The Virginia Corporation
of Richmond

MASTER LIST OF PROCEDURES

Procedure No.	Procedure Title	Revision/ Field Change No.	Date
VC-ADMIN-100	Management Interface for Waterford #3 PSI	Rev. 0	12/27/82
VC-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
VC-ADMIN-102	Notification of Reportable Indications for Waterford #3	Rev. 0	1/20/82
		F.C. 1	9/13/82
		Rev. 1	3/01/83
VC-QA-101	Site Quality Assurance for Waterford #3 Preservice Inspection	Rev. 0	1/20/82
		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
		Rev. 1	3/01/83
VC-QA-103	Generation and Control of Procedures for Waterford #3 PSI	Rev. 0	1/20/82
		F.C. 1	1/28/82
		F.C. 2	7/09/82
		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
ISI-1.2	Preservice Inspection Documentation	Rev. 0	1/27/82
		F.C. 1	1/28/82
		F.C. 2	8/10/82
		F.C. 3	9/15/82
		Rev. 1	3/01/83
ISI-2.1	Ultrasonic Equipment Calibration Confirmation	Rev. 0	2/10/82
		F.C. 1	12/15/82
		Rev. 1	3/01/83

Procedure No.	Procedure Title	Revision/ Field Change No.	Date
ISI-2.2	Manual Ultrasonic Examination of Full Penetration Circumferential and Longitudinal Ferritic Butt Welds	Rev. 0	2/10/82
		F.C. 1	4/01/82
		F.C. 2	7/06/82
		Rev. 1	3/01/83
ISI-2.3	Manual Ultrasonic Examination of Circumferential and Longitudinal Butt Welds in Clad Ferritic Vessels and Class 1 Loop Piping	Rev. 0	2/10/82
		F.C. 1	4/01/82
		F.C. 2	5/11/82
		Rev. 1	3/01/83
ISI-2.4	Ultrasonic Examination of Studs and Bolts	Rev. 0	2/10/82
		F.C. 1	8/05/82
		F.C. 2	12/16/82
		Rev. 1	3/01/83
ISI-2.5	Ultrasonic Thickness Measurement	Rev. 0	2/10/82
		F.C. 1	10/14/82
		Rev. 1	3/01/83
ISI-2.6	Manual Ultrasonic Examination of Steam Generator Stay Cylinder Welds	Rev. 0	5/26/82
		Rev. 1	7/15/82
		Rev. 2	8/23/82
		F.C. 1	10/18/82
		Rev. 3	3/01/83
ISI-2.7	Manual Ultrasonic Examination of Full Penetration Circumferential and Longitudinal Austenitic Butt Welds	Rev. 0	2/10/82
		F.C. 1	3/08/82
		F.C. 2	4/01/82
		F.C. 3	6/16/82
		F.C. 4	10/14/82
		Rev. 1	3/01/83
ISI-2.8	Manual Ultrasonic Examination of Circumferential Butt Welds Between Clad Ferritic Piping and Austenitic Safe Ends	Rev. 0	2/15/82
		Rev. 1	4/29/82
		F.C. 1	6/18/82
		F.C. 2	7/14/82
		Rev. 2	3/01/83

MASTER LIST OF PROCEDURES

Procedure No.	Procedure Title	Revision/ Field Change No.	Date
ISI-3.1	Liquid Penetrant Examination Using the Color-Contrast Solvent Removable Technique	Rev. 0	1/08/82
		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
ISI-4.1	Magnetic Particle Examination of Bolting Utilizing the Dry Continuous Method	Rev. 0	2/10/82
ISI-4.2	Magnetic Particle Examination of Bolting by Continuous Method Utilizing Wet, Fluorescent Medium	Rev. 0	2/10/82
ISI-4.3	Magnetic Particle Examination of Welds Utilizing the Dry, Continuous Method	Rev. 0	2/10/82
		F.C. 1	7/16/82
		Rev. 1	3/01/83
ISI 4.4	Magnetic Particle Examination of Welds by Continuous Method Utilizing Wet, Fluorescent Medium	Rev. 0	2/11/82
		Rev. 1	4/29/82
		F.C. 1	7/16/82
		Rev. 2	3/01/83
ISI-5.1	VT-1 Visual Examination	Rev. 0	6/25/82

The Virginia Corp.
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Richmond, Virginia 23228

Procedure Title: Management Interface for Waterford #3 PSI

Procedure No.: VC-ADMIN-100

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: 1-28-82

Approved for Use Customer: 1/29/82

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☐ Reviewed With Comments as Noted; Incorporate Comments, and Resubmit; Proceed With Order.
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By: BE Baird
Date:

Rev. 0 Date: 12/27/82	Rev. ____ Date: ____
Prepared by:	Prepared by:
Reviewed by: For T.B.	Reviewed by:
Reviewed by:	Reviewed by:
	Customer:
Rev. ____ Date: ____	Rev. ____ Date: ____
Prepared by:	Prepared by:
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Reviewed by:	Reviewed by:
Customer:	Customer:
Rev. ____ Date: ____	Rev. ____ Date: ____
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Customer:	Customer:

The Virginia Corporation
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Proc. No. VC-ADMIN-100 Rev. 0
Date: 1/27/82 Page 1 of 4

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
3.3 10CFR-50
3.4 VCR Quality Assurance Manual
3.5 VCR Quality Assurance Procedures and NDE Procedures for Waterford Preservice Inspection
3.6 VCR Program Plan and Schedule

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).

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.

5.4 Management will limit communication, to the extent practicable, to the following:

(1) Ebasco Technical Section (corporate)
(2) Ebasco Site Coordinator (through site manager)
(3) Ebasco Contracts Section (corporate and site)

All telephone conversations will be confirmed in writing if requested.

5.5 It will be the responsibility of management to resolve all technical questions from the site with Mr. B. Baril and advise the site supervisor accordingly.

5.6 Management is responsible for assisting Ebasco, upon request, concerning the resolution of any problem that may arise during the preservice inspection and with Louisiana Power and Light or the regulatory authorities.

5.7 It will be the responsibility of management to direct all correspondence and invoice submittal to the designates set forth in the contract.

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BY: John Corriveau

DATE: 4/18/83

Procedure Title: Field Documentation Control

Procedure No.: VC-ADMIN-101

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services Corporation - Agent

Approved for Use Virginia Corporation: Marvin M. Levinger

Approved for Use Customer:

Rev. 0 **Date:** 1/20/82	**Rev.** **Date:**
Prepared by: Marvin M. Levinger	**Prepared by:**
Reviewed by: Marvin M. Levinger	**Reviewed by:**
Reviewed by: Thomas B Munson	**Reviewed by:**
	Customer:
Rev. 1 **Date:** 3/1/83	**Rev.** **Date:**
Prepared by: Daniel L Jensen	**Prepared by:**
Reviewed by: Thomas B Munson LWIII	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer: JC 4/18/83	**Customer:**
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer:	**Customer:**

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.

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. 1

5.0 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.

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.

7.1B 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 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.

12.0 Control of Documentation of Non-Conformance

12.1 All non-conformance reports will be contained in a single file, arranged in chronological order, and filed by report number.

13.0 Control of Documentation of Site Audits

13.1 Records of site audits and corrective action will be filed under separate cover in chronological order.

14.0 Control of Job Correspondence

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.

The
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BY:
DATE: 4-18-83

Procedure Title: Notification of Reportable Indications for Waterford No. 3

Procedure No.: VC-ADMIN-102

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services Corporation - Agent

Approved for Use Virginia Corporation:

Approved for Use Customer:

Rev. 0 **Date:** 1/20/82	**Rev.** 1 **Date:** 3/1/83
Prepared by:	**Prepared by:** Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III	**Reviewed by:** Thomas B Munson Lvl III
Reviewed by: Thomas B Munson	**Reviewed by:**
	Customer: 4/18/83
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer:	**Customer:**
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer:	**Customer:**

The Virginia Corporation
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Proc. No. VC-ADMIN-102 Rev. 1

Date: 3/1/83 Page 1 of 2

1.0 Purpose

1.1 To establish a written procedure for the reporting and disposition of reportable indications, preservice inspection, Waterford #3.

2.0 References

2.1 VCR ISI Procedures - Waterford

2.2 VCR QA Procedures - Waterford

2.3 VCR Administration Procedures - Waterford

2.4 ASME Section XI, Boiler and Pressure Vessel Code, Summer, 1978

2.5 VCR Program Plan - Waterford

2.6 Ebasco Administrative Procedure ASP-IV-81

3.0 Responsibility

The responsibility for reporting, documenting, and disposition at owner's discretion, of reportable indications will rest solely with the VCR site supervisor.

4.0 Reporting

4.1 When reportable indications are encountered during the preservice inspection, the VCR site supervisor will review the examination report data sheet and the examination report indication sheet before any action is taken.

4.2 After the information on the above documents has been verified, the original data sheet and indication sheet will be filed under the proper zone in the VCR master data file. A copy of the indication sheet will be forwarded to the Ebasco PSI construction coordinator and the Louisiana Power and Light PSI coordinator within twenty-four hours. A copy of the indication sheet will be placed in the VCR "Reportable Indications Acitve" file. 1

5.0 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. 1 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. 1 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 Assurance for Waterford No. 3 Preservice Inspection

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BY:
DATE:

Procedure No.: VC-QA-101

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services Corporation - Agent

Approved for Use Virginia Corporation:

Approved for Use Customer:

Rev. 0 **Date:** 1/20/82	**Rev.** 1 **Date:** 3/1/83
Prepared by:	**Prepared by:** Daniel L Jensen
Reviewed by:	**Reviewed by:** Thomas B Munson
Reviewed by: Thomas B Munson	**Reviewed by:**
	Customer: 4/13/83
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
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Customer:	**Customer:**
Rev. **Date:**	**Rev.** **Date:**
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Customer:	**Customer:**

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

5.1 It shall be the responsibility of the VCR site job supervisor 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.

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 areas 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.

8.0 Reports

8.1 Results of the site visits shall be reported on forms similar to Figure 1. The report shall identify the areas or items audited, the identification of the audit 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 within a thirty calendar days of his notification. Final recommendations 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.

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 (show NCR No.): ______________

Team Members: ______________ ______________

Signed: ______________ Date: ______________

Copies: ______________ ______________

Figure 1

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: Procedural Nonconformance

Procedure No.: VC-QA-102

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services Corporation - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING

This Document is:
☒ Reviewed Without Comments
☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.
☐ Rejected: Revise and Resubmit.

NOTE:
Review of this document, with or without comments is for general conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all material, equipment, services and documentation in strict accordance with the Purchase Order.

BY:
DATE: [illegible]

Rev. 0 Date: 1/20/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by:

Rev. 1 Date: 3/1/83
Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: 4/18/83

Rev. Date:
Prepared by:
Reviewed by:
Reviewed by:
Customer:

Rev. Date:
Prepared by:
Reviewed by:
Reviewed by:
Customer:

Rev. Date:
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Customer:

Rev. Date:
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Reviewed by:
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Customer:

The Virginia Corporation
of Richmond

Proc. No. VC-QA-102 Rev. 1

Date: 3/1/83 Page 1 of 4

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.

4.2.2 An immediate report of the apparent major nonconformance (Figure 1) shall be made to the customer, and the VCR Quality Assurance Manager, or his designee, by the VCR supervisor.

4.2.3 Each major nonconformance report (Figure 1) shall be given a sequential number, and logged in the nonconformance report file. This number shall be recorded under item one (1) of the report .

4.2.4 For major nonconformances, the VCR supervisor, or his designee, shall complete items two (2) through nine (9) of the report, fully describing the nonconforming condition.

4.3 Minor nonconformance

4.3.1 A minor nonconformance is defined as any nonconformance that does not meet the criteria of paragraph 4.2.1.

4.3.2 An immediate report of the apparent minor nonconformance (Figure 2) shall be made to the VCR Quality Assurance Manager by the VCR supervisor.

4.3.3 Each minor nonconformance report (Figure 2) shall be given a sequential number, and logged in the nonconformance report file.

5.0 Disposition - major nonconformance

5.1 When a major nonconformance report is completed, it will be forwarded promptly to the EBASCO Q.A. site supervisor for further processing. A copy will also be forwarded to the VCR Q.A. Manager.

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. 1

6.0 Disposition - minor nonconformance

6.1 Determination shall be made of the legitimacy and extent of the nonconformance.

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

EBASCO SERVICES INCORPORATED

QUALITY ASSURANCE

NONCONFORMANCE REPORT

Distribution:
White - PQAE or Site QA Supervisor
Yellow - Organization recommending disposition
Pink - Initiator of NCR

PORT NO.(1) ____________

INSTRUCTIONS: *(See back of form)*

CLIENT OR PROJECT (2)		DRAWING NO./SPEC NO. (3)
SUPPLIER, CONSTRUCTION QC OR CONTRACTOR (4)	P.O. NO. (5)	
DESCRIPTION OF COMPONENT, PART OR SYSTEM (6)		

I. DESCRIPTION OF NONCONFORMANCE (7) *(Items Involved, Specification, Code or Standard to Which Items Do Not Comply, Submit Sketch if Applicable)*

NAME AND SIGNATURE OF PERSON REPORTING NONCONFORMANCE (8)	TITLE/COMPANY	DATE (9)

II. RECOMMENDED DISPOSITION (10) *(Submit Sketch if Applicable)*

NAME AND SIGNATURE OF PERSON RECOMMENDING DISPOSITION (11)	TITLE/COMPANY	DATE (12)

III. EVALUATION OF DISPOSITION BY EBASCO, REASON FOR DISPOSITION (13)

IV. CORRECTIVE ACTION (14) ☐ Required ☐ Not Required

V.(15) ☐ ENGINEERING	☐ QUALITY ASSURANCE	☐ CONSTRUCTION	☐ OTHER ________
NAME (SIGNATURE)	NAME (SIGNATURE)	NAME (SIGNATURE)	NAME (SIGNATURE)
DATE	DATE	DATE	DATE
☐ ACCEPTED ☐ REJECTED ☐ ACCEPTED WITH COMMENTS	☐ ACCEPTED ☐ REJECTED ☐ ACCEPTED WITH COMMENTS	☐ ACCEPTED ☐ REJECTED ☐ ACCEPTED WITH COMMENTS	☐ ACCEPTED ☐ REJECTED ☐ ACCEPTED WITH COMMENTS

VI. VERIFICATION OF DISPOSITION ☐ REQUIRED ☐ NOT REQUIRED (16)

(17) BY ____________ SIGNATURE ____________ TITLE ____________ DATE ____________
EBASCO VENDOR QA OR QA ENGINEERING

FIGURE 1

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.

Item (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.

The
Virginia Corp.
of Richmond

MINOR NONCONFORMANCE REPORT #_____

Page______ of______

Minor Nonconformance Reported by:____

Date:_______________

Description of Minor Nonconformance:

Disposition/Corrective Action:

Verification of Disposition/Corrective Action:

VCR Field Supervisor______________________________Date:_______________

VCR Quality Assurance Manager:______________________Date:_______________

SAMPLE

Action to Prevent Recurrance:

Required________ Not Required________

QC:____

Figure 2

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: Generation and Control of Procedures for Waterford No. 3 Preservice Inspection

Procedure No.: VC-QA-103

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services Corporation - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING
This Document is:
☑ Reviewed Without Comments
☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit; Proceed with order.
☐ Rejected: Revise and Resubmit.
NOTE:
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BY: John L Cannizzo
DATE: 4-13-83

Rev. 0 **Date:** 1/20/82	**Rev.** **Date:**
Prepared by: Thomas B Munson	**Prepared by:**
Reviewed by: Thomas B Munson Lvl III	**Reviewed by:**
Reviewed by:	**Reviewed by:**
	Customer:
Rev. 1 **Date:** 3/1/83	**Rev.** **Date:**
Prepared by: Daniel L Jensen	**Prepared by:**
Reviewed by: Thomas B Munson Lvl III	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer: 4/18/83	**Customer:**
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer:	**Customer:**

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.

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 Final procedure

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

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 0", 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.

5.5 Three copies of the procedure, (one controlled and two 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.

5.6 Ebasco will retain one controlled copy and one uncontrolled 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.

5.8 Prior to examination, each Level II technician at the 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.

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 per paragraph 5.8. 1

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. 1

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.

Figure 1

The
Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title:

Procedure No.:

Plant Site:

Customer:

Approved for Use
Virginia Corporation:

Approved for Use
Customer:

Rev. ______ Date: __________
Prepared by: ____________________
Reviewed by: ____________________
Reviewed by: ____________________

Rev. ______ Date: __________
Prepared by: ____________________
Reviewed by: ____________________
Reviewed by: ____________________
Customer: ____________________

Rev. ______ Date: __________
Prepared by: ____________________
Reviewed by: ____________________
Reviewed by: ____________________
Customer: ____________________

Rev. ______ Date: __________
Prepared by: ____________________
Reviewed by: ____________________
Reviewed by: ____________________
Customer: ____________________

Rev. ______ Date: __________
Prepared by: ____________________
Reviewed by: ____________________
Reviewed by: ____________________
Customer: ____________________

Rev. ______ Date: __________
Prepared by: ____________________
Reviewed by: ____________________
Reviewed by: ____________________
Customer: ____________________

The Virginia Corp. of Richmond

FIELD CHANGE

Page_____ of_____

Procedure No:________________ Revision No:________________ Date:__________

Procedure Title:____

Field Change No:__________________ Date:_____________

<u>Change Action</u>:

Originated by:______________________________ Date:____________

Approved by:______________________________ Date:____________
Virginia Corp. of Richmond - Level III

Approved by:______________________________ Date:____________
Virginia Corp. of Richmond - QA

LP&L Approval:______________________________ Date:____________

Ebasco Review:______________________________ Date:____________

Figure 2

The Virginia Corp. of Richmond

FIELD CHANGE (Continuation Sheet)

Page______ of______

Procedure No: **Revision No:**____________________ **Date:**____________

Procedure Title:____

Field Change No:______________________ **Date:**____________

Continuation:

Originated by:____ Date:________________

Approved by:____ Date:________________
Virginia Corp. of Richmond - Level III

Approved by:____ Date:________________
Virginia Corp. of Richmond - QA

LP&L Approval:____ Date:________________

Ebasco Review:____ Date:________________

Figure 3

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: System Verification and Marking for Waterford #3 Preservice Inspection

Procedure No.: ISI 1.1

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services Corporation - Agent

Approved for Use Virginia Corporation: Marvin M. Renninger

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING

This Document is:

☑ Reviewed Without Comments
☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.
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BY:
DATE: 4-18-83

Rev. 0 Date: 1/20/82	Rev. 1 Date: 3/1/83
Prepared by: Daniel L Jensen	Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson LvlIII	Reviewed by: Thomas B Munson LvlIII
Reviewed by: Marvin M. Renninger	Reviewed by:
	Customer: 4/18/83
Rev. Date:	Rev. Date:
Prepared by:	Prepared by:
Reviewed by:	Reviewed by:
Reviewed by:	Reviewed by:
Customer:	Customer:
Rev. Date:	Rev. Date:
Prepared by:	Prepared by:
Reviewed by:	Reviewed by:
Reviewed by:	Reviewed by:
Customer:	Customer:

The Virginia Corporation
of Richmond

Proc. No. ISI 1.1 Rev. 1

Date: 3/1/83 Page 1 of 16

1.0 Scope

1.1 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.

3.3 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) 1

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.

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

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.

7.0 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.

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). 1

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 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 seam 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.

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.)

8.2.4.2 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.)

8.2.4.3 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.

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. 1

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.

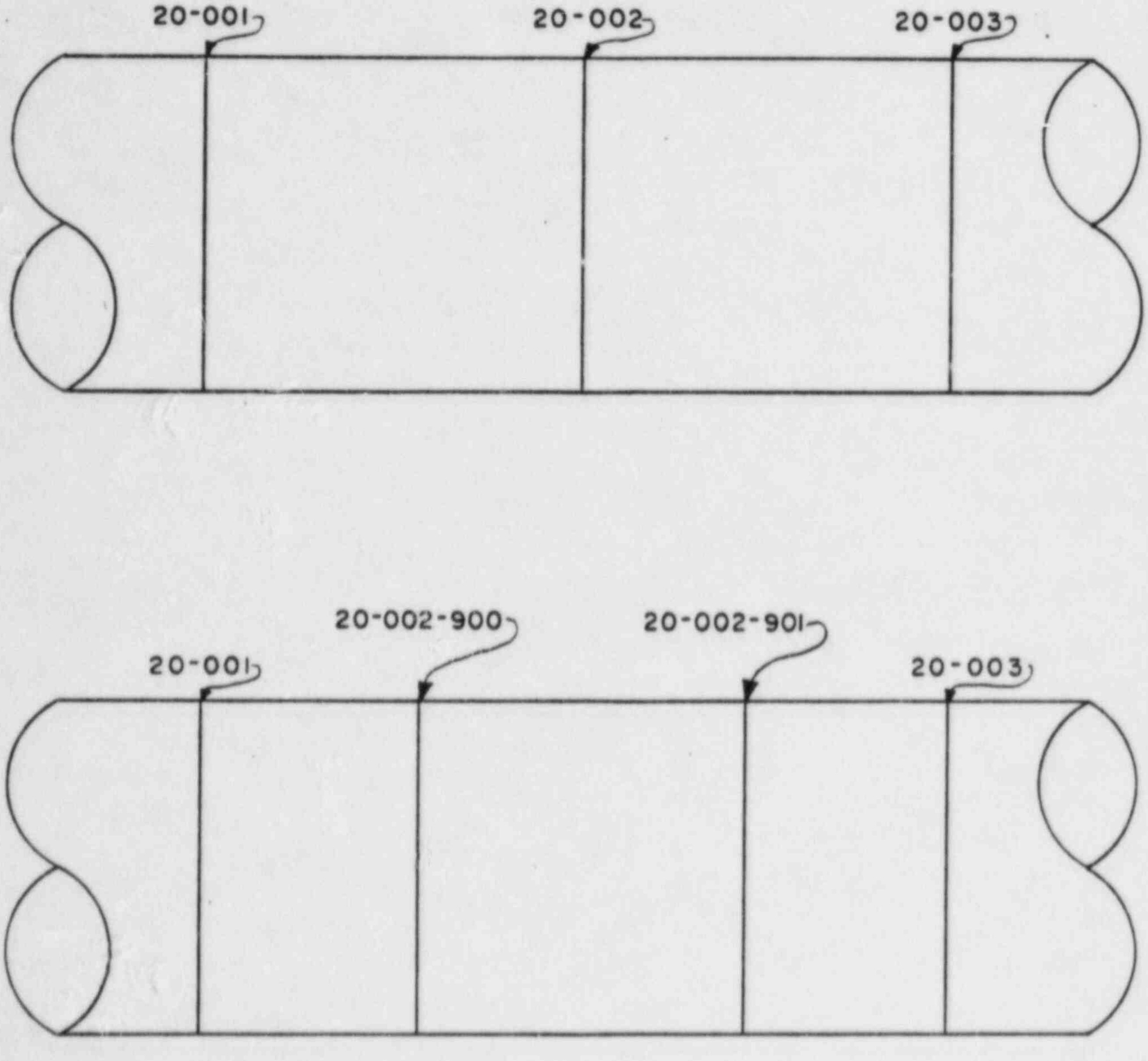
9.2.5 At no time shall the weld identification number be marked on the weld material or on the weld fusion zone.

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.

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 re-examination.

FIG. 1

Numbering Sequence for Replacement Welds

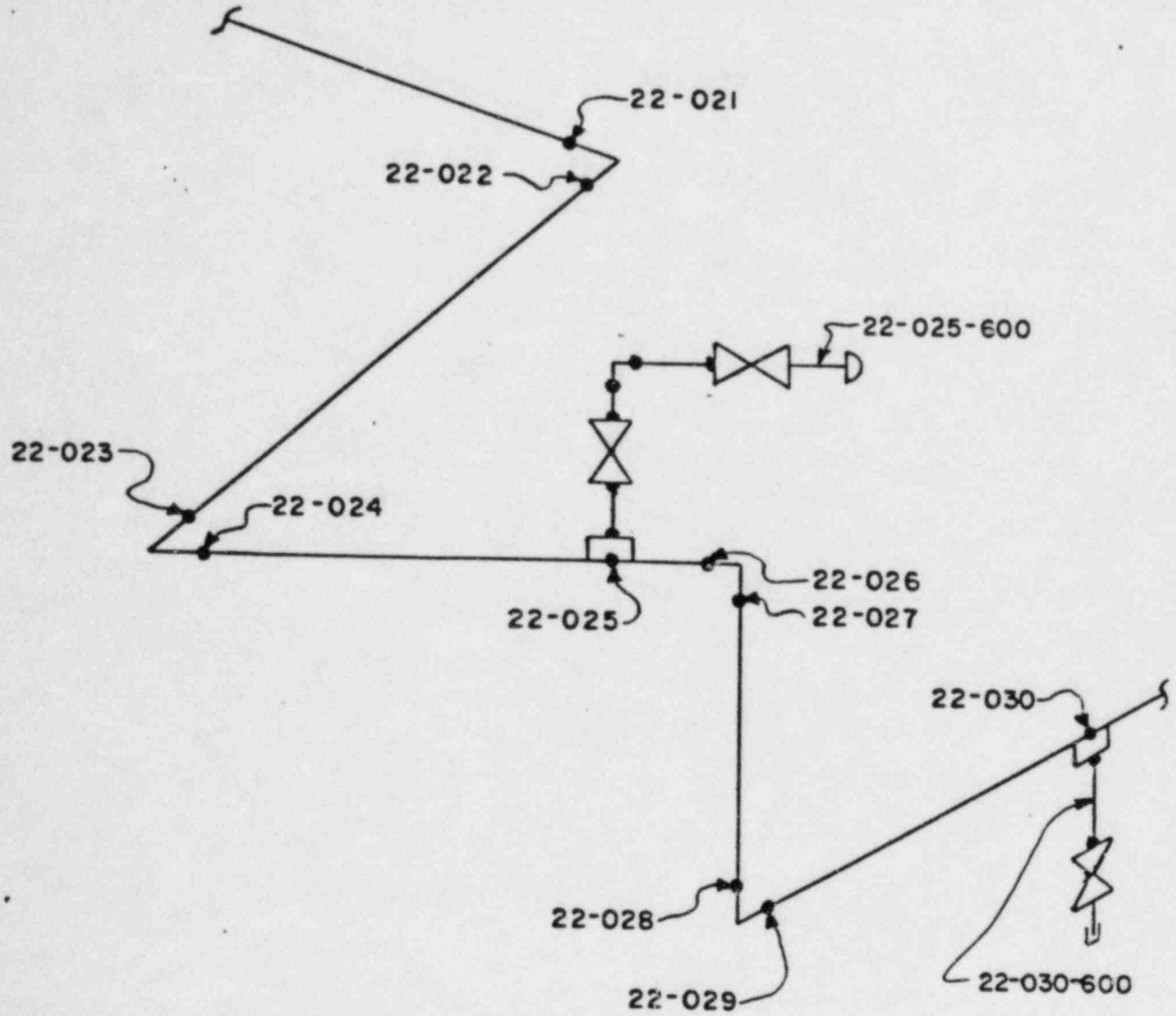


(Illustrative Only)

1

FIG. 2

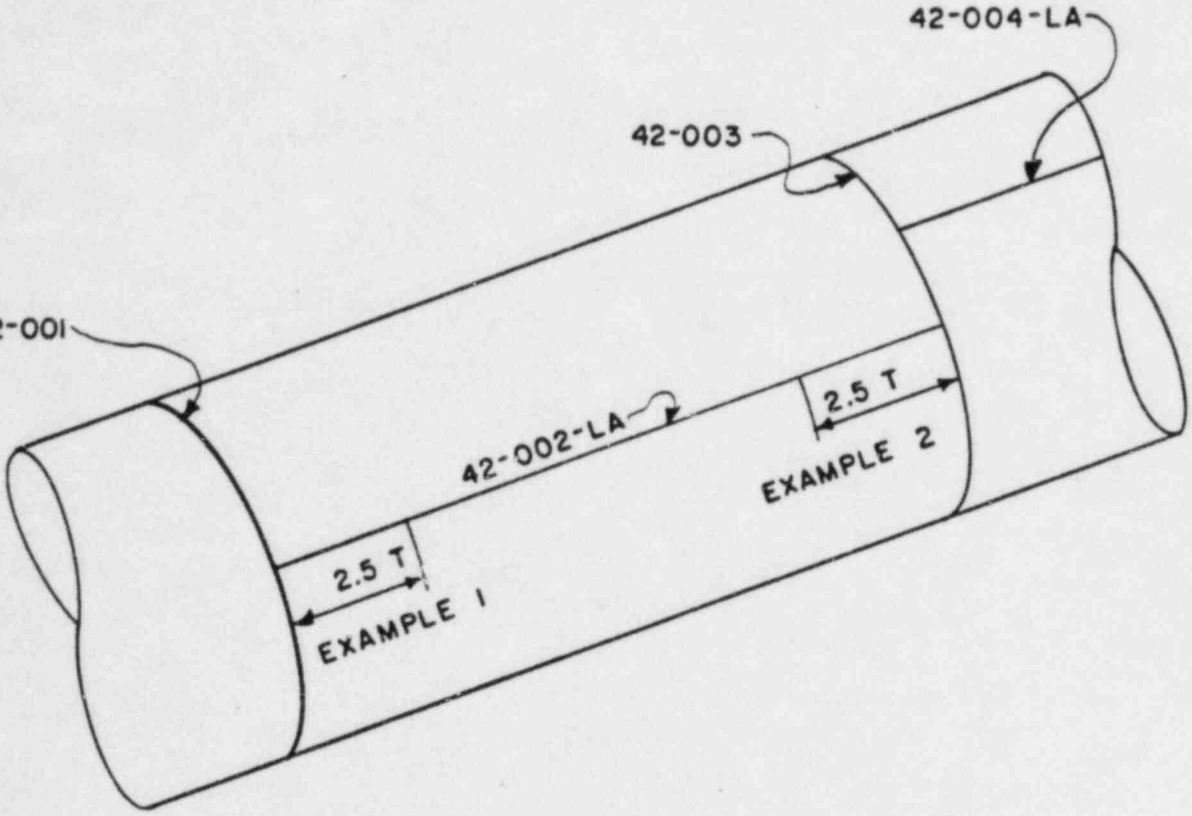
Numbering Sequence for Welds Designated for Hydrostatic Testing Only



(Illustrative Only)

FIG. 3

Designation of Longitudinal Seam Weld Areas for Class 2 Piping Examination



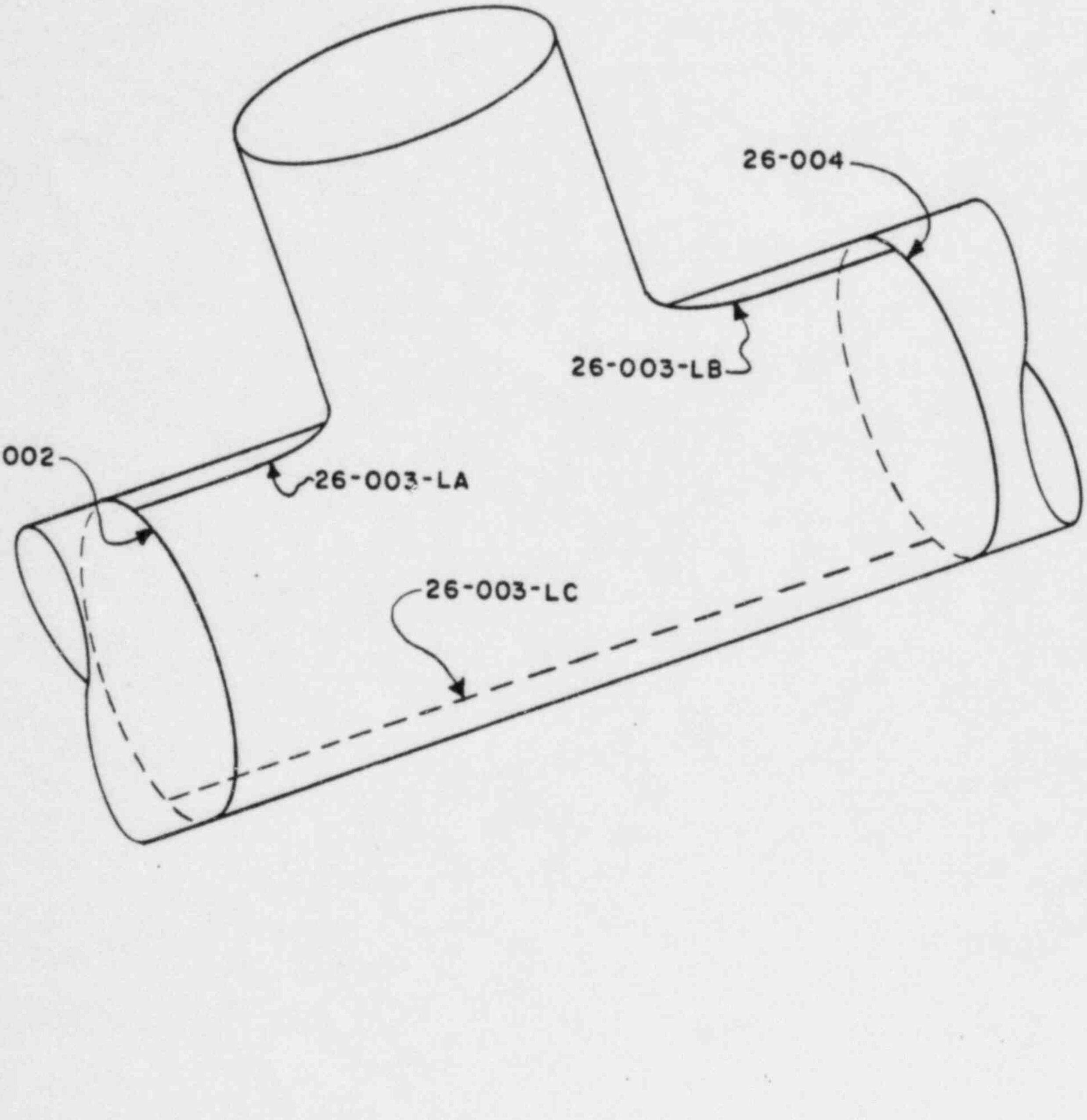
Example 1: This area of the longitudinal weld shall be designated the number 42-002-LA-1.

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

(Illustrative Only)

FIG. 4

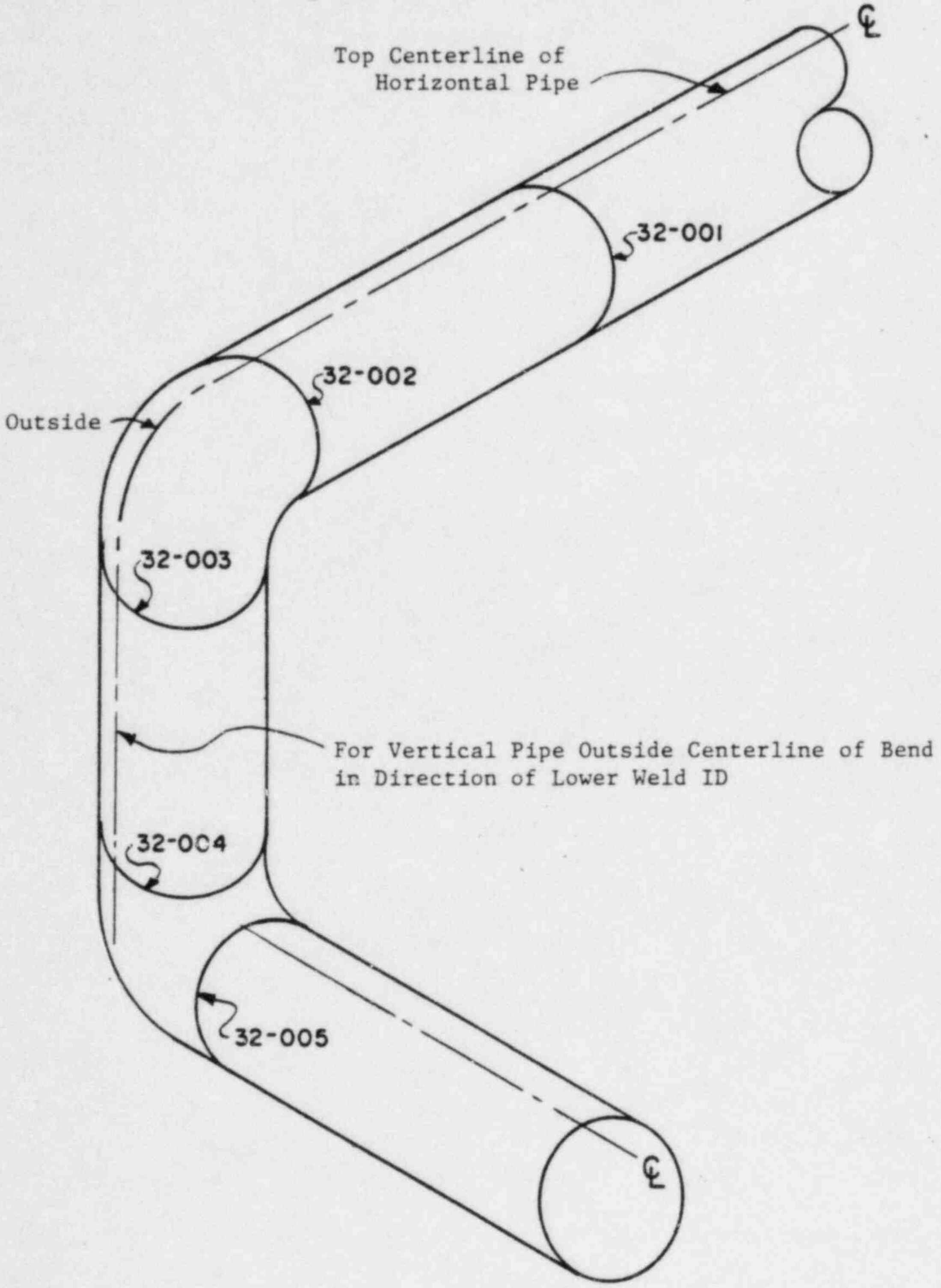
Designation for Longitudinal Welds in Tees



(Illustrative Only)

FIG. 5

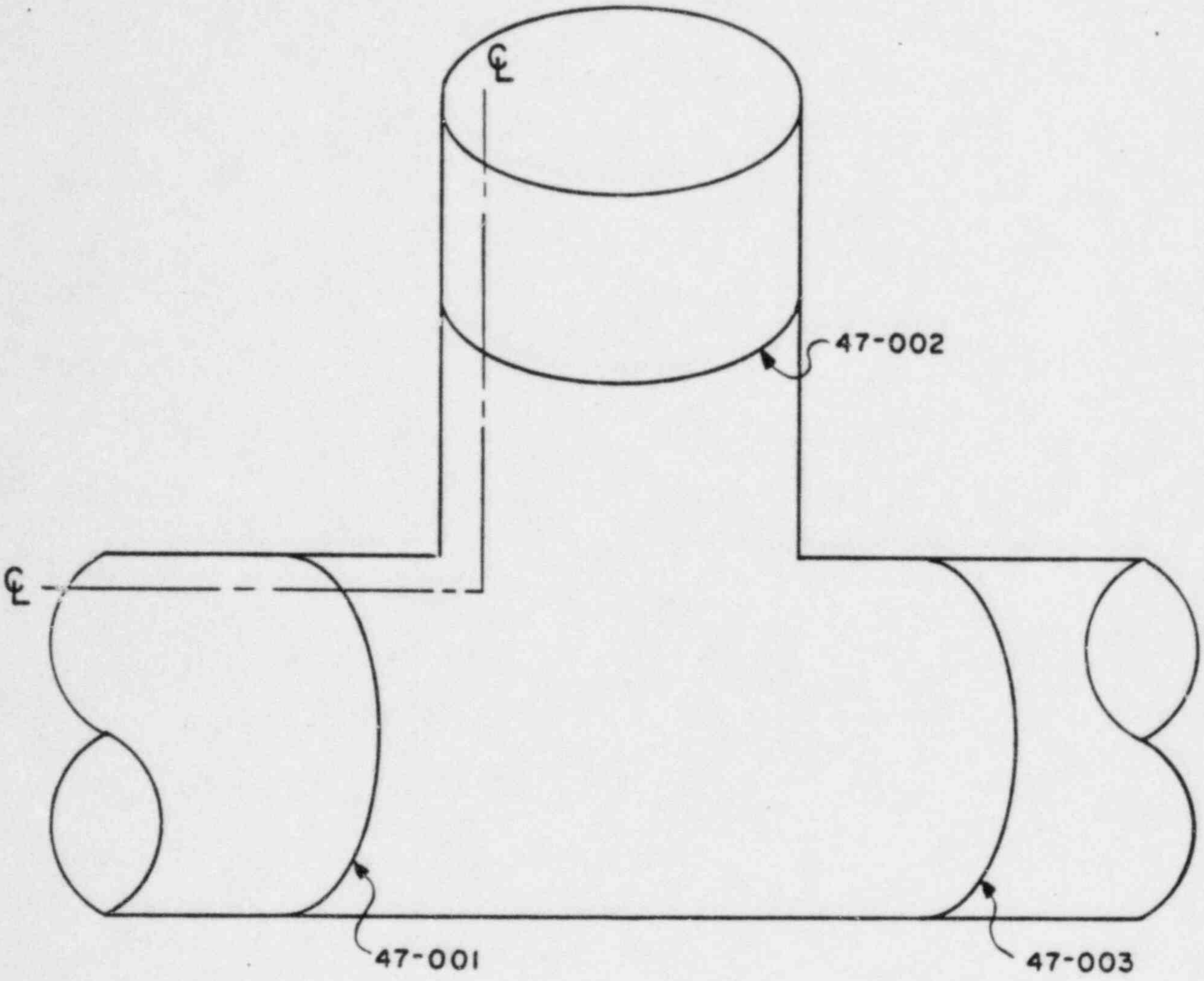
Centerline Marking for Horizontal and Vertical Pipelines



(Illustrative Only)

FIG. 6

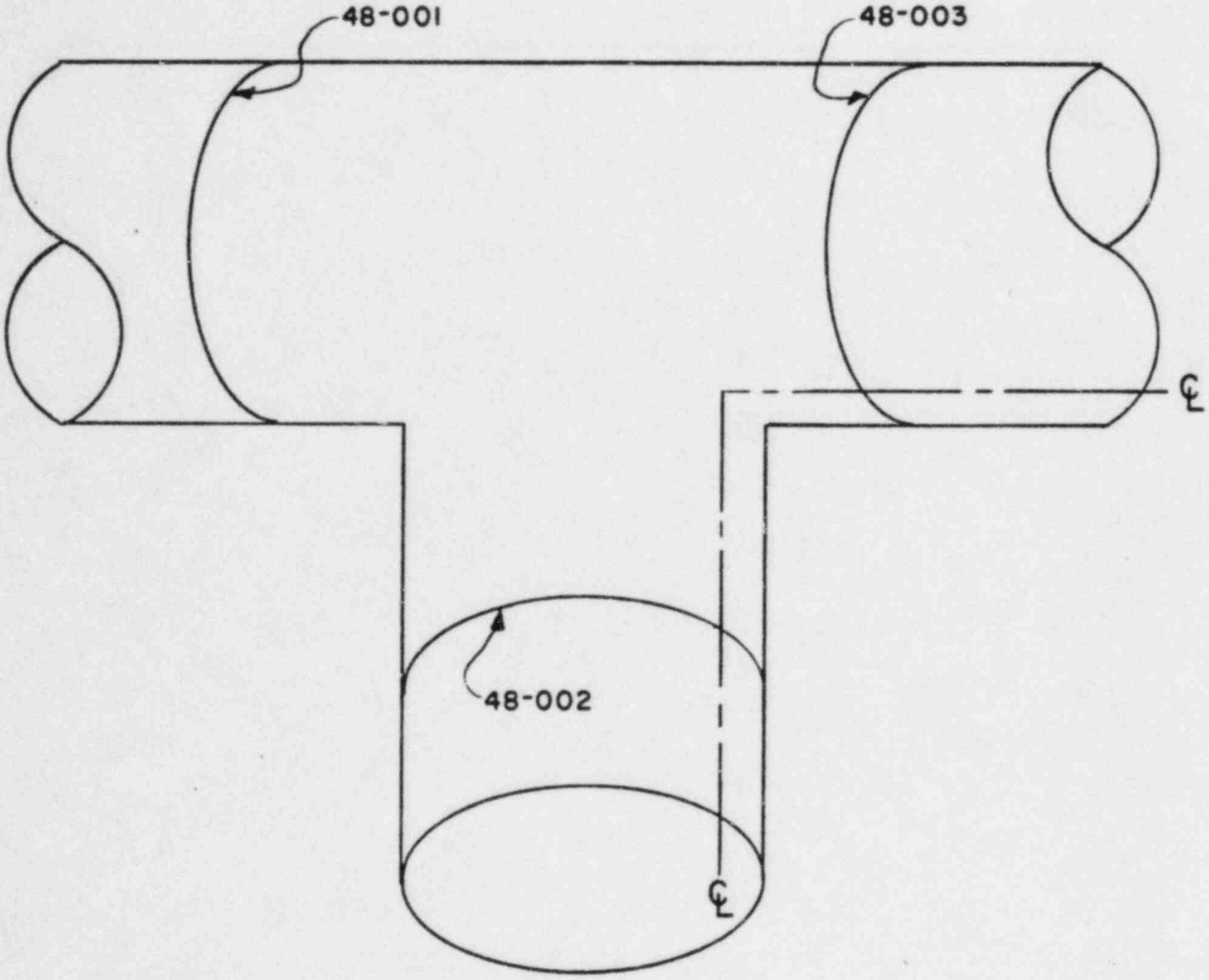
Centerline Marking for Vertical Runs Up from Tee or Branch Connection



(Illustrative Only)

FIG. 7

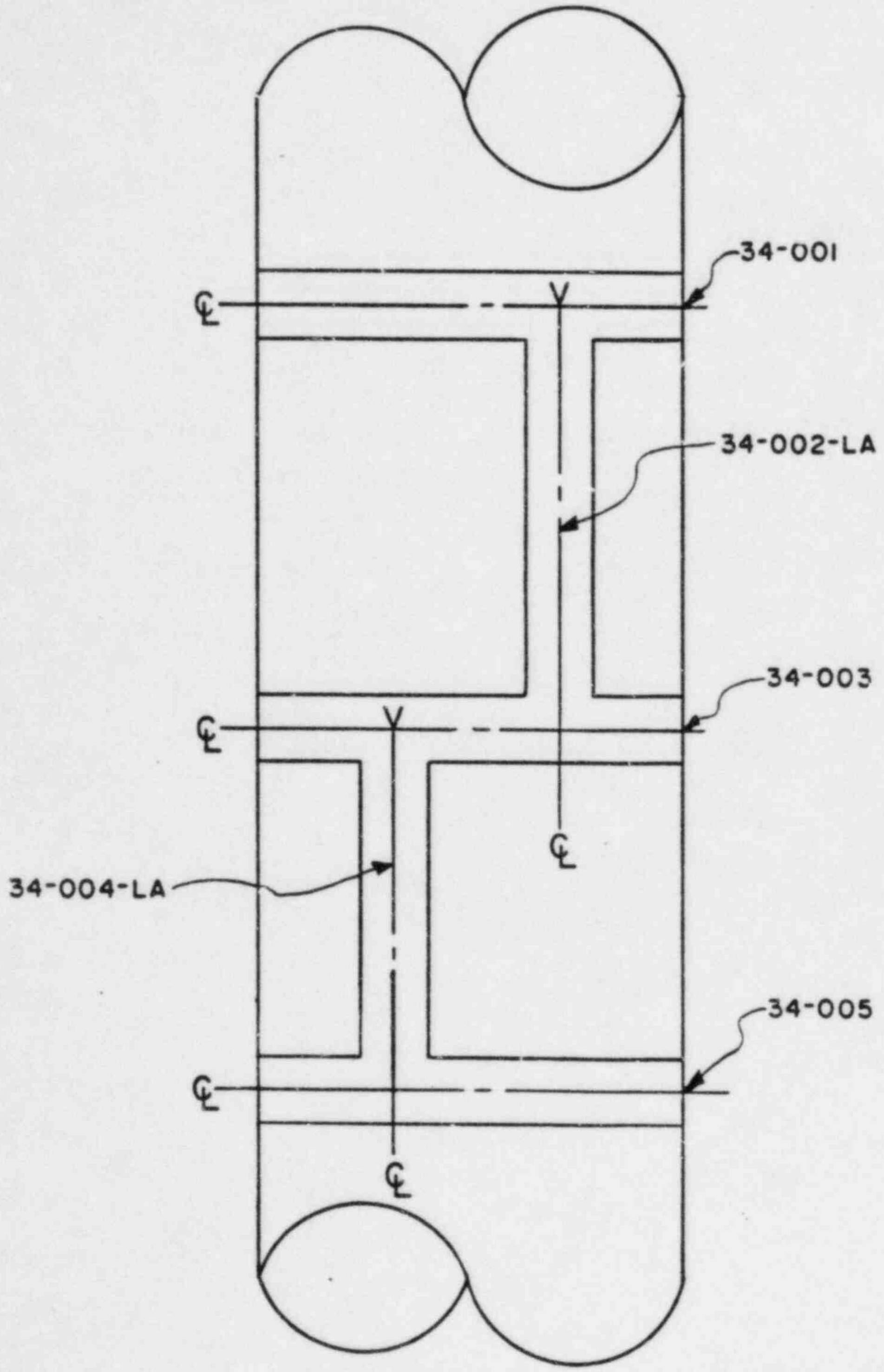
Centerline Marking for Vertical Runs Down from Tee or Branch Connection



(Illustrative Only)

FIG. 8

Centerline Marking for Longitudinal Welds



(Illustrative Only)

The
Virginia Corp.
of Richmond

(804) 346-0146
3605 Mayland Court
Richmond, VA 23233

Procedure Title: Preservice Inspection Documentation

Procedure No.: ISI 1.2

Plant Site: Waterford #3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING
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☐ Rejected: Revise and Resubmit
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BY:
DATE: 4-13-83

Rev. 0 Date: 1/27/82
Prepared by: Daniel L Jensen
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Rev. 1 Date: 3/1/83
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Customer: 4/18/83

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Reviewed by:
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1.0 Scope

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 Preservice Inspection Program Plan.

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.

5.3.2 Surface two shall be the side of the weld in the 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.

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.

5.7.2 The depth, width and location of all indications parallel to the weld shall be recorded by the perpendicular distance from the centerline of the weld to each side of the indication.

5.7.3 The length and location of all indications transverse to the weld shall be recorded by the perpendicular distance from the centerline of the weld to each end of the indication. The distance from the centerline to the ends of the indication shall be identified as to the direction of measurement. This shall be achieved by utilizing the scan direction reference identities applicable to the side of the weld in conjunction with the measurement (i.e., .5"(2), .3"(5), .2"(5), .4"(5), etc.) (Reference figure 5).

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 | 1

Site Supervisor as long as the change does not directly affect the test results. This change shall be initialled by the Virginia Corporation Site Supervisor and the Authorized Nuclear Inservice Inspector.

