 7.1.1 Prior to performing angle beam examinations, the base material through which the angle beam will pass (reference Figures 4, 5, 6, and 7) shall be completely scanned with a straight beam search unit to detect reflectors which might affect the interpretation of the results of the angle beam examinations.
 - 7.1.2 C___ibration shall be as indicated in paragraph 6.3.
 - 7.1.3 Scans shall overlap at least ten percent.
 - 7.1.4 Alternatively, the base metal examination may be conducted concurrently and at the same calibration as described in paragraph 6.4, provided that the scan sensitivity (2 x reference) is at least as sensitive as that required in paragraph 6.3.
- 7.2 Straight Beam Examination for Weld Metal and HAZ
 - 7.2.1 The examination for planar reflectors shall be performed on the entire volume of weld and adjacent base material in accordance with Figure 4, 5, 6, and 7.

7.2.2 Calibration shall be as indicated in paragraph 6.4.

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7.2.3	reflection from an op	verified by obtaining a posite surface of the material the two surfaces are parallel.		
7.2.4	Scans shall overlap a	at least ten percent.		
7.3 Angle Be	am Examination for Refl	lectors Parallel to the Weld		
7.3.1		reflectors parallel to node from both sides of		
7.3.2	material with a $\frac{1}{2}$ nod sides of the weld, the	to examine the required de examination from both he reasons for the partial documented in accordance		
7.3.3	The area of interest and the required amou	shall be the weld and HAZ, unt of base metal on each side ce Figures 4, 5, 6, and 7).		
7.3.4	Calibration shall be	as indicated in paragraph 6.5.		
7.3.5	be examined, with the transmitting an angle axis. The search unit from the weld such the through the whole are be examined. Concurn unit shall be swivele progressively indexed	Il start at one edge of the area e ultrasonic search unit e beam perpendicular to the weld it shall be moved towards and away hat the calibrated beam passes ea of the weld and base metal to rent with this scan, the search ed 15° right and 15° left, and d along the length of the weld such pattern follows a "saw tcoth" pattern.		

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7.3.5, continued

The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure. When practical, the examination shall be accomplished from both sides of the weld except where restricted by part geometry or access.

- 7.4 Angle Beam Examination for Reflectors Transverse to the Weld
 - 7.4.1 The angle beam examination for reflectors transverse to the weld shall be performed on the weld crown and adjacent base material as necessary to examine the required volume of weld and base material by $\frac{1}{2}$ node in two directions along the weld.
 - 7.4.2 If it is impossible to examine the required material with a 1/2 node examination from both sides of the weld, the reasons for the partial examination shall be documented in accordance with paragraph 9.4
 - 7.4.3 The area of interest shall be the weld and HAZ, and the required amount of base metal or each side of the weld (reference Figures 4, 5, 6, and 7.
 - 7.4.4 Calibration shall be as indicated in paragraph 6.5.
 7.4.5 The search unit shall be placed at 5T on one edge of the inspection area directing the angle beam into the material parallel to the weld axis. From this position the search unit shall be moved parallel to the weld and indexed toward the opposite side of the weld such that the next scan will cover at least 10 percent of the area covered by the previous adjacent scan. Parallel scans shall be repeated in this manner until the opposite side of the weld and base metal is reached and examined. The

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7.4.5. continued

search unit shall be swiveled 15° right and 15° left and progressively indexed along the length of the weld such that the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure, except where restricted by part geometry or access.

7.4.6 Where the weld axis is not perpendicular to the examination surface, scanning shall be performed on an overlapping pattern as detailed in paragraph 7.4.5, until the entire volume of the weld metal and required base metal is examined.

7.5 Scanning shall be performed at a gain setting of at least 2 times the reference level (6dB increase in amplitude). Recording of indications shall be carried out with the gain control set at the reference level.

7.6 Rate of search unit movement shall not exceed 6in./sec. (153 mm/sec.).

8.0 Evaluation and Recording of Straight Beam Examination for Laminar Reflectors

- 8.1 All areas giving indications equal to or greater than the back reflection shall be recorded.
- 8.2 All areas where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications in the same plane shall be recorded.
- 8.3 The following data shall be recorded for laminar reflectors:
 - 8.3.1 Sweep reading of laminar reflectors from the surface.
 - 8.3.2 Position from the reference marking.
 - 8.3.3 Location parallel to the reference marking for each search unit position, giving the recordable extent of the indication as the laminar area is scanned on parallel scan paths.

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- 8.4 Where laminar reflectors interfere with the scanning of examination volumes for planar reflectors, the angle beam examination technique shall be modified to examine the maximum feasible volume, within the specified examination volume, and the description of the volume excluded by the lamination shall be noted on the data sheet.
- 9.0 Evaluation and Recording of Straight Beam and Angle Beam Indications in the Weld and Heat Affected Zone
 - 9.1 All indications 20% of the primary reference DAC or greater shall be investigated to determine the shape, identity, location, and type of indication. Additionally, all indications, regardless of amplitude, which the examiner judges to be potentially indicative of a crack or lack of fusion shall be investigated to determine the shape, identity, location, and type of indication.
 - 9.1.1 Any indication categorized as a flaw shall be recorded and reported in accordance with the requirements of reference 2.3.
 - 9.1.2 Any indication resulting from the metallurgical structure within the material shall be considered when assessing the effectiveness of the examination. Restrictions or variations to the examination due to the metallurgical structure shall be reported. Additional search unit angles may be used during evaluation as an aid in interpretation.
 - 9.1.3 Clad interface and back wall reflections need not be recorded.
 - 9.1.4 Geometric indications that are equal to or greater than 50% of the primary reference DAC shall be acknowledged by recording their length and location.
 - 9.2 Any flaw indication which is equal to, or greater than, 50% of the primary reference DAC shall be evaluated to the extent necessary to determine the size, shape, identity, and location of the reflector. Indications shall be recorded in accordance with paragraph 9.3, and reported in accordance with the requirements of reference 2.3.

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Data required when indications are equal to, or greater than, 50% of DAC: 9.3.1

- All search unit position and location dimensions shall be recorded to the nearest tenth of an inch.
- 9.3.2 Maximum percent of DAC, sweep reading of indication, search unit position, location along the length of the weld, and beam direction.

9.3.3 Through-Wall Dimension:

9.3

9.3.3.1 For reflectors 50 to 100% DAC. the minimum and maximum sweep readings and their position and location along the length of the reflector for 50% DAC when approaching and moving away from the reflector's maximum signal direction.

9.3.3.2

For reflectors exceeding 100% DAC, minimum and maximum sweep readings and their position and location along the length of the reflector for 50% of the maximum amplitude when approaching and moving away from the reflector's maximum signal direction.

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9.3.4 Length Dimension

9.3.4.1 The length of the reflector shall be obtained by recording the position and location along the length of weld as determined by 50% of DAC for each end of the reflector.

9.4

Welds that did not receive a complete examination according to paragraph 7.0 shall have the partial examination noted on the data sheet as follows:

9.4.1 The extent of the examination performed shall be noted.

- 9.4.2 If the volumetric examination was performed from one side of the weld only, it shall be noted and an entry made indicating what steps were taken to ensure that the required area on the far side of the weld was examined.
- 9.4.3 The reason(s) that a specific examination was impractical shall be noted. For example, support or component restricts access, fitting prevents adequate ultrasonic coupling on one side, component to component weld prevents ultrasonic examination, etc.
- 9.5 Investigation and reporting of indications shall be performed at the reference sensitivity.

10.0 Documentation of Examination

10.1 All data relative to the examination and r (ab. -) ications shall be reported in accordance with reference 2.', and on forms similar to those shown in Figures 8, 9, and 10.

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Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

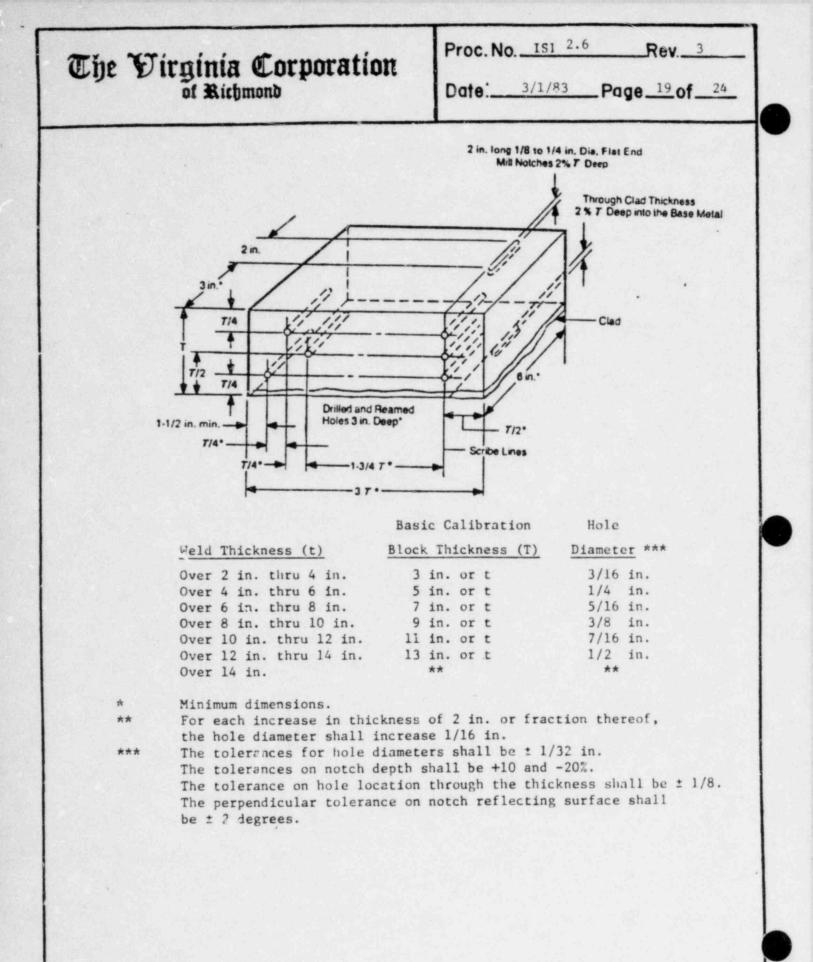
Angle Beam Examination*

Nominal	Transducer										
Material Thickness	Maximum Size	Nominal Frequency	Nominal Angles								
.25" to .40"	1/4" dia. or 1/4" x 1/4"	2.25 MHZ	45 ⁰	600							
>.40" to 1.00"	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	45°	600							
>1.00" to 1.20"	3/4" dia. or 3/4" x 3/4"	2.25 MHZ	45°	600							
> 1.20"	1-1/8" dia. or 1" x 1"	2.25 MHZ	45°	600							

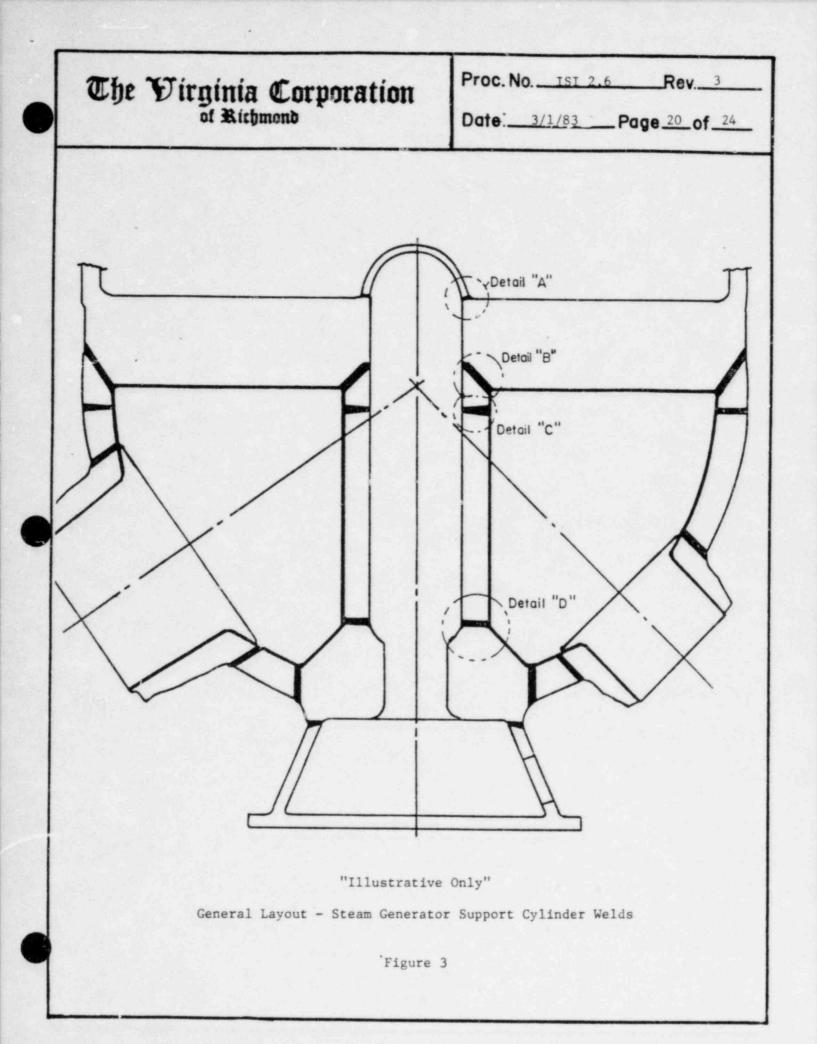
Straight Beam Examination*

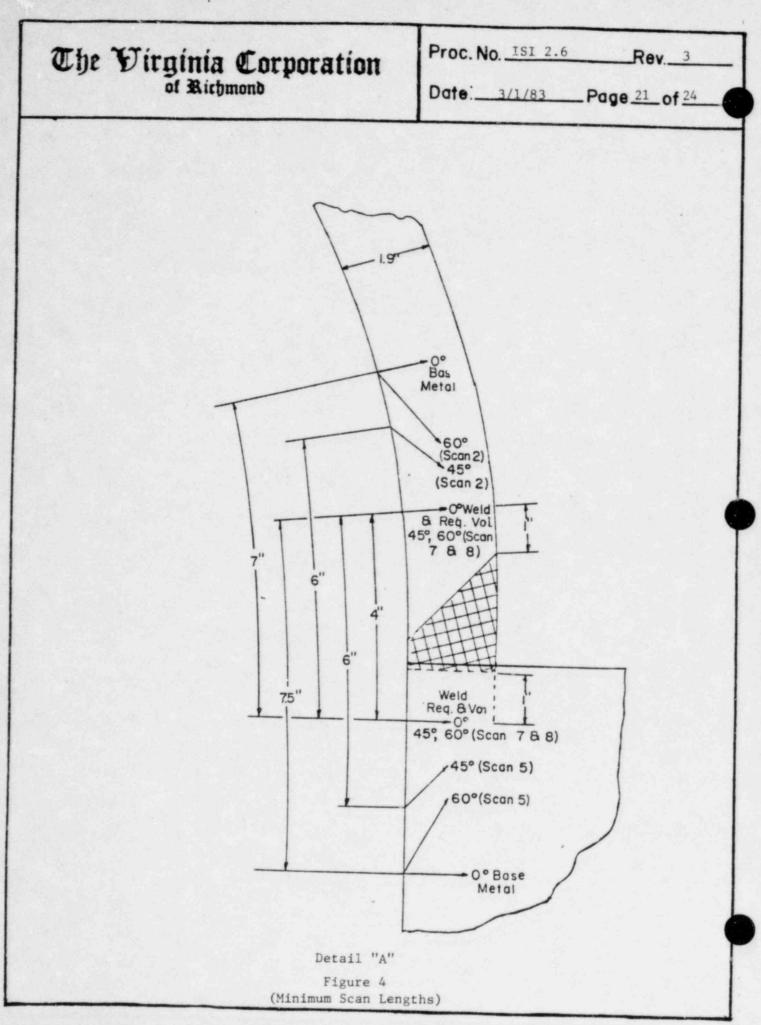
Nominal Pipe	Transducer								
Diameter	Maximum Size	Nominal Frequency							
less than 12" dia.	1/2" dia. or 1/2" x 1/2"	2.25 MHZ							
12" dia. and greater	1-1/8" dia. or 1" x 1"	2.25 MHZ							

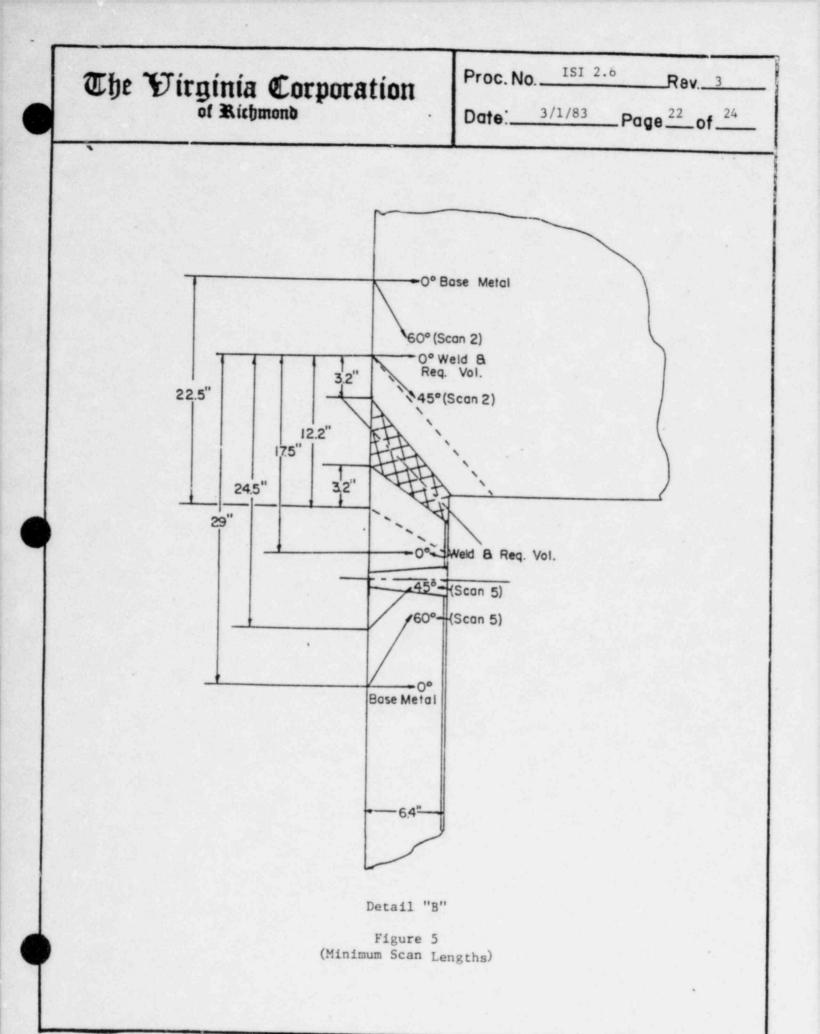
*Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.

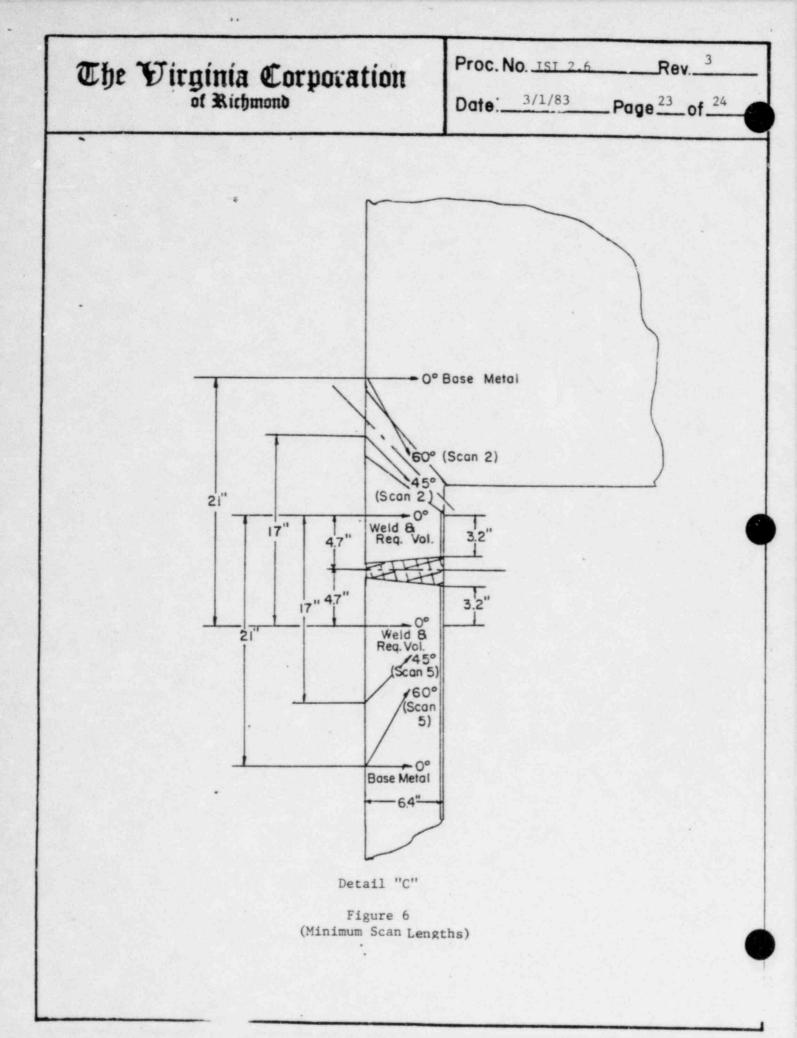


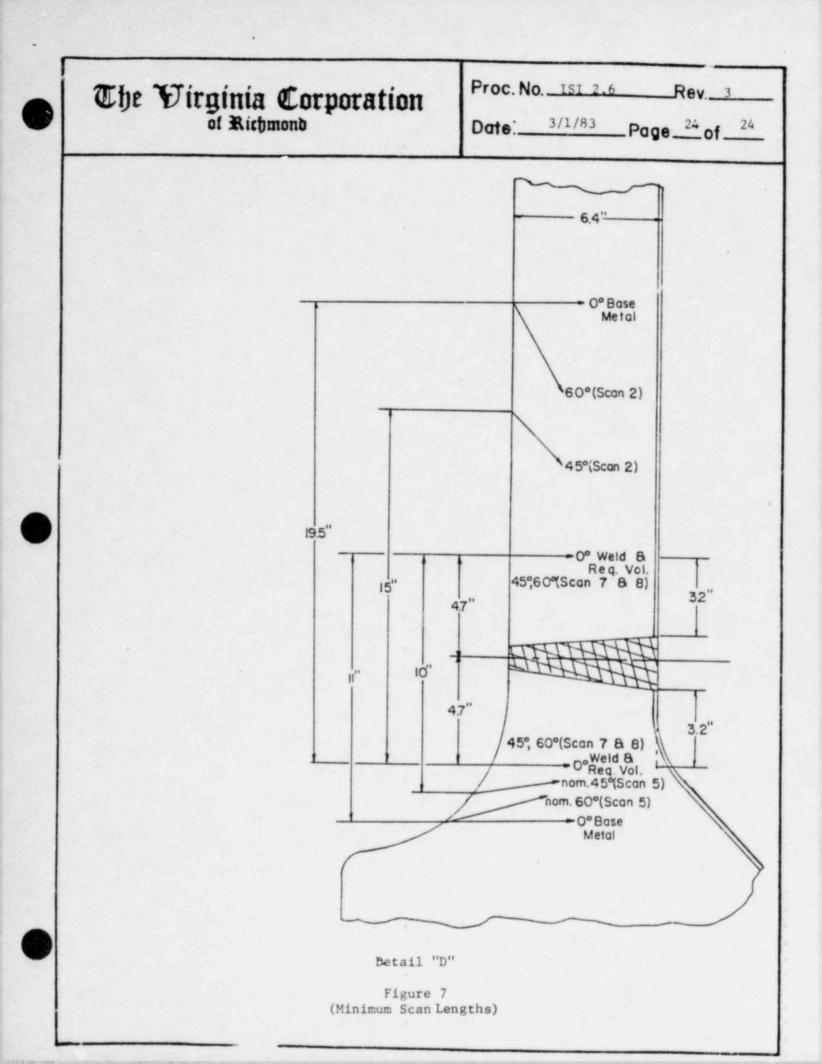
"ILLUSTRATIVE ONLY" Typical Calibration Block Figure 2











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	-		Compo	nent/Pi	ping	Syste	em		Pipe	Siz	e Wel	d Type	Cal. B	lock #		lant:	Patah	Nia
Continuati	on Sheet	Attached	1						0°	1-1	5.	(08					batth	NOA
Yes	N					Tran S/N		r	0-	4-	2	60°	Mfgr.	T	nstrum	Model		
			-			Size							S/N			RepRa		
Field Chang Yes N	ies:					Freq	uenc	4					Reject			Filte		
If Yes, Num						Beam							Damp		-	Coax		
Calibr	ation 0	0		2 & 5	1				78	8	Scan		Freq.			Video		
alibration						ind En						Entry		Ca)°		ion Che 5°	cks 6	0°
eflector	Signal		Signal			int T		Signa			Statement and statement	t To:	In	Out	In	Out	In	Out
ocation	Amp.	Sweep	Amp.	Sweep	Scri Lin		50% DAC	Amp.	Sw	eep		DAC						
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ef. dB													×× ××					
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	-	2.18	Figure	2 9	Ultr	asonia	Examination Re	eport	- Cont	inuation	Sheet	Page	of
Virginia Corp.		Custor	Customer Plant				Unit	Loop/ Zone	Iso/Drawing	No.			
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1.0 Scope

1.1

This procedure is applicable to, and describes, the requirements for manual ultrasonic examination of full penetration circumferential and longitudinal austenitic butt welds and adjacent base metal in piping having a nominal wall thickness of 0.2 inches to 6.0 inches, and vessels with a nominal wall thickness of less than 2.0 inches, that are formed by extrusions, castings, forgings, or rolled plate. Materials to be examined include similar metal welds in austenitic steels. This procedure is written in compliance with ASME Code, Section XI, Appendix III and Supplement 7 of Appendix III.

2.0 References

- 2.1 1977 edition of ASME Boiler and Pressure Vessel Code, Section XI, with addenda through summer, 1978.
- The Virginia Corporation Written Practice for the Qualification 2.2 and Certification of NDE Personnel, NDE 4.1, Rev. 3, dated 3/6/81.
- 2.3 The Virginia Corporation Procedure ISI 1.2, Preservice Inspection Documentation (latest revision).
- 2.4 The Virginia Corporation Procedure ISI 2.1, Ultrasonic Equipment Calibration Confirmation (latest revision).
- 2.5 The Preservice Inspection Program Plan.
- The Virginia Corporation Procedure VC-QA-103, Generation and 2.6 Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Qualifications

Personnel performing examinations to this procedure shall 3.1 be qualified and certified to at least Level II in accordance with the document referenced in paragraph 2.2. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

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4.0	General	Requirements							
	4.1	The area to be examined and contacted by the search unit							
		shall be checked to ensure that it is free of dirt, loose							
		scale, machining or grinding particles, weld splatter,							
		or other foreign matter that would impair the free							
		movement of the search unit or affect the examination.							
		If such conditions are detected, they will be rectified							
		prior to conducting the examination. The identity and location of welds to be examined shall							
	4.2								
		be as specified in reference 2.							
	4.3	The examinations conducted in a							
		shall be done from the O.D. sur							
	4.4	Calibration shall be .performed							
		calibration block which corresp							
		of the component. The calibrat	ion/examination surface						
		shall be noted on the report.	김 김 김 홍종 그는 것이 가장을 잡다.						
	4.5	Examinations shall consist of n							
		shear wave techniques applied i							
		and two directions perpendicula							
			eometry, access, or metallurgical						
		characteristics impede effectiv							
		A zero degree longitudinal beam							
		through which the angle beam mu	st pass.						
	Faudamen								
4		t and Material Requirements							
		Ultrasonic flaw detection instru-							
			stepped gain control calibrated						
		in units of 2 dB or less, and sh							
		requirements of reference 2.4 p							
		plant site. Qualifications may	be valid for a period not to						
		exceed three months.							

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- 5.2 Search units shall be selected in accordance with figure 1. Transducers used shall be certified by the manufacturer as to serial number, size, and central frequency. Search units shall be capable of providing the applicable calibrations as required in paragraph 6.0
- 5.3 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used for preservice examinations.
- 5.4 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.
 5.5 Calibration Blocks
 - 5.5.1 The basic calibration blocks shall be made from material of the same nominal diameter and nominal wall thickness or pipe schedule as the pipe to be examined.
 - 5.5.2 The finish on the surface of the calibration blocks shall be representative of the surface finishes of the piping.
 - 5.5.3 Design of the calibration blocks and reflectors shall be essentially as depicted in Figures 2 through 5. Additional reflectors may be installed provided they do not interfere with establishing the primary reference.

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5.6 Wedges used to produce shear wave for angle beam examination shall be within ±2° of the manufacturer's designated angle as required by reference 2.4.

6.0 Calibration

6.1

Prior to conducting examinations, the complete system to be utilized shall be calibrated on the applicable calibration block. The system shall include the ultrasonic unit (and battery pack, if applicable), cable or cables, search unit, couplant, and any other apparatus, instrument or circuit employed between the instrument and the calibration block surface. Once calibration has been established, any change to any part of the system, including the operator, will require at least a verification of the calibration, which shall be documented.

- 6.1.1 The search unit shall be selected in accordance with Figure 1.
- 6.1.2 The calibration block shall be identified and selected from reference 2.5.
- 6.1.3 The temperature difference between the examination surface and basic calibration block surface shall not exceed 25° F.
- 6.1.4 The maximum calibration indications shall be obtained with the sound beam oriented essentially perpendicular to the axis of the calibration reflector. The center line of the search unit shall be at least 3/4 in. (19 mm) from the nearest side of the block or pipe. (Rotation of the beam into a corner formed by the reflector and the side of the block may produce a higher amplitude signal at a longer beam path; this beam path shall not be used for calibration.)

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- 6.1.5 Calibration shall be performed from the surface (clad or unclad) of the calibration block which corresponds to the component surface to be examined.
- 6.2 Straight Beam Calibration for Weld Metal and HAZ
 - 6.2.1 Position the search unit for the maximum response from the ¹/₄T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ¹/₄T hole is positioned at 2.0 on the graticule.
 - 6.2.2 Position the search unit for the maximum response from the 3/4T hole. Using the sweep range control, adjust the sweep position so that the leading edge of the response from the 3/4T hole is positioned at 6.0 on the graticule.
 - 6.2.3 Repeat steps 6.2.1 and 6.2.2 until no further adjustment is necessary. Note: Other sweep positions may be used when necessary to obtain a broader sweep range for piping systems with varying thickness.
 - 6.2.4 Position the search unit for the maximum response from the hole giving the maximum signal amplitude. Adjust the sensitivity control to 80% of full screen height (FSH). Mark the peak of the indication on the screen.
 - 6.2.5 Position the search unit for the maximum response from the remaining hole(s). Without changing the sensitivity control, mark the peak of the indication(s) on the screen.
 - 6.2.6 Connect the screen marks and extrapolate through the thickness (¹/₄T on each end) to provide a smooth DAC curve. This shall be the primary reference level.

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transducers for ev the near zone is p	ine transducers and/or dual valuation of indications in permitted if applied in accord- nirements of paragraph 6.1.
6.3 Angle Beam Calibration for6.3.1 The response from	
manner: 6.3.1.1 Posit	AC curve in the following tion the search unit for the maxi- response from the $\frac{1}{2}$ T hole. Using
the s sweep of th	weep delay control, adjust the position so that the leading edge to response from the $\frac{1}{4}$ T hole is tioned at 2.0 on the graticule.
6.3.1.2 Posit mum r the s sweep of th	ion the search unit for the maxi- esponse from the 3/4T hole. Using weep range control, adjust the position so that the leading edge e response from the 3/4T hole is ioned at 6.0 on the graticule.
6.3.1.3 Repea	it steps 6.3.1.1 and 6.3.1.2 until arther adjustment is necessary.
mum r highe sensi scree	ion the search unit for the maxi- esponse from the hole giving the st signal amplitude. Adjust the tivity control to 80% of full in height (FSH). Mark the peak is indication on the screen.
mum r hole(tivit	ion the search unit for the maxi- esponse from the remaining s). Without changing the sensi- y control, mark the peak of the ation(s) on the screen.

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- 6.3.1.6 Connect the screen marks and extrapolate through the thickness (¹/₄T on each end) to provide a smooth DAC curve. This shall be the primary reference level.
 6.3.1.7 The sensitivity shall then be estab
 - lished from the I.D. surface notch by setting the signal response amplitude from the I.D. notch at the level of the DAC curve.

6.3.2 When it is necessary to examine materials such as centrifically cast stainless steel, using refracted longitudinal waves and the I.D. notch cannot be resolved, the following calibration shall be performed.

- 6.3.2.1 Adjust the sweep in accordance with paragraphs 6.3.1.1 through 6.3.1.3.
 6.3.2.2 Position the search unit for the maximum response from the ¹/₄T hole. Adjust the sensitivity control to 80% FSH. Mark the peak of the indication on the screen.
- 6.3.2.3 Position the search unit for the maximum response from the ½T hole. Without changing the sensitivity control, mark the peak of the indication on the screen.
- 6.3.2.4 Connect the screen marks for the $\frac{1}{4}T$ and $\frac{1}{2}T$ holes and extrapolate up to $\frac{1}{4}T$ on each end to provide a smooth DAC curve. This shall be the primary reference level.

