



REPORT OF INDEPENDENT NONDESTRUCTIVE EVALUATION

NRC LICENSED FACILITY

WATTS BAR NUCLEAR STATION

UNITED STATES TESTING COMPANY PROJECT 1047

MAY 17, 1978

PREPARED FOR

UNITED STATES NUCLEAR REGULATORY COMMISSION OFFICE OF INSPECTION AND ENFORCEMENT

NRC CONTRACT NO. NRC-05-78-304

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quality assurance program audits vendor surveillance concrete testing on-site inspection nondestructive testing environmental evaluations training programs

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NRC Contract No. NRC-05-78-304 Task II

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ABSTRACT

United States Testing Company performed an independent nondestructive examination on selected welds at the Nuclear Regulatory Commission licensed facility, Watts Bar Nuclear Station, near Spring City, Tennessee. The methods used during this project were radiographic examination of thirty-three (33) welds, liquid penetrant examination of five (5) welds and visual examination of ten (10) welds. The purpose of these examinations was to determine the feasibility of conducting direct inspections as a means of ensuring that NRC licensed reactor facilities are constructed in such a manner as to protect the health and safety of the public. The procedures used were basic United States Testing Company procedures revised to reflect code requirements of the components being examined. Personnel assigned to the task were certified to ANSI N45.2.6 and SNT-TC-1A as applicable. Results of the examinations were compared with those of the licensee. Test procedures, personnel qualifications and test results are included in this report. Also included is an analysis comparing the cost for work performed by an independent contractor against the capital expenditure that would be required if the NRC were to perform the examinations.

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INTRODUCTION

The objective of Task II was to determine the feasibility of conducting direct inspections using a contractor experienced in nondestructive examination as a means of ensuring that NRC licensed reactor facilities are constructed in such a manner as to protect the health and safety of the public. This task involves the actual radiographic, liquid penetrant and visual examination of pressure-retaining welds in components and piping at an NRC licensed facility selected by the NRC.

The reactor facility selected by the NRC for evaluation was the Watts Bar Nuclear Station, located approximately eight miles southeast of Spring City, Tennessee. Licensee of this facility is the Tennessee Valley Authority.

The United States Testing Company performed the examinations for the NRC at the above facility and compared the UST/NRC test results with the records and radiographs of the licensee. The field operation, examination and comparison were performed under the surveillance of Mr. B. Crowley, NRC Region II Inspector.

In addition to the field activities, a cost estimate was developed to aid the NRC in determining the feasibility of continuing this program by using a contractor to perform the examinations, or by establishing an NRC task force to perform the examinations.

In this report the United States Testing Company details the method of operation, results of the examination, results of the comparison between UST/NRC examination data and those already recorded by the licensee, problem areas, recommendations and cost analysis.

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SCOPE OF TESTING

The scope of testing involved radiographic examination of thirty-three (33) welds, liquid penetrant examination of five (5) welds and visual examination of ten (10) welds.

Welds for radiographic examination were selected on the following basis:

- A. Eleven (11) field piping welds within the reactor coolant boundary (no more than four (4) welds in any one pipe size);
- B. Ten (10) field welds in safety related piping systems outside the reactor coolant boundary (no more than two (2) welds in any one system);

C. Six (6) field welds in the containment structure within the containment;

D. Six (6) field welds in safety-related structures.

In addition to radiographic examination, the following examinations were performed:

- A. Liquid penetrant examination of five (5) Class I welds in the reactor coolant boundary;
- B. Visual examination of ten (10) Class II welds in the safety related piping systems outside the reactor coolant boundary;
- C. Comparison of all UST/NRC radiographs with the radiographs of the licensee.

Welds selected represented a balance with respect to difficulty of examination, difficulty of welding position, wall thickness and difficulty of accessibility.

No examinations were performed that had not previously been performed by the licensee or a subcontractor of this utility.

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PERSONNEL

The United States Testing Company assigned the following personnel to perform Task II for the NRC:

Charles Sheridan: Project Director - Certified Level III ANSI N45.2.6 and SNT-TC-1A, Level II Liquid Penetrant

Joseph Dreibelbis: Technician - Certified Level III SNT-TC-1A, Radiographic and Liquid Penetrant

Peter Shaub: Technician - Certified Level II SNT-TC-1A, Radiographic and Liquid Penetrant

Aaron Siggins: Technician - Certified Level II SNT-TC-1A, Radiographic and Liquid Penetrant

Copies of certification on the above personnel are included in this report as Appendix A.

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<u>Test Equipment</u>

The following equipment was used to perform all tests.

Radiographic Test Equipment

Camera: Tech Ops. Model Number: 533 Serial Number: 133

Source: Automation Industries Type: Iridium 192 Size: 1/8" X 3/32" Model Number: 3790 Serial Number: 11577 Leak tested: 4/12/78

Densitometer: X-Right Company Model Number: 301 Serial Number: 01238 Calibration: Step wedge No. 10185 (traceable to the National Bureau of Standards)

Liquid Penetrant Test Material

Manufacturer: Magnaflux Corporation

Penetrant: SKL-HF/S Formula B Batch No.: 78A-052

Developer: SKD-NF Formula B Batch No.: 78C-026

Cleaner: SKC-NF Formula B Batch No.: 78C-022

Certification of the above materials to be within sulfur/halogen requirements and free of mercury contamination was supplied by the Magnaflux Corporation on Purchase Order Number 35533.

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In addition to the preceding, the United States Testing Company supplied a laboratory trailer (includes developing tanks, drying oven, and interpretation room), pick-up truck, chemicals, film and all other necessary test materials.

Test Procedures

Testing was performed to standard United States Testing procedures which had been previously submitted to the NRC for review. Revision of the standard procedures was necessary to comply with licensee code commitments and was performed by our Level III personnel on site.

Procedures used during the testing and revisions listed as attachments are included in this report as follows:

Radiographic Procedures Appendix B

UST-RT-2

Attachment NRC 1

Attachment NRC 2

Attachment NRC 3

Attachment NRC 4

Liquid Penetrant Procedure Appendix C

UST-PT-3

Attachment NRC 1

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Site Operations

The United States Testing personnel and Mr. B. Crowley reported to the Watts Bar Nuclear Station on April 17, 1978. A pretesting meeting was held at this facility with TVA site personnel.

During the day of April 17, 1978 the mobile laboratory was set in position and TVA construction provided the necessary blocking, water and electric service. While the laboratory was being prepared, the initial weld joints were selected for testing.

Testing began on the third shift on April 17, 1978 on a planned schedule of 11 P.M. to 7 A.M. to prevent interference with plant construction. Testing operations were conducted as planned each day from the start through April 30, 1978.

On May 1 and 2, 1978, after testing was complete, comparison of the UST/NRC test results with results of tests performed by the licensee was conducted by the United States Testing and Nuclear Regulatory Commission personnel.

At 2:30 P.M., May 2, 1978 an exit interview was conducted by NRC personnel and attended by United States Testing.

Nondestructive Examination

Results of the testing conducted during Task II at the Watts Bar Nuclear Station are divided into groups as specified in the Scope of Testing section of this report.

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Field Welds Within the Reactor Coolant Pressure Boundary Radiographic testing was performed to UST-RT-2 and Attachment NRC 1. A summary of the test results follows:

Weld Joint Number: 1-68D-W001-02

System: Reactor Coolant Hot Leg

Weld Position: 6G

Material: Centrifugal Cast Stainless Steel to Steam Generator

Specified Wall Thickness: 2,60 inches

Specified I.D.: 31 inches

Location: Unit 1 reactor building

Code requirement: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda

Test results: No relevant indications

Technique and reader sheets included in Appendix D, number D1.

Weld Joint Number: 1-068F-W003-01

System: Reactor Coolant Crossover

Weld Position: 6G

Material: Centrifugal Cast Stainless Steel to Steam Generator

Specified Wall Thickness: 2.60 inches

Specified I.D.: 31 inches

Location: Unit 1 reactor building

Code requirement: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D2

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Weld Joint Number: 1-068B-W003-02 System: Reactor Coolant Cold Leg Weld Position: 5G Material: Centrifugal Cast Stainless Steel to Reactor Coolant Pump Specified Wall Thickness: 2.32 inches Specified I.D.: 27¹/₂ inches Location: Unit 1 Reactor building ASME Section III, Subsection NB, 1971 Code requirement: Summer 1973 Addenda Test Results: No relevant indications Technique and reader sheets included in Appendix D, number D3 Weld Joint Number: 1-074B-D055-14 System: Residual Heat Removal Weld Position: 5G Material: Stainless Steel Pipe to Valve Body Specified Wall Thickness: ,719 inches Specified I.D.: 6 inches Location: Unit 1 Reactor building Code requirement: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda Test Results: No relevant indications Technique and reader sheets included in Appendix D, number D4

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Weld Joint Number: 1-063B-D091-06 System: Safety Injection Weld Position: 5G Material: Centrifugal Cast Stainless Steel to Valve Body Specified Wall Thickness: 1.000 inch Specified I.D.: 10 inches Location: Unit 1 Reactor building Code Requirement: ASME, Section III, Subsection NB, 1971 Summer 1973 Addenda Test Results: No relevant indications; Technique and reader sheets included in Appendix D, number D5

Weld Joint Number: 1-063B-D090-10

System: Safety Injection

Weld Position: 5G

Material: Centrifugal Cast Stainless Steel to Valve Body

Specified Wall Thickness: 1.000 inch

Specified I.D.: 10 inches

Location: Unit 1 Reactor building

Code Requirements: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda

Test Results: No relevant indication

Technique and reader sheets included in Appendix D, number D6



Weld Joint Number: 1-087B-D040-08
System: Upper Head Injection
Weld Position: 5G
Material: Stainless Steel Pipe to Tee
Specified Wall Thickness: .812 inch
Specified I.D.: 8 inches
Location: Unit 1 Reactor building
Code Requirement: ASME Section III, Subsection NB, 1971
Summer 1973 Addenda
Test Results: No relevant indications
Technique and reader sheets included in Appendix D, number D7

Weld Joint Number: 1-063B-D092-10

System: Safety Injection

Weld Position: 6G

Material: Stainless Steel Cast Elbow to Stainless Steel Cast Tee

Specified Wall Thickness: 1.000 inch

Specified I.D.: 10 inches

Location: Unit I Reactor building

Code Requirements: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D8

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Weld Joint Number: 1-063B-D092-09
System: Safety Injection
Weld Position: 2G
Material: Stainless Steel Pipe to Stainless Steel Cast Tee
Specified Wall Thickness: .719 inch
Specified I.D.: 6 inches
Location: Unit 1 Reactor building
Code Requirement: ASME Section III, Subsection NC,1971
Summer 1973 Addenda
Test Results: No relevant indications
Technique and reader sheets included in Appendix D, number D9

Weld Joint Number: 1-074B-D054-10

System: Residual Heat Removal

Weld Position: 5G

Material: Stainless Steel Pipe to Stainless Steel Pipe

Specified Wall Thickness: _906 inch-

Specified I.D.: 8 inches

Location: Unit 1 Reactor building

Code Requirement: ASME Section III, Subsection NC,1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number DIO

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Weld Joint Number: 1-074B-D053-01 System: Residual Heat Removal Weld Position: 6G Material: Stainless Steel Cast Pipe to Tee Specified Wall Thickness: 1.250 inch Specified I.D.: 14 inches Location: Unit 1 Reactor building Code Requirement: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda Test Results: No relevant indications Technique and reader sheets included in Appendix D, number D11

In addition to the radiographic examination, the following welds in the reactor coolant pressure boundary were also examined by the liquid penetrant method.

1-068F-W003-01 - Size 31" 1-074B-D055-14 - Size 6" 1-063B-D091-06 - Size 10" 1-087B-D040-08 - Size 8" 1-074B-D053-01 - Size 14"

No relevant indications were noted during the examination of the above welds.

Liquid Penetrant Test Reports are included in this report as Appendix E.

Testing was performed to Procedure UST-PT-3 and Attachment NRC-1 included in this report as Appendix C.



Field Welds in Safety Related Piping Outside the Reactor Coolant Boundary Radiographic examination of the welds in this category was performed to Procedure UST-RT-2 and Attachment NRC-1.