6.4 Form numbers (see attachments for completion requirements)

100 Series - 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 Flywheel

200 Series - Liquid Penetrant Data Reports

PT-201	Liquid Penetrant Examination Report
PT-202	Liquid Penetrant Weld Indication Record
PT-203	Liquid Penetrant Indication Record

300 Series - Magnetic Particle Data Reports

MT-301	Magnetic Particle Examination Report
MT-302	Magnetic Particle Weld Indication Record
MT-303	Magnetic Particle Indication Record

400 Series - Visual Examination Data Reports

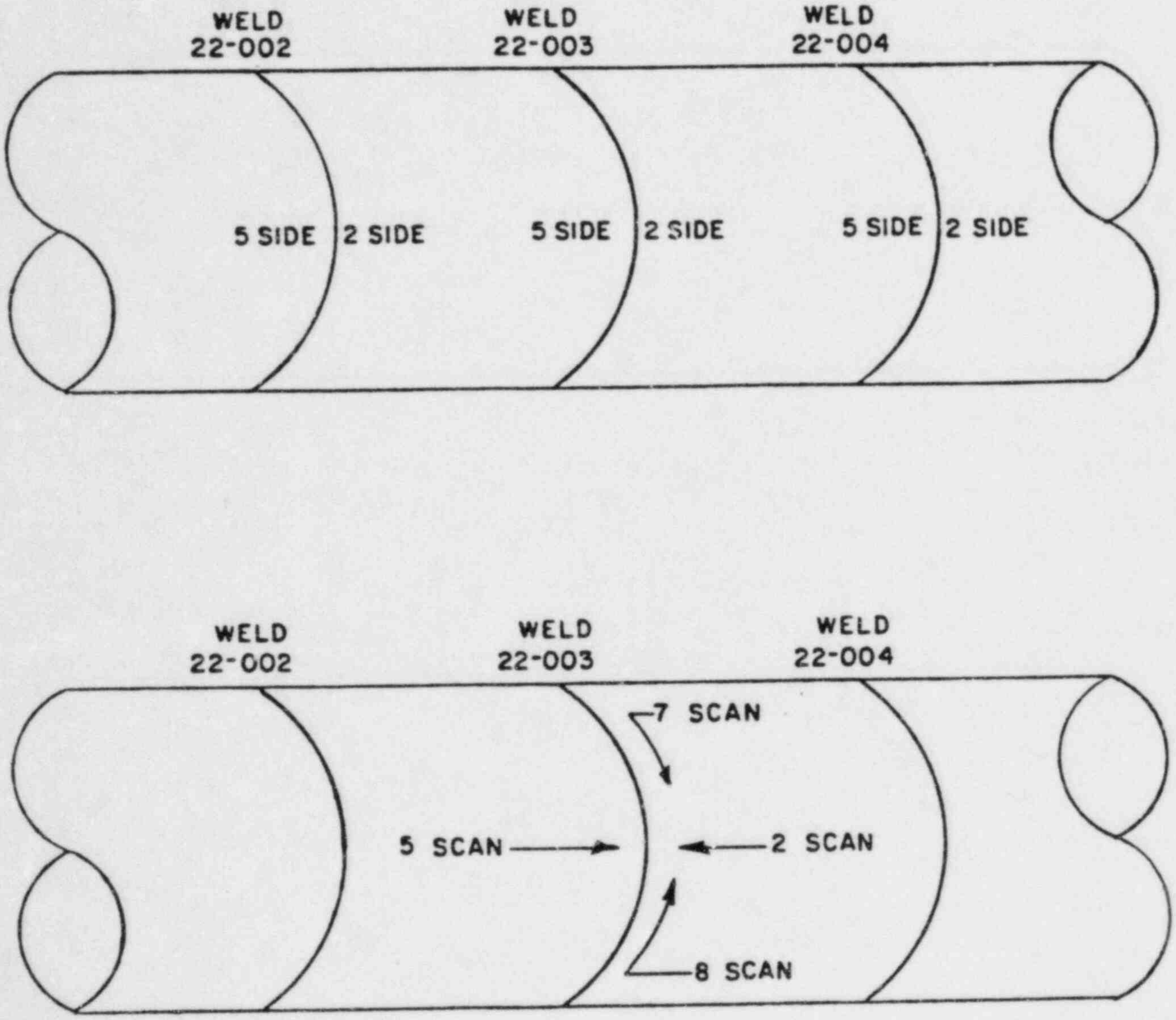
VT-401	Visual Examination Report for VT-1
VT-402	Visual Examination Weld Indication Record
VT-403	Visual Examination Indication Record

600 Series - Eddy Current Examination Data Reports

ET-601 Eddy Current Calibration Sheet - "Thickness" 1

FIG. 1

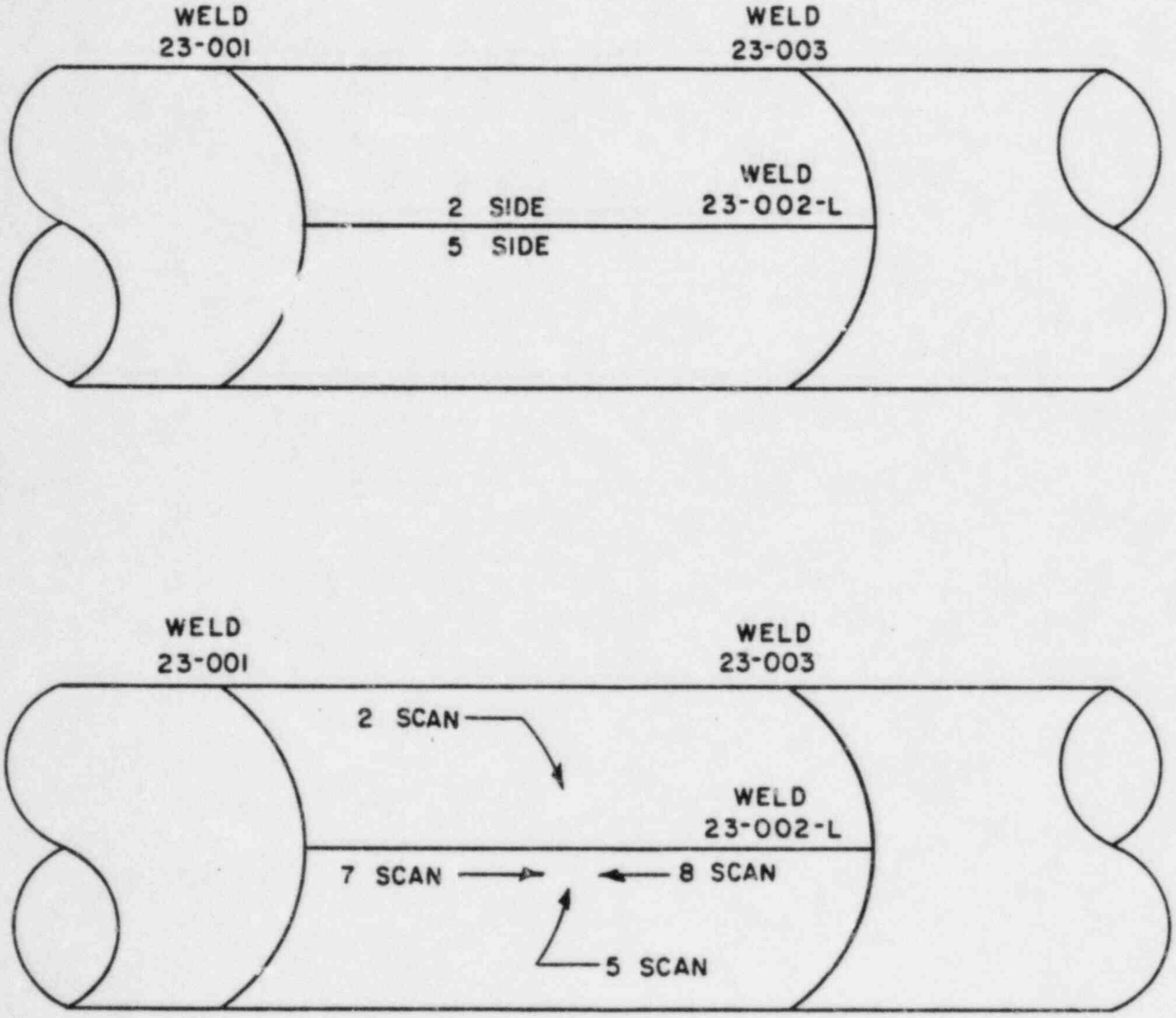
Circumferential Welds in Pipe and Horizontal Vessels



(Illustrative Only)

FIG. 2

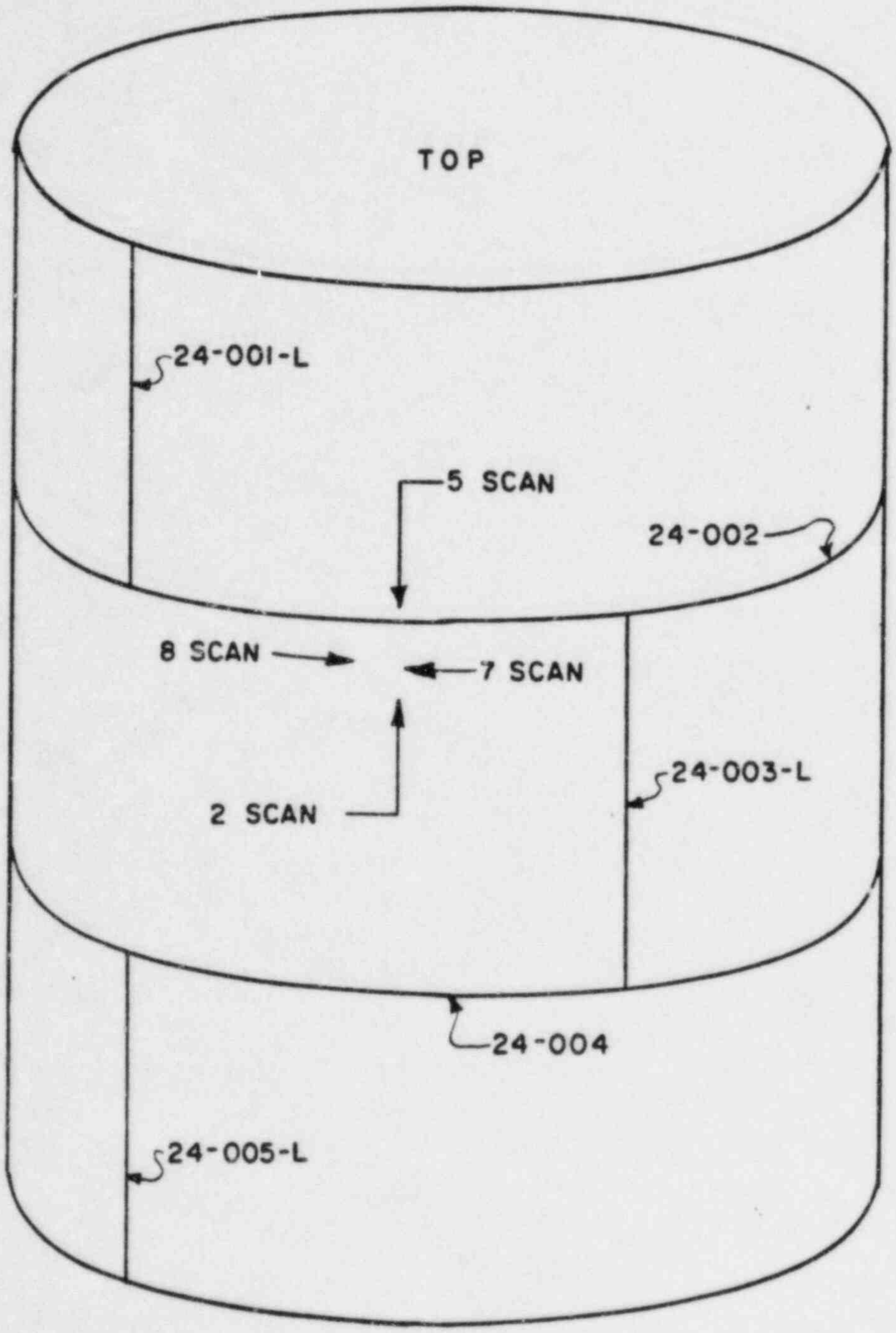
Welds in Pipe and Horizontal Vessels



(Illustrative Only)

FIG. 3

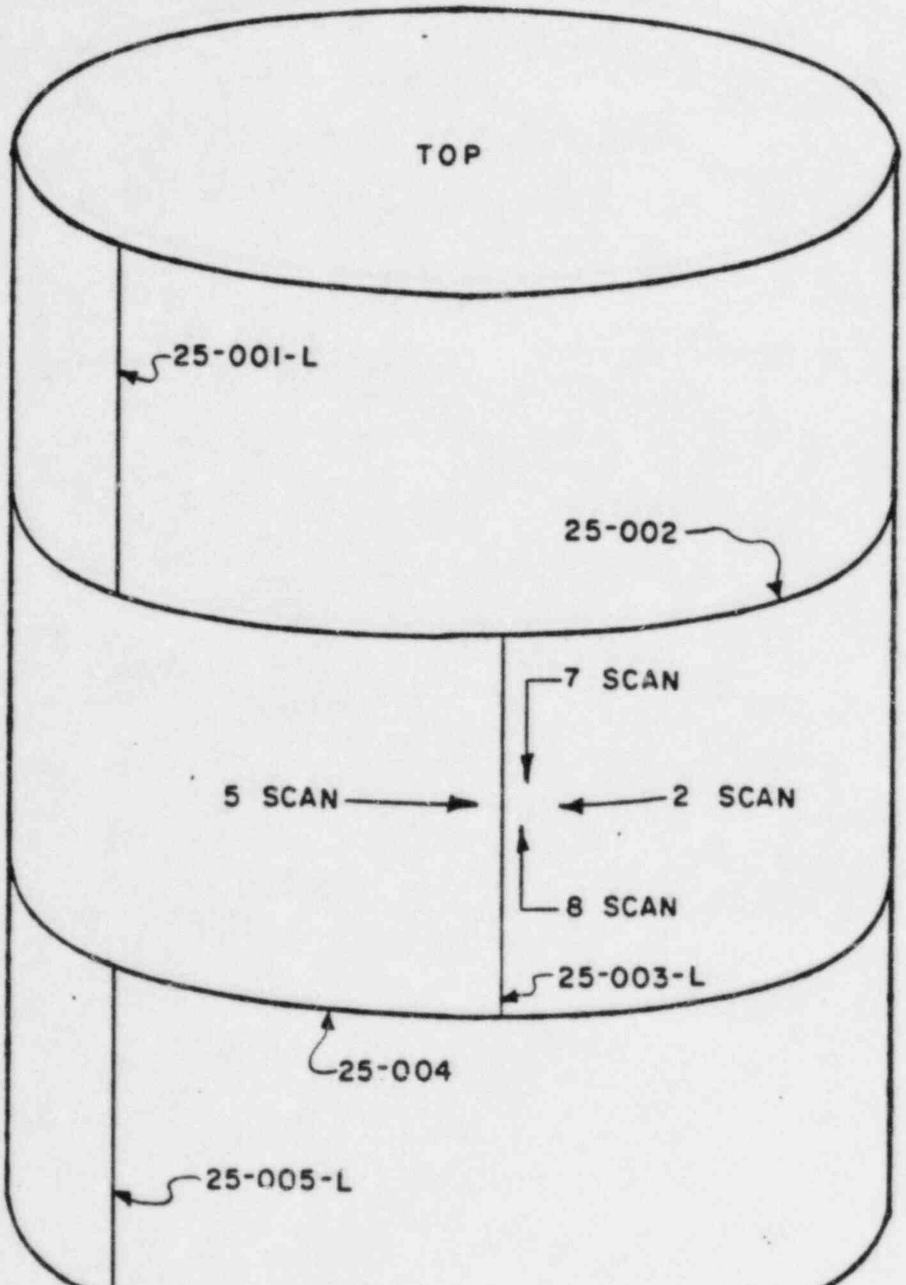
Circumferential Welds in Vertical Vessels



(Illustrative Only)

FIG. 4

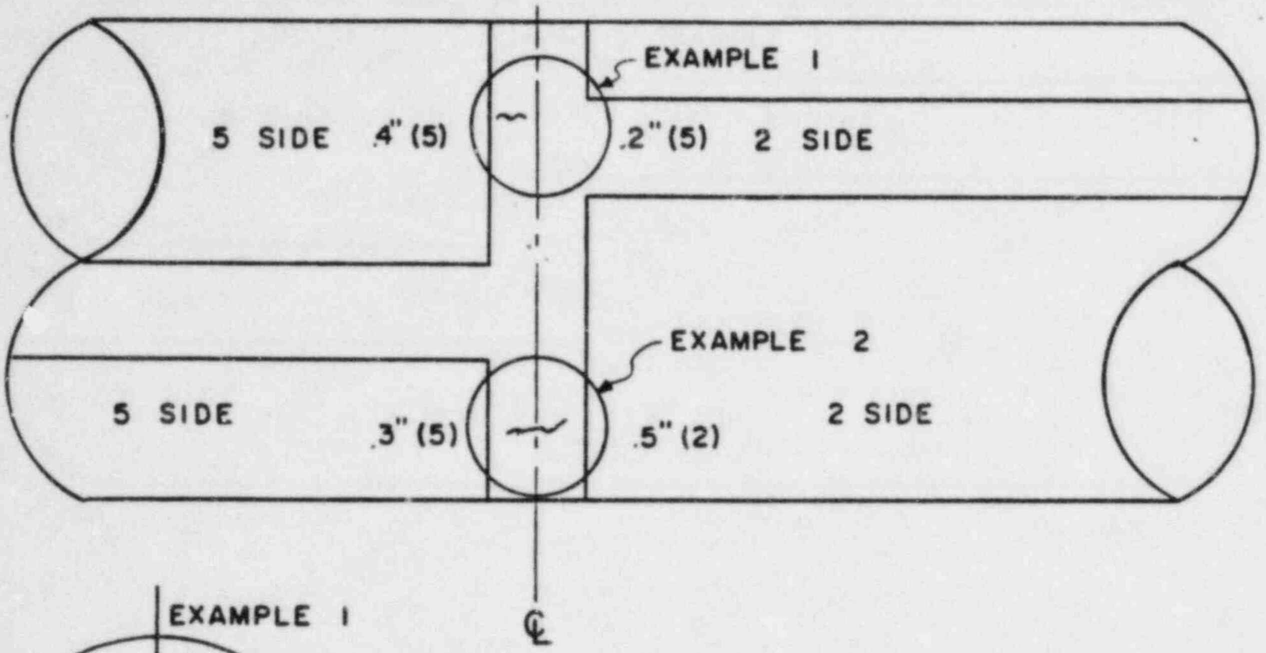
Longitudinal Welds in Vertical Vessels

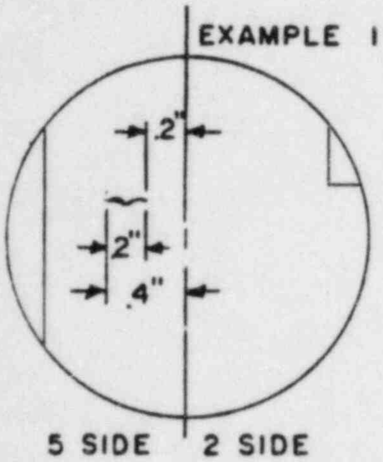


(Illustrative Only)

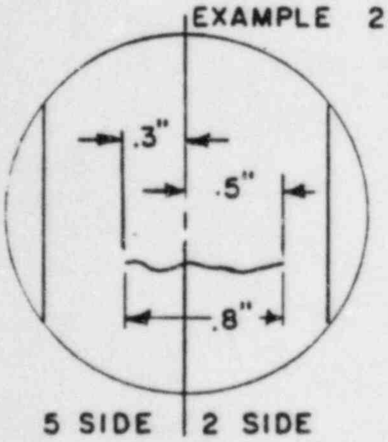
FIG. 5

Indication Recording





When a transverse indication does not cross the centerline of a weld, the distance from each end of the indication to the weld centerline shall be recorded in reference to the side of the weld in which it is on. .2" (5 side), .4" (5 side).



When a transverse indication does cross the centerline of a weld, the distance from each end of the indication to the weld centerline shall be recorded in reference to the side of the weld in which it is on. .3" (5 side), .5" (2 side).

ULTRASONIC EXAMINATION REPORT

(Form UT 101)

Block No.	Information Required
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 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)
14.	Calibration block identification number
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.
23.	UT instrument damping control setting when calibrated. 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.
27.	UT instrument filter control setting when calibrated. If any change between 0°, 45° or 60° calibration, an additional ultrasonic examination data form shall be completed.
28.	Search unit cable length.

ULTRASONIC EXAMINATION REPORT
(Form UT 101) cont'd

Block No.	Information Required
29.	UT instrument video setting when calibrated. If any change between 0°, 45° and 60° calibration, an additional ultrasonic examination data form shall be completed.
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.	Enter calibration reference reflector location (i.e. 1T, 2T, 3T or ¼T, ½T, 3/4T).
33., 35., 39.	Enter signal amplitude from reference reflector as a percentage of FSH.
34., 36., 40.	The location of the reference reflector signal along the horizontal axis of the CRT screen (i.e. sweep location).
37., 41.	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 for the maximum reference response.
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.	Total of all calibrated gain control settings used to establish DAC curve.
44.	The time of initial calibration and subsequent calibration checks.
45.	Enter sweep positions and amplitudes of calibration reflectors required for the examination, and complete the DAC as it would be represented on the CRT of the calibrated ultrasonic instrument.
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.

1

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Customer 1	Plant 2	Unit 3	Loop/Zone 4	Iso/Drawing No. 5
Procedure 6	Exam Surface 7	Examiner/Level 8	VCR Supervisor 9	Date 10
Component/Piping System 11	Pipe Size 12	Weld Type 13	Cal. Block # 14	Couplant: 15 Type_____ Batch No._____

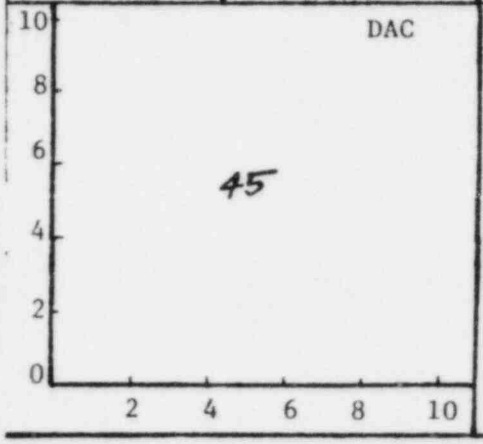
Continuation Sheet Attached
_____Yes _____No 30

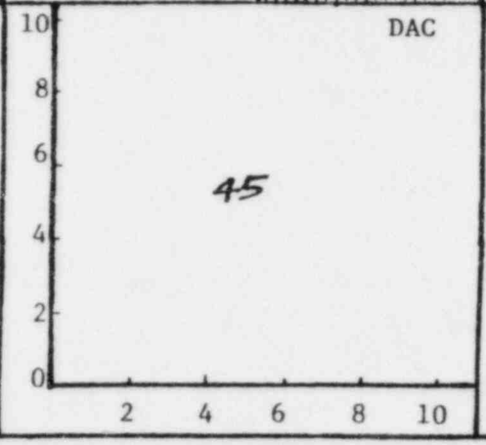
Field Changes:
Yes_____ No_____ 31
If Yes, Number

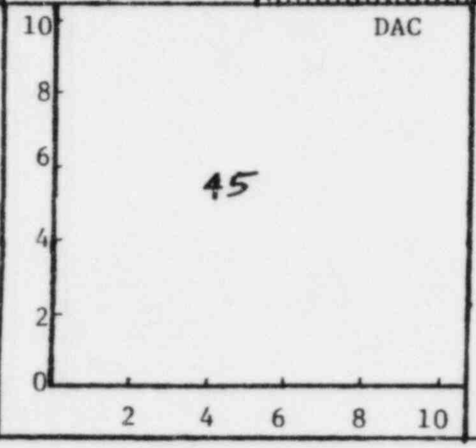
Transducer	0°	45°	60°
S/N	16	16	16
Size	17	17	17
Frequency	18	18	18
Beam Angle	19	19	19

Instrument			
Mfgr.	20	Model	25
S/N	21	RepRate	26
Reject	22	Filter	27
Damp	23	Coax	28
Freq.	24	Video	29

Calibration 0°			2 & 5 Scan				7 & 8 Scan				Calibration Checks					
					Sound Entry Point To:				Sound Entry Point To:		0°		45°		60°	
Calibration Reflector Location	Signal Amp.	Sweep	Signal Amp.	Sweep	Scribe Line	50% DAC	Signal Amp.	Sweep	Scribe Line	50% DAC	In	Out	In	Out	In	Out
32	33	34	35	36	37	38	39	40	41	42			44			
Ref. dB	43		43				43									







Additional Comments/Sketch

46

ULTRASONIC EXAMINATION REPORT - CONTINUATION SHEET

(Form UT 101a)

Block No.	Information Required
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 metal 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)

ULTRASONIC EXAMINATION REPORT - CONTINUATION SHEET

(Form UT 101a) cont'd

Block No.	Information Required
25.	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°)

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Ultrasonic Examination Report - Continuation Sheet

Page of

Customer 1	Plant 2	Unit 3	Loop/ Zone 4	Iso/Drawing No. 5
Procedure 6	Exam Surface 7	Examiner/Level 8	VCR Supervisor 9	Date 10
Component/Piping System 11	Pipe Size 12	Weld Type 13	Cal. Block 14	Couplant: Type & Batch # 15

Weld No.	▨	Base Metal Scan	Scan Direction				Inspection Limitations	Surface Condition		Examination Results		Remarks
			2	5	7 & 8	0		Base Metal	Weld	UT	Visual	
16		17	18	19	20	21	22	23	24	25	26	27

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 datum point or weld ℄ to the nearest end of the indication at the point where the signal has reduced to 50% of maximum response.
16.	Similarly, measure and record the distance from the datum point or weld ℄, 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 ℄ 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)

ULTRASONIC EXAMINATION REPORT INDICATION RECORD

(Form UT 102) cont'd

Block No.	Information Required
21.	Record the search unit refracted angle in the material as calculated on the IIW block
22.	Indicate the direction that the search unit is pointing when recording the indication (i.e. 2,5,7, 8)
23.	Measure and record the thickness of the base metal on the 2 side of the weld.
24.	Measure and record the thickness of the weld at or near the centerline of the weld
25.	Measure and record the thickness of the base metal on the 5 side of the weld
26.	Record any information necessary to help characterize the indication

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Ultrasonic Examination Report — Indication Record

Customer 1	Plant 2	Unit 3	Loop / Zone 4
Procedure 5	Examiner/Level 6	VCR Supervisor 7	Date 8
Component/Piping System 9	ISO Drawing No. 10	Cal. Standard No./Thickness 11	

Weld No.	Ind No.	Max.% DAC	Indication Length		Minimum Depth		Maximum Depth		Beam Angle	Beam Dir.	Base Metal Thickness 2 Side	Weld Thick.	Base Metal Thickness 5 Side	Remarks
			From	To	S.U. Pos.	Sweep Reading	S.U. Pos.	Sweep Reading						
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

ULTRASONIC DATA SHEET FOR STUDS AND BOLTS

(Form UT-103)

Block No.	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.	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.	Transducer beam angle
19.	Transducer wave mode (longitudinal or shear)
20.	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 calibrated
26.	Ultrasonic instrument model identification
27.	Ultrasonic instrument rep. rate control setting when calibrated
28.	Ultrasonic instrument filter control setting when calibrated
29.	Douplant 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

ULTRASONIC DATA SHEET FOR STUDS AND BOLTS

(Form UT-103) cont'd.

35. & 36.	Total of all calibrated gain control settings used to establish DAC curve
37., 38., 39., & 40.	The location of the reference reflector signal along the horizontal axis of the CRT screen (i.e., sweep location)
41.	Signal to noise ratio between the threaded area and the reference notch reflector at the reference dB
42.	The time of initial calibration and subsequent calibration checks
43.	The identify of material being tested
44. & 45.	Indicate the results of the examination in accordance with the referenced procedure in block no. 5
46.	Indicates any unusual examination problems
47. & 48.	Indicate the results of the visual examination performed prior to the ultrasonic examination

The Virginia Corp.
OF RICHMOND

ULTRASONIC DATA SHEET FOR STUDS & BOLTS

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Procedure 5	Examiner/Level 6		Date 7
Component/Piping System 8	ISO Drawing No. 9	VCR Supervisor 10	

CALIBRATION BLOCK		TRANSDUCER		INSTRUMENT			
Cal. Block No.	11	S/N	15	Manu.	20	Model	26
CALIBRATION SURFACE		Size	16	S/N	21	Rep Rate	27
Flat End	12	Freq	17	Reject	22	Filter	28
Groved End	13	Beam Angle	18	Damp	23	Couplant Batch No.	29
Other:	14	Wave Mode	19	Freq	24		
		Long ☐	Shear ☐	Video	25	Coax	30

CALIBRATION

DAC Point "A" 31 %FSH REF DB 35 Sweep Position 37

DAC Point "B" 32 %FSH Sweep Position 38

DAC Point "C" 33 %FSH REF DB 36 Sweep Position 39

DAC Point "D" 34 %FSH Sweep Position 40

Signal To Noise Ratio 41

Calibration Checks 42

IN OUT

IN OUT

IN OUT

EXAMINATION RESULTS

ITEM NO.	RESULTS		COMMENTS	VISUAL	
	NRI	RI		SATIS	UNSAT
43	44	45	46	47	48

VCR Form-UT-103 (rev. 1, 8/82)

ULTRASONIC INDICATION RECORD FOR STUDS AND BOLTS

(Form UT 104)

Block No.	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.	Sketch or Iso. number
10.	Signature of VCR site supervisor, after reviewing data sheet 1
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.

The Virginia Corp. of Richmond

Ultrasonic Indication Record for Studs & Bolts

Customer 1	Plant 2	Unit 3	Loop /Zone 4
Procedure 5	Examiner/Level 6		Date 7
Component/Piping System 8	Iso/Drawing No. 9	VCR Supervisor 10	

Indication Signal Amplitude 11

Indication Depth 12

Indication Location 13

Indicate by sketch below approximate location of indication.

14

Form UT-104

2/82

ULTRASONIC DATA SHEET FOR THICKNESS MEASUREMENT

(Form UT 105)

1

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 when using more than one material thickness for calibration
29.	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

ULTRASONIC DATA SHEET FOR THICKNESS MEASUREMENT

(Form UT 105)

Block No.	Information Required
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

The
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of Richmond

Ultrasonic Data Sheet for Thickness Measurement

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Component/Piping System 5	Examiner/Level 6	Date 7	
Procedure 8	Iso/Drawing No. 9	VCR Supervisor 10	Continuation Sheet Attached [ ] Yes 11 [ ] No

Equipment

Instrument	
Mfgr.	12
Model	13
S/N	14
Reject	15
Damp.	16
Freq.	17
Rep. Rate	18
Filter	19
Video	20
Couplant	21

Transducer	
Mfgr. 22	Size 23
Freq. 24	
Serial No. 25	
Coax. Cable 26	
Gain 27	

Calibration	
Cal. Block	28
Cal. Block	29
Range Cal.	30
Calibration Checks	
31	

Examination Results

Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5	Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5
32	33	34	35	36	32	33	34	35	36

Sketch/Identification 37

ULTRASONIC DATA SHEET FOR THICKNESS MEASUREMENT

(Form UT 105a)

Block No.	Information Required
1.	Customer name
2.	Plant name
3.	Unit number
4.	Unit loop or zone (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 VCE site supervisor after reviewing data sheet
11.	Enter identity (as given on the reference Iso.) of the weld being examined
12.	All thickness readings recorded shall be referenced to the actual location of the reading by means of sketch or sketches on the report form
13.	Enter thickness reading taken directly on the weld
14.	Enter thickness reading taken on the scan 2 side
15.	Enter thickness reading taken on the scan 5 side
16.	Use this space for drawing sketches to identify measuring points

The Virginia Corp. of Richmond

Ultrasonic Data Sheet for Thickness Measurement

Continuation Page __ of __

Customer 1

Plant 2

Unit 3

Loop/Zone 4

Component/Piping System 5

Examiner/Level 6

Date 7

Procedure 8

Iso/Drawing No. 9

VCR Supervisor 10

Examination Results

Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5	Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5
11	12	13	14	15	11	12	13	14	15

Sketch/Identification

16

Form UT-105a

3/82

UT DATA SHEET FOR REACTOR COOLANT PUMP FLYWHEEL

(Form UT-106)

<u>Block No.</u>	<u>Information Required</u>
1.	Customer name
2.	Plant name
3.	Plant unit number
4.	Unit loop or zone identity (whichever is applicable)
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 size
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 calibrated
19.	UT instrument damping control setting when calibrated
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 calibrated
25.	Coax cable length and type of connector (i.e., 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 percentage of FSH

UT DATA SHEET FOR REACTOR COOLANT PUMP FLYWHEEL

(Form UT-106) cont'd.

29. Enter signal amplitude from far hole as a percentage of FSH
30. Total of all calibrated gain control settings used to establish DAC curve
31. & 32. The location of the near and far hole reflector signals along the horizontal axis of the CRT screen (i.e., sweep position)
33. Pump number being examined
34. & 35. Results of the examination
36. Indicate any unusual examination problems

The Virginia Corp. of Richmond

ULTRASONIC DATA SHEET FOR REACTOR COOLANT PUMP FLYWHEEL

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Component 5	Examiner/Level 6		Date 7
Procedure 8	ISO Drawing No. 9	VCR Supervisor 10	

TRANSDUCER		INSTRUMENT				Calibration Checks 27	
S/N	11	Manu.	16	Model	22	In	Out
Size	12	S/N	17	RepRate	23	In	Out
Freq	13	Reject	18	Filter	24	In	Out
Beam Angle	14	Damp	19	Coax	25	In	Out
Wave: 15 long ☐ shear ☐		Freq	20	Couplant	26		
		Video	21	Batch No			

CALIBRATION

Near Hole 28 %FSH Sweep Position 31

Far Hole 29 %FSH Sweep Position 32

Ref. Gain 30 dB

EXAMINATION RESULTS

FLYWHEEL DESIGNATION	Results		COMMENTS
	NRI	RI	
33	34	35	36

VCR FORM — UT-106 (Rev. 0, 8/82)

UT INDICATION RECORD FOR REACTOR COOLANT PUMP FLYWHEEL

(Form UT-107)

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 and appropriate revisions and field changes
6.	Operator's signature and level certifying the examination was performed in accordance with the referenced procedure and field changes
7.	Date the examination was performed
8.	Identity of component
9.	Sketch or iso. number
10.	Signature of VCR supervisor after reviewing data
11.	Amplitude of the indication
12.	Location of the indication
13.	Draw approximate location of indication

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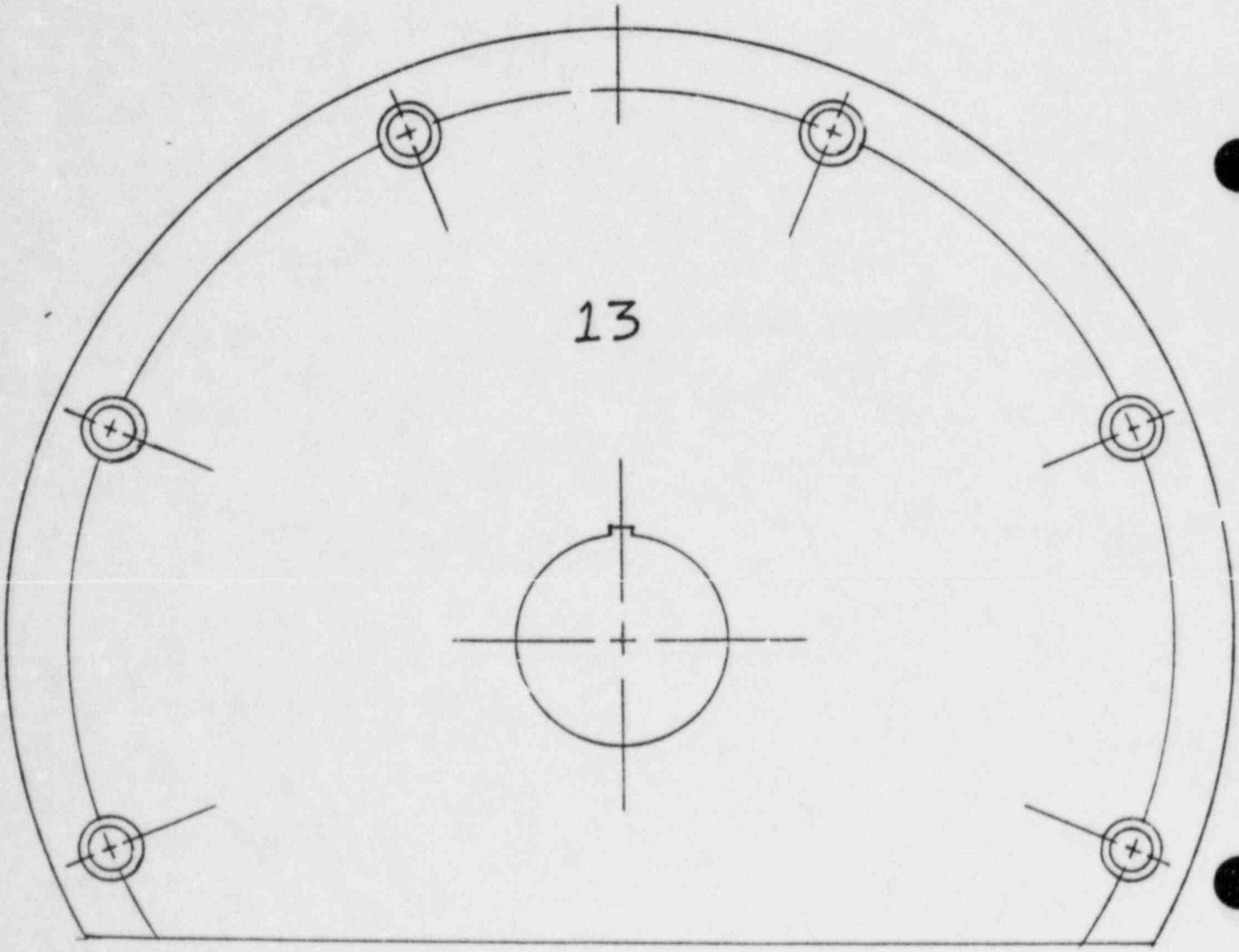
ULTRASONIC INDICATION RECORD FOR REACTOR COOLANT PUMP FLYWHEEL

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Procedure 5	Examiner/Level 6		Date 7
Component 8	ISO Drawing No. 9	VCR Supervisor 10	

Indication Signal Amplitude 11

Indication Location 12

* Indicate on Sketch Below Approximate Location of Indication.



LIQUID PENETRANT EXAMINATION REPORT

(Form PT 201)

Block No.	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.	Sketch or Iso. number
10.	Signature of VCR site supervisor, after reviewing data sheet
11.	Manufacturer of family grouping
12.	Material designation, i.e. Spotcheck, Dubl-check
13.	Material type and batch no. for penetrant, i.e. DP-51/80F813
14.	Material type and batch no. for developer, i.e. D-100/21J674
15.	Material type and batch number for remover, i.e. DR-60/60H425
16.	The weld identification (as given on the reference Iso., if applicable) of the weld or item being examined
17.	Identify any conditions affecting the performance of the examination
18.	Enter the results of the examination by inserting a check in "NRI" if no reportable indications are found, or a check in "RI" if reportable indications are found. If the "RI" block is checked, complete a form PT 202 for indication record.
19.	Indicate here the results of performing an examination in accordance with the requirements of ISI 5.1. The results of the visual examination shall be recorded by inserting a check in 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

The
Virginia Corp.
of Richmond

Liquid Penetrant
Examination Report

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Procedure 5	Examiner/Level 6		Date 7
Component/Piping System 8	ISO Drawing No. 9	VCR Supervisor 10	

	Manufacturer	Type	Batch No.	▨
Penetrant	11	12	13	▨
Developer	11	12	14	▨
Remover	11	12	15	▨

Weld/Item Number	Comments	PT Results		VT Results	
		NRI	RI	SAT.	UNSAT.
16	17	18	18	19	19

Form PT-201

2/82

LIQUID PENETRANT WELD INDICATION RECORD

(Form PT-202)

Block No.	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 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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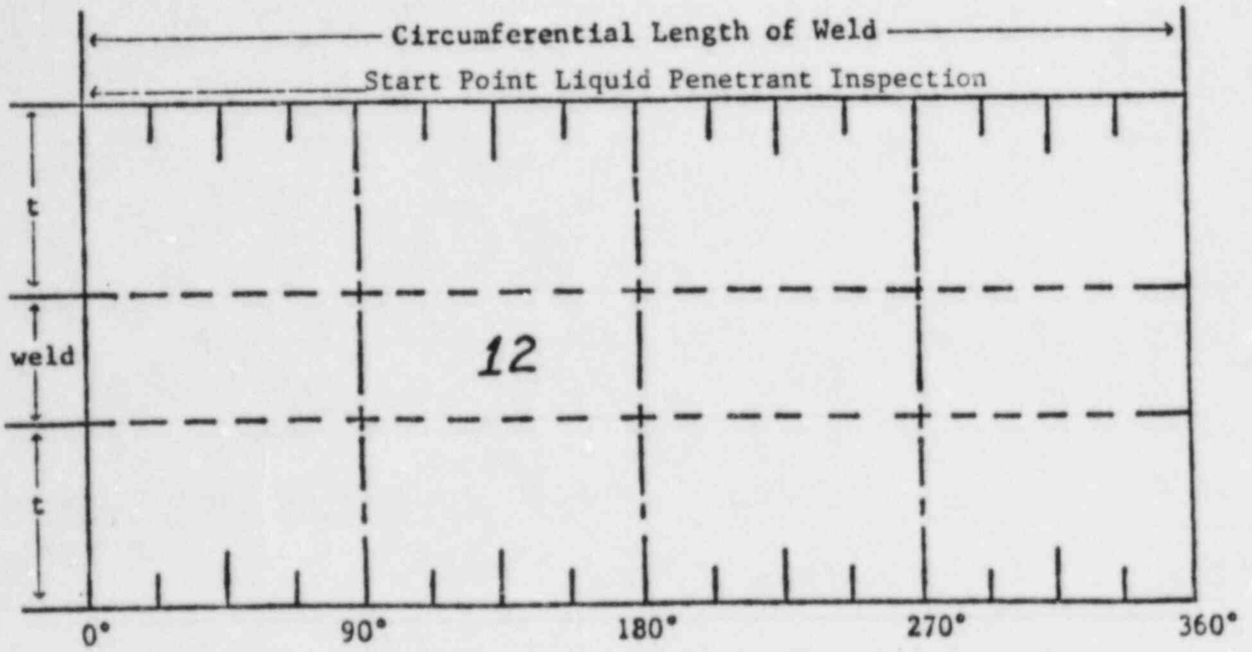
Liquid Penetrant Weld Indication Record

Customer 1
Plant 2
Unit 3
Loop /Zone 4
Procedure 5
Examiner/Level 6
Date 7
Component/Piping System 8
VCR Supervisor 9
Weld No. 10
ISO/Drawing No. 11



12

Remarks

13

LIQUID PENETRANT INDICATION RECORD

(Form PT-203)

Block No.	Information Required
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 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.	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

The Virginia Corp.
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Liquid Penetrant Indication Record

Customer 1

Plant 2

Unit 3

Loop/ Zone 4

Procedure 5

Examiner/Level 6

Date 7

Component/Piping System 8

VCR Supervisor 9

Item No. 10

ISO/Drawing No. 11

12

Comments:

13

MAGNETIC PARTICLE EXAMINATION REPORT

(Form MT 301)

Block No.	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 revisisons 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.	Signature of VCR site supervisor, after reviewing data sheet
8.	Date of examination
9.	Identify of component or system
10.	Sketch or Iso. number
11.	Condition of surface, (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 the particles being used
14.	Type of particles being used, i.e. 8A
15.	Batch number of magnetic particles
16.	Type of magnetizing current being used for examination
17.	The manufacturer of the magnetizing unit
18.	Type or model of magnetizing unit being used for the examination
19.	The serial number of the magnetizing unit
20.	Check appropriate blank when using continuous or residual magnetization
21.	If using coil, enter the amount of amperage used and the number of turns in the coil used during examination
22.	If using prods, enter the tip spacing in inches and the amperage used
23.	If using yoke, enter the pole spacing in inches
24.	The identity (as given in the referenced Iso., if applicable) of the weld or item being examined
25.	Identify any conditions affecting the performance of the examinations. Describe any reporatable indications, or identify any separate sheet or photograph utilized to record indications.

MAGNETIC PARTICLE EXAMINATION REPORT

(Form MT 301)

Block No.	Information Required
26.	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.
27.	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

The
Virginia Corp.
of Richmond

Magnetic Particle Examination Report

Customer 1
Plant 2
Unit 3
Loop /Zone 4
Procedure 5
Examiner/Level 6
VCR Supervisor 7
Date 8
Component/Piping System 9
ISO Drawing No. 10
Surface Condition 11
Type of Particles 12 __Wet __Dry __Visible __Flourescent
Manufacturer 13
Type 14
Batch Number 15
Current 16 __AC __DC __HWDC
Machine Mfr. 17
Type/Model 18
Serial No. 19
Magnetization 20 Continuous __Residual
Coil 21 Amps. ____ No. Turns
Prods 22 Spacing ____ Amps.
Yoke 23 Spacing

Weld / Item	Comments	MT Results		VT Results	
		NRI	RI	Sat	Unsat
24	25	26	26	27	27

Form MT-301

2/82

MAGNETIC PARTICLE WELD INDICATION RECORD

(Form MT 302)

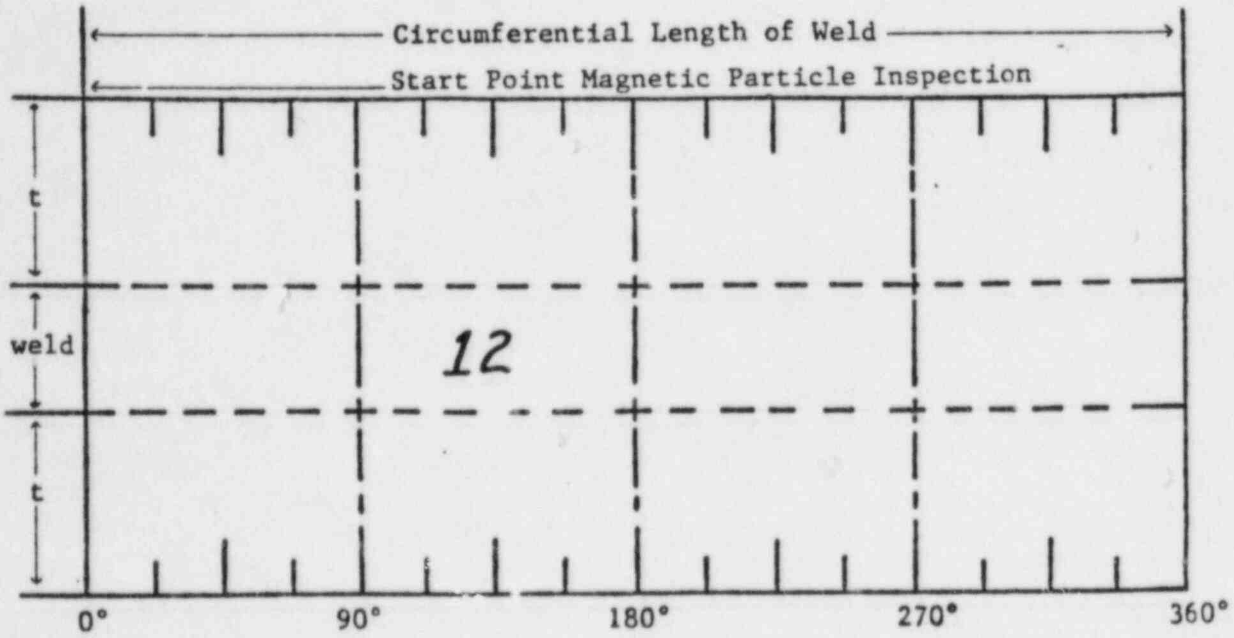
Block No.	Information Required
1.	Customer name
2.	Plant name
3.	Unit number
4.	Unit loop or zone identity (whichever is applicable)
5.	Examination procedure number, including appropriate revisions and field change numbers
6.	Operator's signature and level certifying that the examinations have been performed in accordance with the referenced procedure and field change
7.	Date of examinations
8.	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.

The
Virginia Corp.
of Richmond

Magnetic Particle

Weld Indication Record

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Procedure 5	Examiner/Level 6	Date 7	
Component/Piping System 8	VCR Supervisor 9		
Weld No. 10	ISO/Drawing No. 11		



Remarks

13

MAGNETIC PARTICLE INDICATION RECORD

(Form MT-303)

Block No.	Information Required
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

The Virginia Corp. of Richmond

Magnetic Particle Indication Record

Customer 1

Plant 2

Unit 3

Loop/Zone 4

Procedure 5

Examiner/Level 6

Date 7

Component/Piping System 8

VCR Supervisor 9

Item No. 10

ISO/ Drawing No. 11

12

Comments:

13

VISUAL EXAMINATION REPORT

(Form VT 401)

Block No.	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 that the examinations have been performed in accordance with the referenced 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.	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 conditions affecting the performance of the examinations. Describe any reportable indications or identify any separate sheet or photograph utilized to record indications.
15.	Identify any visual aids utilized to aid in the examination of each item.

The Virginia Corp.
of Richmond

Visual Examination Report
for
Category VT-1

Customer 1

Plant 2

Unit 3

Loop/Zone 4

Procedure 5

Examiner/Level 6

Date 7

Component/Piping System 8

ISO Drawing No. 9

VCR Supervisor 10

Weld/ Item	Exam Results		Comments	Visual Aids
	NRI	RI		
11	13	13	14	15

VISUAL EXAMINATION WELD INDICATION RECORD

(Form VT 402)

Block No.	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.

The Virginia Corp. of Richmond

Visual Examination

Weld Indication Record

Customer 1

Plant 2

Unit 3

Loop/Zone 4

Procedure 5

Examiner/Level 6

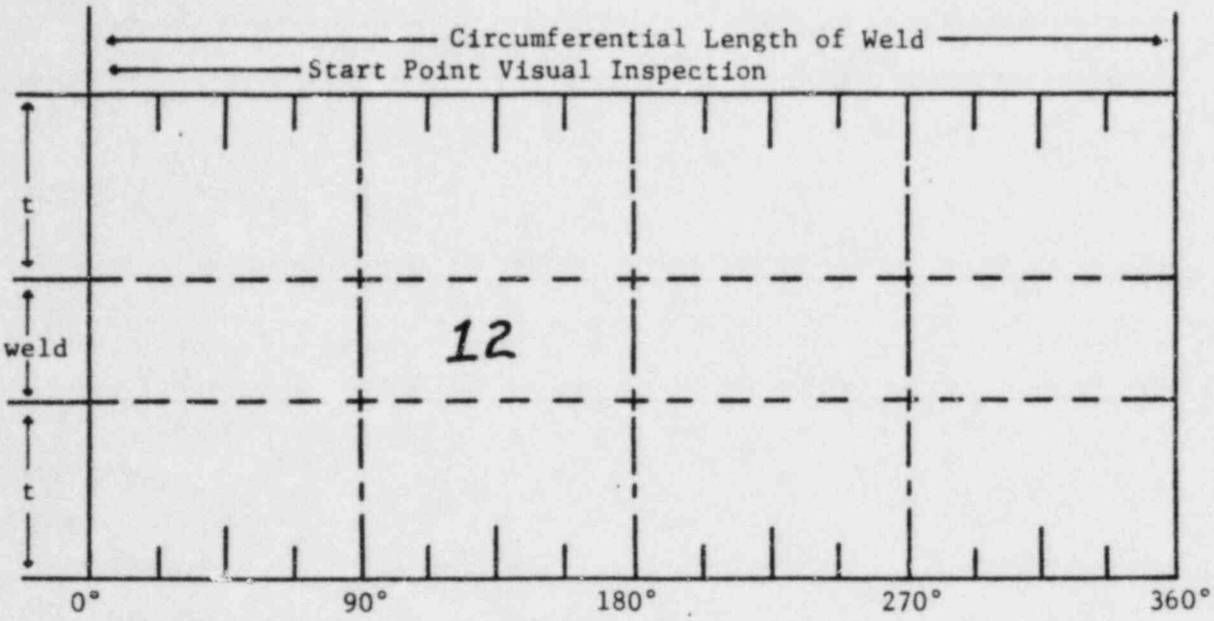
Date 7

Component/Piping System 8

VCR Supervisor 9

Weld No. 10

ISO Drawing No. 11



Remarks

13

VISUAL EXAMINATION INDICATION RECORD

(Form UT-403)

Block No.	Information Required
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 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.	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

The Virginia Corp. of Richmond

Visual Examination Indication Record

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Procedure 5	Examiner/Level 6	Date 7	
Component/ Piping System 8	VCR Supervisor 9		
Item No. 10	ISO/Drawing No. 11		

12

Comments:

13

VT-403

EDDY CURRENT CALIBRATION SHEET - "THICKNESS"

(Form ET-601)

Block No.	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 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 performed
9.	Identity of the component or 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.	Probe 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)

The
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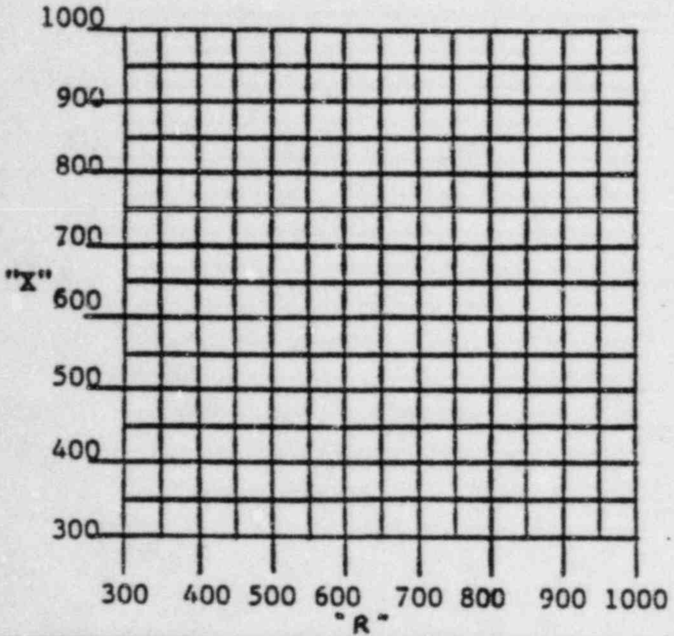
of Richmond

EDDY CURRENT
CALIBRATION SHEET
"THICKNESS"

Customer 1	Plant 2	Unit 3	Loop/Zone 4
Procedure 5	Examiner/Level 6	VCR Supervisor 7	Date 8
Componet/system 9		ISO/Drawing No. 10	Surface Condition 11

INSTRUMENT		PROBE		Calibration checks
Manufacturer 12	Model 14	Manufacturer 16	Type 18	In Out In Out
Serial No. 13	Frequency 15	Size 17	Frequency 19	20

INSTRUMENT CALIBRATION CURVE

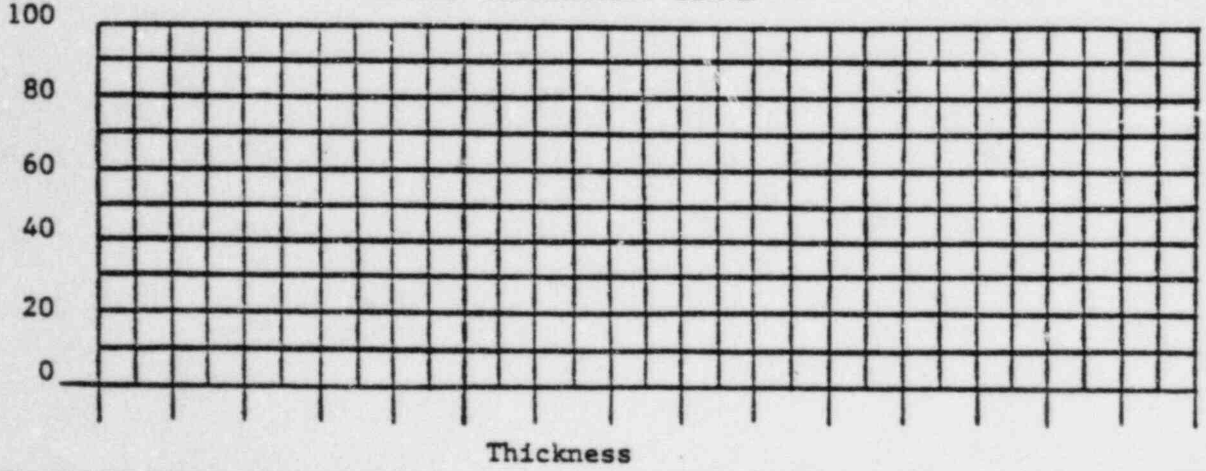


Operating point ________

List null points:

21

METER CALIBRATION CURVE



22

VCR Form-ET-601

(Rev. 0, 9/82)

The
Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: ULTRASONIC EQUIPMENT CALIBRATION CONFIRMATION

Procedure No.: ISI 2.1

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES
INCORPORATED
QUALITY
ASSURANCE
ENGINEERING

This Document is:

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☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.

☐ Rejected: Revise and Resubmit.

NOTE:

Review of this document, with or without comments, is for general conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.

BY:
DATE: 4-18-83

Rev. 0 **Date:** 2/10/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by:

Rev. 1 **Date:** 3/1/83
Prepared by: Daniel F Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: 4/13/83 Jame G Dickinson L III 4/21/83

Rev. ____ **Date:** ____
Prepared by: ____
Reviewed by: ____
Reviewed by: ____
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Rev. ____ **Date:** ____
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Rev. ____ **Date:** ____
Prepared by: ____
Reviewed by: ____
Reviewed by: ____
Customer: ____

The Virginia Corporation of Richmond

Proc. No. ISI 2.1 Rev. 1

Date: 3/1/83 Page 1 of 9

1.0 Scope

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

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, 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.

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 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%	+6dB
20%	+12dB

Note:

(1) 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.

7.1.1 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 spread:

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.

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 ¼T hole. Move the unit toward the hole until the response from the ¼T 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 ½T and 3/4T holes.

8.0 Recording, Evaluation and Reports

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, % of Full Screen
80%	-6dB	32 - 48%
80%	-12dB	16 - 24%
40%	+6dB	64 - 96%
20%	+12dB	64 - 96%

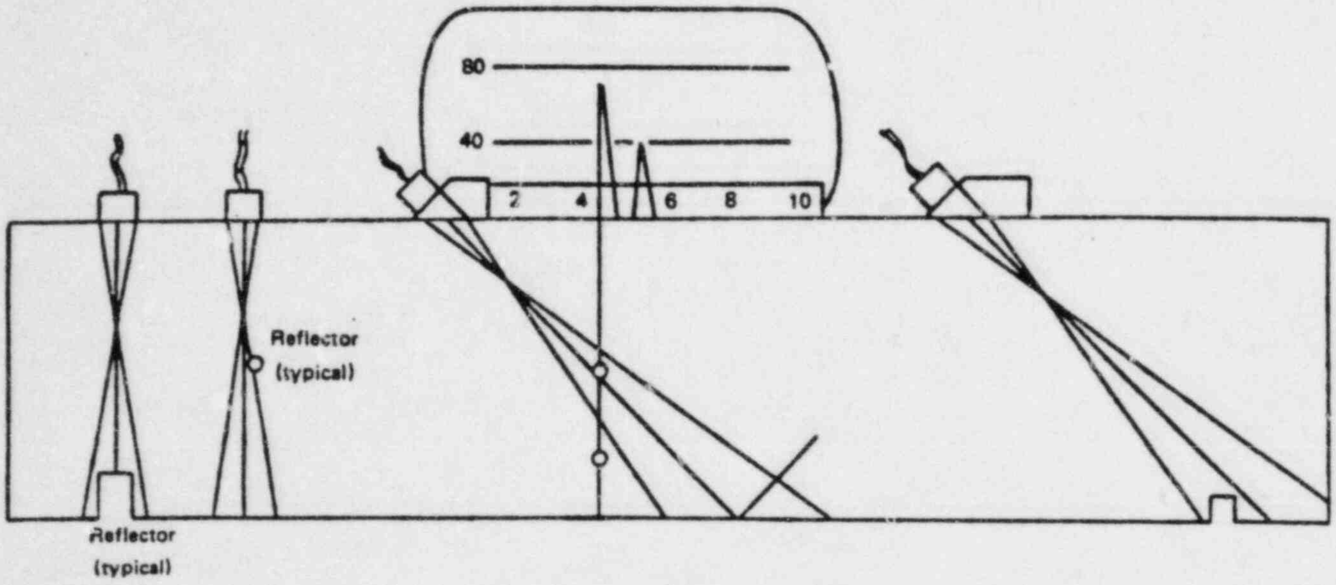
Note:

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

8.4 Beam exit point shall be marked on the search unit.

8.5 Beam angle shall be within ±2° of nominal, and shall be reported on the examination report.

8.6 Beam spread shall be reported on the examination report.



SCREEN HEIGHT LINEARITY

Figure 1

ULTRASONIC INSTRUMENT QUALIFICATION TO MEET SECTION V AND XI OF THE ASME CODE

Amplitude Linearity Verification

1st Signal Amplitude	100%	90%	80%	70%	60%	50%	40%	30%	20%
2nd Signal Amplitude									
2nd Signal Allowable Ampl.	45-55%	50-40	45-35	40-30	35-25	30-20	25-15	20-10	15-5

Control Settings: Damping ________ Reject ________ Rep. Rate ________

Amplitude Control Linearity Verification

Original Signal Amplitude	DB Control Change	Signal Amplitude	Signal Amplitude Limits
80% FSH	-6DB		32 - 48
80% FSH	-12DB		16 - 24
40% FSH	+6DB		64 - 96
20% FSH	+12DB		64 - 96

Note: Minus denotes decrease in amplitude; plus denotes increase.