6.3.2.5 Adjust the sensitivity control to bring the $\frac{1}{2}$ T hole to 80% FSH. Mark

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6.3.2.6	the peak of this signal on the screen and record the dB. Position the search unit for the maxi- mum response from the 3/4T hole. With- out changing the sensitivity control, mark the peak of the indication on the
6.3.2.7	screen. Connect the screen marks for the $\frac{1}{2}T$ and $3/4T$ holes and extrapolate up to $\frac{1}{4}T$ on each end to provide a smooth DAC curve. This shall be the primary
6.3.2.8	reference level. Adjust the sensitivity control to bring the 3/4T hole to 80% FSH. Mark the peak of this indication on the screen
6.3.2.9	and record the dB. With the 3/4T hole at 80% FSH position the search unit on the 7/8T hole and mark the peak of the indication. Con-
	nect the screen marks for the $3/4T$ hole and the $7/8T$ hole and extrapolate up to $\frac{1}{4}T$ on each end to provide a smooth DAC. This shall be the primary reference level.
6.3.2.10	This will produce three DAC curves on the screen. Each DAC curve will have its respective reference gain setting which shall be recorded on the data sheet.
6.3.2.11	Evaluation of reflectors will be to its respective DAC curve and reference gain setting along the sweep base line.
6.4 Angle Beam Calibrati	ion for Full Node Examination

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	6.4.1	The response	from the I.D. and O.D. notches shall
		be used to en	stablish the slope, shape, and sensi-
		tivity of the	e DAC curve in the following manner:
		6.4.1.1	Position the search unit for the maxi-
			mum response from the I.D. notch. Us-
			ing the sweep delay control, adjust the
			sweep position so that the leading edge
			of the response from the I.D. notch is
			positioned at 4.0 on the graticule.
		6.4.1.2	Position the search unit for the maxi-
			mum response from the O.D. notch. Us-
			ing the sweep range control, adjust the
			sweep position so that the leading edge
			of the response from the O.D. notch is
			positioned at 8.0 on the graticule.
		6.4.1.3	Repeat steps 6.4.1.1 and 6.4.1.2 until
			no further adjustment is necessary.
		6.4.1.4	Position the search unit for the maxi-
			mum response from the I.D. notch. Ad-
			just the sensitivity control to 80% of
			FSH. Mark the peak of the indication
			on the screen.
		6.4.1.5	Position the search unit for the maxi-
			mum response from the O.D. notch.
			Without changing the sensitivity con-
			trol. mark the peak of the indication
			on the screen.
		6.4.1.6.	Connect the screen marks and extrapo-
			late the DAC at either end for a dis-
			tance of $\frac{1}{2}T$. This shall be the pri-
			mary reference level.
6.5	Angle	Beam Calibrati	on for 1½ Node Examination
	6.5.1	The response	from the I.D. and O.D. notches shall
		he used to e	stablish the slope, shape, and sensi-
			나는 아이들은 것은 아이들은 것은 것은 것은 것을 하는 것을 하는 것을 수 있다. 가지 않는 것은 것은 것을 가지 않는 것을 수 있다. 것을 가지 않는 것을 수 있는 것을 수 있는 것을 것을 수 있는 것을 수 있는 것을 것을 수 있는 것을 것을 것을 수 있는 것을 것을 수 있다. 것을 것을 것을 것을 수 있는 것을

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	tivity of th	ne DAC c	urve in the following manner:
	6.5.1.1	Positi	on the search unit for the maxi- sponse from the I.D. notch. Us-
			e sweep delay control, adjust th
			position so that the leading edg
			response from the I.D. notch is
			oned at 3.0 on the graticule.
	6.5.1.2		on the search unit for the maxi-
		mum r	esponse from the O.D. notch. Us
		ing th	e sweep range control, adjust th
		sweep	position so that the leading edg
		of the	response from the O.D. notch is
		positi	oned at 6.0 on the graticule.
	6.5.1.3	Repeat	steps 6.5.1.1 and 6.5.1.2 until
			ther adjustment is necessary.
	6.5.1.4		on the search unit for the maxi-
		mum re	sponse from the I.D. notch $(1\frac{1}{2})$
		node).	Check that the leading edge is
		at or	near 9.0 on the graticule.
	6.5.1.5	Positi	on the search unit for the maxi-
		mum re	sponse from the I.D. notch $(\frac{1}{2}$
		node).	Adjust the sensitivity control
		to 80%	FSH. Mark the peak of the indi
			on the screen.
	6.5.1.6		on the search unit for the maxi-
			sponse from the O.D. notch (1
			Without changing the sensi-
			control, mark the peak of the
	6.5.1.7		tion on the screen. on the search unit for the maxi-
			sponse from the I.D. notch $(1\frac{1}{2})$
			Without changing the sensi-
			control, mark the peak of the
			tion on the screen.
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6.5.1.8

Connect the screen warks and extrapolate the DAC at rither end for a distance of $\frac{1}{2}T$. This shall be the primary reference level.

- 6.6 When using the straight beam or angle beam techniques, variables such as weld preparation, weld crown width, or physical interference may be encountered. These variables may be eliminated by one or more of the following. Note: Other sweep positions may be used when necessary to obtain a broader sweep range for piping systems with varying thickness.
 - 6.6.1 Reducing the dimension of the wedge edge-to-beam entry point.
 - 6,6.2 Reducing search unit size.

6.6.3 Increasing beam angle.

- 6.6.4 Increasing the metal path by at least an additional $\frac{1}{2}$ node.
- 6.6.5 Additional surface preparation.
- 6.7 Calibration Verification
 - 6.7.1 A system calibration check, which is the verification of the instrument sensitivity and sweep range calibration, shall be performed at the beginning and end of each examination category, or every four hours, whichever is less, and with any change in examination personnel.
 - 6.7.2 A decrease in sensitivity of 20% or 2 dB shall require recalibration and re-examination of all items
 examined since the previous acceptable calibration check. All data taken since the last calibration check shall be marked void.
 - 6.7.3 An increase in sensitivity of 20% or 2 dB shall require recalibration, re-examination, and data correction of all indications reported since the previous acceptable calibration or check.

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6.7.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be re-examined.

Examination

- 7.1 Straight Beam Examination for Base Metal
 - 7.1.1 Prior to performing angle beam examinations, the base material through which the angle beam will pass (reference Figures 6 and 7) shall be completely scanned with a straight beam search unit to detect laminar reflectors which might affect the interpretation of the results of the angle beam examination.
 - 7.1.2 The sensitivity of the instrument shall be adjusted at a location free of indications so that the initial back reflection from the far side of the plate will be 80 percent of full screen height.
 - 7.1.3 Areas containing laminar indications that may affect angle beam examinations shall be noted. All areas giving indications equal to or greater than the remaining back reflection shall be recorded on the data sheet. Also, record all areas where one or more discontinuities produce a continuous loss of back reflection accompanied by continuous indications in the same plane.
 - 7.1.4 Alternatively, the base metal examination may be conducted concurrently and at the same calibration as described in paragraph 6.2, provided that the scan sensitivity (2 x reference) is at least as sensitive as that required in paragraph 7.1.2.

7.2 Straight Beam Examination for Weld Metal and HAZ

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	7.2.1	If the angle beam examination is restricted to a
		full node or $1\frac{1}{2}$ node examination from one side of
		the weld, a calibrated straight beam examination
		shall be performed, providing the weld crown is
		flat enough to make satisfactory transducer contact.
	7.2.2	The area to be examined shall be the weld metal and
		the adjacent base material on the restricted side
		of the weld to the extent allowed by the geometric
		configuration (see Figure 6). Scans shall over-
		lap at least ten percent.
	7.2.3	Calibration shall be as indicated in paragraph 6.2.
7.3	Angle I	Beam - Reflectors Parallel to the Weld
	7.3.1	The primary scan for reflectors parallel to the
		weld shall be $\frac{1}{2}$ node from both sides of the weld.
	7.3.2	Full node or $1\frac{1}{2}$ node shall only be used when it
		is impossible to examine the required material
		with a $\frac{1}{2}$ node examination from both sides of the
		weld.
	7.3.3	The area of interest shall be the weld and HAZ,
		and the required amount of base metal on each
		side of the weld (reference Figures 6 and 7).
	7.3.4	The scan pattern shall start at one edge of the
		area to be examined with the ultrasonic search
		unit transmitting an angle beam perpendicular to
		the weld axis. The search unit shall be moved to-
	lite i fi	wards and away from the weld such that the cali-
		brated beam passes through the whole area of the
		weld and base metal to be examined. Concurrent
		with this scan, the search unit shall be
		swiveled 15° right and 15° left and progressively
		indexed along the length of the weld such that

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the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure. The examination shall be accomplished from both sides of the weld. For welds where scanning access is not available from both sides, the I.P.& L. P.S.I. coordinator will be notified.

7.3.5 Calibration for 1/2 node, full node, or 1-1/2 node examination shall be accomplished according to paragraph 6.3, 6.4, or 6.5.

7.4 Angle Beam - Reflectors Transverse to the Weld

- 7.4.1 The angle beam examination for reflectors transverse to the weld (examination directions 7 and 8) shall be performed on the weld crown and adjacent base material as necessary to examine the weld root by 1/2 node in two directions along the weld. When the weld crown configuration prohibits a 1/2 node examination, a full node examination shall be performed with the search unit adjacent to the weld crown.
 7.4.2 The search unit shall be placed on one
 - edge of the inspection area directing the angle beam into the material parallel to the weld axis. From this position the search unit

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shall be moved parallel to the weld and indexed toward the opposite side of the weld such that the next scan will cover at least 10 percent of the area covered by the previous adjacent scan. Parallel scans shall be repeated in this manner until the opposite side of the weld and 14 base metal is reached and examined. Alternately, the search unit may be swiveled 15° right and 15° left and progressively indexed along the length of the weld such that the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "saw-tooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass.

7.4.3 The weld and the required amount of adjacent base metal is to be fully examined by one of the techniques described in paragraph 7.4.2.
7.4.4 Calibration for ½ node, full node, or 1½ node examination shall be accomplished according to paragraph 6.3, 6.4, or 6.5.

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	7.5	Extent of Examination	
		7.5.1 The volume subject	to examination and extent
		of scan length sha	ll be in accordance with Figures
		6 and 7.	
		7.5.2 Butt welded branch	connection welds shall be
		examined by scanning	ng both transverse and parallel
		to the weld accord:	ing to paragraph 7.3 and 7.4.
		The examination vol	lumes are shown in Figure 9.
		7.5.3 Longitudinal welds	adjacent to circumferential
		welds shall be example	mined by scanning both transverse
		and parallel to the	e weld according to paragraphs
		7.3 and 7.4.	
	7.6	Examinations utilizing more	than one DAC curve shall be
		examined once at the higher i	sensitivity, and evaluated
		at the applicable sensitivity	۷.
	7.7		shall not exceed 6" per second.
	7.8	Scanning sensitivity shall be	e at least twice (+6 dB) the
		calibration or reference sen	sitivity.
.0	Evalu	ation and Recording of Indication	ons
	8.1	All indications 20% of the pr	rimary reference DAC or greater
		shall be investigated to dete	ermine the shape, identity,
		location, and type of indicat	tion. Additionally, all
		indications, regardless of a	amplitude, which the examiner
		judges to be potentially ind	dicative of a crack or lack
		of fusion shall be investigat	ted to determine the shape,
		identity, location, and type	of indication.

8.1.1 Any indication categorized as a flaw shall be recorded and reported in accordance with the requirements of reference 2.3.

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- 8.1.2 Any indication resulting from the metallurgical structure within the material shall be considered when assessing the effectiveness of the examination. Restructions or variations to the examination due to the metallurgical structure shall be reported.
- 8.1.3 Geometric indications that are equal to or greater than 50% of the primary reference DAC shall be acknowledged by recording their length and location.
- 8.2 Any indication which is equal to or greater than 50% of the primary reference DAC shall be evaluated to the extent necessary to determine the size, shape, identity, and location of the reflector. Indications shall be reported in accordance with the requirements of reference 2.3.

Welds that did not receive a complete examination according to paragraph 7.0 shall have the partial examination noted on the data sheet as follows:

- 8.3.1 The extent of the examination performed shall be noted.
- 8.3.2 If the volumetric examination was performed from one side of the weld only, it shall be noted and an entry made indicating what steps were taken to ensure that the required area on the far side of the weld was examined.
- 8.3.3 The reason(s) that a specific examination was impractical shall be noted. For example, support or component restricts access, fitting prevents adequate ultrasonic coupling on one side, component to component weld prevents ultrasonic examination, etc.

8.3

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- 8.4 Investigation and reporting of indications shall be performed at the reference sensitivity. Other frequencies, sizes, or beam angles may be used as an aid in evaluating or interpreting examination results.
- 9.0 Documentation of Examination
 - 9.1
- All data relative to the examinations and reportable indications shall be reported in accordance with reference 2.3, and on forms similar to those shown in Figures 10, 11, and 12.

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Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

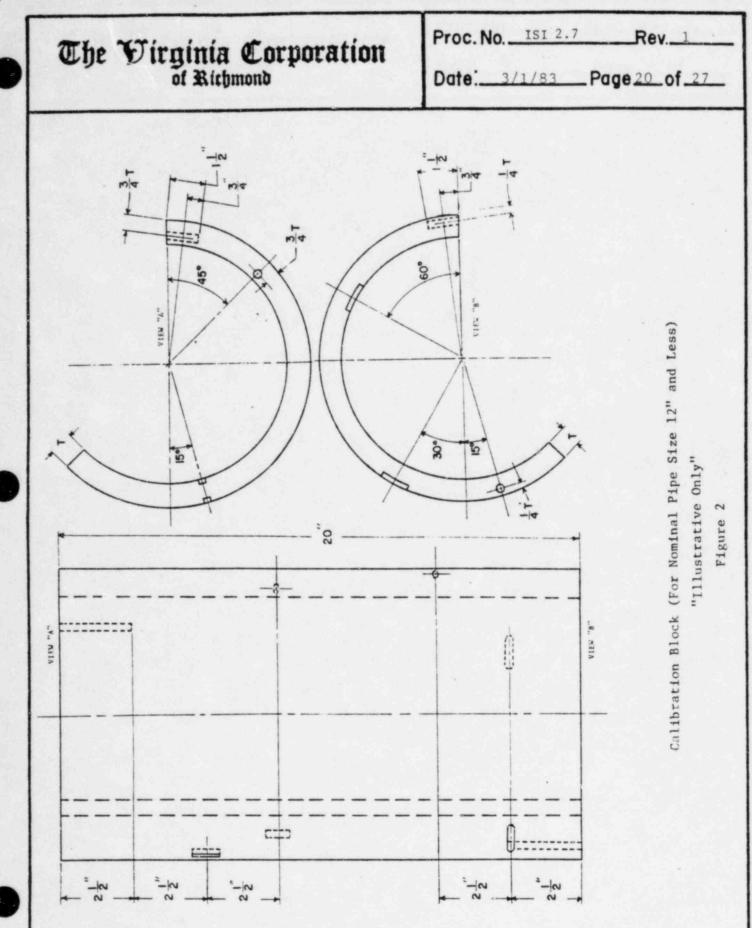
Angle Beam Examination*

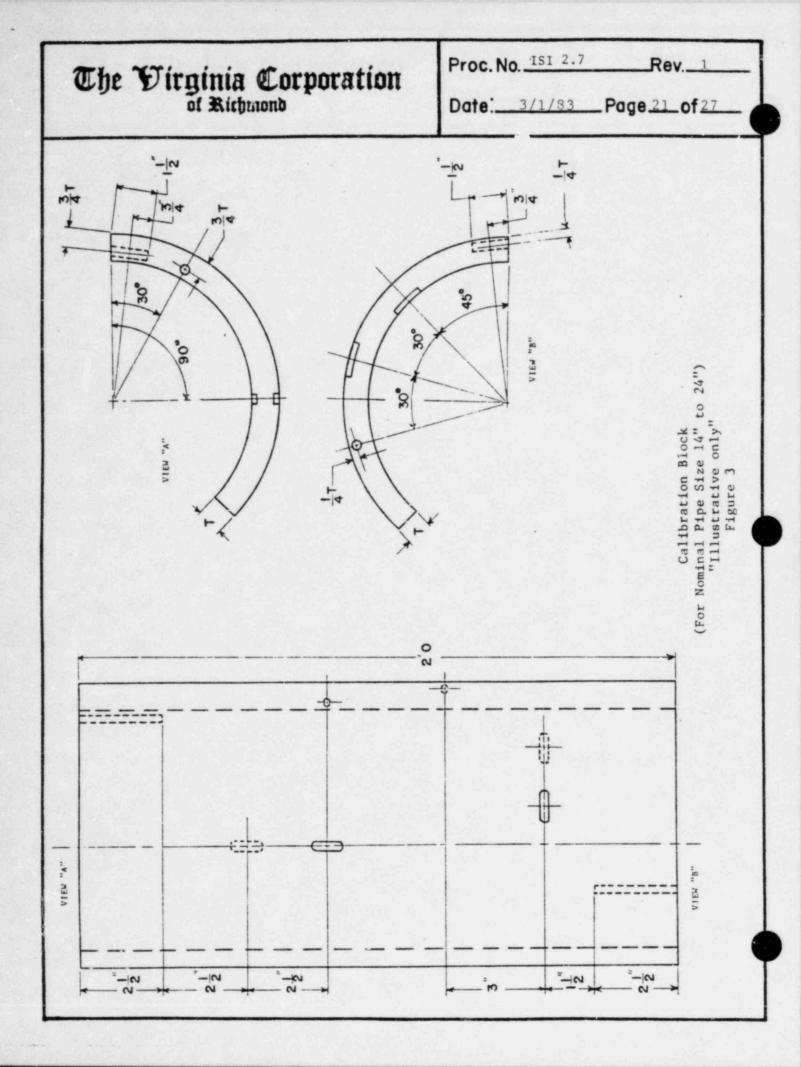
Nominal	Transducer			
Material Thickness	Maximum Size	Nominal Frequency	Nominal Angle	
.250" to .400"	1/4" dia. or 1/4" x 1/4"	2.25 MHZ	45°	
.400" to 1.000"	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	45°	
1.000" to 1.200"	3/4" dia. or 3/4" x 3/4"	2.25 MHZ	45°	
1.200" and greater	1" dia. or 1" x 1"	2.25 MHZ	45°	

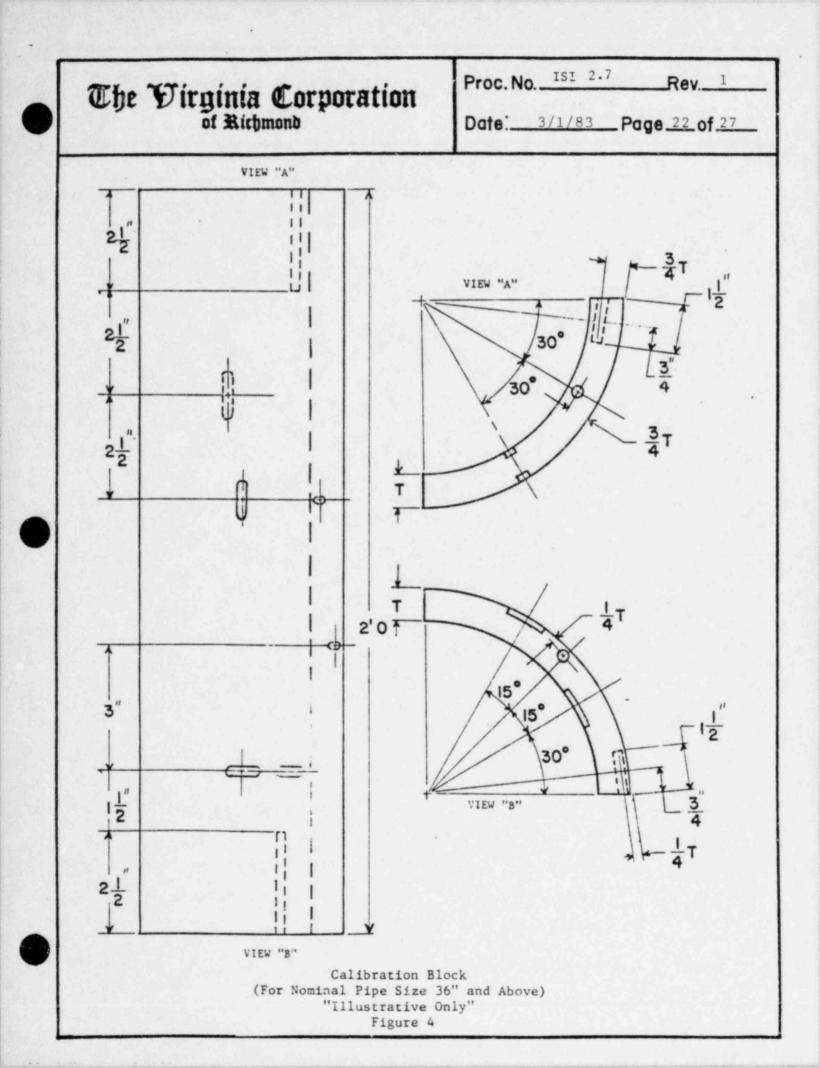
Straight Beam Examination*

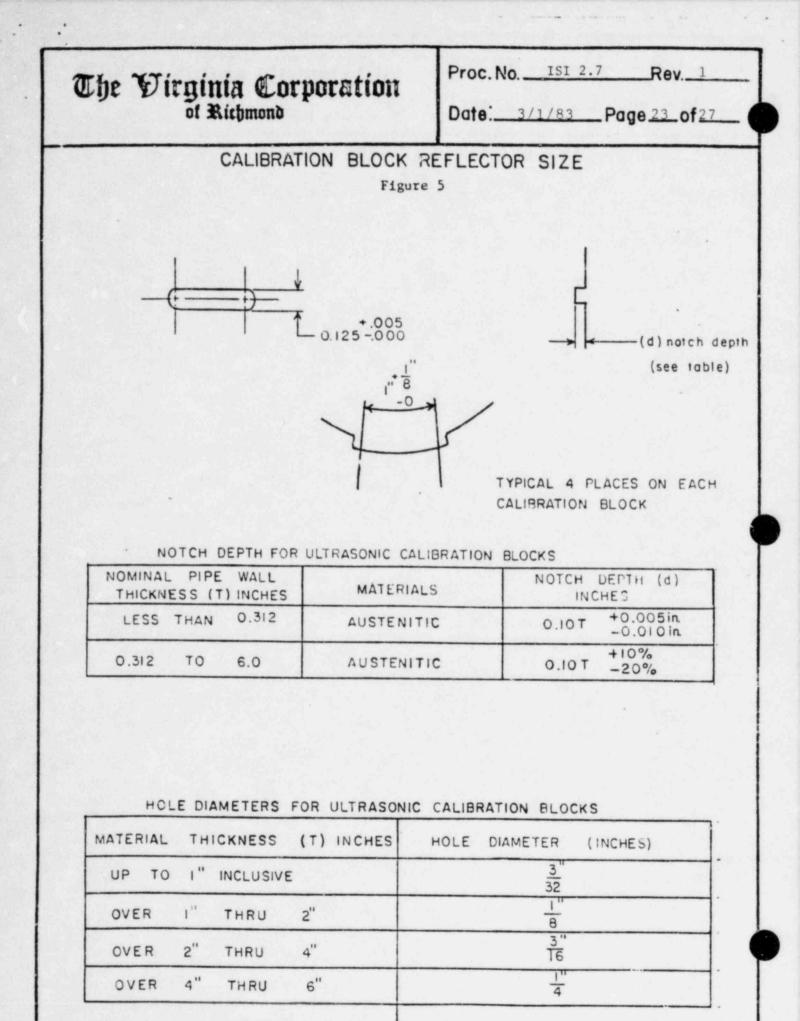
Nominal Pipe	Transducer			
Diameter	Maximum Size	Nominal Frequency		
less than 12" dia.	1/2" dia. or 1/2" x 1/2"	2.25 MHZ		
12" dia. and greater	1" dia. or 1" x 1"	2.25 MHZ		

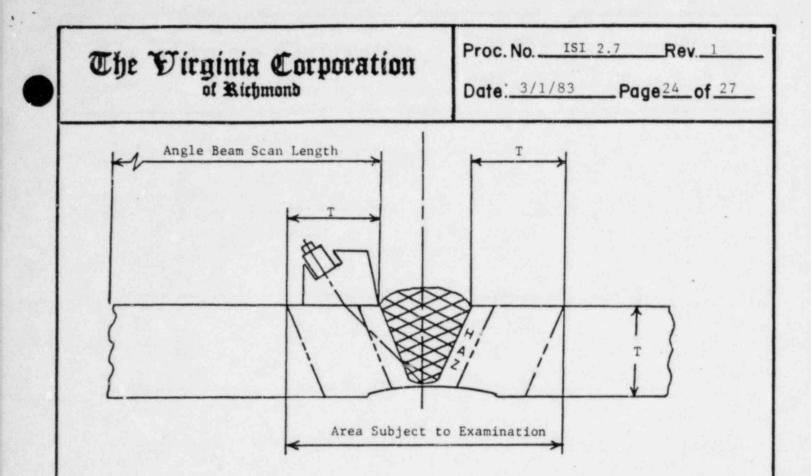
* Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.









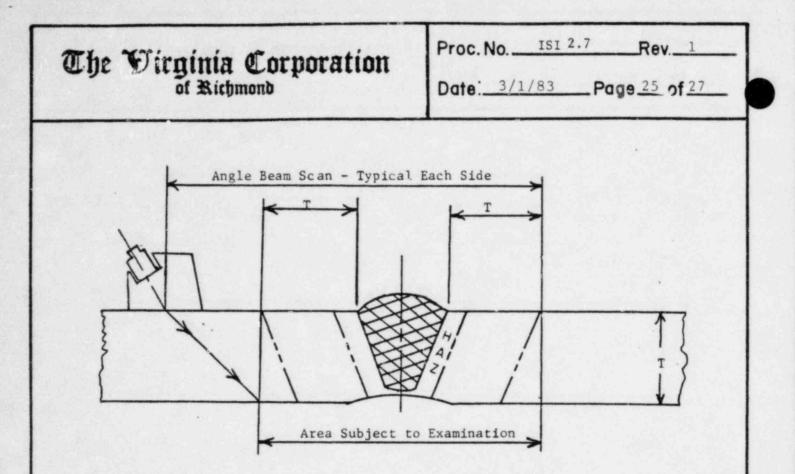


Angle beam scan length as shown above, shall be as follows:

	erial kness	Minimum Scan Length 45°
.200	to .400	1.25"
	to 1.000	3.00"
. 200	to 1.200	4.00"
	to 1.500	5.00"
. 500	and Greater	1.1 x 3T

Full Node Examination

Figure 6



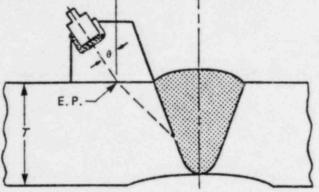
For angle beam scan length as shown above, add the following from each side of the weld fusion line.

Material	Minimum Scan
Thickness	Length 45°.
.200" to .400"	1.00"
.400" to 1.000"	2.25"
1.000" to 1.200"	2.75"
1.200" to 1.500"	3.25"
1.500" and Greater	1.2 x 2T

Half Node Examination

Figure 7

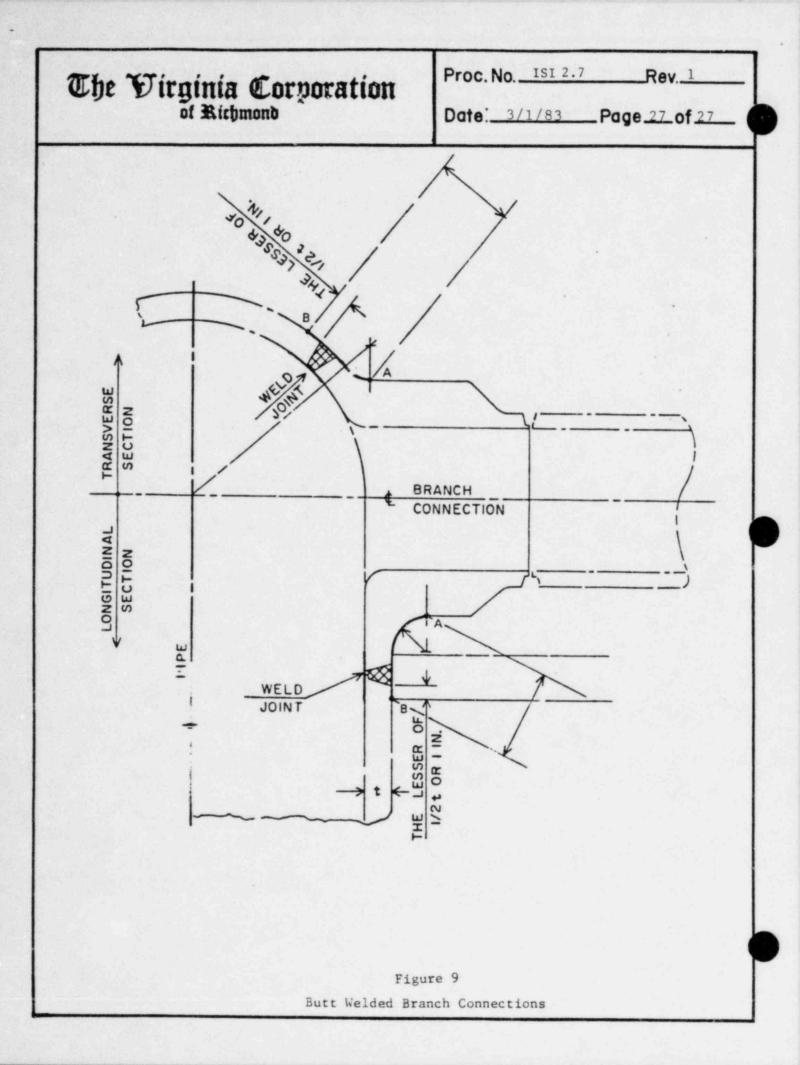
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The beam path shall be increased by at least one-half vee if dimension "A" is greater than:

0.93 T for = 43° to 45° 1.6 T for = 58° to 60° 2.5 T for = 68° to 70°

> Weld Coverage Figure 8



-	Fig	ure 10					Ultre	son	ic E	xamin	ation	Repor	rt				
AF	The		Custo	mer			Plant			Un	it	Loop/Zo	one I oo	Drawin	ng No.		
EVE	Virginia	Corp.	Proce	dure		Exam Sur	face	Exam	iner	/Level		VCR Su	pervis	or .		Date	
NU			Compo	nent/Pi	ping	System		Pipe	Siz	e Weld	Туре	Cal. B	lock #	Coup1 Type		Batch	No
Continuati	on Sheet	Attached						0°	45	. 1	60°					batten	NO
Yes		0				Transduce S/N	r	0-	43		60-	Mfgr.	T	nstr.me	Model		
	and the second s		1			Size			-			S/N	1		RepRa		
Field Chang Yes N	es:					Frequency	,					Reject			Filte		
If Yes, Num	and the second se					Beam Ang						Damp			Coax		
	ation 0	0		2 & 5				78	8	Scan		Freq.			Video		
alibration						nd Entry				Sound				ibrati	on Che	cks	~ .
eflector	Signal		Signal	1	Po	int To:	Signa	1		Point	and the second se	0			•		0°
cation	Amp.	Sweep	Amp.	Sweep	Scri	and the second sec	Amp.	S	Sem			In	Out	In	Out	In	Out
		++		+	Lin	e DAC		4	HE	Line	DAC						
		+				+++	hra	111	+-								
		+			1-	NTN	140	#	++	-							
				17	\mathbf{t}	14/14	1111	-N	36								
				110	PI	W/NW	MiD					1					
				1	1	- W	p										
				7	D)	Lan											
					P												
ef. dB																	
0		DAC 1	.0			DAC	10			1.2.4	DAC	Additi	onal Co	omments	s/Sketc	h	
3			8				8-					1.1.1					
			4														
1			1				0					10.0					
T			4				4					1.00					
1			4				2-										
			0			1					States 1						
1																	

Form UT-101

	-		Figure	11	Ultr	asonic	Examination	Report	- Cont	inuation s	Sheet	Page	of
F		The			Custon	ner ·	Plan	t		Unit	Loop/ Zone	Iso/Drawing	No.
Virginia Corp.			Procedu	ure	Exam Surfac	e Exami	ner/Lev	rel	VCR Superv	visor	Date		
-					Compon	ent/Pip	ping System	Pipe S	ize	Weld Type	Cal. Block	Couplant: T	ype & Batch
eld		Base Metal	Sca	n Dir	ection		Γ		Surfac Base	e Condition		on Results	
lo.		Scan	2	5	7 & 8	0	Inspection Limi	tations	Metal	Weld	UT	Visual	Remarks
										_			
									0				
							1	A	15				
							Inf.	PA	AL	7			
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6	-1		The			omer			Pla	in c			ľ	Unit	Loop / Zone	
1	N	Vir	of Richmo	Corp.	Proc	Procedure Exami			iner/Le	ner/Level VCR Supe			perv	visor	Date	
	-	-			Comp	Component/Piping System			ISO Drawing No.				10	Cal. Standard No./Thickness		
1d 0.		Max.% DAC		ation gth To	S.U.	m Depth Sweep [Reading	Maximum S.U. Pos.		Beam	Beam Dir.	Base Met Thickne 2 Side	ess W	eld Lck.		Remarks	
	NO.	DAG	T L'OII		103.			Incad Ing	Angre					. J J DIGE	ACHIGE KS	
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Plant Site:	Waterford No. 3	Inis Digotification is: Reviewed WithComments Reviewed With Comments as Noted: Incomprate Communis, and Resubmit: Proceed with order. Rejected: Revise and Resubmit				
Customer:	gent with the applicable specifications only and in no way relieves the maintacturer					
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Approved for Use Customer:		DATE: 74-18-83				
Reviewed by: Thomas		ed by:				
Reviewed by: <u>Juan</u>	comm. Le renge - Reviewe	ed by:				
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Rev1 Prepared by: <u>Thomas</u> Reviewed by: <u>Thomas</u> Reviewed by: <u>Mar</u> Customer: Rev2 Prepared by: <u>Dan</u>	Date: <u>4/29/82</u> Bate: <u>4/29/82</u> Rev. Date: <u>4/29/82</u> Rev. Prepare Reviewe Cust Date: <u>3/1/83</u> Rev. Date: <u>3/1/83</u> Rev. Prepare Cust Reviewe Cust Reviewe	ed by:				

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1.0

1.1 This procedure is applicable to, and describes, the requirements for manual ultrasonic examination of full penetration circumferential butt welds between clad ferritic piping and nozzles, and austenitic safe ends. This procedure complies with ASME Code, Section XI, Appendix 3, and ASME Code, Section V, Article 4, where applicable.