Results of tests were as follows:

Weld Joint Number: 2-063A-D120-05

System: Safety Injection

Weld Position: 5G

Material: Stainless Steel Pipe to Valve

Specified Wall Thickness: .280 inch-

Specified I.D.: 6 inches

Location: Auxiliary Building Pump Room 2A-A

Code Requirement: ASME Section III, Subsection NC, 1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D12

Weld Joint Number: 2-063A-D119-09

System: Safety Injection

Weld Position: 5G

Material: Stainless Steel Pipe to Elbow

Specified Wall Thickness: .237 inch

Specified I.D.: 4 inches

Location: Auxiliary Building, Pump Room 2A-A

Code Requirement: ASME Section III, Subsection NC,1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D13

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Weld Joint Number: 2-074A-D026-03
System: Residual Heat Removal
Weld Position: 5G
Material: Stainless Steel Pipe to Elbow
Specified Wall Thickness: .322 inch
Specified I.D.: 4 inches
Location: Auxiliary Building, Pump Room 2A
Code Requirement: ASME Section III, Subsection NC, 1971
Summer 1973 Addenda
Test Results: No relevant indications
Technique and reader sheets included in Appendix D, number D14

Weld Joint Number: 1-003C-D011-07

System: Auxiliary Feed Water

Weld Position: 5G

Material: Carbon Steel Pipe to Pipe

Specified Wall Thickness: .337 inch

Specified I.D.: 4 inches

Location: Auxiliary Building, Elevation 737

Code Requirement: ASME Section III, Subsection NC,1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D15

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Weld Joint Number: 2-072A-D037-09
System: Containment Spray
Weld Position: 5G
Material: Stainless Steel, Pipe to Pipe
Specified Wall Thickness: .375 inch
Specified I.D.: 16 inches
Location: Auxiliary Building, Heat Exchanger Room 2B
Code Requirement: ASME Section III, Subsection NC, 1971
 Summer 1973 Addenda
Test Results: No relevant indications
Technique and reader sheets included in Appendix D, number D16

Weld Joint Number: 1-072A-D063-09

System: Containment Spray

Weld Position: 5G

Material: Stainless Steel, Elbow to Pipe

Specified Wall Thickness: .365 inch

Specified I.D.: 10 inches

Location: Auxiliary Building, Elevation 737

Code Requirement: ASME Section III, Subsection NB, 1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D17

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Weld Joint Number: 2-062A-D117-05 System: Chemical and Volume Control Weld Position: 5G Material: Stainless Steel, Pipe to Tee Specified Wall Thickness: .216 inch Specified I.D.: 3 inches Location: Auxiliary Building, Elevation 713 Code Requirement: ASME Section III, Subsection NC, 1971 Summer 1973 Addenda Test Results: No relevant indications Technique and reader sheets included in Appendix D, number D18

Weld Joint Number: 1-062A-D022-15

System: Chemical and Volume Control

Weld Position: 5G

Material: Stainless Steel, Pipe to Valve

Specified Wall Thickness: .280 inch

Specified I.D.: 6 inches

Location: Auxiliary Building, Charging Pump Room 1A-A

Code Requirement: ASME Section III, Subsection NC, 1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D19

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Weld Joint Number: 1-003B-D003-06 System: Feedwater Weld Position: 5G Material: Carbon Steel, Pipe to Valve Specified Wall Thickness: .843 inch Specified I.D.: 16 inches Location: South Valve Room Code Requirement: ASME Section III, Subsection NC, 1971 Summer 1973 Addenda Test Results: No relevant indications Technique and reader sheets included in Appendix D, number D20

Weld Joint Number: 2-074A-D030-06

System: Residual Heat Removal

Weld Position: 2G

Material: Stainless Steel, Pipe to Saddle

Specified Wall Thickness: .216 inch

Specified I.D.: 3 inches

Location: Auxiliary Building, Heat Exchanger Room 2A

Code Requirement: ASME Section III, Subsection NC, 1971 Summer 1973 Addenda

Test Results: No relevant indications

Technique and reader sheets included in Appendix D, number D21

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In addition to radiographic examinations on the above welds, visual inspection was performed on all ten (10) welds.

Results of this examination were as follows:

- A. Welds were free of slag, porosity and weld splatter.
- B. Welds were free of cracks, overlap, undercut, and lack of fusion or penetration.
- C. The surface finishes of all welds were suitable for radiographic examinations.

No relevant indications were noted.

Field Welds in the Containment Structure Within the Containment Radiographic examination of the welds in this category was performed to Procedure UST-RT-2 and Attachment NRC-2.

Results of tests were as follows:

Weld Number: Bl (View 10-11)

Structure: Containment

Weld Position: 2G

Material: Carbon Steel

Specified Thickness: 1-3/8 inch

Location: Unit 2, Reactor Building Aa 325⁰

Code Requirement: ASME Section III, Subsection NE, 1971, Winter 1971 Addenda and ASME Section VIII, Div. 1, 1971, Winter 1971, Par. UW-51

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D22



Weld Number: 2-3 (0-90°) View 22-23

Structure: Containment

Weld Position: 3G

Material: Carbon Steel

Specified Thickness: 1-3/8 inch

Location: Unit 2, Reactor Building Aa 30°

Code Requirement: ASME Section III, Subsection NE 1971, Winter 1971 Addenda and ASME Section VIII, Div. 1, 1971, Winter 1971, Par. UW-51

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D23

Weld Number: 100A (View 22-23)

Structure: Containment

Weld Position: 2G

Material: Carbon Steel

Specified Thickness: 1-3/8 inch

Location: Unit 2, Reactor Building Aa 60⁰

Code Requirement: ASME Section III, Subsection NE, 1971, Winter 1971 Addenda and ASME Section VIII, Div. 1, 1971, Winter 1971, Par. UW-51

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D24

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Weld Number: 1-2 (90-180°) View 15-16

Structure: Containment

Weld Position: 3G

Material: Carbon Steel

Specified Thickness: 1-3/8 inches

Location: Unit 1, Reactor Building Aa 108⁰

Code Requirement: ASME Section III, Subsection NE, 1971, Winter 1971 Addenda and ASME Section VIII, Div. 1, 1971, Winter 1971, Par. UW-51

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D26

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Weld Number: 3A View 0-1

Structure: Containment Weld Position: 2G Material: Carbon Steel

Specified Thickness: 1-3/8 inches

Location: Unit 1, Reactor Building Aa 15⁰

Code Requirement: ASME Section III, Subsection NE, 1971, Winter 1971 Addenda and ASME Section VIII, Div. 1, 1971, Winter 1971, Par. UW-51

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D27

Field Welds in Safety Related Structures

Radiographic examination of welds in this category was performed to Procedure UST-RT-2 and Attachments NRC-3 and 4. Results of tests are as follows:

Weld Number: 1H3

Structure: Primary Makeup H₂O Tank

Material: Carbon Steel

Specified Thickness: 5/16 inch

Location: Outdoor Storage Yard, Unit 1

Code Requirement: ASME Section III, Subsection ND, 1974, Winter 1975 Addenda ND 5200 and 5281

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D28



Weld Number: 1H4 Structure: Refueling H₂O Storage Tank Material: Stainless Steel Specified Thickness: 5/16 inch Location: Outside Storage Yard, Unit 1 Code Requirement: ASME Section III, Subsection NC, 1974, Winter 1975 Addenda NC 5200 and Section V Test Results: No relevant indications Techniques and reader sheets are included in Appendix D, number D29 Weld Number: 2V2

Structure: Refueling H₂O Storage Tank

Material: Stainless Steel

Specified Thickness: 5/16 inch

Location: Outside Storage Yard, Unit 1

Code Requirement: ASME Section III, Subsection NC, 1974, Winter 1975 Addenda NC 5200 and Section V

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D30

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Weld Number: 1-2 Girth $(90-180^{\circ})$

Structure: Chemical & Volume Control Holding Tank No. 74-3743

Material: Stainless Steel

Specified Thickness: 5/16 inch

Location: Auxiliary Building, Elevation 692

Code Requirement: ASME Section III, Subsection ND, 1974, Appendix X NA 5322

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D31

Weld Number: Al (View 6-7)

Structure: Chemical & Volume Control Holding Tank No. 74-3744

Material: Stainless Steel

Specified Thickness: 5/16 inch

Location: Auxiliary Building, Elevation 692

Code Requirement: ASME Section III, Subsection ND, 1974, Appendix X ND 5321

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D32

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Weld Number: C1 (View 3-4)

Structure: Chemical & Volume Control Holding Tank No. 74-3744

Material: Stainless Steel

Specified Thickness: 5/16 inch

Location: Auxiliary Building, Elevation 692

Code Requirement: ASME Section III, Subsection ND, 1974, Appendix X ND 5321

Test Results: No relevant indications

Technique and reader sheets are included in Appendix D, number D33

Comparison of Radiographic Examination Results

After completion of all examinations a comparision of the UST/NRC radiographs with those of the licensee was performed.

Results of this comparison are as follows:

	Comments
Weld Number: 1-68D-W001-02	Note: United States Testing
Duplication of Weld: Yes	used overlap panoramic. TVA used 3 penetrameters in alternate locations.
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	
Weld Number: 1-068F-W003-01	Note: United States Testing used overlap panoramic.
Duplication of Weld: Yes	TVA used 3 penetrameters in alternate locations.
Penetrameter Requirement: Accept	in arcenace rocacions.
Density Requirement: Accept	
Technique: See note	

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	Comments
Weld Number: 1-068B-W003-02	Note: United States Testing
Duplication of Weld: Yes	used overlap panoramic
Penetrameter Requirement: Accept	technique. TVA used 3
Density Requirement: Accept	penetrameters in alter-
Technique: See note	nate locations.
Weld Number: 1-0748-D055-14	Note: United States Testing
Duplication of Weld: Yes	used two exposures and
Penetrameter Requirement: Accept	pentrameters in weld.
Density Requirement: Accept	TVA used penetrameter
Technique: See note	and shim.
Weld Number: 1-063B-D091-06 Duplication of Weld: Yes Penetrameter Requirement: Accept Density Requirement: Accept Technique: Same	
Weld Number: 1-063B-D090-10	*Views 3-0 and 0-1 fail to meet
Duplication of Weld: Yes	density requirements of +30%, -15%.
Penetrameter Requirement: Accept	United States Testing used pene-
Density Requirement: Unsatisfactory*	trameter in weld in alternate
Technique: Same	locations to qualify density.

	Comments
Weld Number: 1-087B-D040-08 Duplication of Weld: Yes Penetrameter Requirement: Accept	Note: United States Testing used Type T film. TVA used M film.
Density Requirement: Accept	
Technique: See note	
Weld Number: 1-063B-D092-10 Duplication of Weld: Yes Penetrameter Requirement: Accept Density Requirement: Accept Technique: See note	Note: United States Testing used two exposures with penetrameter in weld area. TVA used shimmed penetra- meter.
Weld Number: 1-063B-D092-09 Duplication of Weld: Yes Penetrameter Requirement: Accept Density Requirement: Accept Technique: See note	Note: United States Testing used two penetrameters without shims and M film. TVA used shimmed penetra- meter and R film.
Weld Number: 1-074B-D054-10 Duplication of Weld: Yes Penetrameter Requirement: Accept Density Requirement: Accept Technique: Same	
Technique: Same	



	Comments
Weld Number: 1-074B-D053-06	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 2-063A-D120-05	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 2-063A-D119-09	Note: United States Testing
Duplication of Weld: Yes	used 4½" X 10" M film. TVA used 5" X 7" R film.
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	
Weld Number: 2-074A-D026-03	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	



·	Comments
Weld Number: 1-003C-D011-07	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 2-072A-D037-09	Note: United States Testing used double wall
Duplication of Weld: Yes	technique. TVA used single wall technique.
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	
Weld Number: 1-072A-D063-09	*Use of #17 penetrameter instead of #10 fails to meet code re-
Duplication of Weld: Yes	quirements.
Penetrameter Requirement: Unsatisfactory*	
Density Requirement: Accept	
Technique: Same	
Weld Number: 2-062A-D117-05	Note: United States Testing used M film. TVA used
Duplication of Weld: Yes	R film.
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	

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	Comments
Weld Number: 1-062A-D022-15	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	•
Weld Number: 1-003B-D003-06	Note: United States Testing
Duplication of Weld: Yes	used double wall technique and AA film. TVA used
Penetrameter Requirement: Accept	single wall technique and M film.
Density Requirement: Accept	
Technique: See note	
Weld Number: 2-074A-D030-06	Note: United States Testing
*Duplication of Weld: Yes	used M film. TVA used R film.
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	
·	
Weld Number: Bl (View 10-11)	Note: Processing artifacts.
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	

Project 1047

	Comments
Weld Number: 2-3 (View 22-23)	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 100A (View 22-23)	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 3-4 (View 7-8)	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 1-2 (View 15-16)	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	

Project 1047

UNITED STATES TESTING COMPANY, INC.

	Comments
Weld Number: 3A (View 0-1)	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 1H3	Note: Film shows 4T hole on penetrameter. Marginal
Duplication of Weld: Yes	sensitivity and film quality.
Penetrameter Requirement: Accept	quurrey.
Density Requirement: See note.	
Technique: Accept.	
Weld Number: 1H4	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: 2U2	Note: Poor film quality.
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	

Project 1047



	Comments
Weld Number: 1-2	Note: TVA appeared to use X-ray for radiograph.
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: See note	
Weld Number: Al	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	
Weld Number: Cl	
Duplication of Weld: Yes	
Penetrameter Requirement: Accept	
Density Requirement: Accept	
Technique: Same	

Comparison of the radiographs may be summarized as follows:

A. All radiographs could be interpreted.

- B. All weld joints were identifiable as being duplicated.
- C. One (1) TVA radiograph did not show the correct penetrameter.
- D. One (1) TVA radiograph failed to meet the +30%, -15% density requirement.

Project 1047



Problem Areas

During the examination performed by the United States Testing Company at the Watts Bar Station, problems were encountered in the following areas:

- A. The capacity of the thickness gauge supplied by the United States Testing Company was not great enough to determine accurately the thickness of the heavy wall centrifugal cast stainless steel piping in the reactor coolant loops.
- B. Punch marks used for location were not always the same distance from the edge of the welds; consequently they did not in every case define the area of interest, resulting in the need to reshoot several of the welds.
- C. Manual developing of film, during peak periods of examination, required full time attention from one member of the radiograph team.
- D. Additional sets of penetrameters would have simplified the technique required to qualify the radiographs of stainless steel piping on which the deposited weld metal and the pipe O.D. were ground to the same plane.
- E. It was difficult to modify standard procedures on site because of the amount of time and clerical personnel required and the availability of ASME codes.

Recommendations for Improvement in Future Assignments

To increase the efficiency of future operations, the United States Testing Company recommends that:

A. A planning meeting be held prior to arrival of the Laboratory on site.
 Objectives of this meeting include:

Project 1047



- 1. Selection of systems and welds to be examined.
- 2. Determination of Code class, wall thickness, size, material type and configuration of welds to be examined.
- B. A thickness gauge sufficient to measure the selected material and wall thickness be supplied as part of the laboratory equipment.
- C. Extra penetrameter sets be supplied as determined necessary during the planning meeting.
- D. Necessary revisions to procedures be developed before arrival of the examination personnel on site.
- E. Three (3) testing personnel be assigned to the radiographic team. The principle duty of one (1) man would be development and interpretation of film. During testing at Watts Bar Station it was necessary to add the additional man.

Cost Analysis

The estimated cost to the NRC for an independent examination of ten (10) nuclear sites per year is one hundred thirty-nine thousand three hundred eighty dollars (\$139,380.00). This figure represents a total for all costs including equipment, personnel, supervision and profit. Breakdown of the above is listed in Table A.