Control Settings: Damping ________ Reject ________ Rep. Rate ________

Instrument: Mfgr. ____________, Model ________ S/N ________

Transducer: S/N ________ Size ______ Freq. _____ Type ________

Reference Calibration Standard: S/N/ ________________

Screen Height Linearity: Acceptable ____ Not Acceptable ____

Amplitude Control Linearity: Acceptable ____ Not Acceptable ____

Remarks: ________________________________

____

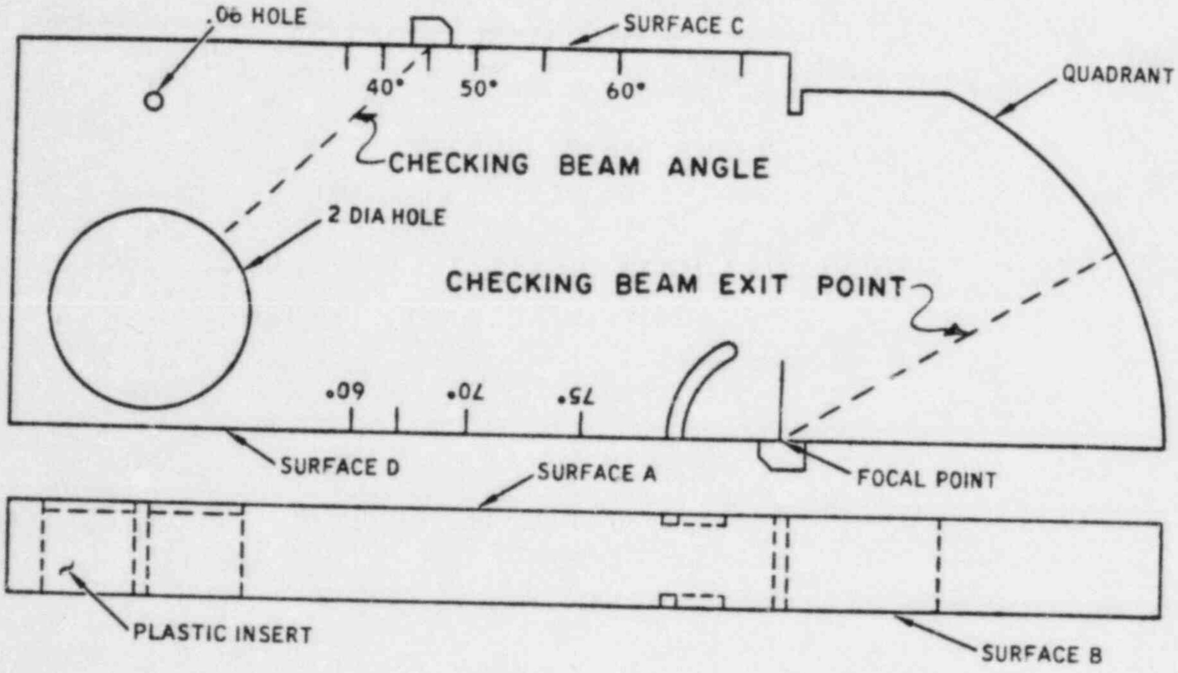
Inspector(s) ________________ Date ________

Report Reviewed By ________________ Date ________

Figure 2

FIG. 3

Beam Angle and Exit Point Determination
Using IIW Block, Type I



The Virginia Corp.
of Richmond

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Richmond, Virginia 23228

Procedure Title: MANUAL ULTRASONIC EXAMINATION OF FULL PENETRATION CIRCUMFERENTIAL AND LONGITUDINAL FERRITIC BUTT WELDS

Procedure No.: ISI 2.2

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
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BY:
DATE: 4-18-83

Rev. 0 **Date:** 2/10/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by:

Rev. 1 **Date:** 3/1/83
Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: James H. Dickinson L III 4/18/83 4/21/83

Rev. **Date:**
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The Virginia Corporation
of Richmond

Proc. No. ISI 2.2 Rev. 1
Date: 3/1/83 Page 1 of 26

1.0 Scope

1.1 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.

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 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.

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.

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.)

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 ¼T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ¼T 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. 1

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 (¼T 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.

6.3 Angle Beam Calibration for ½ Node Examination

6.3.1 The response from the ¼T and 3/4T side-drilled holes shall be used to establish the slope and the shape of the DAC curve in the following manner:

6.3.1.1 Position the search unit for the maximum response from the ¼T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ¼T hole is positioned at 2.0 on the graticule.

6.3.1.2 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.

6.3.1.3 Repeat steps 6.3.1.1 and 6.3.1.2 until no further adjustment is necessary.

6.3.1.4 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.

6.3.1.5 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.

6.3.1.6 Connect the screen marks and extrapolate through the thickness (¼T 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 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 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

80% of FSH. Mark the peak of the indication on the screen.

6.4.1.5 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.

6.4.1.6 Connect the screen marks and extrapolate the DAC at either end for a distance of ½T. This shall be the primary reference level.

6.5 Angle Beam Calibration for 1½ 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:

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.

6.5.1.2 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 graticule.

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

6.5.1.4 Position the search unit for the maximum response from the I.D. notch (1½ node). Check that the leading edge is at approximately 9.0 on the graticule.

6.5.1.5 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 on the screen.

6.5.1.6 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.

6.5.1.7 Position the search unit for the maximum response from the I.D. notch (1½ 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.

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-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 ½ 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 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 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.

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 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

7.2.1 If the angle beam examination is restricted to a full node or 1½ 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 overlap at least ten percent.

7.2.3 Calibration shall be as indicated in paragraph 6.2

7.3 Angle Beam - Reflectors Parallel to the Weld

7.3.1 The primary scan for reflectors parallel to the weld shall be ½ node from both sides of the weld.

7.3.2 Full node or 1½ node shall only be used when it is impossible to examine the required material with a ½ 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 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. 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 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.

7.5 Extent of Examination

7.5.1 The volume subject to examination and extent of scan length shall be in accordance with Figures 6 and 7.

7.5.2 Butt welded branch connection welds shall be 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.

7.5.3 Longitudinal welds adjacent to circumferential 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.

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 Indications

8.1 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.

8.1.1 Any indication categorized as a flaw shall be recorded and reported in accordance with the requirements of reference 2.3. 1

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. 1

8.3 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.

8.4 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.

Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

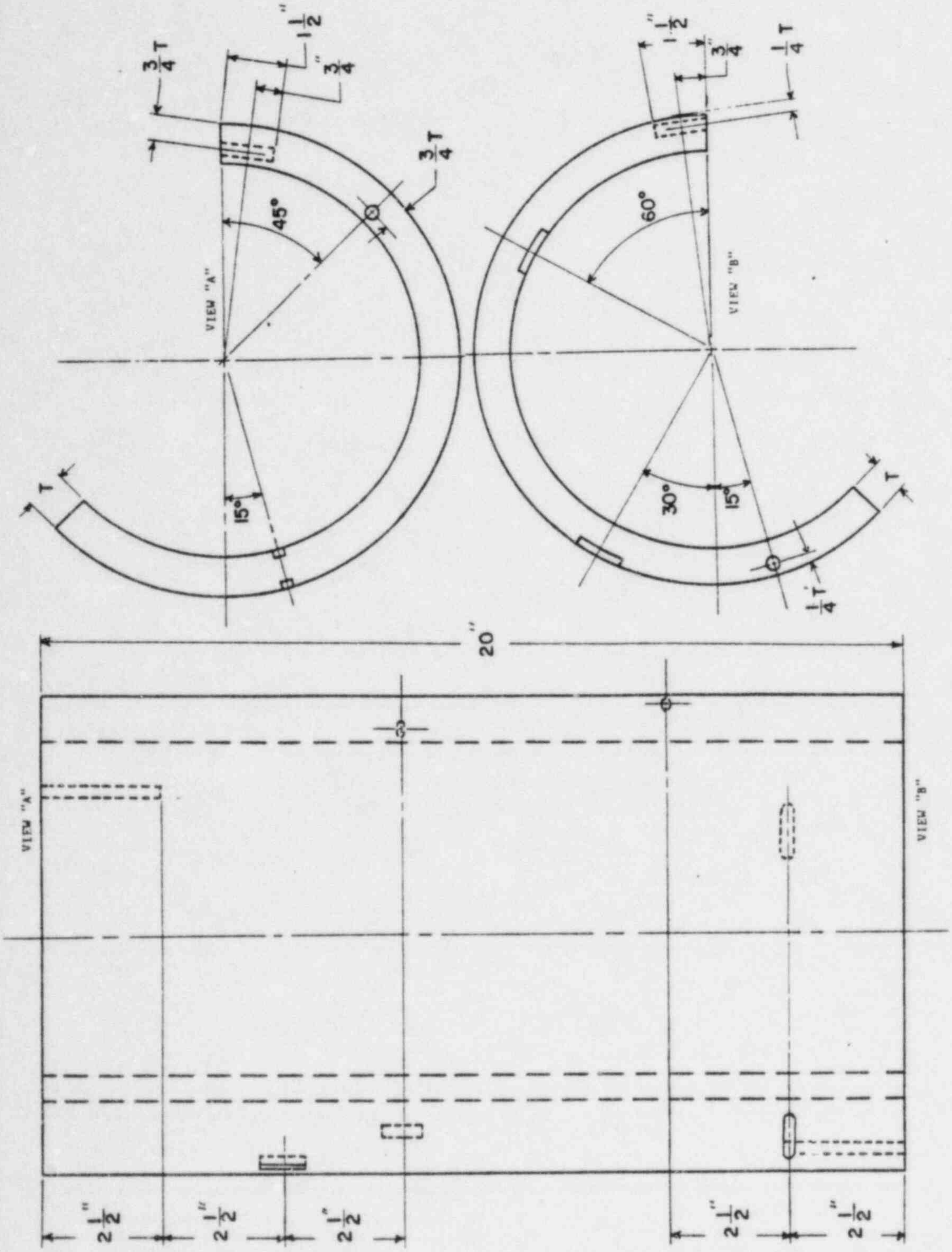
Angle Beam Examination*

Nominal Material Thickness	Transducer		
	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 Diameter	Transducer	
	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

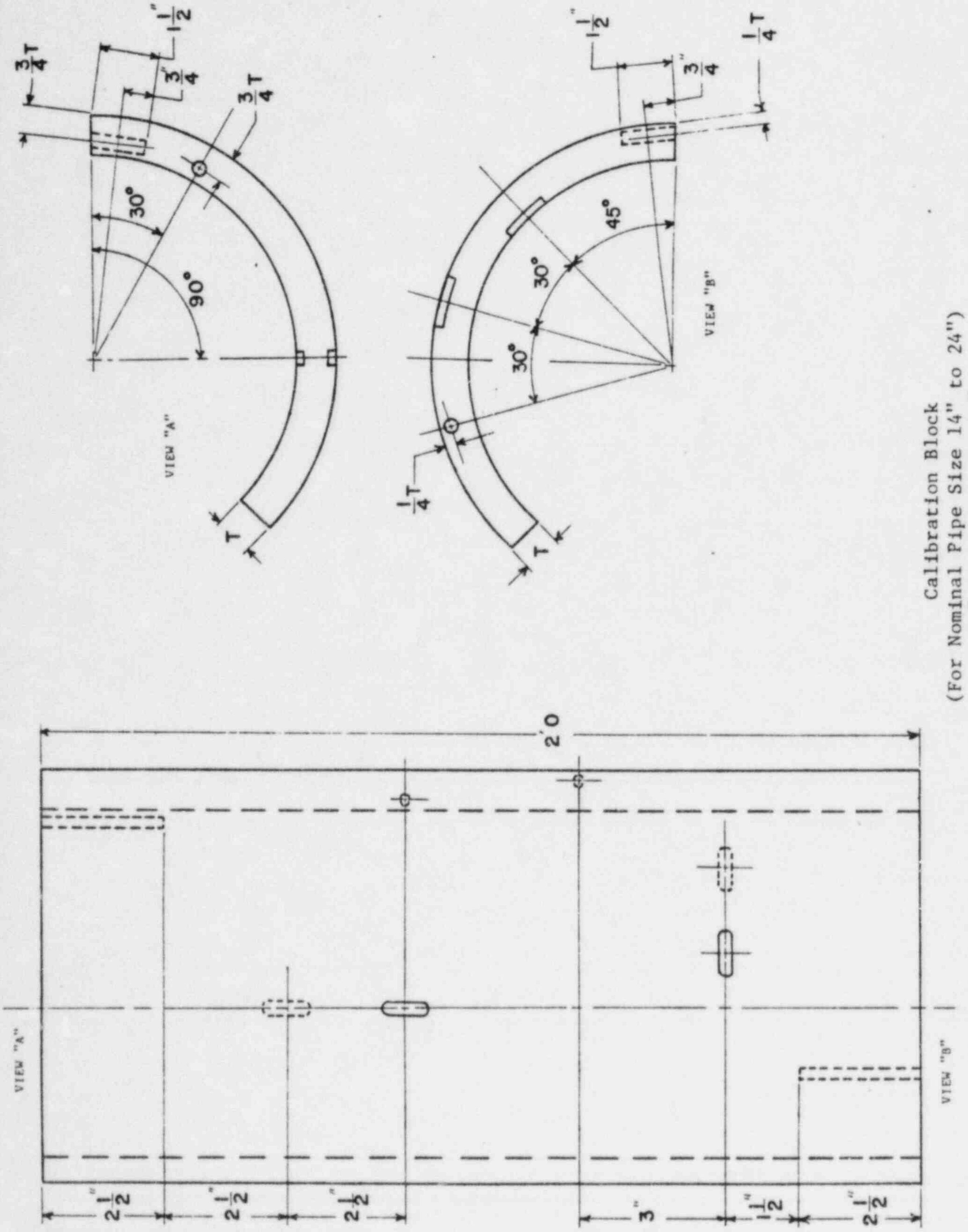
* Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.



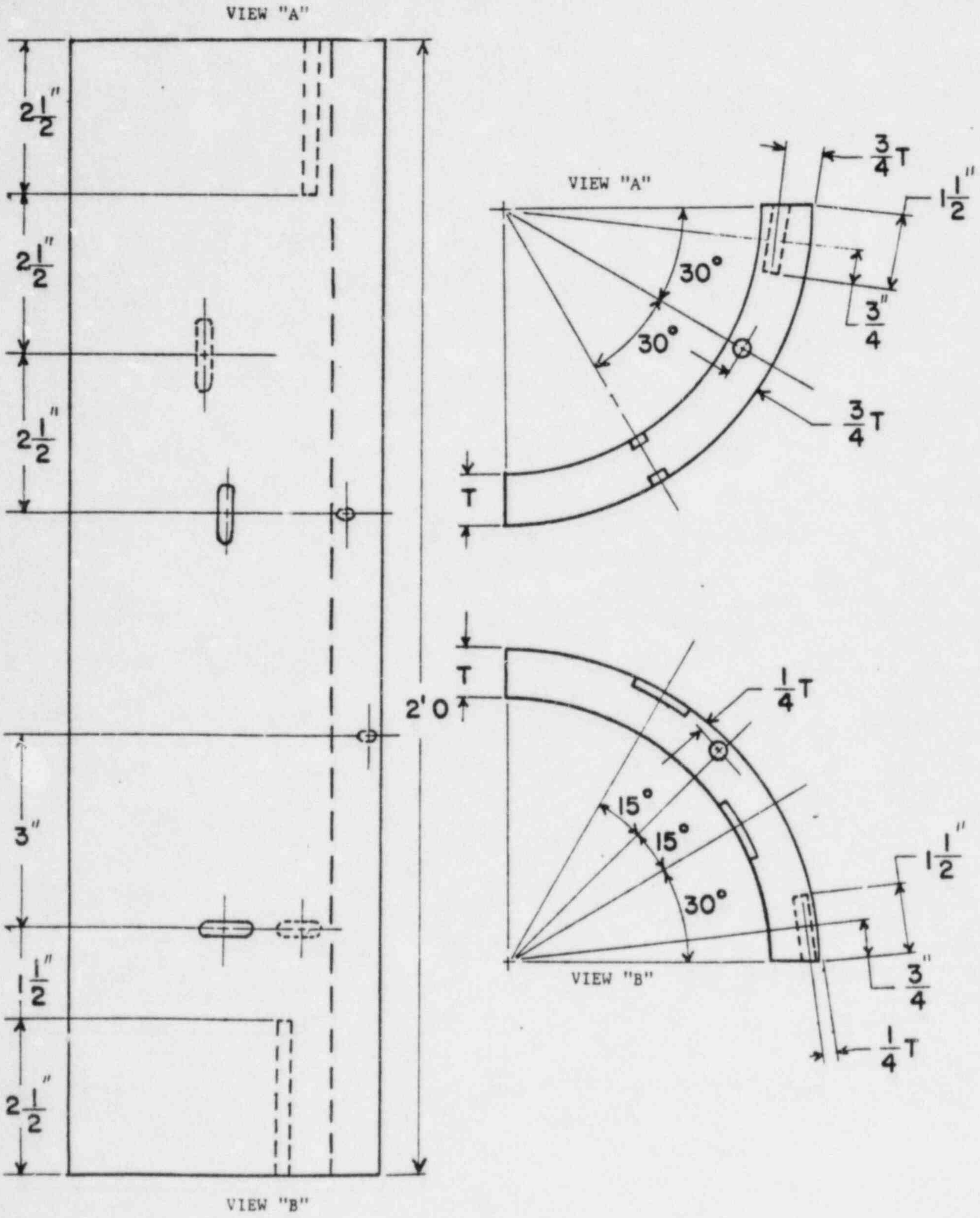
Calibration Block (For Nominal Pipe Size 12" and Less)

"Illustrative Only"

Figure 2



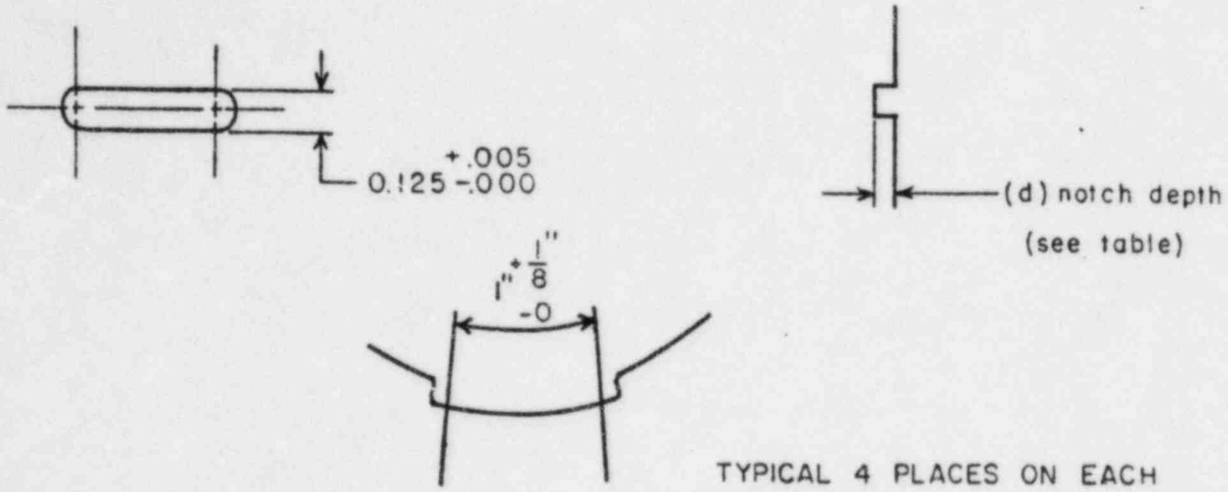
Calibration Block
(For Nominal Pipe Size 14" to 24")
"Illustrative only"
Figure 3



Calibration Block
(For Nominal Pipe Size 36" and Above)
"Illustrative Only"
Figure 4

CALIBRATION BLOCK REFLECTOR SIZE

Figure 5



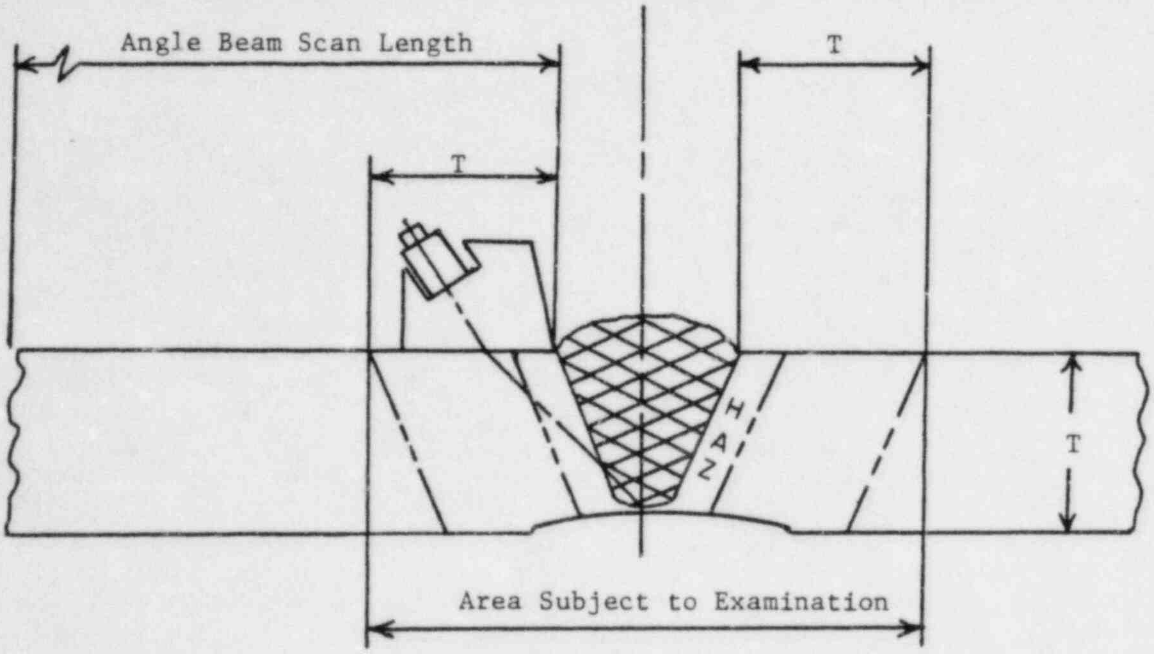
TYPICAL 4 PLACES ON EACH CALIBRATION BLOCK

NOTCH DEPTH FOR ULTRASONIC CALIBRATION BLOCKS

NOMINAL PIPE WALL THICKNESS (T) INCHES	MATERIALS	NOTCH DEPTH (d) INCHES
LESS THAN 0.312	FERRITIC	0.10T +0.005in. −0.010in.
0.312 TO 6.0	FERRITIC	$0.104T - 0.009^{2}T$ +10% −20%

HOLE DIAMETERS FOR ULTRASONIC CALIBRATION BLOCKS

MATERIAL THICKNESS (T) INCHES	HOLE DIAMETER (INCHES)
UP TO 1" INCLUSIVE	3"/32
OVER 1" THRU 2"	1"/8
OVER 2" THRU 4"	3"/16
OVER 4" THRU 6"	1"/4

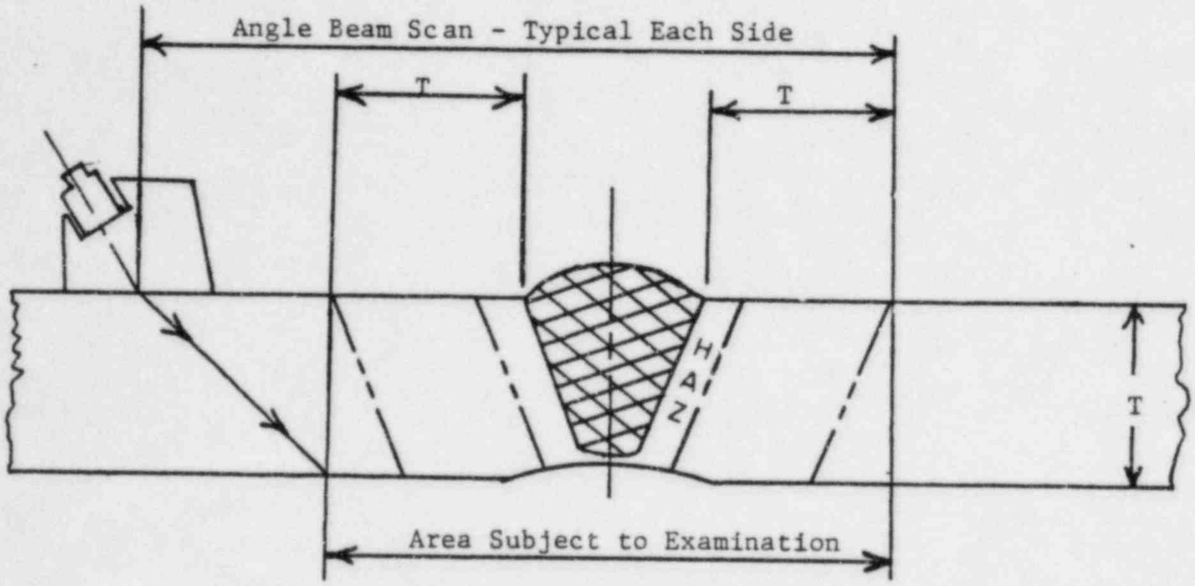


Angle beam scan length as shown above, shall be as follows:

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

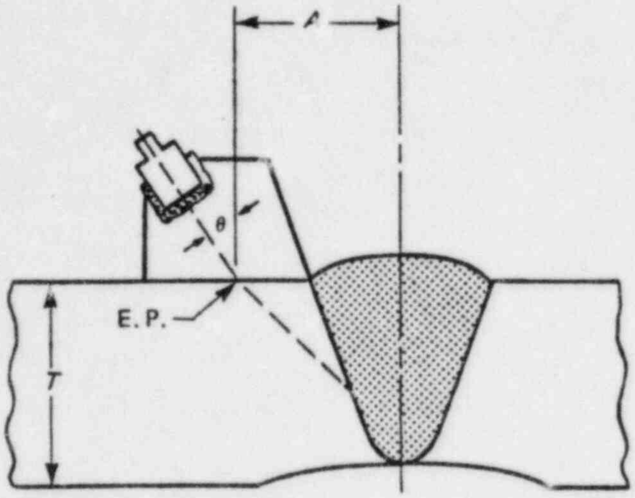


For angle beam scan length as shown above, add the following from each side of the weld fusion line.

Material Thickness	Minimum Scan 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



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

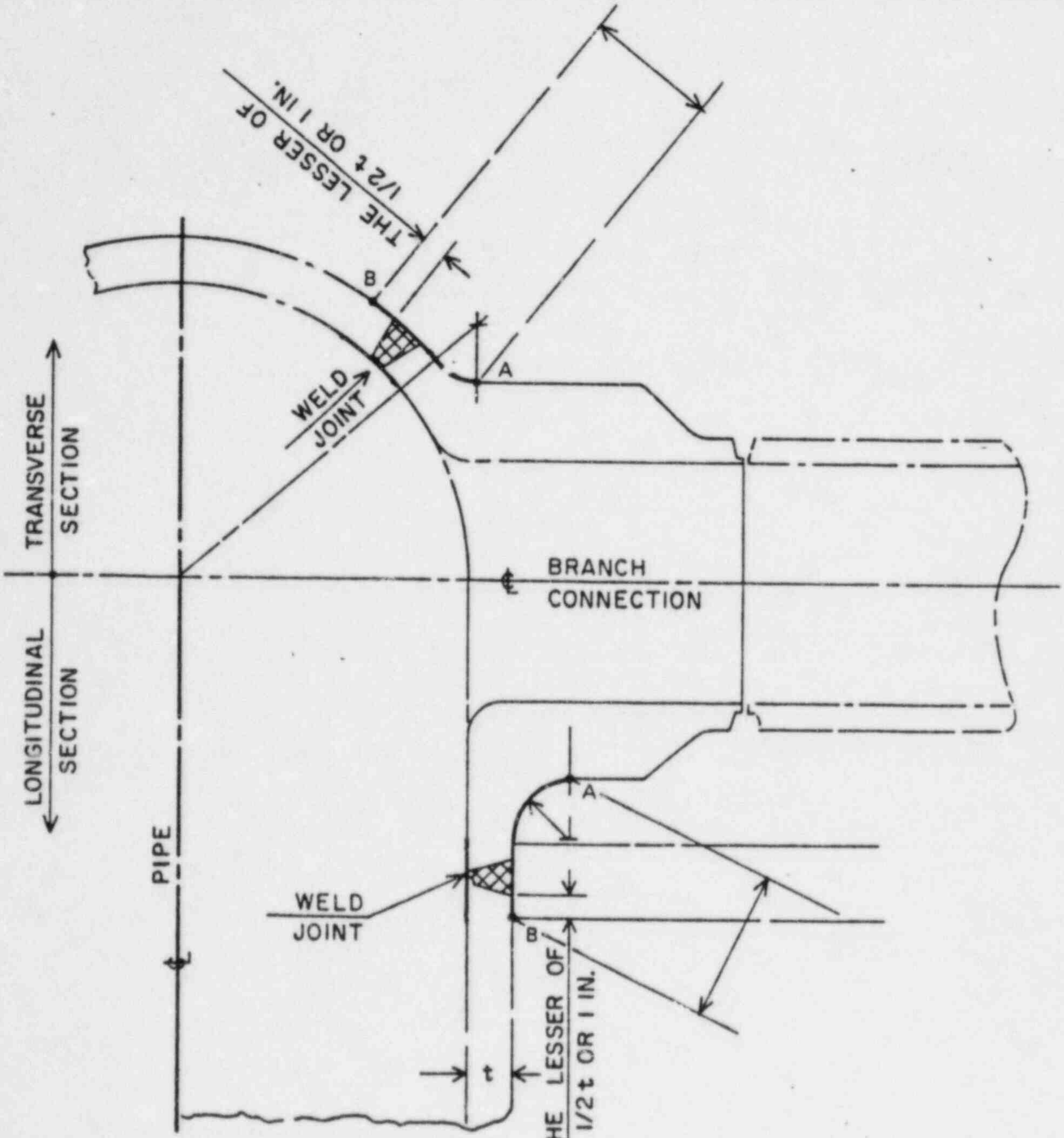


Figure 9

Butt Welded Branch Connections

Figure 10

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Customer	Plant	Unit	Loop/Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block #	Couplant: Type____ Batch No.____

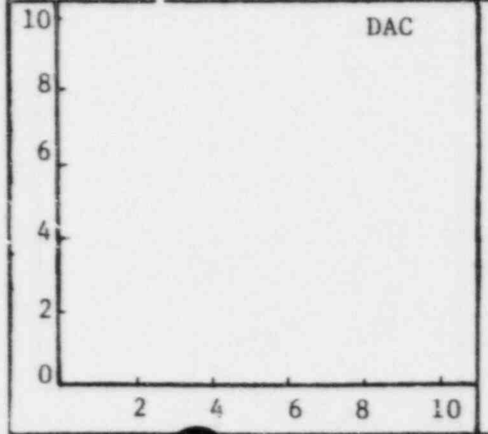
Continuation Sheet Attached
____Yes ____No

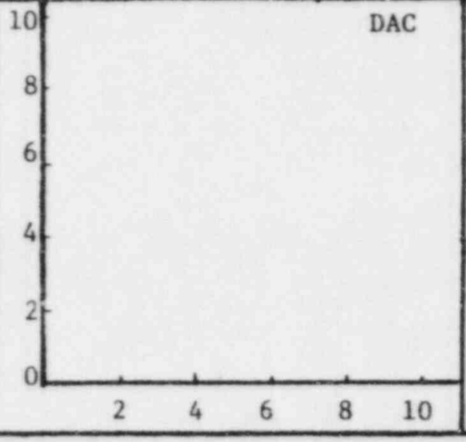
Field Changes:
Yes____ No____
If Yes, Number

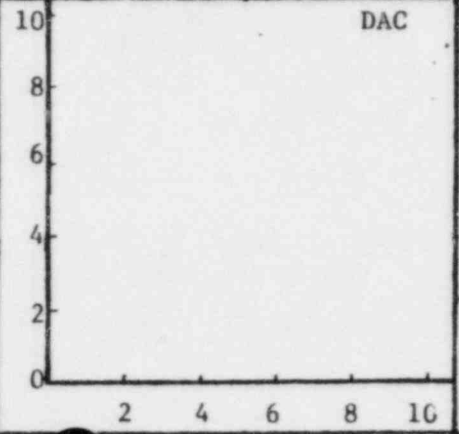
Transducer	0°	45°	60°
S/N			
Size			
Frequency			
Beam Angle			

Instrument			
Mfgr.		Model	
S/N		RepRate	
Reject		Filter	
Damp		Coax	
Freq.		Video	

Calibration 0°			2 & 5 Scan				7 & 8 Scan				Calibration Checks					
					Sound Entry Point To:				Sound Entry Point To:		0°		45°		60°	
Calibration Reflector Location	Signal Amp.	Sweep	Signal Amp.	Sweep	Scribe Line	50% DAC	Signal Amp.	Sweep	Scribe Line	50% DAC	In	Out	In	Out	In	Out
					▨	▨			▨	▨						
Ref. dB					▨	▨			▨	▨						







Additional Comments/Sketch

Figure 11

The Virginia Corp. of Richmond

Ultrasonic Examination Report - Continuation Sheet

Page of

Customer
Plant
Unit
Loop/ Zone
Iso/Drawing No.
Procedure
Exam Surface
Examiner/Level
VCR Supervisor
Date
Component/Piping System
Pipe Size
Weld Type
Cal. Block
Couplant: Type & Batch #

Weld No.	▨	Base Metal Scan	Scan Direction				Inspection Limitations	Surface Condition		Examination Results		Remarks
			2	5	7 & 8	0		Base Metal	Weld	UT	Visual	

Form UT-101a

2/82

Figure 12

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Indication Record

Customer
Plant
Unit
Loop / Zone

Procedure
Examiner/Level
VCR Supervisor
Date

Component/Piping System
ISO Drawing No.
Cal. Standard No./Thickness

Weld No.	Ind No.	Max.% DAC	Indication Length		Minimum Depth		Maximum Depth		Beam Angle	Beam Dir.	Base Metal Thickness 2 Side	Weld Thick.	Base Metal Thickness 5 Side	Remarks
			From	To	S.U. Pos.	Sweep Reading	S.U. Pos.	Sweep Reading						

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MANUAL ULTRASONIC EXAMINATION OF CIRCUMFERENTIAL AND LONGITUDINAL BUTT WELDS IN CLAD FERRITIC VESSELS AND CLASS 1 LOOP PIPING

Procedure No.: ISI 2.3

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING

This Document is:

☑ Reviewed Without Comments

☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.

☐ Rejected: Revise and Resubmit.

NOTE:

Review of this document, with or without comments, is for general conformance with the applicable specifications only and in no way relieve the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.

BY: J. J. Gonzalez
DATE: 4-18-83

Rev. 0 **Date:** 2/10/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by: Marvin M. Persinger

Rev. 1 **Date:** 3/1/83
Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: James H Dickinson Lvl II 4/18/83 4/21/83

Rev. ______ **Date:** ______
Prepared by: ______
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Reviewed by: ______
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Customer: ______

Rev. ______ **Date:** ______
Prepared by: ______
Reviewed by: ______
Reviewed by: ______
Customer: ______

The Virginia Corporation
of Richmond

Proc. No. ISI 2.3 Rev. 1

Date: 3/1/83 Page 1 of 19

1.0 Scope

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 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 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.

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.

4.2 The identity and location of welds to be examined shall be as 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.

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.

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.

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 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.

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 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-examined.

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.

6.3 Straight Beam Calibration for Base Metal

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 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.

6.4.2 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.

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.

6.5 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.

6.5.2.1, continued

(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).

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).

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 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

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.

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 Beam 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.

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 ½T 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

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.

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. 1

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 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. 1

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.

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.

Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

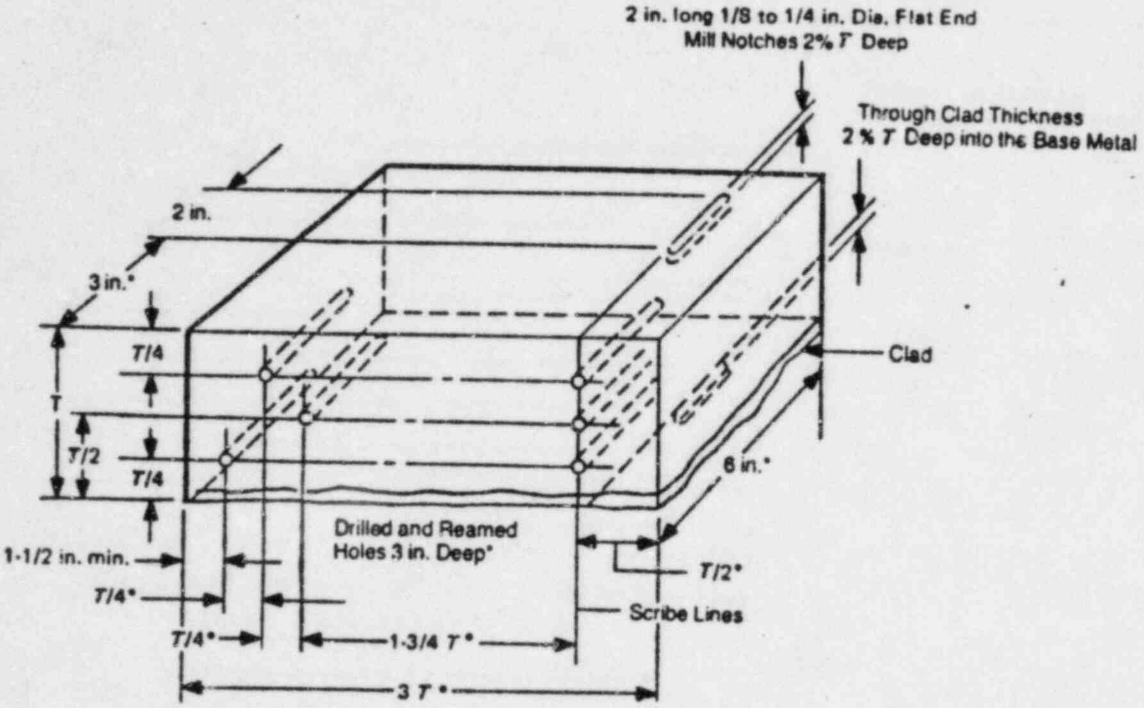
Angle Beam Examination*

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

Straight Beam Examination*

Nominal Pipe Diameter	Transducer	
	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.



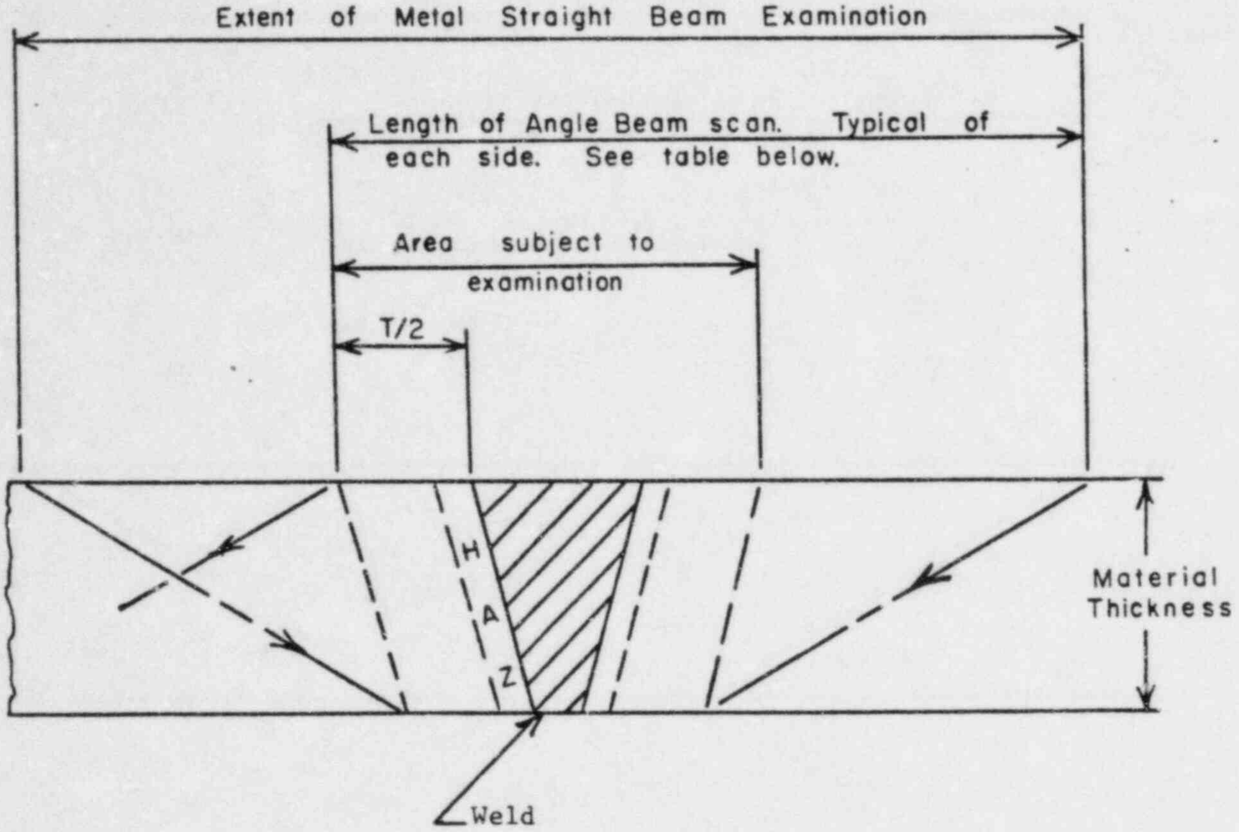
Weld Thickness (t)	Basic Calibration Block Thickness (T)	Hole Diameter ***
Over 2 in. thru 4 in.	3 in. or t	3/16 in.
Over 4 in. thru 6 in.	5 in. or t	1/4 in.
Over 6 in. thru 8 in.	7 in. or t	5/16 in.
Over 8 in. thru 10 in.	9 in. or t	3/8 in.
Over 10 in. thru 12 in.	11 in. or t	7/16 in.
Over 12 in. thru 14 in.	13 in. or t	1/2 in.
Over 14 in.	**	**

* Minimum dimensions.

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

*** The tolerances for hole diameters shall be ± 1/32 in.
The tolerances on notch depth shall be +10 and -20%.
The tolerance on hole location through the thickness shall be ± 1/8.
The perpendicular tolerance on notch reflecting surface shall be ± 2 degrees.

"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	45°	60°
2.5"	3.75	5.75
3"	4.5	6.75
3.5"	5.25	8.0
4"	6.0	9.0
4.5"	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

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Customer	Plant	Unit	Loop/Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block #	Couplant: Type____ Batch No.____

Continuation Sheet Attached
____Yes ____No

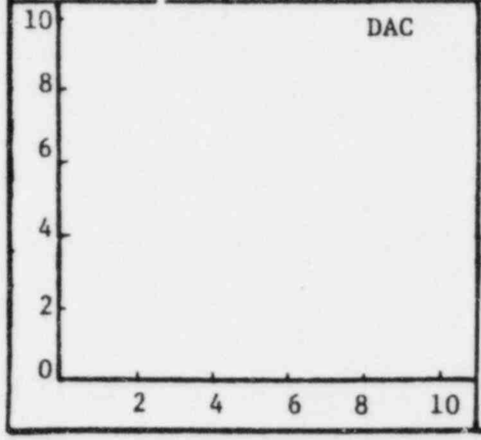
Field Changes:
Yes______ No______
If Yes, Number

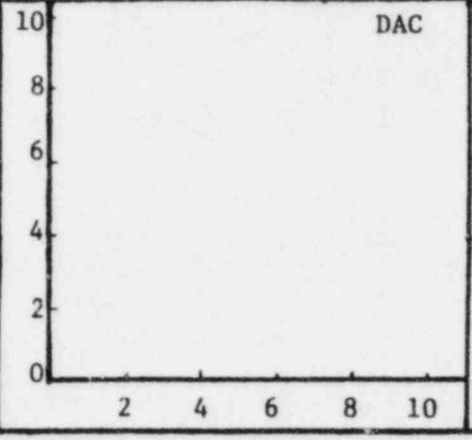
Transducer	0°	45°	60°
S/N			
Size			
Frequency			
Beam Angle			

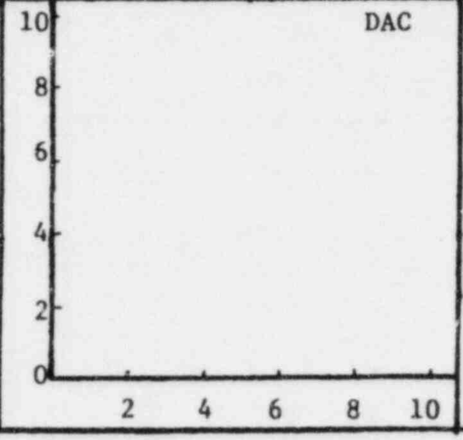
Instrument

Mfgr.		Model	
S/N		RepRate	
Reject		Filter	
Damp		Coax	
Freq.		Video	

Calibration 0°			2 & 5 Scan				7 & 8 Scan				Calibration Checks					
					Sound Entry Point To:				Sound Entry Point To:		0°		45°		60°	
Calibration Reflector Location	Signal Amp.	Sweep	Signal Amp.	Sweep	Scribe Line	50% DAC	Signal Amp.	Sweep	Scribe Line	50% DAC	In	Out	In	Out	In	Out
Ref. dB																







Additional Comments/Sketch

Form UT-101

2/82

Figure 5

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of Richmond

Ultrasonic Examination Report - Continuation Sheet

Page of				
Customer	Plant	Unit	Loop/ Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block	Couplant: Type & Batch #

Weld No.	▨	Base Metal Scan	Scan Direction				Inspection Limitations	Surface Condition		Examination Results		Remarks
			2	5	7 & 8	0		Base Metal	Weld	UT	Visual	

Figure 6

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Indication Record

Customer	Plant	Unit	Loop / Zone
Procedure	Examiner/Level	VCR Supervisor	Date
Component/Piping System	ISO Drawing No.	Cal. Standard No./Thickness	

Weld No.	Ind No.	Max.% DAC	Indication Length		Minimum Depth		Maximum Depth		Beam Angle	Beam Dir.	Base Metal Thickness 2 Side	Weld Thick.	Base Metal Thickness 5 Side	Remarks
			From	To	S.U. Pos.	Sweep Reading	S.U. Pos.	Sweep Reading						

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: ULTRASONIC EXAMINATION OF STUDS AND BOLTS

Procedure No.: ISI 2.4

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES
INCORPORATED

QUALITY
ASSURANCE
ENGINEERING

This Document is:

☑ Reviewed Without Comments

☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.

☐ Rejected: Revise and Resubmit

NOTE:

Review of this document, with or without comments, is for general conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.

BY:

DATE: 4-13-83

Rev. 0 Date: 2/10/82	Rev. Date:
Prepared by: Thomas B Munson	Prepared by:
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Reviewed by:	Reviewed by:
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Customer:	Customer:

The Virginia Corporation
of Richmond

Proc. No. ISI 2.4 Rev. 1

Date: 3/1/83 Page 1 of 9

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. 1

2.0 References

2.1 1977 Edition of ASME Boiler and Pressure Vessel Code, 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.

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.

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 ISI 2.5 prior to use at the Waterford 3 site. Qualifications may be valid for a period not to exceed three months.

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.

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 ½ the length of the stud or bolt to be examined.

6.1.3 The temperature difference between the examination surface and basic calibration block surface shall not exceed 25° F.

6.2 Sweep range calibration

6.2.1 Position the transducer on the calibration block to obtain a clear reflection from notch "A" of Figure 2.

6.2.2 Using notch "A" reflector, adjust the delay and range controls so that the notch reflector is at sweep position 1.2.

6.2.3 Position the first back reflection at sweep position 6.6 on the screen with the delay control.

6.2.4 Repeat delay and range control adjustments until the reflectors start at their respective positions. The sweep is now set for 100% coverage of the calibration block length.

6.3 Distance amplitude correction

6.3.1 Position the transducer over notch "A".

6.3.2 Adjust the sensitivity control to provide an 80% full screen height (FSH) indication from notch "A". Mark the peak of the indication on the screen with a grease pencil or other suitable marker. This will correspond to DAC point "A" on the data sheet.

6.3.3 Position the transducer over notch position "B" of Figure 2.

6.3.4 Without changing the sensitivity control, mark the peak of this indication on the screen. This will correspond to DAC point "B" on the data sheet.

6.3.5 Connect the screen marks and extrapolate point "A" through the end of the calibration block to provide a smooth DAC curve. Record the reference dB on the data sheet for DAC point "A". This is the primary reference level for the first half of the stud length.

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, 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.

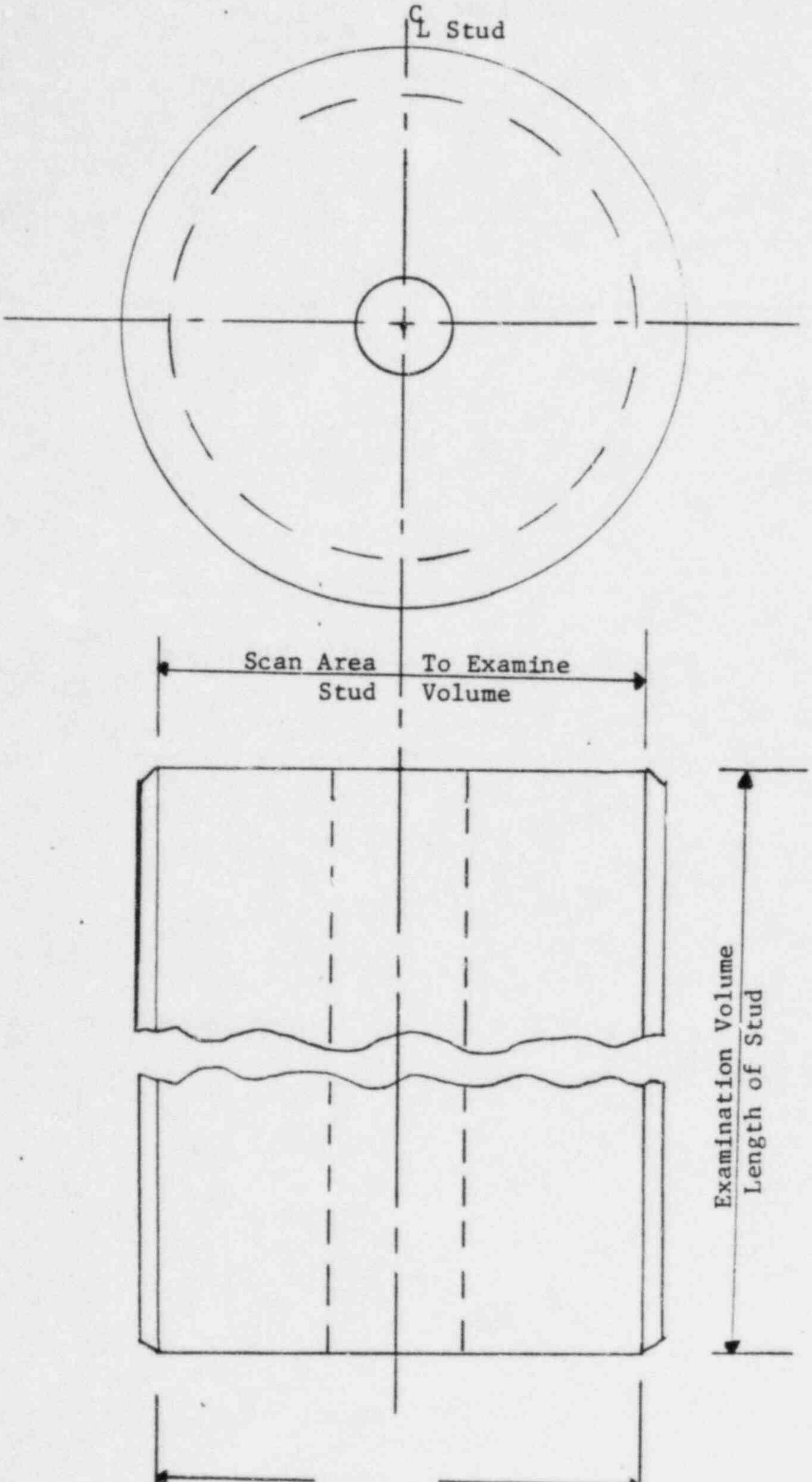
8.2 Indications that are 50% of DAC or more shall be evaluated and recorded on the ultrasonic indication report to the extent that shape, orientation, location, and possible identity of the indication producing area can be assessed. The extremities of the discontinuity shall be defined as the points 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.

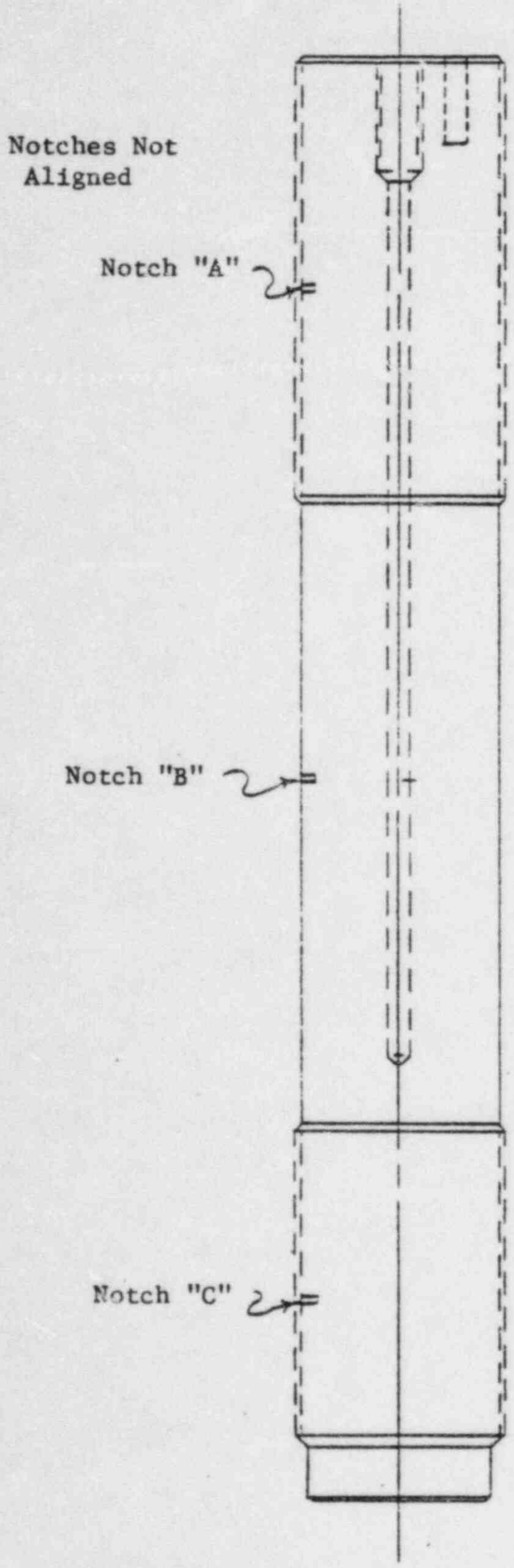
8.4 In the event that reportable indications are detected on items that are not permanently identified with a unique designation, the item shall be securely tagged or positively identified.