2.0 References

Scope

- 2.1 1977 edition of ASME Boiler and Pressure Vessel Code, Section XI, with addenda through summer, 1978
- 2.2 The Virginia Corporation Written Practice for the Qualification and Certification of NDE Personnel, NDE 4.1, Rev. 3, dated 3/6/81
- 2.3 The Virginia Corporation procedure ISI 1.2, Preservice Inspection Documentation (latest revision)
- 2.4 The Virginia Corporation procedure ISI 2.1, Ultrasonic Calibration Confirmation (latest revision)
- 2.5 The Preservice Inspection Program Plan
- 2.6 1977 Edition of ASME Boiler and Presssure Vessel Code, Section V, with addenda through summer, 1978
- 2.7 The Virginia Corporation procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision)

3.0 Personnel Qualifications

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with the document referenced in paragraph 2.2. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of an ultrasonic examination.

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4.0	General	Requirements	
	4.1	The area to be examined and o	contacted by the search unit shall
		be checked to ensure that it	is free of dirt, loose scale,
		machining or grinding partic.	les, weld splatter, or other
		foreign matter that would imp	pair the free movement of the
		search unit or affect the exa	amination. If such conditions
		are detected, they will be re examination.	ectified prior to conducting the
	4.2	The identity and location of as specified in reference 2.5	welds to be examined shall be
	4.3	The examinations conducted in	accordance with this procedure
		shall be done from the O.D.	surface using contact methods.
	4.4	Calibration shall be performe	ed from the side of the calibration
		block which corresponds to the	ne O.D. surface of the component.
		The calibration/examination s report.	surface shall be noted on the
	4.5	Examinations shall consist of	f nominal 45° and 60° angle beam
		shear wave techniques applied	in two directions parallel and
		two directions perpendicular	to the weld axis, except where
		restricted by part geometry of	or access. A 0° longitudinal
		beam shall be applied to all	areas through which the angle
		beams must pass. Other angle	es may be used provided the
		measured difference between t	the angles is at least 10
		degrees. The use of the refr	acted longitudinal beam technique
		may be applied when necessary	, in two directions parallel and
		perpendicular to the axis. T	he refracted longitudinal shall
		be restricted to a half node	examination.
5.0	Equipmen	at and Material Requirements	
	5.1		truments shall be of the A-scan pulse
			paras

he A-scan pulse echo type, equipped with a stepped gain control calibrated in units of 2 dB or less, and shall be qualified to the requirements of reference 2.4 prior to use at the Waterford 3 site. Qualifications may be valid for a period not to exceed three months.

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- 5.2 Search units shall be selected in accordance with Figure 1. Transducers used shall be certified by the manufacturer as to serial number, size, and central frequency. Search units shall be capable of providing the applicable calibrations as required in paragraph 6.0.
- 5.3 Cables connecting the flaw detector to the search unit shall be the coaxial type. Standard lengths of 6 ft. or 12 ft. shall be used for preservice examinations.
- 5.4 A couplant medium, such as Sonotrace 40, manufactured by Echo Laboratories, Inc., or equivalent, shall be applied to the test surface. Couplant materials shall be analyzed for halogen content according to ASTM D-808, and the residual halogens shall not exceed 1% by weight. Couplant materials shall also be analyzed for sulfur content according to ASTM D-219, and the residual sulfur shall not exceed 1% by weight. All areas shall be dry wiped to remove excess couplant following examination.
- 5.5 Calibration Blocks
 - 5.5.1 Design of the calibration blocks and reflectors shall be essentially as depicted in Figure 2, and shall comply with the requirements of reference 2.6. Exceptions shall be noted in the final report.
 - 5.5.2 Where possible, the material from which the block is fabricated shall be from one of the following:
 - (a) nozzle drop out from the component
 - (b) a component prolongation
 - (c) material of the same material specification, product form, and heat treatment as the materials being joined.
 - 5.5.3 The finish on the surfaces of the block shall be representative of the surface finishes of the component.
 - 5.5.4 Additional reflectors may be installed; these reflectors shall not interfere with establishing the primary reference.

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5.5.5 Figure 2 shows calibration block configuration with hole size and location. Each weld on the component or piping system shall be represented by a calibration block having a thickness which meets the requirements of Figure 2. The calibration block thickness must be within one inch (plus or minus) of the component or piping weld thickness. Where the calibration block thickness, plus or minus one inch, spans two of the weld thickness ranges shown in Figure 2, the block's use shall be acceptable in the range of plus or minus one inch of the block's thickness. For example, a four-inch calibration block shall be acceptable for weld thicknesses of three inches to five inches. The holes shall be in accordance with the thickness of the block. Where two or more base metal thicknesses are involved, the calibration block thickness is determined from the average thickness of the weld.

5.5.6 The basic calibration block shall be curved for welds in materials with diameters 20 in. (508 mm) and less. A single curved basic calibration block may be used to calibrate the examination on surfaces in the range of curvature from 0.9 to 1.5 times the basic calibration block diameter.

5.5.7 For examination of welds in materials where the diameter is greater than 20 in. (508 mm), a block of essentially the same curvature, or, alternately, a flat basic calibration block, shall be used.

Wedges used to produce shear wave for angle beam examination shall be within ±2° of the manufacturer's designated angle as required by reference 2.4.

5.6

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6.0

Calibration

- 6.1 Instrument calibration for screen height linearity, amplitude control linearity, and beam spread measurement shall be performed prior to use at the Waterford 3 plant site, and every three months thereafter in accordance with reference 2.4.
- 6.2

Prior to conducting examinations, the complete system to be utilized shall be calibrated on the applicable calibration block. The system shall include the ultrasonic unit (and battery pack, if applicable), cable or cables, search unit, couplant, and any other apparatus, instrument or circuit employed between the instrument and the calibration block surface. Once calibration has been established, any change to any part of the system, including the operator, will require at least a verification of the calibration, which shall be documented.

- 6.2.1 The search unit shall be selected in accordance with Figure 1.
- 6.2.2 The calibration block shall be identified and selected from reference 2.5.
- 6.2.3 The temperature difference between the examination surface and basic calibration block surface shall not exceed 25°F.
- 6.2.4 The maximum calibration indications shall be obtained with the sound beam oriented essentially perpendicular to the axis of the calibration reflector. (Rotation of the beam into a corner formed by the reflector and the side of the block may produce a higher amplitude signal at a longer beam path; this beam path shall not be used for calibration).
- 6.2.5 Calibration shall be performed from the surface of the calibration block which corresponds to the component surface to be examined.

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6.3	Straight	eam Calibration for Weld Metal and HAZ				
	6.3.1	from the ½T hole. Usi adjust the sweep posit	it for the maximum response ng the sweep delay control, ion so that the leading rom the ½T hole is positioned			
	6.3.2		it for the maximum response			
	0.5.2	from the 3/4T hole. U	sing the sweep range control, ion so that the leading			
		edge of the response f	rom the 3/4T hole is			
		positioned at 4.5 on t	he graticule.			
	6.3.3	Repeat steps 6.3.1 and	6.3.2 until no further			
		adjustment is necessary	у.			
	6.3.4	Other sweep positions i	may be used in 6.3.1 and			
		6.3.2, if necessary, to	o keep the back reflection			
		on the screen when this	cker sections are encountered.			
	6.3.5	Position the search un	it for the maximum response			
		from the hole giving the	he highest signal amplitude.			
		Adjust the sensitivity	control to 80% of full			
		screen height (FSH). 1	Mark the peak of the			
		indication on the scree	en.			
	6.3.6	Position the search un:	it for the maximum response			
		from the remaining hold	e(s). Without changing			
		the sensitivity control	1, mark the peak of the			
		indication(s) on the so	creen.			
	6.3.7	Connect the screen mark	ks and extrapolate through			
		the thickness ($\frac{1}{4}T$ on each	ach end) to provide a smooth			
		DAC curve. This shall	be the primary reference			
		level.				
	6.3.8	The use of delay line	transducers and/or dual			
		transducers for evaluat	tion of indications in the			
		near zone is permitted	if applied in accordance			
		with the requirements of	of paragraph 6.1.			

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6.4	Angle Be	am Calibratio	on for Exam	mination from the Clad Ferritic		
	Side					
	6.4.1	Sweep Range	e Calibrat:	ion		
		6.4.1.1	response	the search unit for the maximum from the ½T side-drilled hole. he left edge of this indication		
				2 on the screen with the delay		
			control.			
		6.4.1.2	response	the search unit for the maximum from the 3/4T hole. Adjust		
				edge of this indication to line		
			6 on the	screen with the range control.		
		6.4.1.3		elay and range control adjustments		
		•		e ½T and 3/4T hole reflections		
				sweep lines 2 and 6 respectively.		
		6.4.1.4		the search unit for maximum		
				from the square notch on the		
			opposite	surface. The indication will		
				ear sweep line 8.		
		6.4.1.5	Two divis	sions on the sweep equal 1/2T.		
		6.4.1.6	Other swe	eep positions may be used when		
				ing to paragraphs 6.4.1.1 through		
			6.4.1.5 w	when it is necessary to obtain		
			a broader	r sweep range for piping systems		
			with vary	ying thicknesses		
6	5.4.2	Distance-Am	plitude Co	orrection		
		6.4.2.1	Calibrati	ion from the clad side		
			(a) Posit	tion the search unit for maximum		
			respo	onse from the hole which gives		
			the h	highest amplitude.		
			(b) Adjus	st the sensitivity control to		
			provi	ide an 80% FSH response from		
			the h	nole. Mark the peak of the		
			indic	cation on the screen		
			(c) Posit	tion the search unit for maximum		
			respo	onse from each of the remaining holes.		

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	(d) (e)	on the screen.
	(f)	side-drilled holes to provide the distance amplitude curve. This is
6.4.2.2		the primary reference level. bration from the Unclad Side From the clad side of the block, determine the dB change in ampli- tude between the 3/4T and 5/4T positions.
	(b)	From the unclad side, perform calibrations as noted in 6.4.2.1 (a) through (d).
	(c)	the 5/4T hole, position the search unit for maximum amplitude from the 3/4T hole. Decrease the sig- nal amplitude by the number of dB determined in (a). Mark the height of this signal amplitude
	(d)	at sweep line 10 (5/4T). Connect the screen marks to pro- vide the distance-amplitude curve. This is the primary re- ference level. This will permit evaluation of indications down

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to the clad surface (near sweep line 8).

- 6.4.3 When it is necessary to examine materials such as carbon steel clad to centrifugally cast stainless steel safe ends on pipe diameters which will not permit calibration of the 3/4T and 5/4T holes due to the curvature of the I.D. surface. The following calibration with a 45° refracted longitudinal wave shall be used from the carbon steel side and the centrifically cast stainless steel side.
 - 6.4.3.1 Adjust the sweep positions in accordance with paragraph 6.4.1.1 through
 6.4.1.4 when the I.D. notch can be resolved.
 - 6.4.3.2 Distance amplitude correction 6.4.3.2.1 Calibration from the carbon
 - steel side
 - (a) Position the search unit for the maximum response from the hole which gives the highest amplitude.
 - (b) Adjust the sensitivity control to provide an 80% FSH response from the side drilled hole. Mark the peak of the indication on the screen.
 - (c) Position the search unit for the maximum response from the remaining holes.

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- (d) Mark the peak of these indications on the screen and extrapolate the DAC curve ¹/₄T on each end to provide a smooth DAC curve. This shall be the primary reference level.
- (e) The sensitivity shall then be established from the I.D. notch by setting the signal response amplitude from the I.D. notch at the level of the DAC curve.
- 6.4.3.3 When the I.D. notch cannot be resolved, adjust the sweep positions in accordance with paragraph 6.4.1.1 through 6.4.1.3.

6.4.3.4 Distance amplitude correction

- (a) Position the search unit for the maximum response from the hole that gives the highest amplitude.
- (b) Adjust the sensitivity control to provide an 80% FSH response from the side drilled hole. Mark the peak amplitude of the indication on the screen.
- (c) Position the search unit for the maximum response from the remaining holes and mark their peak amplitude positions on the screen and extrapolate ¹/₄T on each end to produce a smooth DAC curve. This

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shall be the primary reference level and sensitivity level.

For calibrations on the austenitic side. the calibrations shall be in accordance with 6.4.3.1 through 6.4.3.4 for whichever situation applies.

6.4.4

For dissimilar metal welds less than 2" nominal wall thickness that fall into Appendix III Examination Criteria, the calibration block will have an I.D. notch on the clad side that will not penetrate the carbon steel-clad interface.

- 6.4.4.1 When the I.D. notch does not penetrate the carbon steel-clad interface, use the same calibration technique as paragraph 6.4.3.4 (a) through (c).
- 6.5 Angle Beam Calibration for Examination from the Austenitic Side

Ar le Beam Calibration for 1/2 Node Examination 6.5.1

- 6.5.1.1 The response from the 1/1 and 3/4T sidedrilled holes shall be used to establish the slope and the shape of the DAC curve in the following manner.
 - (a) Position the search unit for the maximum response from the 1/1 hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the 1/1 hole is positioned at 2.0 on the graticule.
 - (b) Position the search unit for the maximum response from the 3/4T

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	hole. Using the sweep range con- trol, adjust the sweep position so that the leading edge of the response from the 3/4T hole is
(c)	positioned at 6.0 on the graticule. Repeat steps 6.3.1.1 and 6.3.1.2 until no further adjustment is necessary.
(d)	Position the search unit for the maximum response from the hole giving the highest signal ampli-
	tude. Adjust the sensitivity control to 80% of full screen height (FSH). Mark the peak of the indication on the screen.
(e)	Position the search unit for the maximum response from the remain- ing hole(s). Without changing the sensitivity control, mark the peak of the indication(s) on the
	screen.
(f)	Connect the screen marks and extrapolate through the thickness $(\frac{1}{4}T$ on each end) to provide a smooth DAC curve. This shall be the primary reference level.
(g)	The sensitivity shall then be established from the I.D. surface notch by setting the signal re- sponse amplitude from the I.D. notch at the level of the DAC
6.5.2 Angle Beam Cali	curve. bration for Full Node Examination
6.5.2.1 The r	esponse from the I.D. and O.D. es shall be used to establish

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the slope, shape, and sensitivity of the DAC curve in the following manner. (a) Position the search unit for the

- maximum response from the I.D. notch. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the I.D. notch is positioned at 4.0 on the graticule.
- (b) Position the search unit for the maximum response from the 0.D. notch. Using the sweep range control, adjust the sweep position so that the leading edge of the response from the 0.D. notch is positioned at 8.0 on the graticule.
- (c) Repeat steps 6.4.1.1 and 6.4.1.2 until no further adjustment is necessary.
- (d) Position the search unit for the maximum response from the I.D. notch. Adjust the sensitivity control to 80% of FSH. Mark the peak of the indication on the screen.
- (e) Position the search unit for the maximum response from the O.D. notch. Without changing the sensitivity control, mark the peak of the indication on the screen.
 (f) Connect the screen marks and extrapolate the DAC at either end for a distance of ¹/₂T. This shall

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6.5.3 Angle Beam Cali	be the primary reference level. ibration of $l\frac{1}{2}$ Node Examination
	response from the I.D. & O.D. nes shall be used to establish
	slope, shape, & sensitivity of
	DAC curve in the following manner.
	Position the search unit for the
	maximum response from the I.D.
	notch. Using the sweep delay con-
	trol, adjust the sweep position
	so that the leading edge of the
	response from the I.D. notch is
	positioned at 3.0 on the graticule
(b)	Position the search unit for the
	maximum response from the O.D.
	notch. Using the sweep range
	control, adjust the sweep position
	so that the leading edge of the
	response from the O.D. notch is
	positioned at 6.0 on the grati-
	cule.
(c)	Repeat steps 6.5.1.1 and 6.5.1.2
	until no further adjustment is
	necessary.
(d)	Position the search unit for the
	maximum response from the I.D.
	notch $(1\frac{1}{2} \text{ node})$. Check that the
	leading edge is at approximately
	9.0 on the graticule.
	Position the search unit for the
	maximum response from the I.D.
	notch $(\frac{1}{2}$ node). Adjust the sen-
	sitivity control to 80% FSH.

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Mark the peak of the indication on the screen.

- (f) Position the search unit for the maximum response from the O.D. notch (1 node).
 Without changing the sensitivity control, mark the peak of the indication on the screen.
- (g) Position the search unit for the maximum response from the I.D. notch (1¹/₂ node).
 Without changing the sensitivity control, mark the peak of the indication on the screen.
- (h) Connect the screen marks and extrapolate the DAC at either end for a distance of ¹2T. This shall be the primary reference level.

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- 6.5.4 Other sweep positions may be used when calibrating to paragraph 6.5.1, 6.5.2, or 6.5.3 when it is necessary to obtain a broader sweep range for piping systems with varying thicknesses.
- 6.6

When using the straight beam or angle beam techniques, variables such as weld preparation, weld crown width, or physical interference may be encountered. These variables may be eliminated by one or more of the following.

- 6.6.1 Reducing the dimension of the wedge edge-to-edge beam entry point.
- 6.6.2 Reducing search unit size
- 6.6.3 Increasing beam angle
- 6.6.4 Increasing the metal path by at least an additional 1/2 node.
- 6.6.5 Additional surface preparation
- 6.7 Calibration Verification
 - 6.7.1 A system calibration check, which is the verification of the instrument sensitivity and

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sweep range calibration, shall be performed at the beginning of each day of examinations and at the end of each examination category, or every four hours, whichever is less, and with any change in examination personnel.

- 6.7.2 A decrease in sensitivity of 20% or 2 dB shall require recalibration and re-examination of all items examined since the previous acceptable calibration check. All data taken since the last calibration check shall be marked void.
- 6.7.3 An increase in sensitivity of 20% or 2dB shall require recalibration, re-examination, and data correction of all indications reported since the previous acceptable calibration or check.
- 6.7.4 If any point on the DAC curve has moved on the sweep line more than 10% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination areas shall be reexamined.

7.0 Examination

7.1 Straight Beam Examination for Base Metal

7.1.1 Prior to performing angle beam examinations, the base material through which the angle beam will pass (reference Figures 4, 5 and 6) shall be completely scanned with a straight beam search unit to detect laminar reflectors which

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might affect the interpretation of the results of the angle beam examination.

- 7.1.2 The sensitivity of the instrument shall be adjusted at the location free of indications so that the initial back reflection from the far side of the plate will be 80 percent of full screen height.
- 7.1.3 Areas containing laminar indications that may affect angle beam examinations shall be noted. All areas giving indications equal to or greater than the remaining back reflection shall be recorded on the data sheet. Also, record all areas where one or more discontinuities produce continuous loss of back reflection accompanied by continuous indications in the same plane.
- 7.1.4 Alternatively, the base metal examination may be conducted concurrently and at the same calibration as described in paragraph 6.2, provided that the scan sensitivity (2 x reference) is at least as sensitive as that required in paragraph 7.1.2.
- Straight Beam Examination for Weld Metal and HAZ
 7.2.1 If the angle beam examination is restricted to a full node or 1¹/₂ node examination from the austenitic side of the weld, a calibrated straight beam examination shall be performed, providing the weld crown is flat enough to make satisfactory transducer contact.

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7.2.2	The area to be exam	nined shall be the weld metal
	and the adjacent ba	se materia on the restricted
	side of the weld to	the extent allowed by the geometric
	configuration (see	Figure 7). Scans shall overlap
	at least ten percen	t.
7.2.3	Calibration shall b	e as indicated in paragraph 6.3.
7.3 Angle Bea	am-Reflectors Paralle	el to the Weld
7.3.1	The primary scan fo	or reflectors parallel to the
	weld shall be 1/2 nod	e from both sides of the weld.
7.3.2	Full node or 11/2 nod	e shall only be used when it
	is impossible to ex	amine the required material
	with a ½ node exami	nation for the austenitic side
	of the weld only.	A full or 1 ¹ / ₂ node examination
	shall never be perf	ormed on the carbon clad side.
7.3.3	The area of interes	t shall be the weld and HAZ,
	and the required an	ount of base metal on each side
	of the weld (refere	nce Figures 4, 5 and 6).
7.3.4	The scan pattern sh	all start at one edge of the
	area to be examined	with the ultrasonic search unit
	transmitting an ang	le beam perpendicular to the
	weld axis. The sea	rch unit shall be moved towards
	and away from the w	eld such that the calibrated
	beam passes through	the whole area of the weld and
	base metal to be ex	amined. Concurrent with this
	scan, the search un	it shall be swiveled 15° right
	and 15° left and pr	ogressively indexed along the
	length of the weld	such that the whole scan pattern
	follows a "saw-toot	h" pattern. The "pitch" of the
	"saw-tooth" shall b	e such that on each pass the
	ultrasonic beam cov	ers at least 10 percent of the
		and the second

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area covered by the previous adjacent pass. The weld and required amount of adjacent base metal is to be fully examined by this procedure. The examination shall be accomplished from both sides of the weld. For welds where scanning access is not available from both sides, the L.P& L. PSI coordinator will be notified.

- 7.3.5 Calibration for ½ node from the clad ferritic side shall be accomplished according to paragraph 6.4.
- 7.3.6 Calibration for ½ node, full node, or 1½ node examination from the austenitic side shall be accomplished according to paragraph 6.5

7.4 Angle Beam-Reflector Transverse to the Weld

7.4.1 The angle beam examination for reflectors transverse to the weld shall be performed on the weld crown and adjacent base material as necessary to examine the weld root by 1/2 node in two directions along the weld. When the weld crown configuration prohibits a 1/2 node examination, a full node examination shall be performed with the search unit adjacent to the crown for the austenitic side only, and highlighted on the report. A full node examination shall never be performed on the carbon clad side. 7.4.2 The search unit shall be placed on one edge of the inspection area directing the angle beam into the material parallel to the weld axis. From this position, the search unit shall be moved parallel to the weld and indexed toward the opposite side of the weld such that the next scan will cover at least 10 percent of the area covered by the previous adjacent scan. Parallel scans shall be repeated in this manner until the opposite side of the weld and base metal

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is reached and examined. Alternately, the search unit may be swiveled 15° right and 15° left and progressively indexed along the length of the weld such that the whole scan pattern follows a "saw-tooth" pattern. The "pitch" of the "sawtooth" shall be such that on each pass the ultrasonic beam covers at least 10 percent of the area covered by the previous adjacent pass.

- 7.4.3 The weld and the required amount of adjacent base metal is to be fully examined by one of the techniques described in paragraph 7.4.2.
- 7.4.4 Calibration for ½ node from the clad ferritic side shall be accomplished according to paragraph 6.4.
- 7.4.5 Calibration for ½ node, full node, or 1½ node examination from the austenitic side shall be accomplished according to paragraph 6.5.
- 7.5 Extent of Examination
 - 7.5.1 The volume subject to examination and extent of scan length shall be in accordance with Figures 4, 5, and 6.
- 7.6 Examinations utilizing more than one DAC curve shall be examined once at the higher sensitivity, and evaluated at the applicable sensitivity.
- 7.7 Rate of search unit movement shall not exceed 6" per second.
- 7.8 Scanning sensitivity shall be at least twice (+6 dB) the calibration or reference sensitivity.
- 8.0 Evaluation and Recording of Straight Beam Examination for Laminar Reflectors
 - 8.1 All areas giving indications equal to, or greater than, the back reflection shall be recorded.

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8.2 All areas where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications in the same plane shall be recorded.

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- 8.3 The following data shall be recorded for laminar reflectors:8.3.1 Sweep reading of laminar reflectors from the surface.
 - 8.3.2 Position from the reference marking.
 - 8.3.3 Location parallel to the reference marking for each search unit position, giving the recordable extent of the indication as the laminar area is scanned on parallel scan paths.
- 8.4 Where laminar reflectors interfere with the scanning of examination volumes for planar reflectors, the angle beam examination technique shall be modified to examine the maximum feasible volume, within the specified examination volume, and the description of the volume excluded by the lamination shall be noted on the data sheet.
- 9.0 Evaluation and Recording of Straight Beam and Angle Beam Indications in the Weld and Heat Affected Zone.

9.1 All indications 20% of the primary reference DAC or greater shall be investigated to determine the shape, identity, location, and type of indication. Additionally, all indications, regardless of amplitude, which the examiner judges to be potentially indicative of a crack or lack of fusion shall be investigated to determine the shape, identity, location, and type of indication.

- 9.1.1 Any indication categorized as a flaw shall be recorded and reported in accordance with the requirements of reference 2.3.
- 9.1.2 Any indication resulting from the metallurgical structure within the material shall be considered when assessing the effectiveness of the examination. Restrictions or variations to the examination due

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to the metallurgical structure shall be reported. Additional search unit angles may be used during evaluation as an aid in interpretation.

- 9.1.3 Clad interface and back wall reflections need not be recorded.
- 9.1.4 Geometric indications that are equal to, or greater than, 50% of the primary reference DAC shall be acknowledged by recording their length and location.
- 9.2 Any indication which is equal to, or greater than, 50% of the primary reference DAC shall be evaluated to the extent necessary to determine the size, shape, identity, and location of the reflector. Indications shall be recorded in accordance with paragraph 9.3, and reported in accordance with the requirements of reference 2.3.
- 9.3 Data required when indications are equal to, or greater than, 50% of DAC:
 - 9.3.1 All search unit position and location dimensions shall be recorded to the nearest tenth of an inch.
 - 9.3.2 Maximum percent of DAC, sweep reading of indication, search unit position, location along the length of the weld, and beam direction.

9.3.3 Through-Wall Dimension:

> 9.3.3.1 For reflectors 50 to 100% DAC, the minimum and maximum sweep readings and their position and location along the length of the reflector for 50% DAC when approaching and moving away from the reflector's maximum signal direction.

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9.3.3.2 For reflectors exceeding 100% DAC. minimum and maximum sweep readings and their position and location along the length of the reflector for 50% of the maximum amplitude when approaching and moving away from the reflector's maximum signal direction.

9.3.4 Length Dimension

The length of the reflector shall 9.3.4.1 be obtained by recording the position and location along the length of weld as determined by 50% of DAC for each end of the reflector.

Welds that did not receive a complete examination according to paragraph 7.0 shall have the partial examination noted on the data sheet as follows:

- 9.4.1 The extent of the examination performed shall be noted.
- 9.4.2 If the volumetric examination was performed from one side of the weld only, it shall be not i and an entry made indicating what steps were taken to ensure that the required area on the far side of the weld was examined.
- 9.4.3 The reason(s) that a specific examination was impractical shall be noted. For example, support or component restricts access, fitting prevents adequate ultrasonic coupling on one side, componentto-component weld prevents ultrasonic examination, etc.
- 9.5 Investigation and reporting of indications shall be performed at the reference sensitivity.

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10.0 Documentation of Examination

9.1 All data relative to the examinations and reportable indications shall be reported in accordance with reference 2.3, and on forms similar to those shown in Figures 8, 9, and 10.

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Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

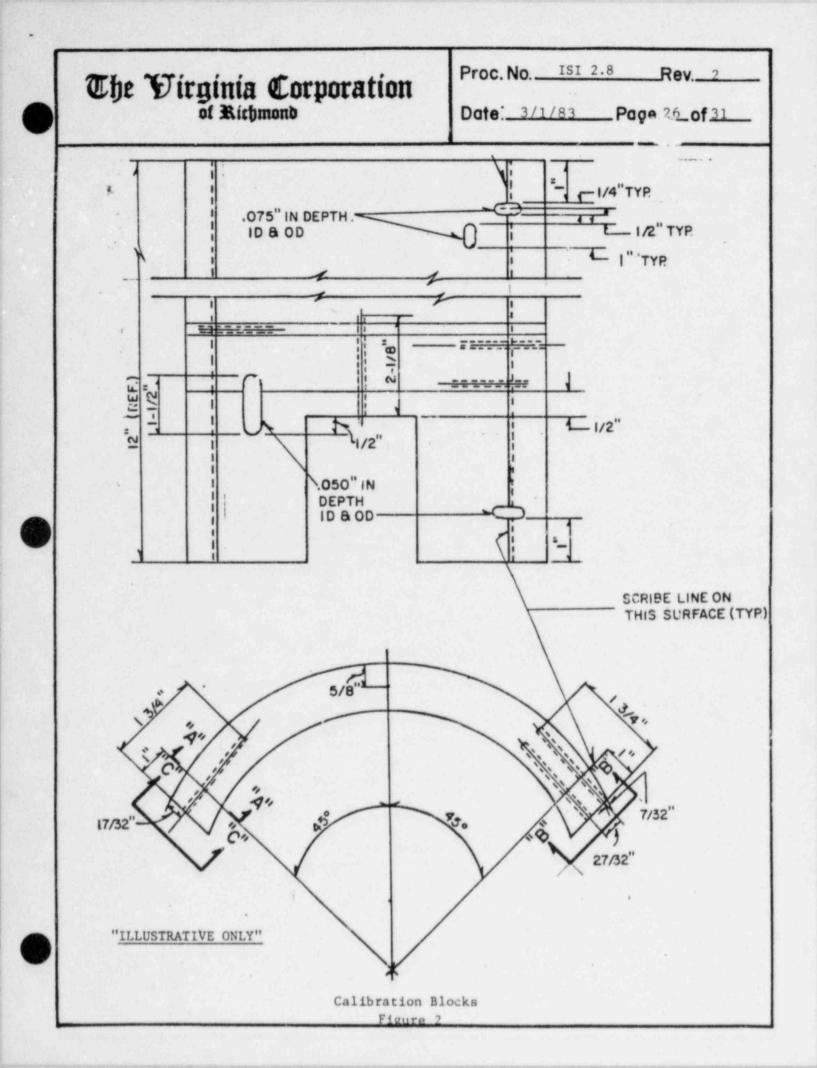
Angle Beam Examination*

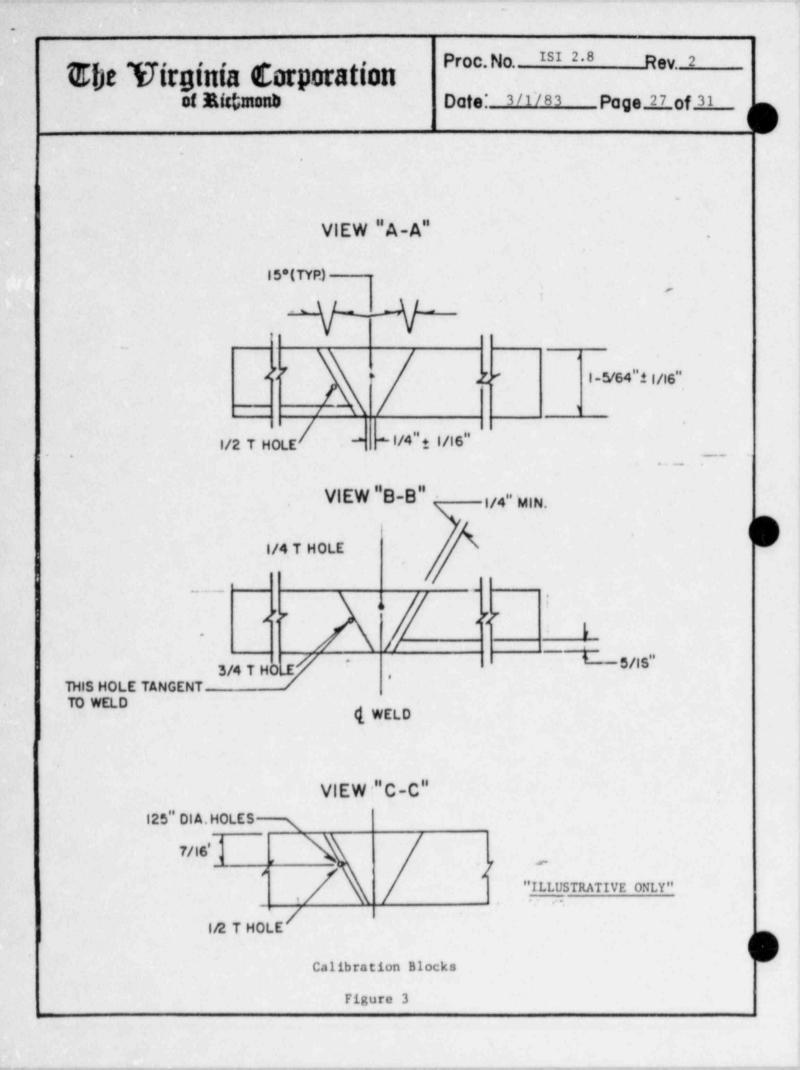
Nominal	Transducer		
Material Thickness	Maximum Size	Nominal Frequency	Nominal Angle
.250" to .400"	1/4" dia. or 1/4" x 1/4"	2.25 MHZ	45°
.400" to 1.000"	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	45°
1.000" to 1.200"	3/4" dia. or 3/4" x 3/4"	2.25 MHZ	45°
1.200" and greater	1" dia. or 1" x 1"	2.25 MHZ	45°

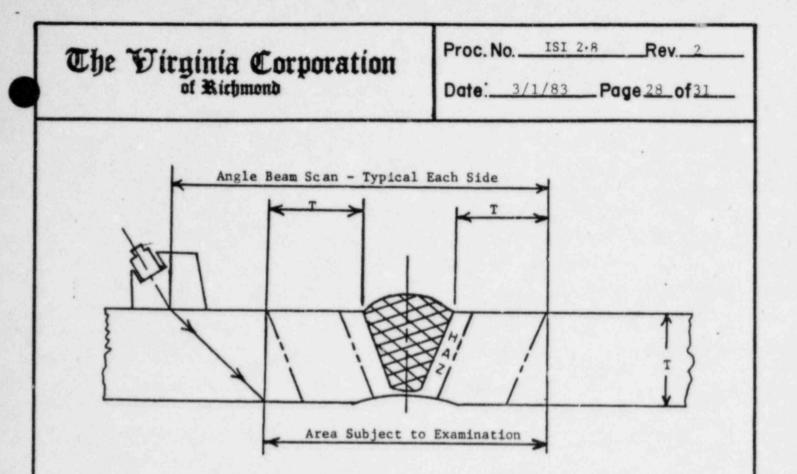
Straight Beam Examination*

Nominal Pipe	Transducer		
Diameter	Maximum Size	Nominal Frequency	
less than 12" dia.	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	
12" dia. and greater	1" dia. or 1" x 1"	2.25 MHZ	

* Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.