The estimated cost to the NRC for equipment for an examination program for ten (10) nuclear sites to be performed by them is fifty-one thousand eighty nine dollars (\$51,089.00). Breakdown of the equipment cost is listed in Table B.

Project 1047



The cost of the licenses, fees and insurance required for the NRC to implement its own program is estimated to be five thousand dollars (\$5,000.00) in addition to the equipment costs listed in Table B.

No estimate of the labor and overhead costs involved can be prepared with the information available to our organization. We estimate, however, that a total of three thousand nine hundred twenty (3,920) man hours would be required to complete the program.

It should be noted that no estimate is included in this report for development and implementation of the following:

A. Radiation Safety Program.

B. Nondestructive Examination Procedures.

C. Test Equipment Calibration Program.

All of the above would be required if the NRC were to develop its own Task Force.

Project 1047



TABLE A

Independent Contractor Cost Summary Per Year:

Radiographic Examination		\$96,504.00
Magnetic Particle Examination		12,063.00
Liquid Penetrant Examination		12,063.00
Miscellaneous Equipment		11,500.00
Trailer, Truck		7,250.00
	Total	\$139,380.00

TABLE B

Equipment Cost to the NRC:		
Cobalt 60 Camera (30 Curie Source)		\$8,339.00
Iridium 192 Camera (5 new 100 curie sources		2,850.00
@ \$550.00 each)	• •	2,750.00
Liquid Penetrant		500.00
Equipment & Material (includes film, chemistry,		
dosimeters, densitometer, etc.)		15,650.00
Trailer (darkroom)		13,500.00
Truck		7,500.00
	Total	\$51,089.00

Project 1047





Conclusion

We believe that the program developed in Task II should be continued by an independent NDE contractor. Verification that safety-related systems have been inspected and examined in accordance with project specifications and code requirements will provide the confidence that the Nuclear Power Plants are constructed in such a manner as to protect the health and safety of the public.

Additionally, if nonconformances such as those disclosed on this task exist, corrective action can be taken prior to such time as detrimental effects could result, and with minimal delays in construction.

The cost analysis shows that if the NRC were to pursue the program with its own task force, increased staffing and a large capital expenditure for equipment would be required. In addition, the necessary development of an entire radiation safety program, test procedures and a calibration program would be a formidable task. The cost and effort involved to develop the above would not be justified for a short-term project.

If continued through the use of a contractor, the program will necessitate no capital expenditures or staff increases for the NRC. Safety and calibration programs have already developed and implemented. Basic test procedures have already been developed. Personnel and equipment are scheduled on an "on-call" basis.

Thus an effective program can be implemented at minimum cost to the NRC and with the flexibility required to fit the licensees' construction schedules.



Appendix A

PERSONNEL QUALIFICATIONS



0

PROFESSIONAL RECORD

SHERIDAN, CHARLES A.

Quality Assurance Engineer

ACADEMIC TRAINING:

Cornell University - Industrial Relations Arbitration

Rutgers University - Grievance Handling

Rockland Community College - Management Skills, Supervisory Skills in Modern Management Administration of Human Resources.

ASME Courses in the requirements of Section III & XI

United States Testing Course - Non-Destructive Examination

EMPLOYMENT RECORD:

Dates	Company	Position
1972 - Present	United States Testing Co., Inc.	Quality Assurance Engineer
1969 - 1972	Phelps Dodge Cable and Wire	Quality Assurance Superintendent
1967 - 1969	Wilcox & Gibbs Company	Supervisor of Field Engineering
1964 - 1967	Wilcox & Gibbs Company	Technical Supervisor
1955 - 1964	Wilcox & Gibbs Company	Manufacturing Super- visor

PROFESSIONAL EXPERIENCE:

United States Testing Co., Inc.

Mr. Sheridan is directly responsible for the operation of United States Testing projects involving on-site testing and surveillance during construction, operations and plant outages. These projects include Indian Point Nuclear Units 1, 2 and 3, Millstone Unit 1, Midland Units 1 and 2, Zimmer Nuclear Unit, and James A. Fitzpatrick Nuclear Unit.



PROFESSIONAL EXPERIENCE:

United States Testing Co., Inc. (cont'd)

Duties also involve the project coordination of surveillance activities for the Cofrentes Nuclear project and audit-management of the Clinton Nuclear project.

Mr. Sheridan specializes in quality assurance system evaluation and fabrication engineering. His responsibilities include contractor quality control and assurance surveillance, evaluation of materials, welding and fabrication applications at vendor facilities and Nuclear Plant Construction Sites.

Phelps Dodge Cable and Wire

Manufacture of high voltage power cable. Mr. Sheridan's duties as Q. A. Superintendent included supervision and responsibility for material inspection, final testing, customers representatives and certified test reports.

Wilcox & Gibbs Company

Supervisor of field engineering, responsibilities included equipment design development and field testing of new and improved automatic machinery using mechanical hydraulic and electrical systems, trouble shooting and evaluation of customers' complaints.

Supervised scheduling, production, quality control, cost control of high value, close tolerance components. Responsible to Vice President of Manufacturing.

Supervised 45 men in manufacturing, heat treating, welding, brazing, hand finishing, tumbling, inspection, milling, turret lathe, drilling, precision grinding, assembly, punchpress, painting, tool making.

PROFESSIONAL AFFILIATION

Chamber of Commerce, Nyack, New York.

Industrial Management Club of Rockland County.

DOCUMENT OF QUALIFICATION

(ANSI N45 - 2.6)

This is to certify that

CHARLES A. SHERIDAN

has been and is qualified to perform inspection and testing services in the following areas: Mechanical Equipment and facility inspection including Nuclear Power Generation component fabrication and facility construction. ASME Section II, III, V, VIII, IX, & XI.

His capability in these areas is Level

III

Basis for Certification:

Formal Education Various programs at Cornell University, Rutgers University, and Rockland Community College. Related Training ASME training seminars in the requirements of Section XI (I.S.I.) and Section III (Nuclear Components) United States Testing Course in Non-Destructive Examination. Training program in structual fabrication, welding. ASME Code requirements, 10CFR50 App. B, Coast Guard Standards, NASA Specifications. ANSI N 45.2 requirements and NRC regulatory Guides. Related Experience: 1972 - Present - United States Testing Co. Assigned as Project Coordinator to the Indian Point, Millstone, Pilgrim, & Fitzpatrick Nuclear Station projects. Responsible during modification, maintenance, and refueling for the interface between the Utility QA/QC personnel and the United States Testing personnel assigned to the site. Project coordinator on the Zimmer and Midland Nuclear Stations, responsible during construction for the liaison between the utility, and the United States Testing Co. Project <u>Coordinator of the Cofrentes Project.</u> Responsibilities include coordination of vendor surveillance assignments of all inspections, review of vendor procedures, purchase orders and specifications and the preparation of Inspection Point Programs. Responsible for quality assurance system evaluation and fabrication engineering. Responsibilities include contractor quality control and assurance surveillance, evaluation of materials, welding, and fabrication applications at vendor facilities and Nuclear Power Plant Construction Sites.

Date: Revised 1/19/77 Page 1 of 2

By:

Designated Representative United States: Testing Company, Inc.

DOCUMENT OF QUALIFICATION (ANSI N45 - 2.6)

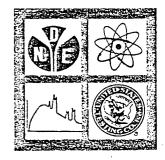
This is to certify that

CHARLES A. SHERIDAN

has been and is qualified to perform inspection and testing services in the following areas:

His capability in these areas is Level	III
Basis for Certification:	
Formal Education Related Training	
	for the development and implementation of elps Dodge Cable and Wire Company.
Quality Assurance Superintendent for cable, including supervision and resp	manufacture of high voltage power ponsibility for material inspection, final
testing, customers representatives an	nd certified test reports. 1955 - 1967 -
Wilcox & Gibbs Company. Supervisor o	of field engineering, production and
quality control, fabrication, heat tr	eating, welding, etc.
- <u></u>	
Date: <u>Revised 1/19/77</u> By:	
Page 2 Of 2 Form USTF - TQ -1.4	Designated Representative United States Testing Company, Inc.

NONDESTRUCTIVE EXAMINATION DIVISION 430 Little Clinton Street, Reading, Pa. 19601 (215) 376-7434



NDE PERSONNEL CERTIFICATION RECORD

NAME ____Charles Sheridan

ADDRESS Nyack, New York

EDUCATION

_	SCHOOL	LOCATION	DATES	CURRICULUM
	Nvack High School	Nyack, N. Y.	1939-1943	Academic
	Rockland Comm.Coll	Rockland County		Management
	Cornell & Rutgers	· · · · · · · · · · · · · · · · · · ·		Management
•			······································	

TECHNICAL TRAINING

CONDUCTED BY	LOCATION	DATES	METHODS
U.S. Testing Co.	Reading, Pa.	April 1973	NDE Methods
U.S. Testing Co.	Hoboken, N.J.	October 1975	Penetrant
	· ·		
			·
		·	

EXPERIENCE

EMPLOYER	ADDRESS	DATES	METHODS
U.S. Testing Co.	Hoboken, N.J.	1972 to present	· · · · · · · · · · · · · · · · · · ·
Phelps Dodge Corp.	Yonkers, N.Y.	1969-1972	
Willcox & Gibbs	Nyack, N.Y.	1946-1969	· · · · · · · · · · · · · · · · · · ·

EXAMINATION RESULTS

	METHOD	RADIOGRAPHY	ULTRASONIC	LIQUID PENETRANT	MAG. PARTICLE
-	GENERAL			93.3 x.3 = 27.9	
ŀ	SPECIFIC			100 x.3 = 30.0	
	PRACTICAL			100 x.4 = 40.0	
Ŀ	COMPOSITE			97.2	
/	EYE EXAM.			6/18/75	
	APPROVED LEVEL			II	
	DATE			10/20/75	
ł	EXAMINER III			Hertumstead	



PROFESSIONAL RECORD

DREIBELBIS, JOSEPH W.

SNT-TC-1A, Level III, PT,RT,UT,MT

ACADEMIC TRAINING

Reading High School - Reading, Pa. 1965

Penn State University - Wyomissing, Pa. 1966

TECHNICAL TRAINING

United States Testing Co., Inc. Radiation Safety, 40 hours - 1966

Krautkramer, Stratford, Conn. Ultrasonic inspection and measuring - 40 hours - 1970

ASNT sponsored Ultrasonic course, Level I - 40 hours - 1971

Empire Steel Co. -Level II - MT,PT, in accordance with QCP-106 - 1970

Berks Vocational Technical School Blue print and reading - 27 hours - 1971

ASNT sponsored Radiography course, Level II - 40 hours - 1973

United States Testing Co., Inc. :

Radiation Safety, 16 hours - 1975

Level II MT, PT in accordance with UST-TC-1A, Rev. 3 - 1975



PROFESSIONAL EXPERIENCE

United States Testing Company, Inc.

July 1965 - April 1968

Operated as a qualified radigrapher using Irl92, Co60, portable X-ray units and 2.5 Mev Linear accelerator. The majority of activity associated with steel castings. Radiography including casting layout and establishing techniques.

Empire Steel Castings, Inc.

April 1968 - Sept. 1972

Operated as NDE Technician using radiography, magnetic particle, ultrasonic and liquid penetrant examinations on steel castings. Promoted January 1972 to NDE Supervisor. Responsibilities included:

- 1) Final interpretation of all specification work in RT,UT, MT and PT.
- 2) Adherence to applicable NDE codes and specifications.
- 3) Developed RT and UT techniques on castings.
- 4) Implemented UT testing procedures for flaw detection and thickness measurement on steel castings.
- 5) Initiated UT inspection and procedures in areas of plant for final inspection to assure minimum wall dimenstion and aid in design layout.

United States Testing Company, Inc.

Sept. 1972 - Sept. 1974

Responsibilities during this period included:

- Radiographic inspection of pipe welds and various components at Eddystone and Martin's Creek Power Generating Stations.
- 2) Casting layout, establishing techniques and radiographic interpretation.

Sept. 1974 - March 1975

Responsibilities during this period included:

 Functioned as Supervisor responsible for writing procedures and establishing techniques on NDE menthods used on inspection of fabricated welds for Omega Tower Transmission Station.



PROFESSIONAL EXPERIENCE (cont'd)

- Developed various UT techniques on pipe welds, plate, castings.
- 3) Various field assignments in RT,MT,UT and PT in accordance with codes such as ASME, AWS, API, MIL-STD 271, etc.

March 1975 - Oct. 1976

Responsibilities during this period included:

- Nondestructive examination supervisor with total responsibility for casting layout, establishing techniques, interpretation of results, defect mark-up and weld documentation for casting upgrading department.
- Functioned as Radiation Operations Supervisor assisting in maintaining NRC rules and regulations and isotope safety training programs.

Oct 1976 to Present

Responsibilities during this period include:

Qualified by written examination in accordance with SNT-TC-lA to Level III certification and also designated as Radiation Protection Officer.

- Practical and classroom training of personnel for qualification in RT,PT,MT and UT Level I, Level II per SNT-TC-1A guidelines.
- 2) Write NDE procedures and develope technquues.
- 3) Insure compliance to customer Quality Assurance requirements including selection of test methods.
- Insure NDE and casting upgrading is performed in accordance with U. S. Testing Co., Inc. Quality Assurance Manual.
- 5) Maintain equipment calibration.
- 6) Maintain all NRC rules and regulations.
- 7) Training of personnel in radiation safety per Company Procedures.

NONDESTRUCTIVE EXAMINATION DIVISION 430 Little Clinton Street, Reading, Pa. 19601 (215) 376-7434



NDE PERSONNEL CERTIFICATION RECORD

AME Dreibelbis, Joseph W.

ADDRESS Shillington, Pa.