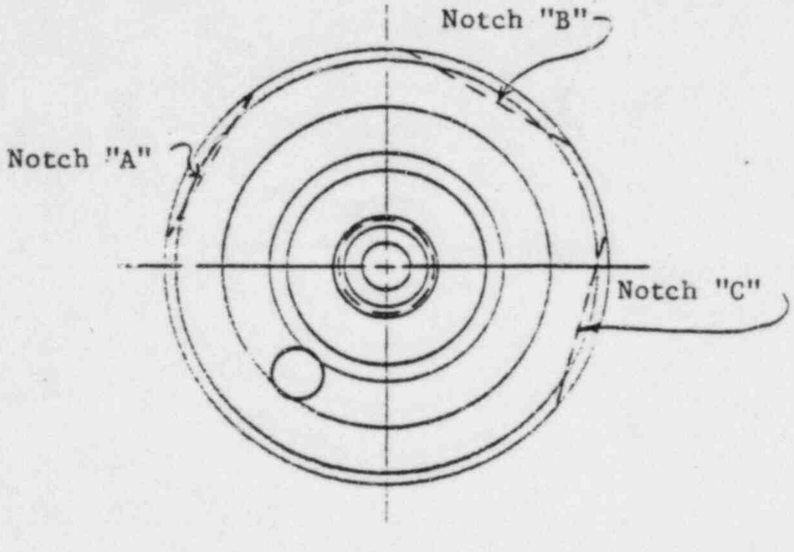
9.0 Documentation of examination

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



Volume of Examination
Figure 1





NOTCH DIMENSIONS

BOLT OR STUD SIZE	MAX. NOTCH DIMENSIONS	
	DEPTH (IN.)*	AREA (IN.^{2})
≥4 IN. DIAMETER	0.157	0.059
2 IN. TO 4 IN. DIAMETER	0.107	0.027

* NOTE:
NOTCH DEPTH TO BE MEASURED FROM THE BOTTOM OF THE THREAD ROOT TO BOTTOM OF NOTCH.

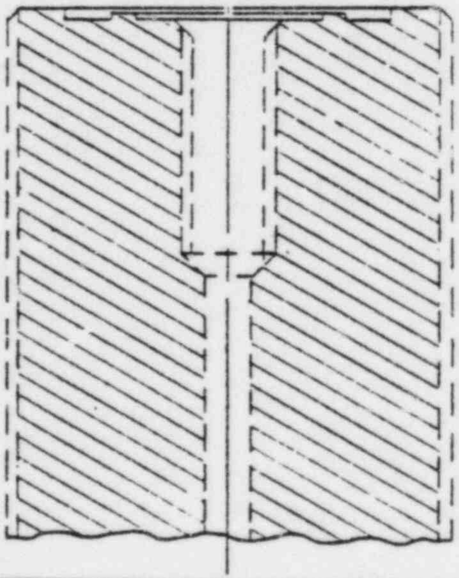


Figure 2

Figure 3

The Virginia Corp.
OF RICHMOND

ISI 2.4

1

ULTRASONIC DATA SHEET
FOR
STUDS & BOLTS

Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Level		Date
Component/Piping System	ISO Drawing No.	VCR Supervisor	

CALIBRATION BLOCK	**TRANSDUCER**	**INSTRUMENT**	
Cal. Block No.	S/N	Manu.	Model
CALIBRATION SURFACE	Size	S/N	Rep Rate
Flat End	Freq	Reject	Filter
Groved End	Beam Angle	Damp	Couplant Batch No.
Other:	Wave Mode	Freq	
	Long ☐ Shear ☐	Video	Coax

CALIBRATION

DAC Point "A"____________%FSH REF DB____________. Sweep Position________

DAC Point "B"____________%FSH Sweep Position________

DAC Point "C"____________%FSH REF DB____________ Sweep Position________

DAC Point "D"____________%FSH Sweep Position________

Signal To Noise Ratio __________ : __________

Calibration Checks	
IN	OUT
IN	OUT
IN	OUT

EXAMINATION RESULTS

ITEM NO.	RESULTS		COMMENTS	VISUAL	
	NRI	RI		SATIS	UNSAT

VCR Form—UT-103 (rev. 1, 8/82)

Figure 4

The
Virginia Corp.
of Richmond

ISI 2 [illegible]

Ultrasonic Indication Record
for
Studs & Bolts

Customer	Plant	Unit	Loop /Zone
Procedure	Examiner/Level		Date
Component/Piping System	Iso/Drawing No.	VCR Supervisor	

Indication Signal Amplitude ______________

Indication Depth ______________

Indication Location ____

____

____

Indicate by sketch below approximate location of indication.

Form UT-104

2/82

The
Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: ULTRASONIC THICKNESS MEASUREMENT

Procedure No.: IS. 2.5

Plant Site: Waterford No. 3

Customer: Louisiana Power and Lig...
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES
INCORPORATED
QUALITY
ASSURANCE
ENGINEERING

This Document is:

☑ Reviewed Without Comments
☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.
☐ Rejected: Revise and Resubmit.

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Review of this document, with or without comments, is for general conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.

BY:
DATE: 4-18-83

Rev. 0 **Date:** 2/10/82	**Rev.** 1 **Date:** 3/1/83
Prepared by: Thomas B Munson	**Prepared by:** Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III	**Reviewed by:** Thomas B Munson Lvl III
Reviewed by:	**Reviewed by:**
	Customer: James G Dickinson Lvl III 4/18/83 4/21/83
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer:	**Customer:**
Rev. **Date:**	**Rev.** **Date:**
Prepared by:	**Prepared by:**
Reviewed by:	**Reviewed by:**
Reviewed by:	**Reviewed by:**
Customer:	**Customer:**

The Virginia Corporation
of Richmond

Proc. No. ISI 2.5 Rev. 1
Date: 3/1/83 Page 1 of 6

1.0 Scope

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 pulse-echo 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

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-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 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.

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 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 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 ¼" 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.

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.

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.

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.

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.

6.2.4 Place the transducer on the thinner section of calibration material and, by using the sweep delay, adjust the sweep position so that the first back reflection signal is at the appropriate graticule for the desired screen range.

6.2.5 Place the transducer on the thicker section of calibration material and, by using the sweep range control, adjust the sweep position so that the first back reflection signal is at the appropriate graticule for the desired screen range.

6.2.6 Continue steps 6.2.4 and 6.2.5 until no further adjustment is necessary.

6.3 Calibration When Only One Material Thickness is Used for Calibration (Alternate Method)

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

6.3.2 Select the appropriate frequency and range control settings.

6.3.3 Place the transducer on the calibration material and, by using the sweep delay, adjust the sweep so that the first back reflection signal is at the appropriate graticule for the desired screen range.

6.3.4 With the transducer on the same material, adjust the sweep range control so that the second back reflection is at the appropriate graticule.

6.3.5 Continue steps 6.3.3 and 6.3.4 until no further adjustment is necessary.

6.4 Calibration Verification

6.4.1 A calibration check, which is the verification of sweep range calibration, shall be performed at the beginning of each set of thickness measurements covered by the same calibration block(s), and with any change in examination personnel.

6.4.2 If any point in the sweep range calibration is 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 Thickness is then read directly off the screen in inches and shall be read to the nearest 1% of full screen sweep.

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. 1

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.

Figure 1

The Virginia Corp. of Richmond

ISI 2.5

Ultrasonic Data Sheet for Thickness Measurement

Customer	Plant	Unit	Loop/Zone

Component/Piping System	Examiner/Level	Date

Procedure	Iso/Drawing No.	VCR Supervisor	Continuation Sheet Attached [ ] Yes [ ] No

Equipment

Instrument	Transducer		Calibration
Mfgr.	Mfgr.	Size	Cal. Block
Model			Cal. Block
S/N	Freq.		Range Cal.
Reject			Calibration Checks
Damp.	Serial No.		
Freq.			
Rep. Rate	Coax. Cable		
Filter			
Video	Gain		
Couplant			

Examination Results

Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5	Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5

Sketch/Identification

The Virginia Corp. of Richmond

Figure 2

ISI 2.5

Ultrasonic Data Sheet for Thickness Measurement

Continuation Page __ of __

Customer	Plant	Unit	Loop/Zone
Component/Piping System	Examiner/Level	Date	
Procedure	Iso/Drawing No.	VCR Supervisor	

Examination Results

Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5	Weld Number	Meas. Point	Reading Weld	Reading Scan 2	Reading Scan 5

Sketch/Identification

Form UT-105a

2/82

The Virginia Corp. of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MANUAL ULTRASONIC EXAMINATION OF STEAM GENERATOR STAY CYLINDER WELDS

Procedure No.: ISI 2.6

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING

This Document is:

☑ Reviewed Without Comments

☐ Reviewed With Comments as Noted: Incorporate Comments, and Resubmit: Proceed with order.

☐ Rejected. Revise and Resubmit.

NOTE:
Review of this document, with or without comments, is for general conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.

BY:
DATE: 4-13-83

Rev. 0 **Date:** 5/26/82
Prepared by: Thomas B Munson
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Rev. 1 **Date:** 7/15/82
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The Virginia Corporation
of Richmond

Proc. No. ISI 2.6 Rev. 3
Date: 3/1/83 Page 1 of 24

1.0 Scope

1.1 This procedure is applicable to, and describes, the requirements for manual ultrasonic examination of steam generator stay cylinder welds for Waterford 3. 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 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, 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.

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.

4.2 The identity of welds to be examined shall be as designated in reference 2.5.

4.3 The location and configuration of welds to be examined shall be as shown in figures 3, 4, 5, 6, and 7.

4.4 The examinations conducted in accorance with this procedure shall be performed from the I.D. (non-clad) surface using contact methods.

4.5 Calibration shall be performed from the side of the calibration block which corresponds to the I.D. (non-clad) surface of the steam generator stay cylinder. The calibration/examination surface shall be noted on the reports.

4.6 Examination 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. Where other pairs of angles are used, the measured difference between the angles shall be at least 10 degrees. A 0° 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 A-scan pulse echo type, equipped with a stepped gain control, calibrated in units of 2dB 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.

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.

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 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.

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 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.

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 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-examined.

6.2.5 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.

6.3 Straight Beam Calibration for Base Metal

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 ¼T 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 ¼T and 3/4T hole reflections start at sweep lines 2 and 6.

Note: Other sweep positions may be used for material with varying thickness. 3

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.

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.

6.5 Angle Beam Calibration

6.5.1 Sweep Range Calibration

6.5.1.1 Position the search unit for the maximum response from the ¼T 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 ¼T and 3/4T hole reflections start at sweep lines 2 and 6 respectively.

Note: Other sweep positions may be used for material with varying thickness. 3

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 ¼T.

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.

(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). 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. 3

(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.

6.5.2.3 (c) Connect the screen marks and extrapolate through the thickness (¼T on each side) to provide a smooth DAC curve. This shall be the primary reference level. 3

(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 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

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.

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.

7.3 Angle Beam Examination for Reflectors Parallel to the Weld

7.3.1 The primary scan for reflectors parallel to the weld shall be ½ node from both sides of the weld.

7.3.2 If it is impossible to examine the required material with a ½ 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 Figures 4, 5, 6, and 7).

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 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.

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 ½ 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 ½T 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

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.

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.

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.

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

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 recordable indications shall be reported in accordance with reference 2.[illegible], and on forms similar to those shown in Figures 8, 9, and 10.

Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

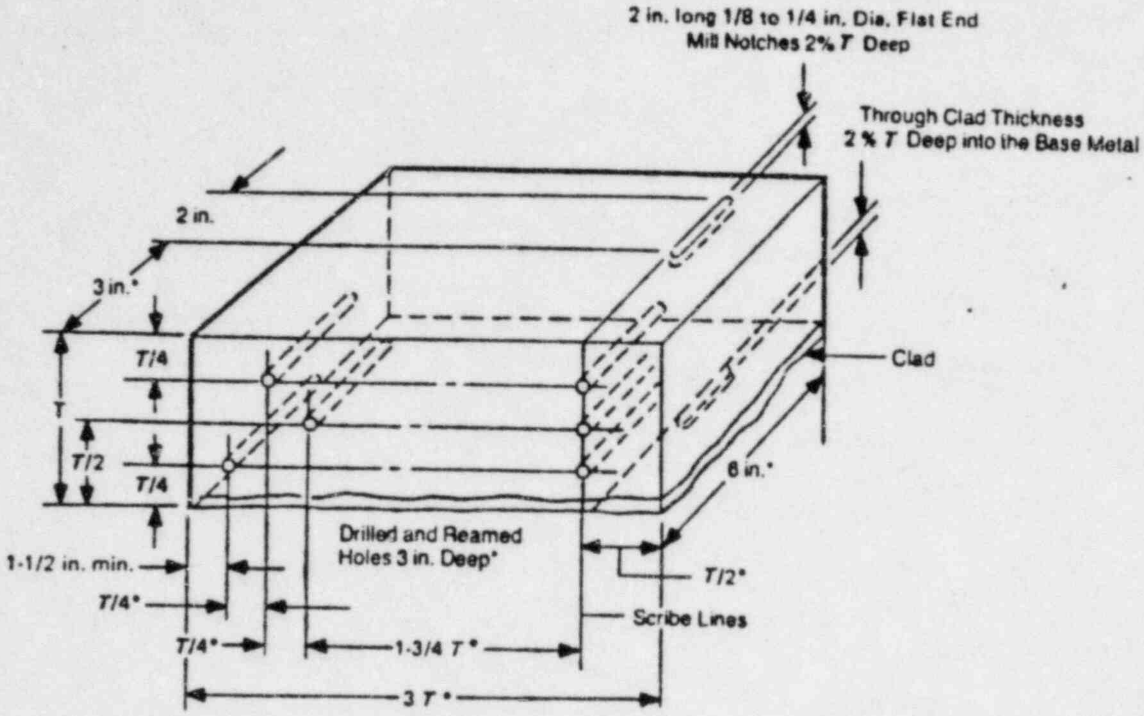
Angle Beam Examination*

Nominal Material Thickness	Transducer			
	Maximum Size	Nominal Frequency	Nominal Angles	
.25" to .40"	1/4" dia. or 1/4" x 1/4"	2.25 MHZ	45°	60°
>.40" to 1.00"	1/2" dia. or 1/2" x 1/2"	2.25 MHZ	45°	60°
>1.00" to 1.20"	3/4" dia. or 3/4" x 3/4"	2.25 MHZ	45°	60°
> 1.20"	1-1/8" dia. or 1" x 1"	2.25 MHZ	45°	60°

Straight Beam Examination*

Nominal Pipe Diameter	Transducer	
	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.



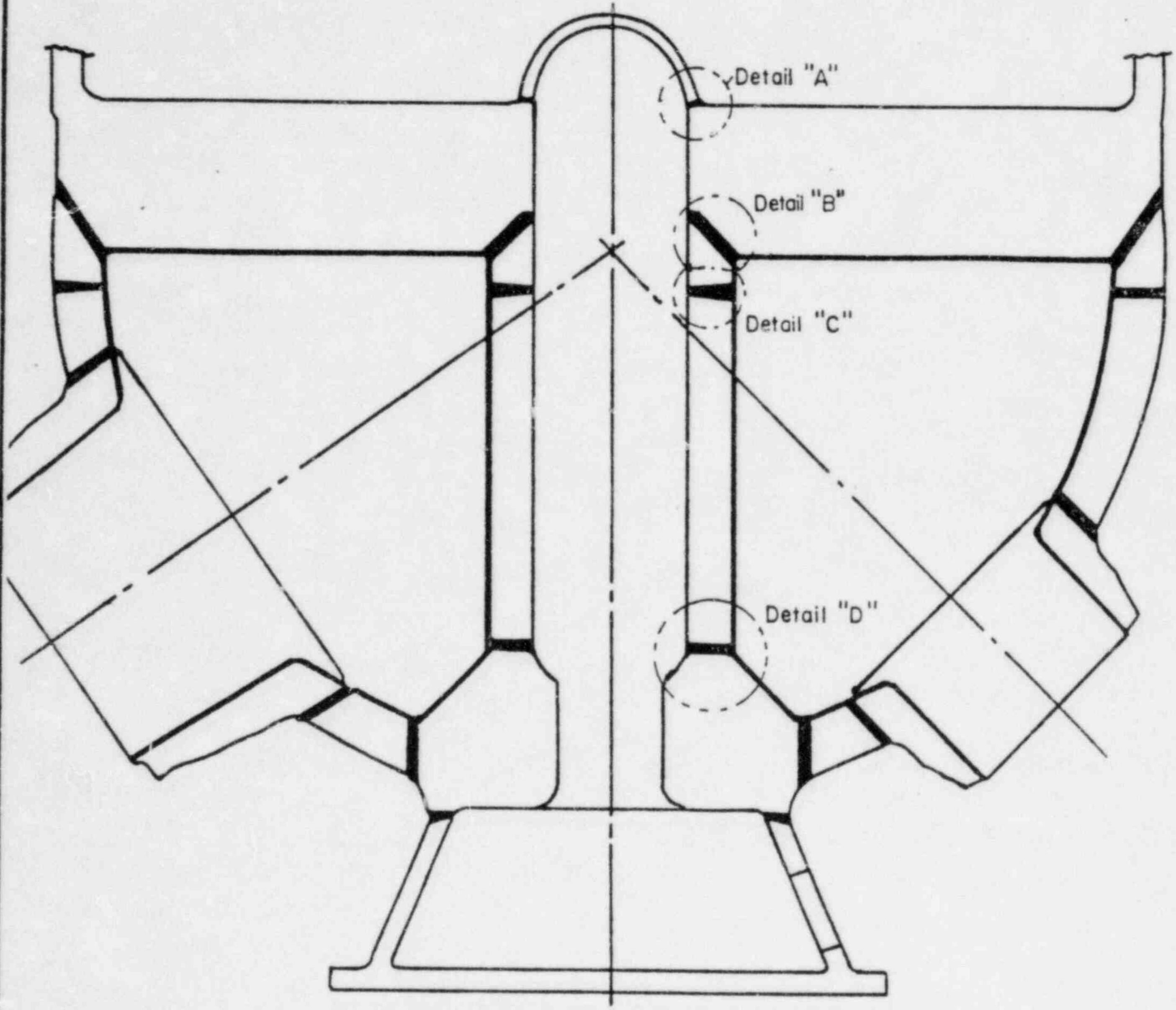
Weld Thickness (t)	Basic Calibration Block Thickness (T)	Hole Diameter ***
Over 2 in. thru 4 in.	3 in. or t	3/16 in.
Over 4 in. thru 6 in.	5 in. or t	1/4 in.
Over 6 in. thru 8 in.	7 in. or t	5/16 in.
Over 8 in. thru 10 in.	9 in. or t	3/8 in.
Over 10 in. thru 12 in.	11 in. or t	7/16 in.
Over 12 in. thru 14 in.	13 in. or t	1/2 in.
Over 14 in.	**	**

* Minimum dimensions.

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

*** The tolerances for hole diameters shall be ± 1/32 in.
The tolerances on notch depth shall be +10 and -20%.
The tolerance on hole location through the thickness shall be ± 1/8.
The perpendicular tolerance on notch reflecting surface shall be ± 2 degrees.

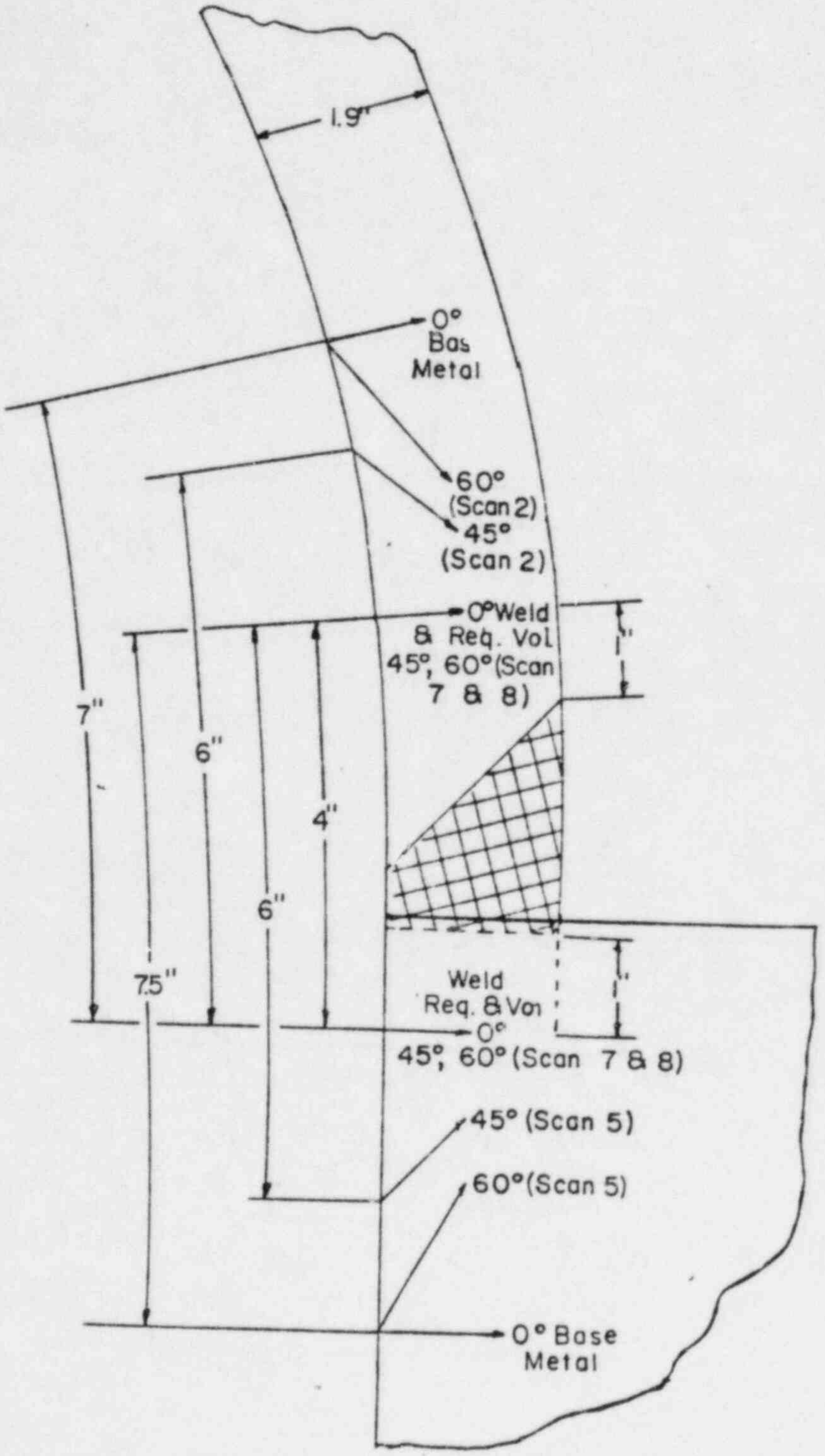
"ILLUSTRATIVE ONLY"
Typical Calibration Block
Figure 2



"Illustrative Only"

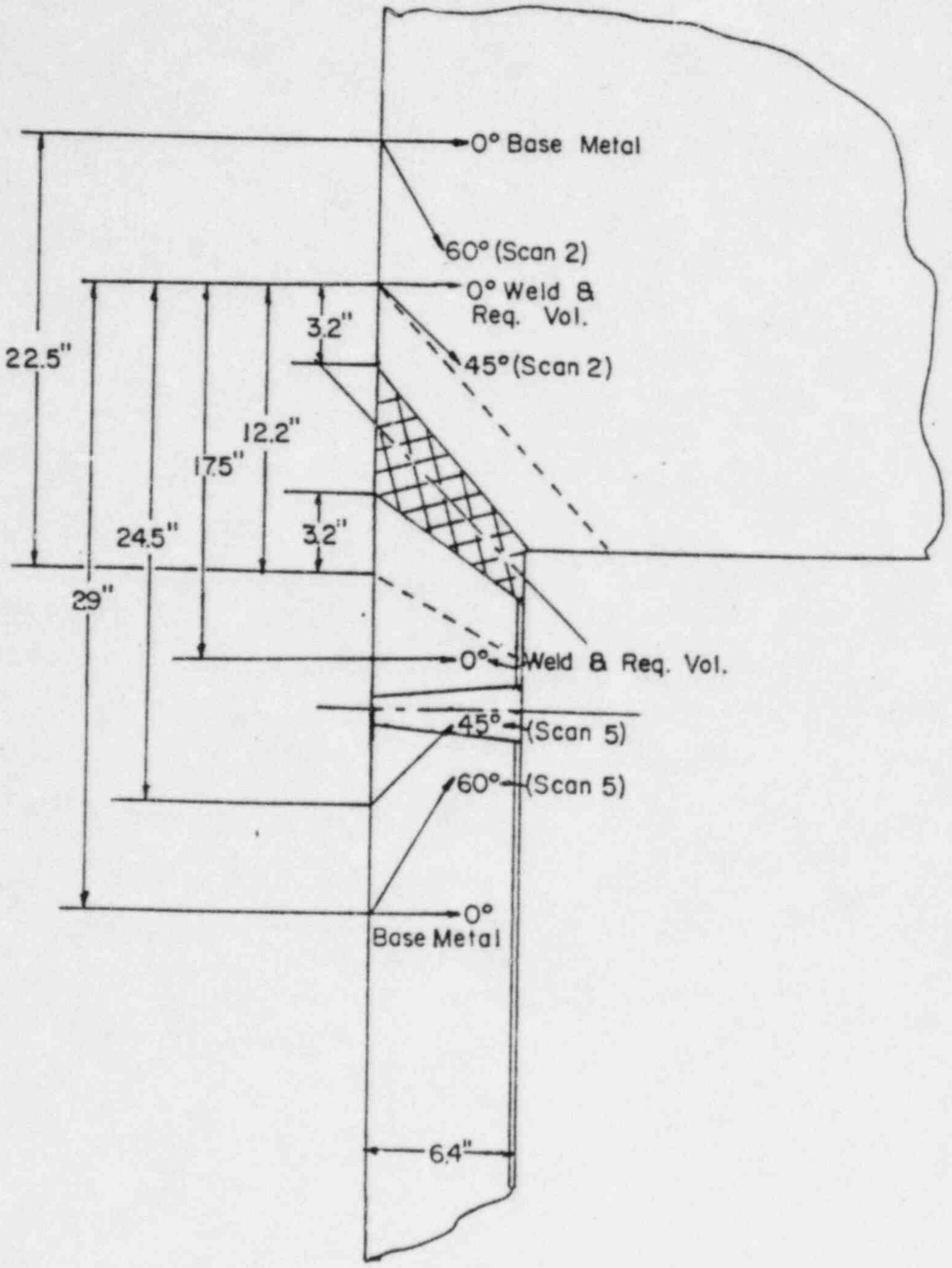
General Layout - Steam Generator Support Cylinder Welds

Figure 3



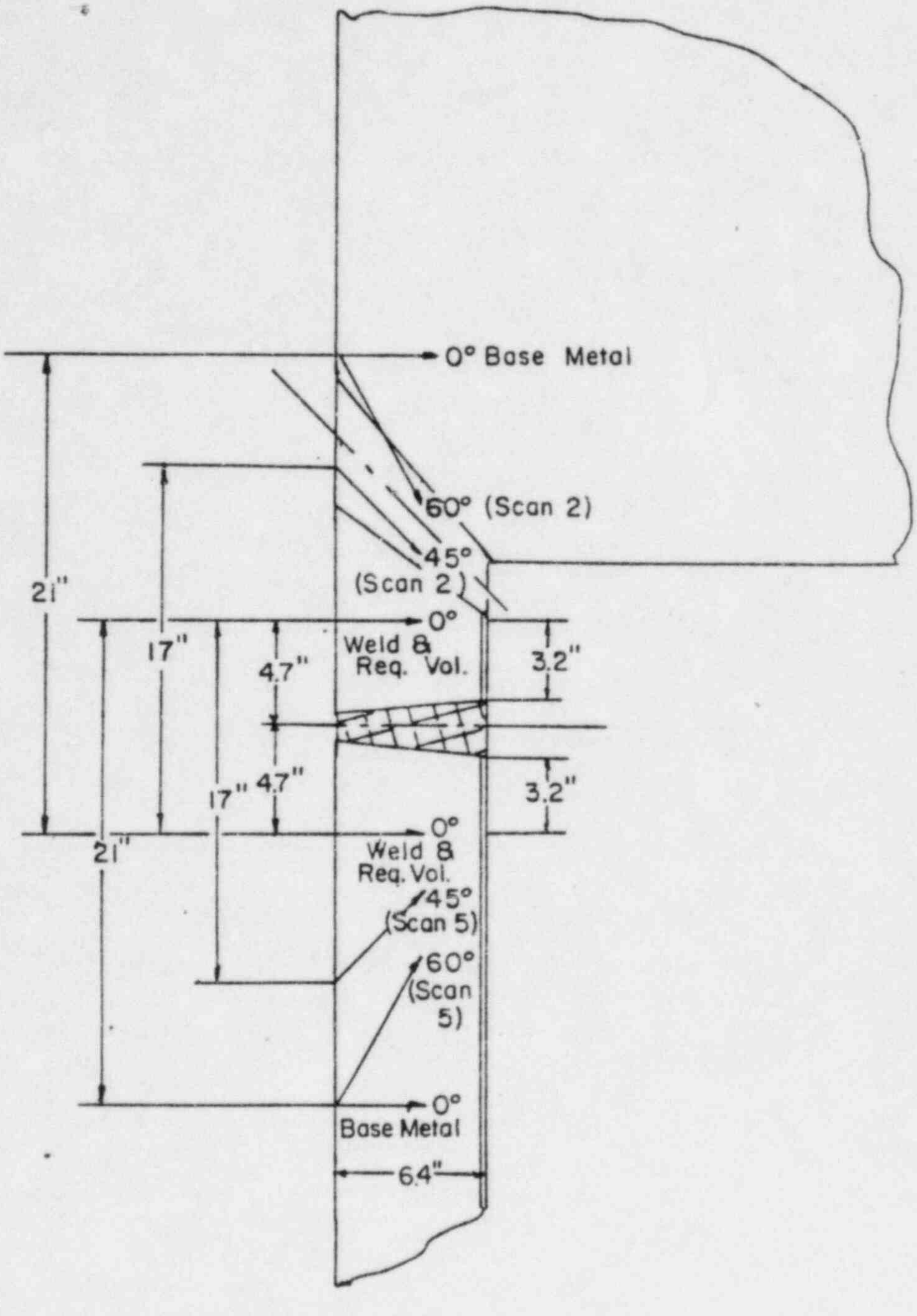
Detail "A"

Figure 4
(Minimum Scan Lengths)



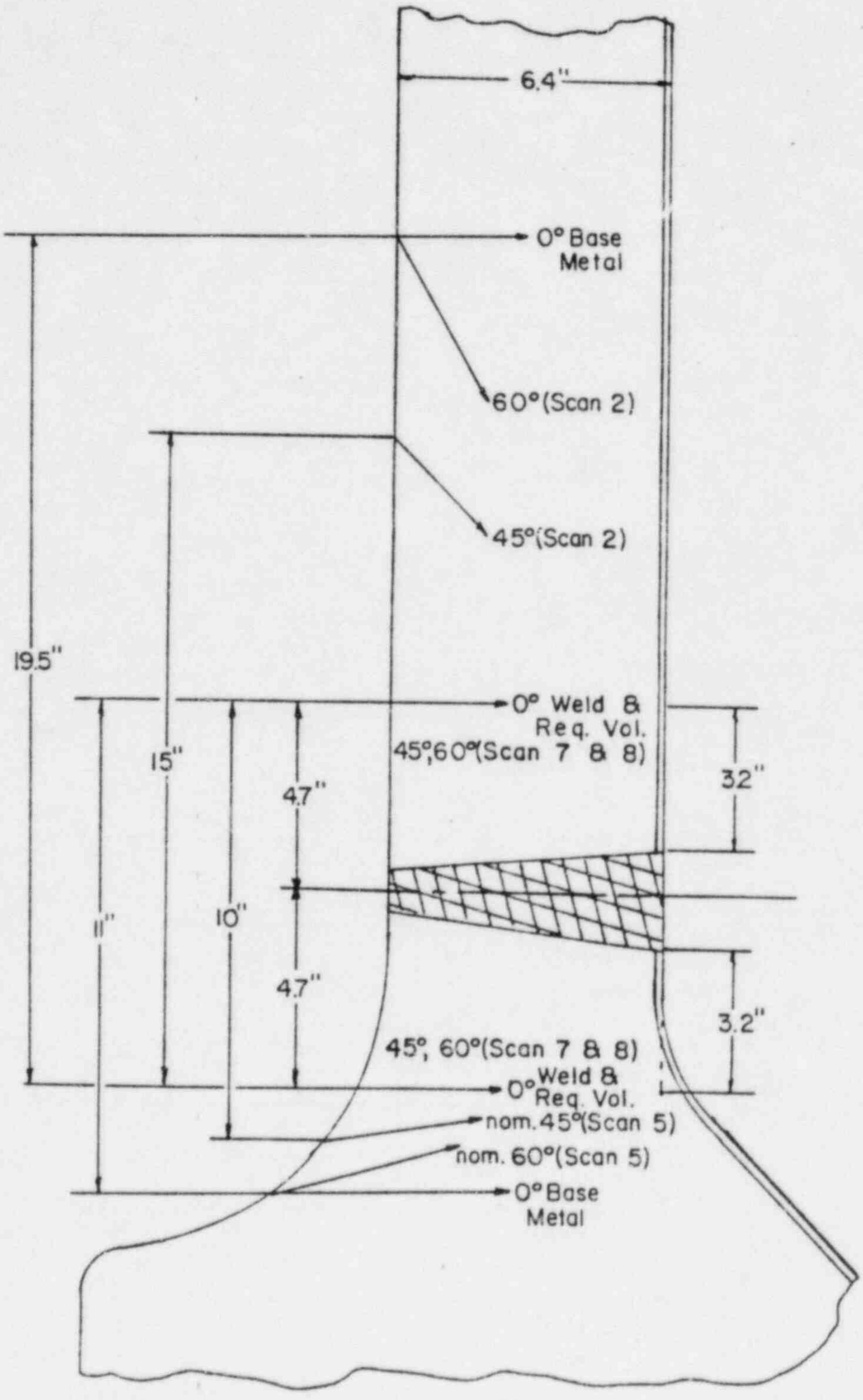
Detail "B"

Figure 5
(Minimum Scan Lengths)



Detail "C"

Figure 6
(Minimum Scan Lengths)



Detail "D"

Figure 7
(Minimum Scan Lengths)

Figure 8

The
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Ultrasonic Examination Report

Customer	Plant	Unit	Loop/Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block #	Couplant: Type____ Batch No.____

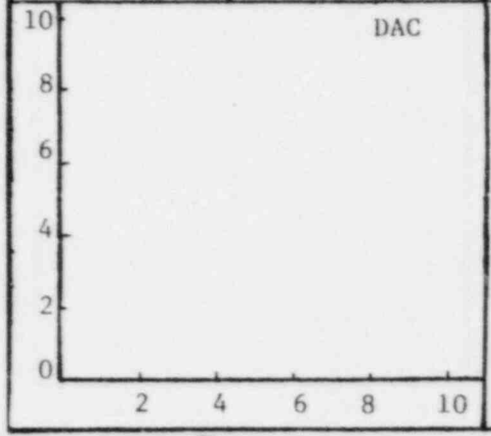
Continuation Sheet Attached
____Yes ____No

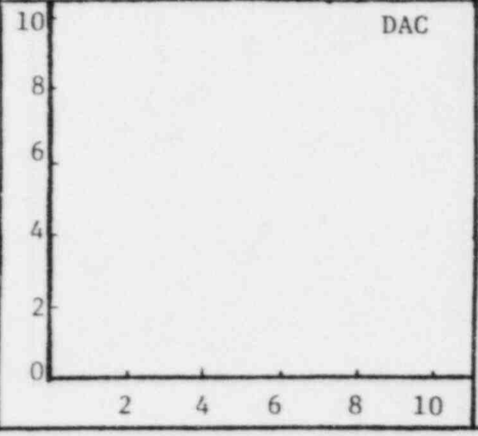
Field Changes:
Yes____ No______
If Yes, Number

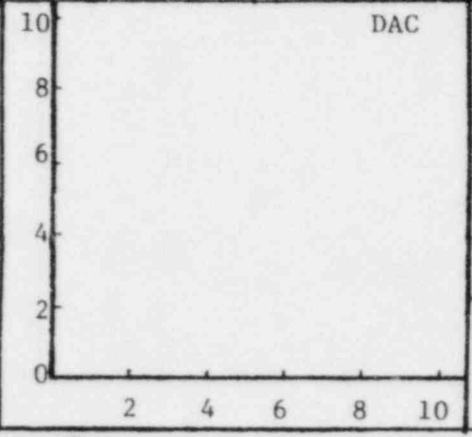
Transducer	0°	45°	60°
S/N			
Size			
Frequency			
Beam Angle			

Instrument			
Mfgr.		Model	
S/N		RepRate	
Reject		Filter	
Damp		Coax	
Freq.		Video	

Calibration 0°			2 & 5 Scan				7 & 8 Scan				Calibration Checks					
					Sound Entry Point To:				Sound Entry Point To:		0°		45°		60°	
Calibration Reflector Location	Signal Amp.	Sweep	Signal Amp.	Sweep	Scribe Line	50% DAC	Signal Amp.	Sweep	Scribe Line	50% DAC	In	Out	In	Out	In	Out
Ref. dB																







Additional Comments/Sketch

Form -101

2/82

Figure 9

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Ultrasonic Examination Report - Continuation Sheet

Page of

Customer	Plant	Unit	Loop/ Zone	Iso/Drawing No.

Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date

Component/Piping System	Pipe Size	Weld Type	Cal. Block	Couplant: Type & Batch #

Weld No.	▨	Base Metal Scan	Scan Direction				Inspection Limitations	Surface Condition		Examination Results		Remarks
			2	5	7 & 8	0		Base Metal	Weld	UT	Visual	

The Virginia Corp. of Richmond

Figure 10

Ultrasonic Examination Report

Indication Record

Customer	Plant	Unit	Loop / Zone
Procedure	Examiner/Level	VCR Supervisor	Date
Component/Piping System	ISO Drawing No.	Cal. Standard No./Thickness	

Weld No.	Ind No.	Max.% DAC	Indication Length		Minimum Depth		Maximum Depth		Beam Angle	Beam Dir.	Base Metal Thickness 2 Side	Weld Thick.	Base Metal Thickness 5 Side	Remarks
			From	To	S.U. Pos.	Sweep Reading	S.U. Pos.	Sweep Reading						

2/82

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MANUAL ULTRASONIC EXAMINATION OF FULL PENETRATION CIRCUMFERENTIAL AND LONGITUDINAL AUSTENITIC BUTT WELDS

Procedure No.: ISI 2.7

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B. Munson

Approved for Use Customer:

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INCORPORATED
QUALITY
ASSURANCE
ENGINEERING
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DATE: 04-13-83

Rev. 0 Date: 2/10/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by:

Rev. 1 Date: 3/1/83
Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: [illegible] 4/12/83 James H Dickson L III 4/21/83

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The Virginia Corporation of Richmond

Proc. No. ISI 2.7 Rev. 1

Date: 3/1/83 Page 1 of 27

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.

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.

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.

4.2 The identity and location of welds to be examined shall be as specified in reference 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. Other angles may be used where part geometry, access, or metallurgical characteristics impede effective use of 45 degree angle beam. A zero degree longitudinal beam shall be applied to all areas through which the angle beam must pass.

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 plant site. Qualifications may be valid for a period not to exceed three months.

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.

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.)

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 $\frac{1}{4}$T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the $\frac{1}{4}$T 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. 1

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 ($\frac{1}{4}$T 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.

6.3 Angle Beam Calibration for ½ Node Examination

6.3.1 The response from the ¼T and 3/4T side-drilled holes shall be used to establish the slope and the shape of the DAC curve in the following manner:

6.3.1.1 Position the search unit for the maximum response from the ¼T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ¼T hole is positioned at 2.0 on the graticule.

6.3.1.2 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.

6.3.1.3 Repeat steps 6.3.1.1 and 6.3.1.2 until no further adjustment is necessary.

6.3.1.4 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.

6.3.1.5 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.

6.3.1.6 Connect the screen marks and extrapolate through the thickness (¼T 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.

6.3.2 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 ¼T 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 ¼T and ½T holes and extrapolate up to ¼T 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 ½T hole to 80% FSH. Mark the peak of this signal on the screen and record the dB.

6.3.2.6 Position the search unit for the maximum response from the 3/4T hole. Without changing the sensitivity control, mark the peak of the indication on the screen.

6.3.2.7 Connect the screen marks for the ½T and 3/4T holes and extrapolate up to ¼T on each end to provide a smooth DAC curve. This shall be the primary reference level.

6.3.2.8 Adjust the sensitivity control to bring the 3/4T hole to 80% FSH. Mark the peak of this indication on the screen and record the dB.

6.3.2.9 With the 3/4T hole at 80% FSH position the search unit on the 7/8T hole and mark the peak of the indication. Connect the screen marks for the 3/4T hole and the 7/8T hole and extrapolate up to ¼T 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 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 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 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 80% of FSH. Mark the peak of the indication on the screen.

6.4.1.5 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.

6.4.1.6. Connect the screen marks and extrapolate the DAC at either end for a distance of ½T. This shall be the primary reference level.

6.5 Angle Beam Calibration for 1½ 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:

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.

6.5.1.2 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 graticule.

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

6.5.1.4 Position the search unit for the maximum response from the I.D. notch (1½ node). Check that the leading edge is at or near 9.0 on the graticule.

6.5.1.5 Position the search unit for the maximum response from the I.D. notch (½ node). Adjust the sensitivity control to 80% FSH. Mark the peak of the indication on the screen.

6.5.1.6 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.

6.5.1.7 Position the search unit for the maximum response from the I.D. notch (1½ 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 ½T. 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 ½ 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.

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.

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 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

7.2.1 If the angle beam examination is restricted to a full node or 1½ 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 overlap at least ten percent.

7.2.3 Calibration shall be as indicated in paragraph 6.2.

7.3 Angle Beam - Reflectors Parallel to the Weld

7.3.1 The primary scan for reflectors parallel to the weld shall be ½ node from both sides of the weld.

7.3.2 Full node or 1½ node shall only be used when it is impossible to examine the required material with a ½ 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 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. 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 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.

7.5 Extent of Examination

7.5.1 The volume subject to examination and extent of scan length shall be in accordance with Figures 6 and 7.

7.5.2 Butt welded branch connection welds shall be 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.

7.5.3 Longitudinal welds adjacent to circumferential 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.

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 Indications

8.1 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.

8.1.1 Any indication categorized as a flaw shall be recorded and reported in accordance with the requirements of reference 2.3. 1

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 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.

8.4 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.

Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

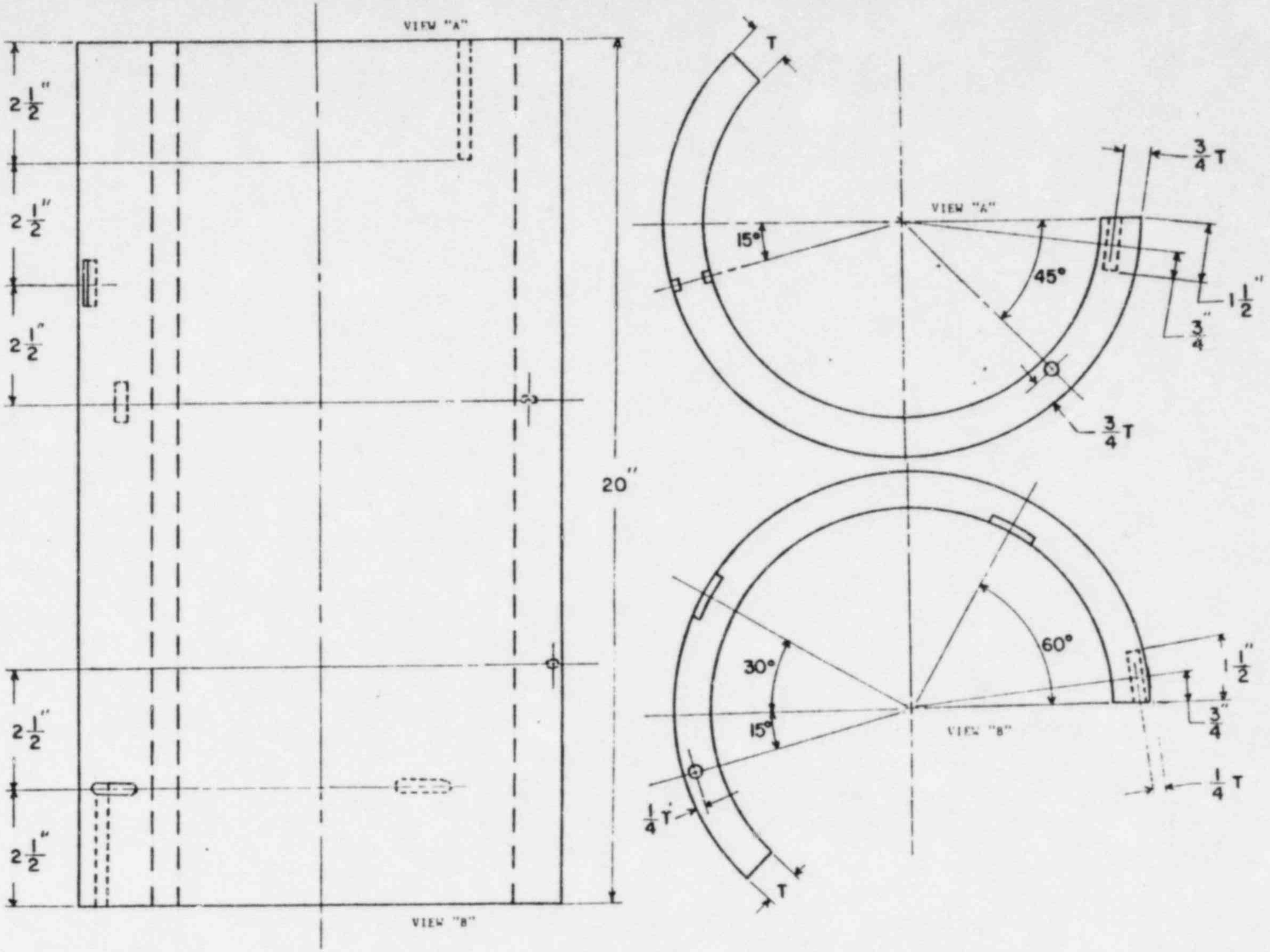
Angle Beam Examination*

Nominal Material Thickness	Transducer		
	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 Diameter	Transducer	
	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

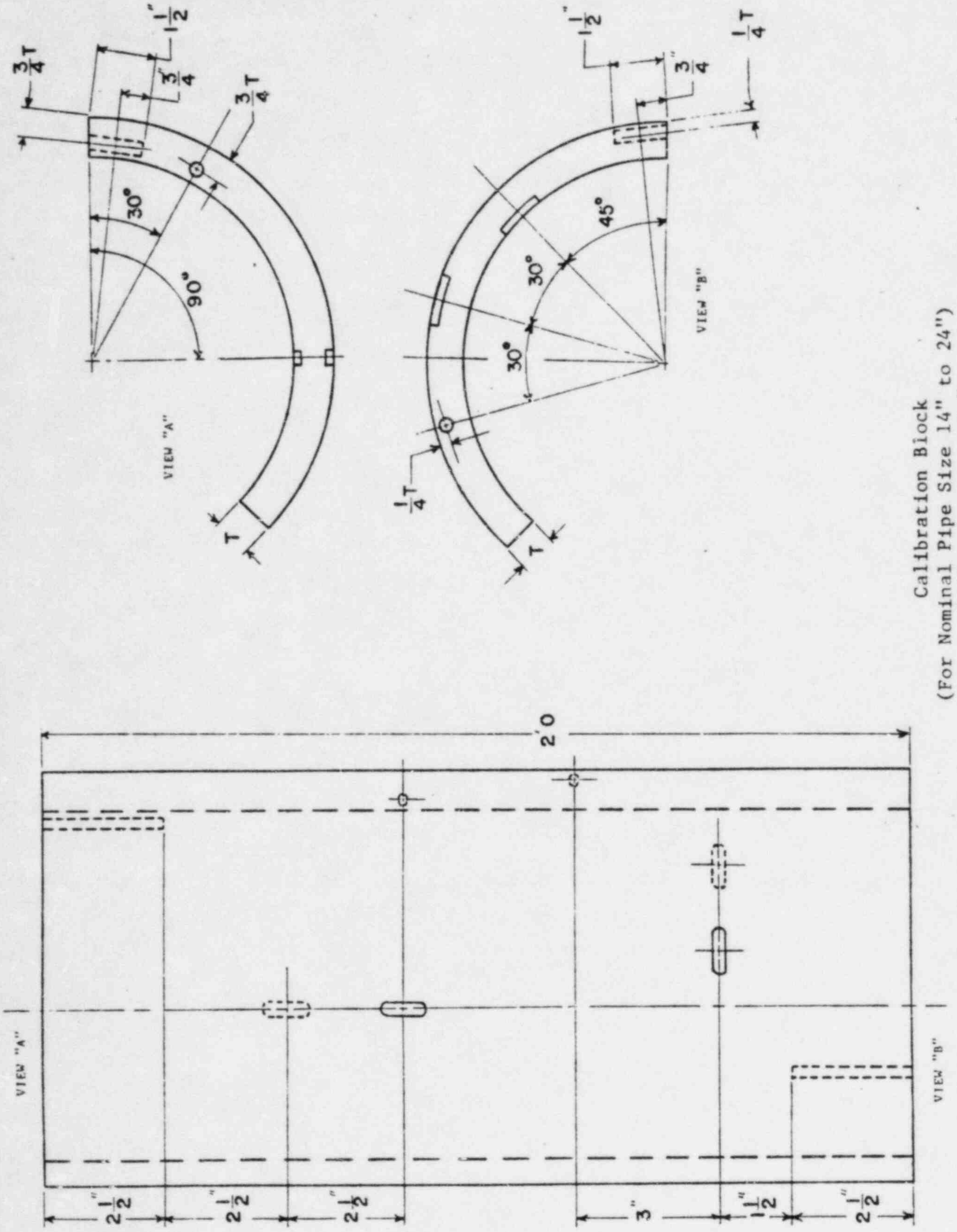
* Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.