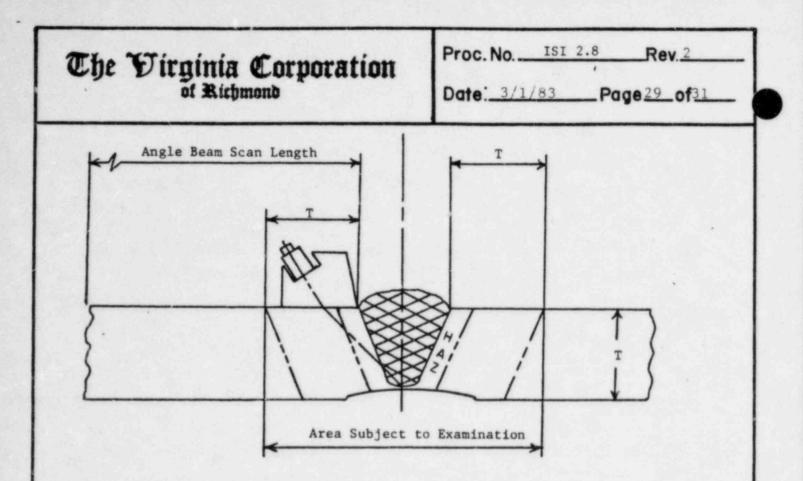
For angle beam scan length as shown above, add the following from each side of the weld fusion line.

Material	Minimum Scan	Minimum Scan
Thickness	Length 45°	Length 60°
.200" to .400"	1.00"	1.75"
.400" to 1.000"	2.25"	4.00"
1.000" to 1.200"	2.75"	4.75"
1.200" to 1.500"	3.25"	5.75"
1.500" and Greater	1.2 x 2T	1.9 x 2T

Straight beam scan length shall be in accordance with the above, as determined by the beam angle being used.

Half Node Examination

Figure 4

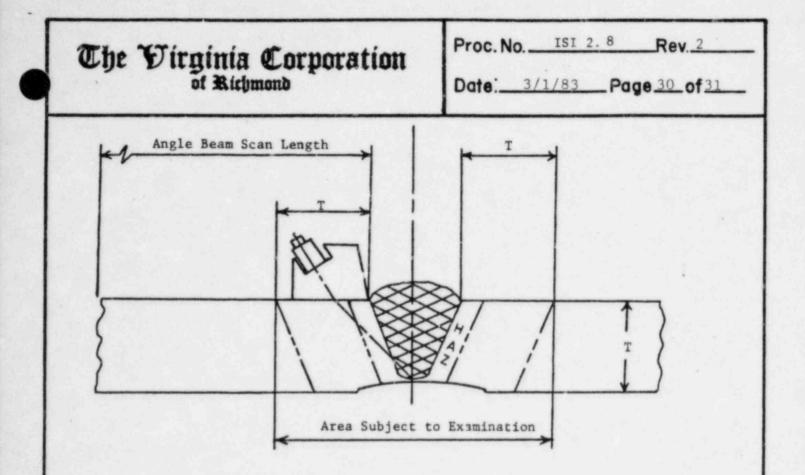


Angle beam scan length as shown above, shall be as follows:

Material Thickness	Minimum Scan Length 45°	Minimum Scan Length 60°
.200 to .400	1.25"	1.75"
.400 to 1.000	3.00"	5.75"
1.000 to 1.200	4.00"	7.00"
1.200 to 1.500	5.00"	8.75"
1.500 and Greater	1.1 x 3T	1.9 x 3T

Straight beam scan length shall be in accordance with the above, as determined by the beam angle being used.

Full Node Examination Figure 5



Angle beam scan length as shown above, shall be as follows:

	erial ckness	Minimum Scan Length 45°	Minimum Scan Length 60°
.200	to .400	1.75"	2.50"
.400	to 1.000	4.00"	6.50"
1.000	to 1.200	5.25"	9.25"
1.200	to 1.500	6.50"	10.00"
1.500	and Greater	1.1 x 4T	1.9 x 4T

Straight beam scan length shall be in accordance with the above, as determined by the beam angle used.

Node and ½ Examination Figure 6

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The beam path shall be increased by at least one-half vee if dimension "A" is greater than:

0.93 T for = 43° to 45° 1.6 T for = 58° to 60° 2.5 T for = 68° to 70°

> Weld Coverage Figure 7

> > .

Customer Plant Unit Loop/Zone[Iso/Drawing No. Virginia Corp. etsktmast Frocedure Exam Surface Examiner/Level VCR Supervisor Date Continuation Sheet Attached Yes No Transducer 0° 45° 60° Transducer Batch Virginia Corp. etsktmast No Transducer 0° 45° 60° Instrument Batch Ves No Size Size Si/N RepRate Field Changes: Frequency Reflect Filter Model If Yes, Nuber Calibration 0° 2.6.5 Scan 7.6.8 Scan Sound Entry Calibration Sugal Sugal Sugal Sound Entry Frequency Calibration Co* Calibration Co* Calibration Calibration Coax Coat Calibration Coax Calibration Coax Calibration Coax Coax Coax Coax Calibration Coax Coax <th></th> <th>I</th> <th>figure 8</th> <th>1</th> <th></th> <th></th> <th></th> <th>Ult</th> <th>ason</th> <th>ic E</th> <th>xam</th> <th>nination</th> <th>Repo</th> <th>rt</th> <th></th> <th></th> <th>-</th> <th></th>		I	figure 8	1				Ult	ason	ic E	xam	nination	Repo	rt			-	
Component/Piping System Pipe Size Weld Type Cal. Block # Couplant: TypeBatch Continuation Sheet Attached YesNo	(A)	The		Custo	omer			Plant				Unit	Loop/Z	onelso	/Drawi	ag No.		
Component/Piping System Pipe Size Weld Type Cal. Block # Couplant: TypeBatch Continuation Sheet Attached Yes No Transducer 0° 45° 60° Instrument Yes No Size S/N Mfgr. Model Size Sile Sile Field Changes: Yes No Size Size Sile Sile Sile Sile Sile Field Changes: Calibration 0° 2.6.5 Scan 7.6.8 Scan Frequency Reflect Filter Calibration 0° 2.6.5 Scan 7.6.8 Scan Freq. Video Calibration Signal Location Amp. Sweep Surfal Sweep Surfal Sweep Location Amp. Sweep Stitle 507 In Out In O 4.5° 60 Scribe 507 In Out In Location Amp. Sweep Stribe 507 In Out In Map. Sweep Surfal Surfal Surfal Surfal Surfal Surfal Ref. dB Surfal Surfal Surfal Surfal Surfal		irginia	Corp.	Proce	edure		Exam Sur	face	Exa	niner	Leve	el	VCR St	upervis	or		Date	
Continuation Sheet Attached Yes Transducer 0° 45° 60° Instrument Yes No Size S/N RepRate Model Size Size S/N RepRate Frequency Reiect Filter If Yes, Number Calibration 0° 2 6 5 Scan Frequency Reiect Filter Calibration Signal Signal Sound Entry Point To: Signal Video Location Amp. Sweep Scribe SoZ In Out In Out In Location Amp. Sweep Scribe SoZ In Out In Out In Line DAC DAC DAC DAC DAC DAC DAC DAC Ref. dB DAC DAC DAC DAC DAC DAC DAC DAC DAC	U			Compo	onent/Pi	ping	System		Pipe	Size	We	eld Type	Cal. B	lock /			Batch	No
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If Yes, Number Damp Coax Calibration 0° 2 & 5 Scan 7 & 8 Scan Free, Video Calibration Signal Signal Sound Entry Point To: Sound Entry Point To: Signal Amp. Sweep Scribe 507 In Out In Out In Location Amp. Sweep Scribe 507 Ine Damp Calibration Checks Location Amp. Sweep Scribe 507 In Out In Out In Location Amp. Sweep Scribe 507 In Out In Out In Location Amp. Sweep Sound Entry Signal Sweep Scribe 507 In Out In Line DAC In Out In Out In In In Location In In In In In In In Location In In In In In In Location In In In In In In Location In In In In In In Locati										-				-				
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Form UT-102

Virginia	Corp.		(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23228
Procedure Title:		t Examination Us Solvent Removabl	EBASCO SERVICES
Procedure No.:	ISI 3.1		ASLURANCE ENCODEERING
Plant Site:	Waterford #3		THIS DOCUMENTALL IS: Reviewed Without Comments Reviewed With Comments as Noted: Incomparts Comments, and Resubmit: Protect with order. Reseted: Hense
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Approved for Use Virginia Corporation	: Thomas 13 1	Muna	or contractor from full resonnshifting for delivery of all materials, ament, services and documentation is strict accordance with the Purchase Order.
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1.0 Scope

1.1 This procedure describes the requirements for the performance of color contrast solvent removable liquid penetrant examination of . ferrous and nonferrous materials for defects open to the surface. This procedure is in compliance with ASME Code Section XI and the requirements of ASME Section V, Article 6.

2.0 References

- 2.1 ASME Boiler and Pressure Vessel Code Section XI, 1977 edition with addenda through Summer, 1978.
- ASME Section V. Article 6, 1977 edition with addenda through 2.2 Summer, 1978.
- The Virginia Corporation of Richmond procedure NDE-4.1, Rev. 3, 2.3 dated 3/6/81, Written Practice for the Qualification and Certification of NDE Personnel.
- 2.4 The Virginia Corporation procedure ISI-2.1, Rev. O, Preservice Inspection Documentation.

3.0 Personnel Requirements

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II in accordance with reference 2.3. Level I and/or Level I trainees (Level I-LTD) may be employed as assistants. Level I and/or Level I trainees (Level I-LTD) shall not independently evaluate or accept the results of a liquid penetrant examination.

4.0 Equipment and Materials

4.1 Ali penetrant materials shall be supplied with batch number and certification attesting to the residual amounts of sulfur and halogen. Penetrant materials shall be analyzed for halogen content according to ASTM D-808 and the residual halogens shall not exceed 1% by weight. Penetrant materials shall also be analyzed for sulfur content according to ASTM D-129 and the residual

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sulfur shall not exceed 1% by weight. The VCR Site Job Supervisor shall document acceptance of materials received in accordance with this section.

- 4.2 All penetrant materials used to perform the examination shall be from the same family groupings. Interm'xing of penetrant materials from different family groups is not prmitted. This includes cleaner/remover, penetrant and developer.
- 4.3 The following penetrant materials are approved for use with this procedure. Approved equivalents may be used if they meet the requirements of paragraph 4.1; however, the procedure must be re-qualified.

Sherwin incorporated

Dub1	Check	Type	DR-60	
Dub1	Check	Type	DP-51	
Dub1	Check	Type	D-100	
	Dubl	Dubl Check	Dubl Check Type	Dubl Check Type DR-60 Dubl Check Type DP-51 Dubl Check Type D-100

Materials by different manufacturers shall not be used concurrently for the examination of a particular item.

4.4 Clean lint-free, dry cloths or absorbent paper shall be used during the performance of the examination.

5.0 General Requirements

- 5.1 Lighting at the work area during all steps of examination per paragraph 6.0 Examination shall be sufficient to resolve a 1/32 inch wide (maximum) black line on an 18% neutral gray background placed on or near the surface to be examined. Flashlights and/or extension lights may be used to achieve sufficient lighting.
- 5.2 Surface preparation
 - 5.2.1 The surface area to be examined and adjacent area for at least one (1) inch shall be dry and free from all oil, grease, scale, lint, slag, welding flux, weld spatter, dirt, paint, or other extraneous matter that would obscure openings or otherwise interfere with the examination. If such conditions are detected, they will be rectified prior to conducting the examination.

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- 5.2.2 As-welded surfaces, following the removal of slag, shall be considered suitable for dye penetrant examination without grinding if this does not interfere with interpretation of the test results, and, if the weld contour blends into the base metal.
- 5.2.3 Power wire brushing is permitted for removal of extraneous materials, at the discretion of the PSI Construction Coordinator.
- 5.3 Examination Area
 - 5.3.1 The examination area shall be the weld surface and adjacent base metal on each side of the weld edge, as required by Figures 1 through 13.
 - 5.3.2 The specific welds or other areas to be examined shall be as defined in the preservice inspection plan.
- 5.4 The temperature of the part to be examined shall not be below 40°F nor above 125°F. Temperatures outside of this range will require an additional procedure qualified to the requirements of reference 2.2
- 5.5 Associated equipment used to perform liquid penetrant examinations, that contain mercury or mercury compounds, shall not be used.
- 5.6 Safety
 - 5.6.1 Some penetrant materials are highly flammable and therefore shall not be heated nor used near any open flame.
 - 5.6.2 Penetrant materials that are flammable shall not be used in open containers. Safety type cans shall be used.
 - 5.6.3 Adequate ventilation shall be maintained during the use of all penetrant materials, especially in confined areas.

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6.0 Examination

- Pre-cleaning The area to be examined shall be thoroughly cleaned 6.1 using the remover/cleaner of the family type listed in paragraph 4.3.
 - Allow a minimum of ten minutes for excess cleaner/ 6.1.1 remover to evaporate before proceeding with the examination.
- Penetrant application 6.2
 - Penetrant shall be applied by spraying or brushing only. 6.2.1 If the surface is too large for complete examination in the prescribed time, the surface shall be examined in suitable increments with sufficient overlap to assure complete coverage of the surfaces being examined.
- Penetrant dwell time 6.3
 - Penetration, or dwell time, is critical. The complete 6.3.1 examination surface shall be keps wet by the addition of penetrant, as necessary, to ensure that no drying occurs during the entire dwell time. Whenever possible. the penetrant shall be applied to the examination area plus an additional one (1) inch on each side. If drying of any portion of the examination surface occurs during the dwell time, the part shall be thoroughly re-cleaned and re-tested.
 - 6.3.1.1 For temperatures of the surface under examination≥40°F and <60°F, the dwell time shall be a minimum of 30 minutes and a maximum of 75 minutes.
 - For temperatures of the surface under exami-6.3.1.2 nation≥60°F up to 125°F, the dwell time shall be a minimum of 15 minutes and a maximum of 60 minutes.

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- 6.4 Excess penetrant removal
 - As much excess penetrant as possible shall be removed by 6.4.1 wiping the surface thoroughly with a clean lint-free dry cloth or absorbent paper.
 - Remaining excess penetrant shall be removed by wiping 6.4.2 the surface with a clean lint-free cloth or absorbent paper lightly dampened with a penetrant remover/ cleaner (Ref. par. 4.2 and 4.3.
 - Flushing of the surface with any liquid following appli-6.4.3 cation of the penetrant, and prior to development, is prohibited.
- 6.5 Surface drying
 - 6.5.1 Drying of examination surfaces after removal of excess penetrant shall be accomplished only by normal evaporation. Forced air circulation in excess of normal ventilation in the examination area shall not be used.
 - 6.5.2 Drying time, for surface drying after removal of excess penetrant, and prior to developer application shall be a minimum of five minutes and a maximum of ten minutes.
- 6.6 Developer application
 - 6.6.1 Prior to developer application, the developing liquid shall be agitated to assure that the solids are in liquid suspension prior to its application, and shall be applied by spraying.
 - 6.6.2 Developer shall be applied so as to produce a thin, uniform coating over the entire examination area. Insufficient coating may not be adequate to draw the penetrant out of discontinuities. Conversely, excessive coating of developer may result in pooling and may mask indications, requiring the item being examined to be re-cleaned and re-tested.

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6.6.3 Developing time shall be a minimum of seven minutes and not longer than thirty minutes. The surface should be observed during the application of the developer and during the developing time, in order to detect the nature of certain indications which might tend to bleed out excessively.

7.0 Evaluation and Recording of Indications

- 7.1 Mechanical discontinuities at the surface will be indicated by bleeding out of the penetrant. However, localized surface imperfactions, such as may occur from machining marks or surface conditions, may produce similar indications which are non-relevant.
- 7.2 Any reportable indication which is believed to be nonrelevant shall be regarded as a discontinuity and shall be re-examined to verify whether or not actual discontinuities are present. Additional surface conditioning may be required.
- 7.3 Relevant indications are those which result from mechanical discontinuities.
- 7.4 The examiner shall investigate and evaluate all relevant indications in terms of the reporting requirements of paragraph 7.5. Following investigation, the examined area shall either be wiped clean of developer or, as a minimum, the recordable indication area (if any) may be left as is for subsequent review by customer or regulatory agency personnel subject to the time limitations of paragraph 6.6.3.
- 7.5 Reportable Indications
 - 7.5.1 The indications in the table below, occurring in the examination area, are considered relevant and are to be recorded and reported to the customer or his agent within 24 hours.

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Description	Thickness/Other	Indications
Dissimilar and similar welds in piping, both ferritic and austenitic	≤.312" >.312" to 2.0" 2.0" & over	>1/8" >3/16" >1/4"
Pressure retaining bolting 2" and over	non-axial indications axial indications	>1/4"
Vessel supports and support members for piping, valves, and pumps, both ferritic and ~ustenitic	.625" to 2.0" 2.0" & over	>3/16" >1/4"
Pressure retaining welds in pump casings and valve bodies	> 2.0"	>1/4"
Pressure retaining welds in control rod drive housings	N/A	> 3/16"

8.0 Final Cleaning

8.1 When examination and evaluation are complete, the examination area shall be thoroughly cleaned with cleaner/remover which may be applied by flushing or spraying directly onto the surface and wiping with cloth or absorbent pape".

9.0 Documentation of Examination

9.1 All data relative to the examination shall be reported in accordance with Reference 2.4 and on forms similar to those shown in figures 14, 15, and 16.

Reportable

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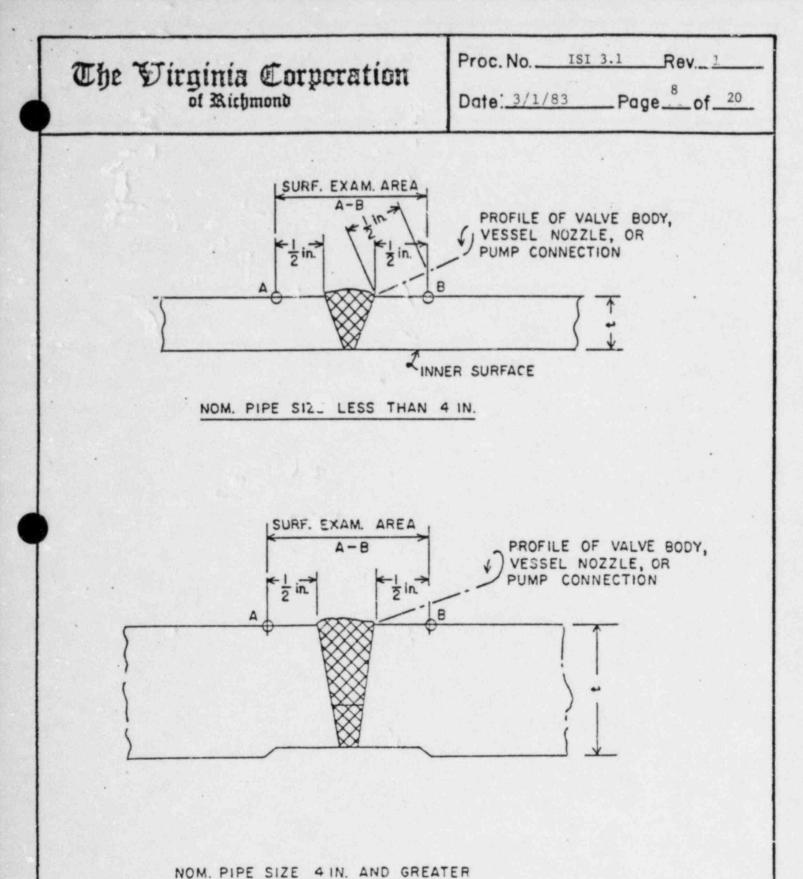
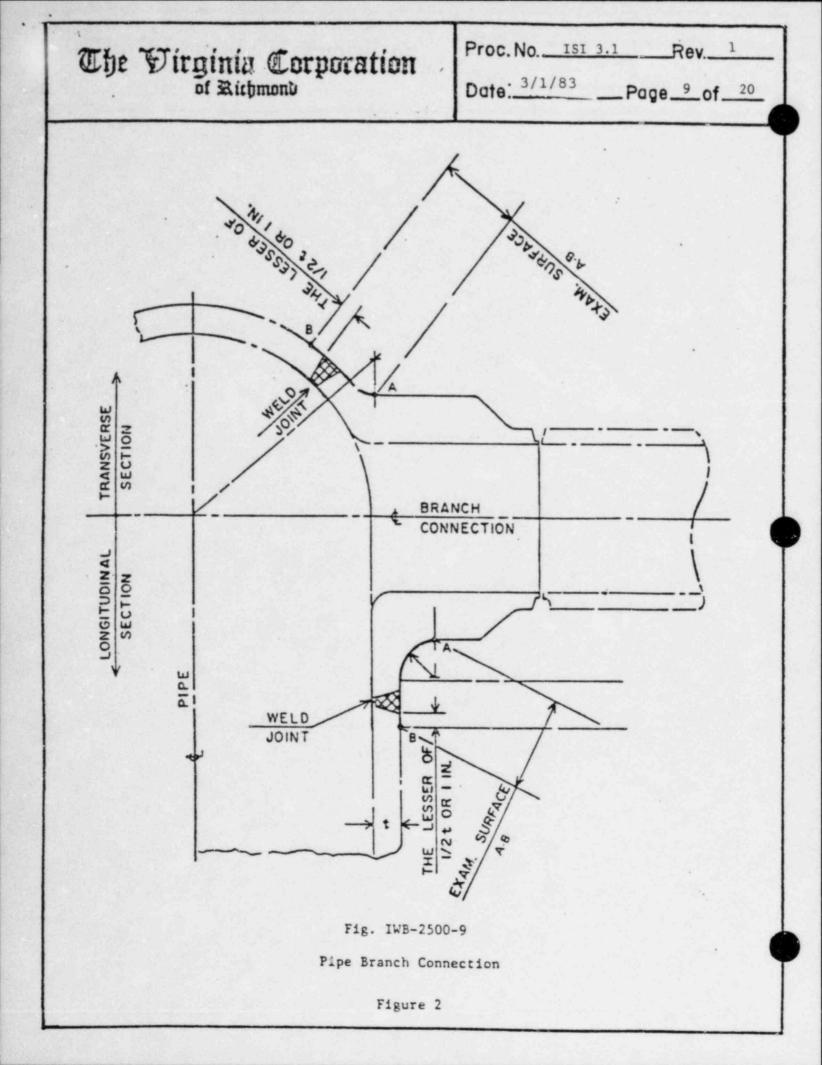
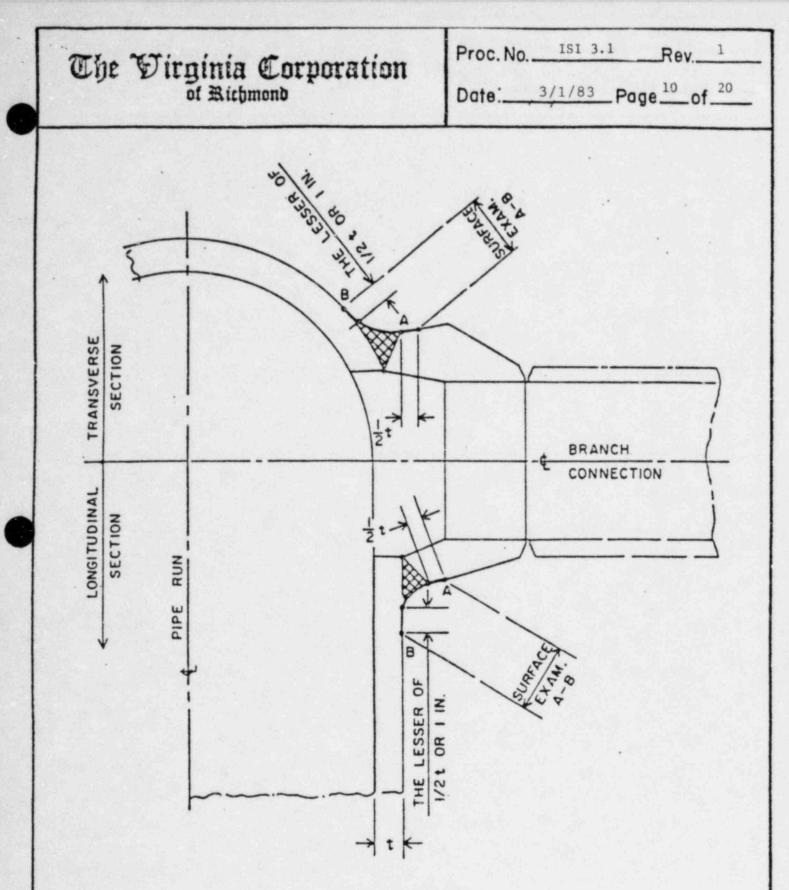
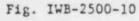


Fig. IWE-2500-8

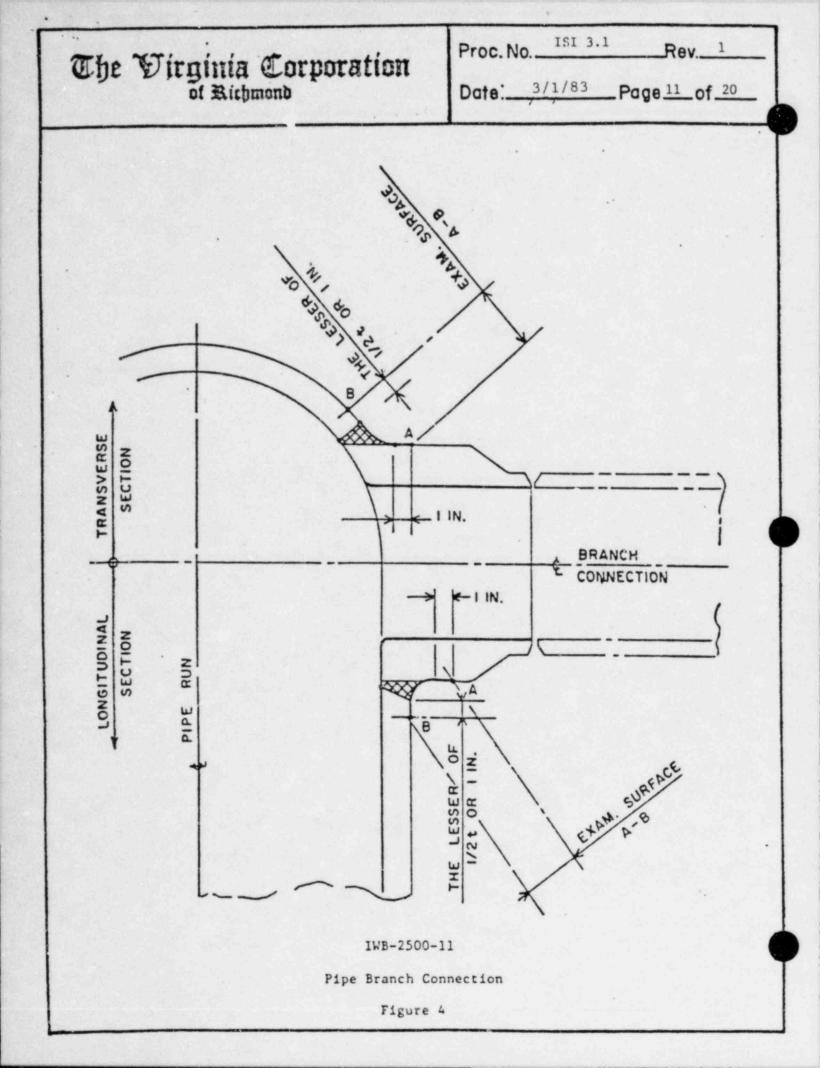
Similar and Dissimilar Metal Welds in Piping

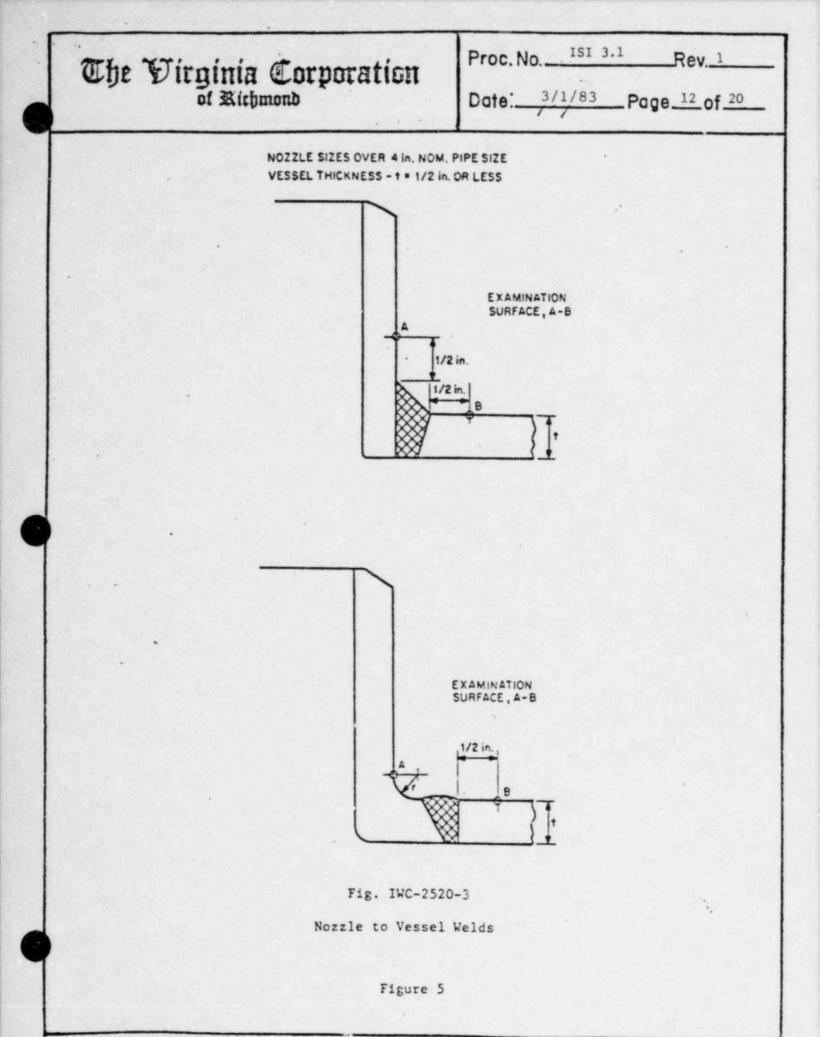


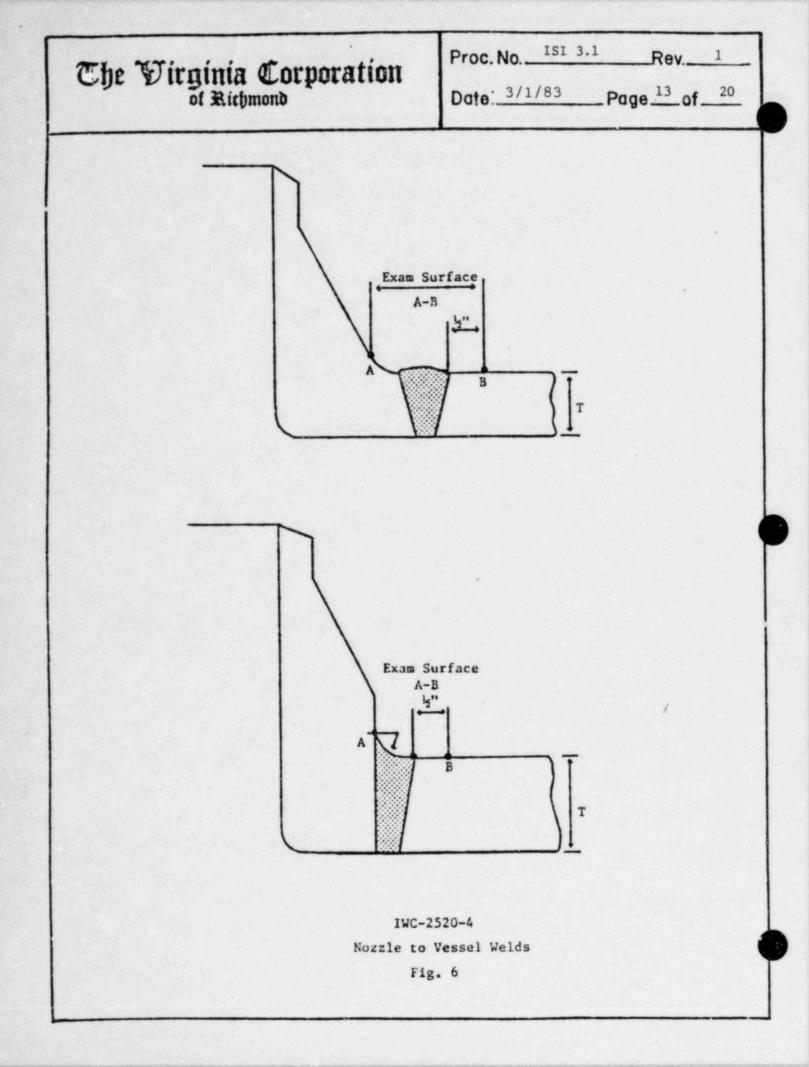


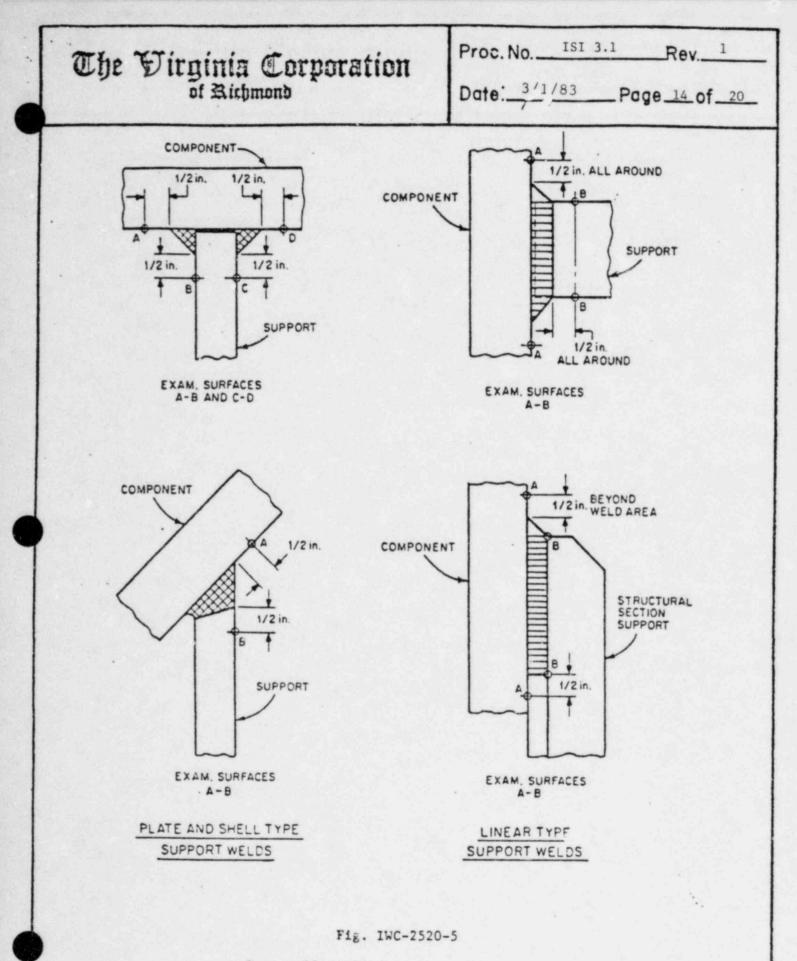


Pipe Branch Connection







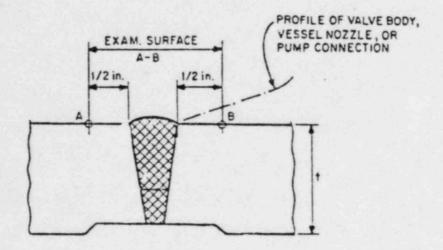


Integrally Welded Component Supports

Figure 7

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PROFILE OF VALVE BODY, VESSEL NOZZLE, OR PUMP CONNECTION

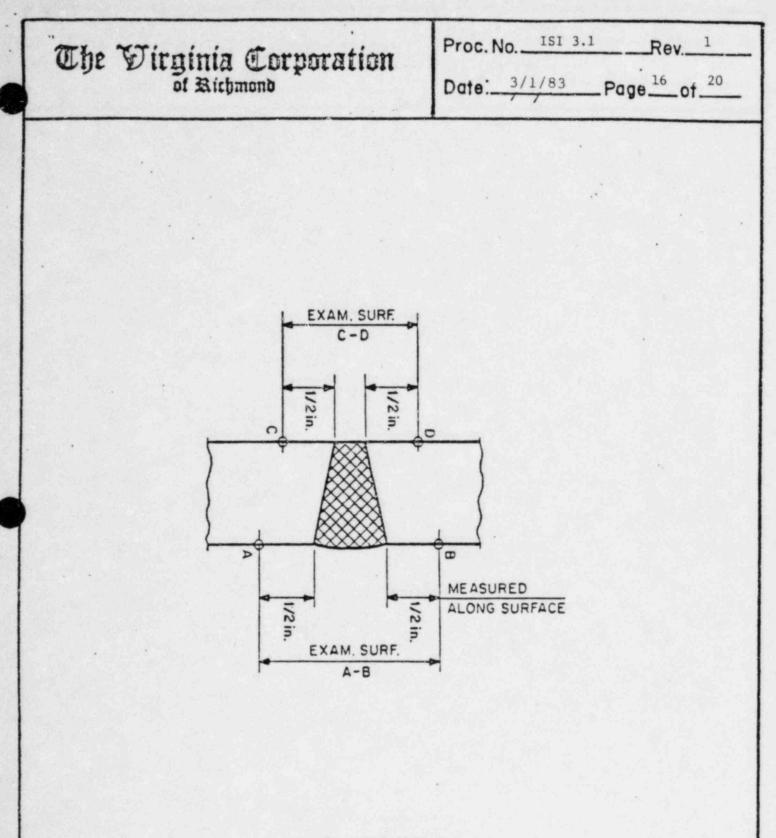
NOM. PIPE WALL THICKNESS, t = 1/2 in. OR LESS

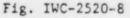


NOM. PIPE WALL THICKNESS + OVER 1/2 in.