Certification Card #147

EDUCATION

SCHOOL	LOCATION	DATES	CURRICULUM
Reading High School	Reading, Pa.	1965	
Penn State Univ.	Reading, Pa.	1966	Electronics
		<u> </u>	
·		<u> </u>	

TECHNICAL TRAINING

CONDUCTED BY	LOCATION	DATES	METHODS
ASNT sponsored	Reading, Pa.	40 hrs. 1973	Lvl II,Radiograph
ASNT sponsored	Reading, Pa.	30 hr. 1971	Lvl I,Ultrasonics
Krautkramer	Conr.	40 hr. 1970	Ultrasonics
U.S.Testing Co.	Reading, Pa.	16 hr. 1975	Radiation Safety

EXPERIENCE

EMPLOYER	ADDRESS	DATES	METHODS
U.S.Testing Co., Inc.	Reading, Pa.	9/72 to present	RT-MT-UT-PT
Empire Stl Casting	Reading, Pa.	4/68 thru 9/72	RT-MT-UT-PT
U.S.Testing Co., Inc.		7/66 thru 4/68	Radiography

EXAMINATION RESULTS

METHOD	RADIOGRAPHY	ULTRASONIC	LIQUID PENETRANT	MAG. PARTICLE
GENERAL	84.5x.3=25.4	96 x.3=28.8	93 x.3= 27.9	94 x.3=28.2
SPECIFIC	100 x.3=30	100x.3=30	86.5x.3= 26	84 x.3=25.
PRACTICAL	100 x.4=40	100x.4=40	95 x.4= 38	98 x.4=39.2
COMPOSITE	95.4%	98.8%	91.9%	92.6%
EYE EXAM.	1-03-73	1-03-78	1-03-73	1-03-78
APPROVED LEVEL	III	III	III	III
DATE	10-26-76	10-27-76	10-23-76	10-20-76
EXAMINER III	Demated	Sectumented	Herlumetrad	Houmstead



PROFESSIONAL RECORD

SHAUB, PETER G.

Nondestructive Examination Technician

ACADEMIC TRAINING

Reading High School - Reading, Pa. 1971

Reading Area Community College - Reading, Pa. 1973

Liberal Arts - Associate Degree (two-year course)

TECHNICAL TRAINING

Reading-Muhlenberg VO-TECH - Design & Drafting 1971

United States Testing Co., Inc.:

Radiation Safety, 16 hours - 1973

Radiography Level I, 30 hours - 1974. In accordance with UST-TC-1A, Rev. 3.

Radiation Safety, 16 hours - 1975

Radiography Level II, 40 hours - 1975. In accordance with UST-TC-1A, Rev. 3.

Magnetic Particle, Level II, 20 hours - 1975. In accordance with UST-TC-1A, Rev. 3.

Liquid Penetrant, Level II, 12 hours - 1977. In accordance with UST-TC-1A, Rev. 5.

PROFESSIONAL EXPERIENCE

United States Testing Company, Inc.

July 1973 - December 1973

Operated a qualified radiographer using iridium 192, Co60, beryllium window x-ray machine, 300 Kv x-ray machine and 2.5 mev. linear accelerator. The majority of activity was associated with casting radiography.



PROFESSIONAL EXPERIENCE (cont'd)

United States Testing Company, Inc.

December 1973 - August 1974

Functioned as a working supervisor responsible for maintaining a quality control system of electronic components through the use of radiography, an AQL of 0.3 was maintained during the duration of the contract.

August 1974 - September 1975

Functioned as a crew leader on various field site jobs. Field experience includes Martin's Creek Generating Station, Eddy Stone Generating Station, and nuclear components.

September 1975 - April 1976

Operated as a Level II site supervisor for pipe line assignment located in Fishkill, New York. Responsible for radiographic and magnetic particle examination.

April 1976 - June 1977

Operated as a Level II radiographer. Activity consisted of field work and in-house casting radiography including layout and establishing techniques; also performing vendor surveillance. Appointed to the position of radiation operating supervisor in June 1976.

June 1977 - September 1977

Operated as Level II site supervisor assigned to Power Authority of the State of New York and responsible for final acceptance of radiograph. Radiographic and magnetic particle examination performed on newly constructed reboiler system and various in-service components.

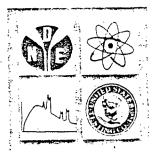
September 1977 to Present

Operating as Level II in radiography, magnetic particle and liquid penetrant examination on various assignments in accordance with ASME, AWOS, API, and military codes.

Duties include:

- 1) Writing NDE procedures and developing techniques.
- 2) Assisting in maintaining equipment calibration and compliance to customer quality assurance requirements.
- 3) Performing vendor surveillance for various customers which includes third party evaluation of radiograph.

NONDESTRUCTIVE EXAMINATION DIVISION 430 Little Clinton Street, Reading, Pa. 19601 (215) 376-7434



NDE PERSONNEL CERTIFICATION RECORD

hME

Shaub, Peter G.

ADDRESS __ Reading, Pa.

SCHOOL	LOCATION	DATES	CURRICULUM
Reading High School	Reading, PA	1971	College Prep.
Rdg Area Comm. Coll.	Reading, Pa.	9/71 thru 6/73	Assoc. Degree
			Liberal Arts

TECHNICAL TRAINING

CONDUCTED BY	LOCATION	DATES	METHODS
U.S.Testing Co.	Reading, Pa.	October 1973	16 hrs. Radiation
			Safety
U.S.Testing Co.	Reading, Pa.	March 1974	RT-Level-I-30 hr:
U.S.Testing Co.	Reading, Pa.	April 1975	16 hrs. Radiatio
U.S.Testing Co.	Reading, Pa.	20 hrs MT, 1975	Safety

EXPERIENCE

EMPLOYER	ADDRESS	DATES	METHODS
U.S.Testing Co.	Reading, PA	12/75 to present	RT-II,MT-II
U.S.Testing Co.	Reading, PA	3/74-12/75	RT-I, MT-II
U.S.Testing Co.	Reading, PA	7/73-3/74	Asst.Technician

EXAMINATION RESULTS

METHOD	RADIOGRAPHY	ULTRASONIC	LIQUID PENETRANT	MAG. PARTICLE
GENERAL	91 x.3=27.3		86.7x.3=26.0	84.x.3 = 25.3
SPECIFIC	$88 \times 3 = 26.4$		89.5x.3=26.9	95 x.3 =38.5
PRACTICAL	93 x.4=37.2		90.9x.4=38.0	90 x.4 =36.0
COMPOSITE	90.9%	· · · · · · · · · · · · · · · · · · ·	90.9%	89.5%
EYE EXAM.	01-16-73		01-16-78	01=16-78
APPROVED LEVEL	II		II	II
DATE	12,-8-75	-	2-2-78	5-02-75
EXAMINER III	Set unstrad		4. Doenvelling	Usenhw David



PROFESSIONAL RECORD

SIGGINS, AARON

Nondestructive Examination Technician Level II, RT,UT,MT,PT

ACADEMIC TRAINING

Oley Vall	Ley High	School		-	1975
Kutztown	State C	ollege.	Kutztown,Pa.		1976

TECHNICAL TRAINING

United States Testing Co., Inc.	
Radiation Safety, 16 hours	- 1976
Radiography Level I in accordance	
with UST-TC-1A, Rev. 5	- 1976
Radiography Level II, in accordance	
with UST-TC-1A, Rev. 5	- 1977
Liquid penetrant and magnetic	
particle examination in	
accordance with UST-TC-1A,	
Rev. 5	- 1977
Ultrasonic examination in accordance	
with UST-TC-1A, Rev. 5	- 1977

PROFESSIONAL EXPERIENCE

United States Testing Co., Inc.

September 1976 - Present

Functioned as a qualified technician in radiography, ultrasonics, magnetic particle and liquid penetrant examination. Thoroughly familiar with operation and establishing techniques using radioactive isotopes, low energy xray machines and 2.5 Mev linear accelerator.



PROFESSIONAL EXPERIENCE

United States Testing Co., Inc.

September 1976 - Present

Functioned in the capacity of Lead Technician on various field assignments using RT,MT,PT and UT examination methods.

Operated as a Level II Ultrasonic Technician under contract with Kaiser Engineering at Perry Nuclear Power Plant. Testing performed on imbedded plate located in reactor housing wall in accordance with ASME Sect. III.

In addition conducted classroom instruction on ultrasonics to on-site personnel from Kaiser, Gilbert's, CEI and Newport News.

Conducted classroom practical demonstration on RT,UT,MT and PT for DCAS Representatives taking NDE training course.

NONDESTRUCTIVE EXAMINATION DIVISION 430 Little Clinton Street, Reading, Pa. 19601 (215) 376-7434



AME Aaron Siggins

ADDRESS Fleetwood, Pa.

EDUCATION

SCHOOL	LOCATION	DATES	CURRICULUM
Oley Valley High	Oley, Pa.	1975	Academic
Kutztown St. Coll,	Kutztown, Pa,	1976	l yr (math)
		` 	

TECHNICAL TRAINING

CONDUCTED BY	LOCATION	DATES	METHODS
U.S.Testing Co., Inc.	Reading, Pa.	Sept. 1976	Radiation Safet
U.S.Testing Co., Inc.	Reading, Pa.	Sept. 1976	
		Feb. 1977	UT,MT,PT,RT
			· · · · · · · · · · · · · · · · · · ·

EXPERIENCE

EMPLOYER	ADDRESS	DATES	METHODS
U.S.Testing Co., In	c. Reading, Pa.	9/76 to present	Level II
			UT,MT,PT,RT
		· · · · · · · · · · · · · · · · · · ·	

EXAMINATION RESULTS

METHOD	RADIOGRAPHY	ULTRASONIC	LIQUID PENETRANT	MAG. PARTICLE
GENERAL	90x.3= 27.0	85x.3= 25.5	100x.3 = 30.0	78.4x.3=23.5
SPECIFIC	88x.3= 26.4	100x.3=30.0	100x.3= 30.0	92.3x.3=27.6
PRACTICAL	90x.4 = 36.0	95x.4 = 38.0	99x.4= 39.6	95 x.4=38.0
COMPOSITE	89.4%	93.5%	99.6%	89.1%
EYE EXAM.	01/16/78	01/16/78	01/16/78	01/16/78
APPROVED LEVEL	2W	II	II	II
DATE	6-18-77	10-19-77	8-18-77	8-19-77
EXAMINER III	parts W. Dreile	la fragelini Drei	All sent W. Liney	Spenh & reif
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## Appendix B

## RADIOGRAPHIC PROCEDURE AND ATTACHMENTS

# U.S. TESTING CO.

# READING, PA. 19606

Procedure for Radiographic Examination

PROCEDURE NO.	REVISION	Page	
UST-RT-2	. —	<u>    1                                </u>	of <u>17</u>
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R. P. Indap	J Dreitellin		3-2-77

U.S. TESTING CO. Procedure for Radiographic Examination PROCEDURE NO.

UST-RT-2

## **RECORD OF REVISIONS**

REV.	PREPARED BY	APPROVED BY & EFFECTIVE DATE	DESCRIPTION OF REVISION
1 1 1	J.Dreibelbis J.Dreibelbis J.Dreibelbis	L. E. Moll L. E. Moll L. E. Moll	<ul> <li>7.2 Update to latest addenda</li> <li>10.1 Revise fig. 1,2,3</li> <li>12.5.1 Update to latest addenda</li> </ul>
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#### 1.0 Scope

1.1 This procedure will be used when radiographic examination is to be performed in accordance with ASME Code, Section V, article 2.

#### 2.0 Safety Requirements

2.1 Each person operating radiographic equipment shall comply with the Company procedures and applicable safety codes to insure adequate protection from radiation hazard.

#### 3.0 Personnel Qualification

- 3.1 Radiographic personnel shall be qualified and certified in accordance with the latest revision of UST-TC-lA, "Personnel Qualification Procedures for Certification in Nondestructive Testing Methods".
- 3.2 UST-TC-1A is in complience with the guidelines provided in following documents. American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A (1975 addition). MIL-STD 271E (ships) "Nondestructive Testing Requirements for Metals".

#### 4.0 Surface Preparations

- 4.1 Materials Surfaces shall satisfy the requirements of the applicable materials specifications, with additional conditioning, if necessary, by any suitable process to a degree that surface irregularities cannot mask or be confused with discontinuities.
- 4.2 Welds The weld ripples or weld surface irregularities on both the inside (where accessible) and outside, shall be removed by any suitable process to such a degree that the resulting radiographic image due to any irregularities cannot mask or be confused with the image of any discontinuity.
- 4.3 Surface Finish The finished surface of all butt-welded joints may be flush with the base material or may have reasonably uniform crowns, with reinforcement not to exceed that specified in the referencing Code Section.

#### 5.0 Type of Films

5.1 Radiographs shall be made using industrial radiography film type 1 or 2. A particular choice of film (from type 1 or 2) will depend upon radiographic quality level and maximum economically permissable exposure time.



#### 6.0 Processing of Films

6.1 Films will be processed either by manual processing or automatic processor. All radiographs shall be free from mechanical, chemical or other blemishes to the extent that they cannot mask or be confused with the image of any discontinuity in the object being radiographed.

#### 7.0 Density Limitations of Radiographs

- 7.1 The transmitted film density through the radiographic image of the body of the appropriate penetrameter and the area of interest shall be 1.8 minimum for single film viewing for radiographs made with an X-ray source and 2.0 minimum for radiographs made with a gamma-ray source. For composite viewing of double film exposures, the minimum density shall be 2.6. Each radiograph of a composite set shall have a minimum density of 1.3. The maximum density shall be 4.0 for either single or composite viewing.
- 7.2 Densitometers shall be used for assuring compliance with film density requirements and step wedge calibration films traceable to a national standard shall be used for checking densitometer calibration. A tolerance of .05 in density is allowed for variations between different density readings.

#### 8.0 Intensifying Screens

- 8.1 Lead foil screens should be used for energies exceeding 125 KV. The screens should have a minimum of 0.005 inch thickness and a maximum of 0.020 inch thickness. Lead screens should be free of scratches, wrinkles, pits and oxide coating which may interfere with good radiographic resolution.
- 8.2 Fluorescent screens shall not be used.