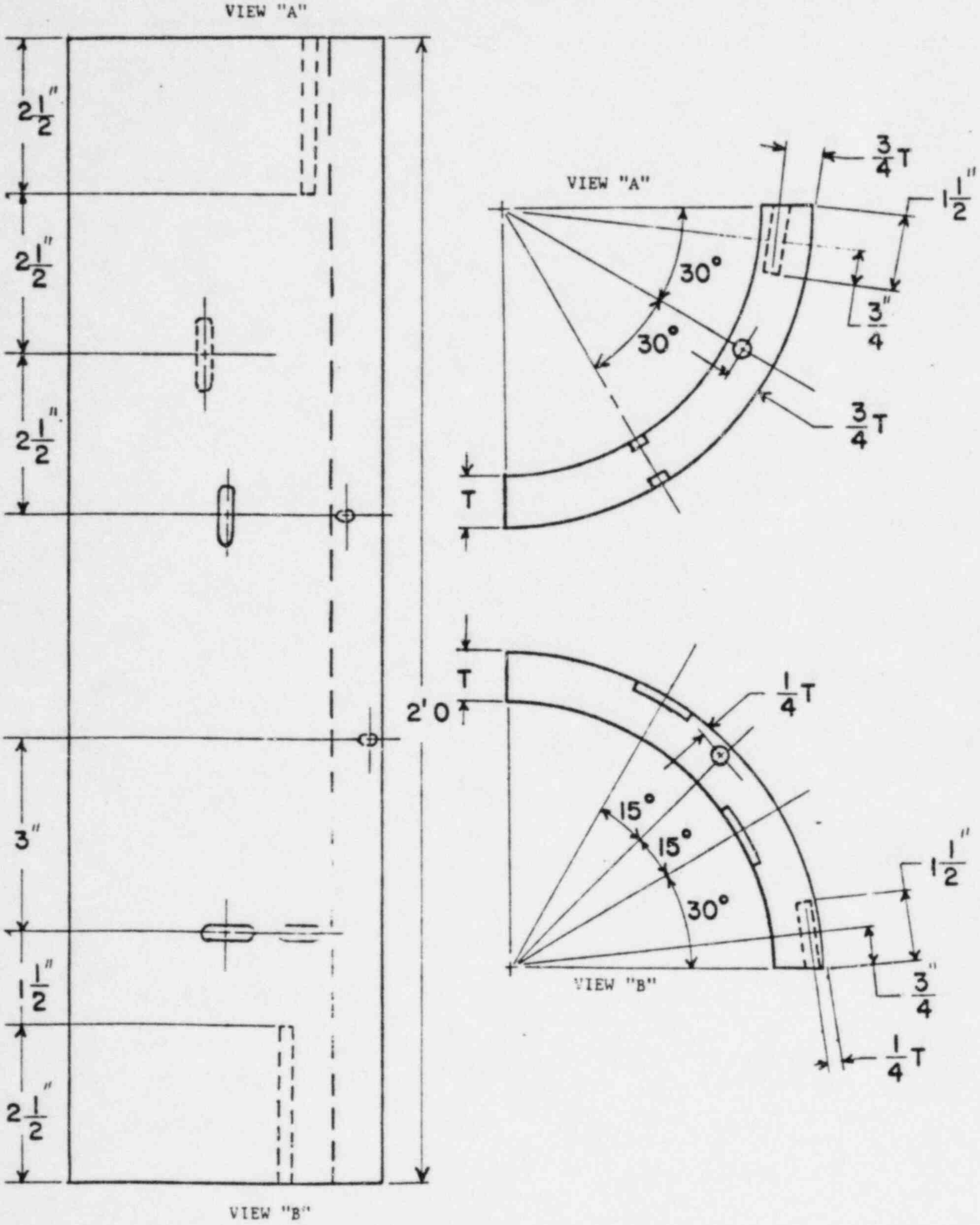
Calibration Block (For Nominal Pipe Size 12" and Less)

"Illustrative Only"

Figure 2



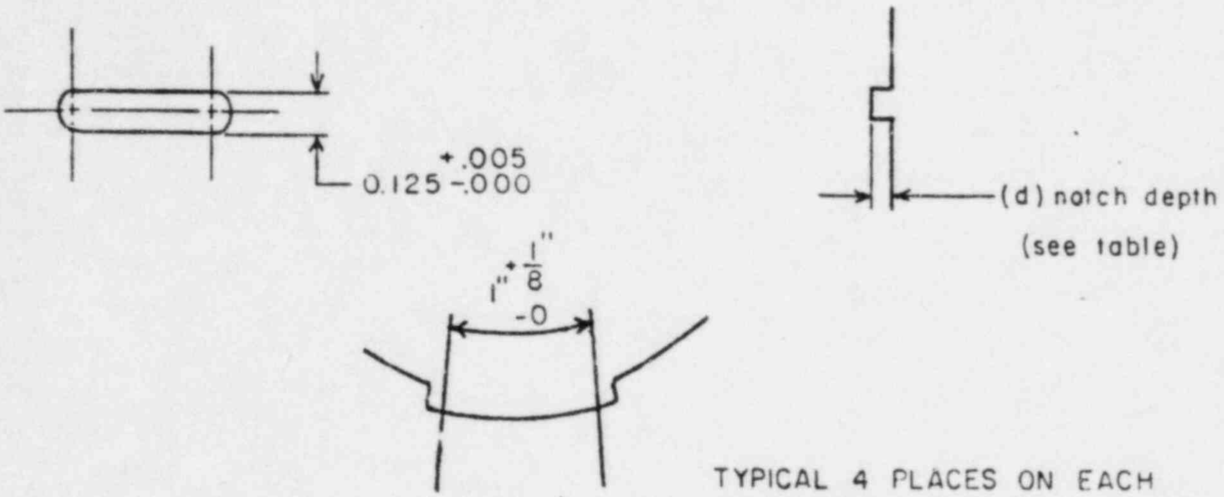
Calibration Block
(For Nominal Pipe Size 14" to 24")
"Illustrative only"
Figure 3



Calibration Block
(For Nominal Pipe Size 36" and Above)
"Illustrative Only"
Figure 4

CALIBRATION BLOCK REFLECTOR SIZE

Figure 5



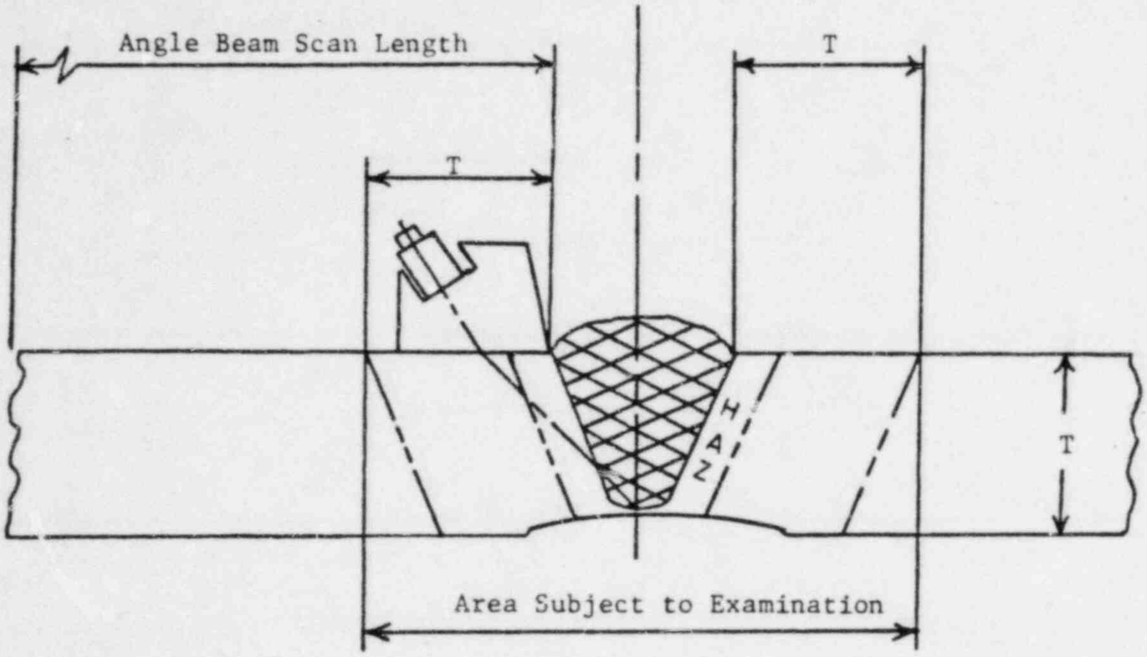
TYPICAL 4 PLACES ON EACH CALIBRATION BLOCK

NOTCH DEPTH FOR ULTRASONIC CALIBRATION BLOCKS

NOMINAL PIPE WALL THICKNESS (T) INCHES	MATERIALS	NOTCH DEPTH (d) INCHES
LESS THAN 0.312	AUSTENITIC	0.10T +0.005 in. −0.010 in.
0.312 TO 6.0	AUSTENITIC	0.10T +10% −20%

HOLE DIAMETERS FOR ULTRASONIC CALIBRATION BLOCKS

MATERIAL THICKNESS (T) INCHES	HOLE DIAMETER (INCHES)
UP TO 1" INCLUSIVE	$\frac{3''}{32}$
OVER 1" THRU 2"	$\frac{1''}{8}$
OVER 2" THRU 4"	$\frac{3''}{16}$
OVER 4" THRU 6"	$\frac{1''}{4}$

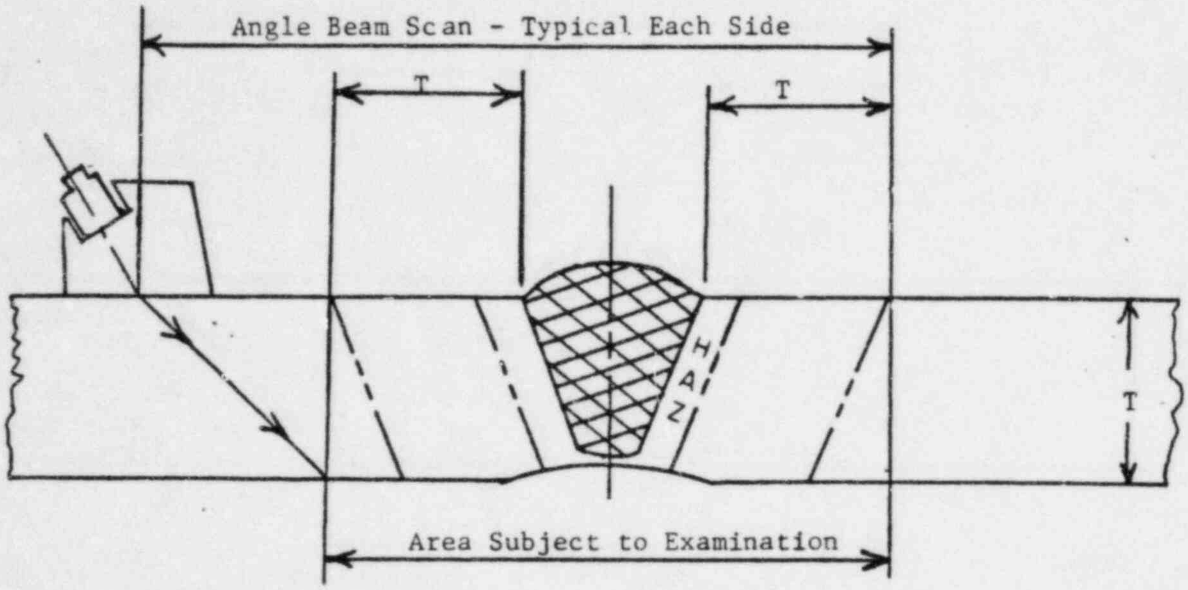


Angle beam scan length as shown above, shall be as follows:

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

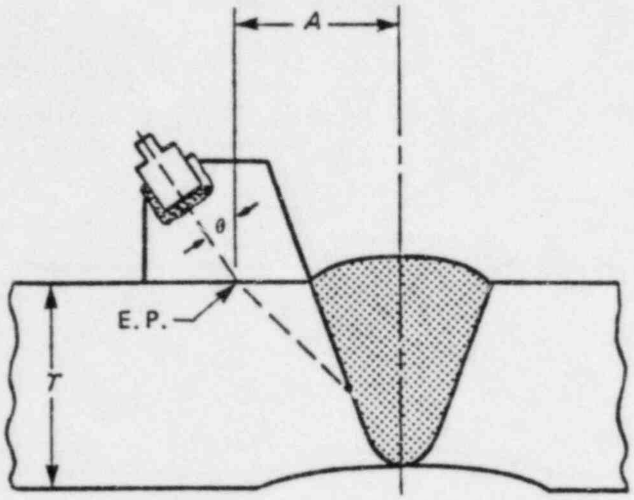


For angle beam scan length as shown above, add the following from each side of the weld fusion line.

Material Thickness	Minimum Scan 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



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

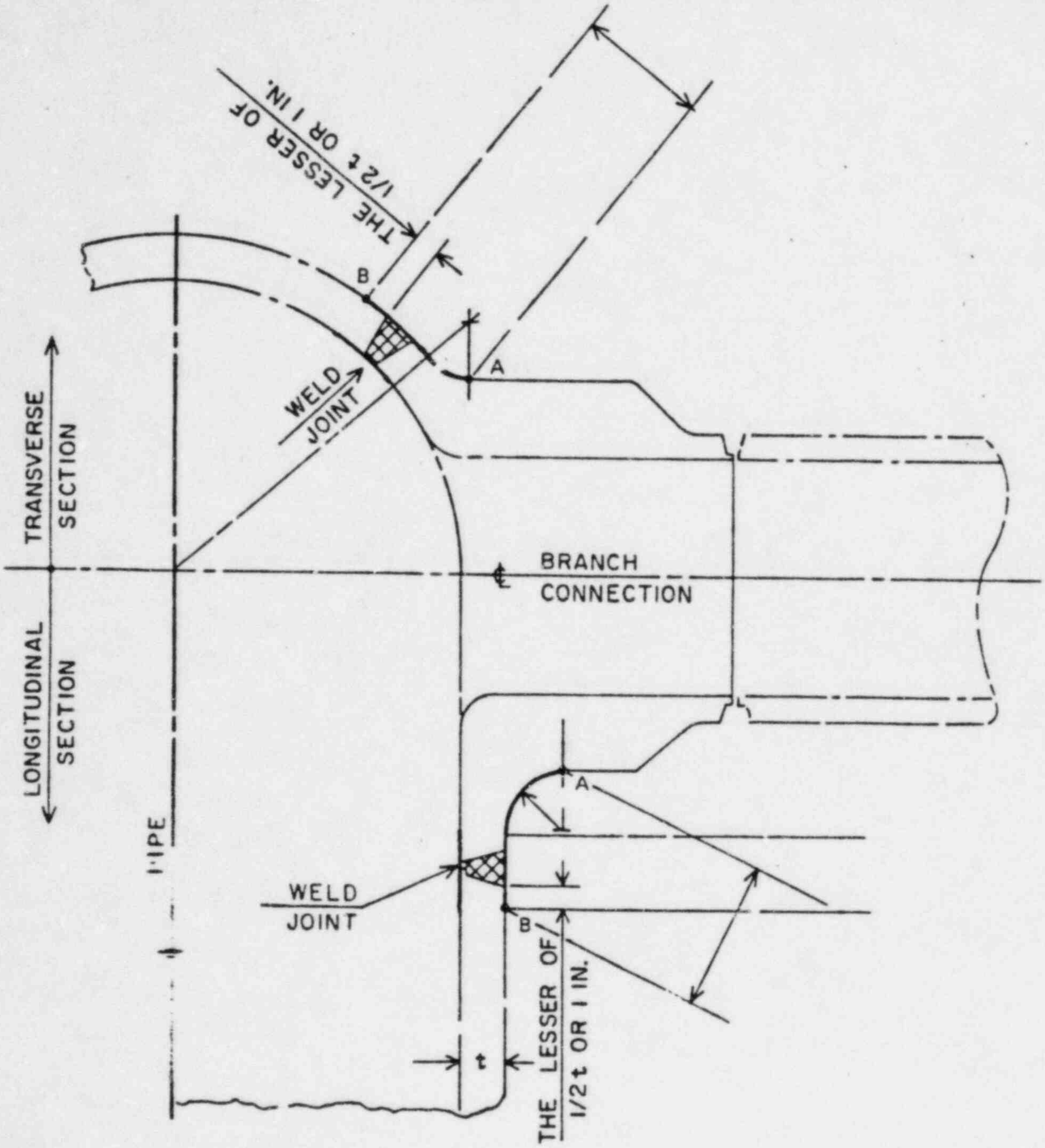


Figure 9

Butt Welded Branch Connections

Figure 10

The
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Ultrasonic Examination Report

Customer	Plant	Unit	Loop/Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block #	Couplant: Type______ Batch No.______

Continuation Sheet Attached
_____Yes _____No

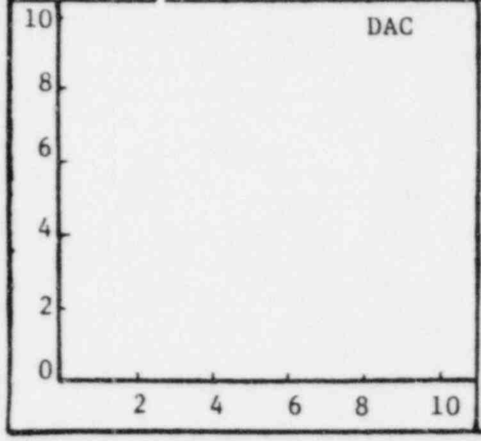
Field Changes:
Yes______ No______
If Yes, Number

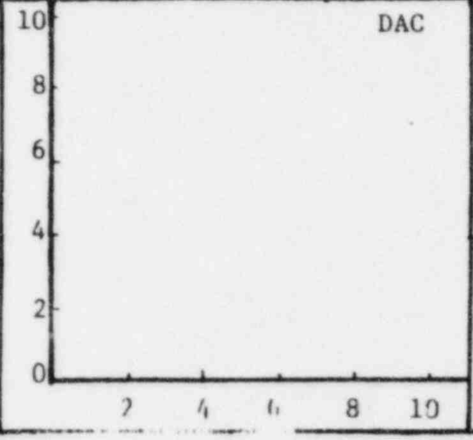
Transducer	0°	45°	60°
S/N			
Size			
Frequency			
Beam Angle			

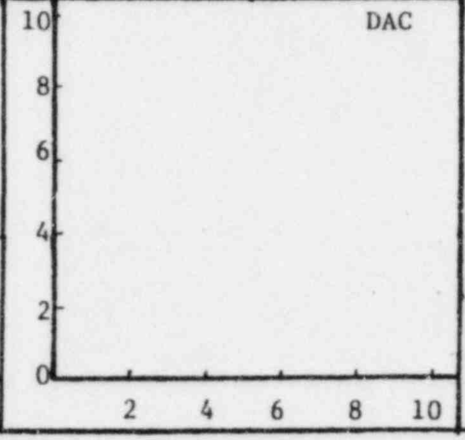
Instrument

Mfgr.		Model	
S/N		RepRate	
Reject		Filter	
Damp		Coax	
Freq.		Video	

Calibration 0°			2 & 5 Scan				7 & 8 Scan				Calibration Checks					
Calibration Reflector Location	Signal Amp.	Sweep	Signal Amp.	Sweep	Sound Entry Point To:		Signal Amp.	Sweep	Sound Entry Point To:		0°		45°		60°	
					Scribe Line	50% DAC			Scribe Line	50% DAC	In	Out	In	Out	In	Out
Ref. dB																







Additional Comments/Sketch

Form UT-101

2/82

Figure 11

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Ultrasonic Examination Report - Continuation Sheet

Page of

Customer	Plant	Unit	Loop/ Zone	Iso/Drawing No.

Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date

Component/Piping System	Pipe Size	Weld Type	Cal. Block	Couplant: Type & Batch #

Weld No.	▨	Base Metal Scan	Scan Direction				Inspection Limitations	Surface Condition		Examination Results		Remarks
			2	5	7 & 8	0		Base Metal	Weld	UT	Visual	

Figure 12

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Indication Record

Customer	Plant	Unit	Loop / Zone
Procedure	Examiner/Level	VCR Supervisor	Date
Component/Piping System	ISO Drawing No.	Cal. Standard No./Thickness	

Weld No.	Ind No.	Max.% DAC	Indication Length		Minimum Depth		Maximum Depth		Beam Angle	Beam Dir.	Base Metal Thickness 2 Side	Weld Thick.	Base Metal Thickness 5 Side	Remarks
			From	To	S.U. Pos.	Sweep Reading	S.U. Pos.	Sweep Reading						

The
Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MANUAL ULTRASONIC EXAMINATION OF CIRCUMFERENTIAL BUTT WELDS BETWEEN CLAD FERRITIC PIPING AND AUSTENITIC SAFE ENDS

Procedure No.: ISI 2.8

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES
INCORPORATED
QUALITY
ASSURANCE
ENGINEERING

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BY:
DATE: 4-18-83

Rev. 0 Date: 2/15/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by: Marvin N. Firsinger

Rev. 1 Date: 4/29/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by: Marvin N. Firsinger
Customer:

Rev. 2 Date: 3/1/83
Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: 7/18/83 Dickinson L III 7/21/83

Rev. Date:
Prepared by:
Reviewed by:
Reviewed by:
Customer:

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The Virginia Corporation
of Richmond

Proc. No. ISI 2.8 Rev. 2
Date: 3/1/83 Page 1 of 31

1.0 Scope

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

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 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.

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.

4.2 The identity and location of welds to be examined shall be as specified in reference 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° 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. The use of the refracted longitudinal beam technique may be applied when necessary, in two directions parallel and perpendicular to the axis. The refracted longitudinal shall be restricted to a half node examination.

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. Qualifications may be valid for a period not to exceed three months.

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.

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.

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 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.

6.3 Straight Beam Calibration for Weld Metal and HAZ

6.3.1 Position the search unit for the maximum response from the ¼T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ¼T hole is positioned at 1.5 on the graticule.

6.3.2 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 4.5 on the graticule.

6.3.3 Repeat steps 6.3.1 and 6.3.2 until no further adjustment is necessary.

6.3.4 Other sweep positions may be used in 6.3.1 and 6.3.2, if necessary, to keep the back reflection on the screen when thicker sections are encountered.

6.3.5 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.

6.3.6 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.

6.3.7 Connect the screen marks and extrapolate through the thickness (¼T on each 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 evaluation of indications in the near zone is permitted if applied in accordance with the requirements of paragraph 6.1.

6.4 Angle Beam Calibration for Examination from the Clad Ferritic Side

6.4.1 Sweep Range Calibration

6.4.1.1 Position the search unit for the maximum response from the ¼T 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 ¼T and 3/4T hole reflections start at sweep lines 2 and 6 respectively.

6.4.1.4 Position the search unit for maximum response from the square notch on the opposite surface. The indication will appear near sweep line 8.

6.4.1.5 Two divisions on the sweep equal ¼T.

6.4.1.6 Other sweep positions may be used when calibrating to paragraphs 6.4.1.1 through 6.4.1.5 when it is necessary to obtain a broader sweep range for piping systems with varying thicknesses. 2

6.4.2 Distance-Amplitude Correction

6.4.2.1 Calibration from the clad side

(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 side-drilled holes to provide the distance amplitude curve. This is the primary reference level.

6.4.2.2 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 6.4.2.1 (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). 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).

6.4.3 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 2

(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.

(d) Mark the peak of these indications on the screen and extrapolate the DAC curve ¼T 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. 2

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 ¼T on each end to produce a smooth DAC curve. This 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. 2

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

6.5.1 Angle Beam Calibration for ½ Node Examination

6.5.1.1 The response from the ¼T and 3/4T side-drilled 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 ¼T hole. Using the sweep delay control, adjust the sweep position so that the leading edge of the response from the ¼T hole is positioned at 2.0 on the graticule.

(b) 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.

(c) 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 amplitude. 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 remaining 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 (¼T 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 response amplitude from the I.D. notch at the level of the DAC curve.

6.5.2 Angle Beam Calibration for Full Node Examination

6.5.2.1 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.

(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 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 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 ½T. This shall be the primary reference level.

6.5.3 Angle Beam Calibration of 1½ Node Examination

6.5.3.1 The response from the I.D. & O.D. notches shall be used to establish the slope, shape, & 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 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 graticule.

(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 (1½ node). Check that the leading edge is at approximately 9.0 on the graticule.

(e) Position the search unit for the maximum response from the I.D. notch (½ node). Adjust the sensitivity control to 80% FSH.

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 (1½ 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 ½T. This shall be the primary reference level.

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. 2

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 ½ 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 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 re-examined.

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 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.

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 1½ 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.

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 7). Scans shall overlap at least ten percent.

7.2.3 Calibration shall be as indicated in paragraph 6.3.

7.3 Angle Beam-Reflectors Parallel to the Weld

7.3.1 The primary scan for reflectors parallel to the weld shall be ½ node from both sides of the weld.

7.3.2 Full node or 1½ node shall only be used when it is impossible to examine the required material with a ½ node examination for the austenitic side of the weld only. A full or 1½ node examination shall never be performed on the carbon clad side.

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 4, 5 and 6).

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 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. 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. 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 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 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 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 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.

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.

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 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.

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

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

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.

Figure 1

TRANSDUCER AND SEARCH UNIT SELECTION

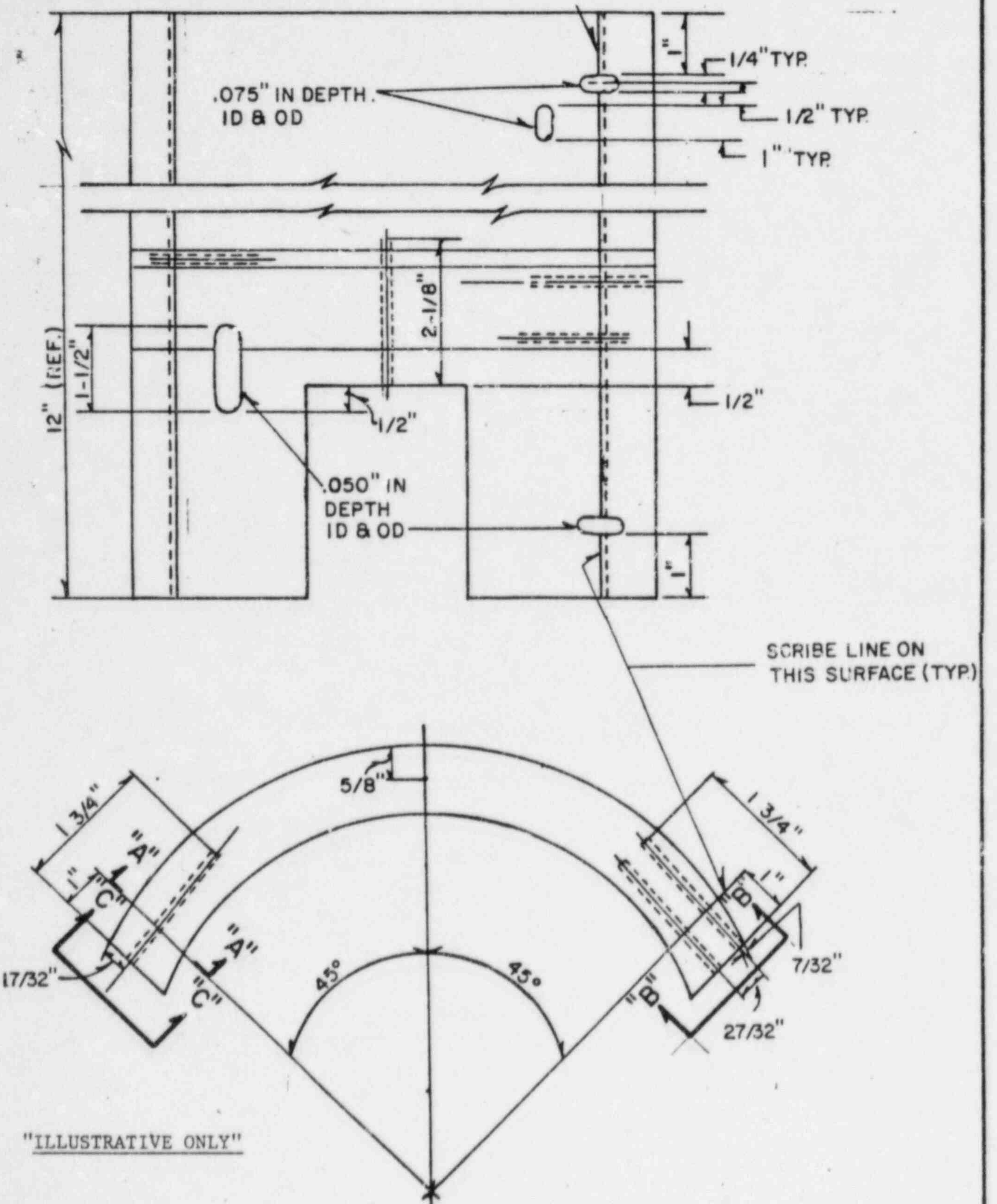
Angle Beam Examination*

Nominal Material Thickness	Transducer		
	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 Diameter	Transducer	
	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

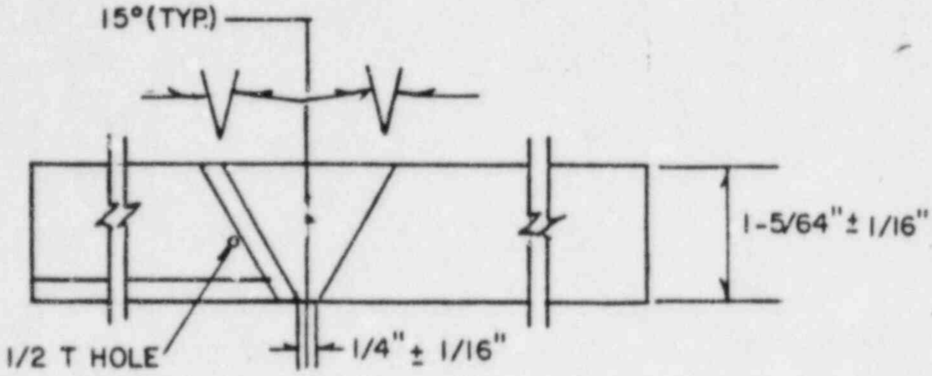
* Note: Other transducers may be used where weld geometry or metallurgical characteristics impede effective use of the above listed angles, frequencies, or sizes.



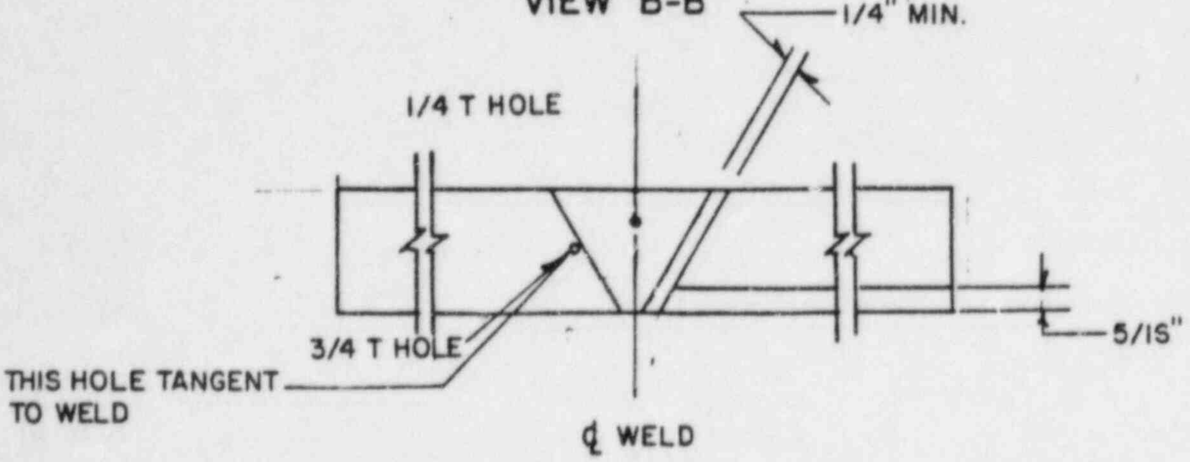
"ILLUSTRATIVE ONLY"

Calibration Blocks
Figure 2

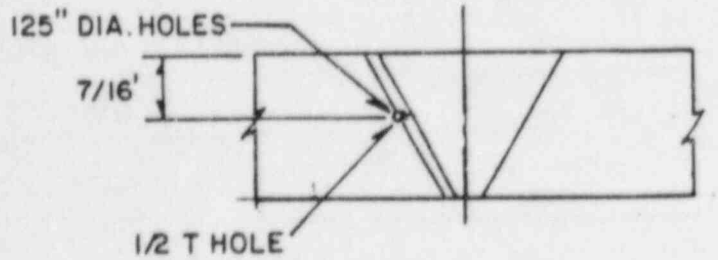
VIEW "A-A"



VIEW "B-B"



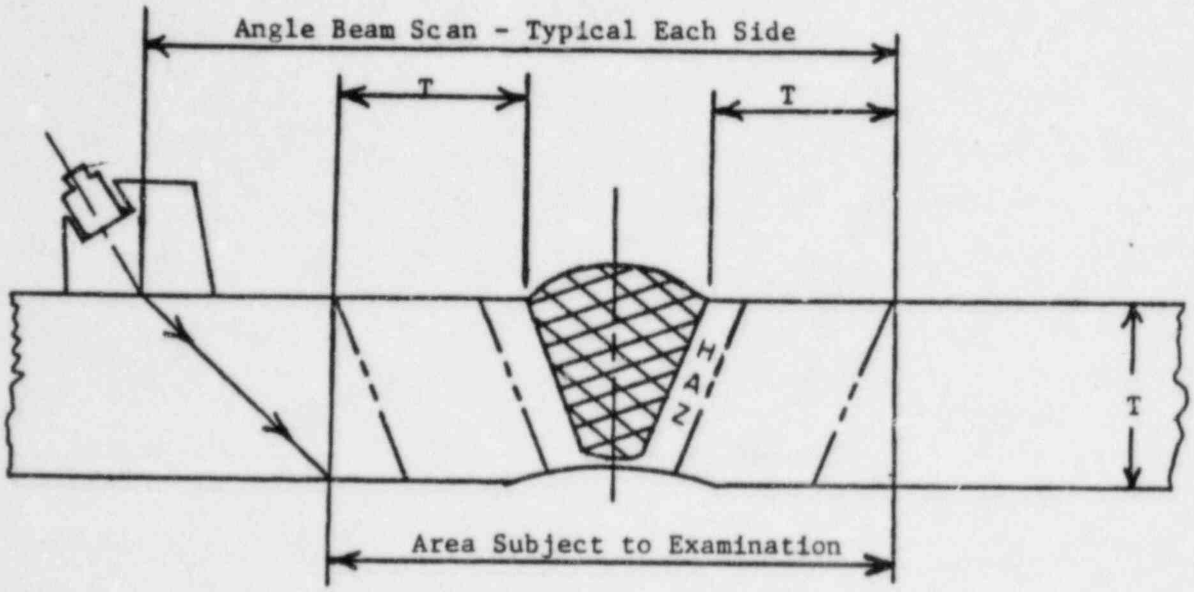
VIEW "C-C"



"ILLUSTRATIVE ONLY"

Calibration Blocks

Figure 3



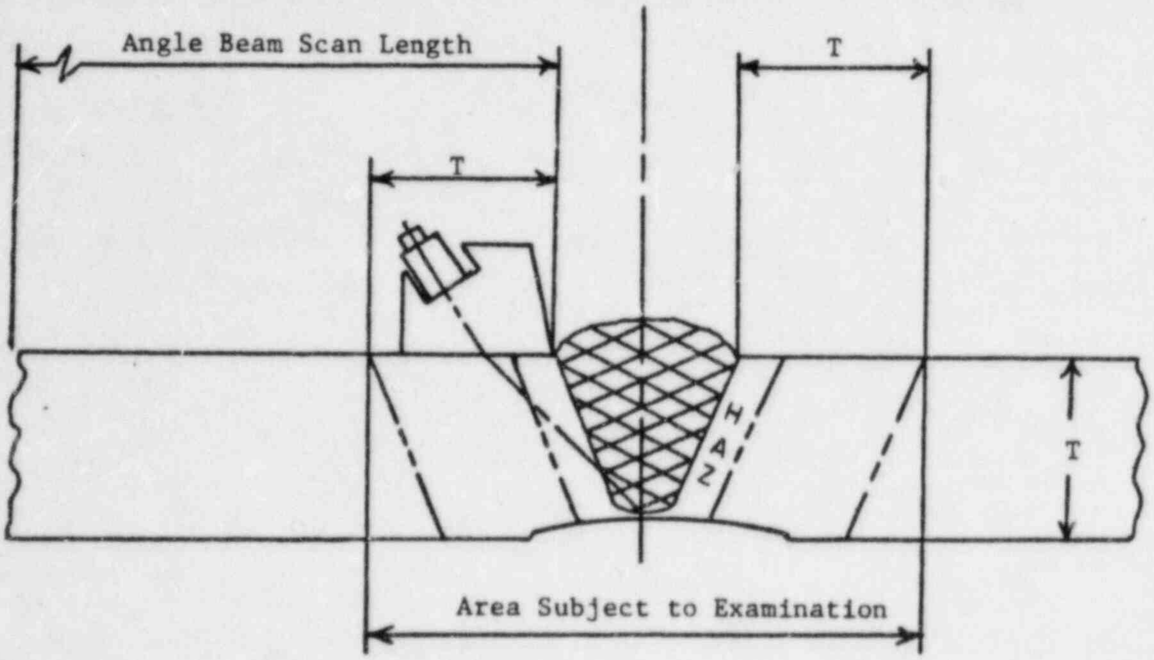
For angle beam scan length as shown above, add the following from each side of the weld fusion line.

Material Thickness	Minimum Scan Length 45°	Minimum Scan 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



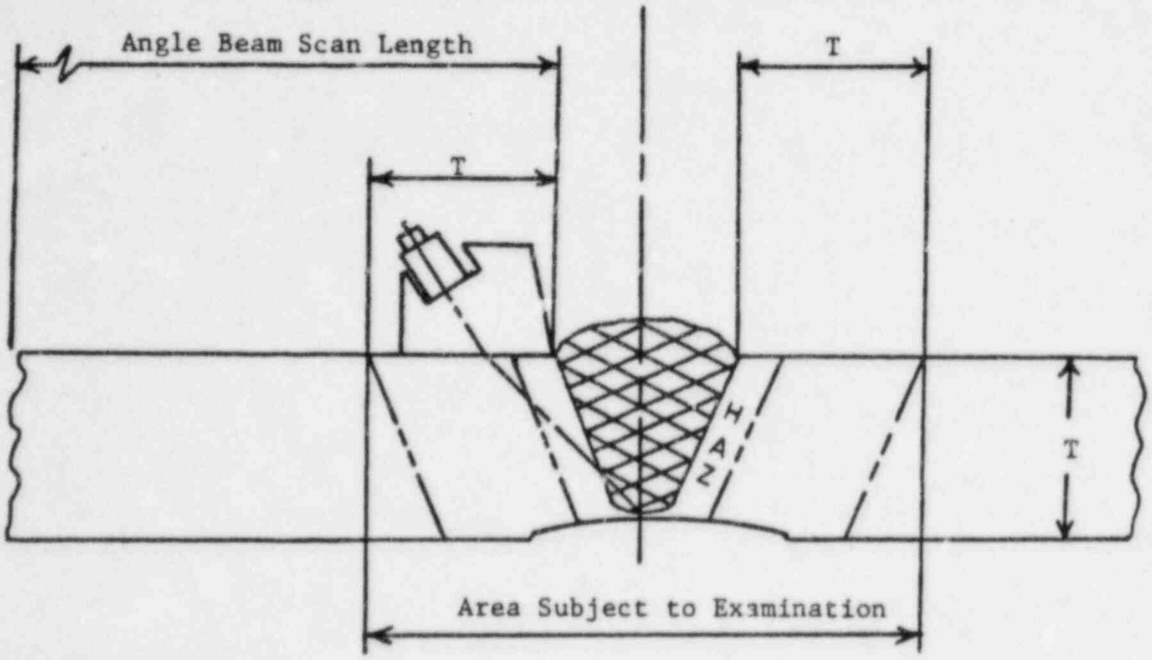
Angle beam scan length as shown above, shall be as follows:

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

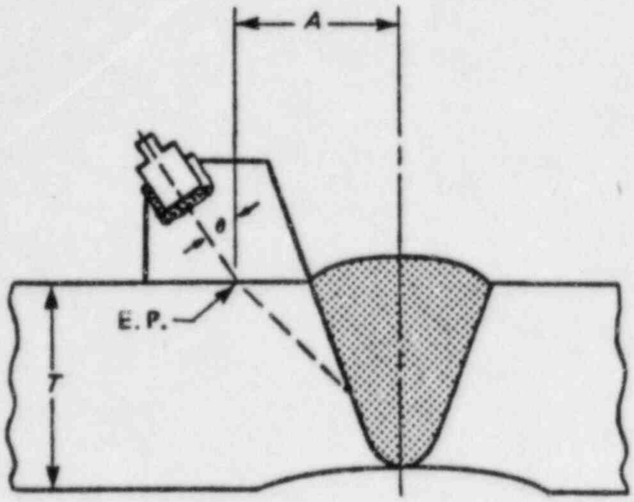


Angle beam scan length as shown above, shall be as follows:

Material Thickness	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



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

Figure 8

The Virginia Corp. of Richmond

Ultrasonic Examination Report

Customer	Plant	Unit	Loop/Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block #	Couplant: Type_____ Batch No.____

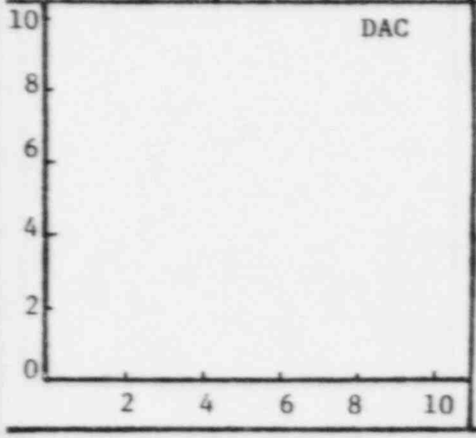
Continuation Sheet Attached
_____Yes _____No

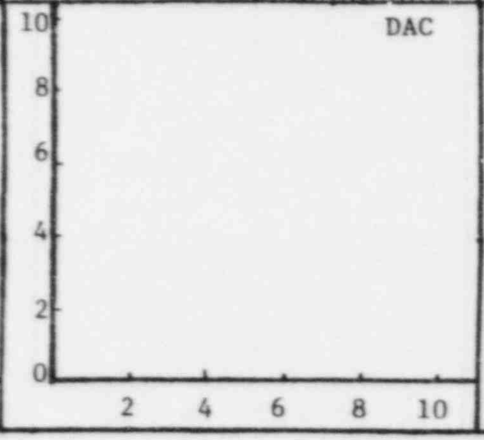
Field Changes:
Yes_____ No______
If Yes, Number

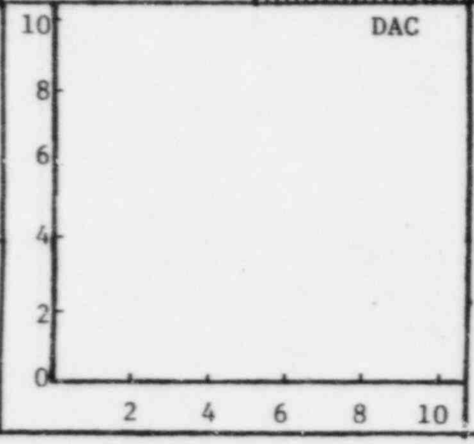
Transducer	0°	45°	60°
S/N			
Size			
Frequency			
Beam Angle			

Instrument			
Mfgr.		Model	
S/N		RepRate	
Reject		Filter	
Damp		Coax	
Freq.		Video	

Calibration 0°			2 & 5 Scan				7 & 8 Scan				Calibration Checks					
					Sound Entry Point To:				Sound Entry Point To:		0°		45°		60°	
Calibration Reflector Location	Signal Amp.	Sweep	Signal Amp.	Sweep	Scribe Line	50% DAC	Signal Amp.	Sweep	Scribe Line	50% DAC	In	Out	In	Out	In	Out
Ref. dB																







Additional Comments/Sketch

Form UT-101

2/82

Figure 9

The
Virginia Corp.
of Richmond

Ultrasonic Examination Report - Continuation Sheet

Page of

Customer	Plant	Unit	Loop/ Zone	Iso/Drawing No.
Procedure	Exam Surface	Examiner/Level	VCR Supervisor	Date
Component/Piping System	Pipe Size	Weld Type	Cal. Block	Couplant: Type & Batch #

Weld No.	▨	Base Metal Scan	Scan Direction				Inspection Limitations	Surface Condition		Examination Results		Remarks
			2	5	7 & 8	0		Base Metal	Weld	UT	Visual	

2/82

Figure 10

The Virginia Corp.
of Richmond

Ultrasonic Examination Report

Indication Record

Customer

Plant

Unit

Loop / Zone

Procedure

Examiner/Level

VCR Supervisor

Date

Component/Piping System

ISO Drawing No.

Cal. Standard No./Thickness

Weld No.	Ind No.	Max.% DAC	Indication Length		Minimum Depth		Maximum Depth		Beam Angle	Beam Dir.	Base Metal Thickness 2 Side	Weld Thick.	Base Metal Thickness 5 Side	Remarks
			From	To	S.U. Pos.	Sweep Reading	S.U. Pos.	Sweep Reading						

Form UT-102

2/82

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: Liquid Penetrant Examination Using the Color-Contrast Solvent Removable Technique

Procedure No.: ISI 3.1

Plant Site: Waterford #3

Curtomer: Louisiana Power & Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES
INCORPORATED

QUALITY
ASSURANCE
ENGINEERING

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BY:
DATE: 4-18-83

Rev. 0 Date: 1/8/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by:

Rev. 1 Date: 3/1/83
Prepared by: Daniel L Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by:
Customer: James G. Dickinson L III 4/12/83 4/21/83

Rev. Date:
Prepared by:
Reviewed by:
Reviewed by:
Customer:

Rev. Date:
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Prepared by:
Reviewed by:
Reviewed by:
Customer:

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.

2.2 ASME Section V, Article 6, 1977 edition with addenda through Summer, 1978.

2.3 The Virginia Corporation of Richmond procedure NDE-4.1, Rev. 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. 0, 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 All 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 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. Intermixing of penetrant materials from different family groups is not permitted. 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
Remover/Cleaner	Dubl Check Type DR-60
Penetrant	Dubl Check Type DP-51
Developer	Dubl Check Type D-100

1

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.

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.

6.0 Examination

6.1 Pre-cleaning - The area to be examined shall be thoroughly cleaned using the remover/cleaner of the family type listed in paragraph 4.3.

6.1.1 Allow a minimum of ten minutes for excess cleaner/remover to evaporate before proceeding with the examination.

6.2 Penetrant application

6.2.1 Penetrant shall be applied by spraying or brushing only. 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.

6.3 Penetrant dwell time

6.3.1 Penetration, or dwell time, is critical. The complete examination surface shall be kept 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.

6.3.1.2 For temperatures of the surface under examination ≥ 60°F up to 125°F, the dwell time shall be a minimum of 15 minutes and a maximum of 60 minutes.

6.4 Excess penetrant removal

6.4.1 As much excess penetrant as possible shall be removed by wiping the surface thoroughly with a clean lint-free dry cloth or absorbent paper.

6.4.2 Remaining excess penetrant shall be removed by wiping 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.

6,4.3 Flushing of the surface with any liquid following application 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.

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 non-relevant 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.

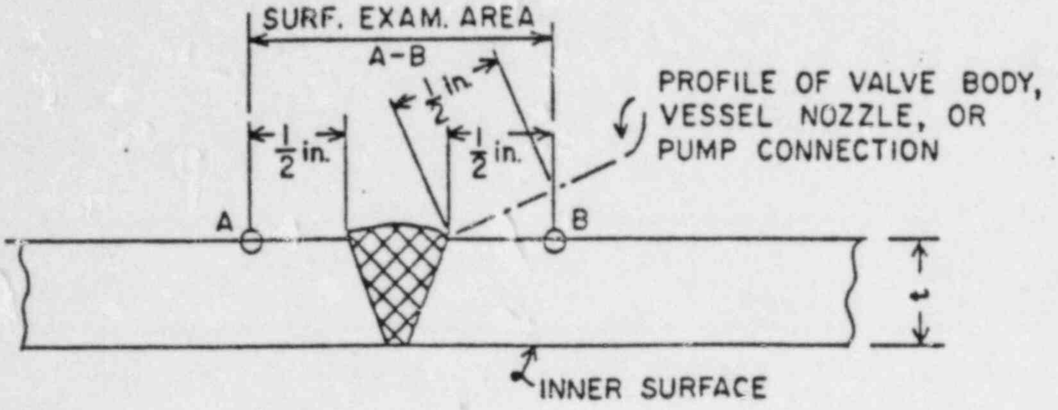
Description	Nominal Wall Thickness/Other	Reportable Indications
Dissimilar and similar welds in piping, both ferritic and austenitic	≤.312" >.312" to 2.0" 2.0" & over	>1/8" >3/16" >1/4"
Pressure retaining bolting 2" and over	non-axial indications axial indications	>1/4" > 1"
Vessel supports and support members for piping, valves, and pumps, both ferritic and austenitic	.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

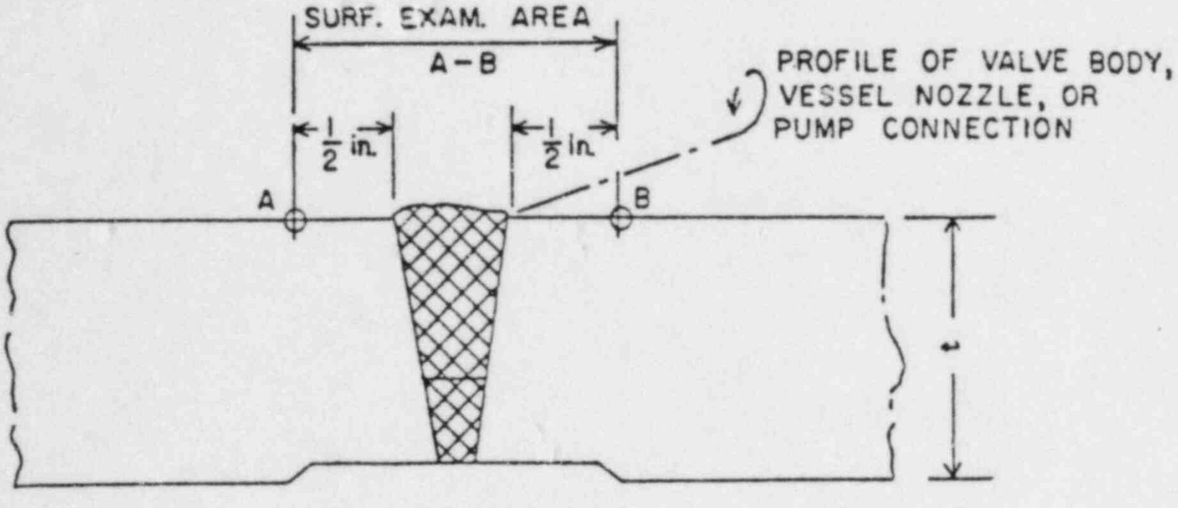
8.1 When examination and evaluation are complete, the examination area shall be thoroughly cleaned with cleaner/remover which may be applied by flushing or spraying directly onto the surface and wiping with cloth or absorbent paper.

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.



NOM. PIPE SIZE LESS THAN 4 IN.



NOM. PIPE SIZE 4 IN. AND GREATER

Fig. IWB-2500-8

Similar and Dissimilar Metal Welds in Piping

Figure 1

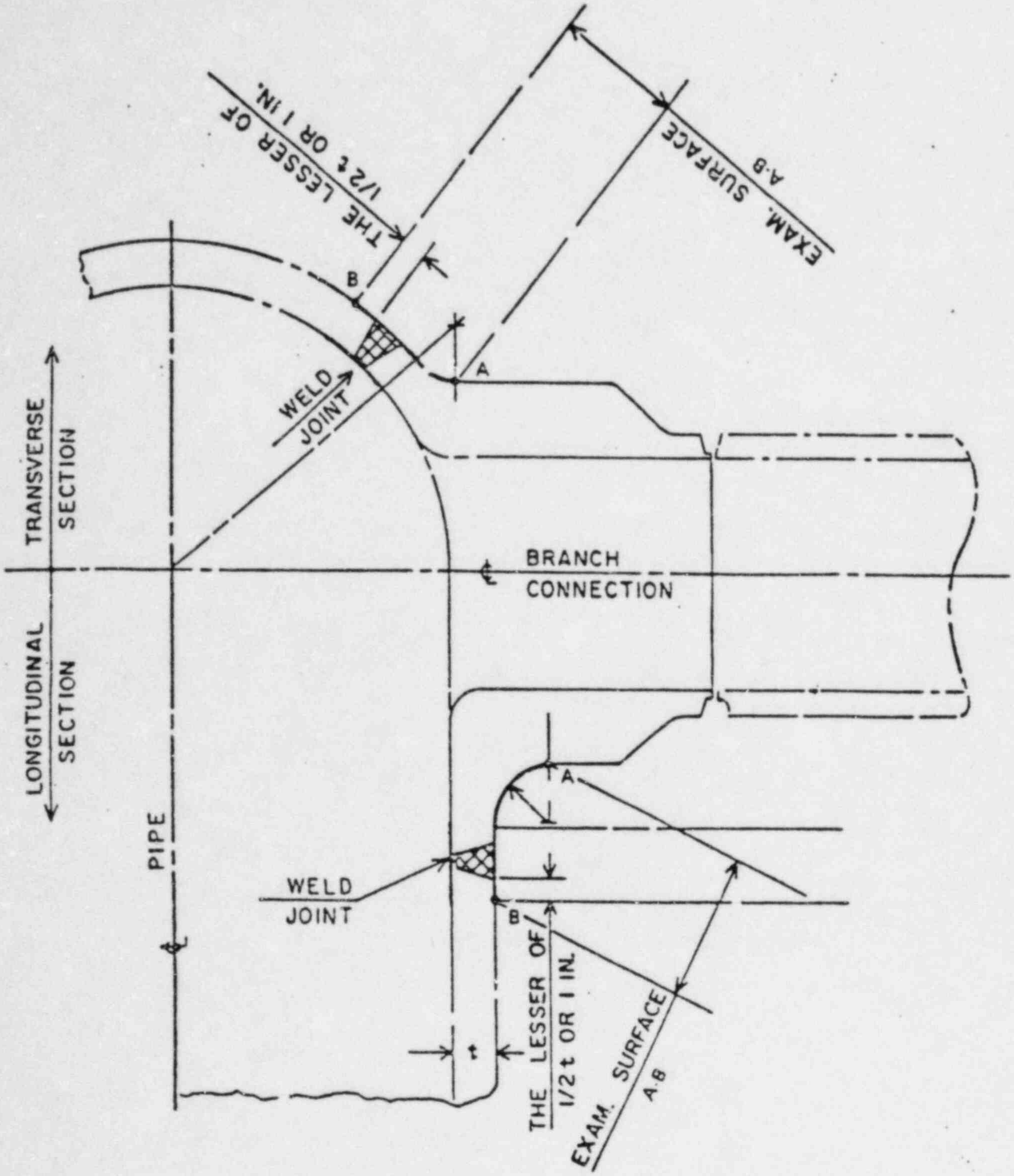


Fig. IWB-2500-9

Pipe Branch Connection

Figure 2

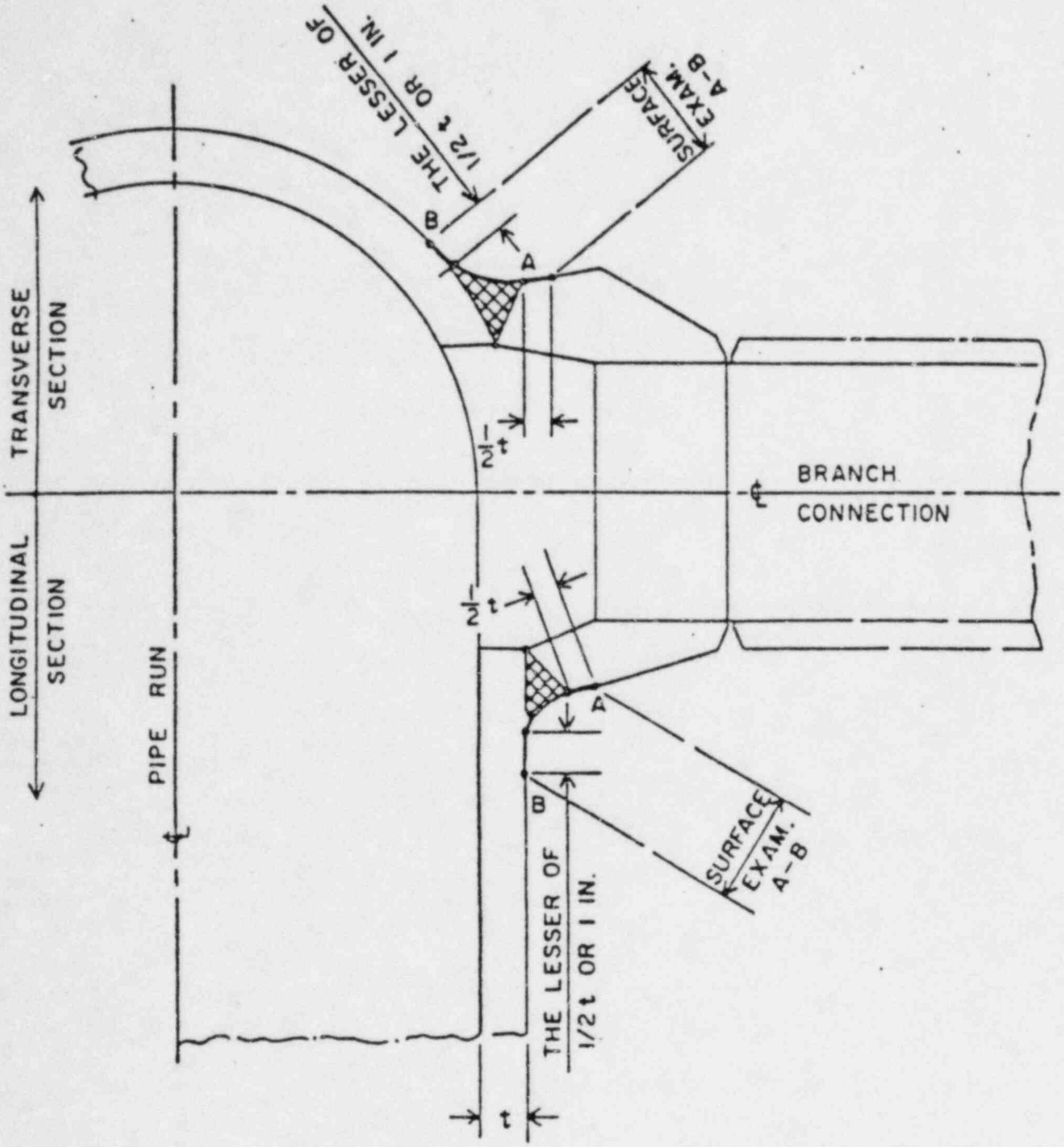
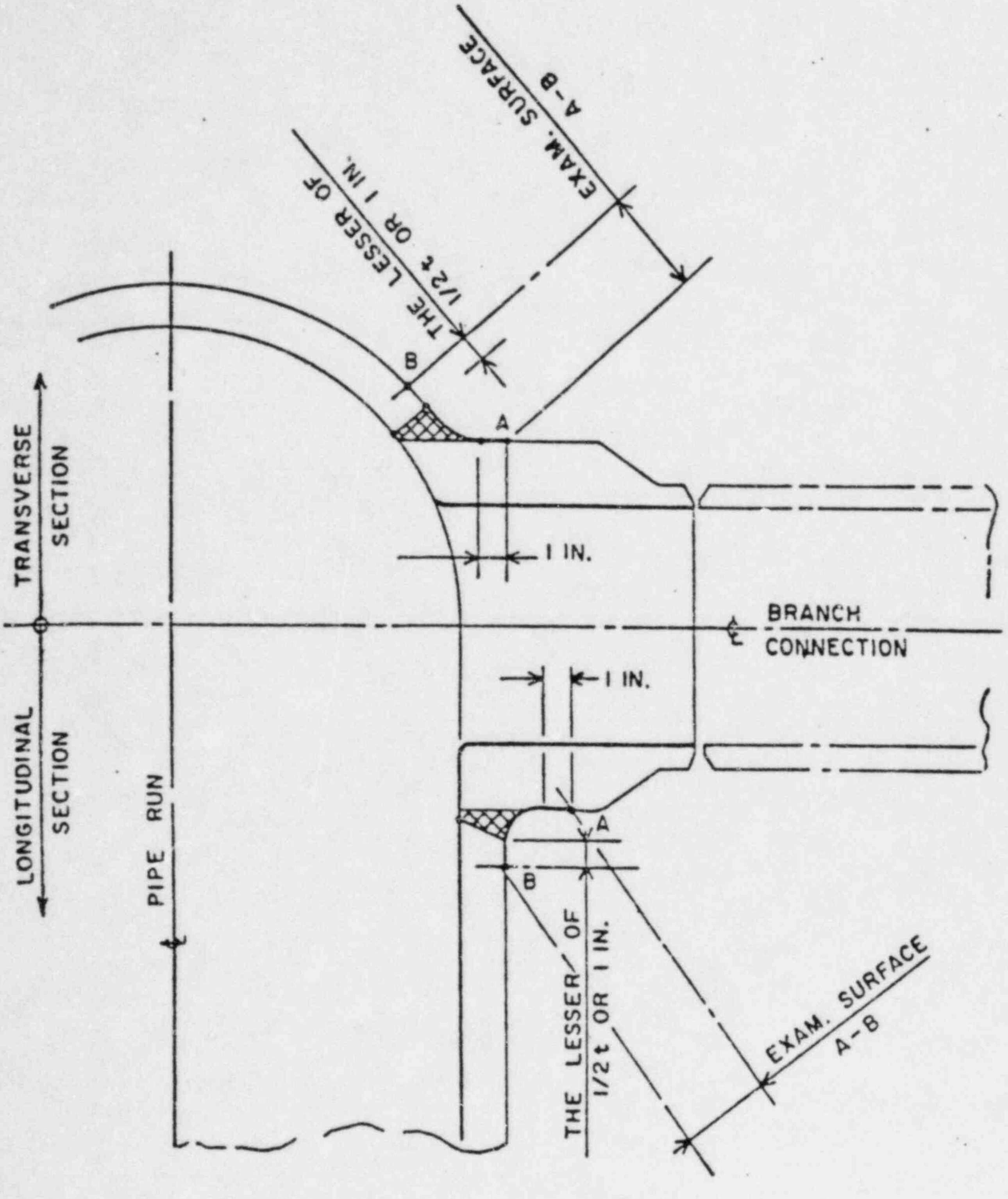