IWC-2520-7

Welds in Piping





Welds in Pump Casing and Valve Bodies

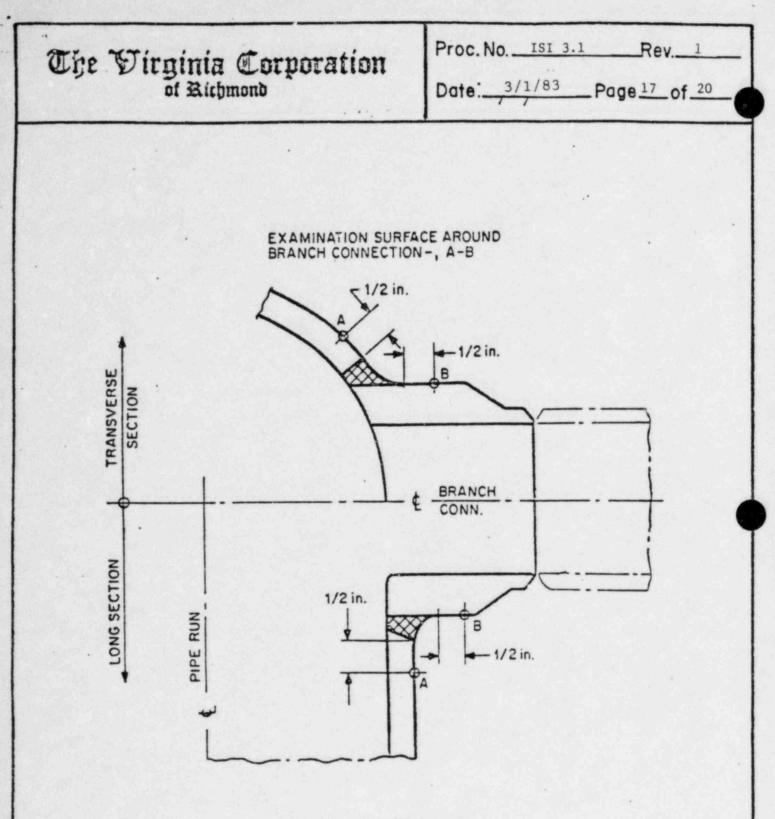
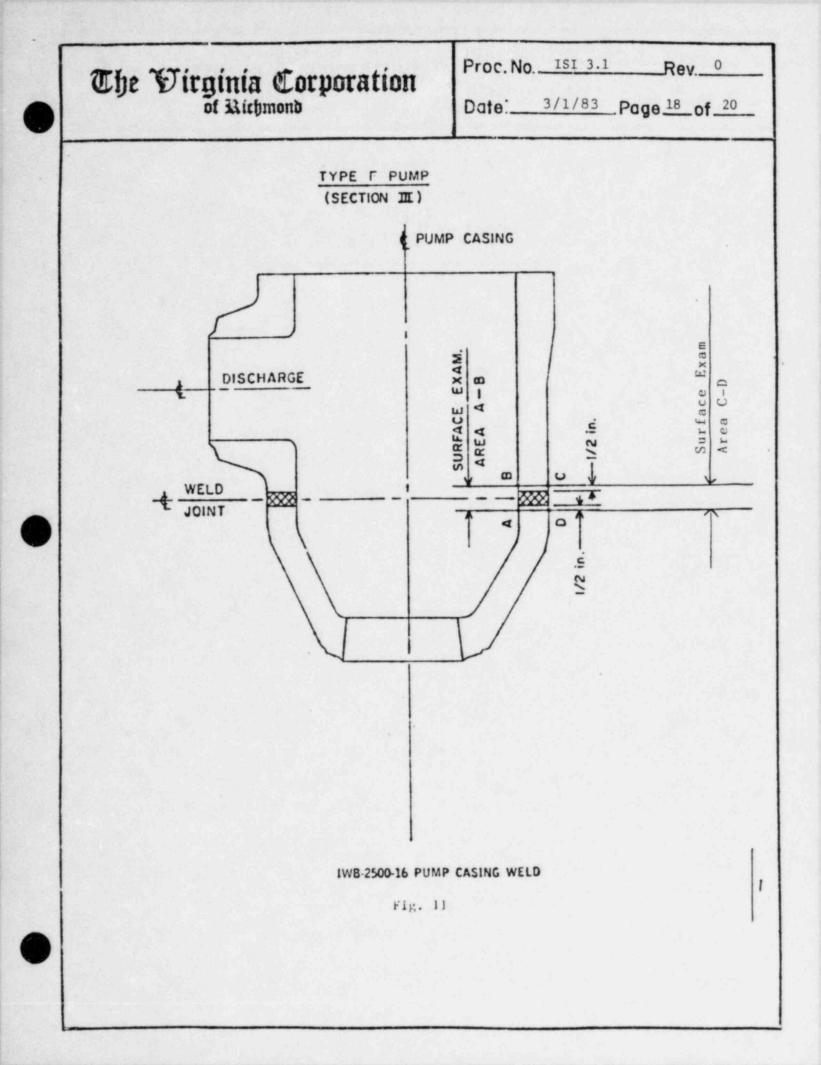
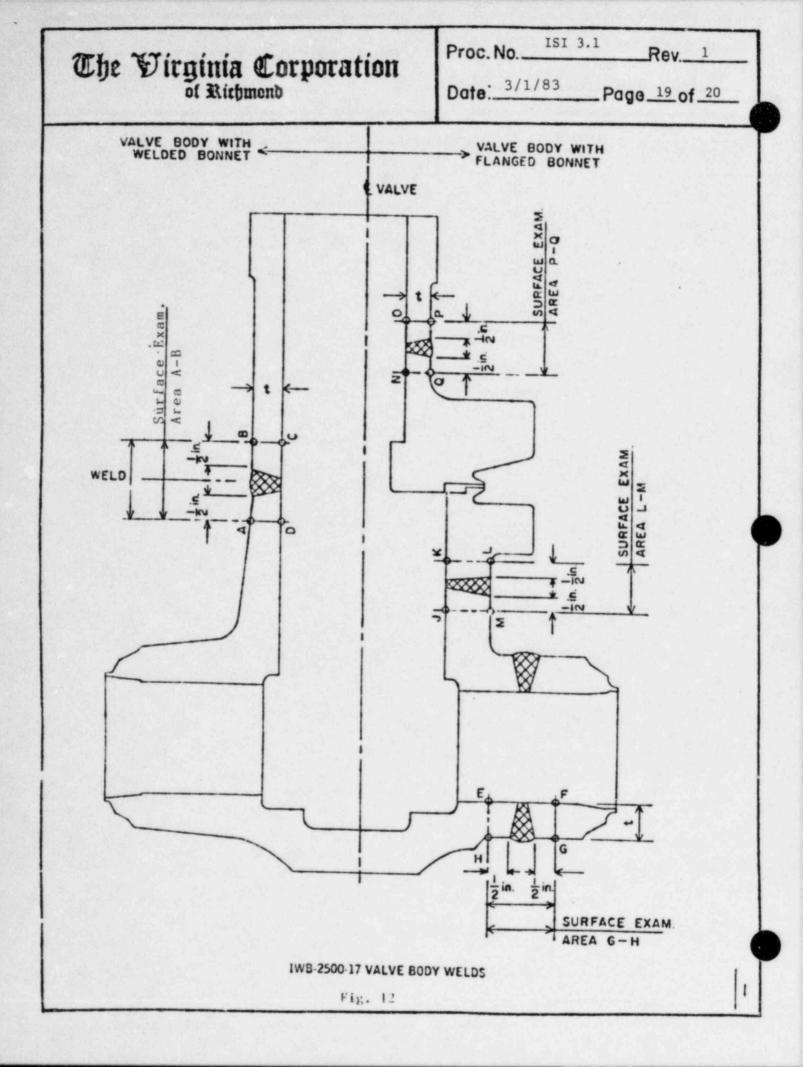
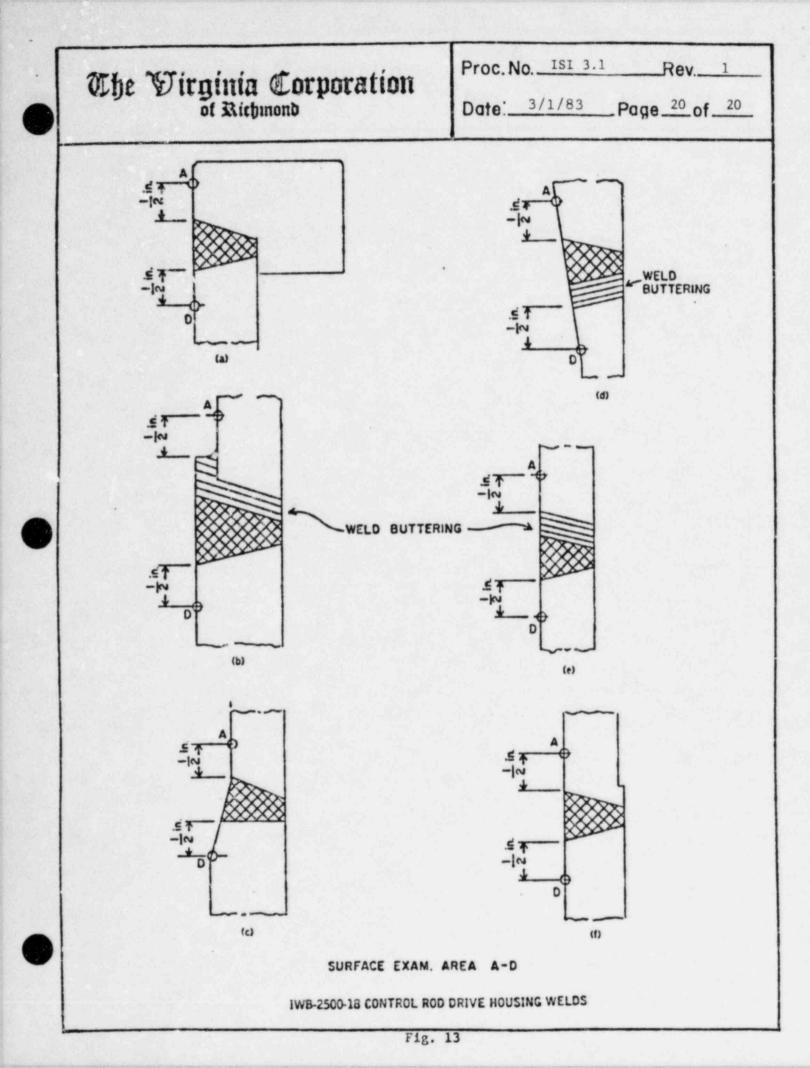


Fig. IWC-2520-9

Branch Conneciton Welds







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Procedure		Examiner/Level			Dat	e	
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Developer			-				
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Virginia Co	Figure 16	ISI 3.1		Penet	
Customer	Plant		Unit		Loop/ Zone
Procedure	Examiner/Level			Date	
Component/Piping System			VCR Supe	rvisor	
Item No.		ISO/Draw	ing No.		
Comments:	SALA	PL	A A		

Virginia	Corp.		(804) 266-8741 P. O. Box 9474 5809 Lakeside Ave. Richmond, Virginia 23221
Procedure Title:	MAGNETIC PARTICLE THE DRY CONTINUOU		F BOLTING UTILIZING
		•	EBASCO SERVICES INCORPORATED
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1.0	Scope		
	1.1	of magnetic particle examination	arface, using continuous method a as produced by yoke or coil be used with this procedure. compliance with ASME Code,
2.0	Referen	ces	
	2.1	ASME Boiler and Pressure Vesse with addenda through summer,	el Code, Section XI, 1977 edition 1978.
	2.2	ASME Section V, Article 7, 19 summer, 1978.	77 edition with addenda through
	2.3	Practice for the Qualification Personnel, Rev. 3, dated 3/6/2	81.
	2.4	The Virginia Corporation ISI Documentation (latest revision	
	2.5	Preservice Inspection Program	Plan.
	2.6		edure VC-QA-103, Generation and erford No. 3 Preservice Inspection
3.0	Personn	el Requirements	
	3.1	qualified and certified to at with reference 2.3. Level I a	ions to this procedure shall be least Level II, in accordance and/or Level I trainees (Level istants. Level I and/or Level I not independently evaluate

or accept the results of a magnetic particle examination.

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Date: 2/10/82

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4.0 Equipment and Materials

- 4.1 Magnetizing equipment shall be electromagnetic yokes capable of producing longitudinal magnetization by A.C., or portable magnetic particle unit capable of passing the required amount of half wave D.C. (HWDC) current through a multiturn coil looped around the part.
 - 4.1.1 This equipment shall be calibrated at least once every twelve months and following major repair, periodic overhaul, or damage.
 - 4.1.2 Electromagnetic yokes shall be Parker Research Corp., Model DA-200 contour probe, or approved equivalent. Yokes shall have a calibrated lifting power of at least 10 pounds for A.C. at the maximum pole spacing to be used. A calibration sticker shall be affixed to the yoke, and shall state the serial number of the yoke, the maximum pole spacing, the date of calibration, and the person responsible for calibration. Minimum pole spacing will be three (3) inches, and yokes shall not be used with pole spacings beyond that stated on the calibration sticker.

4.1.3

Portable magnetic particle equipment shall be Econospect Corp. or equivalent, and shall produce HWDC amperage in the desired range. Specific equipment shall be chosen depending upon the amperage necessary for a specific examination. The unit's meter readings shall be compared to those of a control test meter with current transformer arrangement, connected so as to monitor the output current. The accuracy of the entire control test meter arrangement shall be verified annually by means traceable to a national standard. Comparative

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readings shall be taken at a minimum of three output levels encompassing the useable range. The unit's meter reading shall not deviate by more than ±10% of full scale, relative to the actual current value as shown by the test meter.

All examination medium materials shall be supplied with batch number and certification attesting that the medium material was manufactured in accordance with ASME Code, Section V. The medium selected for examination shall provide adequate contrast with the background of the surface being examined.

The following dry medium materials, or approved 4.2.1 equivalent, shall be used.

> Magnaflux Corp., No. 1 (Grey), No. 4.2.1.1 3A (Black), or No. 8A (Red). Detek, Inc., M10-100 (Blue-Black), 4.2.1.2 M10-200 (Red), M10-300 (Grey), M10-400 (Yellow).

4.3

4.2

A magnetic particle field indicator (MPFI), see Figure 1, shall be available to determine or verify the suitability of examinations, equipment or materials, as may be necessary. The MPFI may be used to determine or verify such as:

- Adequacy and/or direction of the magnetizing 4.3.1 field.
- Range (extent of surface area) that may be examined 4.3.2 and interpreted for any single "shot".

General Requirements 5.0

5.1

Lighting for visible mediums shall be sufficient to resolve a 1/32 inch wide (maximum) black line on an 18% neutral gray background placed on or near the surface to be examined. Flashlights and/or extension lights may be used to achieve sufficient lighting.

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	5.2	Surface Preparation	
		one inch on all sid yokes, if outside t of dust, dirt, scal	be examined, plus at least es, and the contact area for his area, shall be dry and free e, grease, or other matter that. h the examinations.
			ies that, in the opinion of d mask or hamper interpretations
			face or area preparations, if the responsibility of the
	5.3	The examination area for bolt surface.	ing shall be the entire exposed
	5.4	Surface temperature shall not mediums.	exceed 600°F when using dry
.0	Examir	nations	
	6.1	a light, uniform, dust-like of of the test part while the para application, and before turns powder is removed by means of force to remove the excess para	applied in such a manner that coating settles upon the surface art is being magnetized. After
	6.2	of discontinuities. Examinations shall be conduct the lines of flux from one ex	ed in two directions such that camination are approximately
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perpendicular to the other. Orientation of the lines of flux shall be such that the bolting is examined for circumferential and axial indications.

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- Examinations shall be conducted with sufficient overlap to 6.3 assure 100% coverage of the area required to be examined. Succeeding examinations shall overlap the appropriate area of the preceding examination by at least 1 inch.

Examination for Axial Indications 6.4

- A longitudinal field, generally perpendicular to 6.4.1 suspected axial indications, shall be induced in the part with an alternating current electromagnetic yoke.
- The area of examination shall be limited to within 6.4.2 1/2 of the pole spacing on each side of the yoke. Minimum pole spacing shall be three inches.
- The adequacy of the magnetizing field may be 6.4.3 determined by positioning the MPFI on the surface to be examined. The flux intensity, or field strength, is suitable when a clearly defined line, or lines, of particles form across its copper face when the particles are applied simultaneously with the magnetizing force.
 - If the line, or lines, are not formed, 6.4.3.1 or are not formed in the desired direction, the magnetizing technique, or equipment shall be changed or adjusted so that the required examination is achieved in accordance with this procedure.
 - Satisfactory definition of the line, 6.4.3.2 or lines, on the MPFI verifies the adequacy and suitability of the technique and equipment.

Following the determination of field adequacy, the entire exposed area of the bolting shall be sequentially examined, being careful to allow sufficient overlap as detailed in paragraph 6.3

6.4.4

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6.5	Examinat	ion for Circumf	erential Indications
	6.5.1	suspected cir induced in th	1 field, generally perpendicular to cumferential indications, shall be e part with an HWDC coil coupled to etic particle equipment as described 4.1.3.
	6.5.2	Magnetization current throu	is accomplished by passing HWDC gh a multiturn coil looped around o be examined. This produces a
			d parallel to the axis of the coil.
			or bolting with a length (L)/Diameter
			D) ratio greater than, or equal to,
		4	, the following formula shall be used
			o calculate the ampere-turns to be
		U	sed for magnetization:
			Ampere-turns = $35,000$
			2 + L/D
		6.5.2.2 H	or bolting with a L/D ratio greater
			than, or equal to, 2 and up to 4, the
			ollowing formula shall be used:
			ampere-turns = $\frac{45,000}{L/D}$
		6.5.2.3 H	or L/D ratios less than 2, alternate
			agnecizing methods shall be used.
	6.5.3	The magnetizi	ng coil shall be made of cable, wound
			olting, and the coil's turns shall
		be closely sp	
	6.5.4		examination shall be limited to within
			on each side of the coil.
	6.5.5		than twelve inches shall be examined
			not exceeding eleven inches nominal
		length.	

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The adequacy of the magnetizing field may be 6.5.6 determined by positioning the MPFI on the surface to be examined. The flux intensity, or field strength, is suitable when a clearly defined line, or lines, of particles form across its copper face when the particles are applied simultaneously with the magnetizing force.

- If the line, or lines, are not formed, 6.5.6.1 or are not formed in the desired direction, the magnetizing technique, equipment, or medium shall be changed or adjusted so that the required examination is achieved in accordance with this procedure.
- Satisfactory definition of the line, 6.5.6.2 or lines, on the MPFI verifies the adequacy and suitability of the techniques and equipment.

Following the determination of field adequacy, 6.5.7 the entire exposed area of the bolting shall be sequentially examined, being careful to examine the area within the coil. Sufficient overlap shall be provided as detailed in paragraph 6.3.

Demagnetization of bolting shall be accomplished by slowly passing the bolting through the inside of the coil, prepared in paragraph 6.5, until it is approximately 2 feet beyond the coil. Demagnetization in this manner may also be accomplished by moving the coil instead of the bolting. Post examination cleaning, associated with the test, shall 6.7 be the responsibility of the contractor.

6.6

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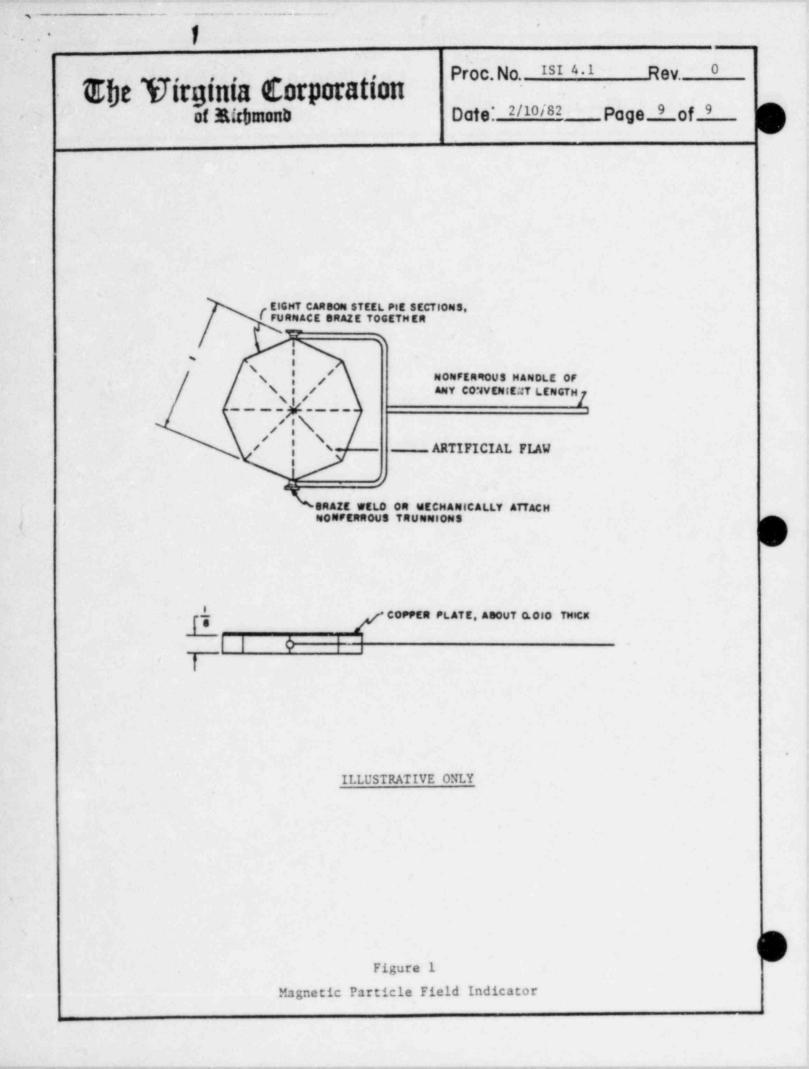
7.0 Evaluation and Recording of Indications

- 7.1 Discontinuities at the surface are indicated by the retention of examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false or nonrelevant indications.
- 7.2 Broad areas of particle accumulation or nonrelevant indications which could mask indications of discontinuities are unacceptable, and those areas shall be cleaned and reexamined.
- 7.3 Reportable Indications

7.3.1 The following relevant indications occuring in the examination area are to be recorded and reported:
a. non-axial indications, greater than ½ inch in length
b. axial indications, greater than 1 inch in length

8.0 Documentation of Examination

8.1 All data relative to the examination, including any reportable indications, shall be reported in accordance with reference 2.4, and on forms similar to those shown in figures 2 and 3.



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Customer		Plant			Unit		L	oop/Zo	ne
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Scope 1.0 This procedure describes the requirements for the performance 1.1 of magnetic particle examination of ferromagnetic bolting for indications open to the surface, using continuous method and longitudinal magnetization as produced by yoke or coil techniques. Wet, fluorescent medium is to be used with this procedure. This procedure is written in compliance with ASME Code, Section XI, and the requirements of ASME Code, Section V, Article 7. References 2.0 ASME Boiler and Pressure Vessel Code, Section XI, 1977 2.1 edition with addenda through summer, 1978. ASME Section V, Article 7, 1977 edition with addenda 2.2 summer, 1978. The Virginia Corporation of Richmond procedure 4.1, 2.3 Written Practice for the Qualification and Certification of NDE Personnel, Rev. 3, dated 3/6/81 The Virginia Corporation ISI 1.2, Preservice Inspection 2.4 Inspection Documentation (latest revision). 2.5 Preservice Inspection Program Plan. The Virginia Corporation Procedure VC-QA-103, Generation and 2.6 Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision). Personnel Requirements 3.0 Personnel performing examinations to this procedure shall be quali-3.1 fied and certified to at least Level II, in accordance with reference 2.3. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of a magnetic particle examination. Equipment and Materials 4.0 Magnetizing equipment shall be electromagnetic yokes capable of pro-4.1 ducing longitudinal magnetization by A.C., or portable magnetic particle unit capable of passing the required amount of half wave

D.C. (HWDC) current through a multiturn coil looped around the part.

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- 4.1.1 This equipment shall be calibrated 4t least every twelve months and following major repair, periodic overhaul, or damage.
- 4.1.2 Electromagnetic yokes shall be Parker Research Corp., Model DA-200 contour probe, or approved equivalent. Yokes shall have a calibrated lifting power of at least 10 pounds for A.C. at the maximum pole spacing to be used. A calibration sticker shall be affixed to the yoke, and shall state the serial number of the yoke, the maximum pole spacing, the date of calibration, and the person responsible for calibration. Minimum pole spacing will be three (3) inches, and yokes shall not be used with pole spacings beyond that stated on the calibration sticker.

Portable magnetic particle equipment shall be 4.1.3 Econospect Corp. or equivalent, and shall produce HWDC amperage in the desired range. Specific equipment shall be chosen depending upon the amperage necessary for a specific examination. The unit's meter readings shall be compared to those of a control test meter with current transformer arrangement, connected so as to monitor the output current. The accuracy of the entire test meter arrangement shall be vertified annually by means traceable to a national standard. Comparative readings shall be taken at a minimum of three output levels encompassing the useable range. The unit's meter reading shall not deviate by more than ±10% of full scale, relative to the actual current value as shown by the test meter.

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4.2 All examination medium materials shall be supplied with batch number and certification attesting that the medium material was manufactured in accordance with ASME Code, Section V. Fluorescent mediums shall be such that the particles emit a brilliant fluorescence when exposed to a suitable "black light." The degree of brilliance shall provide adequate contrast with the similarly exposed background of the surface being examined.

> 4.2.1 Wet, fluorescent mediums shall be provided in prepared bath containers (spray cans).

- 4.2.2 The following wet, fluorescent medium materials, or approved equivalent, shall be used.
 4.2.2.1 Magnaflux Corporation No. 14 AM
- 4.3 When fluorescent particles are used as the examination medium, "black light" (light in the near ultraviolet range - 3300 to 3900 A° of wave length) shall be used to expose the particles and cause them to fluoresce. The light shall have been activated for at least five minutes prior to use in the examination.
 - 4.3.1 Suitable intensity of "black light" at the surface under examination shall be determined using a meter which is sensitive to light in the ultraviolet spectrum, centered on 365nm (3650A). Two readings shall be taken: the first without a filter and the second with an ultraviolet (365nm (3650A)) absorbing filter over the sensing element of the meter. The second reading is deducted from the first and the difference shall be a minimum of 800µW/cm².

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- 4.4 A magnetic particle field indicator (MPFI), see figure 1, shall be available to determine or verify the suitability of examinations, equipment or materials, as may be necessary. The MPFI may be used to determined or verify parameters such as:
 - 4.4.1 Adequacy and/or direction of the magnetizing field.
 - 4.4.2 Fluorescent suitability of fluorescent particle mediums and their compatibility with the "black light" being utilized.
 - 4.4.3 Range (extent of surface area) that may be examined and interpreted for any single "shot".

General Requirements

5.0

5.1 Lighting

5.1.1 The adequacy of "black light" intensity shall be verified in accordance with paragraph 4.3.1 at least once every eight hours of continuous operation, and whenever the work location is changed.

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5.1.1.1 The work area lighting shall be
subdued, shaded or darkened as
necessary to allow easy recognition
of particles when they are being
exposed to "black light".
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5.2 Surface preparation

5.2.1 The surface area to be examined, plus at least one inch on all sides, and the contact area for yokes, if outside this area, shall be dry and free of dust, dirt, scale, grease, or other matter that would interfere with the examinations.

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- 5.2.2 Surface irregularities that, in the opinion of the examiner, would mask or hamper interpretations shall be corrected.
- 5.2.3 Precleaning and surface or area preparations, if required, shall be the responsibility of the contractor.
- 5.3 Examination area

The examination area for bolting shall be the entire exposed surface.

5.4

Surface temperature shall not exceed 135°F when using wet mediums.

ó.0 Examinations

6.1 Examination shall be conducted by the continuous method. The part shall be bathed with the inspection medium to provide an abundant source of suspended particles on the surface of the part and terminating the bath application simultaneously with the initiation of the magnetizing current. Thus, there is no application of the inspection medium while the magnetizing current is flowing. Typically, there may be some overlap relative to cessation of bath application and the flow of magnetizing current.
6.1.1 The wet prepared bath shall be sufficiently

agitated prior to application.

- 6.2 Examinations ahall be conducted in two directions such that the lines of flux from one examination are approximately perpendicular to the other. Orientation of the lines of flux shall be such that the bolting is examined for circumferential and axial indications.
- 6.3 Examinations shall be conducted with sufficient overlap to asure 100% coverage of the area required to be examined. Succeeding examinations shall overlap the appropriate area of the preceding examination by at least 1 inch.

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6.4	Examinat 6.4.1		ons , generally perependicular ndications, shall be induced		
		in the part with an a electromagnetic yoke			
	6.4.2	within ½ of the pole	ion shall be limited to spacing on each side of ole spacing shall be three		
	6.4.3	determined by positi	magnetizing field may be oning the MPFI on the surface flux intensity, or field		
		strength, is suitabl line, or lines, of p	e when a clearly defined articles form across its particles are applied as		
		described in paragra 6.4.3.1 If the 1	ph 6.1 line, or lines, are not		
		direction or equip	or are not in the desired n, the magnetizing technique ment shall be changed		
		examinat	ted so that the required ion is achieved in accordance s procedure.		
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			e and equipment.		
	6.4.4	the entire exposed a be sequentially exam	ination of field adequacy, rea of the bolting shall ined, being careful to allow s detailed in paragraph		

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6.5	Examinat 6.5.1	ion for Circumferen	tial Indications eld, generally perpendicular to
	0.3.1	suspected circumf induced in the pa	erential indications, shall be art with an HWDC coil coupled to particle equipment as described
	6.5.2	Magnetization is	accomplished by passing HWDC
		current through a	a multiturn coil looped around
			e examined. This produces a
		magnetic field pa	arallel to the axis of the coil.
		6.5.2.1 For t	polting with a length (L)/Diameter
		(D) 1	ratio greater than, or equal to,
		4, th	he following formula shall be used
		, to ca	alculate the ampere-turns to be
		used	for magnetization:
		Amj	pere-turns = <u>35,000</u>
			2 + L/D
		6.5.2.2 For 1	bolting with a L/D ratio greater
		than	, or equal to, 2 and up to 4, the
		foll	owing formula shall be used:
		am	pere-turns = $45,000$
			L/D
		6.5.2.3 For	L/D ratios less than 2, alternate
		magn	etizing methods shall be used.
	6.5.3	The magnetizing	coil shall be made of cable, wound
		around the bolti	ng, and the coil's turns shall
		be closely space	d.
	6.5.4	The area of exam	ination shall be limited to within
		five inches on e	ach side of the coil.
	6.5.5	Parts longer tha	n twelve inches shall be examined
		in sections not length.	exceeding eleven inches nominal

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6.5.6

The adequacy of the magnetizing field may be determined by positioning the MPFI on the surface to be examined. The flux intensity, or field strength, is suitable when a clearly defined line, or lines, of particles form across its copper face when the particles are applied simultaneously with the magnetizing force.