#### 9.0 Back Scattered Radiation

- 9.1 Effects of back-scattered radiation can be reduced by confining the radiation beam to the smallest practical cross section and by using lead screens.
- 9.2 As a check on back-scattered radiation, a lead symbol "B", preferably with minimum dimensions of 1/2 inch in height and 1/16 inch in thickness, shall be attached to the back of each film holder. If the image of the "B" appears on the radiograph, protection from back-scatter is insufficient and the radiograph should be considered unacceptable. Additional precaustions should be taken to eliminate the problem.



#### 10.0 Selection of Energy of Radiation

- 10.1 Fig. 1, 2 & 3 provide guidelines on maximum voltage which should be used in the radiography steel, copper and aluminum.
- 10.2 Minimum thickness for which radioactive isotopes may be used are given in Table 1.
- 10.3 When it not practical to perform radiography within voltage ranges specified in 10.1 or when a radioactive isotope source is to be used to radiograph thicknesses less than minimum indicated in 10.2 or when isotopes other than Iridium or Cobalt are to be used, a special technique shall be prepared and proved satisfactory by actual demonstration of penetrameter resolution on minimum thickness of the material to be radiographed.
- 10.4 The maximum thickness for use of radioactive isotopes is primarily dictated by exposure time, and upper limits are consequently not specified.

#### 11.0. Geometrical Unsharpness Limitations

11.1 Geometric unsharpness of the radiograph shall not exceed the following:

Material thickness, in.	Geometrical unsharpness, in.
Under 2	0.020
2 through 3	0.030
Over 3 through 4	0.040
Greater than 4	0.070

#### 12.0 Selection and Use of Penetrameters

- 12.1 Penetrameters described in Fig. 4 shall be used. They shall be manufactured in accordance with the requirements of SE-142 (ASME Code Section V).
- 12.2 Thickness of penetrameters Penetrameters as designated in Table 2 or 3 as applicalbe shall be used for indicated thickness range. For any material thickness range, a thinner penetrameter than listed for that range may be used, provided all other requirements for radiography are met. For welds, the thickness on which the penetrameter is based is the single-wall thickness plus any reinforcement. Backing rings or strips are not to be considered as part of the weld or reinforcement thickness in penetrameter selection.

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- 12.3 Penetrameter sensitivity - Radiography shall be performed within a technique of sufficient sensitivity to display the penetrameter image and the specified hole, which are essential indications of the image quality of the radiographs.
- 12.4 Placement of penetrameters - The penetrameter shall be placed adjacent to the weld seam except in instances where the weld metal is not radiographically similar to the base material or the geometric configuration makes it impractical in which case, the penetrameter may be placed over the weld metal. Where inaccessibility prevents hand placing the penetrameter on the source side, a film side penetrameter shall be placed on the film side of the joint, and a letter "F" at least as high as the identification number shall be placed adjacent to the penetrameter. When configuration or size prevents placing the penetrameter on the object being radiographed, it may be placed on a separate block, provided the block is of radiographically similar material, the same thickness as the object and is placed as close as possible to the object being radiographed.
- 12.5 Number of Penetrameters
  - 12.5.1 Except as provided in 12.5.2 and 12.5.3 one penetrameter shall be used for each radiograph. Each penetrameter shall represent an area of essentially uniform. radiographic density as judged by a densitometer. If the density of the radiograph anywhere through the area of interest varies by more than minus 15% or plus 30%, from the density through to the penetrameter, then an additional penetrameter shall be used for each exceptional area or areas and the radiograph re-taken. The required densities are stated in 7.1. Calculations may be rounded off to the nearest o.l of the requirements of 7.0.
  - 12.5.2

If more than one penetrameter is used, one shall be in the lightest area of the radiograph and the other in the darkest. The. density in the areas of interest controlled by each penetrameter shall meet the requirements of 12.5.1. The intervening densities on the radiograph are acceptable. The additional penetrameter need not be normal to the radiation source.

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UNITED STATES TESTING COMPANY, INC.



- 12.5.3 Where more than one film is used for an exposure, a penetrameter image shall appear on each radiograph except where the source is placed on the axis of the object and a complete circumference radiographed with a single expsoure (panoramic exposure) in which case at least three equally spaced penetrameters shall be used. Where portions of longitudinal welds adjoining the circumferential weld are being examined simultaneously with the circumferential weld, additional penetrameters shall be placed on the longitudinal welds at the ends of the sections of those welds being radiographed. When an array of objects in a circle is radiographed, at least one penetrameter shall show on each object image.
- 12.5.4 If the penetrameter image does not show on one radiograph in double-film technique but does show in composite viewing, interpretation shall be done by double-film viewing.
- 12.6 Shims Under Penetrameters- If the weld reinforcement and/or backing strip are not removed, a shim of material radiographically similar to the weld metal shall be placed under the penetrameter. The shim thickness shall be selected so the total thickness being radiographed under the penetrameter is essentially the same as the total weld thickness plus backing strip, if used and not removed, and other thickness variations such as in nozzle geometrics.
- 13.0 Techniques for radiography of parts, components and butt welds in tubular products, nozzles, valves, flanges and similarly shaped cylindrical objects.
  - 13.1 Single Wall Viewing Radiographic examination of circumferencial butt welds shall be done with single-wall viewing only except as permitted in 13.2. The radiation may pass through one or both walls. Where the source is located outside the cylinder, a minimum of four exposures separated by 90° shall be required for single-wall viewing. When the radiation must pass through two walls of a cylinder, the penetrameter given in Table 3 may be used.
  - 13.2 Double-Wall Viewing Welds joining items with an outside diameter of 3½ in. or less may be radiographed using a technique in which radiation passes through two walls, and the weld in both walls is viewed for acceptance on the same film. The penetrameter shall be placed on the source side. The radiation beam may be offset from the



- 13.2 plane of the welds centerline at an angle sufficient to separate the images of the source-side and film-side portions of the weld so there is no overlap of the areas to be interpreted, in which case a minimum of two exposures taken at  $90^{\circ}$  to each other shall be made for each weld joint. As an alternate, the weld may be radiographed with the radiation beam positioned so the images of both walls are superimposed, in which case at least three exposures shall be made at  $60^{\circ}$  to each other. Penetrameters may be selected from Table 3.
- 13.3 Film Side Penetrameter If the radiation passes through one wall and inaccessibility prevents sourceside placement of the penetrameter, a film-side penetrameter may be used from Table 2. When the radiation must pass through two walls of a cylinder, the penetrameter given in Table 3 may be used.

#### 14.0 Identification of Radiographs

14.1 System of identification. A system of radiograph identification shall be used to produce permanent identification on the radiograph. Identification shall include Company name, Company work Order (which is traceable to customer's purchase order), component heat number and/or serial number, weld or weld seam or part number, date of radiograph. This identification will be included on the radiograph using imprint card flasher unit and/or white ink or lead numbers. In any case, this information shall not obscure the area of interest.

#### 15.0 Location Markers

15.1 Lead location markers which are to appear as radiographic images on the film, shall be placed on the part - not on the film holder/cassette and their locations shall be marked on the surface of the part being radiographed or on a map in a manner permitting the area of interest on a radiograph to be accurately located on the part, and providing evidence on the radiograph that the required coverage on the region being examined has been obtained. The location markers shall be placed on the source-side of the section being radiographed. They may be placed on the film-side of the section if inaccessibility precludes placement on the source-side by hand.

#### 16.0 Records and Documentation

16.1 Radiographer shall complete job radiation report form (Fig. 5) and radiographic technique form (Fig. 6). These forms will provide such information as radiographic specification, source type, source strength

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- 16.1 or voltage, source size, material type and thickness, lead screen thickness, film size, film type, source to film distance, exposure time, description of set-up and shooting sketch if necessary. Radiographer interpretating radiograph shall fill out interpretation form (Fig. 7). Interpretation will be performed using acceptance criteria given in customer's specifications or the applicable attachment prepared by U. S. Testing Co. for that specification.
- 16.2 Customer will be given a complete set of radiographs, copy of completed radiographic technique form and interpretation report form and shooting sketch if necessary.

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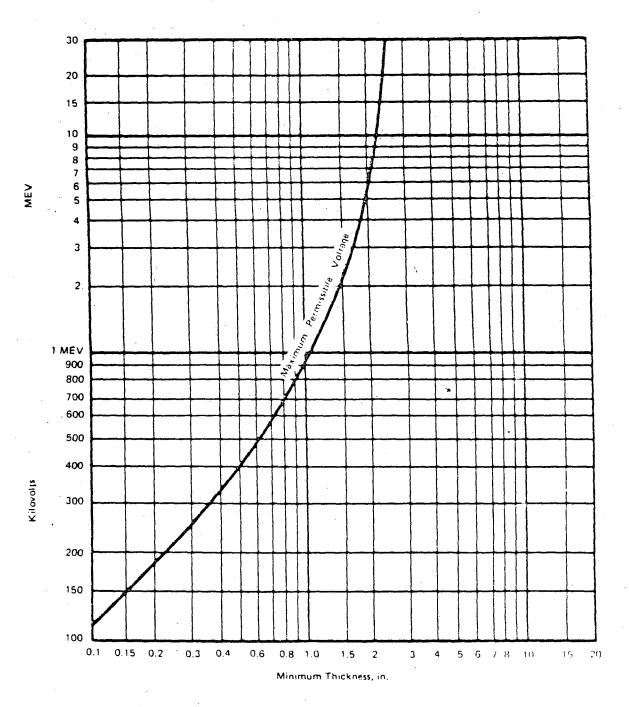
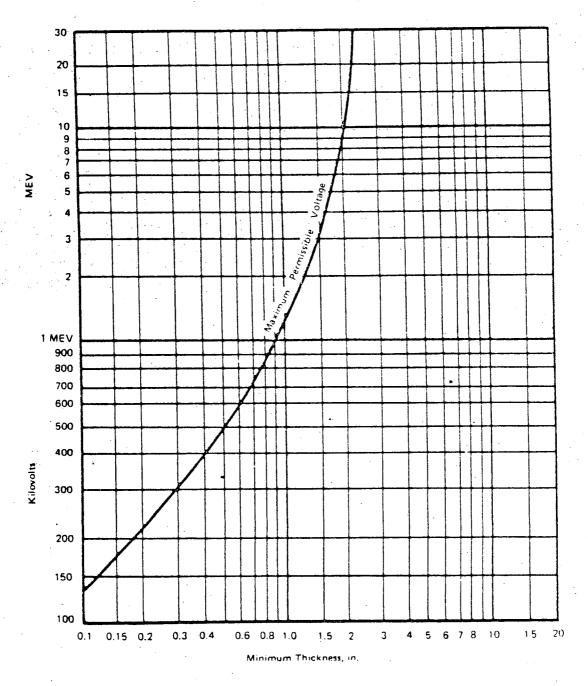
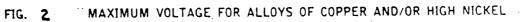
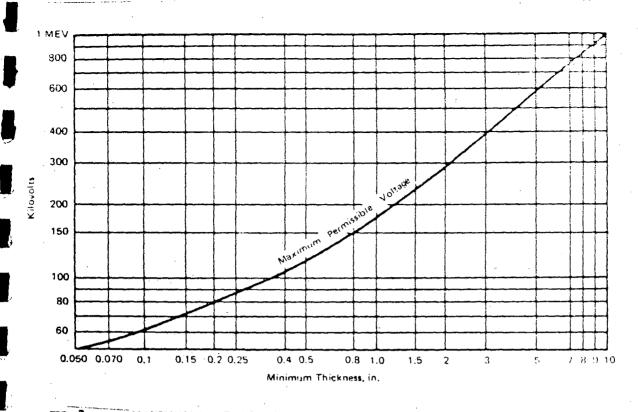


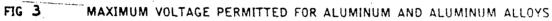
FIG. 1 TO MAXIMUM VOLTAGE FOR STEEL

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Table 1

Minimum Thickness for Radioactive Isotopes

	Minimum	Thickness
Material	Iridium 192	Cobalt 60
Steel	0.75 in.	1.50 in.
Copper or High Nickel	0.65 in.	1.30 in.
Aluminum	2.50 in.	- _

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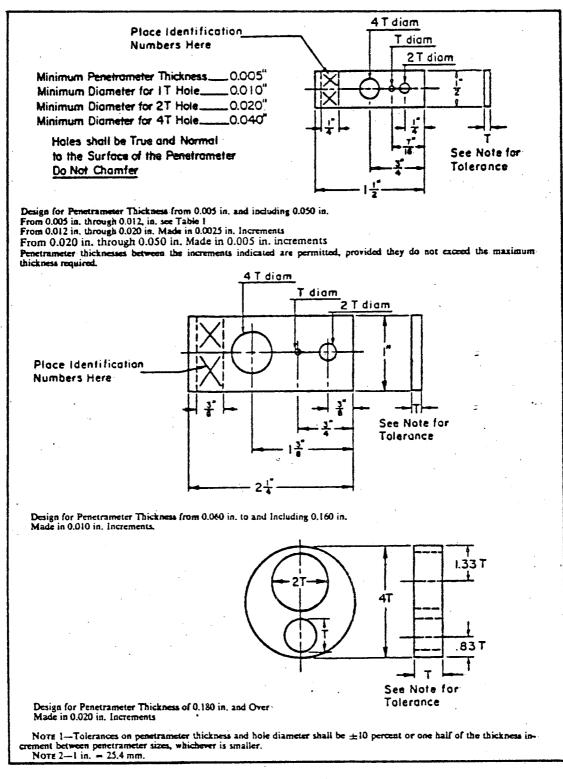


Fig 4 Penetrameter Design

Material Thickness, penetrameter designations, and essential holes for single-wall radiographic technique