Fig. IWB-2500-10

Pipe Branch Connection

Figure 3



IWB-2500-11

Pipe Branch Connection

Figure 4

NOZZLE SIZES OVER 4 in. NOM. PIPE SIZE
VESSEL THICKNESS - t = 1/2 in. OR LESS

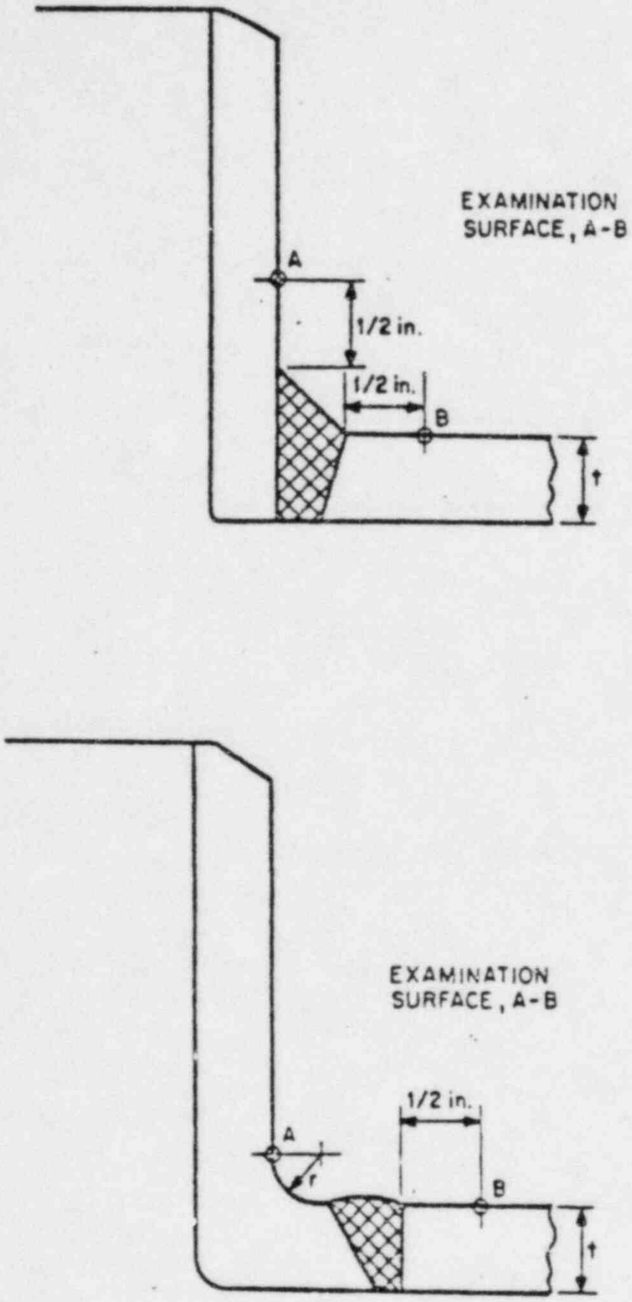
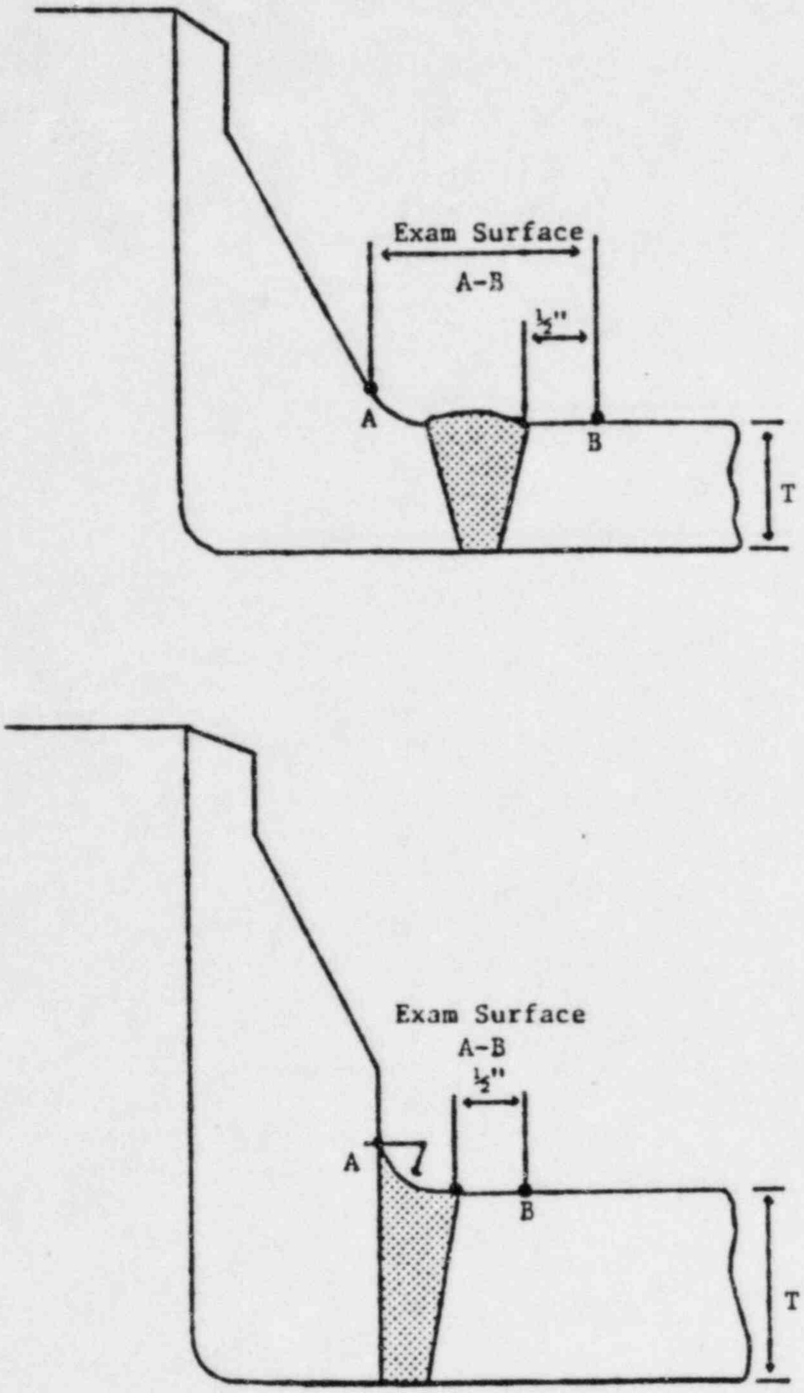


Fig. IWC-2520-3

Nozzle to Vessel Welds

Figure 5



IWC-2520-4

Nozzle to Vessel Welds

Fig. 6

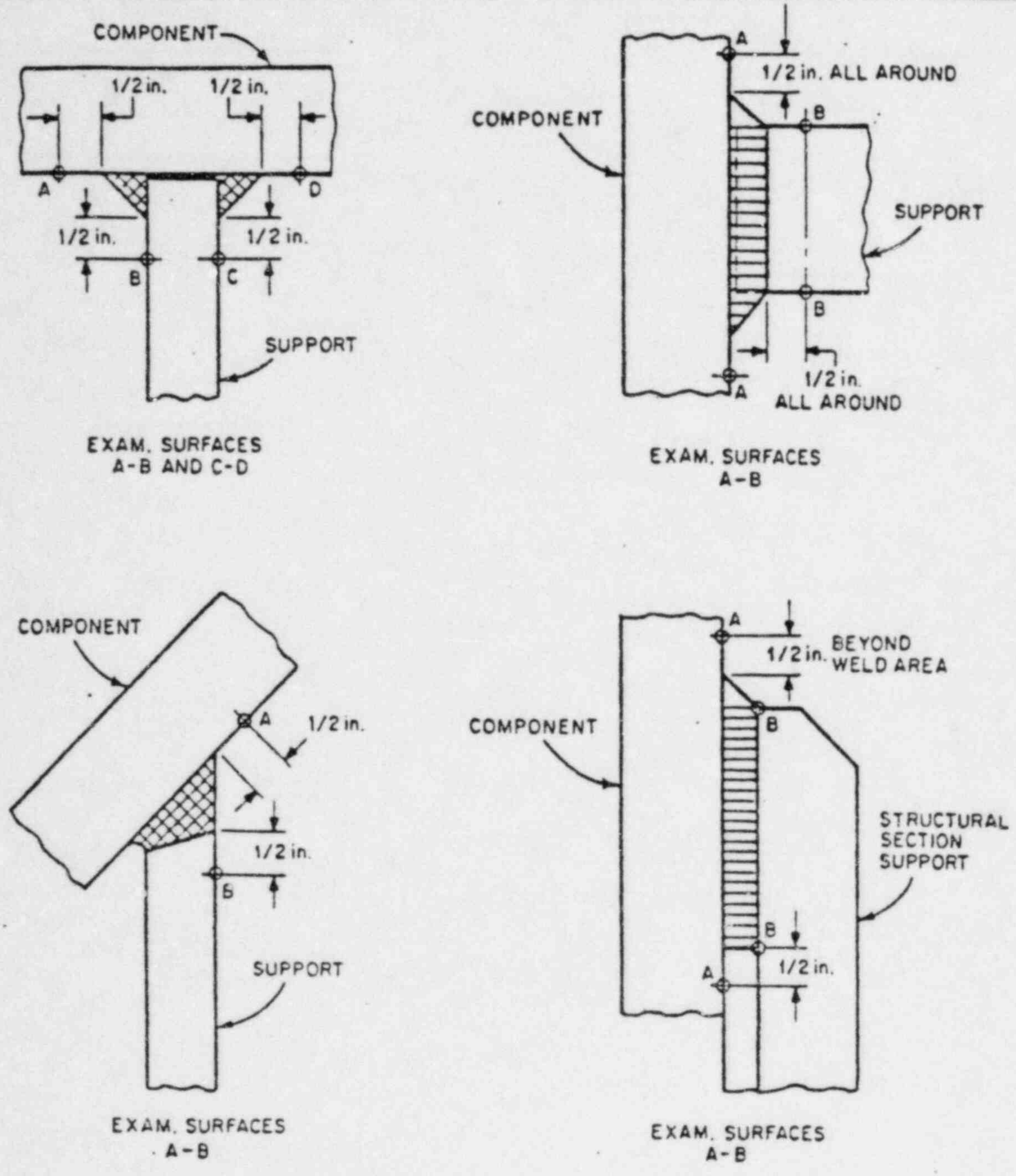


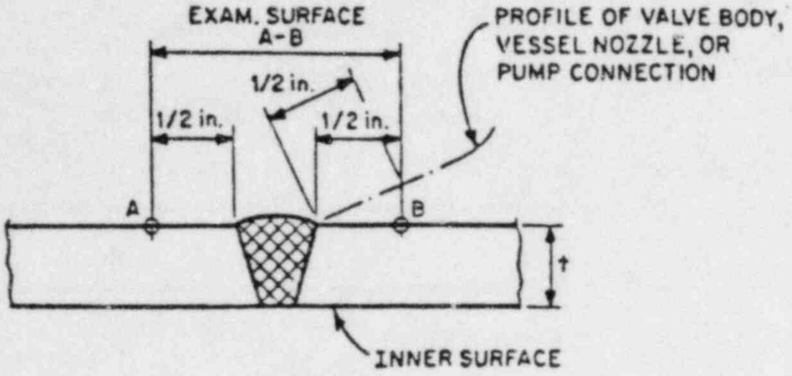
PLATE AND SHELL TYPE
SUPPORT WELDS

LINEAR TYPE
SUPPORT WELDS

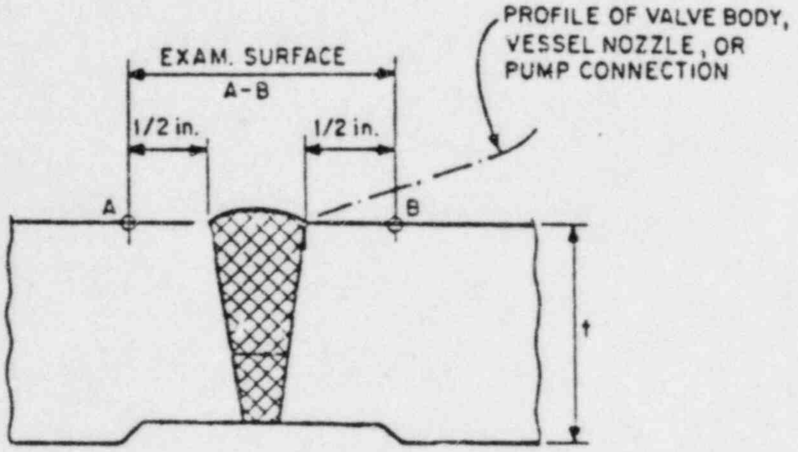
Fig. IWC-2520-5

Integrally Welded Component Supports

Figure 7



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



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

IWC-2520-7

Welds in Piping

Figure 8

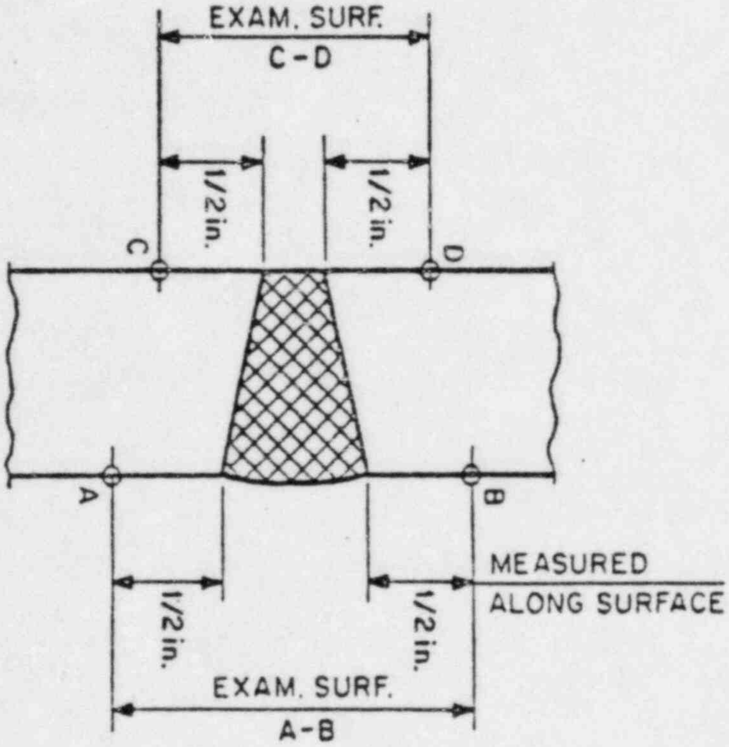


Fig. IWC-2520-8

Welds in Pump Casing and Valve Bodies

Figure 9

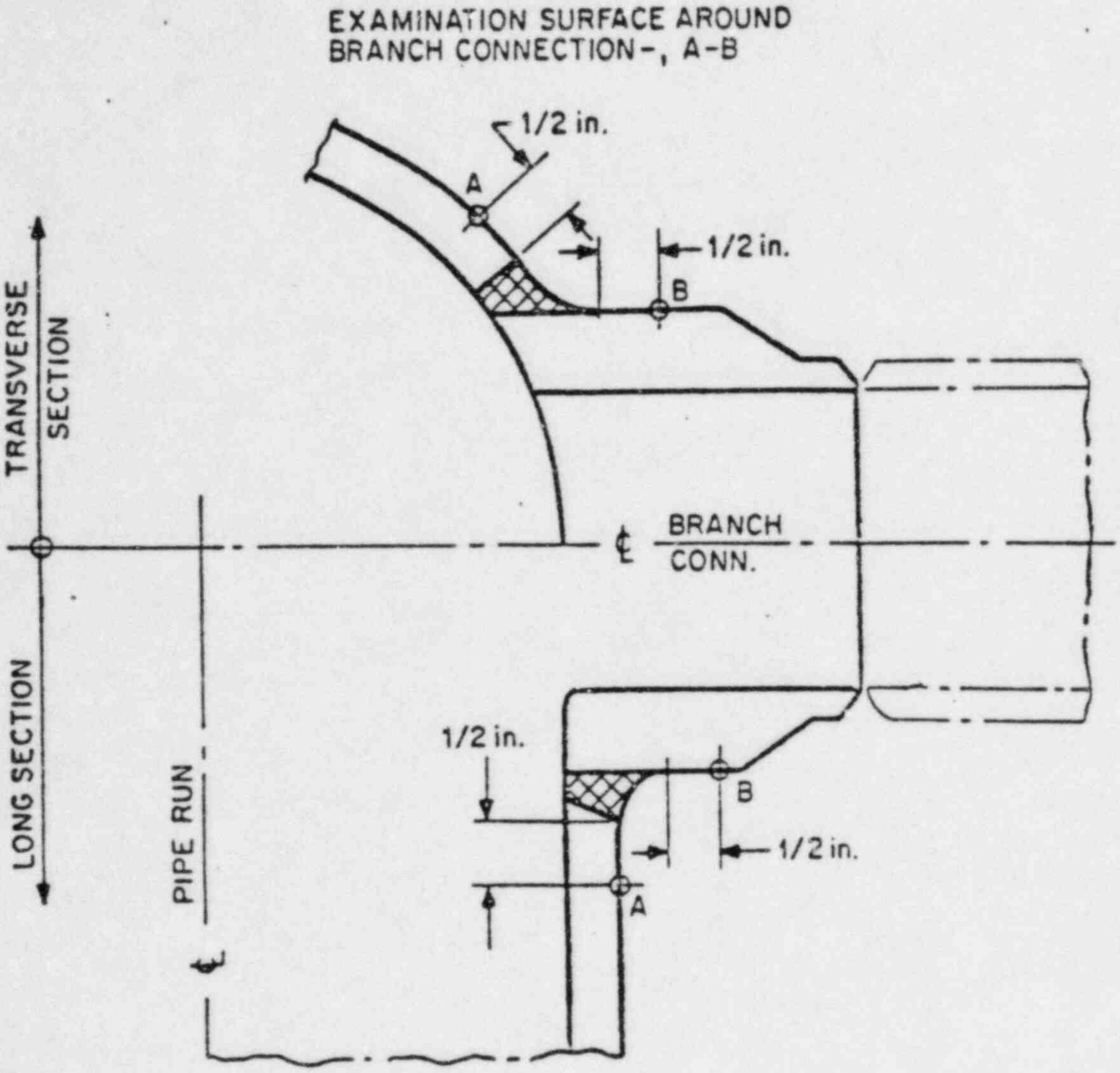
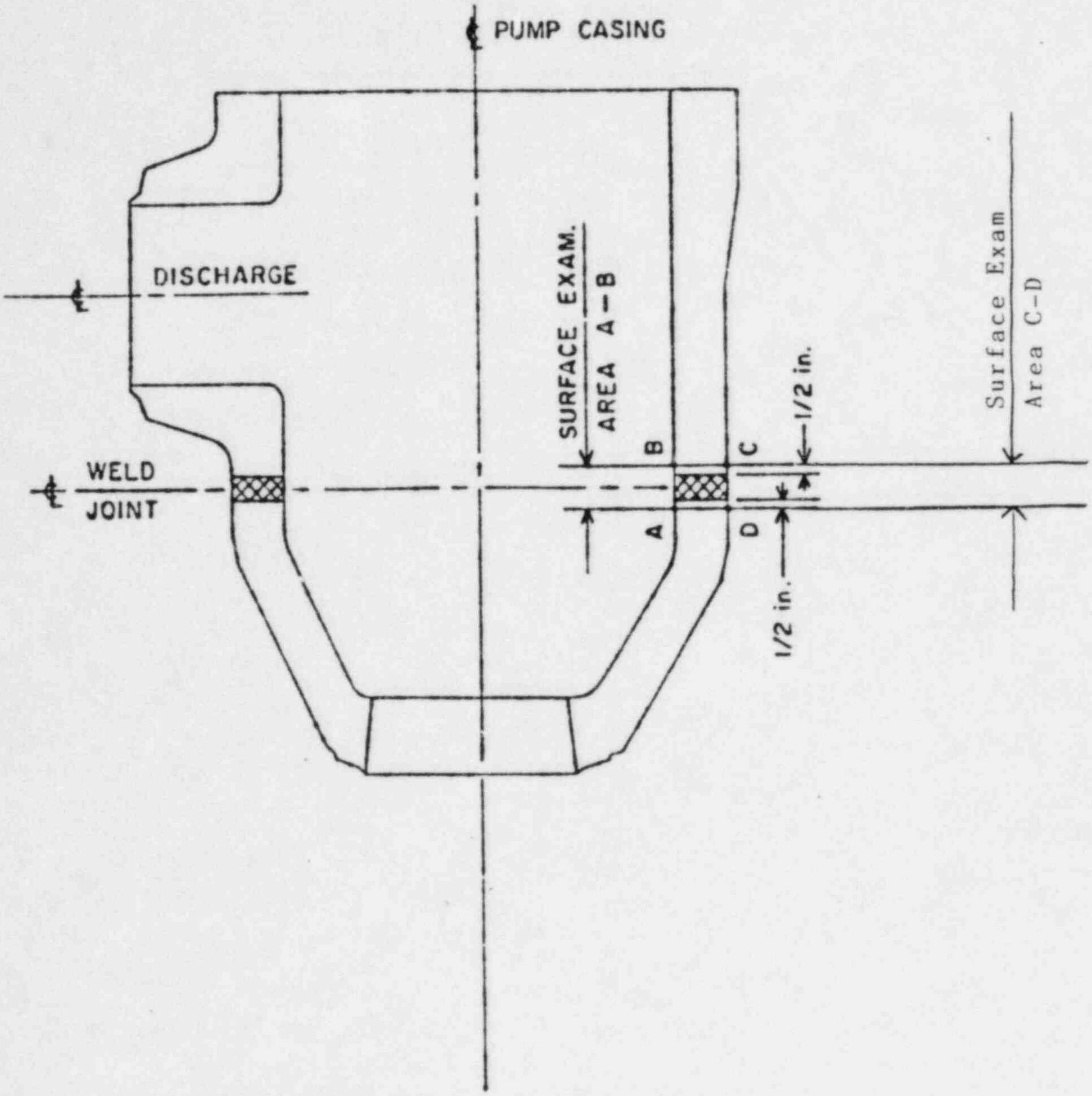


Fig. IWC-2520-9

Branch Conneciton Welds

Figure 10

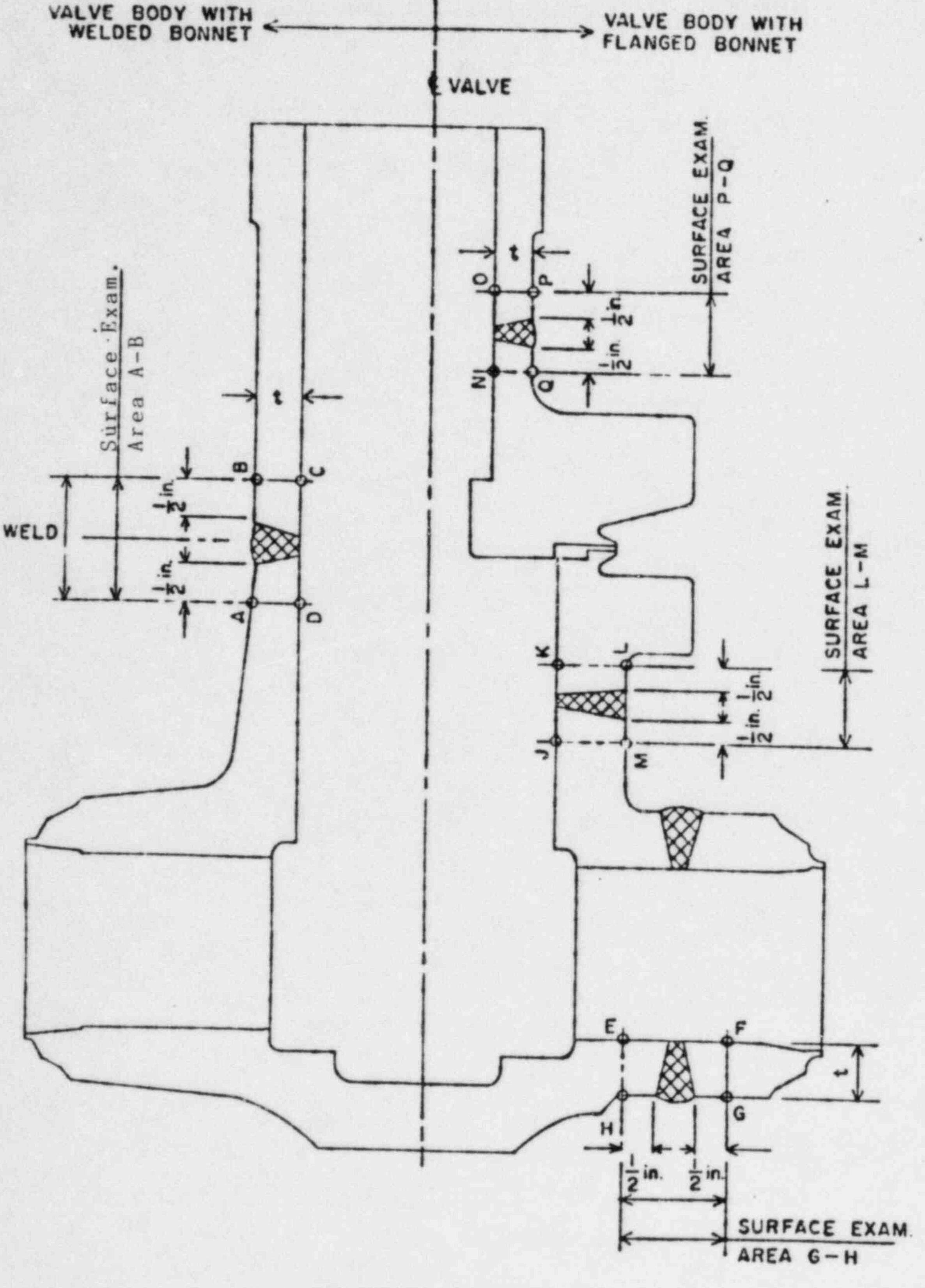
TYPE F PUMP
(SECTION III)



IWB-2500-16 PUMP CASING WELD

Fig. 11

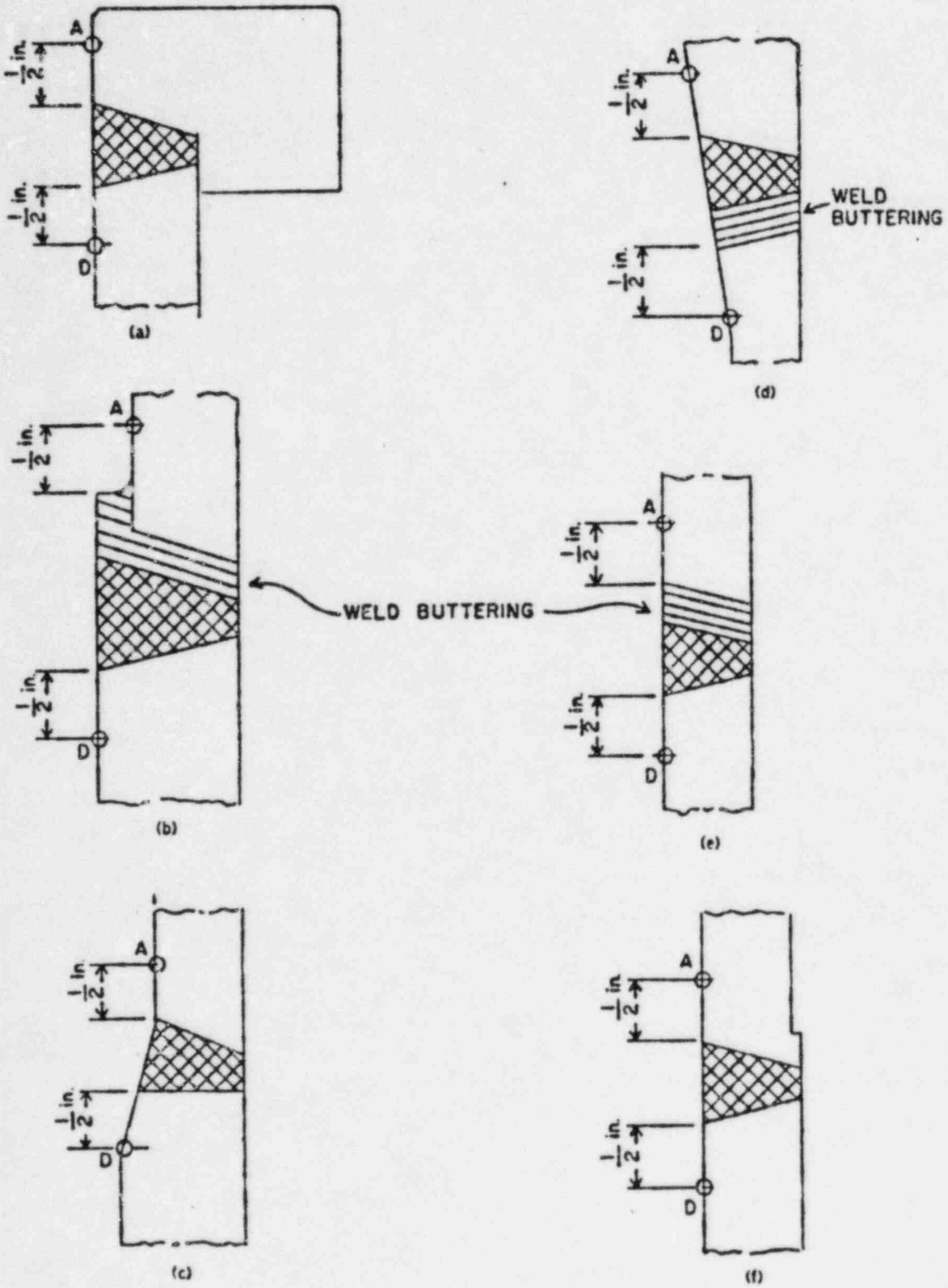
1



IWB-2500-17 VALVE BODY WELDS

Fig. 12

1



SURFACE EXAM. AREA A-D

IWB-2500-18 CONTROL ROD DRIVE HOUSING WELDS

Fig. 13

Figure 14

The Virginia Corp. of Richmond

ISI 3.1

Liquid Penetrant Examination Report

Customer	Plant	Unit	Loop / Zone
Procedure	Examiner/Level		Date
Component/Piping System	ISO Drawing No.	VCR Supervisor	

	Manufacturer	Type	Batch No.
Penetrant			
Developer			
Remover			

Weld/Item Number	Comments	PT Results		VT Results	
		NRI	RI	SAT.	UNSAT.

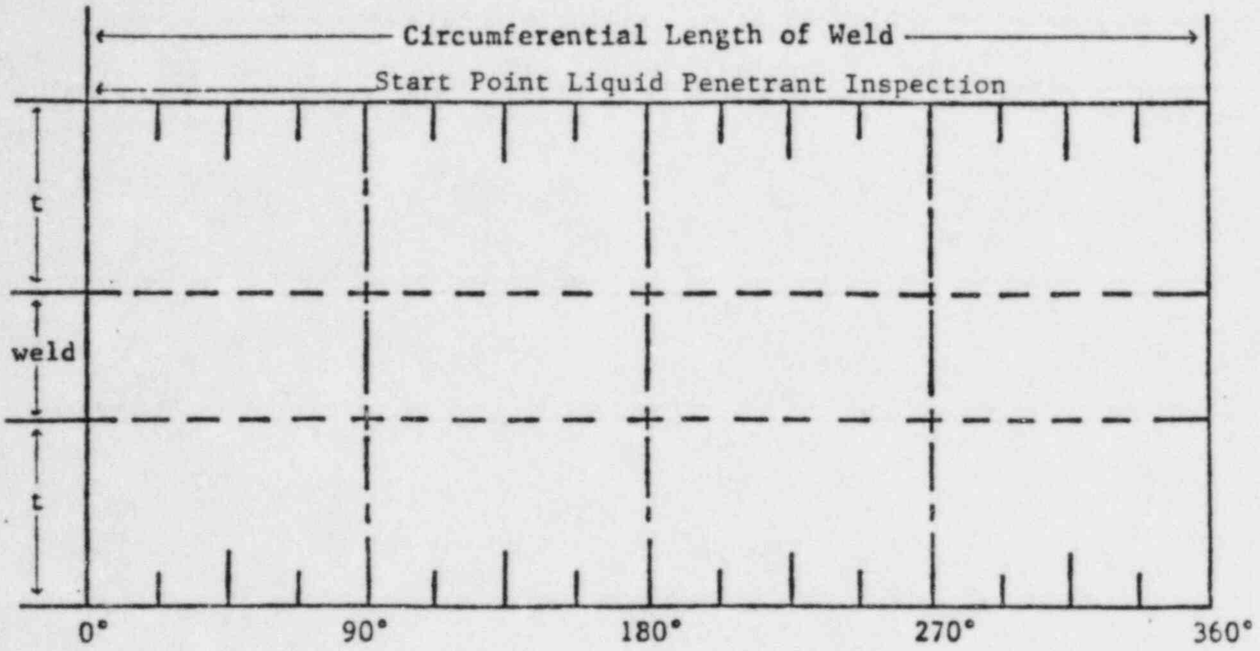
Figure 15

ISI 3.1

The Virginia Corp. of Richmond

Liquid Penetrant Weld Indication Record

Customer	Plant	Unit	Loop /Zone
Procedure	Examiner/Level	Date	
Component/Piping System	VCR Supervisor		
Weld No.	ISO/Drawing No.		



Remarks

Form PT-202

2/82

Figure 16

ISI 3.1

The Virginia Corp. of Richmond

Liquid Penetrant Indication Record

Customer
Plant
Unit
Loop/ Zone

Procedure
Examiner/Level
Date

Component/Piping System
VCR Supervisor

Item No.
ISO/Drawing No.

Comments:

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title:	MAGNETIC PARTICLE EXAMINATION OF BOLTING UTILIZING THE DRY CONTINUOUS METHOD
Procedure No.:	ISI 4.1
Plant Site:	Waterford No. 3
Customer:	Louisiana Power and Light Ebasco Services, Inc. - Agent
Approved for Use Virginia Corporation:	Thomas B Munson
Approved for Use Customer:	3/31/82 James G. Dilanian NDE Level III

EBASCO SERVICES
INCORPORATED
QUALITY
ASSURANCE
ENGINEERING

This Document Is:

☑ Reviewed Without Comments
☐ Reviewed With Comments as Noted: Incorporate Comments and Resubmit: Proceed with order.
☐ Rejected: Revise and Resubmit.

NOTE:
Review of this document, with or without comments, is indicative of conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.

BY: B. Walter Sawicky
DATE: 3/22/82

Rev. 0	**Date:** 2/10/82	**Rev.**	**Date:**
Prepared by: Thomas B Munson		**Prepared by:**	
Reviewed by: Thomas B Munson Lvl III		**Reviewed by:**	
Reviewed by: Marvin M. Berowger		**Reviewed by:**	
		Customer:	
Rev.	**Date:**	**Rev.**	**Date:**
Prepared by:		**Prepared by:**	
Reviewed by:		**Reviewed by:**	
Reviewed by:		**Reviewed by:**	
Customer:		**Customer:**	
Rev.	**Date:**	**Rev.**	**Date:**
Prepared by:		**Prepared by:**	
Reviewed by:		**Reviewed by:**	
Reviewed by:		**Reviewed by:**	
Customer:		**Customer:**	

The Virginia Corporation **of Richmond**	Proc. No. ISI 4.1 Rev. 0 Date: 2/10/82 Page 1 of 9

1.0 Scope

1.1 This procedure describes the requirements for the performance 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. 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, 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.

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 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.

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. 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 equivalent, shall 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".

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 Surface irregularities that, in the opinion of the examiners, 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 The examination area for bolting shall be the entire exposed surface.

5.4 Surface temperature shall not exceed 600°F when using dry 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 Examinations 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 bolting is examined for circumferential and axial indications.

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 1 inch.

6.4 Examination for Axial Indications

6.4.1 A longitudinal field, generally perpendicular to suspected axial indications, shall be induced in the part with an alternating current electromagnetic yoke.

6.4.2 The area of examination shall be limited to within ¼ of the pole spacing on each side of the yoke. Minimum pole spacing shall be three inches.

6.4.3 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.

6.4.3.1 If the line, or lines, are not formed, 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.

6.4.3.2 Satisfactory definition of the line, or lines, on the MPFI verifies the adequacy and suitability of the technique and equipment.

6.4.4 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

6.5 Examination for Circumferential Indications

6.5.1 A longitudinal field, generally perpendicular to suspected circumferential indications, shall be induced in the part with an HWDC coil coupled to portable magnetic particle equipment as described in paragraph 4.1.3.

6.5.2 Magnetization is accomplished by passing HWDC current through a multiturn coil looped around the bolting to be examined. This produces a magnetic field parallel to the axis of the coil.

6.5.2.1 For bolting with a length (L)/Diameter (D) ratio greater than, or equal to, 4, the following formula shall be used to calculate the ampere-turns to be used for magnetization:

$$\text{Ampere-turns} = \frac{35{,}000}{2 + L/D}$$

6.5.2.2 For bolting with a L/D ratio greater than, or equal to, 2 and up to 4, the following formula shall be used:

$$\text{ampere-turns} = \frac{45{,}000}{L/D}$$

6.5.2.3 For L/D ratios less than 2, alternate magnetizing methods shall be used.

6.5.3 The magnetizing coil shall be made of cable, wound around the bolting, and the coil's turns shall be closely spaced.

6.5.4 The area of examination shall be limited to within five inches on each side of the coil.

6.5.5 Parts longer than twelve inches shall be examined in sections not exceeding eleven inches nominal length.

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.

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

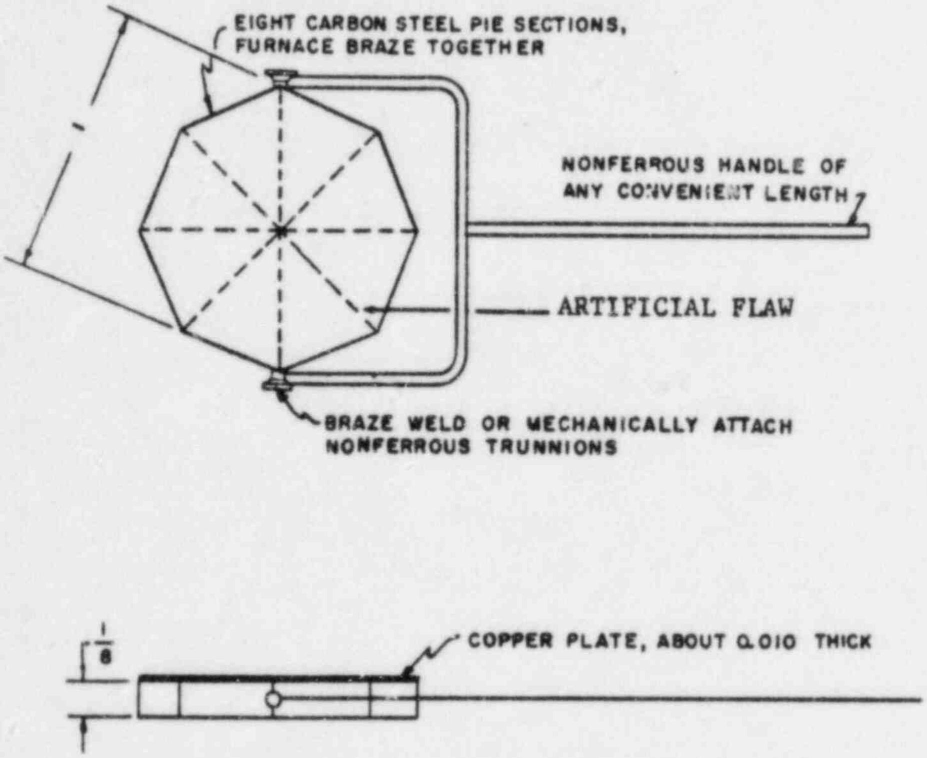
7.3.1 The following relevant indications occuring in the examination area are to be recorded and reported:

a. non-axial indications, greater than ¼ 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 refererence 2.4, and on forms similar to those shown in figures 2 and 3.



ILLUSTRATIVE ONLY

Figure 1

Magnetic Particle Field Indicator

Figure 2

The Virginia Corp. of Richmond

Magnetic Particle Examination Report

Customer	Plant	Unit	Loop /Zone

Procedure	Examiner/Level	VCR Supervisor	Date

Component/Piping System	ISO Drawing No.	Surface Condition

Type of Particles ___Wet ___Dry ___Visible ___Flourescent	Manufacturer	Type	Batch Number

Current ___AC ___DC ___HWDC	Machine Mfr.	Type/Model	Serial No.

Magnetization ___Continuous ___Residual	Coil _______Amps. _______No. Turns	Prods _______Spacing _______Amps.	Yoke _______Spacing	▨

Weld / Item	Comments	MT Results		VT Results	
		NRI	RI	Sat	Unsat

Figure 3

The Virginia Corp. of Richmond

Magnetic Particle Indication Record

Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Level	Date	
Component/Piping System	VCR Supervisor		
Item No.	ISO/ Drawing No.		

Comments:

The Virginia Corp. of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MAGNETIC PARTICLE EXAMINATION OF BOLTING BY CONTINUOUS METHOD UTILIZING WET, FLUORESCENT MEDIUM

Procedure No.: ISI 4.2

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer: JHD 3/31/82 James H. Dulmin NDE Level II

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QUALITY ASSURANCE ENGINEERING
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BY: Walter Sawicky
DATE: 3/22/82

Rev. 0 Date: 2/10/82 Prepared by: Thomas B Munson Reviewed by: Thomas B Munson Lvl III Reviewed by: Marvin M. Beranger	Rev. ______ Date: ______ Prepared by: ______ Reviewed by: ______ Reviewed by: ______ Customer: ______
Rev. ______ Date: ______ Prepared by: ______ Reviewed by: ______ Reviewed by: ______ Customer: ______	Rev. ______ Date: ______ Prepared by: ______ Reviewed by: ______ Reviewed by: ______ Customer: ______
Rev. ______ Date: ______ Prepared by: ______ Reviewed by: ______ Reviewed by: ______ Customer: ______	Rev. ______ Date: ______ Prepared by: ______ Reviewed by: ______ Reviewed by: ______ Customer: ______

1.0 Scope

1.1 This procedure describes the requirements for the performance 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.

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 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 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.

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 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 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.

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 $800 \mu W/cm^2$.

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".

5.0 General Requirements

5.1 Lighting

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

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

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 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.

6.0 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.

6.4 Examination for Axial Indications

6.4.1 A longitudinal field, generally perependicular to suspected axial indications, shall be induced in the part with an alternating current electromagnetic yoke.

6.4.2 The area of examination shall be limited to within ¼ of the pole spacing on each side of the yoke. Minimum pole spacing shall be three inches.

6.4.3 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 as described in paragraph 6.1

6.4.3.1 If the line, or lines, are not formed, or are not 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.

6.4.3.2 Satisfactory definition of the line, or lines, on the MPFI verifies the adequacy and suitability of the technique and equipment.

6.4.4 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.

6.5 Examination for Circumferential Indications

6.5.1 A longitudinal field, generally perpendicular to suspected circumferential indications, shall be induced in the part with an HWDC coil coupled to portable magnetic particle equipment as described in paragraph 4.1.3.

6.5.2 Magnetization is accomplished by passing HWDC current through a multiturn coil looped around the bolting to be examined. This produces a magnetic field parallel to the axis of the coil.

6.5.2.1 For bolting with a length (L)/Diameter (D) ratio greater than, or equal to, 4, the following formula shall be used to calculate the ampere-turns to be used for magnetization:

$$\text{Ampere-turns} = \frac{35{,}000}{2 + L/D}$$

6.5.2.2 For bolting with a L/D ratio greater than, or equal to, 2 and up to 4, the following formula shall be used:

$$\text{ampere-turns} = \frac{45{,}000}{L/D}$$

6.5.2.3 For L/D ratios less than 2, alternate magnetizing methods shall be used.

6.5.3 The magnetizing coil shall be made of cable, wound around the bolting, and the coil's turns shall be closely spaced.

6.5.4 The area of examination shall be limited to within five inches on each side of the coil.

6.5.5 Parts longer than twelve inches shall be examined in sections not exceeding eleven inches nominal length.

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.

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

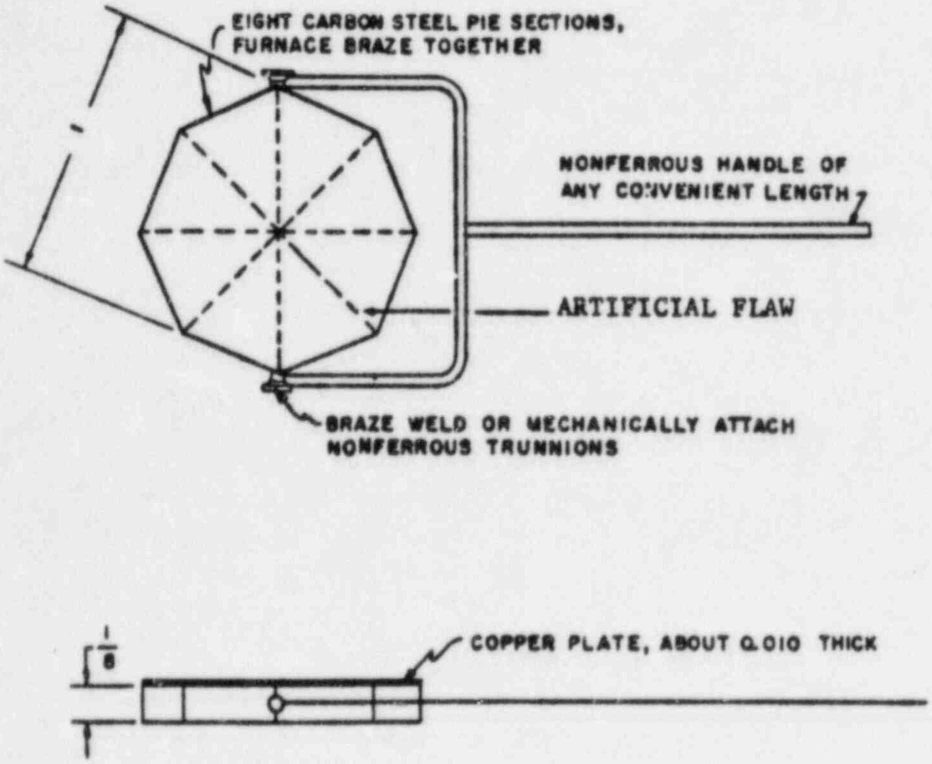
7.3.1 The following relevant indications occuring in the examination area are to be recorded and reported:

a. non-axial indications, greater than ¼ 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 refererence 2.4, and on forms similar to those shown in figures 2 and 3.



ILLUSTRATIVE ONLY

Figure 1

Magnetic Particle Field Indicator

Figure 2

The
Virginia Corp.
of Richmond

Magnetic Particle Examination Report

Customer	Plant	Unit	Loop /Zone
Procedure	Examiner/Level	VCR Supervisor	Date
Component/Piping System	ISO Drawing No.	Surface Condition	
Type of Particles ___Wet ___Dry ___Visible ___Flourescent	Manufacturer	Type	Batch Number
Current ___AC ___DC ___HWDC	Machine Mfr.	Type/Model	Serial No.

Magnetization ___Continuous ___Residual	Coil _______Amps. _______No. Turns	Prods _______Spacing _______Amps.	Yoke _______Spacing	

Weld / Item	Comments	MT Results		VT Results	
		NRI	RI	Sat	Unsat

Form MT-301 2/82

Figure 3

The Virginia Corp. of Richmond

Magnetic Particle Indication Record

Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Level	Date	
Component/Piping System	VCR Supervisor		
Item No.	ISO/ Drawing No.		

Comments:

The
Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MAGNETIC PARTICLE EXAMINATION OF WELDS UTILIZING THE DRY CONTINUOUS METHOD

Procedure No.: ISI 4.3

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES
INCORPORATED
QUALITY
ASSURANCE
ENGINEERING

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BY:
DATE: 4-18-83

Rev. 0 Date: 2/10/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by:

Rev. ____ Date: ____
Prepared by: ____
Reviewed by: ____
Reviewed by: ____
Customer: ____

Rev. 1 Date: 3/1/83
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Reviewed by:
Customer: James H. [illegible] Lvl II
4/18/83 4/21/83

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Prepared by: ____
Reviewed by: ____
Reviewed by: ____
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Prepared by: ____
Reviewed by: ____
Reviewed by: ____
Customer: ____

Rev. ____ Date: ____
Prepared by: ____
Reviewed by: ____
Reviewed by: ____
Customer: ____

The Virginia Corporation
of Richmond

Proc. No. ISI 4.3 Rev. 1
Date: 3/1/83 Page 1 of 21

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.

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.

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. 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 equivalent, shall 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".

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.

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

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.

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.

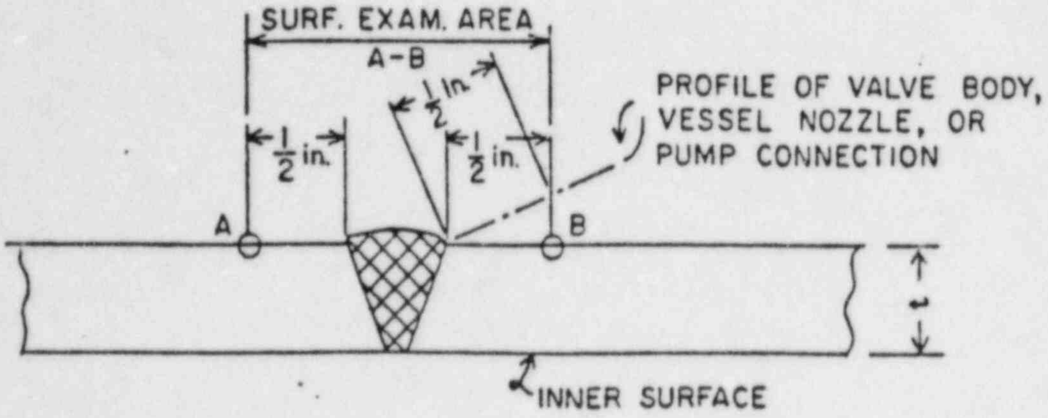
7.3 Reportable Indications

7.3.1 The 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.

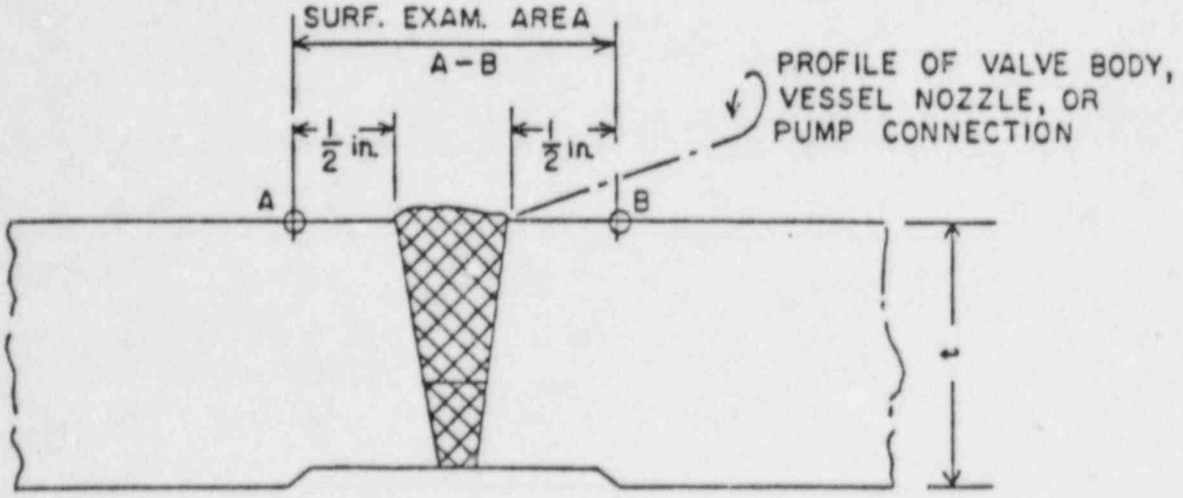
Description	Nominal Wall Thickness/Other	Reportable Indications
Ferromagnetic welds piping	≤ .312" >.312" to 2.0" 2.0" & over	>1/8" >3/16" >1/4"
Ferromagnetic vessel supports and support members for piping, valves, and pumps	.625" to 2.0" 2.0" & over	>3/16" >1/4"
Pressure retaining welds in pump casings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

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.



NOM. PIPE SIZE LESS THAN 4 IN.