- 6.5.6.1 If the line, or lines, are not formed, or are not formed in the desired direction, the magnetizing technique, equipment, or medium shall be changed or adjusted so that the required examination is achieved in accordance with this procedure.
- 6.5.6.2 Satisfactory definition of the line, or lines, on the MPFI verifies the adequacy and suitability of the techniques and equipment.

6.5.7 Following the determination of field adequacy, the entire exposed area of the bolting shall be sequentially examined, being careful to examine the area within the coil. Sufficient overlap shall be provided as detailed in paragraph 6.3.

6.6 Demagnetization of bolting shall be accomplished by slowly passing the bolting through the inside of the coil, prepared in paragraph 6.5, until it is approximately 2 feet beyond the coil. Demagnetization in this manner may also be accomplished by moving the coil instead of the bolting.
6.7 Post examination cleaning, associated with the test, shall

be the responsibility of the contractor.

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Evaluation and Recording of Indications 7.0

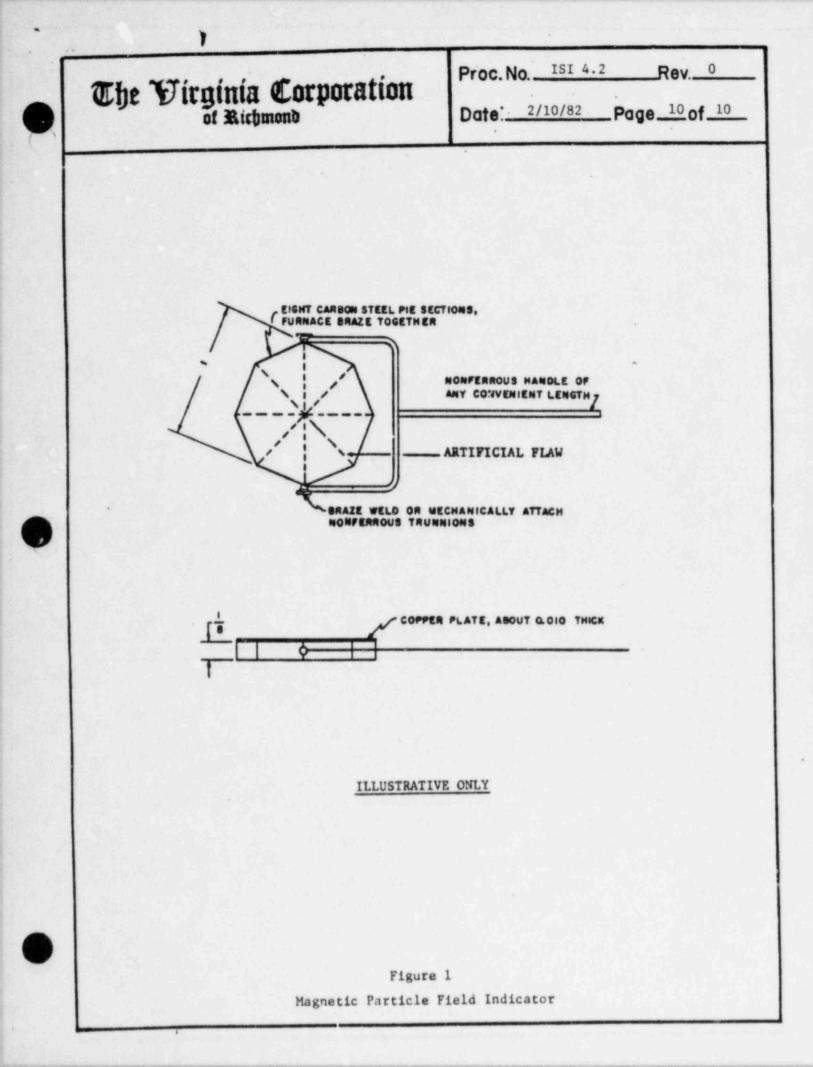
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- Discontinuities at the surface are indicated by the retention 7.1 of examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false or nonrelevant indications.
- Broad areas of particle accumulation or nonrelevant indications 7.2 which could mask indications of discontinuities are unacceptable, ۰., and those areas shall be cleaned and reexamined.
- Reportable Indications 7.3
 - The following relevant indications occuring in 7.3.1 the examination area are to be recorded and reported: non-axial indications, greater than a. 's inch in length axial indications, greater than 1 inch b. in length

Documentation of Examination 8.0

All data relative to the examination, including any reportable 8.1 indications, shall be reported in accordance with reference 2.4, and on forms similar to those shown in figures 2 and 3.



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Customer		Plan	t			Unit		1	.oop/Zo	ne
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Figure 3 Virginia Corp. of Richmond			Magnet Indica	tic Par	
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Component/Piping Sy	vstem		VCR Super	rvisor	
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Procedure Title:	MAGNETIC PARTICLE UTILIZING THE DRY		OD
			EBASCO SERVICES INCORPORATED
Procedure No.:	ISI 4.3		QCALITY ASSURANCE ENGINEERING
Plant Site:	Waterford No. 3	•	Ints Documents is: Reviewed Without Comments Reviewed With Comments as Noted: Incorporate Comments and Resubmit: Proceed with order. Rejected: Revise and Resubmit:
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1.0 Scope

1.1 This procedure describes the requirements for the performance of magnetic particle examination of ferromagnetic weldments in piping 4" diameter and greater and adjacent base metal for indications open to the surface, using continuous method and longitudinal magnetization as produced by yoke technique. Dry medium is to be used with this procedure. This procedure is written in compliance with ASME Code, Section XI, and the requirements of ASME Code, Section V, Article 7.

2.0 References

- 2.1 ASME Boiler and Pressure Vessel Code, Section XI, 1977 edition with addenda through summer, 1978.
- 2.2 ASME Section V, Article 7, 1977 edition with addenda through summer, 1978.
- 2.3 The Virginia Corporation of Richmond Procedure 4.1, Written Practice for the Qualification and Certification of NDE Personnel, Rev. 3, dated 3/6/81.
- 2.4 The Virginia Corporation ISI 1.2, latest revision, Preservice Inspection Documentation.
- 2.5 Preservice Inspection Program Plan.
- 2.6 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Requirements

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II, in accordance with reference 2.3. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of a magnetic particle examination.

4.0 Equipment and Materials

4.1 Magnetizing equipment shall be electromagnetic yokes capable of producing longitudinal magnetization by A.C. current.

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- 4.1.1 This equipment shall be calibrated at least once every twelve months, following major repair, periodic overhaul, or damage.
- 4.1.2 Electromagnetic yokes shall be Parker Research Corp., Model DA-200 contour probe, or approved equivalent. Yokes shall have a calibrated lifting power of at least 10 pounds for A.C. at the maximum pole spacing to be used. A calibration sticker shall be affixed to the yoke, and shall state the serial number of the yoke, the maximum pole spacing, the date of calibration, and the person responsible for calibration. Minimum pole spacing will be three (3) inches, and yokes will not be used with pole spacings beyond that stated on the calibration sticker.

All examination medium materials shall be supplied with batch number and certification attesting that the medium material was manufactured in accordance with ASME Code, Section V. The medium selected for examination shall provide adequate contrast with the background of the surface being examined. 4.2.1 The following dry medium materials, or approved

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	daragrent'	sharr be used.
4	.2.1.1	Magnaflux Corp., No. 1 (Grey), No. 3A
		(Black), or No. 8A (Red).
4	.2.1.2	Detek, Inc., M10-100 (Blue-Black),
		M10-200 (Red), M10-300 (Grey), M10-400
		(Yellow).

4.3

A magnetic particle field indicator (MPFI), see Figure 1,
shall be available to determine or verify the suitability
of examinations, equipment or materials, as may be necessary.
The MPFI may be used to determine or verify such as:
4.3.1 Adequacy and/or direction of the magnetizing field.
4.3.2 Range (extent of surface area) that may be examined and interpreted for any single "shot".

4.2

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5.0

General Requirements

- 5.1 Lighting for visible mediums shall be sufficient to resolve a 1/32 inch wide (maximum) black line on an 18% neutral gray background placed on or near the surface to be examined. Flashlights and/or extension lights may be used to achieve sufficient lighting.
- 5.2 Surface Preparation
 - 5.2.1 The surface area to be examined, plus at least one inch on all sides, and the contact area for yokes, if outside this area, shall be dry and free of dust, dirt, scale, grease, or other matter that would interfere with the examinations.
 - 5.2.2 "As-welded" surfaces, following removal of slag, shall be considered suitable for magnetic particle examination without grinding if this does not interfere with interpretation of the test results if the weld contour blends into the base metal.
 - 5.2.3 Surface irregularities that, in the opinion of the examiners, would mask or hamper interpretations shall be corrected.
 - 5.2.4 . Precleaning and surface or area preparations, if required, shall be the responsibility of the contractor.
 - 5.2.5 Power wire brushing is permitted for removal of extraneous materials, at the discretion of the PSI Construction Coordinator.
- 5.3 Examination Area
 - 5.3.1 The examination area shall be the weld surface and adjacent base metal on each side of the weld edge. as required by Figures 1 through 13.
 - 5.3.2 The specific welds or other areas to be examined shall be as defined in the preservice inspection plan.

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Surface temperature shall not exceed 600° F when using dry 5.4 mediums.

6.0 Examinations

- 6.1
 - Examinations shall be conducted by the continuous method. Visible, dry powder shall be applied in such a manner that a light, uniform, dust-like coating settles upon the surface of the test part while the part is being magnetized. After application, and before turning off current, excess dry powder is removed by means of a dry-air current of sufficient force to remove the excess particles without disturbing any particles attracted by a flux leakage field that is indicative of discontinuities.
- 6.2 Examination shall be conducted in two directions such that the lines of flux from one examination are approximately perpendicular to the other. Orientation of the lines of flux shall be such that the surface examined is examined for indications parallel and transverse to the weld axis.
- 6.3 Examinations shall be conducted with sufficient overlap to assure 100% coverage of the area required to be examined. Succeeding examinations shall overlap the appropriate area of the preceding examination by at least one inch. 6.4
 - Examination for Parallel and Transverse Indications 6.4.1 A longitudinal field in two directions, 90° to each other, shall be induced in the part with an alternating current electromagnetic yoke in accordance with requirements of paragraph 6.4.3 and a setup similar to Figure 14.
 - 6.4.2 The area of examination shall be limited to within 1/4 of the pole spacing on each side of the yoke. Minimum pole spacing shall be three inches.

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6.4.3 The adequacy of the magnetizing field may be determined by positioning the MPFI (Figure 15) on the surface to be examined. The flux intensity, or field strength, is suitable when a clearly defined line, or lines, of particles form across its copper face when the particles are applied simultaneously with the magnetizing force.

- 6.4.3.1 If the line, or lines, are not formed, or are not formed in the desired direction, the magnetizing technique, equipment, or medium shall be changed or adjusted so that the required examination is achieved in accordance with this procedure.
- 6.4.3.2 Satisfactory definition of the line, or lines, on the MPFI verifies the adequacy and suitability of the technique and equipment.
- 6.4.3.3 The adequacy of the field shall be determined with the MPFI in both the parallel and transverse directions with respect to the weld axis.
- 6.4.4 Following the determination of field adequacy, the entire area to be examined shall be sequentially examined, being careful to allow sufficient overlap as detailed in paragraph 6.3. as depicted in Figure 14.

6.5 Demagnetization of weldment is not required.

6.6 Post examination cleaning, associated with the test, shall be the responsibility of the contractor.

-) Evaluation and Recording of Indications
 - 7.1 Discontinuities at the surface are indicated by the retention of examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false or nonrelevant indications.

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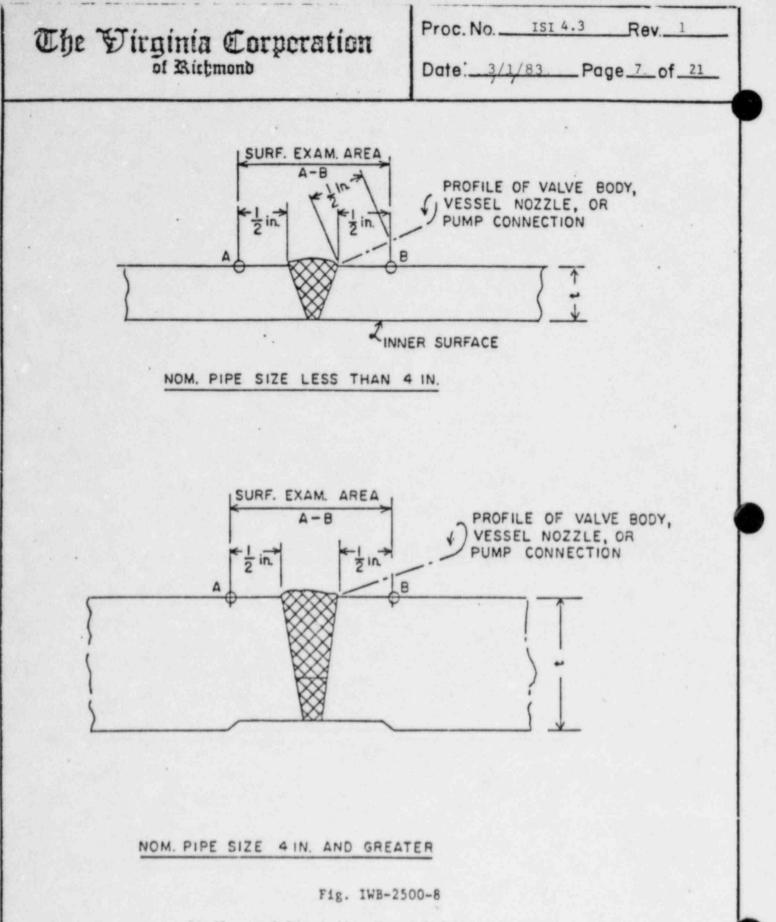
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- 7.2 Broad areas of particle accumulation or nonrelevant indications which could mask indications of discontinuities are unacceptable,
- and those areas shall be cleaned and reexamined.
- 7.3 Reportable Indications
 - 7.3.1 The indications in the table below, occuring in the examination area, are considered relevant and are to be recorded and reported to the customer or his agent within 24 hours.

Description	Nominal Wall Thickness/Other	Reportable Indications	
Ferromagnetic welds piping	≤ .312" >.312" to 2.0" 2.0" & over	>1/8" >3/16" >1/4"	-
Ferromagnetic vessel supports and support members for piping, valves, and pumps	.625" to 2.0" 2.0" & over	3 /16" 1 /4"	
Pressure retaining welds in pump casings and valve bodies	>2.0"	>1/4"	1

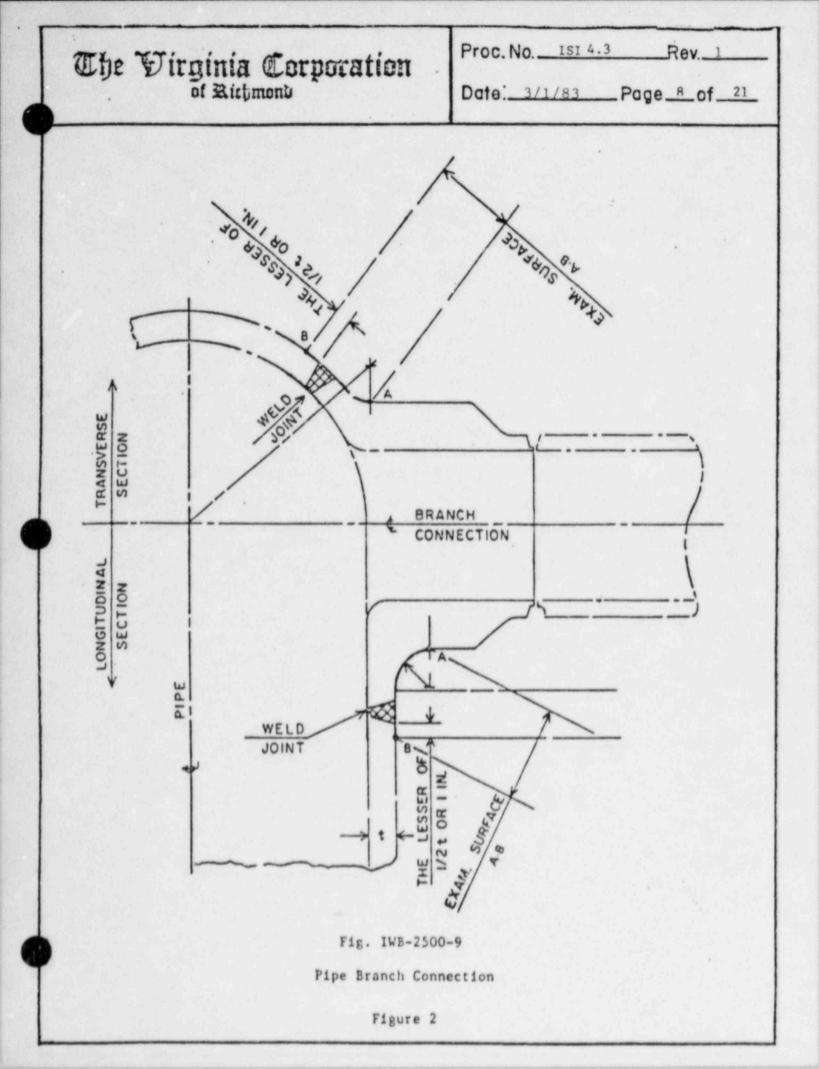
8.0 Documentation of Examination

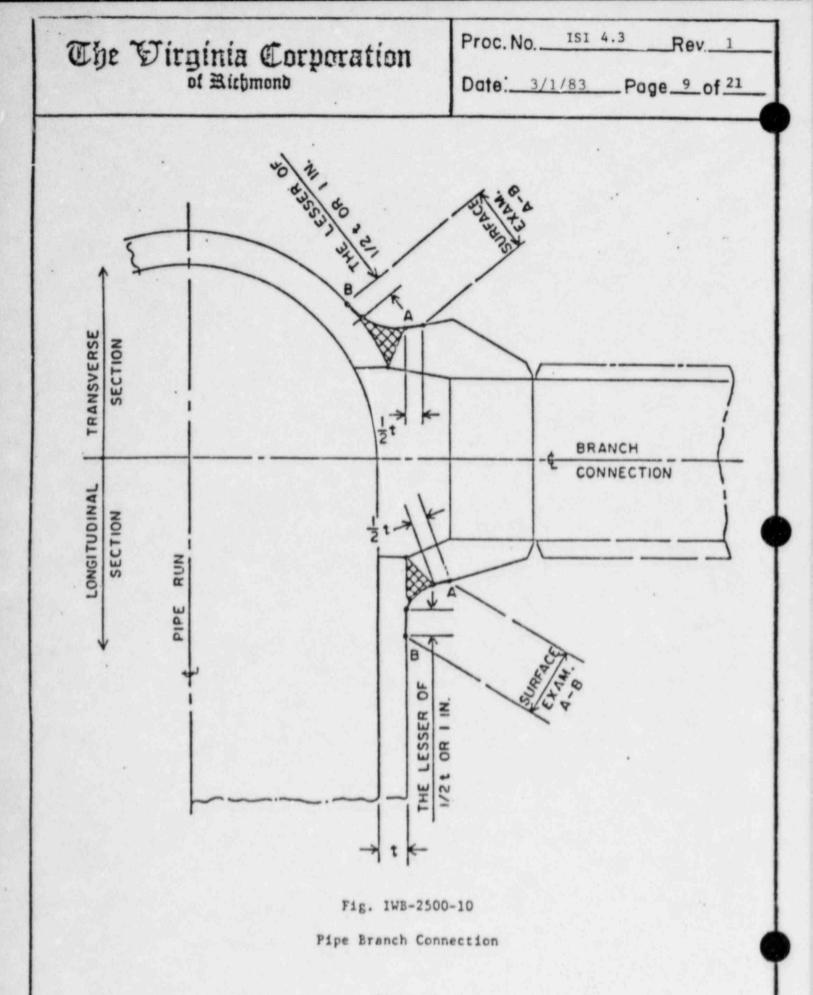
8.1 All data relative to the examination, including any reportable indications, shall be reported in accordance with references 2.4, and on forms similar to those shown in Figures 16 and 17.



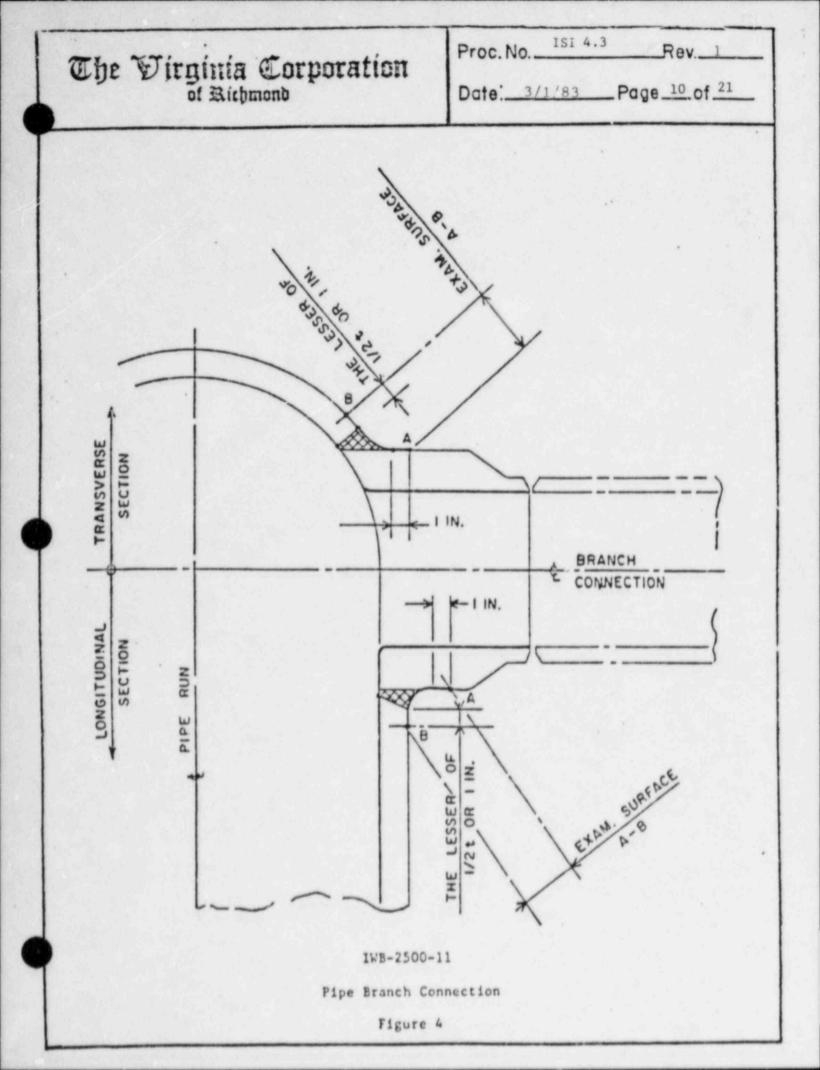
Similar and Dissimilar Metal Welds in Piping

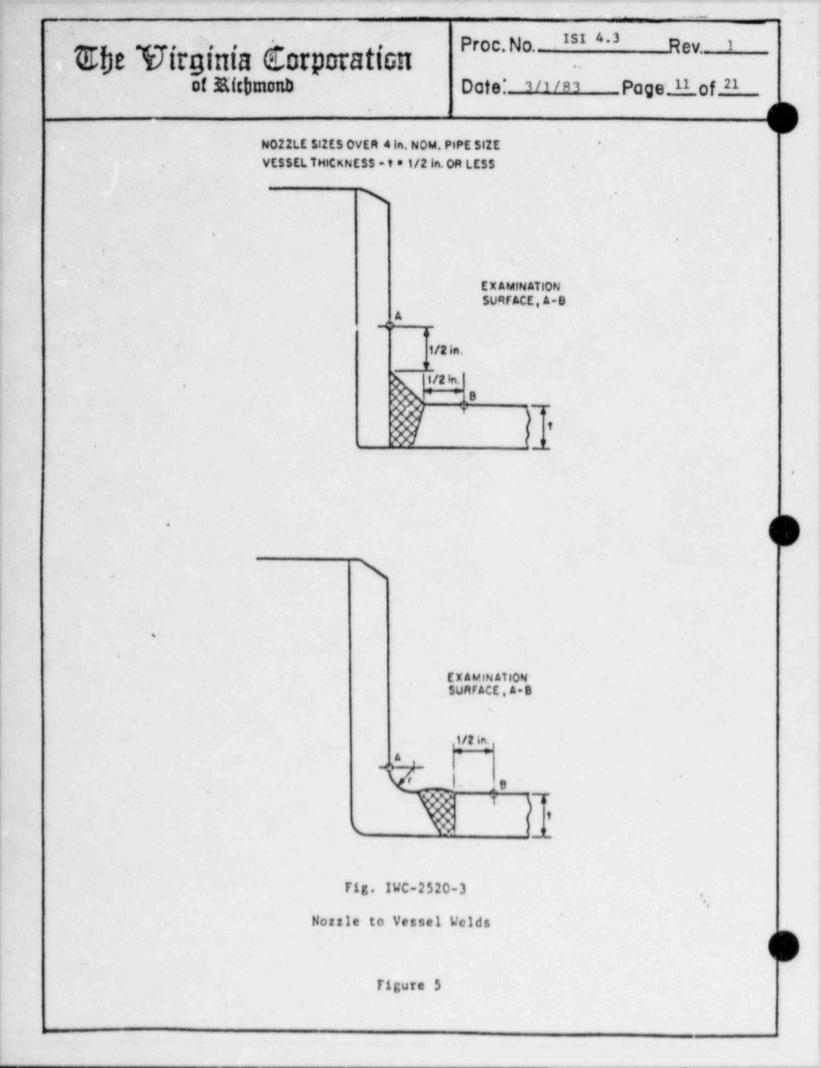
Figure 1

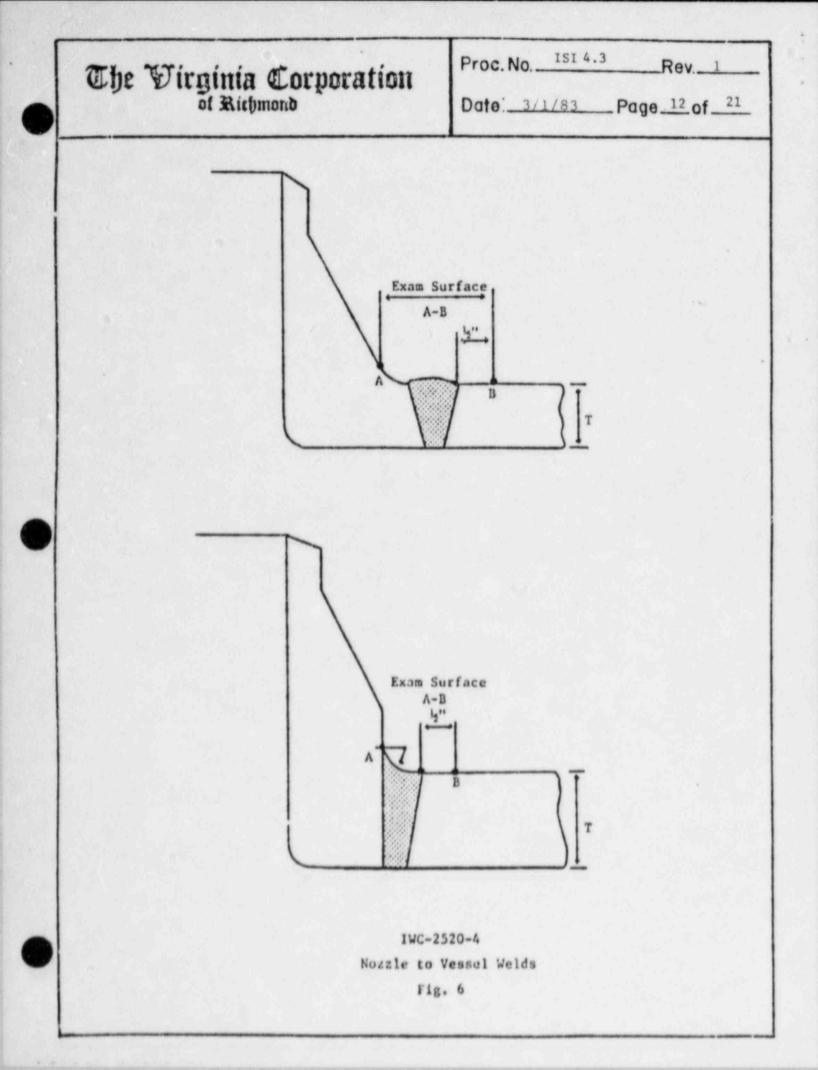












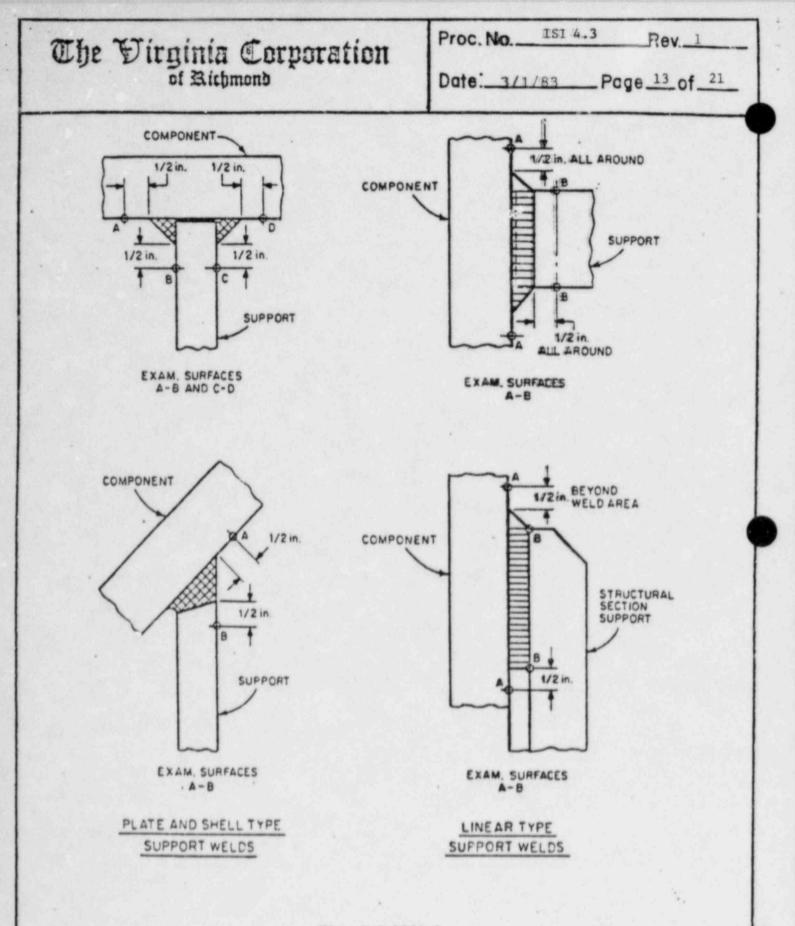
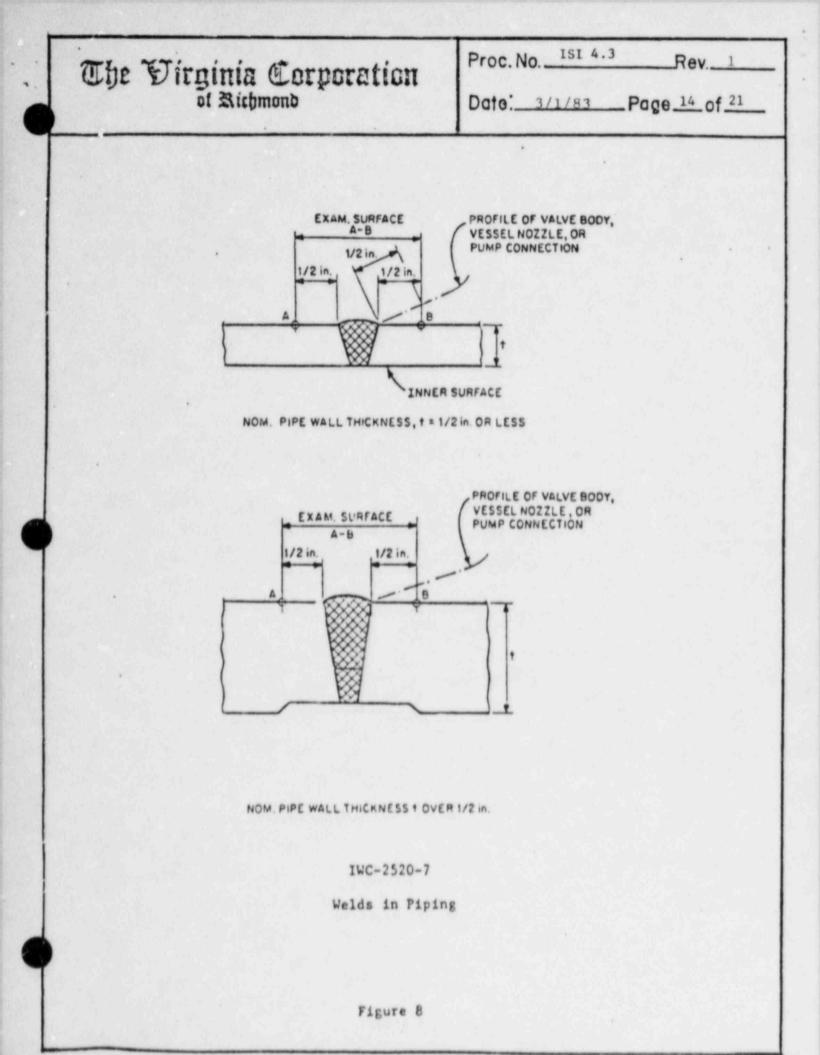
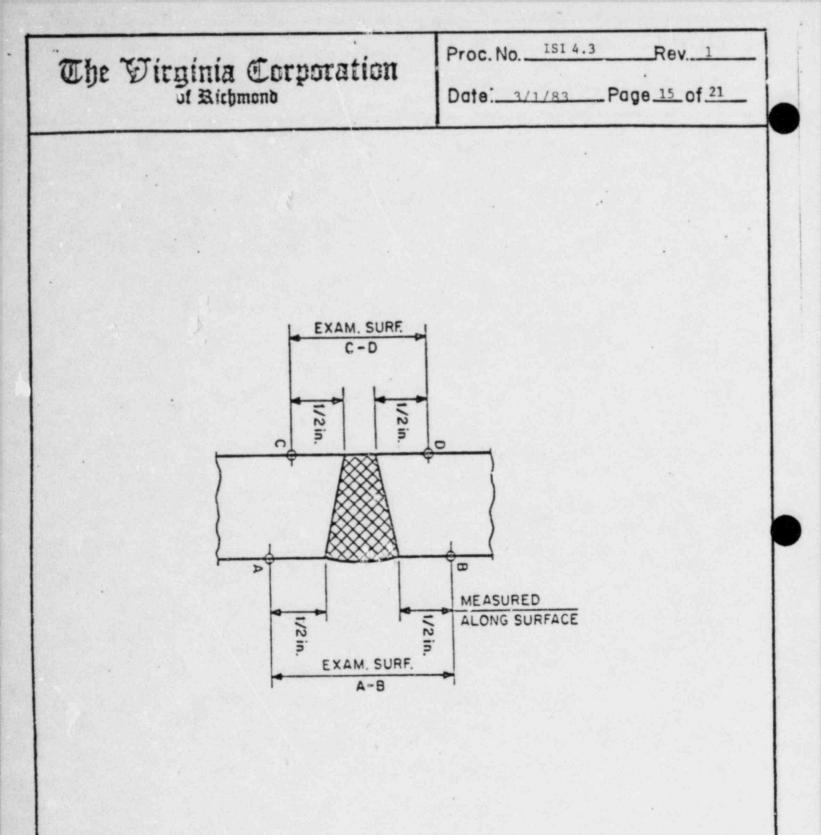