	Penetrameter						
Nominal	Source side	· · · · · · · · · · · · · · · · · · ·	Film	Side			
Single-Wall		Decembral		<b>The second for 1</b>			
Material-Thickness		Essential		Essential			
Range, in.	Designation	Hole	Designation	Hole			
Up to .25 incl.	10	4T	· 7	4T			
Over .25 thru .375	12	4T	10	4T			
Over .375 thru .50	15	4T	12	4T			
Over .50 thru .625	15	4T	12	4T			
Over .625 thru .75	17	4T	15	4T			
Over .75 thru .875	20	4 T	17	4T			
Over .875 thru 1.00	20	4T	17	4 T			
Over 1.00 thru 1.25	25	<b>4T</b>	20	$4 \mathrm{T}$			
Over 1.25 thru 1.50	30	2T	25	2T			
Over 1.50 thru 2.00	35	2T	30	2T -			
Over 2.00 thru 2.50	40	2 <b>T</b>	35 .	2T			
Over 2.50 thru 3.00	45	2T	40	2T			
Over 3.00 thru 4.00	50	2T	45	2T			
Over 4.00 thru 6.00	60	21	• 50	2T			
Over 6.00 thru 8.00	80	2 <b>T</b>	69	2T			
Over 8.00 thru 10.00	100	21	80	2T			
Over 10.00 thru 12.00	120	2T	100	2T			
Over 12.00 thru 16.00	160	2T	120	2T			
Over 16.00 thru 20.00	200	2T	160	21			

#### Table 3

Material thickness, penetrameter designations, and essential holes for double-wall radiographic technique

		Source ameter
Nominal Single-Wall Material Thickness Range in.	Designation	Essential Hole
0 thru 0.375	10	4T
Over 0.375 thru 0.625	12	4T
Over 0.625 thru 0.875	15	4T
Over 0.875 thru 1.00	17	$4 \mathrm{T}$
Over 1.00 thru 1.50	25	2 <b>T</b>
Over 1.50 thru 2.50	30	2 <b>T</b>
Over 2.50 thru 3.00	35	2T
Over 3.00 thru 4.00	40	2т
Over 4.00 thru 6.00	50	2 <b>T</b>

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NON DESTRUCTIVE TESTING DIVISION 430 LITTLE CLINTON STREET

READING, PENNA. 19601 (215) 373-4844



DATE

WORK ORDER NUMBER

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	DRAWING AND/OR PATTERN NO.	30	LEAD SCREEN THICKNESS
-	SERIAL NO.	31	RADIOGRAPHIC SPEC.
-	HEAT NO.	32	
7	TYPE OF MATERIAL	33	NUMBER OF FILMS
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9		35	TYPE OF FILM USED
9	TIME FINISHED JOB:	36	SOURCE MODEL NO./SERIAL NO.
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## U.S. TESTING CO.

# **READING**, PA. 19606

PROCEDURE NO.	REVISION	Page	
UST-RT-2-NRC Attachment 1	0		of
PREPARED BY Joseph W. Dreibelli	REVIEWED BY	APPROVED BY Dreubell UST-TC-1A Lev III	EFFECTIVE DATE



#### Attachment NRC-1

#### 1.0 SCOPE

- 1.1 This attachment will be used in conjunction with the radiographic procedure UST-RT-2.
- 1.2 This attachment shall comply with the requirements of ASME Section III, 1971 edition, Summer 1973 addenda, sub-sections NB and NC requirements for Class 1 and Class 2 components and be in accordance with the requirements of IX-3300 Section III Appendix IX.

#### 2.0 SELECTION OF PENETRAMETERS

- 2.1 Penetrameters shall be in accordance with ASTM E-142-64.
- 2.2 Except as permitted by UST-RT-2 Table 2 and Table 3, the images of the identifying numbers, the pentrameter outline and of the 2t hole are all essential indexes of image quality on the radiograph.
  - 2.2.1 Penetrameters 5, 7, and 10 shall have a .010" X .25" slit which shall appear on the radiograph as the essential index of image quality.

#### 3.0 RADIOGRAPHIC ACCEPTANCE STANDARDS

3.1 Evaluation of Indications

- 3.1.1 Welds that are shown by radiography to be any of the following types of discontinuities are unacceptable:
  - 3.1.1.1 Any type of crack or zone of incomplete fusion or pene-tration.

3.1.1.2 Any other elongated indication which has a length greater than:



#### Attachment NRC-1

3.0 Radiographic acceptance standards (continued)

1/4 inch for t up to 3/4 inch, inclusive. 1/3t for t from 3/4 inch to 2-1/4 inch inclusive. 3/4 inch for t over 2-1/4 inch.

where t is the thickness of the thinner portion of the weld.

3.1.1.3 Any group of indications in line that have aggregate length greater than t in a length of 12t except where the distance between the successive indication exceeds 6L where L is the longest indication in the group.

3.1.1.4 Porosity in excess of that shown as acceptable in ASME Section 3 Appendix VI.

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PROCEDURE NO.	REVISION		Page	
UST-RT-2-Nrc Attachment 2	0			of
PREPARED BY	REVIEWED BY		APPROVED BY	EFFECTIVE DATE
Joseph W. Dreifelli	Shridan	-	J. Dreubell	4/17/78
p. p. m. Srayour			UST-TC-IA LevIII	



Attachment NRC-2

#### 1.0 SCOPE

- 1.1 This attachment will be used in conjunction with the radiographic procedure UST-RT-2.
- 1.2 This attachment shall comply with the requirements of ASME Section III, Sub-section NE, 1971 edition, Winter 1971 addenda and be in accordance with the requirements of Section VIII, Division 1, 1971 edition, Winter 1971 addends, paragraph UW-51.
- 2.0 SELECTION OF PENETRAMETERS
  - 2.1 Penetrameters shall be as shown in figure 1.
  - 2.2 The 5, 7 and 10 penetrameters shall have a slit with dimensions .010" X .25".
  - 2.3 The 2t hole or the slit are essential indexes of image quality.
- 3.0 DENSITY REQUIREMENTS
  - 3.1 Minimum film density shall be 1.3 single film and 2.0 composite viewing.

#### 4.0 ACCEPTANCE STANDARDS

- 4.1 The following types of discontinuities are unaccpetable.
  - 4.1.1 Any type of crack, or zone of incomplete fusion or penetration.
  - 4.1.2 Any elongated slag inclusion which has length greater than

1/4 in. for t up to 3/4 in. 1/3t for t from 3/4 in. to 2-1/4 in. 3/4 in. for t over 2-1/4 in. where t is the thickness of the weld.

4.1.3 Any group of slag inclusions in line that have an aggregate length greater than t in a length of 12t, except when the distance between the successive

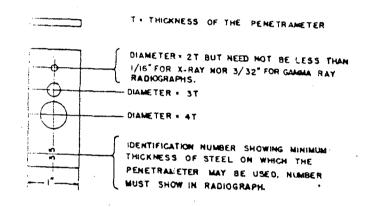


#### Attachment NRC-2

4.0 Acceptance standards (continued)

imperfections exceeds 6L where L is the length of the longest imperfection in the group.

4.1.4 Porosity in excess of that specified by the acceptance standards given in Appendix IV.



PENETRAMET	E	2	
FOR THICKN			
EXCEEDING	2	1/2	IN

PENETRAMETERS SHALL BE MADE OF CARBON STEEL.

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#### Attachment NRC-3

1.0 SCOPE

- 1.1 This attachment will be used in conjunction with the radiographic procedure UST-RT-2.
- This attachment shall comply with the require-1.2 ments of ASME Section III, Sub-section ND, 1974 edition, Appendix X and paragraphs ND 5321, ND 5322.
- 2.0 SELECTION OF PENETRAMETERS
  - 2.1 Penetrameters shall be as shown in figure 1.
  - 2.2 The 5, 7 and 10 penetrameters shall have a slit with dimensions .010" X .250".
  - 2.3 The 2t hole or the slit are essential indexes of image quality.
- 3.0 ACCEPTANCE STANDARDS

100% radiographic requirement. 3.1

- Welds that are shown by radiography to 3.1.1 have any of the following types of discontinuities are unacceptable:
  - 3.1.1.1 Any type of crack or zone of incomplete fusion or penetration.
  - 3.1.1.2 Any other elongated indication which has a length greater than:

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

3.1.1.3 Any group of indications in line that have an aggregate length greater than t in a length of 12t except where the distance between the successives indication exceeds 6L where L is the longest indication in the group.

3.1.1.4 Porosity in excess of that shown as acceptable in Appendix VI.



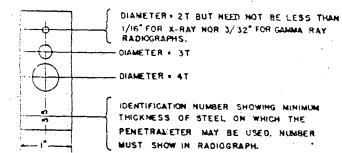
Attachment NRC-3

- 3.0 Acceptance standards (continued)
  - 3.2 Spot radiographic requirement

The acceptability of welds examined by spot radiography shall be determined by (a), (b) and (c) below.

- (a) Welds in which the radiograph shows any type of crack or zone of incomplete fusion or penetration shall be unacceptable.
- (b) Welds in which the radiographs show slag inclusions or cavities shall be unacceptable if the length of any such imperfection is greater than 2/3T where T is the thickness of the thinner plate welded. If several imperfections within the above limitations exist in line, the welds shall be judged acceptable if the sum of the longest dimensions of all such imperfecttions is not more than T in a length of 6T or proportionately for radiographs shorter than 6T and if the longest imperfections considered are separated by at least 3L of acceptable weld metal, where L is the length of the longest imperfection. The maximum length of acceptable imperfections shorter than 1/4 in. shall be acceptable for any plate thickness.
- (c) Porosity is not a factor in the acceptability of welds not required to be fully radiographed.

T . THICKNESS OF THE PENETRAMETER



PENETRAMETER FOR THICKNESSES EXCEEDING 2 J/2 IN.

# PENETRAMETERS SHALL BE HADE OF CARBON STEEL.

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#### Attachment NRC-4

- 1.0 SCOPE
  - 1.1 This attachment will be used in conjunction with the radiographic procedure UST-RT-2.
  - 1.2 This attachment shall comply with the requirements of ASME Section III, Sub-section NC, 1974 Edition, ASME Section V and paragraph NC 5300.
- 2.0 SELECTION OF PENETRAMETERS
  - 2.1 Penetrameters shall be in accordance with ASTM E-142-64.
  - 2.2 Except as permitted by UST-RT-2 Table 2 and Table 3, the images of the identifying numbers, the penetrameter outline and of the 2t hole are all essential indexes of image quality on the radiograph.
    - 2.2.1 Penetrameter 5, 7 and 10 shall have a slit with dimensions .010" X .250" which shall appear on the radiograph as essential index of image quality.
- 3.0 ACCEPTANCE STANDARDS
  - 3.1 Evaluation of Indications (100% Radiography)

Welds that are shown by radiography to have any of the following types of discontinuities are unacceptable:

- 3.1.1 Any type of crack or zone of incomplete fusion or penetration.
- 3.1.2 Any other elongated indication which has a length greater than:

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

3.1.3 Any group of indications in line that have an aggregate length greater than t in a length of 12t except where the distance between the successive indication exceeds 6L where L is the longest indication in the group.



Attachment NRC-4

3.0 Acceptance standards (continued)

3.1.4 Porosity in excess of that shown as acceptable in Appendix VI.



## Appendix C

## LIQUID PENETRANT PROCEDURE AND ATTACHMENTS

## U.S. TESTING CO.

## READING, PA. 19606

Procedure for Liquid Penetrant Examination

PROCEDURE NO.	REVISION	Page	
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U.S.TESTING CO. Procedure for Liquid Penetrant Examination

PROCEDURE NO.

UST-PT-3

# **RECORD OF REVISIONS** REV. APPROVED BY PREPARED BY DESCRIPTION OF REVISION & EFFECTIVE DATE



#### 1.0 SCOPE

- 1.1 This procedure describes methods and techniques to be used to perform liquid penetrant examination on nonporous metallic materials (ferrous and nonferrous), nonmetallic materials (ceramics, plastics and glass).
- 1.2 The procedure covers color contrast (visible dye) and fluorescent penetrant methods of following types:
  - a) Water washable
  - b) Post-emulsifying
  - c) Solvent removable
- 1.3 The procedure permits to use any one of the methods from 1.2 to perform penetrant examination. The use of a particular method will be at the discretion of U. S. Testing, unless a specific method is defined on the applicable drawing or purchase order, or governing specification.
- 1.4 Following standards and documents form a part of this procedure:
  - a) ASME Boiler & Pressure Vessel Code Section I, III, V and VIII.
  - b) ASTM Standard E-165-65 Methods for Liquid Penetrant Inspection.
  - c) AWS D1.1
  - d) ANSI B31.1 & B31.3

#### 2.0 PERSONNEL QUALIFICATIONS

- 2.1 Personnel performing penetrant examination shall be qualified and certified in accordance with the latest revision of UST-TC-lA, "Personnel Qualification Procedures for Certification in Nondestructive Testing Methods".
- 2.2 UST-TC-lA is in complience with the guidelines provided in the document SNT-TC-lA, published by American Society for Nondestructive Testing.

#### 3.0 SURFACE PREPARATIONS

3.1 Customer shall be responsible for surface preparations other than basic cleaning.



- 3.0 Surface Preparations (continued)
  - 3.2 In general, satisfactory results may be obtained when the surface is in the as-welded, as-rolled, as-cast, or as-forged condition but surface preparation by grinding or machining or other methods may be necessary in some instances where irregularities could otherwise mask indications of unacceptable discontinuities. Blasting with shot or dull sand may peen discontinuities at the surface and should not be used.
  - 3.3 Prior to liquid penetrant examination, the surface to be examined and all adjacent areas within at least 1 inch shall be dry and free of any dirt, grease, lint, scale, welding flux, weld spatter, oil or other extraneous matter that could obscure surface openings or otherwise interefere with the examination.
  - 3.4 After mechanical preparation is complete, each surface to be examined shall be dipped, sprayed, wiped or brushed with trichloro ethylene or unused or redistilled acetone.
  - 3.5 All surfaces to be examined shall be dried using a clean, dry cloth or paper towel and the remaining solvent allowed to evaporate for a minimum period of five minutes before applying penetrant.

#### 4.0 PENETRANT MATERIALS

- 4.1 The penetrant examination materials shall be certified in accordance with the requirements of ASTM D129-64 and ASTM D808-63. The residual amount of total sulfur or halogens shall not exceed one percent by weight.
- 4.2 Certifications shall make reference to the material identifications and batch number.
- 4.3 The components of a penetrant family shall not be intermixed with those of another manufacturer.