NOM. PIPE SIZE 4 IN. AND GREATER

Fig. IWB-2500-8

Similar and Dissimilar Metal Welds in Piping

Figure 1

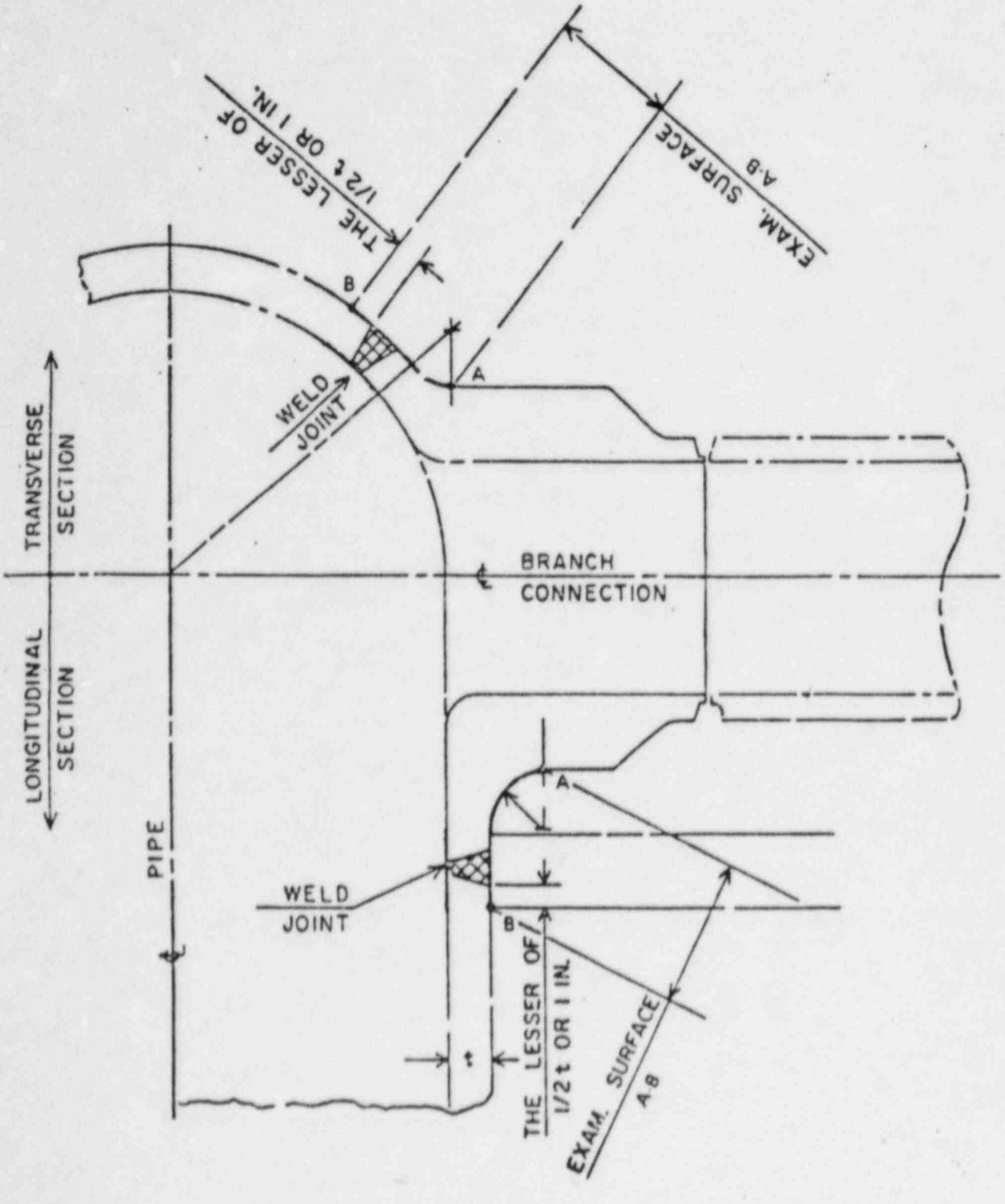


Fig. IWB-2500-9

Pipe Branch Connection

Figure 2

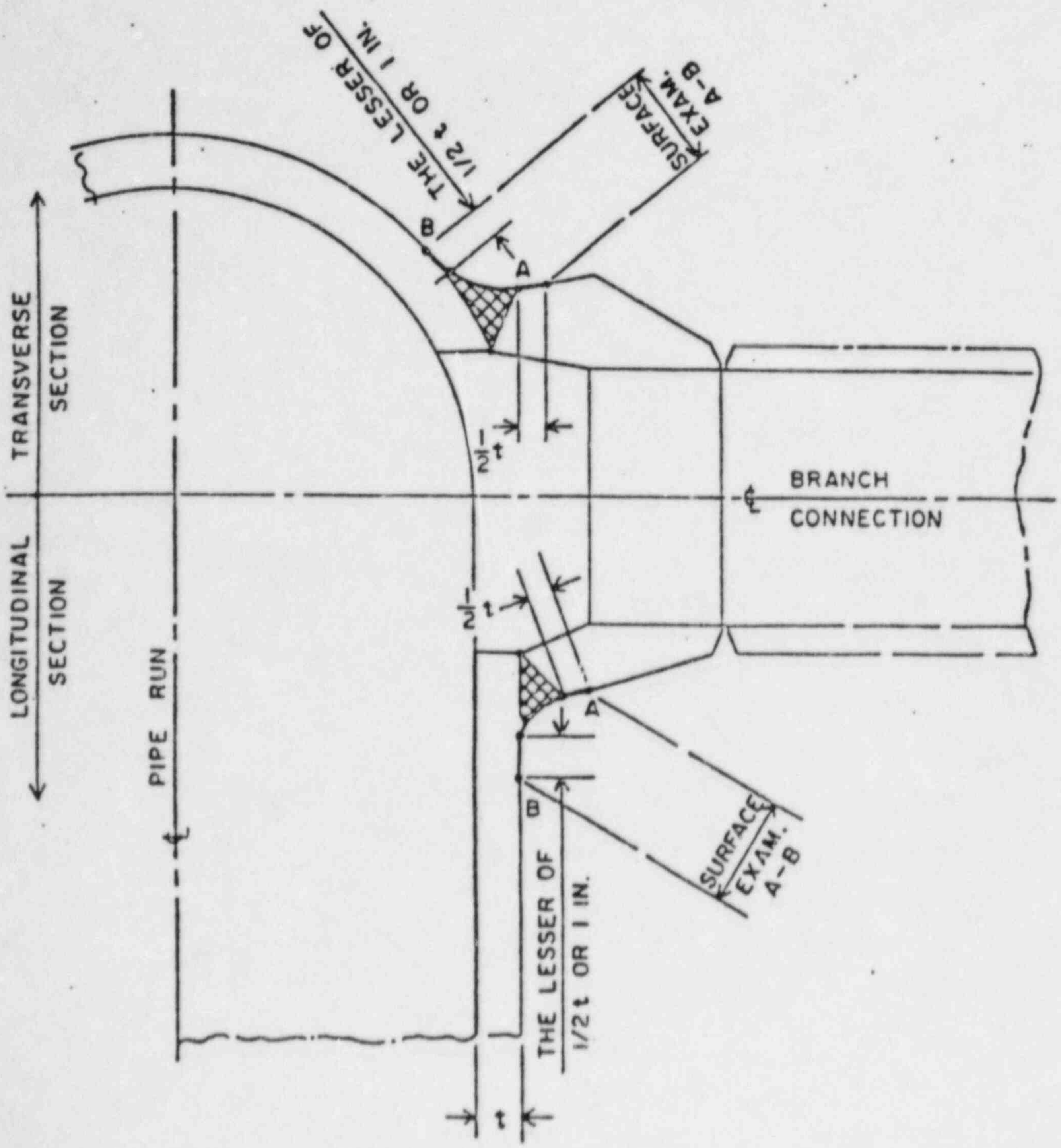
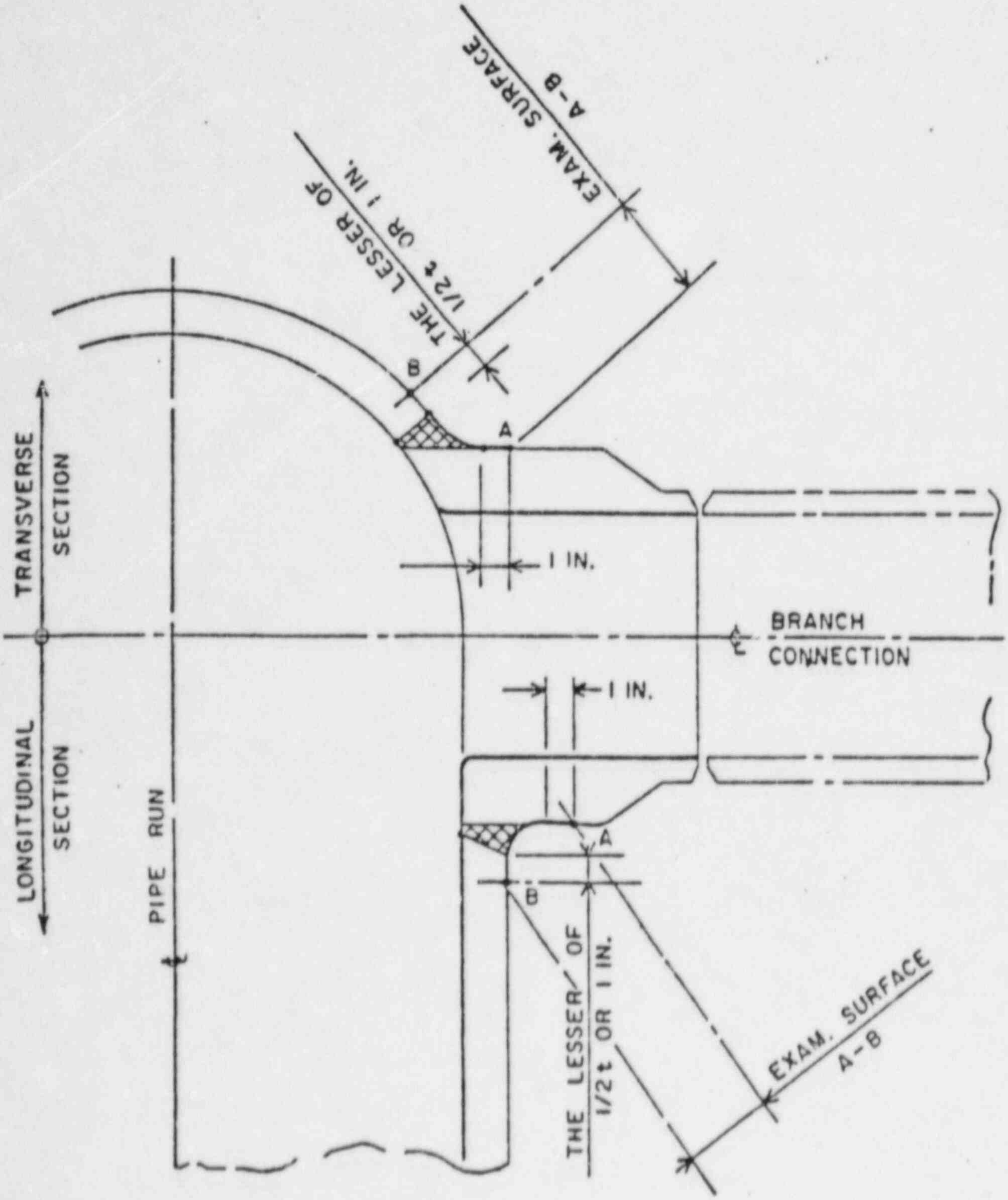


Fig. IWB-2500-10

Pipe Branch Connection

Figure 3



IWB-2500-11

Pipe Branch Connection

Figure 4

NOZZLE SIZES OVER 4 in. NOM. PIPE SIZE
VESSEL THICKNESS - t = 1/2 in. OR LESS

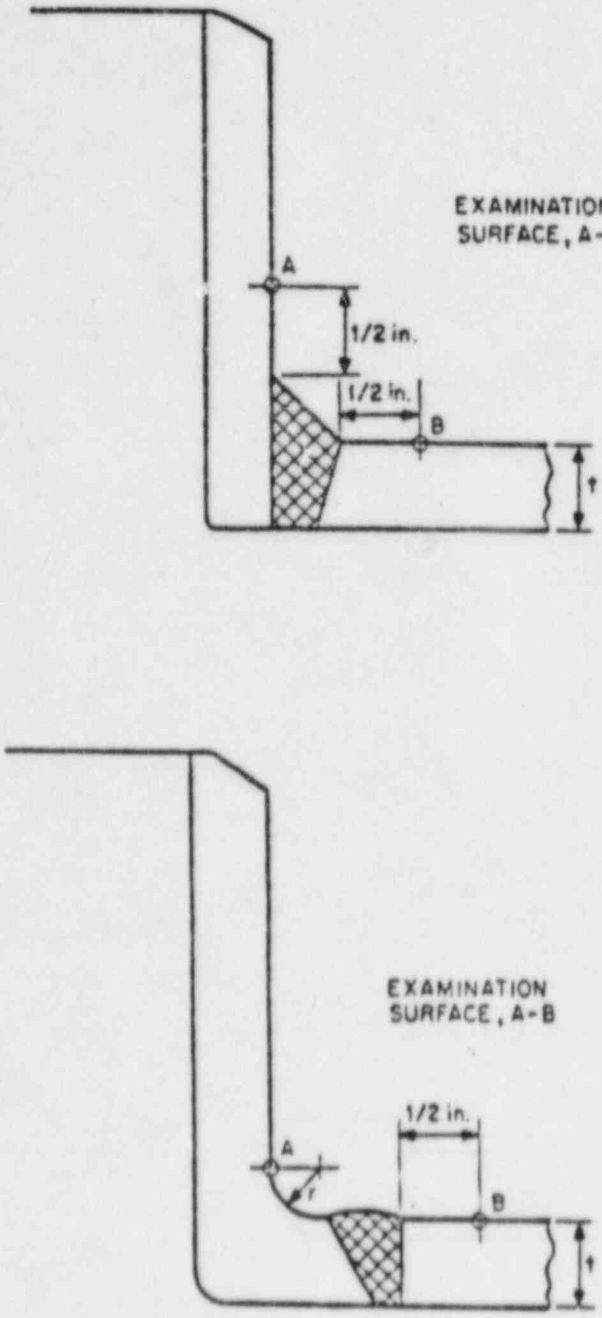
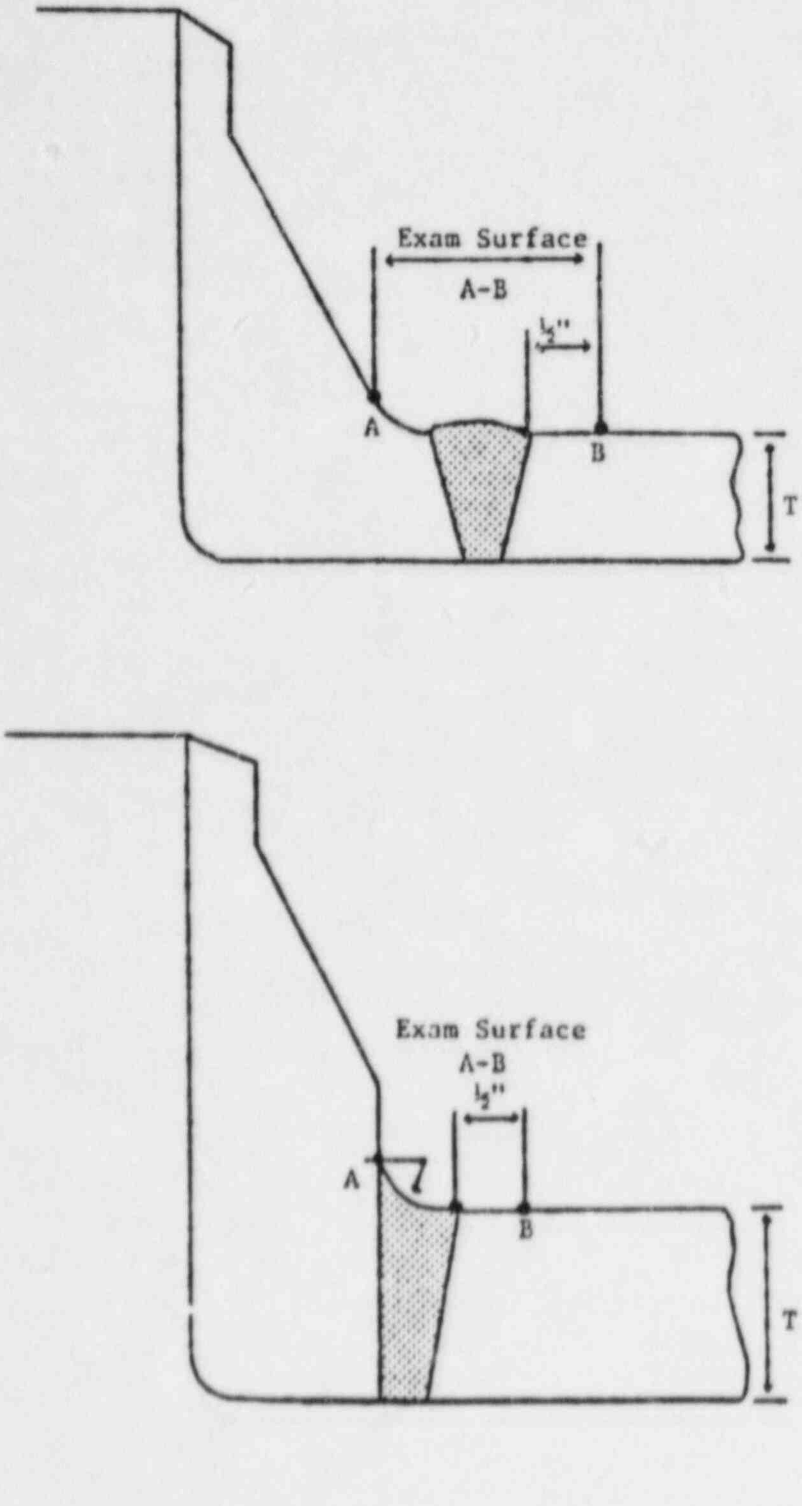


Fig. IWC-2520-3

Nozzle to Vessel Welds

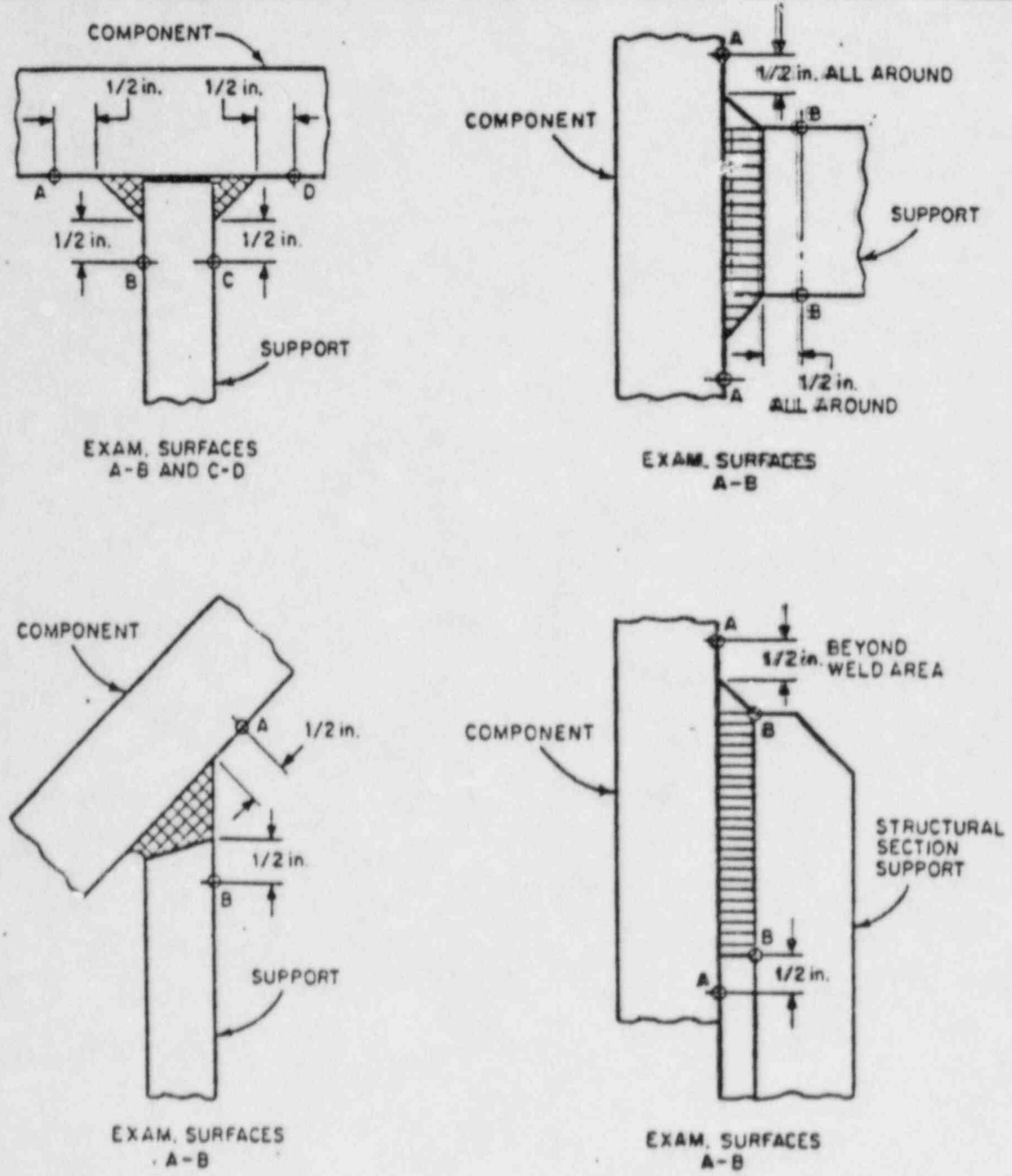
Figure 5



IWC-2520-4

Nozzle to Vessel Welds

Fig. 6



EXAM. SURFACES
A-B AND C-D

EXAM. SURFACES
A-B

EXAM. SURFACES
A-B

EXAM. SURFACES
A-B

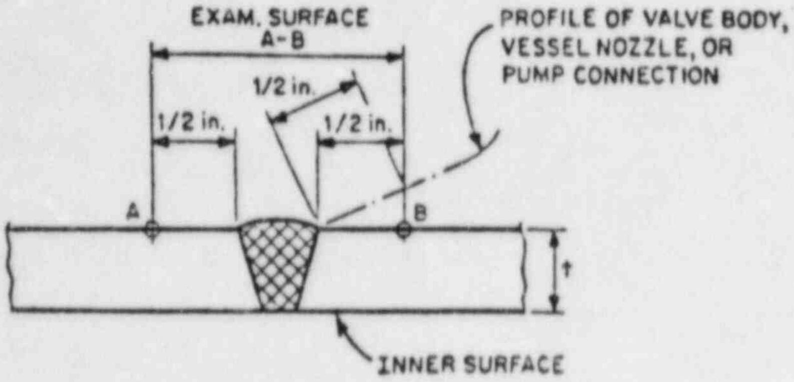
PLATE AND SHELL TYPE
SUPPORT WELDS

LINEAR TYPE
SUPPORT WELDS

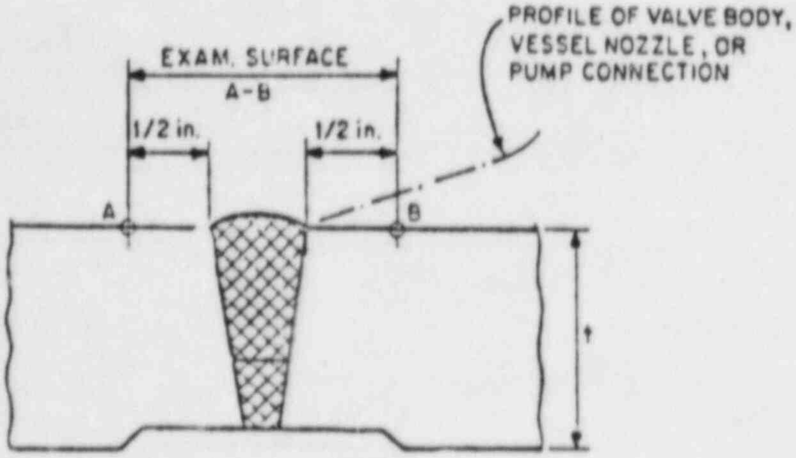
Fig. IWC-2520-5

Integrally Welded Component Supports

Figure 7



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



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

IWC-2520-7

Welds in Piping

Figure 8

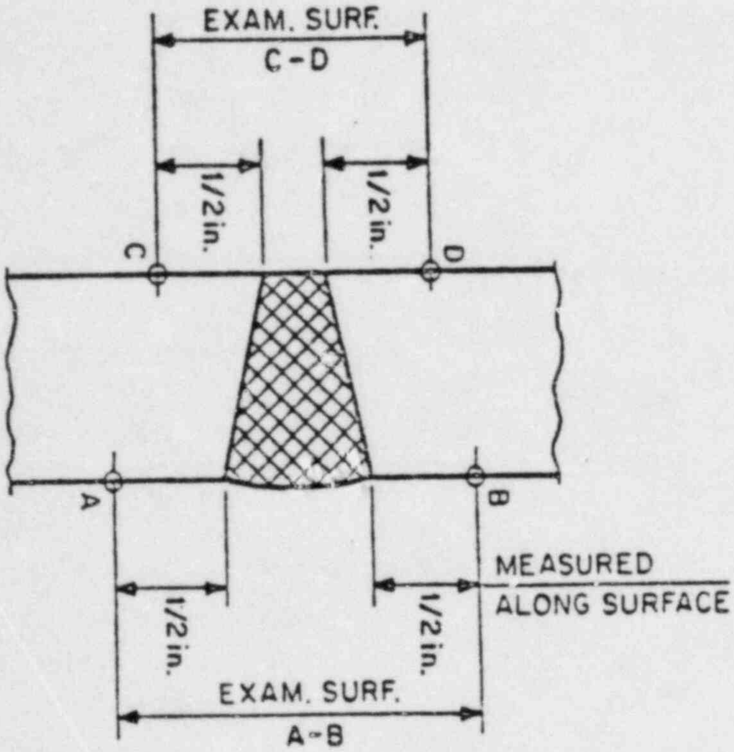


Fig. IWC-2520-8

Welds in Pump Casing and Valve Bodies

Figure 9

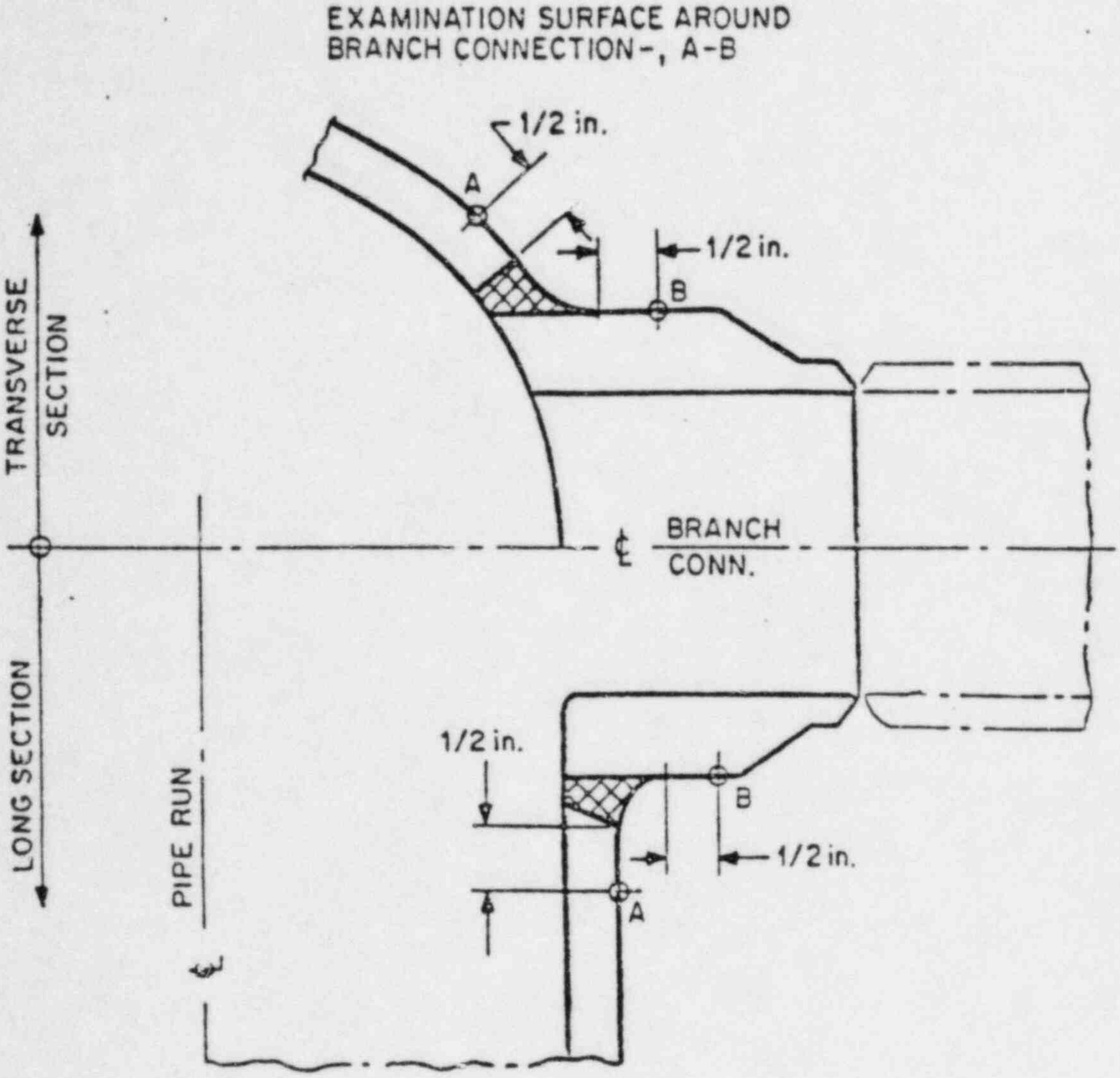
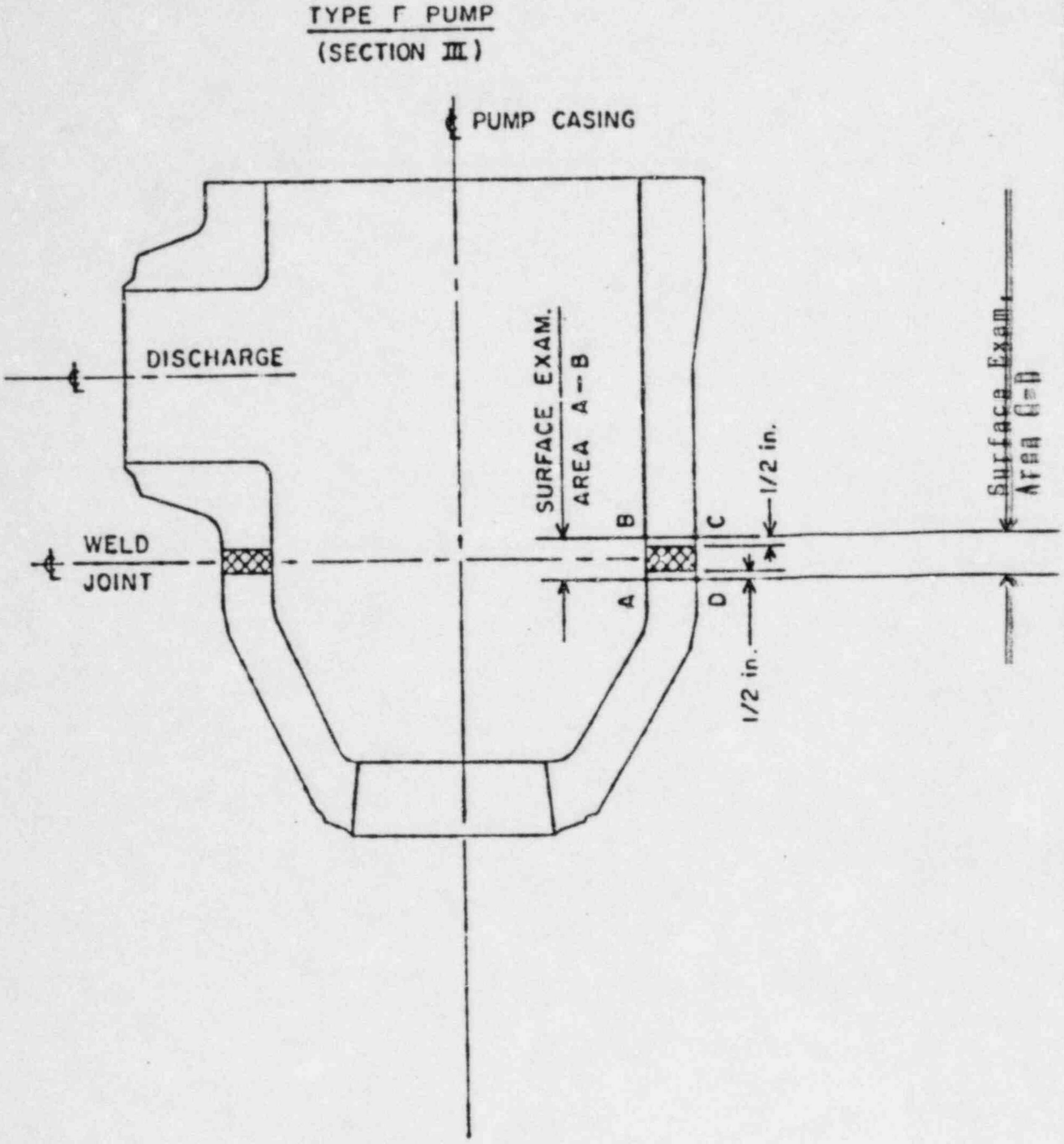


Fig. IWC-2520-9

Branch Conneciton Welds

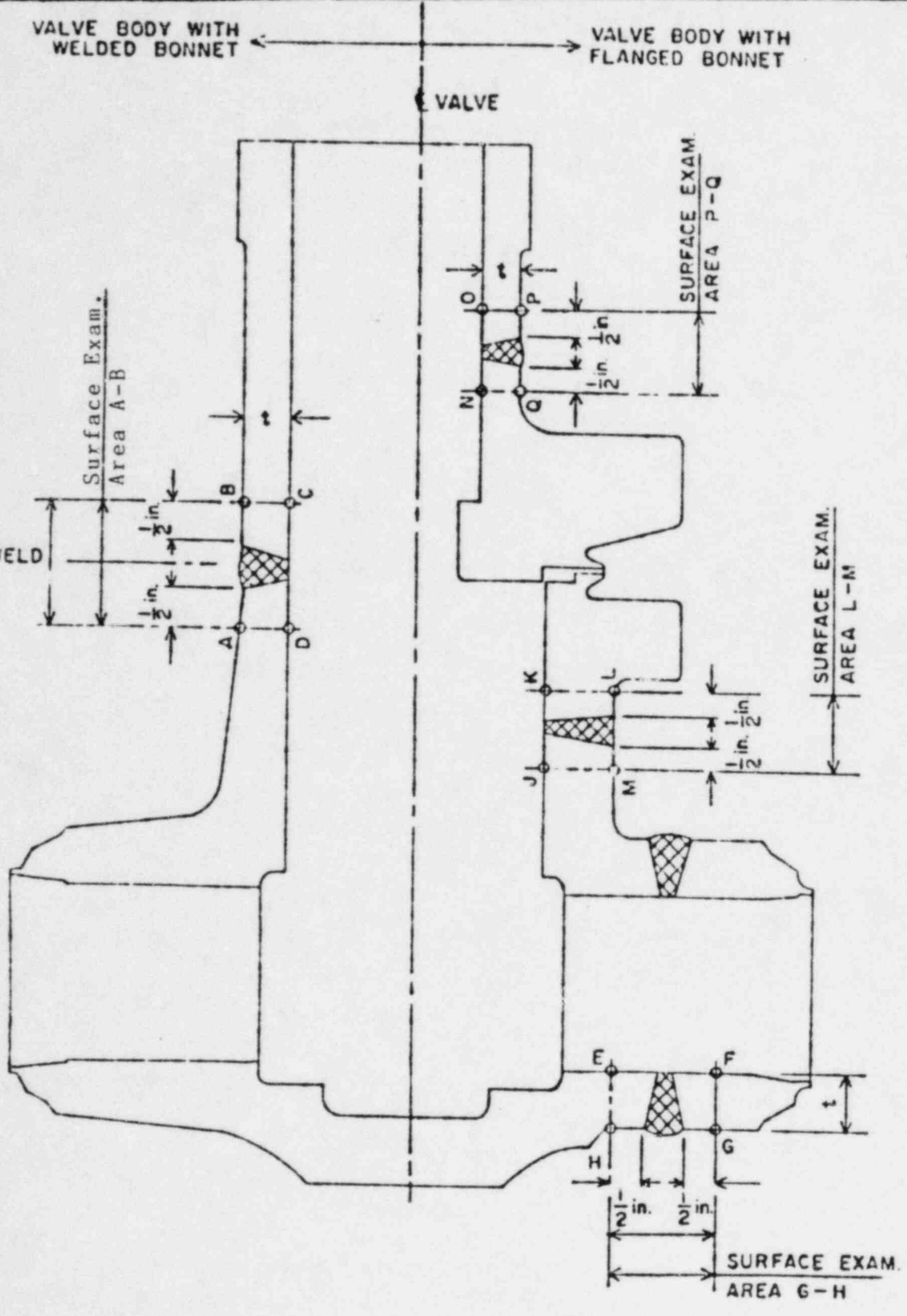
Figure 10



IWB-2500-16 PUMP CASING WELD

Fig. 11

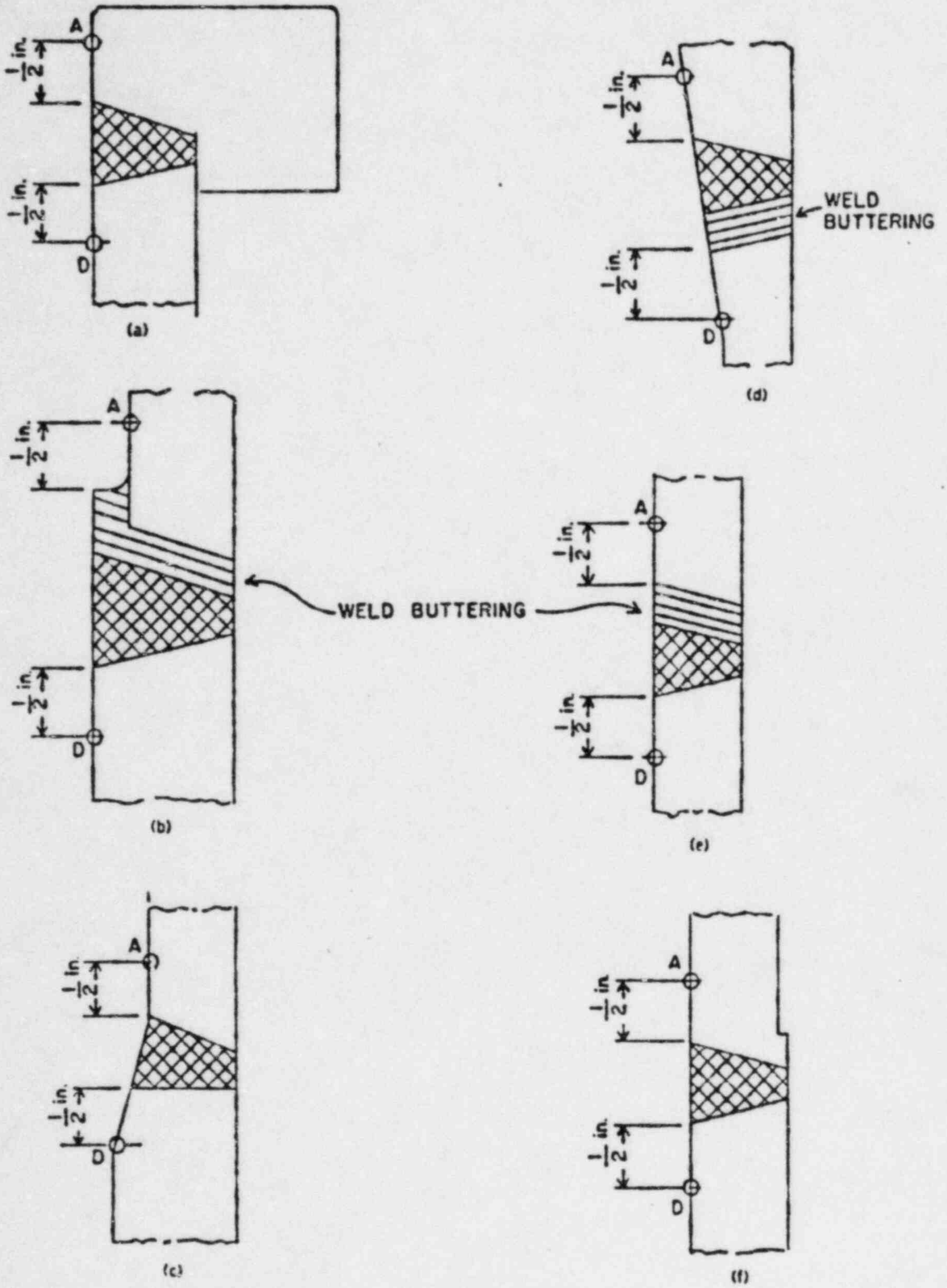
1



IWB-2500-17 VALVE BODY WELDS

Fig. 12

1



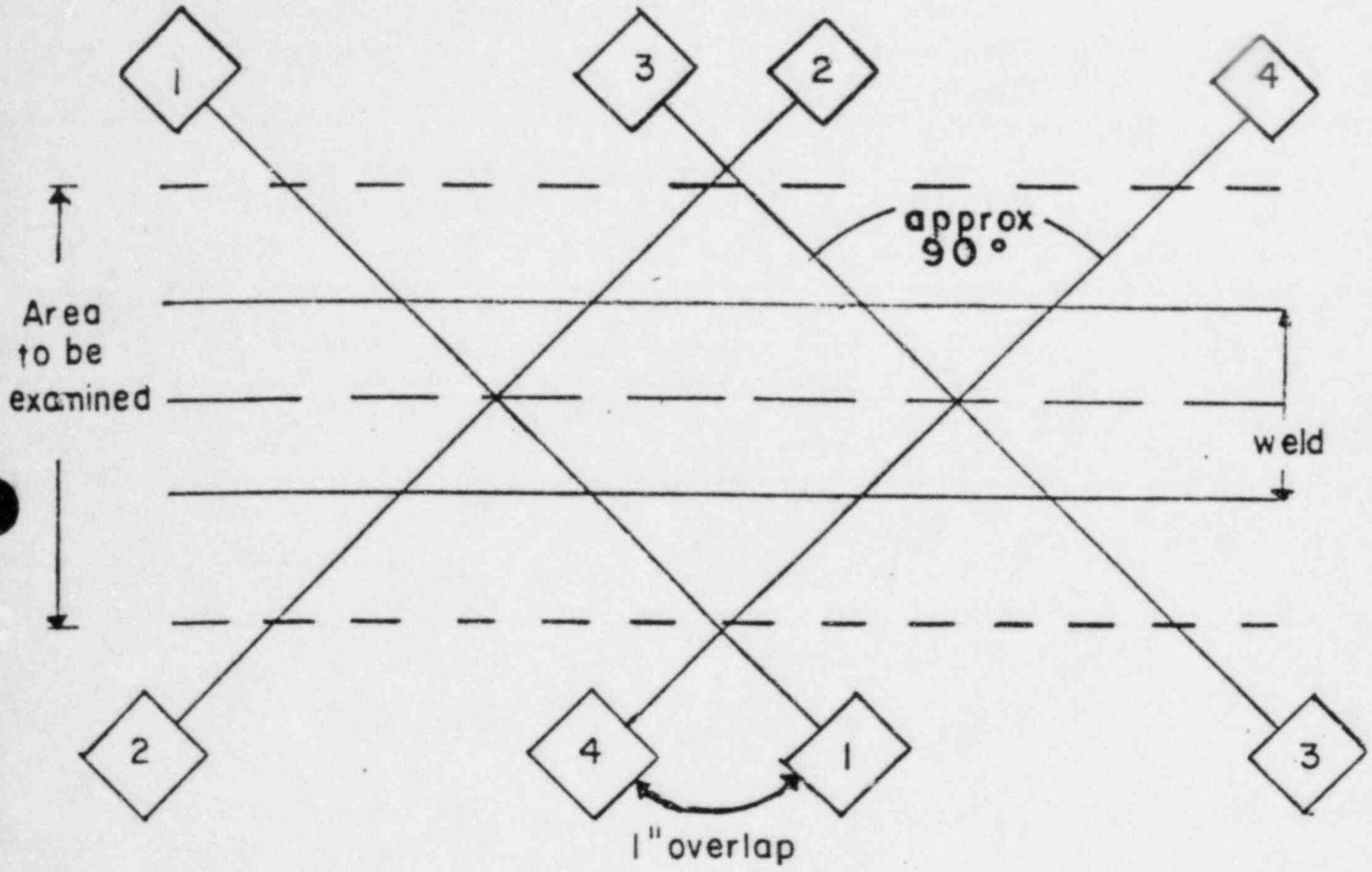
SURFACE EXAM. AREA A-D

IWB-2500-18 CONTROL ROD DRIVE HOUSING WELDS

Fig. 13

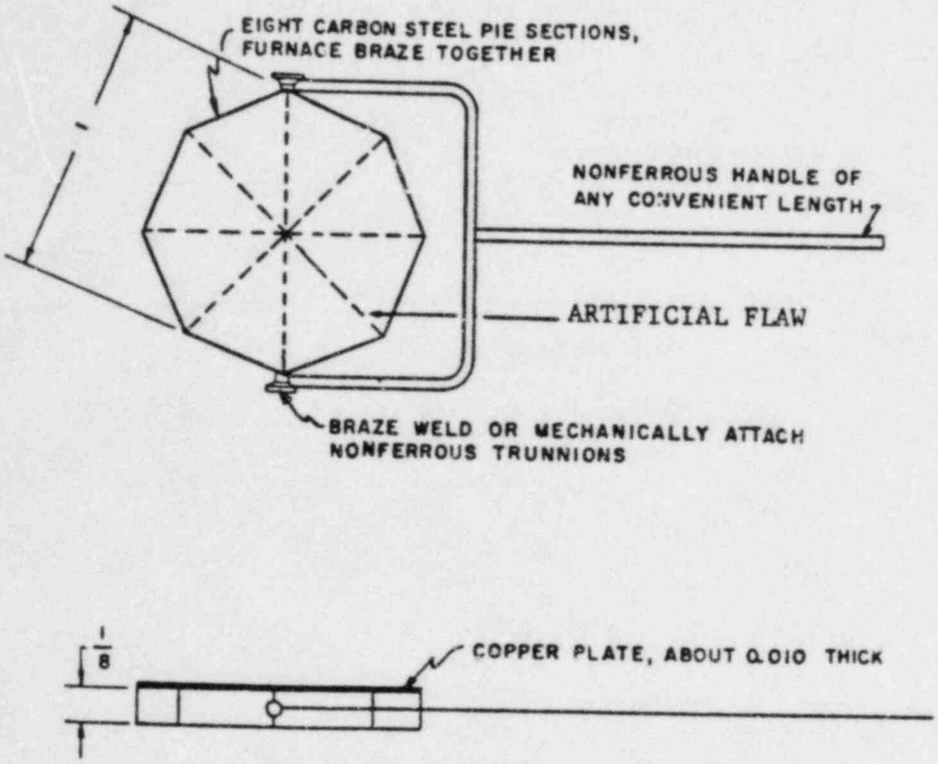
YOKE POSITIONING FOR WELD EXAMINATION

ILLUSTRATIVE ONLY



PROBE POSITIONS SHOWING 2 DIRECTIONS 90° TO EACH OTHER AND 1" OVERLAPPING ON SURFACE TO BE EXAMINED

Figure 14



ILLUSTRATIVE ONLY

Figure 15
Magnetic Particle Field Indicator

Figure 16

The Virginia Corp. of Richmond

ISI 4.3

Magnetic Particle Examination Report

Customer | Plant | Unit | Loop /Zone

Procedure | Examiner/Level | VCR Supervisor | Date

Component/Piping System | ISO Drawing No. | Surface Condition

Type of Particles ___ Wet ___ Dry ___ Visible ___ Flourescent | Manufacturer | Type | Batch Number

Current ___ AC ___ DC ___ HWDC | Machine Mfr. | Type/Model | Serial No.

Magnetization ___ Continuous ___ Residual | Coil ________ Amps. ________ No. Turns | Prods ________ Spacing ________ Amps. | Yoke ________ Spacing | ▨

Weld / Item	Comments	MT Results		VT Results	
		NRI	RI	Sat	Unsat

Form MT-301

2/82

Figure 17

ISI 4.3

The Virginia Corp. of Richmond

Magnetic Particle
Weld Indication Record

Customer

Plant

Unit

Loop/Zone

Procedure

Examiner/Level

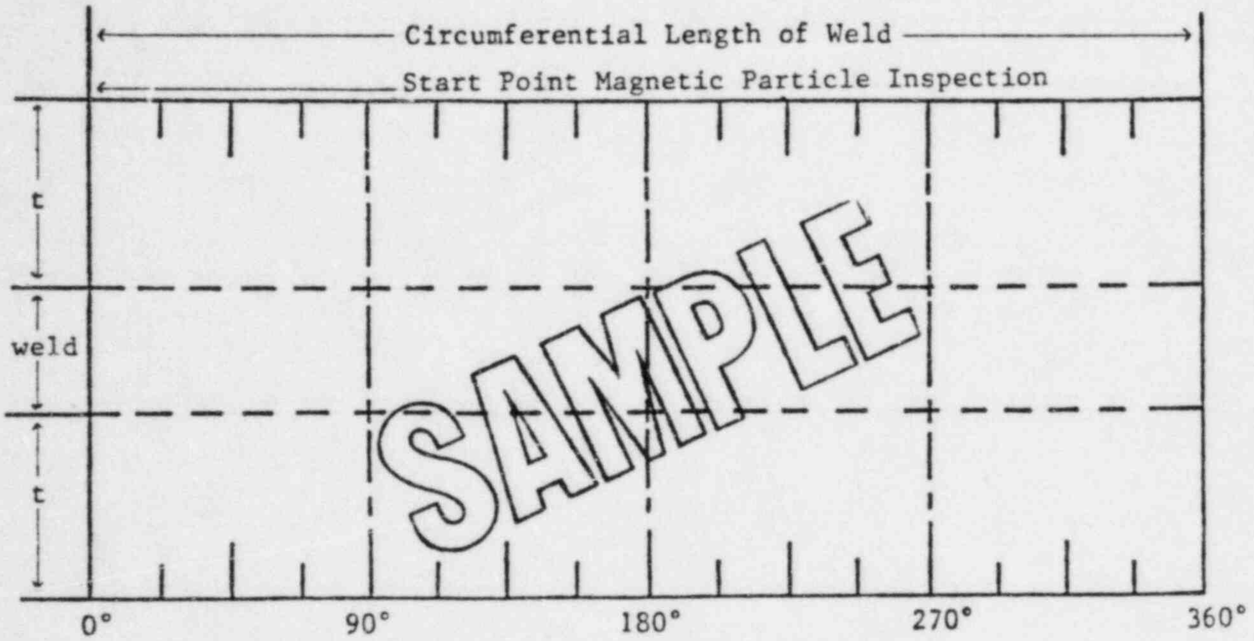
Date

Component/Piping System

VCR Supervisor

Weld No.

ISO/Drawing No.



Remarks

Form MT-302

2/82

The Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: MAGNETIC PARTICLE EXAMINATION OF WELDS BY CONTINUOUS METHOD UTILIZING WET, FLUORESCENT MEDIUM

Procedure No.: ISI 4.4

Plant Site: Waterford No. 3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer:

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING

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☐ Reviewed With Comments as Noted: Incorporate Comments and Resubmit: Proceed with order.
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BY: [illegible]
DATE: [illegible]

Rev. 0 **Date:** 2/11/82
Prepared by: Thomas B Munson
Reviewed by: Thomas B Munson Lvl III
Reviewed by: Marvin M. Bersinger

Rev. ___ **Date:** ___
Prepared by: ___
Reviewed by: ___
Reviewed by: ___
Customer: ___

Rev. 1 **Date:** 4/29/82
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Reviewed by: Marvin M. Bersinger
Customer: ___

Rev. ___ **Date:** ___
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Reviewed by: ___
Reviewed by: ___
Customer: ___

Rev. 2 **Date:** 3/1/83
Prepared by: Daniel Jensen
Reviewed by: Thomas B Munson Lvl III
Reviewed by: [illegible]
Customer: [illegible] 4/18/83 James G. Dickinson III 4/21/83

Rev. ___ **Date:** ___
Prepared by: ___
Reviewed by: ___
Reviewed by: ___
Customer: ___

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. 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

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.

4.0 Equipment and Materials

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

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 $\mu W/cm^2$.

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 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 4.3.1 at least once every eight hours of continuous operation, and whenever the work location is changed.

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".

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 and 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 preparation, if required, shall be the responsibility of the contractor.

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

6.0 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 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 ¼ of the pole spacing on each side of the yoke. Minimum pole spacing shall be three inches.

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.

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.

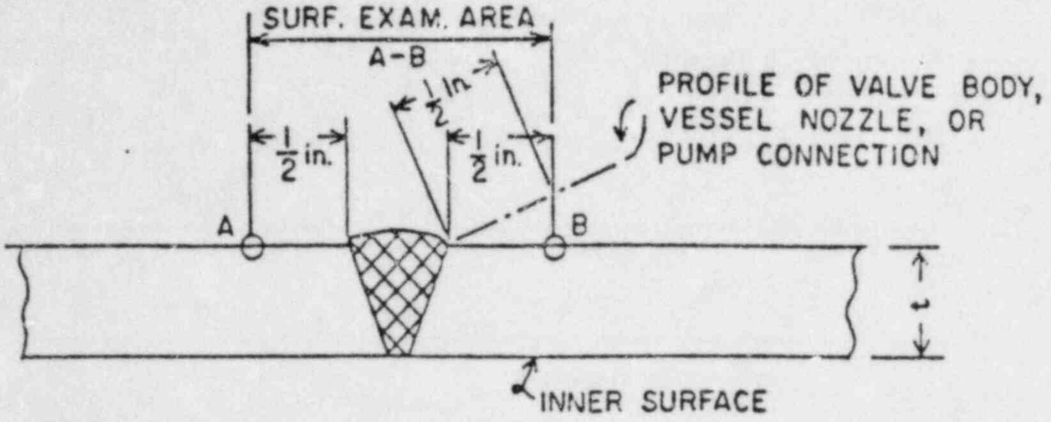
7.3 Reportable Indications

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.

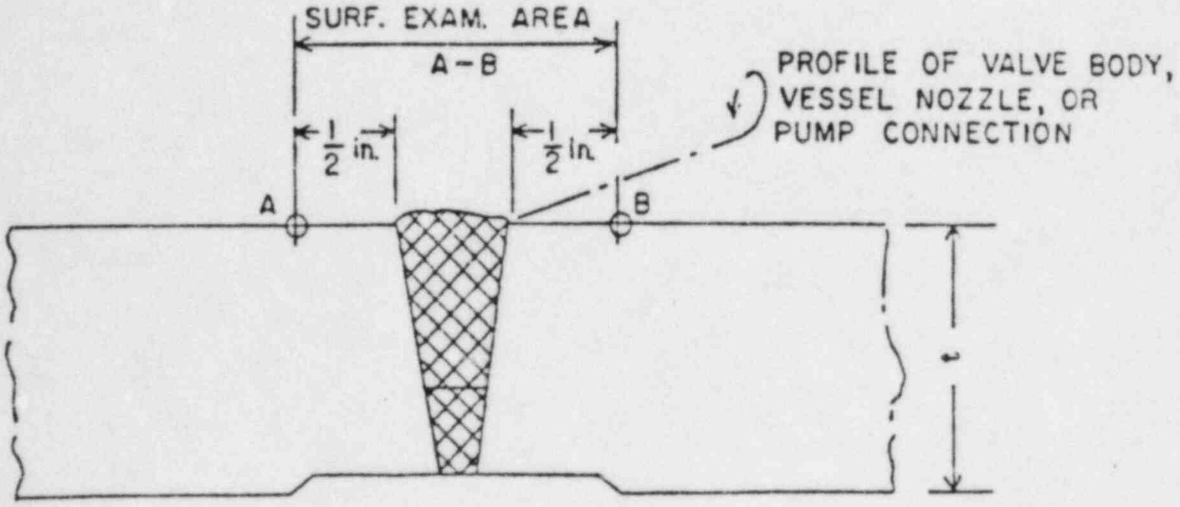
Description	Nominal Wall Thickness/Other	Reportable Indications	
Ferromagnetic welds piping	≤ .312" > .312" to 2.0" 2.0 and over	>1/8" >3/16" >1/4"	2
Ferromagnetic vessel supports and support members for piping, valves, and pumps	.625" to 2.0" 2.0" and over	>3/16" >1/4"	
Pressure retaining welds in pump casings and valve bodies	>2.0"	>1/4"	2

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 LESS THAN 4 IN.