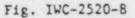
Fig. IWC-2520-5

Integrally Welded Component Supports

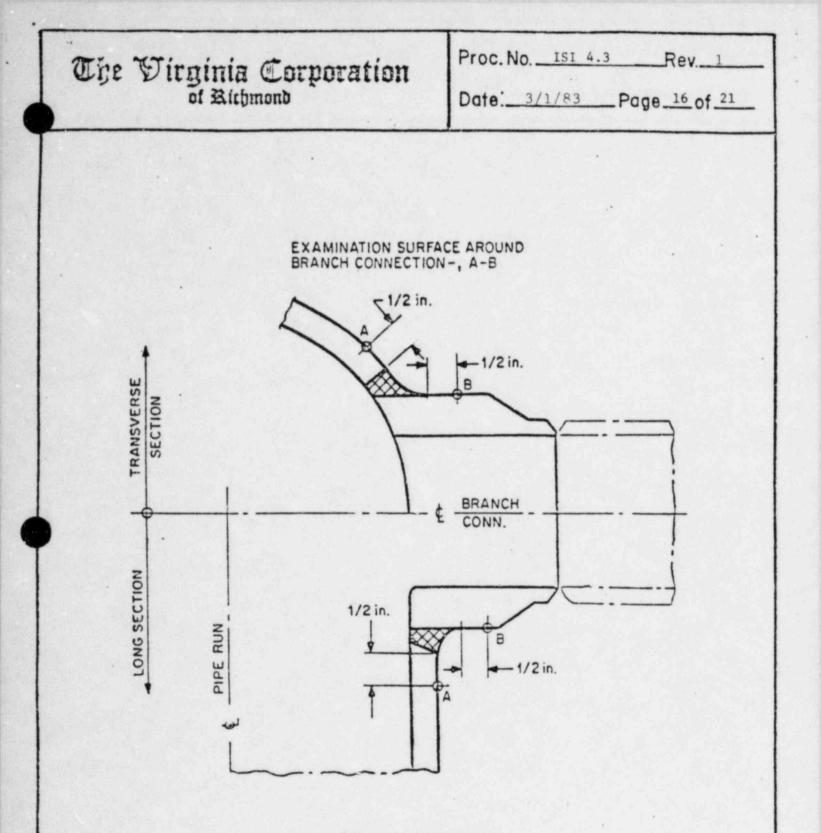
Figure 7

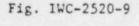


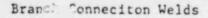


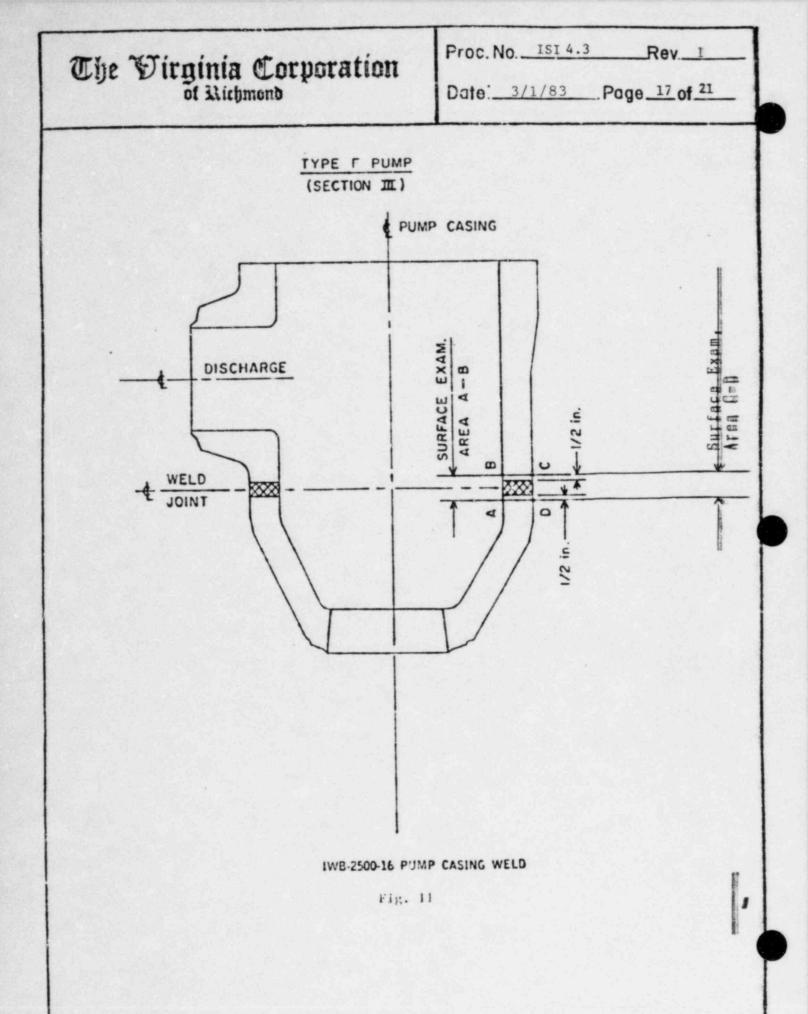


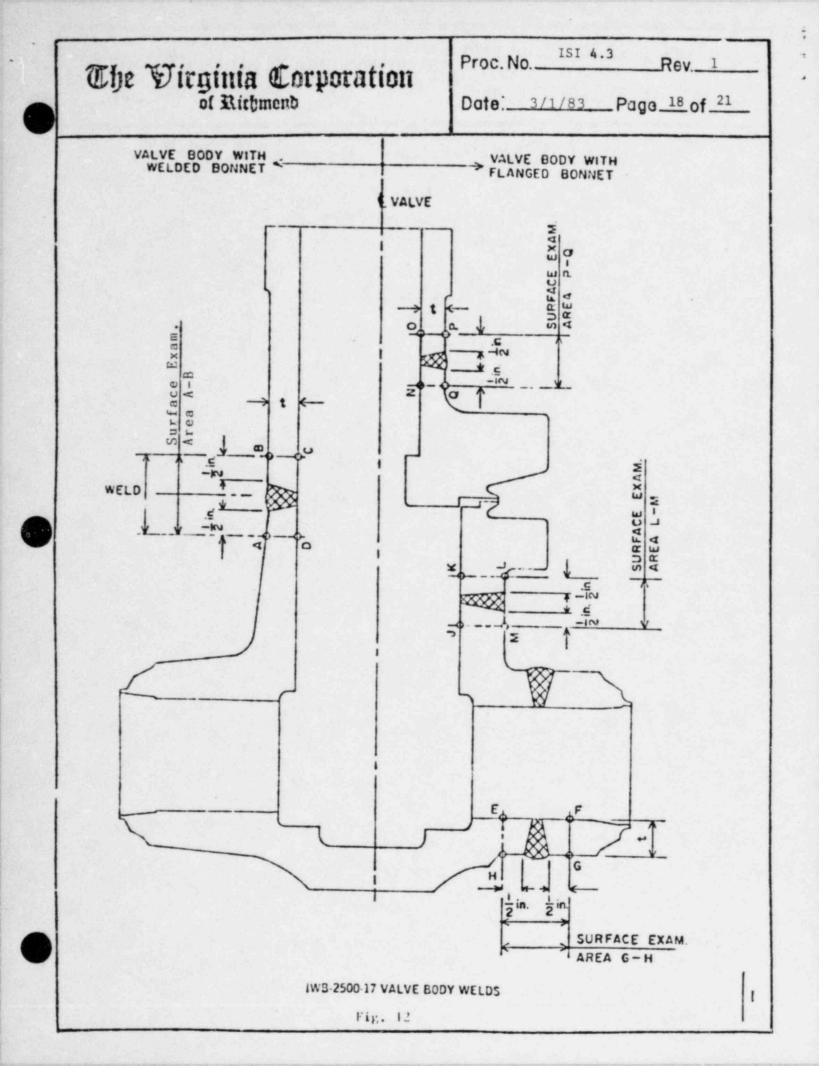
Welds in Pump Casing and Valve Bodies

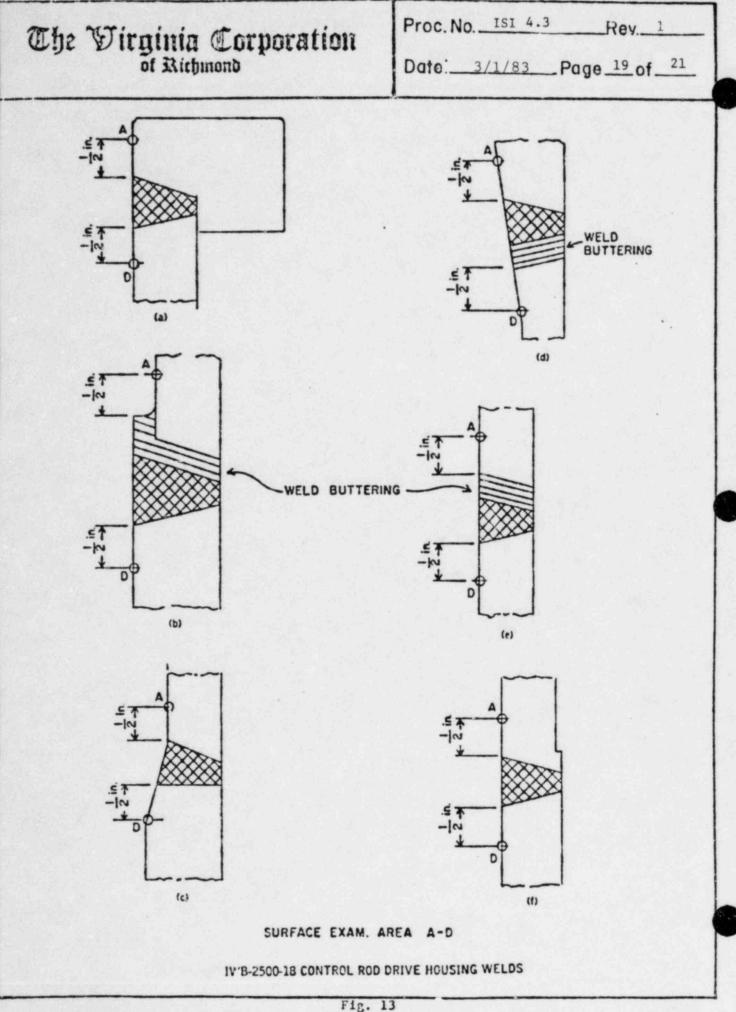


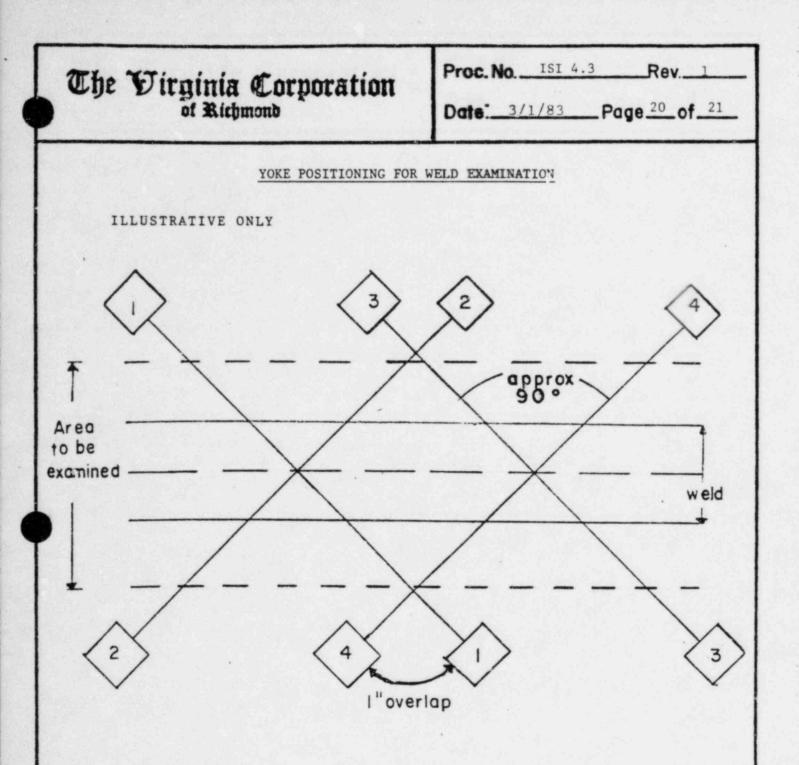






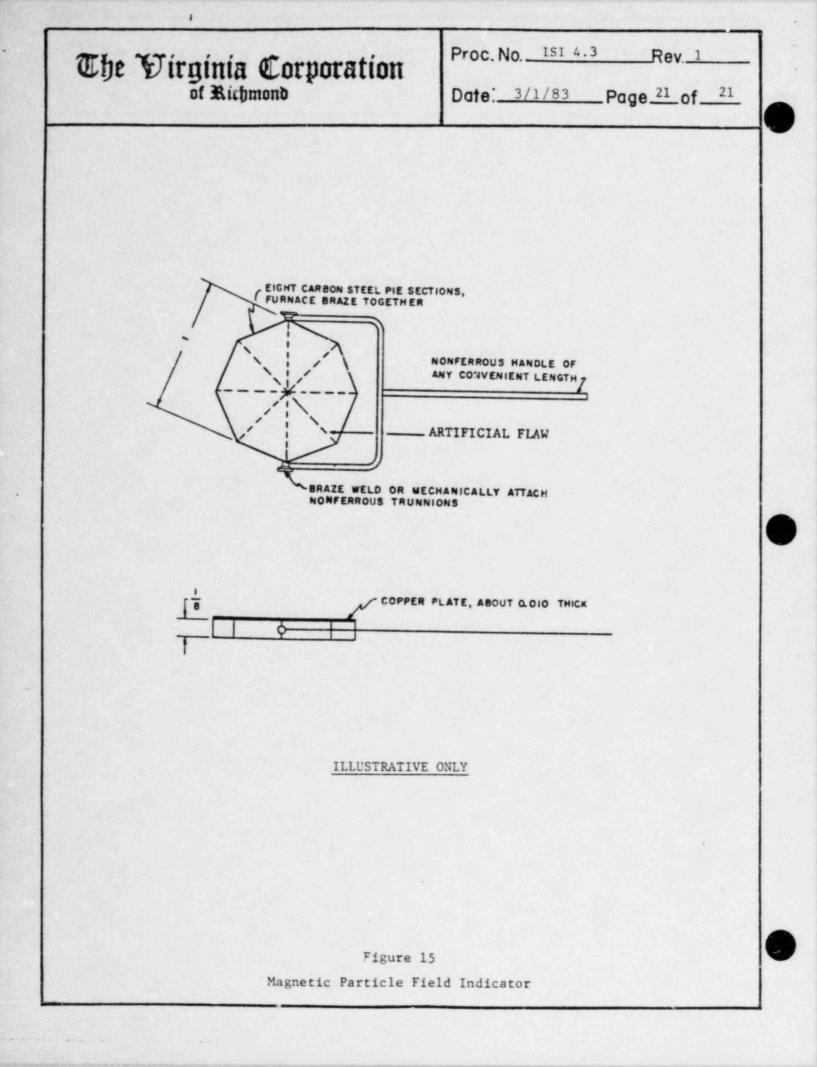






PROBE POSITIONS SHOWING 2 DIRECTIONS 90° TO EACH OTHER AND I" OVERLAPPING ON SURFACE TO BE EXAMINED

Figure 14



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Type of Particle Wet Dry		ble F	louresc		ianufactur	er	Type	2	Batch	Number	
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1.0

1.1 This procedure describes the requirements for the performance of magnetic particle examination of ferromagnetic weldments in piping 4" diameter and greater, and adjacent base metal for indications open to the surface, using continuous method and longitudinal magnetization as produced by yoke technique. Wet, fluorescent medium is to be used with this procedure. This procedure is written in compliance with ASME code, Section XI, and the requirements of ASME code, Section V, Article 7.

2.0 References

Scope

- 2.1 ASME Boiler and Pressure Vessel Code, Section XI, 1977 edition with addenda through summer, 1978.
- 2.2 ASME Section V, Article 7, 1977 edition with addenda through summer, 1978.
- 2.3 The Virginia Corporation of Richmond Procedure 4.1, Written Practice for the Qualification and Certification of NDE Personnel, Rev. 3, dated 3/6/81.
- 2.4 The Virginia Corporation ISI 1.2, Preservice Inspection Documentation (latest revision).
- 2.5 Preservice Inspection Program Plan.
- 2.6 The Virginia Corporation Procedure VC-QA-103, Generation and Control of Procedures for Waterford No. 3 Preservice Inspection (latest revision).

3.0 Personnel Requirements

3.1 Personnel performing examinations to this procedure shall be qualified and certified to at least Level II, in accordance with reference 2.3. Level I and/or Level I trainees (Level I-Ltd) may be employed as assistants. Level I and/or Level I trainees (Level I-Ltd) shall not independently evaluate or accept the results of a magnetic particle examination.

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4.0 Equipment and Materials

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- 4.1 Magnetizing equipment shall be electromagnetic yokes capable of producing longitudinal magnetization by A.C. current.
 - 4.1.1 This equipment shall be calibrated at least once every twelve months, and following major repair, periodic overhaul, or damage.
 - 4.1.2 Electromagnetic yokes shall be Parker Research Corp., Model DA-200 contour probe, or approved equivalent. Yokes shall have a calibrated lifting power of at least 10 pounds for A.C. at the maximum pole spacing to be used. A calibration sticker shall be affixed to the yoke, and shall state the serial number of the yoke, the maximum pole spacing, the date of calibration, and the person responsible for calibration. Minimum pole spacing will be three (3) inches, and yokes will not be used with pole spacings beyond that stated on the calibration sticker.
- 4.2 All examination medium materials shall be supplied with batch number and certification attesting that the medium material was manufactured in accordance with ASME Code, Section V. Fluorescent mediums shall be such that the particles emit a brilliant fluorescence when exposed to a suitable "black light". The degree of brilliance shall provide adequate contrast with the similarly exposed background of the surface being examined.
 - 4.2.1 Wet, fluorescent mediums shall be provided in prepared bath containers (spray cans).
 - 4.2.2 The following wet, fluorescent medium materials, or approved equivalent, shall be used.
 4.2.2.1 Magnaflux Corporation No. 14 AM

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- 4.3 When fluorescent particles are used as the examination medium, "black light" (light in the near ultraviolet range -3300 to 3900 A° of wave length) shall be used to expose the particles and cause them to fluoresce. The light shall have been activated for at least five minutes prior to use in the examination.
 - 4.3.1 Suitable intensity of "black light" at the surface under examination shall be determined using a meter which is sensitive to light in the ultraviolet spectrum, centered on 365nm (3650A). Two readings shall be taken: the first without a filter and the second with an ultraviolet (365nm (3650A)) absorbing filter over the sensing element of the meter. The second reading is deducted from the first and the difference shall be a minimum of 800 w/cm².
- 4.4 A magnetic particle field indicator (MPF1), see Figure 1, shall be available to determine or verify the suitability of examinations, equipment or materials, as may be necessary. The MPFI may be used to determine or verify parameters such as:
 - 4.4.1 Adequacy and/or direction of the magnetizing field.
 - 4.4.2 Fluorescent suitability of fluorescent particle mediums and their compatibility with the "black light" being utilized.
 - 4.4.3 Range (extent of surface area) that may be examined and interpreted for any single "shot".

5.0 General Requirements

5.1 Lighting

5.1.1 The adequacy of "black light" intensity shall be verified in accordance with paragraph 4.3.' at least once every eight hours of continuous operation, and whenever the work location is changed.

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		shaded or easy reco	area lighting shall be subdued, darkened as necessary to allow gnition of particles when they exposed to "black light".
5.2	Surface P	reparation	
	5.2.1	inch on all sides, an if outside this area,	e examined, plus at least one d the contact area for yokes, shall be dry and free of dust, or other matter that would caminations.
	5.2.2	shall be considered s examination without g interfere with interp	following removal of slag, suitable for magnetic particle grinding if this does not pretation of the test results our blends into the base metal.
	5.2.3		es that, in the opinion of the or hamper interpretations
	5.2.4		nce or area preparation, if ne responsibility of the
5.3	Examinati	ion Area	
	5,3,1		shall be the weld surface and on each side of the weld edge, es 1 through 13.
	5.3.2		other areas to be examined In the preservice inspection
5.4	Surface t	emperature shall not e	exceed 135°F when using wet

mediums.

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6.0 Examinations

6.4

6.1 Examination shall be conducted by the continuous method. The part shall be bathed with the inspection medium to provide an abundant source of suspended particles on the surface of the part and terminating the bath application simultaneously with the initiation of the magnetizing current. Thus, there is no application of the inspection medium while the magnetizing current is flowing. Typically, there may be some overlap relative to cessation of bath application and the flow of magnetizing current.

> 6.1.1 The wet prepared bath shall be sufficiently agitated prior to application.

- 6.2 Examination shall be conducted in two directions such that the lines of flux from one examination are approximately perpendicular to the other. Orientation of the lines of flux shall be such that the surface examined is examined for indications parallel and transverse to the weld axis.
- 6.3 Examinations shall be conducted with sufficient overlap to assure 100% coverage of the area required to be examined. Succeeding examinations shall overlap the appropriate area of the preceding examination by at least one inch.

Examination for Parallel and Transverse Indications

- 6.4.1 A longitudinal field in two directions, 90° to each other, shall be induced in the part with an alternating current electromagnetic yoke in accordance with requirements of paragraph 6.4.3 and a setup similar to Figure 14.
- 6.4.2 The area of examination shall be limited to within ¹/₄ of the pole spacing on each side of the yoke. Minimum pole spacing shall be three inches.

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- 6.4.3 The adequacy of the magnetizing field may be determined by positioning the MPFI (Figure 15) on the surface to be examined. The flux intensity, or field strength, is suitable when a clearly defined line, or lines, of particles form across its copper face when the particles are applied simultaneously with the magnetizing force.
 - 6.4.3.1 If the line, or lines, are not formed, or are not formed in the desired direction, the magnetizing technique, equipment, or medium shall be changed or adjusted so that the required examination is achieved in accordance with this procedure.
 - 6.4.3.2 Satisfactory definition of the line, or lines, on the MPFI verifies the adequacy and suitability of the technique and equipment.
 - 6.4.3.3 The adequacy of the field shall be determined with the MPFI in both the parallel and transverse directions with respect to the weld axis.
- 6.4.4 Following the determination of field adequacy, the entire area to be examined shall be sequentially examined, being careful to allow sufficient overlap as detailed in paragraph 6.3, and as depicted in Figure 14.
- 6.5 Demagnetization of weldments is not required.
- 6.6 Post examination cleaning, associated with the test, shall be the responsibility of the contractor.

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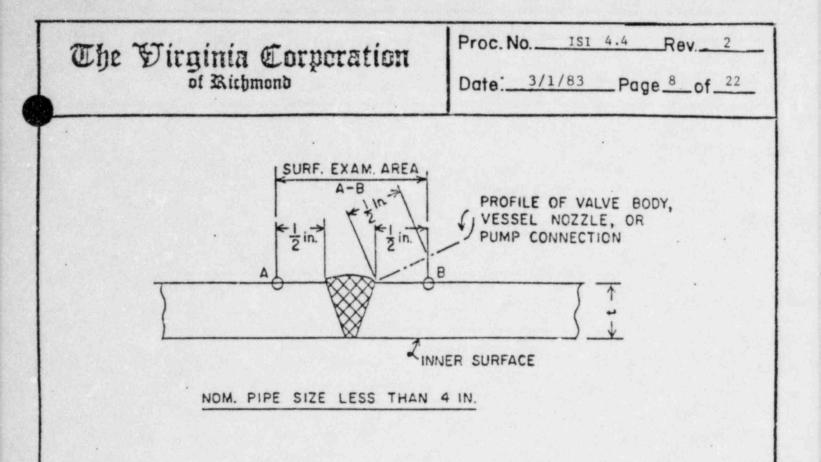
7.0 Evaluation and Recording of Indications

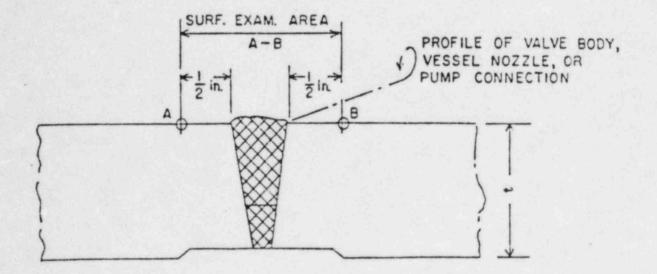
- 7.1 Discontinuities at the surface are indicated by the retention of examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false or nonrelevant indications.
- 7.2 Broad areas of particle accumulation or nonrelevant indications which could mask indications of discontinuities are unacceptable, and those areas shall be cleaned and re-examined.
- 7.3 Reportable Indications
 - 7.3.1 The indications in the table below, occuring in the examination area, are considered relevant and are to be recorded and reported to the customer or his agent within 24 hours.

	Nominal Wall Thickness/Other	Reportable Indications
Ferromagnetic welds piping	≤ .312" >.312" to 2.0' 2.0 and over	>1/8" >3/16" >1/4"
Ferromagnetic vessel supports and support members for piping, valves, and pumps	.625" to 2.0" 2.0" and over	' >3/16" >1/4"
Pressure retaining welds in pump casings and valv bodies		>1/4"

8.0 Documentation of Examination

8.1 All data relative to the examination, including any reportable indications, shall be reported in accordance with references 2.4, and on forms similar to those shown in Figure 16 and 17.

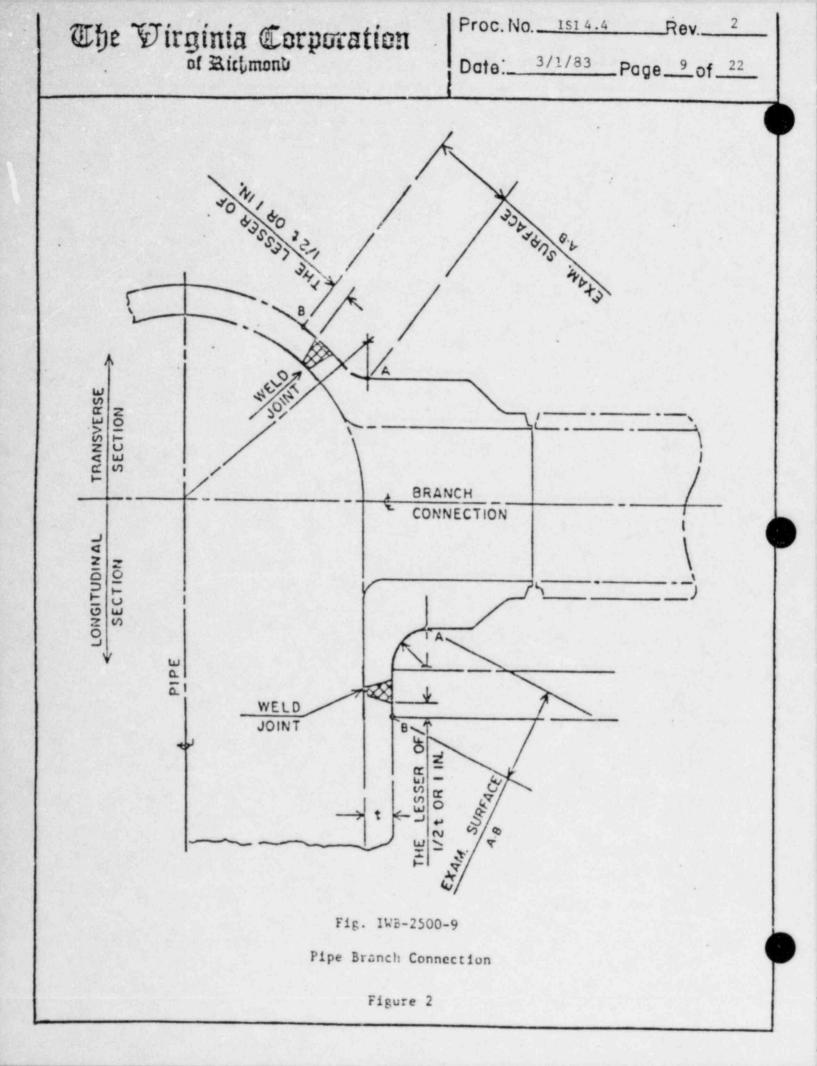


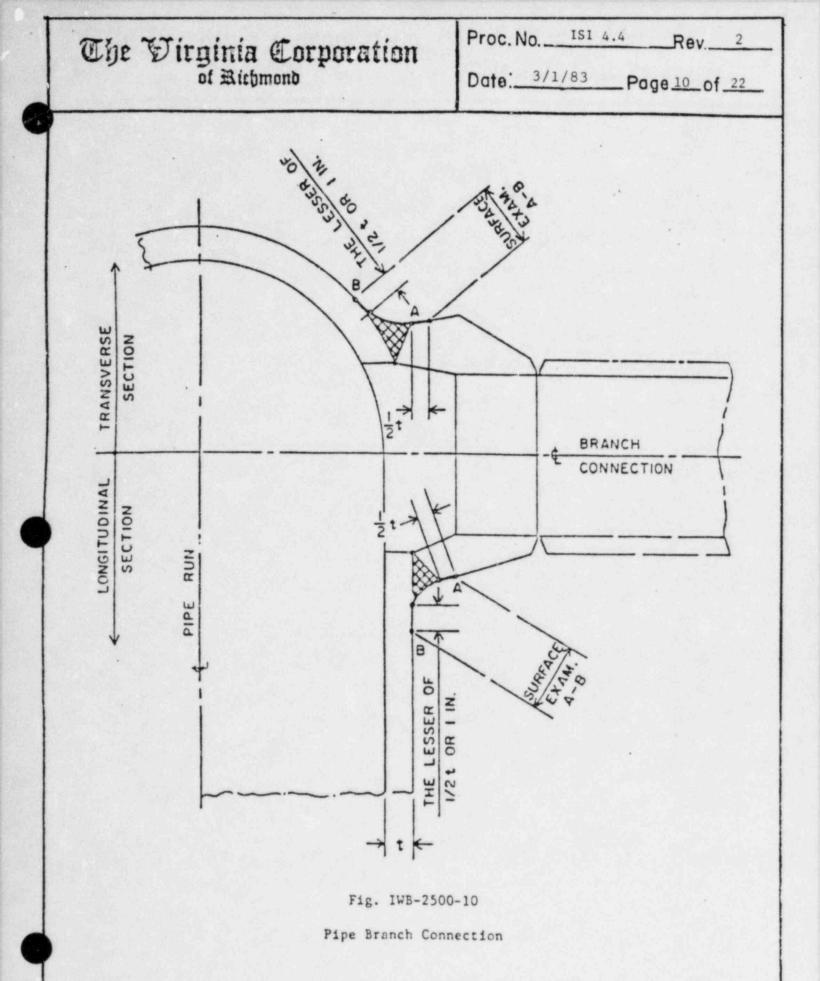


NOM. PIPE SIZE 4 IN. AND GREATER

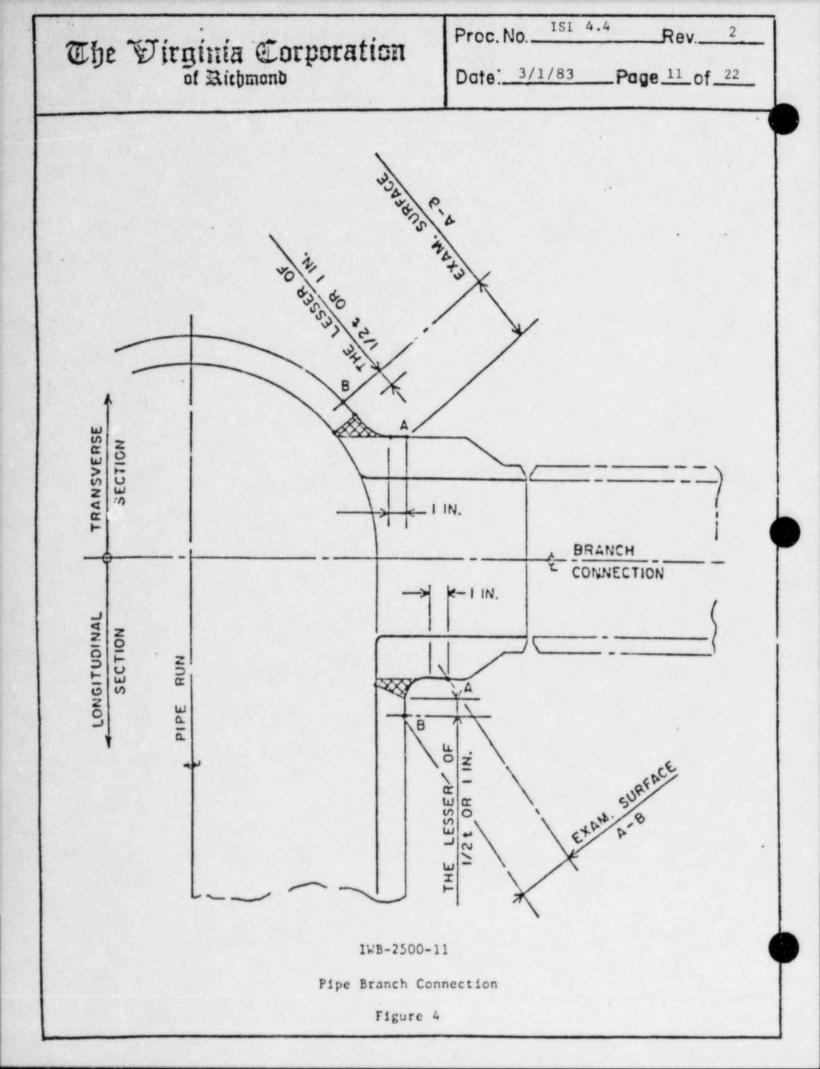
Fig. 1WB-2500-8

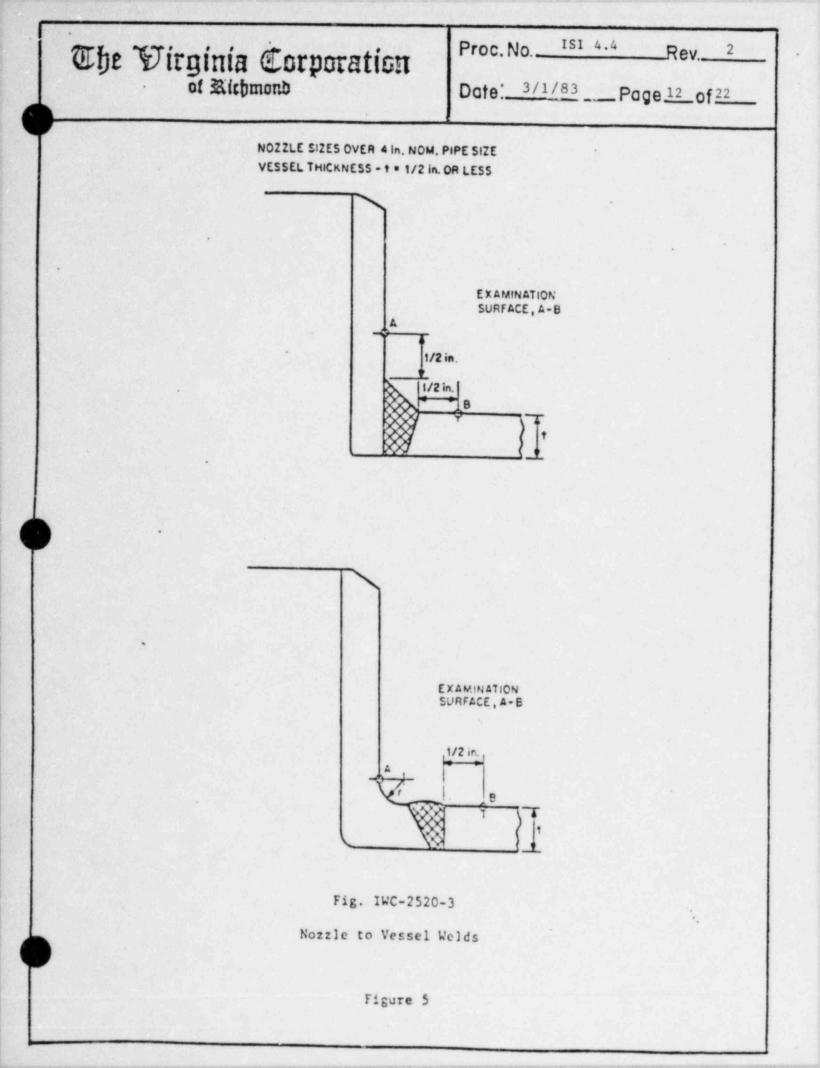
Similar and Dissimilar Metal Welds in Piping

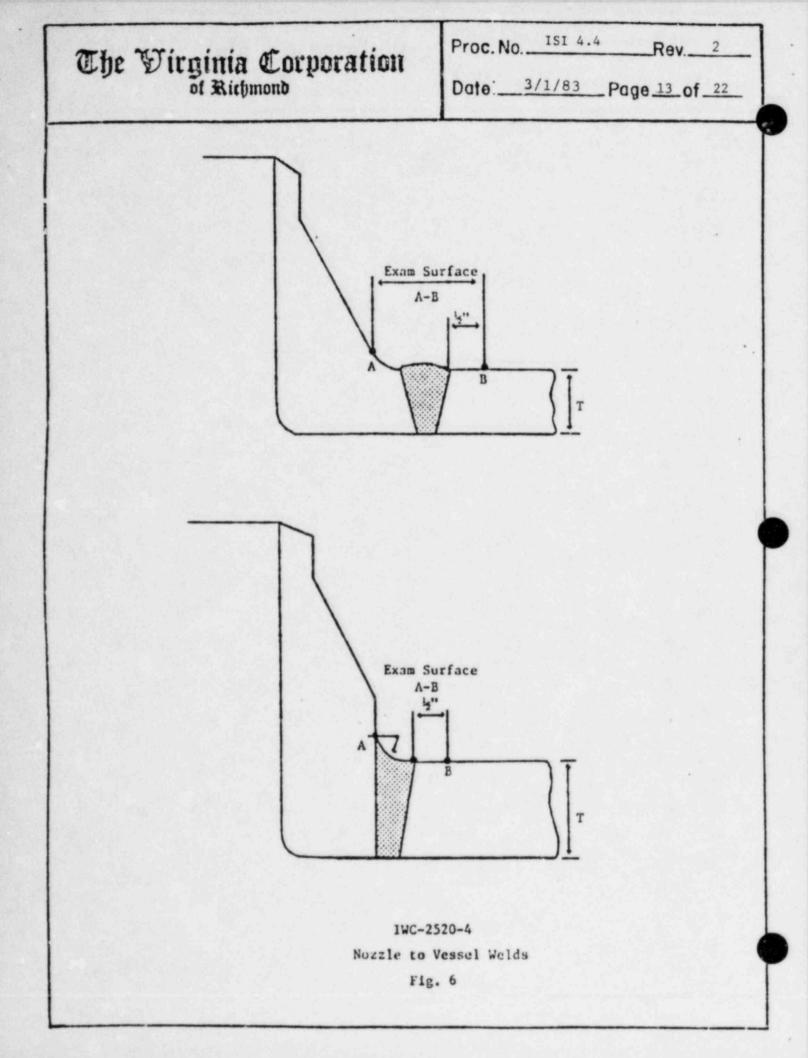


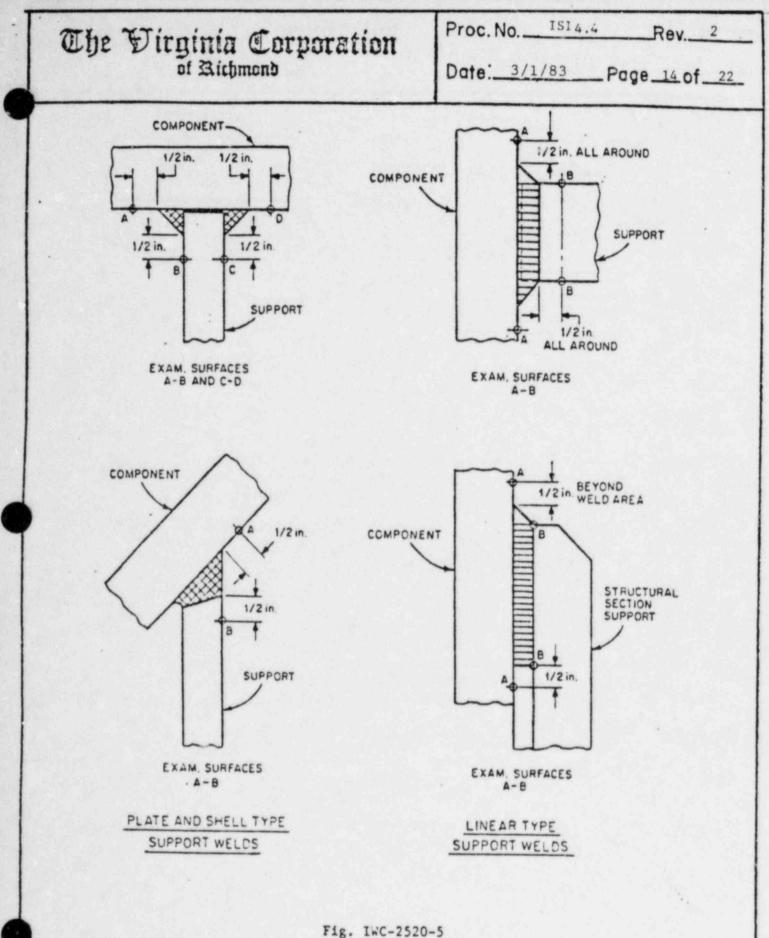








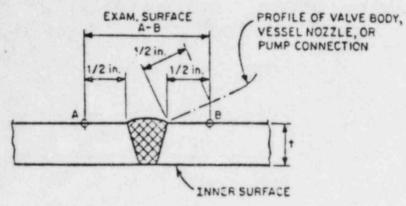




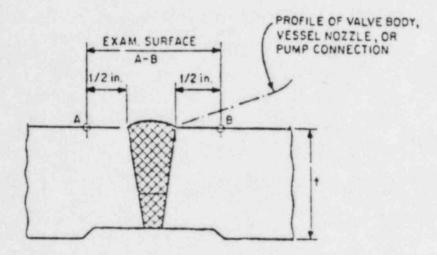
Integrally Welded Component Supports

Figure 7

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NOM. PIPE WALL THICKNESS, t = 1/2 in OR LESS

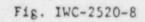


NOM. PIPE WALL THICKNESS + OVER 1/2 in.

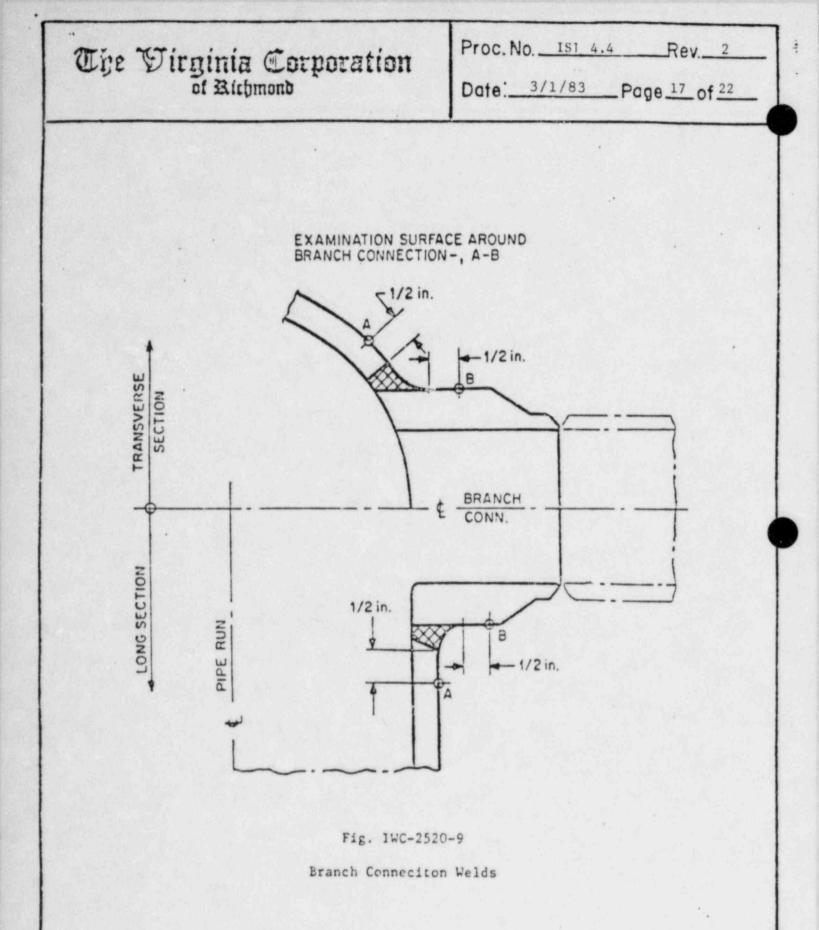
IWC-2520-7

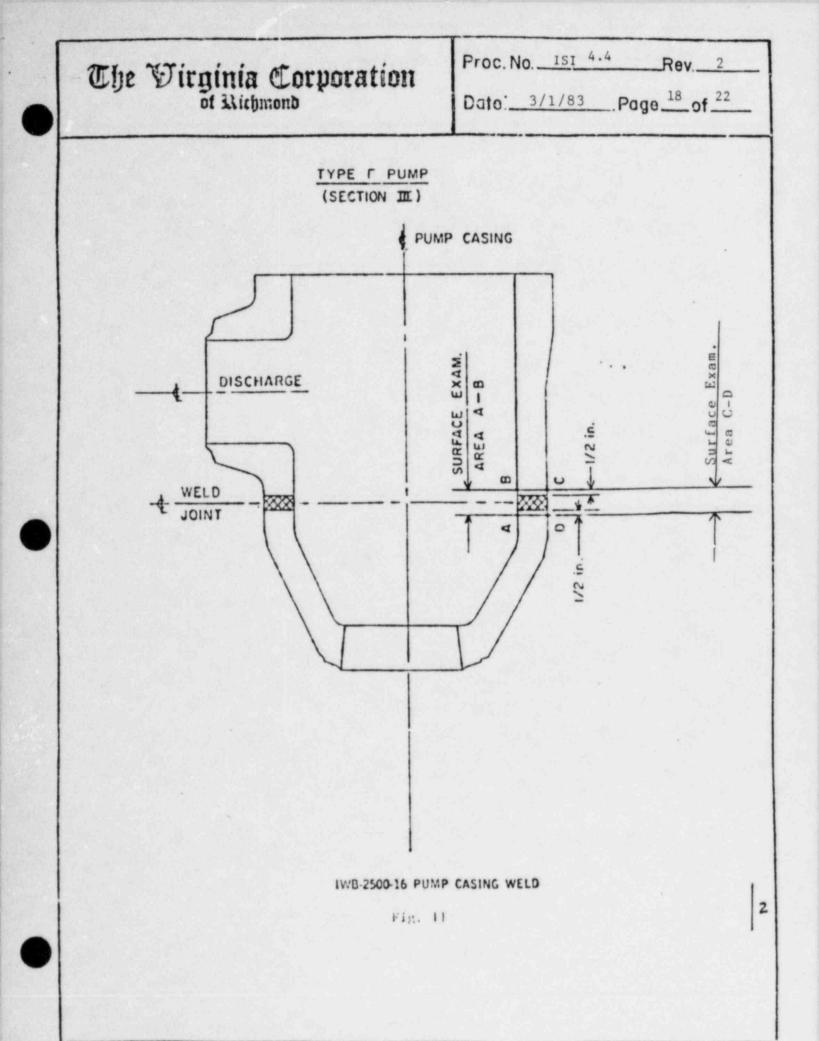
Welds in Piping

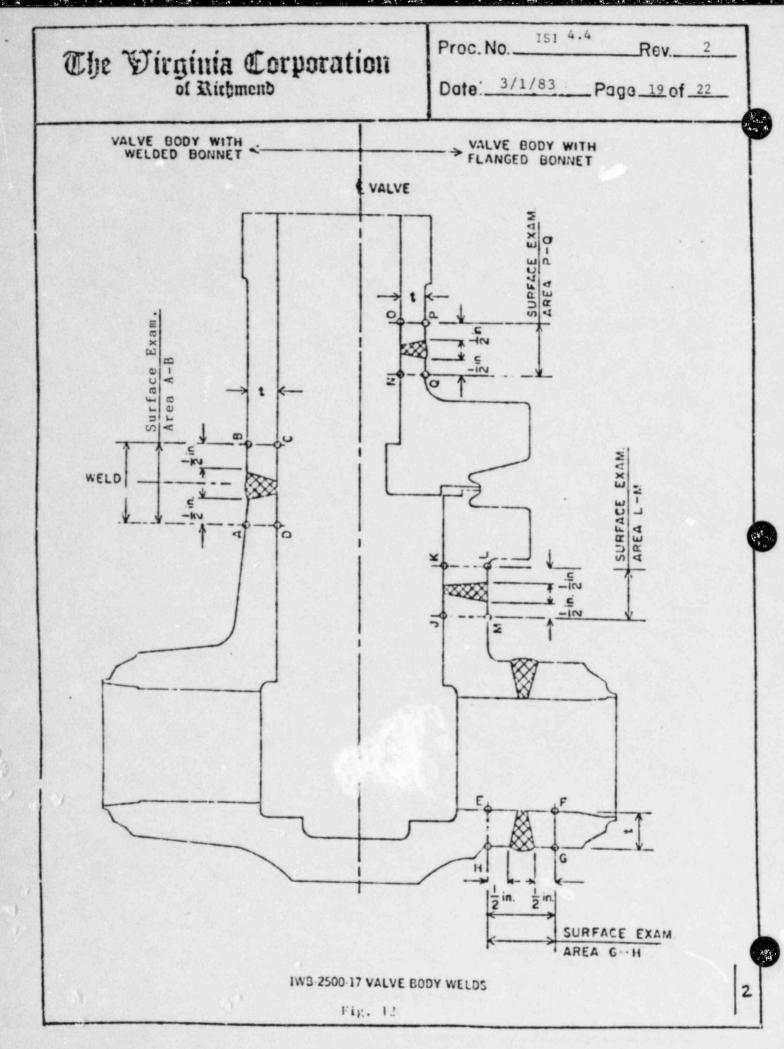
The Virginia Corporation of Richmond	Proc. No. <u>151 4.4</u> Rev. <u>2</u> Date: <u>3/1/83</u> Page <u>16</u> of <u>22</u>
EXAM. SURF.	
1/2 in.	, ,
	MEASURED
1/2 in.	ALONG SURFACE

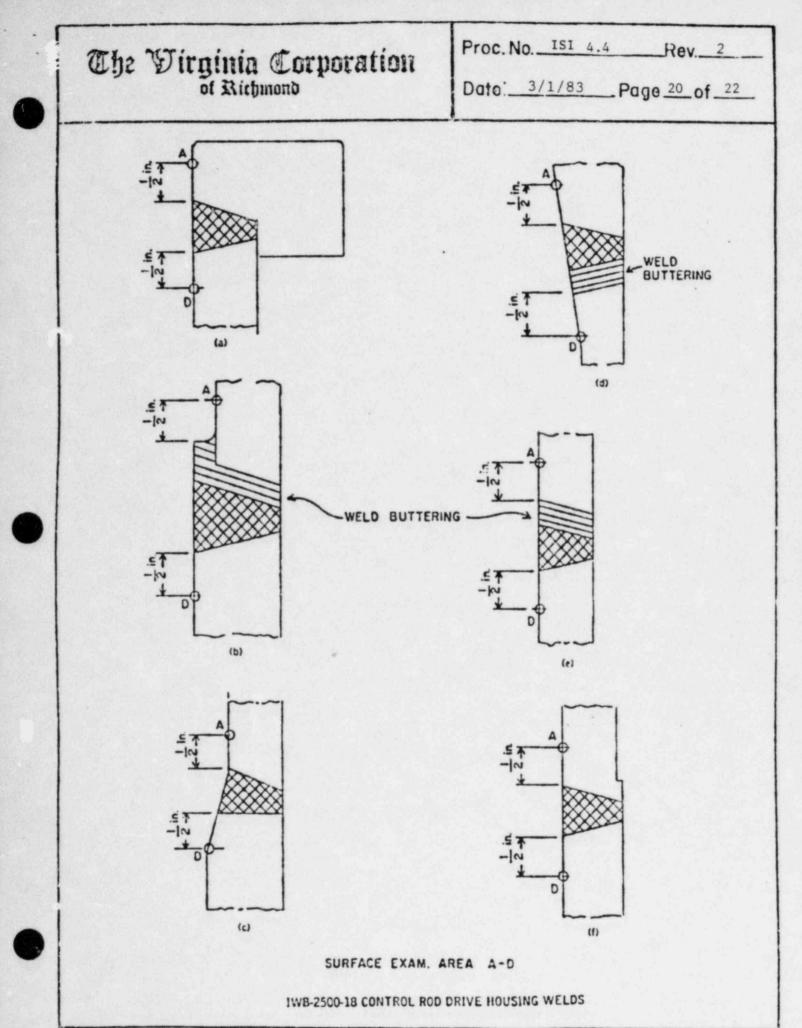


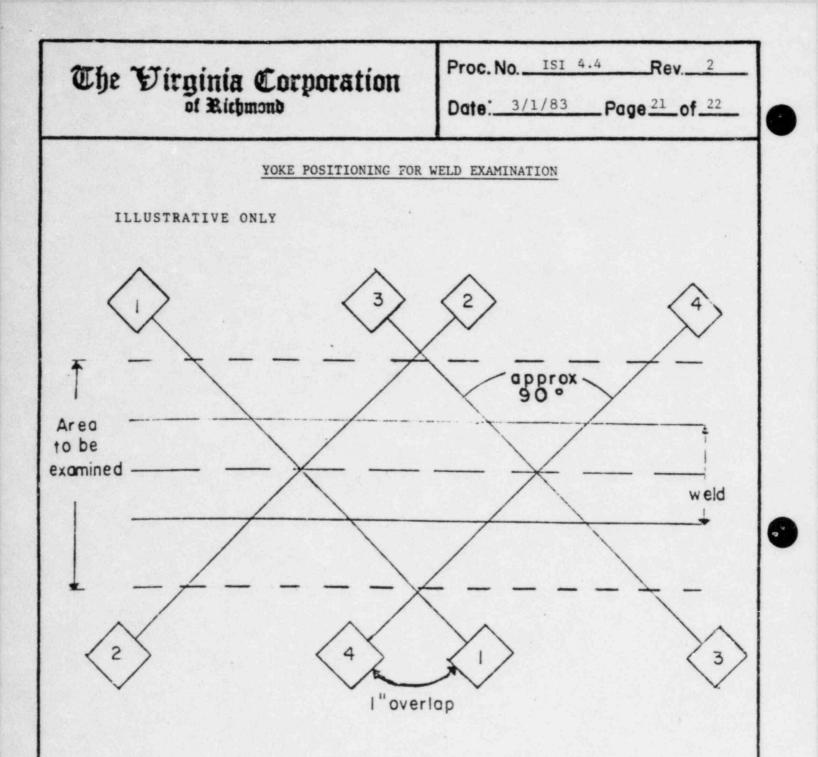
Welds in Pump Casing and Valve Bodies





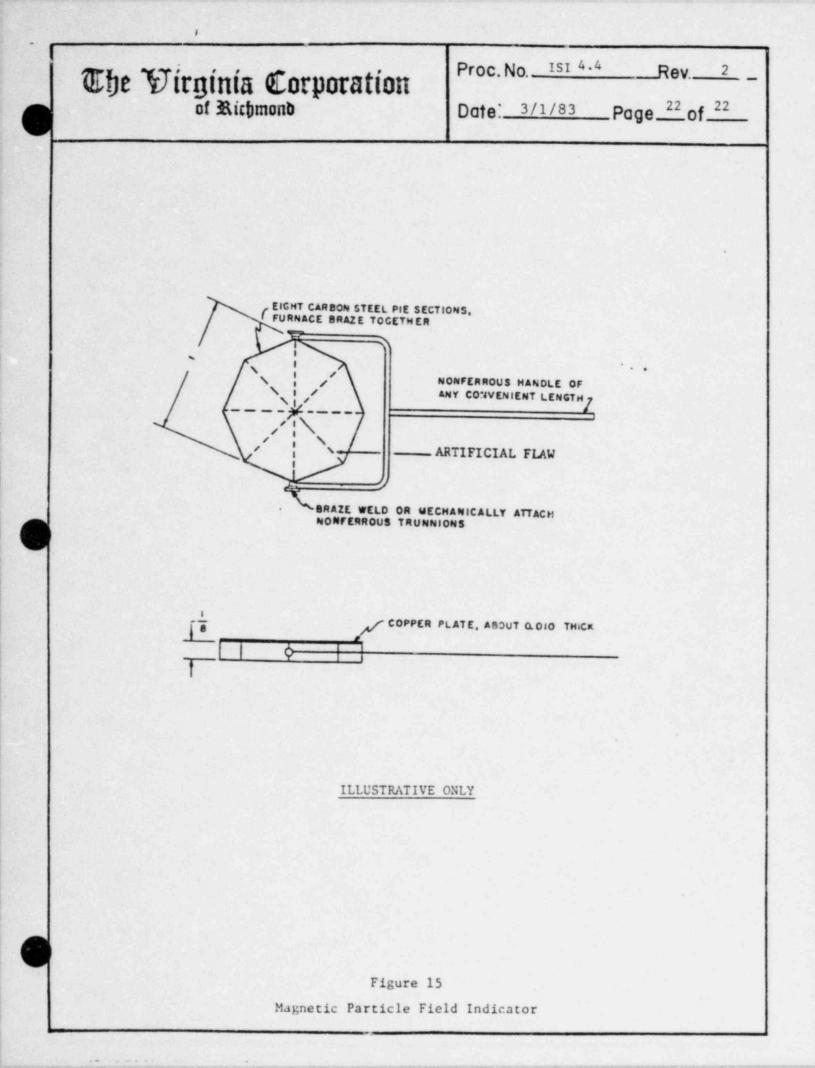






PROBE POSITIONS SHOWING 2 DIRECTIONS 90° TO EACH OTHER AND I" OVERLAPPING ON SURFACE TO BE EXAMINED

Figure 14



	The Virginia Corp. of Richmond	M	agnetic Partic	
ustomer	Plant	Uni	t	Loop /Zone
rocedure	Examiner/Level	VCR Supe	rvisor	Date
omponent/Piping	System	ISO Drawing No.	Surface C	condition
ype of Particle Wet Dry		Manufacturer 1	ype Batch	n Number
AC DC H	Machine Mfr.	Type/Model	Serial No.	
agnetization Continuous Residual	Coil Pro Amps No. Turns	Amps.	Spacing	
Weld / Item	Comments	s	MT Results NRI RI	VT Results Sat Unsat
	AAA	AFE		

.

Customer	Plant		Unit		Loop/Zone
Procedure	Examiner/Level			Date	
Component/Piping Syst	em		VCR Super	visor	
Weld No.		ISO/Draws	ing No.		
weld t t 0°		180° Remarks			360°

Virginia			(BD4) 266-8741 P. O. Box 9474 SBD9 Lakeside Ave. Richmond, Virginia 23228
Procedure Title:	VT-I VISUAL EXAN	INATION	EBASCO SERVICES
Procedure No.:	ISI 5.1		ASSLIBANCE ENGINEERING This Document is:
Plant Site:	Waterford #3		Reviewed With Comments as Noted: Incoreorate Comments and Resubmit; Proceed With Order. Revise and Resubmit NOTE:
Customer:	Louisiana Power Ebasco Services,		Review of this document, with or without comments, is for general conformance with the applicable specifications only and in ne way relieves the manufacturer or con- tractor from full responsibility for delivery of all materials, equip-
Approved for Use Virginia Corporation	: Thomas C	3 Muner	ment, services and documentation in strict accordance with the Per- chase Order By: Angle A. Brance Date: 6-27-82
	the for fire 6-	27-82 Jer	ry Chaps Level TI
Reviewed by: Homa	Date: 6/25/82 Date:	Reviewed by: Reviewed by:	Date:
Prepared by: <u>The</u> Reviewed by: <u>Herm</u> Reviewed by: <u>Market</u> Rev Prepared by: Reviewed by:	. O Munson LIT	Prepared by: Reviewed by: Reviewed by: Customer: Rev. Prepared by: Reviewed by: Reviewed by:	

The	Virg	inia Corporation Action	Proc. No. Date:	<u>ISI 5</u> 6/25/82		of.	4
.0	Scope						
	1.1	This procedure is applicable for, category VT-1, Visual E by the Direct and Remote Met in compliance with the ASME	xamination o	of Nuclear procedure	Plant	Compon	
2.0	Referen	: nces					
	2.1	1977 edition of ASME Boiler XI, with addenda through sur		e Vessel C	ode, S	ection	
	2.2	The Virginia Corporation Wr: and Certification of NDE Per 3/6/81					n
	2.3	The Virginia Corporation pro- Preservice Inspection Docume		-1.2, (lat	est re	vision)	,
3.0	Person	nel Qualifications					
	3.1	Personnel performing visual and certified to at least L 2.2. Level I and/or Level employed as assistants. Le I-Ltd) shall not independen of a visual examination.	evel II in a I trainees (vel I and/or	ccordance Level I-Lt Level I t	with r d) may rainee	referenc be as (Leve	e 21
	3.2	Certified Level II Liquid P. Particle examiners preformin considered to be sufficient. visual examinations of pipe ments of this procedure as a ments. If, however, the exami- examinations, he shall be co- in visual examination.	ng examination ly knowledges and component an adjunct to miner is to	ons of wel able to pe nt welds t their pr perform an	rform o the incipa d sign	visual require 1 assig -off VT	- n-

Surface condition - Visual examinations that require clean 4.1 surfaces, or decontamination for valid interpretation of results, shall be preceded by appropriate cleaning processes.

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4.2 Replication - Surface replication methods shall be considered acceptable provided the surface resolution is at least equivalent to that obtainable by the visual observation.

- 4.3 Area of Examination - The area of examination shall be 100 percent of the readily accessible, exposed portion of the item or part to be examined, unless modified by the Preservice Inspection Plan.
- Equipment Equipment to be used may include, but shall 4.4 not be limited to, mirrors, lighting, visual aids such as telescopes, periscopes, borescopes, fiber optics, T.V. cameras and recorders, and photographs. Permanent records may be made by photograph or video tape of the area being examined, or any anomalies noted.
- 4.5 Lighting - Lighting, natural or artificial, sufficient to illuminate the area to be examined, is required.
- Resolution Both direct and remote visual examination 4.6 resolution shall be considered adequate when the combination of access, lighting and angles of vision, either unaided or corrected, can resolve a black line, 1/32 of an inch wide or less, on an 18 percent neutral gray card placed on the surface to be examined, or in a situation similar to the area to be visually examined.

5.0 Examination

5.1 The VT-1 visual examination shall be conducted to determine the condition of the part, component, or surface examined, including such conditions as cracks, wear, corrosion, erosion, or physical damage on the surfaces of the part of components.

5.2 Examination method

> Direct - The direct visual examination method 5.2.1 shall be used when access to the area of interest, without personal injury or excessive radiation exposure, is sufficient to place the eye within

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

5.2.2

Remote - the remote visual examination method may be substituted for direct, visual examination if personal injury or excessive radiation exposure could result if direct visual examination was used. For this examination method, use may be made of equipment as detailed in paragraph 4.4. Any systems of equipment used shall demonstrate the ability to provide resolution at least equivalent to that obtainable by direct visual observation.

5.3 Examinations performed may be inclusive of, but not limited to, the following items.

> 5.3.1 Welds - The area examined shall be the weld and the adjacent base metal for at least one wall thickness beyond each edge of the weld. The general condition of these areas shall be noted, including such conditions as scratches, wear, cracks, weld arc strikes, or corrosion. The identity and location of specific welds to be examined shall be identified in the Preservice Inspection Plan.

5.3.2 Bolts, studs, nuts, washers, threads in base material and ligaments - May be examined either in place or when disassembled. The identity and location of specific bolted connections to be examined shall be identified in the Preservice Inspection Program Plan.

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5.3.2.1	In-place examination - Studs, nuts, and bolts shall be examined to ensure they remain tightened in place. The exposed surfaces of stud threads, nuts, and bolt heads shall be examined to ensure they are free of cuts, dents, or cracks.
5.3.2.2	Disassembled examination - Threads shall be examined to ensure that they are free of burrs, deformations, wear, galling, or cracks. Bolt shanks, head root radii, and shanks shall be examined for evidence of wear, galling, cracking, or flaking.

5.3.3 Valve internals shall be examined for any burr-, scratches, errosion or worn areas. Any of these conditions shall be reported on forms VT-401, VT 402 or VT-403 in accordance with paragraph 6.0.

6.0 Reporting

- 6.1 All data relative to the examinations, and reportable indications, shall be reported in accordance with Virginia Corporation procedure ISI-1.2, "Preservice Inspection Documentation", and on forms similar to those in Figures 1, 2 and 3.
 6.2 Supplemental sketches or photographs used to report conditions
 - or discontinuities shall be permanently identified to the system and component.

Procedure Examiner/Level Date Component/Piping System ISO Drawing No. VCR Supervisor	Virginia Co of Richmond	Figure 1		xaminati for agory	on Report
Component/Piping System ISO Drawing No. VCR Supervisor	Customer	Plant	Uni	t	Loop/Zone
eld/ Exam Results Item NRI RI Comments Visual Aids	Procedure	Examiner/Level			Date
Item NRI RI Comments Visual Aids	Component/Piping System	ISO Drawing No.	VCI	R Supervis	or
			-		Visual Aids

Form WT- Ant

Customer	Plant		Unit		Loop/Zone
Procedure	Examiner	/Level		Date	
Component/Piping Sy	stem		VCR Super	visor	
Weld No.		ISO Dra	wing No.		
weld t	+				
0°	90°	180° Remarks	27	0°	360°
	SIN	Molt.	E.		

Form VT-402

2/82

	rginia Corp.		Examination tion Record
Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Leve	1	Date
Component/ Piping	System	VCR Supe	rvisor
Item No.		ISO/Drawing No.	
		NES	