#### 5.0 APPLICATION OF PENETRANT

- 5.1 Surface to be examined shall be completely coated with penetrant by spraying, brushing or immersion and kept wetted for the required penetration (dwell) time.
- 5.2 Penetration time will generally be as recommended in ASTM E-165 standard unless otherwise specified by drawing or purchase order. Suggested penetration time given in ASTM E-165 are reproduced in Table 1 & 2.



#### 5.0 Application of Penetrant (continued)

- 5.3 The use of a fluorescent penetrant material following a visible dye (color contrast) penetrant examination is forbidden. This situation may arise when a retest is required due to repair or rework.
- 5.4 The ambient temperature will determine the temperature of penetrant materials and the test part which should not be less than  $60^{\circ}$  F nor exceed  $125^{\circ}$  F.
- 5.5 Localized heating or cooling of the specimen shall be permitted provided the temperature range noted above is maintained. Any commercial temperature indicator that will provide a control will be used.
- 5.6 When it is not practical to make liquid penetrant examination within the temperature range 60° F to 125° F, the examination procedure at the proposed temperature requires further qualification. This qualification shall be performed in accordance with the paragraph T-660, Article 6 of ASME Code, Section V.

#### 6.0 REMOVAL OF PENETRANT

- 6.1 Water Washable Type After adequate penetration time, remove the surface film of penetrant on the part by a water rinse. This rinsing must be complete and thorough so that the only penetrant remaining will be within discontinuities of the part. Water temperature should not exceed 110° F. For fluorescent penetrant, the rinsing should be done under black light to make it easier to see when all surface penetrant has been removed.
- 6.2 <u>Post-Emulsifying Type</u> In the post-emulsifying type penetrant, there is an added step required before rinsing. Since the penetrant is not water washable as applied on the part, an emulsifier which combines with the surface penetrant and makes mixture water washable is applied.
  - 6.2.1 Apply the emulsifier either by dipping the part into it or by flowing or spraying it on the part.
  - 6.2.2 The length of time that the emulsifier is allowed to remain on the part is critical, particularly for detecting shallow scratch-like discontinuities. Emulsification period may vary from 10 seconds to 5 minutes depending upon the surface of the part and the type of discontinuities sought. The average time should be about 2 to 3 minutes.

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#### 6.0 Removal of Penetrant (continued)

- 6.2.3 Final rinsing should be done as described in Para. 6.1. If the part cannot be completely washed because of insufficient emulsification of the penetrant, it should be completely reprocessed, with longer emulsification period.
- 6.3 Solvent Removable Type After adequate penetration time, remove excess penetrant by wiping with a clean, dry cloth or absorbent paper. The remaining penetrant shall be removed using cloth or paper moistened with solvent. Care shall be taken not to use an excess of solvent. Flushing of the test surface with any substance is prohibited.

#### 7.0 DRYING

- 7.1 Water Washable and Post-Emulsifying Fluorescent Type Penetrant System - During the preparation of parts for inspection, drying is necessary either following the application of wet developer or to dry the rinse water preceding the use of dry developers. Hot air used for drying should not exceed 200° F.
- 7.2 Water Washable and Post-Emulsifying Visible Dye Penetrant System - Parts are usually dried before application of the developer. Hot air used for drying should not exceed 200° F.
- 7.3 Solvent Removable Penetrant System A period of five minutes shall be allowed for evaporation of solvents prior to development. Since the solvent evaporates rapidly, leaving a uniform film of developer on the surface, no additional drying step is necessary. However, a period of five minutes shall be allowed for evaporation of solvents prior to development.
- 8.0 <u>DEVELOPING</u> After washing off the surface penetrant in the rinse operation, developer is applied to the part to blot back to the surface any penetrant that may have found discontinuities. This is a blotting action, and either a wet developer or a dry developer can be used. Use of a developer is not generally practiced when preparing ceramic parts for inspection.

- 8.0 Developing (continued)
  - 8.1 <u>Water Washable and Post-Emulsifying Fluorescent</u> Penetrant System
    - 8.1.1 Wet Developer
      - 8.1.1.1 Wet developer is purchased as a dry powder which is then mixed with water to form a liquid suspension. Its concentration shall be maintained in accordance with manufacturer's instructions.
      - 8.1.1.2 Parts shall be dipped or sprayed or brushed immediately after rinse operation and shall be dried as stated in para. 7.1. Excess wet developer mix should drain off the part, and part should be positioned to prevent pools of developer from forming.

#### 8.1.2 Dry Developer

8.1.2.1 Apply dry developer after the rinsed part has been dried. Dry developing powder requires a dry surface before it is applied or it will mat heavily in the water remaining on the part. Excess powder may be knocked off by shaking or tapping the part gently. Developing time should be at least half the time allowed for penetration. However, excessively long developing time may cause the penetrant in large deep discontinuities to bleed back, making a broad smudgy indication.

#### 8.2 Water Washable and Post-Emulsifying and Solvent Removable Visible Dye Penetrant System

8.2.1 After excess penetrant has been removed and parts have been thoroughly dried, spray a thin even coating of developer on the area being inspected. The developer is a liquid suspension of a powdered material which should be thoroughly agitated both before using and periodically during application. Spray application of the developer usually used provides a thin, even coating, precluding laps and runs. Brushing, swabbing or dipping may also be used.



#### 8.0 Developing (continued)

8.2.2 After the developer has been applied and is drying, if the parts have an excessive pink hue, clean the parts thoroughly and repeat the entire penetration process.

#### 9.0 EVALUATION OF INDICATIONS

- 9.1 <u>Fluorescent Penetrant System</u> Evaluation shall be conducted in a darkened area using a "Black Light" lamp. The lamp shall emit ultraviolet radiation within 3300 to 3900 angstrom unit range and shall have a light intensity of at least 90 foot-candles at the surface to be examined. A five minute warmup period shall be allowed prior to use of the lamp.
- 9.2 <u>Visible Dye Penetrant System</u> Examination can be visually accomplished either in natural or artifical light. Sufficient time should be allowed for all discontinuities to be revealed. A good rule of thumb is that the developing time should not be less than minimum penetration time shown in Table 1 & 2.
- 10.0 ACCEPTANCE STANDARD Acceptance standard shall be in accordance with applicable specification or purchase order. Few of the more widely used acceptance standards are given in following paragraphs.
  - 10.1 <u>Section III Class I Components, Castings and Forgings</u> NB-2546
    - 10.1.1 Only indications with major dimensions greater than 1/16 in. shall be considered relevant.
    - 10.1.2 The following relevant indications are unacceptable:
      - a) Any linear indications greater than 1/16 in.
         long for materials less than 5/8 in. thick,
         greater than 1/8 in. long for materials from 5/8 in. thick to under 2 in. thick and 3/16
         in. long for materials 2 in. thick and greater;
      - b) Rounded indications with dimensions greater than 1/8 in. for thicknesses less than 5/8 in. and greater than 3/16 in. for thicknesses 5/8 in. and greater.

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10.0 Acceptance Standard (continued)

- Four or more indications in a line_separated by 1/16 in. or less edge to edge;
- d) Ten or more indications in any 6 sq in. of area whose major dimension is no more than 6 in. with the dimensions taken in the most unfavorable location relative to the indications being evaluated.
- 10.2 Section III, Class 1 Components, Fabrication Welds, NB-5352
  - 10.2.1 Unless otherwise specified in this Subsection, the following relevant indications are un-acceptable.
    - a) Any cracks or linear indications;
    - b) Rounded indications with dimensions greater than 3/16 in.;
    - c) Four or more rounded indications in a line separated by 1/16 in. or less edge to edge;
    - d) Ten or more rounded indications in any 6 sq. in. of surface with the major dimension of this area not to exceed 6 in. with the area taken in the most unfavorable location relative to the indications being evaluated.
  - 10.2.2 Indications with major dimensions greater than 1/16 in. shall be considered relevant.

#### 11.0 RECORDS AND REPORTS

- 11.1 Results of liquid penetrant examination will be recorded on the form UST-PT-3-1(Fig. 1). This record shall include following information:
  - a) Brand name and specific type (number or letter designation if available) of penetrant, penetrant remover, emulsifier, and developer.
  - b) Method of pre-examination cleaning and drying, including cleaning materials used and time allowed for drying.

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11.0 Records and Reports (continued)

- c) Method of penetrant application; the length of time that the penetrant remains on the surface; and the temperature of the surface and penetrant during the examination if not within the 60 to 125° F range.
- d) Method of removing excess penetrant from the surface and of drying the surface before applying the developer.
- e) Method of applying the developer and length of developing time before examination.

#### Table 1 Classification of Liquid Penetrant Inspection Methods and Types

Method A - Fluorescent, Liquid Penetrant Inspection

Type 1- water washable Type 2-post-emulsifiable Type 3-solvent-removable

Method B - Visible, Liquid Penetrant Inspection

Туре	1	-	water-washable
Type	2		post-emulsifiable
Type	3	-	solvent-removable

	Table 2 Reco	mmended Dwell Ti	ime		
aterial	Form	Type of Discontinuity	fo	A-1,A-2,A-3, B-3a,b Developer	
luminum, magnesium, teel, brass and ronze, titanium and ligh-temperature lloys	cast-castings and welds wrought- extrusions, forgings,plate	cold shuts, porosity, lack of fusion, cracks (all for laps, cracks (a forms)		5 10	7 7
Carbide-tipped tools lastic Glass eramic	all forms all forms all forms	<pre>lack of fusion, porosity,cracks cracks cracks cracks,porosity</pre>	5	5 5 5 5	7 7 7 7 7

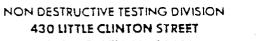
a-For temperature range from 60 to  $125^{\circ}$  F (15 to  $50^{\circ}$  C)

b-All dwell times given are recommended minimums.

c-Maximum penetrant dwell time 60 min.

d-Development time begins directly after application of dry developer and as soon as wet developer coating has dried on surface of parts (recommended minimum).

ITED STATES TESTING COMPANY







WORK ORDER NUMBER

DATE

#### LIQUID PENETRANT EXAMINATION REPORT

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#### Attachment NRC-1

#### 1.0 DRYING

Excess cleaning solvent shall be allowed to evaporate for a minimum of 5 minutes.

#### 2.0 PENETRATION TIME

After application of penetrant a minimum of 10 minutes shall elapse prior to penetrant removal.

#### 3.0 APPLICATION OF DEVELOPER

Shall be applied within 10 minutes after removal of excess penetrant.

#### 4.0 EXAMINATION

Evaluation of indications shall be made after a minimum of 7 minutes and not more than 30 minutes after application of the developer.

#### 5.0 ACCEPTANCE STANDARDS

The following types of relevant indications are not acceptable.

5.1 Any cracks and linear indications.

- 5.2 Rounded indications greater than 3/16 inch.
- 5.3 Four or more rounded indications in a line, separated by 1/16 or less edge to edge.
- 5.4 Ten or more rounded indications in any 6 sq. in. of area or surface. The minor dimension of this area shall be no less than one inch and the area selected shall be taken in the most unfavorable location relative to the indications being evaluated.



Appendix D

## TECHNIQUE AND READER SHEETS

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RADIOGRAPHIC TECHNIQUE

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CUSTOMER     N.R.C.     SOURCE NTE:     F. 192       PURCHASE ORDER NO. NIRC-05-78-304     SOURCE SIZE     10" x 3'.32"       DESCRIPTION OF SPECTAREN     K. QUALITY LEVEL:     2-2.T       DRAWING AND/ORFARTERN NO     L. HEAD SCREENTHICKNESS     0.10//010       SERIAL NO.     L. GBD = WOOL=02     M. REDIDORAPHICSPEC. UST-RT-2.dfl J.       MEAT NO     N.M. INTERPRETATION SEC. ASMETTER 1971     7.3       MEAT NO     S.S.     O. NUMBER OF PLANS     8       PRANCE TO PRACE     S.S.     O. NUMBER OF PLANS     8       PABRICATION PROCESS W/S J.     NUMBER OF PLANS     8       THE OF MATERIAL     S.S.     O. NUMBER OF PLANS     8       PABRICATION PROCESS W/S J.     NUMBER OF PLANS     8       THE OF MATERIAL     S.S.     NUMBER OF PLANS     8       PABRICATION PROCESS W/S J.     NUMBER OF PLANS     8       STARL     S.S.     NUMBER OF PLANS     8       STARL     S.S.     S.S.     S.S.     S.S.       STARL     S.S. <th></th> <th></th> <th>READ</th> <th>DING, PENNA. 1</th> <th>9601 (215)</th> <th>373-484</th> <th>4     </th> <th></th> <th>DATE</th> <th></th> <th>_0/ /</th> <th>9</th> <th></th>			READ	DING, PENNA. 1	9601 (215)	373-484	4 		DATE		_0/ /	9	
DESCRIPTION OF SPECIMEN     K     QUALITY LEVEL     2-2T       DRAWING AND/OR PATTERNINO.     -1     LEAD SCREEN THICKNESS     0.10/010       SERIAL NO.     -68D - W001-02     M     RADIOGRAPHICSPEC: UST-RT-2 att 1       HEATINO.     INTERPRETATION SPEC. ASTMETTIN'S B       TYPE OF MATERIAL     SS       7     SS     0       NUMBER OF FILMS     B       VEWS     THE OF MATERIAL       SS     0       VEWS     THE OF PROSURES       VEWS     THE OF MATERIAL       SS     0       VEWS     THE OF PROSURES       VEWS     T			A SKEWER I	STATISTICS STATISTY			I S	OURCE TYPE:					
DRAWING AND/OR PATTERNING     L. LEAD SCREEN THICKNESS     0.10/010       SERIAL NO.     1-680 = W001-02     M. RADIOGRAPHIC SPEC. UST-RT-2 at 1       HEATNO     N. INTERPRETATION SPEC. ASMETT 19.71     73       TYPE OF MATERIAL     SS     0     NUMBER OF FILMS     8       FABRICATION PROCESS     0     NUMBER OF FILMS     8       VIEW S     TYPE OF MATERIAL     SS     0     NUMBER OF FILMS     8       5-60     1     1     1     1     1     1       5-60     1     1     1     1     1     1       5-60     1     1     1     1     1     1       5-60     1     1     1     1     1     1       5-60     1     1     1     1     1     1		PURCHAS	E.ORDER NO	<u>» NIRC-04</u>	5-78-30	24	J SC	OURCE SIZE	19 x	2/32			
SERIAL NO 1-69D - W001-02 M. RADIOGRAPHIC SPEC. U.ST-RT-2 aft 1 HEATING INTERPRETATION SPEC. ASMETTI 1971 73 A TYPE OF MATERIAL SS OF NUMBER OF FILMS B FABRICATION PROCESS WOOD POULS (NUMBER OF FILMS B) P NUMBER OF FILMS B P NUMER OF F		DESCRIPTI	ON OF SPE	CIMEN			K Q	UALITY LEVEL	2-2	T			
SERIAL NO. 1-690-W001-02 HEATINO HEATINO SPEC. U.ST-RT-2 aft 1 NUMBER OF FILMS 8 FABRICATION PROCESS We of 10 VIEWS CHARACTER CURF VIEWS VIEWS FOR SUSSE VIEWS CURF VIEW CURF VIEWS V		DRAWING	AND/OR/P	ATTERN NO				AD SCREEN	HICKNESS	.0101	NIO		
NE INTERPRETATION SPEC. ASMETTE 19.71 30. TYPE OF MATERIAE SS O NUMBER OF FILMS 8  FABRICATION PROCESS We d  VEWS COMPANY CONFIRMENT CONFIRMANT CONFIRMANT FOR CONTINUE CONFIRMANT FOR CONFIRMATION FOR CONFIRMATI		A. Finish	an a star i s	N. A. Martin and	41-93								
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FABRICATION PROCESS We determined       VEWS       TIME       CURE/mount       CURE/mount       MUMBER OF EXPOSURES       1-2     7 X 17     AA/AA     84     20 in 15     2.6     4.5     19.5'       3-4     1     1     1     1     1     1       7-8     1     1     1     1     1       7-8     1     1     1     1     1       1     1     1     1     1     1		HEAT NO.					N. IN	ITERPRETATIC	N SPEC. A-SI	METT	<u>1971</u>	<u> </u>	60
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UNITED STATES TESTING COMPAN	WORK ORDER NUMBER 20232						
NON DESTRUCTIVE TESTING DIVISION 430 LITTLE CLINTON STREET READING, PENNA: 19601 (215) 373-4844	$\frac{1}{100} \int \frac{1}{100} \int \frac{1}$						
CUSTOMER NRC	I SOURCE TYPE TL						
PURCHASE ORDER NO. NRC-05-78-304	J SOURCE SIZE 1/9×3/32						
DESCRIPTION OF SPECIMEN	K QUALITY LEVEL 2-27						
DRAWING AND/OR PATTERNINO	L LEAD SCREEN THICKNESS . 010/010						
SERIAL NO 1-068D-W001-02	M RADIOGRAPHIC SPEC. UST-RT-Zatt						
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TYPE OF MATERIAL SS	O NUMBER OF FILMS 16						
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VIEWS DENSITY ACCEPT REJECT RESIDENT MILLISIONS SHRINK	TRAFIS CRACKS LACK OF LACK OF REMARKS						
1-2 3.64-35	Scratch [1 film]						
2-3 33-39 2	N.A.D						
3-4 $35-4.1$ V 4-5 $35-3.9$ V	N.A.D.						
5-6 35-3.8	Scratch (1 film)						
6-7 3.6-4, 1	N.A.D.						
7-8 34-38 -	N.A.D.						
8-1 35-36	artificats (film)						
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PShack UST-TSTA USTREVIEWER W.L							
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NON DESTRUCTIVE TEST 430 LITTLE CLINTOR READING, PENNA	N STREET	373-4844		DATE	4-18-7	8
CUSTOMER NRC			SOURCE TYPE			
PURCHASE ORDER NO. NRC-	05-78-3	04	SOURCE SIZE	18×3/32		
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DRAWING AND/OR PATTERN NO.			Be fullight in the California		101.010	
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UNITED STATES TESTING COMPANY	WORK ORDER NUMBER 20,232
NON DESTRUCTIVE TESTING DIVISION 430 LITTLE CLINTON STREET	D2
READING, PENNA 19601 (215) 373-4844	DATE 4/18/28

A CUSTOMER NRC	ALL SOURCE TYPE Ir 192
B PURCHASE ORDER NO NRC-OS-78-304	J SOURCE SIZE //8 × 3/32
C DESCRIPTION OF SPECIMEN	K. QUALITY LEVEL 2-27
D DRAWING AND/ OR PATTERN NO	LEAD SCREEN THICKNESS
E SERIALNO 1-687-2003-01	M RADIOGRAPHIC SPEC UST-RT-ZOH
F THEAT NO.	N. UNTERPRETATION SPEC. ASME SEC III. 1973
ج ج کر کر TYPE OF MATERIAL	O NUMBER OF FILMS
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USTREVIEWER Joseph W. Liefflf 4-19-78 UST-FC/ALEVIEI

DATE

NON DESTRUCTIVE TESTING DIVISION

430 LITTLE CLINTON STREET READING, PENNA. 19601

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(215) 373-4844



DATE 4-19-78

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WORK ORDER 20232

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#### INITED STATES IESTINA COMPANY NUMBER 10636 NON DESTRUCTIVE TESTING DIVISION D4 **430 LITTLE CLINTON STREET** READING, PENNA. 19601 DATE 🗳 (215),373-4844 CUSTOMER NRC 142 Source size 3 2 × 8 PURCHASE ORDER NO. 80 DESCRIPTION OF SPECIMEN QUALITY LEVEL 2-2 ستام ومشرق وفي المربعية الاست من فاتو فيقه شميران المشاور المربعة المربعية الاست معاد مانيا المنافع المربع Ċ K LEAD SCREEN THICKNESS . O [0/.010 DRAWING AND/OR PATTERN NO. SERIAL NO -1-074 B-0055-14 RADIOGRAPHIC SPEC UST-RT-2 a Ζ HEAT NO INTERPRETATION SPEC. ASME Sect III 1971 ST3 Gel HEAT NO ing Alexan al a factoria de la com 14 <u>SS</u> Ġ TYPE OF MATERIAL O. NUMBER OF FILMS 6 NUMBER OF EXPOSURES FABRICATION PROCESS P, CURIE TYPE STATE EXFOSURE PENETRAMETER EILMIN SIZE CURIEMINS MATERIAL THICKNESS ANGLE VIEWS FFD 5F 25 and the Á M 719 7 94 2XIA M 7-3 . . . i p 1 C ... . <u>6</u>. 6. コービ . . $\Delta 21$ V. **.** 1 5 m (**** 13 11125 ~ - 8 The second . terta de Nac <u> </u> Service Service A. 14 10 12 12 1 -talie: p i sign 100-00 12 W. S. S. T. Solar 13-1-2-2-2 . بالأحير م ٠. ŝ. ана (1997) 19 март — Парадарана 19 март — Парадарана 15 6 1.3 . રે શાન્ય છે છે. 1 17 Service and angle to be a management of the service management of the service of the service management of the service of t · · · · 18 n Vel j 19 . 43 S 20 . . **REMARKS:**

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INTERPRETATION REPO

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	DESCRIPTIC	ON OF SPE	CIMEN RH	R		: K	QUALITY LEVE	2-AT			
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UNITED STATES TESTING COMPAN	Y WORK ORDER 20232
NON DESTRUCTIVE TESTING DIVISION 430 LITTLE CLINTON STREET READING, PENNA. 19601 (215) 373-484	D10
A CUSTOMER. NRC	SOURCE TYPE I 192
B PURCHASE ORDER NO	J SOURCE SIZE 18 × 3/32
C DESCRIPTION OF SPECIMEN RHR	K QUALITELEVEL 2-4T
D DRAWING AND/OR PATTERN NO.	L. LEAD SCREEN THICKNESS .010/.010
E SERIAL NO. 1-0748-D054-10	M RADIOGRAPHIC SPEC. UST RT-2 at 1
F. HEAT NO	N. INTERPRETATION SPEC. ASME SECTION NO 1971, STOOD
G TYPE OF MATERIAL SS	O NUMBER OF FILMS
H FABRICATION PROCESS Weld	P. NUMBER OF EXPOSURES 4
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Ponauo yoenhu.	Dreikelly 4-30-18
" UST	TC ~IA INTERPRETATION REPORT

SERIAL NO.     1-9748-0053-01     M     RADICI       HEAT NO.     N     INTERP       TYPE OF MATERIAL     S.S     O     NUMBER       FABRICATION PROCESS     Weld     P     NUMBER       VIEWS     Image: Current of the second	and a second sec	
PURCHASE ORDER NO.     J     SOURC       DESCRIPTION OF SPECIMEN     K     QUALIT       DRAWING AND/OR PATTERN NO.     L     LEAD S       SERIAL NO.     1     -274 B - D053 - 01     M       HEAT NO.     N     INTERP       TYPE OF MATERIAL     S.S.     O     NUMBER       VIEWS     Max     P     NUMBER       VIEWS     Max     P     NUMBER       VIEWS     Max     P     NUMBER       VIEWS     Max     P     O       1     J     J     J       3-4     J     J     J       3-4     J     J     J       SOURCE     I     I     J       NO     N     INTERP     I       VIEWS     Max     P     NUMBER       J     J     J     J       J     J     J     J       J     J     J     J       J     J     J     J       J     J     J     J       J     J     J     J       J     J     J     J       J     J     J     J       J     J     J     J       J	DATE 4/20/18	D
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SERIAL NO. 1-974B - D053-01 M RADIO	level 2-2T	
SERIAL NO. 1-974B - D053-01 M RADIO	REEN THICKNESS . 010 /. 010	
HEAT NO.     N     INTERP       TYPE OF MATERIAL     S.S     O     NUMBE       FABRICATION PROCESS     Wew     P     NUMBE       VIEWS     MM     PROCESS     CURRE/     CURRE/       1-2     7 X 17     AA/A/A     84     99 C     10       2-3     1     1     1     1     1       3-4     1     1     1     1     1       4-1     V     V     V     V     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1     1     1       1     1     1     1	RAPHICSPEC. UST-RT-Zat	 }
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S	PURCHASE	ORDER NO	) D					J. S	OURCES	IZE	/ " G X -	3/32			 
c	DESCRIPTI	ON OF SPE	CIMEN					K G	UALITY I	er, Ne	2-2	T			
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43	O LITTLE CLINTON EADING; PENNA.	STREET	373-4844	•		DATE	4-25-7	3	D
CUSTOMER	NRC				SOURCE TYPE	192			
PURCHASE ORDE	RNO.			ر	SOURCE SIZE	1/3 x 3/3	2 2		
DESCRIPTION OF	SPECIMEN Sate	ety Inject	-	×	QUALITY LEVEL	<u> </u>		<del></del>	
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HEAT NO, -				. 14	INTERPRETATIO	ON SPEC. ASM	ESECTION	<u>C, 197</u>	151
TYPE OF MATERIA	<u>. 5.5</u>			0	NUMBER OF FI	lms 8	• •		
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	CUSTOME	R. N	2C					-   S		YPE	T	92		
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NON DESTRUCTIVE TESTING DIVISION 430 LITTLE CLINTON STREET



WORK ORDER 0232 NUMBER

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WORK ORDER 20232

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NON DESTRUCTIVE TESTING DIVISION

430 LITTLE CLINTON STREET READING, PENNA, 19601

(215) 373-4844



WORK ORDER NUMBER 20232 DATE 4-25-78

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DESCRIPT	ION OF SPE	CIMEN REF.	ieling Stor	Tank	. K .Q	UALITY LEVEL	2-27	<b>-</b> .		
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CUSTOM	ER	NRC			1 SC	DURCE: TYPE	I,142		- - -	÷.,
PURCHAS	E ORDER NO	).			J SC	OURCE SIZE	1/3"x 3/3	2		
DESCRIPT	ION OF SPE	cimen Refu	eling Stora	ge Trink	K Q	UALITY LEVEL	2-27			
		ATTERN NO.	1 1 1 1		4	AD SCREEN 1	THICKNESS , C	010/.010		
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## UNITED STATES TESTING COMPANY, INC.

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## Appendix E

## LIQUID PENETRANT REPORTS

NUED STATES TESTING COMPANY WORK ORDER 20<u>2</u>3 2 NUMBER NON DESTRUCTIVE TESTING DIVISION 430 LITTLE CLINTON STREET 29 DATE 4 READING, PENNA. 19601 (215) 373-4844 E1 LIQUID PENETRANT EXAMINATION REPORT UST PT PROCEDURE AND PT METHOD NRC ATT / 1. CUSTOMER 7. PENETRANT -BRAND NAME & 2 . LOCATION 8. Bar DESIGNATION C OD. PENETRANT REMOVAL -PART IDENTIFICATION 1-068F-0003-9 BRAND NAME Spot 9. 3. (HEAT NO. SERIAL NO., ETC.) DESIGNATION Chec EMULSIFIER -BRAND NAME 4. MATERIAL SPECIFICATION 55 ハシノド 10 DESIGNATION DEVELOPER -BRAND NAME PT SPECIFICATION ASMF 11 DESIGNATION ACCEPTANCE CRITERIA UST PT3 NRCHTI 6. PRECLEANING BY METHOD OF PENETRANT APPLICATION & PENETRATION TIME 2 ) ra METHOD OF REMOVING PENETRANT Ver íaa METHOD OF APPLYING DEVELOPER & DEVELOPING TIME EA OF EXAMINATION ACCEPT DESCRIPTION OF INDICATION REJECT REMARKS 6)01 4.3 KETCH (IF NECESSARY) AMINATION PERFORMED BY: EVALUATION PERFORMED BY: CUSTOMER WITNESS: coans. laro ans LEVEL UST-TC-1A LEVEL I DATE -1A UST-PT-3-1 12

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