NOM. PIPE SIZE 4 IN. AND GREATER

Fig. IWB-2500-8

Similar and Dissimilar Metal Welds in Piping

Figure 1

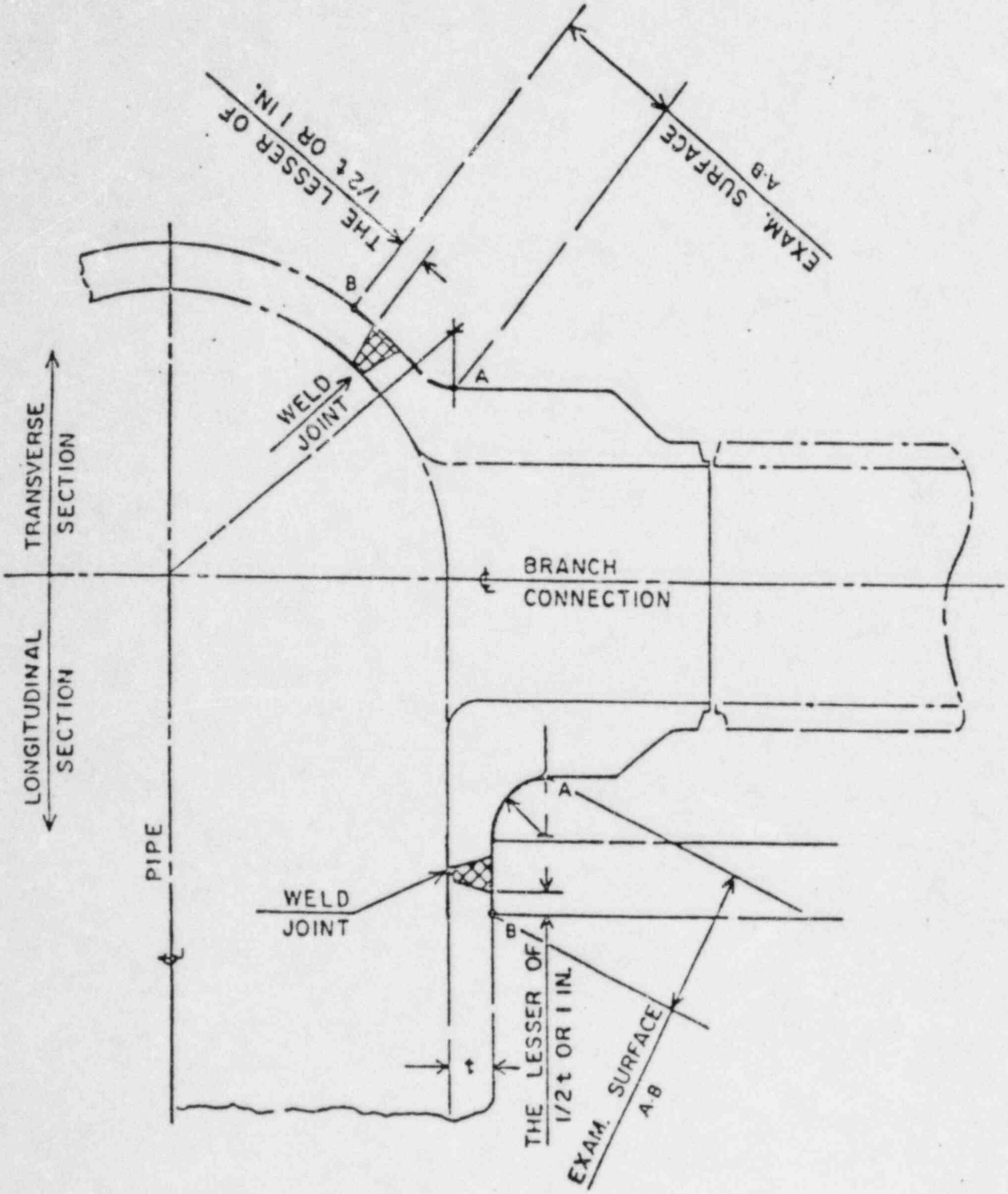


Fig. IWB-2500-9

Pipe Branch Connection

Figure 2

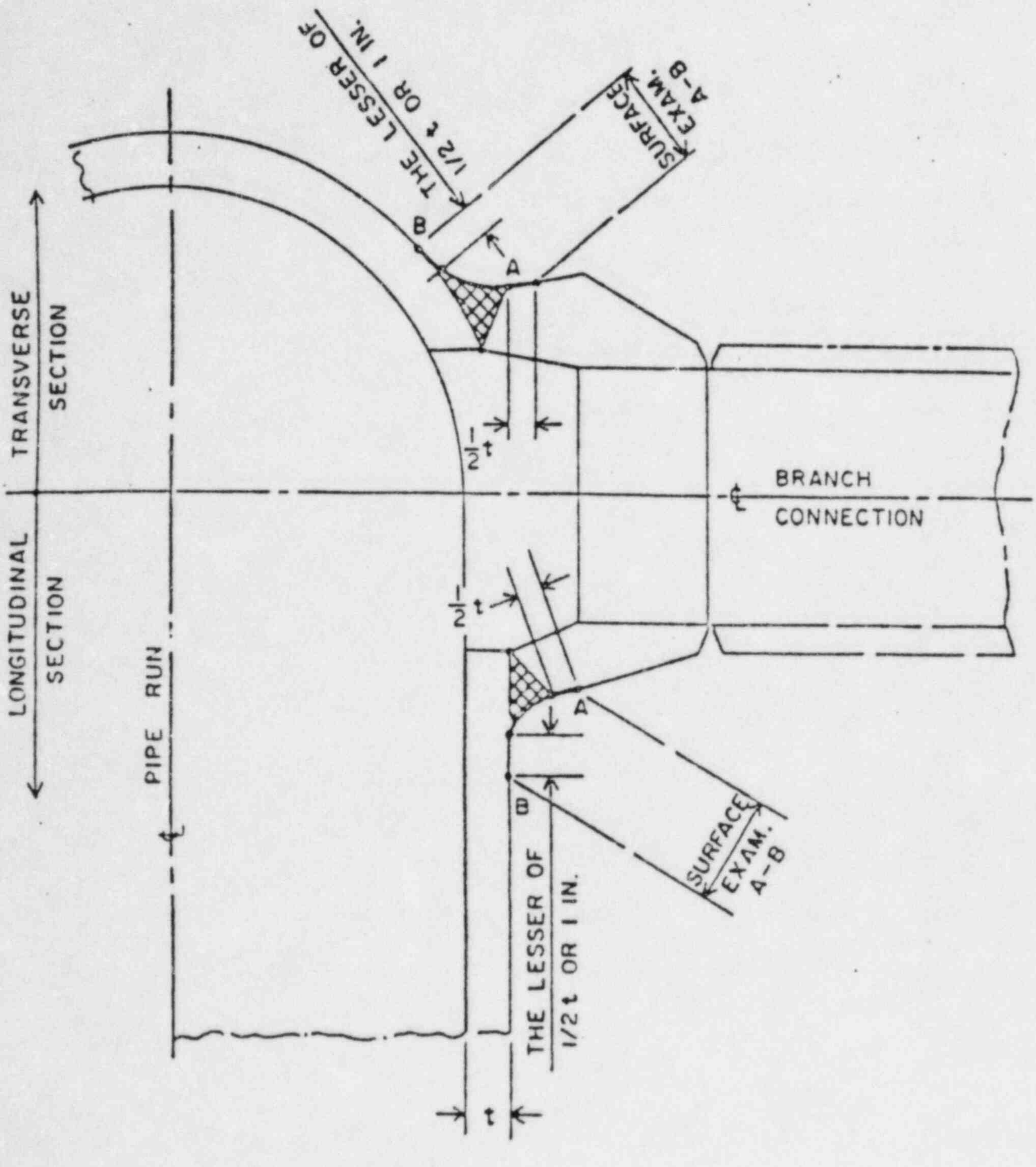
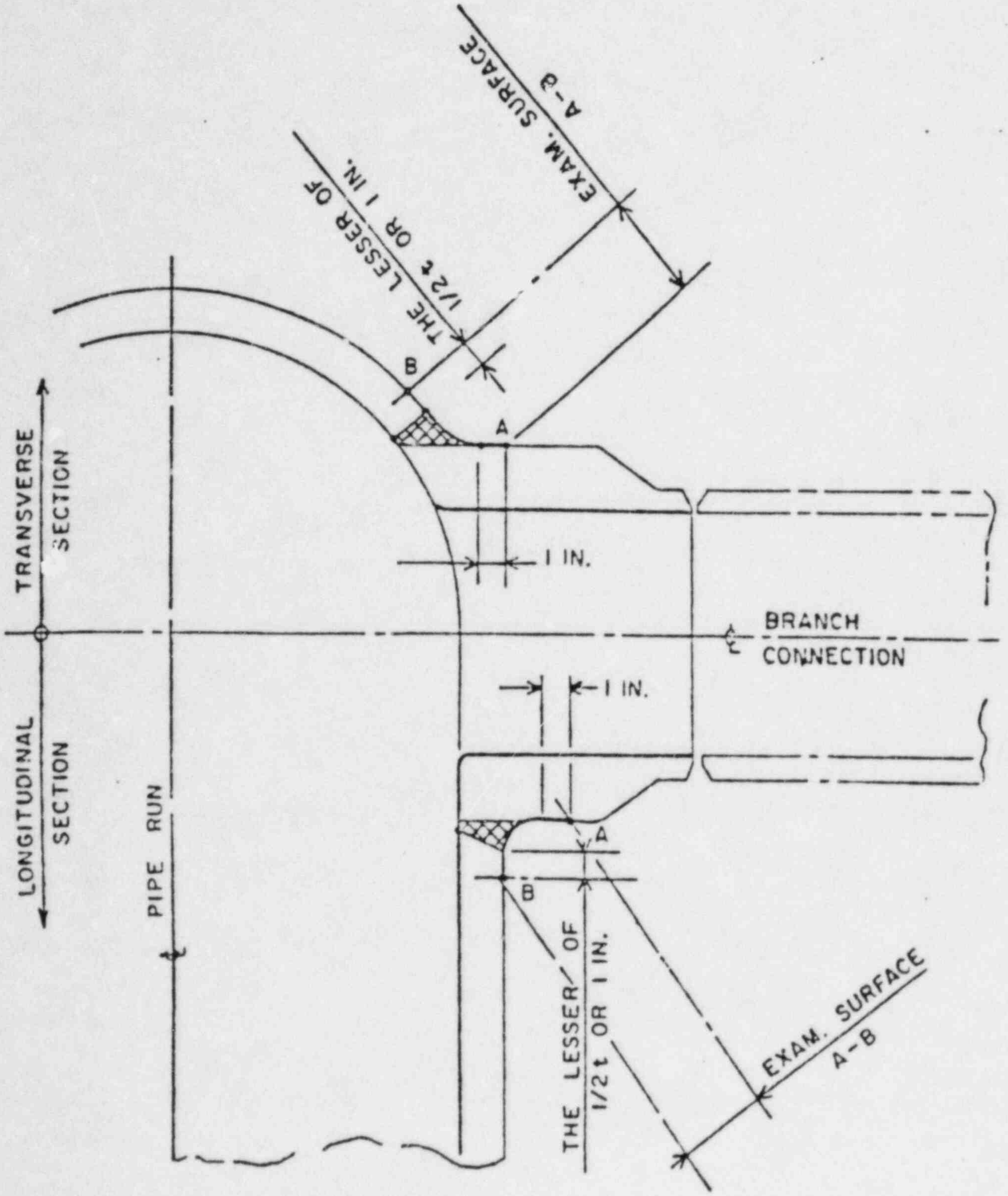


Fig. IWB-2500-10

Pipe Branch Connection

Figure 3



IWB-2500-11

Pipe Branch Connection

Figure 4

NOZZLE SIZES OVER 4 in. NOM. PIPE SIZE
VESSEL THICKNESS - t = 1/2 in. OR LESS

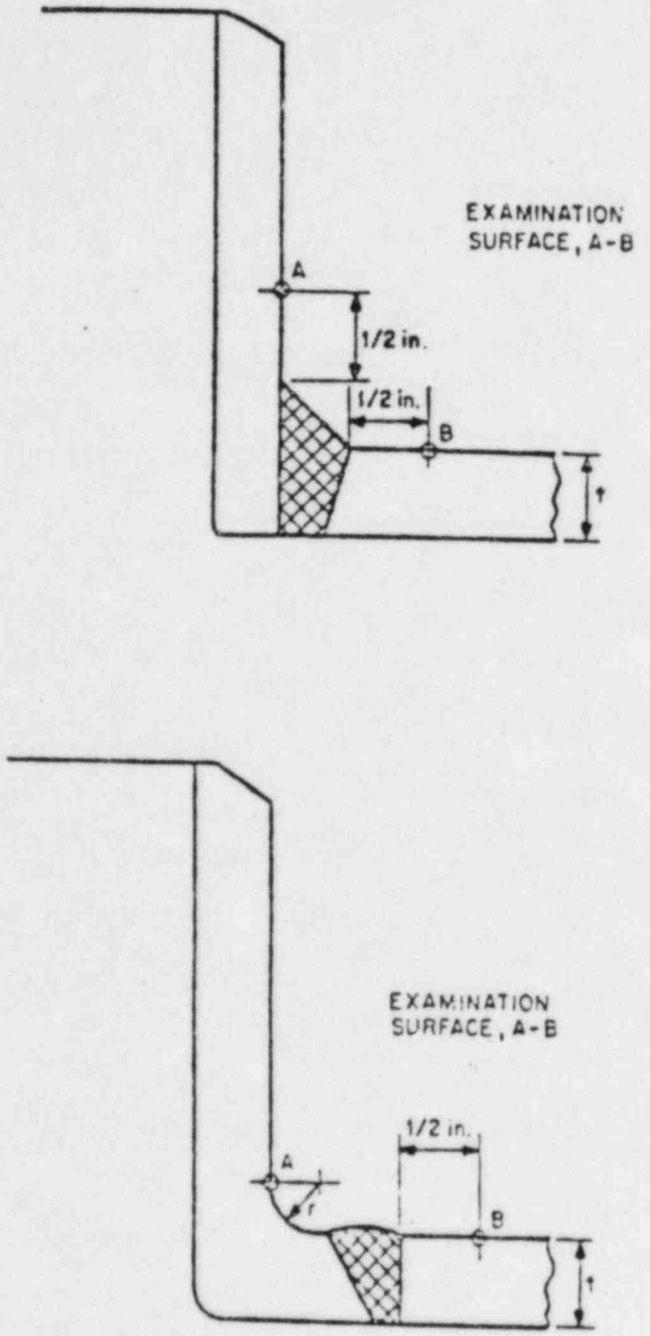
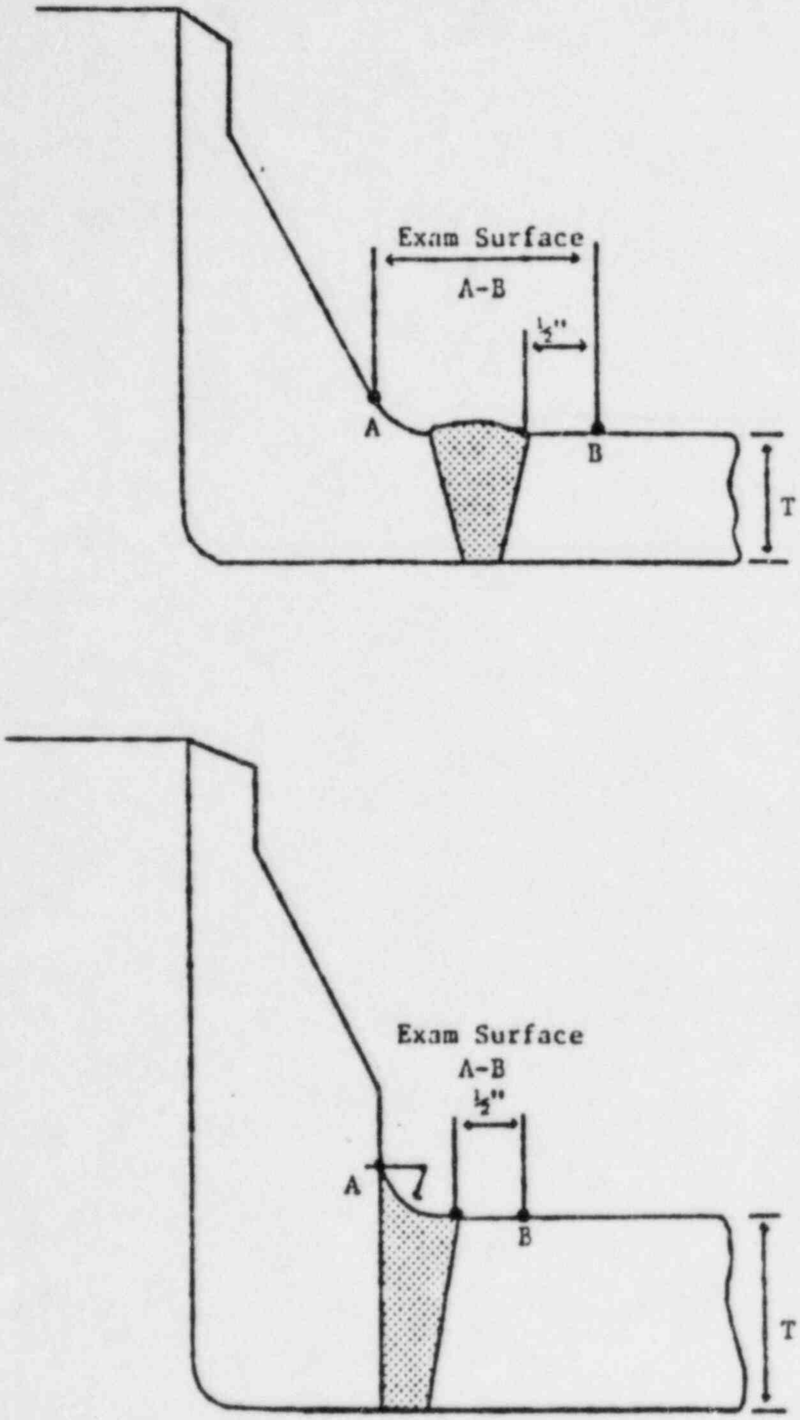


Fig. IWC-2520-3

Nozzle to Vessel Welds

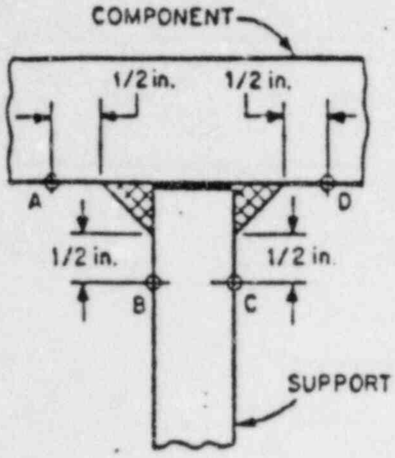
Figure 5



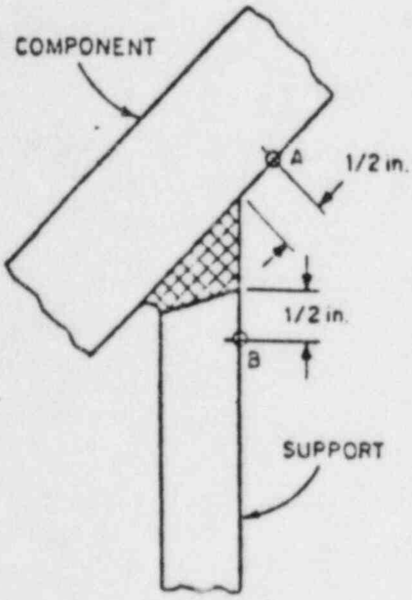
IWC-2520-4

Nozzle to Vessel Welds

Fig. 6

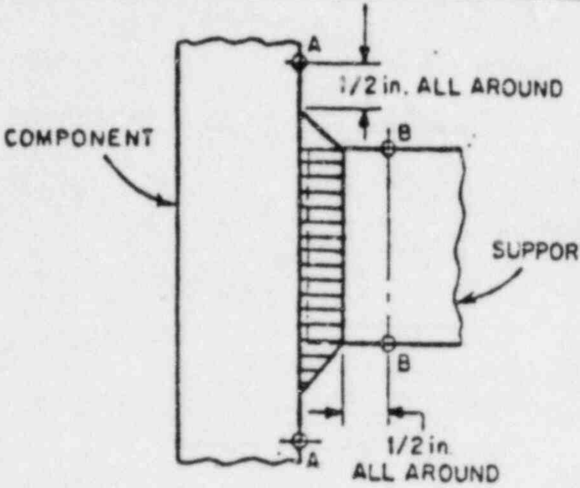


EXAM. SURFACES
A-B AND C-D

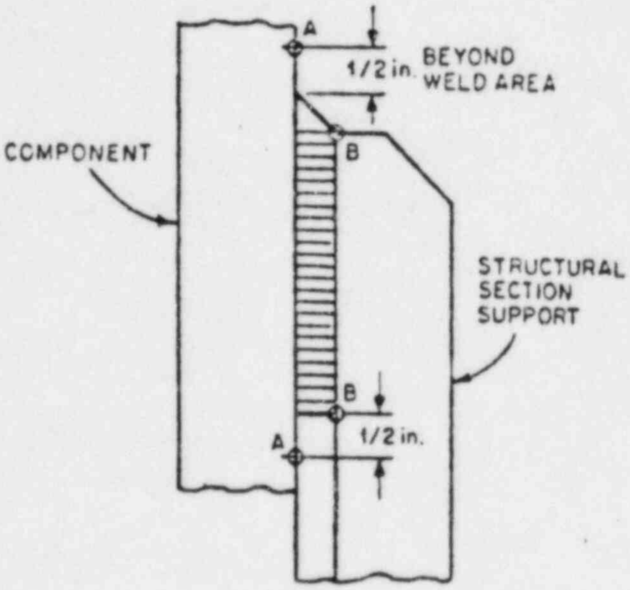


EXAM. SURFACES
A-B

PLATE AND SHELL TYPE
SUPPORT WELDS



EXAM. SURFACES
A-B



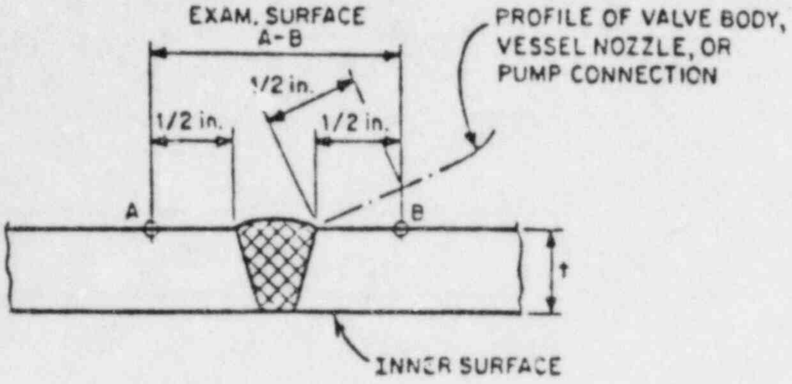
EXAM. SURFACES
A-B

LINEAR TYPE
SUPPORT WELDS

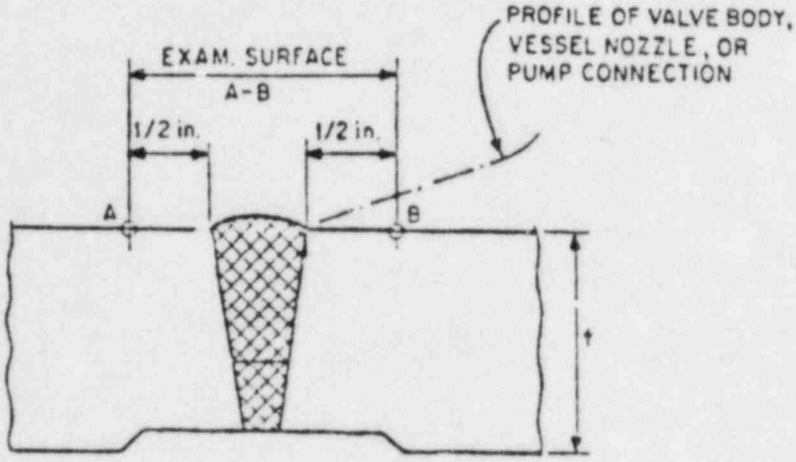
Fig. IWC-2520-5

Integrally Welded Component Supports

Figure 7



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



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

IWC-2520-7

Welds in Piping

Figure 8

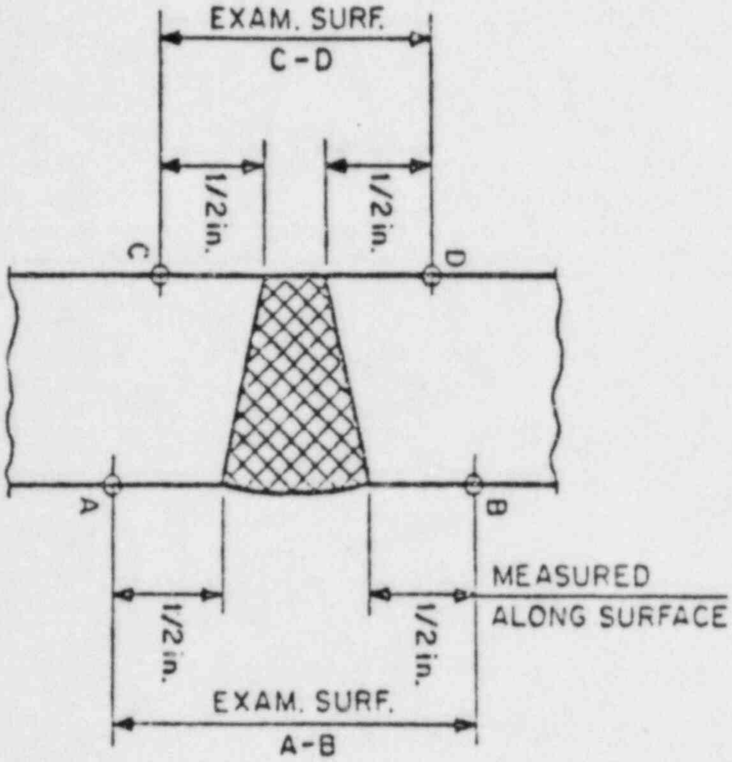


Fig. IWC-2520-8

Welds in Pump Casing and Valve Bodies

Figure 9

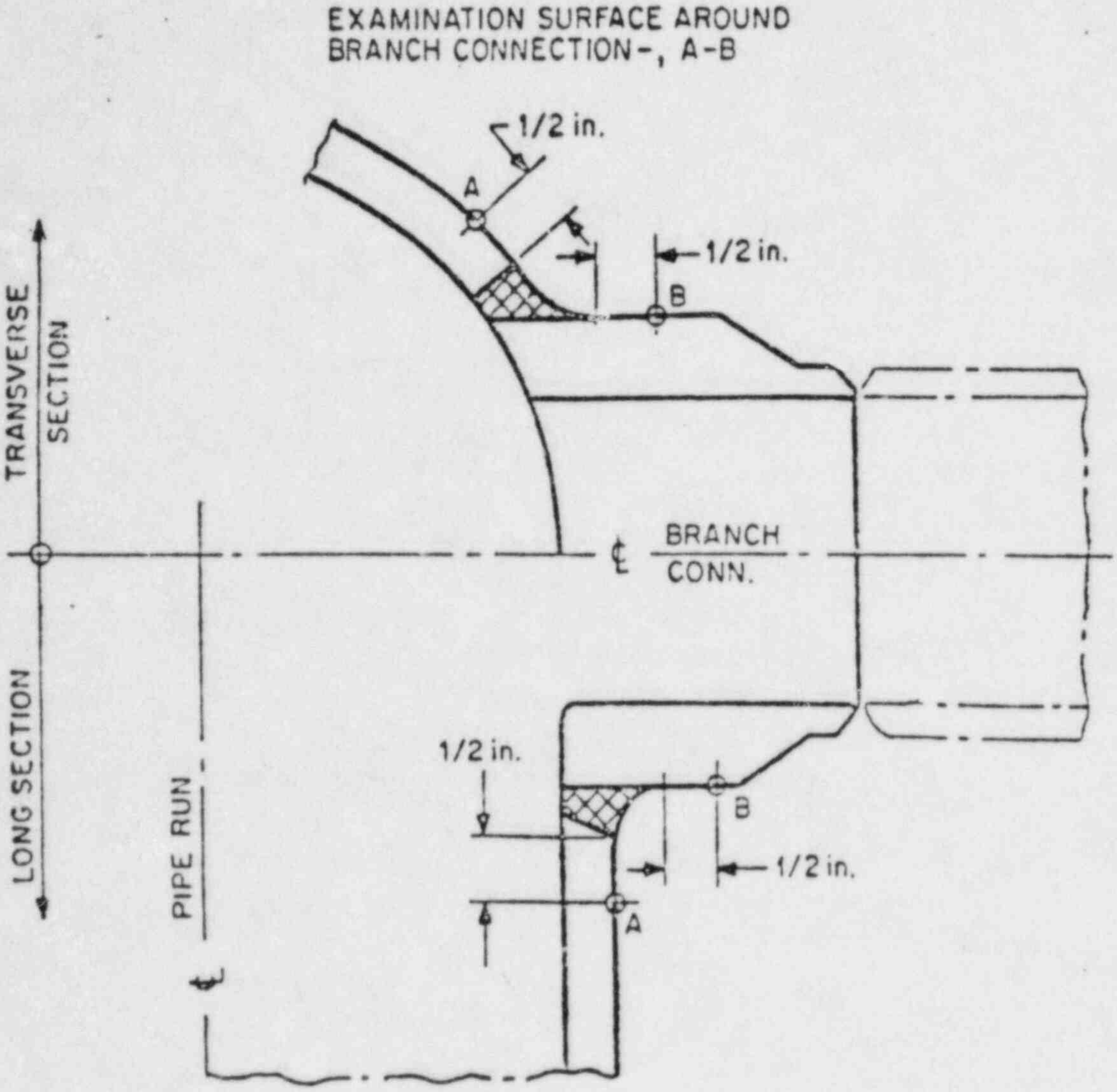
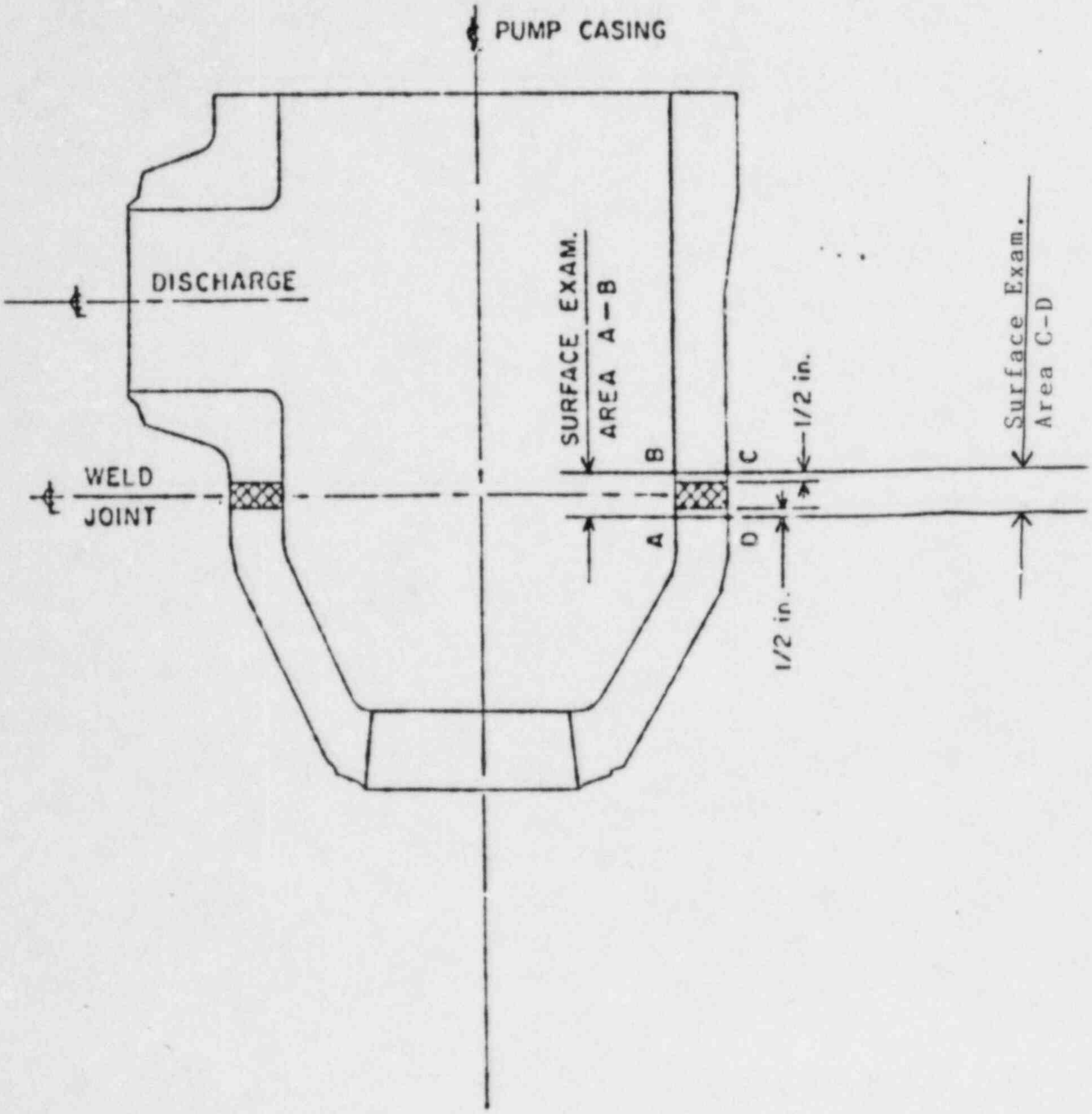


Fig. IWC-2520-9

Branch Conneciton Welds

Figure 10

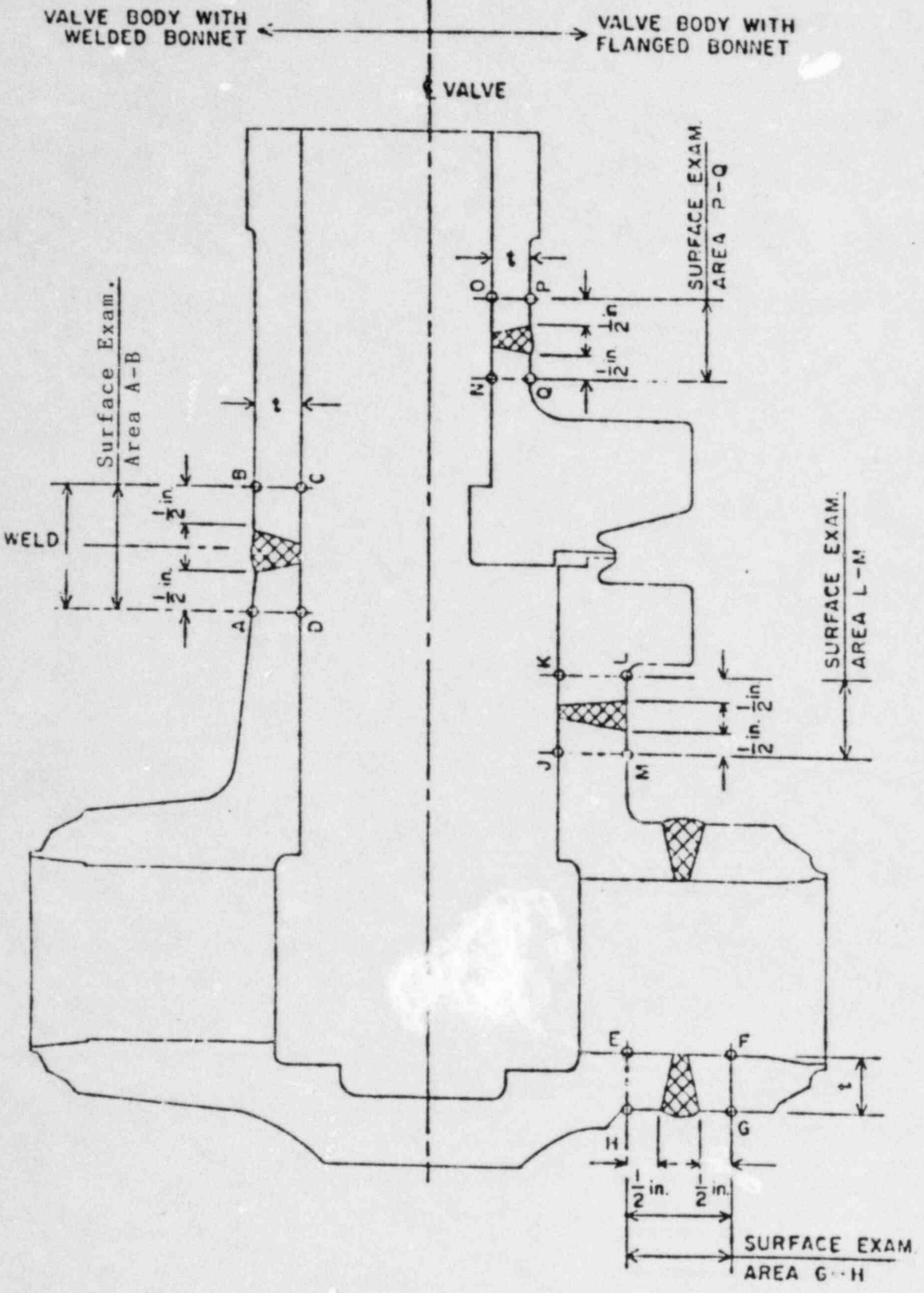
TYPE Γ PUMP
(SECTION III)



IWB-2500-16 PUMP CASING WELD

Fig. 11

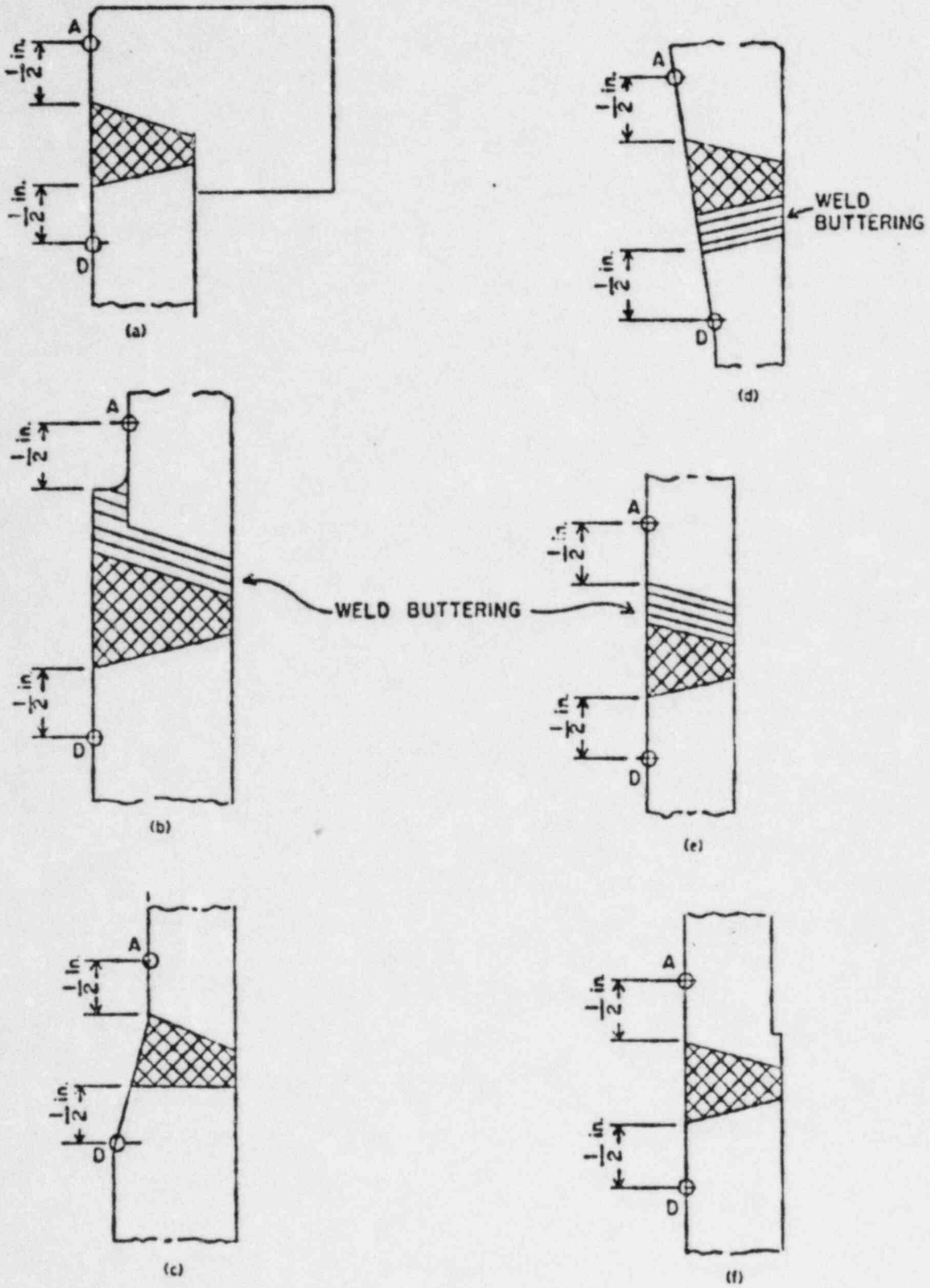
2



IWB-2500-17 VALVE BODY WELDS

Fig. 12

2



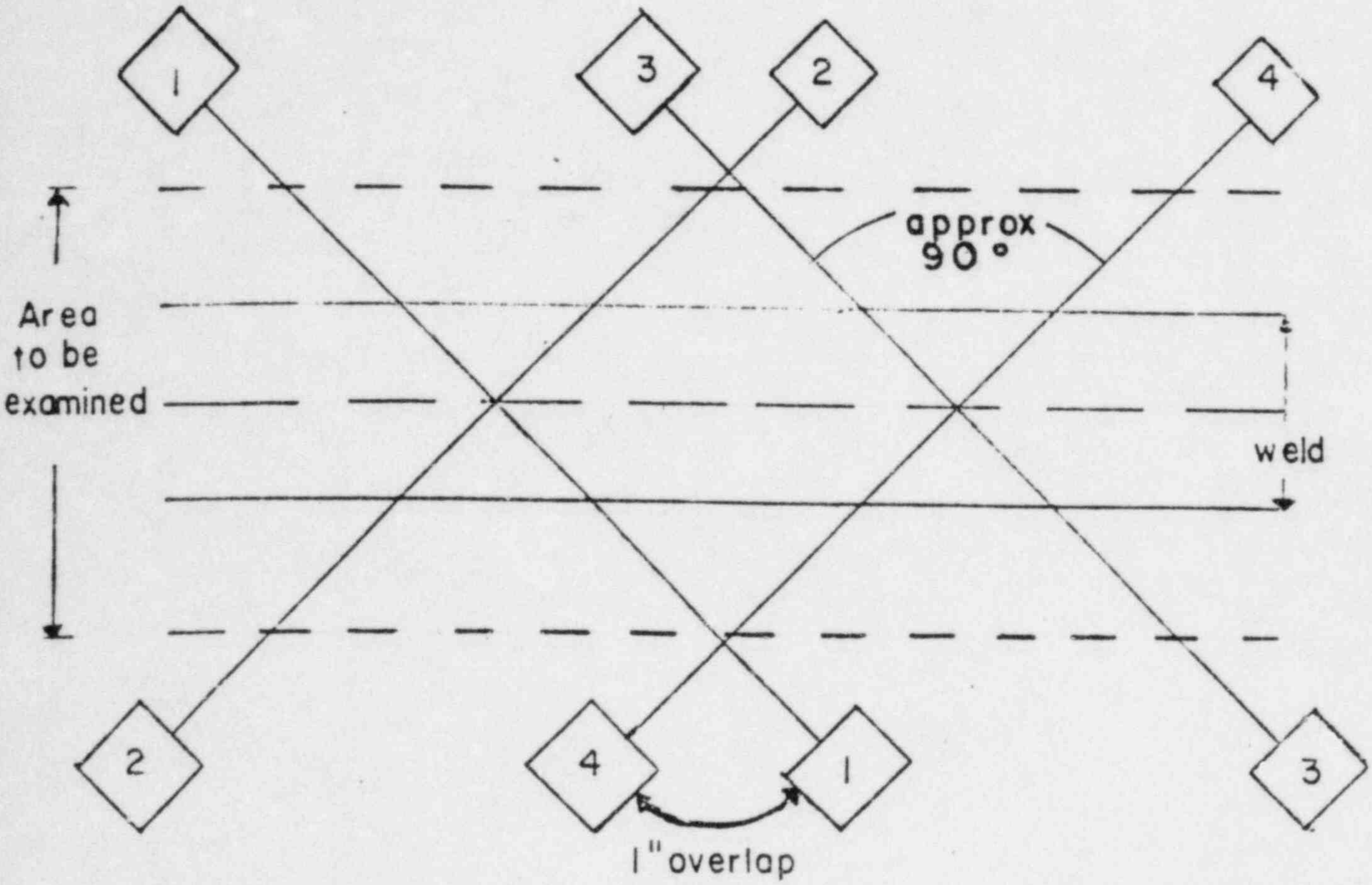
SURFACE EXAM. AREA A-D

IWB-2500-18 CONTROL ROD DRIVE HOUSING WELDS

Fig. 13

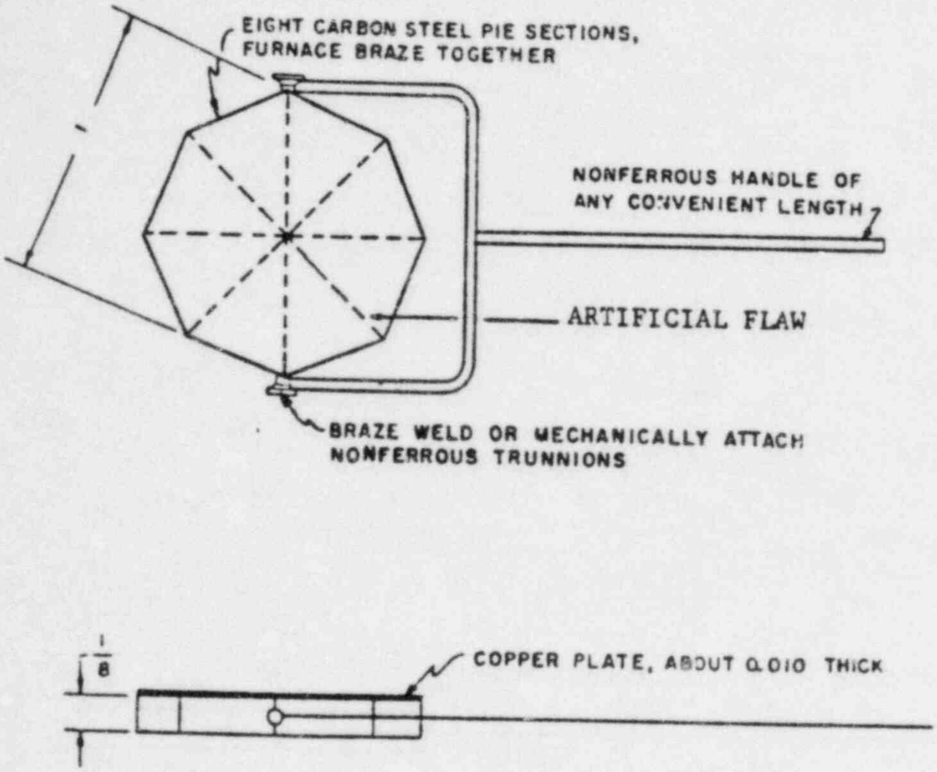
YOKE POSITIONING FOR WELD EXAMINATION

ILLUSTRATIVE ONLY



PROBE POSITIONS SHOWING 2 DIRECTIONS 90° TO EACH OTHER AND 1" OVERLAPPING ON SURFACE TO BE EXAMINED

Figure 14



ILLUSTRATIVE ONLY

Figure 15

Magnetic Particle Field Indicator

Figure 16

The
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ISI 4.4

Magnetic Particle

Examination Report

Customer
Plant
Unit
Loop /Zone

Procedure
Examiner/Level
VCR Supervisor
Date

Component/Piping System
ISO Drawing No.
Surface Condition

Type of Particles
___Wet ___Dry ___Visible ___Flourescent
Manufacturer
Type
Batch Number

Current
___AC ___DC ___HWDC
Machine Mfr.
Type/Model
Serial No.

Magnetization
___Continuous
___Residual

Coil
_______Amps.
_______No. Turns

Prods
_______Spacing
_______Amps.

Yoke
_______Spacing

Weld / Item	Comments	MT Results		VT Results	
		NRI	RI	Sat	Unsat

Form MT-301

2/82

Figure 17

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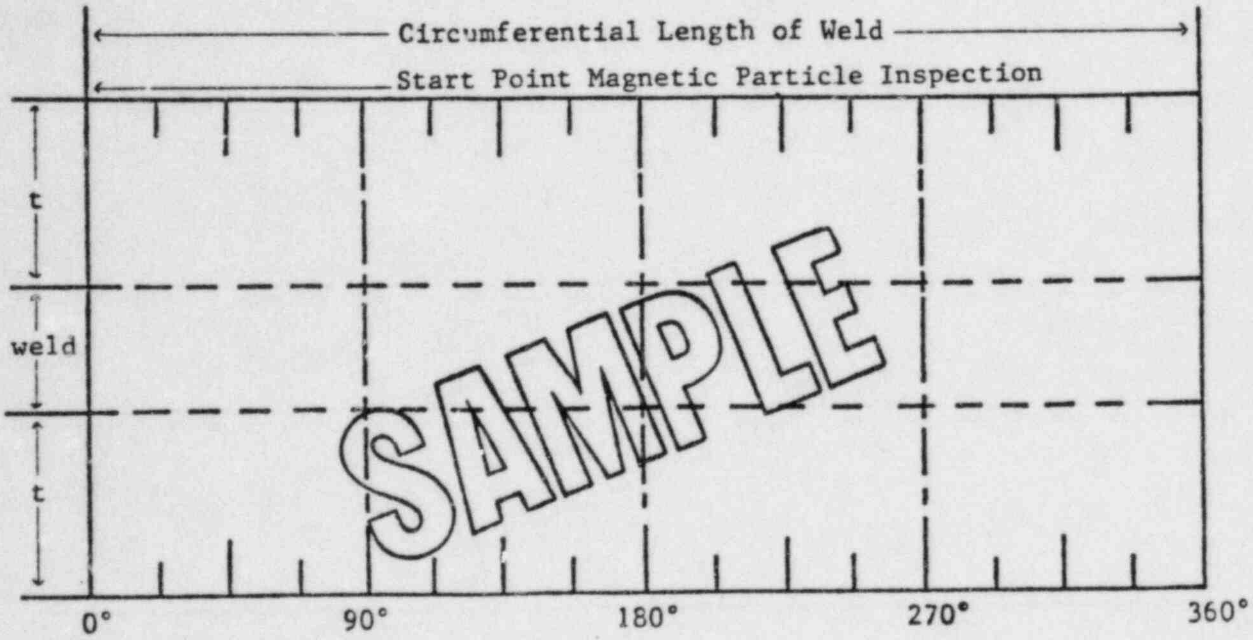
ISI 4.4

Magnetic Particle
Weld Indication Record

Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Level	Date	
Component/Piping System	VCR Supervisor		
Weld No.	ISO/Drawing No.		



Remarks

The
Virginia Corp.
of Richmond

(804) 266-8741
P. O. Box 9474
5809 Lakeside Ave.
Richmond, Virginia 23228

Procedure Title: VT-I VISUAL EXAMINATION

Procedure No.: ISI 5.1

Plant Site: Waterford #3

Customer: Louisiana Power and Light
Ebasco Services, Inc. - Agent

EBASCO SERVICES INCORPORATED
QUALITY ASSURANCE ENGINEERING
This Document is:
☒ Reviewed Without Comments
☐ Reviewed With Comments as Noted; Incorporate Comments, and Resubmit; Proceed With Order.
☐ Rejected; Revise and Resubmit
NOTE:
Review of this document, with or without comments, is for general conformance with the applicable specifications only and in no way relieves the manufacturer or contractor from full responsibility for delivery of all materials, equipment, services and documentation in strict accordance with the Purchase Order.
By:
Date: 6-27-82

Approved for Use Virginia Corporation: Thomas B Munson

Approved for Use Customer: Jerry Patterson for J. Dove 6-27-82 Jerry C Hoops Level III 6/27/82

Rev. 0 Date: 6/25/82	Rev. ___ Date: ___
Prepared by: Thomas B Munson	Prepared by: ___
Reviewed by: Thomas B Munson L III	Reviewed by: ___
Reviewed by:	Reviewed by: ___
	Customer: ___
Rev. ___ Date: ___	Rev. ___ Date: ___
Prepared by: ___	Prepared by: ___
Reviewed by: ___	Reviewed by: ___
Reviewed by: ___	Reviewed by: ___
Customer: ___	Customer: ___
Rev. ___ Date: ___	Rev. ___ Date: ___
Prepared by: ___	Prepared by: ___
Reviewed by: ___	Reviewed by: ___
Reviewed by: ___	Reviewed by: ___
Customer: ___	Customer: ___

The Virginia Corporation
of Richmond

Proc. No. ISI 5.1 Rev. 0

Date: 6/25/82 Page 1 of 4

1.0 Scope

1.1 This procedure is applicable to, and describes the requirements for, category VT-1, Visual Examination of Nuclear Plant Components by the Direct and Remote Methods. This procedure is written in compliance with the ASME code, Section XI.

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, (latest revision), Preservice Inspection Documentation.

3.0 Personnel Qualifications

3.1 Personnel performing visual examinations only, 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 a visual examination.

3.2 Certified Level II Liquid Penetrant, or Magnetic Particle examiners preforming examinations of welds are considered to be sufficiently knowledgeable to perform visual visual examinations of pipe and component welds to the requirements of this procedure as an adjunct to their principal assignments. If, however, the examiner is to perform and sign-off VT-I examinations, he shall be certified to Level II certification in visual examination.

4.0 General Requirements

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

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.

4.4 Equipment - Equipment to be used may include, but shall 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.

4.6 Resolution - Both direct and remote visual examination 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

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

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.

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.

Figure 1

The Virginia Corp. of Richmond

Visual Examination Report for Category VT-1

Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Level		Date
Component/Piping System	ISO Drawing No.	VCR Supervisor	

Weld/ Item	Exam Results		Comments	Visual Aids
	NRI	RI		

Form VT-401

2/82

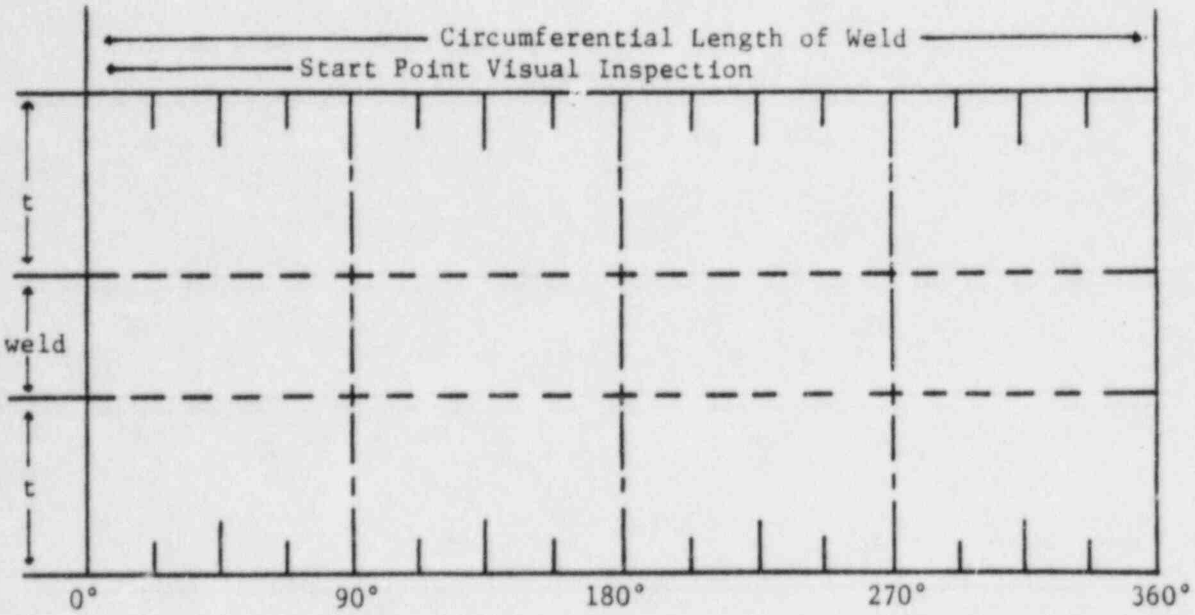
Figure 2

The Virginia Corp. of Richmond

Visual Examination

Weld Indication Record

Customer	Plant	Unit	Loop/Zone
Procedure	Examiner/Level	Date	
Component/Piping System	VCR Supervisor		
Weld No.	ISO Drawing No.		



Remarks

Figure 3

The
Virginia Corp.
of Richmond

Visual Examination Indication Record

Customer

Plant

Unit

Loop/Zone

Procedure

Examiner/Level

Date

Component/ Piping System

VCR Supervisor

Item No.

ISO/Drawing No.

Comments: