



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

March 2, 2009

10 CFR 50.55a(g)(5)(iii)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN P1-35
Washington, D.C. 20555-0001

In the Matter of
Tennessee Valley Authority

)
)

Docket No. 50-260

**BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - AMERICAN SOCIETY OF
MECHANICAL ENGINEERS (ASME) SECTION XI, INSERVICE INSPECTION PROGRAM
FOR THE THIRD TEN-YEAR INSPECTION INTERVAL - REQUEST FOR RELIEF
2-ISI-19, REVISION 1**

In accordance with 10 CFR 50.55a(g)(5)(iii), TVA is requesting relief from certain inservice inspection (ISI) requirements in Section XI of the ASME Boiler and Pressure Vessel Code. The need for this request for relief was identified during ISI examinations during the BFN Unit 2 Cycles 12 and 14 refueling outages. The enclosure to this letter contains BFN Unit 2 request for relief 2-ISI-19, Revision 1.

TVA has determined that certain BFN Unit 2 welds had nondestructive examination (NDE) coverage limitations (less than 90 percent coverage completed) which exceed that specified in ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 welds, Section XI, Division 1." The components are Reactor Pressure Vessel (RPV) nozzles (ASME Section XI, Code Category B-D, Nozzle-To-Vessel Welds) which had calculated NDE examination coverage ranging between 27 and 69 percent completed. The limitations encountered during the performance of ultrasonic (UT) examinations were caused by component configuration. The limitations are inherent to the barrel-type nozzle-to-vessel weld design and are compounded by the close proximity of the biological shield wall.

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NCR

U.S. Nuclear Regulatory Commission
Page 2
March 2, 2009

Hence, TVA is requesting approval of Unit 2 request for relief 2-ISI-19, Revision 1. TVA has determined that the performance of essentially 100 percent UT examination for the subject welds is impractical. Further, TVA considers that performance of UT examinations, to the maximum extent practical, furnishes sufficient information to judge the overall integrity of the welds and provides an acceptable level of quality and safety.

This request is consistent with 2-ISI-19, Revision 0, which was submitted by letter dated June 2, 2003, for other nozzle-to-vessel weld examinations, with less than 90 percent examination coverage, completed during the Unit 2 Cycle 12 refueling outage. NRC approved TVA's request for relief by letter dated April 12, 2004.

There are no new regulatory commitments in this letter. If you have any questions, please contact me at (256) 729-2636.

Sincerely,

A handwritten signature in black ink, appearing to read "F. R. Godwin".

F. R. Godwin
Manager of Licensing
and Industry Affairs

Enclosure
cc: See Page 3

U.S. Nuclear Regulatory Commission
Page 3
March 2, 2009

cc (Enclosure):

Ms. Heather J. Gepford, Acting Branch Chief
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One White Flint, North
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U.S. Nuclear Regulatory Commission
Page 4
March 2, 2009

JEE:JWD:LAJ

Enclosure

cc (Enclosure): w/o enclosure

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N. T. Brumfield, BFT 2A-BFN
Samuel Flood, SAB 1A-BFN
D. E. Jernigan, LP 3R-C
M. J. Lorek, LP 3R-C
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F. C. Mashburn, LP 4K-C
D. C. Matherly, NAB 2A-BFN
J. H. McCarthy, NAB 1A-BFN
W. K. Nesmith, LP 4H-C
L. E. Nicholson, LP 4K-C
M. A. Purcell, BR 4X-C
J. J. Randich, POB 2C-BFN
P. D. Swafford, LP 3K-C
L. E. Thibault, LP 3R-C
S. A. Vance, WT 6A-K
E. J. Vigluicci, ET 11A-K
R. G. West, NAB 2A-BFN
NSRB Support, LP 5M-C
EDMS, WT CA-K

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**TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 2**

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI,
INSERVICE INSPECTION (ISI) PROGRAM**

THIRD TEN-YEAR INSPECTION INTERVAL

REQUEST FOR RELIEF 2-ISI-19, REVISION 1

(SEE ATTACHED)

**TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 2**

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI,
INSERVICE INSPECTION (ISI) PROGRAM**

THIRD TEN-YEAR INSPECTION INTERVAL

REQUEST FOR RELIEF 2-ISI-19, REVISION 1

EXECUTIVE SUMMARY:

This request for relief addresses one (1) Reactor Pressure Vessel (RPV) nozzle-to-head full penetration weld examined during Cycle 12, (in the first period) and nineteen (19) Reactor Pressure Vessel (RPV) nozzle-to-vessel full penetration welds examined during Cycle 14 (in the second period) of the Third Ten-Year ISI interval.

The design configuration of the RPV nozzle-to-vessel weld precludes a 100 percent ultrasonic (UT) examination of the required volume for the full penetration welds of the nozzles listed in Table 1 of this enclosure. These limitations occur when the ASME Section XI, 1995 Edition, 1996 Addenda examination requirements are applied in areas of components constructed and fabricated to early plant designs. Based on a construction permit date prior to January 1, 1971, BFN is exempt from meeting certain provisions of the Code requirements for examination access, to the extent practical, within the limitations of design, geometry and materials of construction of the components in accordance with 10 CFR 50.55a(g)(4).

A UT examination was performed on accessible areas to the maximum extent practical given the physical limitations of the subject nozzle welds utilizing equipment, personnel and techniques qualified in accordance with ASME Section XI, Appendix VIII. The design configuration limits UT examination of the RPV nozzle-to-vessel weld coverage (percentage) as shown in Table 1. TVA concludes that performance of an UT examination of essentially 100 percent of the RPV nozzle-to-vessel full penetration welds would be impractical. The performance of the UT examination of the subject areas to the maximum extent practical provides an acceptable level of quality and safety because the information and data obtained from volume examined provides sufficient information to judge the overall integrity of the welds. Therefore, pursuant to 10 CFR 50.55a(g)(5)(iii), it is requested that relief be granted for the Third Ten-Year ISI inspection interval.

Unit: Two (2)

ISI Interval: ASME Section XI, Third Ten-Year ISI Inspection Interval (May 25, 2001 to May 24, 2011)

Systems: Reactor Pressure Vessel (RPV), System 329

Components: 20 RPV Nozzles, Full Penetration Welds as listed in Table 1

U.S. Nuclear Regulatory Commission
Page 2
February 27, 2009

Hence, TVA is requesting approval of Unit 2 request for relief 2-ISI-19, Revision 1. TVA has determined that the performance of essentially 100 percent UT examination for the subject welds is impractical. Further, TVA considers that performance of UT examinations, to the maximum extent practical, furnishes sufficient information to judge the overall integrity of the welds and provides an acceptable level of quality and safety.

This request is consistent with 2-ISI-19, Revision 0, which was submitted by letter dated June 2, 2003, for other nozzle-to-vessel weld examinations, with less than 90 percent examination coverage, completed during the Unit 2 Cycle 12 refueling outage. NRC approved TVA's request for relief by letter dated April 12, 2004.

There are no new regulatory commitments in this letter. If you have any questions, please contact me at (256) 729-2636.

Sincerely,

F. R. Godwin
Manager of Licensing
and Industry Affairs

Enclosure
cc: See Page 3

ASME Code Class: ASME Code Class 1 (Equivalent)

ASME Section XI Code Edition: 1995 Edition, 1996 Addenda

Code Table: IWB-2500-1

Examination Category: B-D, Full Penetration Welds of Nozzles in Vessels

Examination Item Number: B3.90, Reactor Vessel Nozzle-to-Vessel Welds

Code Requirement: ASME Section XI, Table IWB-2500-1, Examination Category B-D, Item No. B3.90 requires a volumetric examination of essentially 100 percent of the weld and adjacent base material as depicted in Figure IWB-2500-7(a).

Code Requirement From Which Relief Is Requested: Relief is requested from the requirement of ASME Section XI, Table IWB-2500-1, Examination Category B-D, Item No. B3.90 which requires a volumetric examination of essentially 100 percent of the weld and adjacent base material as depicted in Figure IWB-2500-7(a).

LIST OF ITEMS ASSOCIATED WITH THE RELIEF REQUEST:

N6A-NV: RPV Nozzle-to-Head Weld, Cycle 12

N1B-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2A-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2B-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2C-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2D-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2G-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2H-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N2K-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N3A-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N3B-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N3C-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N4B-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N4C-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N4E-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N4F-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N5A-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N5B-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N7-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

N9-NV: RPV Nozzle-to-Vessel Weld, Cycle 14

BASIS FOR RELIEF REQUEST: The design configuration of the RPV nozzle-to-vessel weld precludes an ultrasonic (UT) examination of the essentially 100 percent of the required volume. The component design configuration limits UT examination coverage of the welds to the percentages listed in Table 1, for N6A-NV, N1B-NV, N2A-NV, N2B-NV, N2C-NV, N2D-NV, N2G-NV, N2H-NV, N2K-NV, N3A-NV, N3B-NV, N3C-NV, N4B-NV, N4C-NV, N4E-NV, N4F-NV, N5A-NV, N5B-NV, N7-NV, and N9-NV.

ALTERNATIVE EXAMINATION: None. In lieu of the Code required essentially 100 percent volume ultrasonic examination, TVA proposes an ultrasonic examination of accessible areas to the maximum extent practical given the component design configuration of the RPV nozzle-to-vessel welds.

JUSTIFICATION FOR THE GRANTING OF RELIEF: The design of the subject nozzle-to-vessel welds (N6A-NV, N1B-NV, N2A-NV, N2B-NV, N2C-NV, N2D-NV, N2G-NV, N2H-NV, N2K-NV, N3A-NV, N3B-NV, N3C-NV, N4B-NV, N4C-NV, N4E-NV, N4F-NV, N5A-NV, N5B-NV, N7-NV, and N9-NV, precludes a ultrasonic (UT) examination of the essentially 100 percent of the required examination volume. Access to the nozzle-to-vessel welds is by a series of doorways in the concrete biological shield wall. Insulation behind these doorways is designed for removal around the nozzle circumference.

In order to examine the welds in accordance with the Code requirements, the RPV would require extensive modifications. The physical arrangement of the nozzle-to-vessel weld precludes UT examination from the nozzle side. The limitations are inherent to the barrel-type nozzle-to-vessel weld design is compounded by the close proximity of the biological shield wall.

Scanning for the nozzle surface is ineffective due to the weld location and the asymmetrical inside surface where the nozzle and vessel converge. Coverage was increased by scanning from the outside blend radius of the weld when practical.

Experience from the automated UT examination performed from the inside surface has shown that the nozzle-to-vessel weld coverage will not be greatly improved even if performed from the inside surface utilizing the current state-of-the-art techniques.

The configuration of the nozzle-to-vessel weld precludes UT examination from the nozzle side due to the weld location and the asymmetrical inside surface where the nozzle and vessel converge. The extent of examination coverage from the vessel side provides reasonable assurance that no flaws oriented parallel to the weld are present.

Areas receiving little or no examination coverage are located toward the outside surface of the reactor vessel in the general area of the nozzle inside blend radius (The blend radius

restricts the scanning movement and/or transducer contact). The reactor vessel inner-half of the thickness and inside surface are interrogated with the UT beam. Degradation located at the inside surface or inner-half of the vessel would be located. It should be noted that the nozzle inside radius section received essentially 100 percent examination coverage on these nozzles.

Radiographic examination as an alternate volumetric examination method was determined to be impractical due to radiological concerns. Gaining access to the inside surface of the RPV to place radiographic film would require extensive personnel protection due to high radiation and contamination levels. Also, due to the varying thickness at the outside blend radius of the weld, several radiographs may be required of one area to obtain the required coverage and/or film density. The additional Code coverage gained by radiography is impractical when weighed against the radiological concerns.

Therefore, TVA concludes that performing a UT examination of essentially 100 percent of the nozzle-to-vessel full penetration welds in the RPV would be impractical. Further, it would also be impractical to perform other volumetric examinations (i.e., radiography) which may increase examination coverage.

A maximum extent practical UT examination of the subject areas provides an acceptable level of quality and safety. TVA concludes that significant degradation, if present, would be detected during a UT examination performed to the maximum extent practical of the subject welds. As a result, reasonable assurance of operational readiness of the subject welds has been provided.

This request for relief is consistent with a previous Request For Relief 2-ISI-19, Revision 0, for the BFN Unit 2 RPV nozzle-to-vessel full penetration welds submitted and approved by the NRC in the First Period, of the Third Ten-Year ISI Inspection Interval. Reference NRC Safety Evaluation Report (SER) dated April 12, 2004, TAC NOS. MB9749 and MB9750.

Therefore, pursuant to 10 CFR 50.55a(g)(5)(iii), TVA requests that relief be granted for the referenced examinations for the BFN Unit 2 Third Ten-Year inspection interval.

IMPLEMENTATION SCHEDULE:

This request for relief is applicable to the Third Ten-Year ISI Inspection Interval for BFN Unit 2 (May 25, 2001 to May 24, 2011).

The nozzle-to-vessel welds listed in Table 1 were examined in the first period (Cycle 12 operation) and second period (Cycle 14 operation) of the Third Ten-Year inspection interval.

REFERENCES:

N-GP-31 titled "Calculation of ASME Code Coverage for Section XI, Appendix VIII Ultrasonic Examinations"

Attachments:

Attachment A - 2 ISI Sketches

2-CHM-2046-C, Sheet 1, Reactor Vessel (RPV) Shell Course Weld/Nozzle Locations
(Outside View)

2-ISI-0408-C, Sheet 1, Closure Head Assembly Weld Locations

Attachment B - Weld Examination Data Reports

Weld No. Report No.

N6A-NV R110

N1B-NV R137

N2A-NV R138

N2B-NV R142

N2C-NV R139

N2D-NV R173

N2G-NV R136

N2H-NV R143

N2K-NV R174

N3A-NV R151

N3B-NV R175

N3C-NV R152

N4B-NV R176

N4C-NV R177

N4E-NV R178

N4F-NV R179

N5A-NV R156

N5B-NV R157

N7-NV R080

N9-NV R117

TABLE 1

WELD NUMBER	NPS	ISI DRAWING	PERCENT EXAMINED	REMARKS
N6A-NV	6"	2-ISI-0408-C	36.6%	Nozzle weld examined from the shell side with a 60° RL, 26°, 45°, and 55° Shear wave mode. No Transverse scans were performed from the nozzle side. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N1B-NV	28"	2-CHM-2046-C	31%	Nozzle to vessel weld. Examined using a 43°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N2A-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N2B-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.

WELD NUMBER	NPS	ISI DRAWING	PERCENT EXAMINED	REMARKS
N2C-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N2D-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N2G-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N2H-NV	12"	2-CHM-2046-C	50%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N2K-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.

WELD NUMBER	NPS	ISI DRAWING	PERCENT EXAMINED	REMARKS
N3A-NV	26"	2-CHM-2046-C	41%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N3B-NV	26"	2-CHM-2046-C	41%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N3C-NV	26"	2-CHM-2046-C	41%	Nozzle to vessel weld. Examined using a 40°, 50°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N4B-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.

WELD NUMBER	NPS	ISI DRAWING	PERCENT EXAMINED	REMARKS
N4C-NC	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N4E-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N4F-NV	12"	2-CHM-2046-C	44%	Nozzle to vessel weld. Examined using a 40°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.

WELD NUMBER	NPS	ISI DRAWING	PERCENT EXAMINED	REMARKS
N5A-NV	10"	2-CHM-2046-C	27%	Nozzle to vessel weld. Examined using a 35°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N5B-NV	10"	2-CHM-2046-C	27%	Nozzle to vessel weld. Examined using a 35°, and 60° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N7-NV	4"	ISI-0408-C	69%	Nozzle to vessel weld. Examined using a 45° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.
N9-NV	4"	2-CHM-2046-C	40%	Nozzle to vessel weld. Examined using a 35° shear wave mode and a 60° refracted longitudinal wave mode. Scanning was restricted due to the nozzle configuration. Exams were performed from the shell side and outer blend radius. This weld was examined using PDI qualified personnel, procedures and equipment.

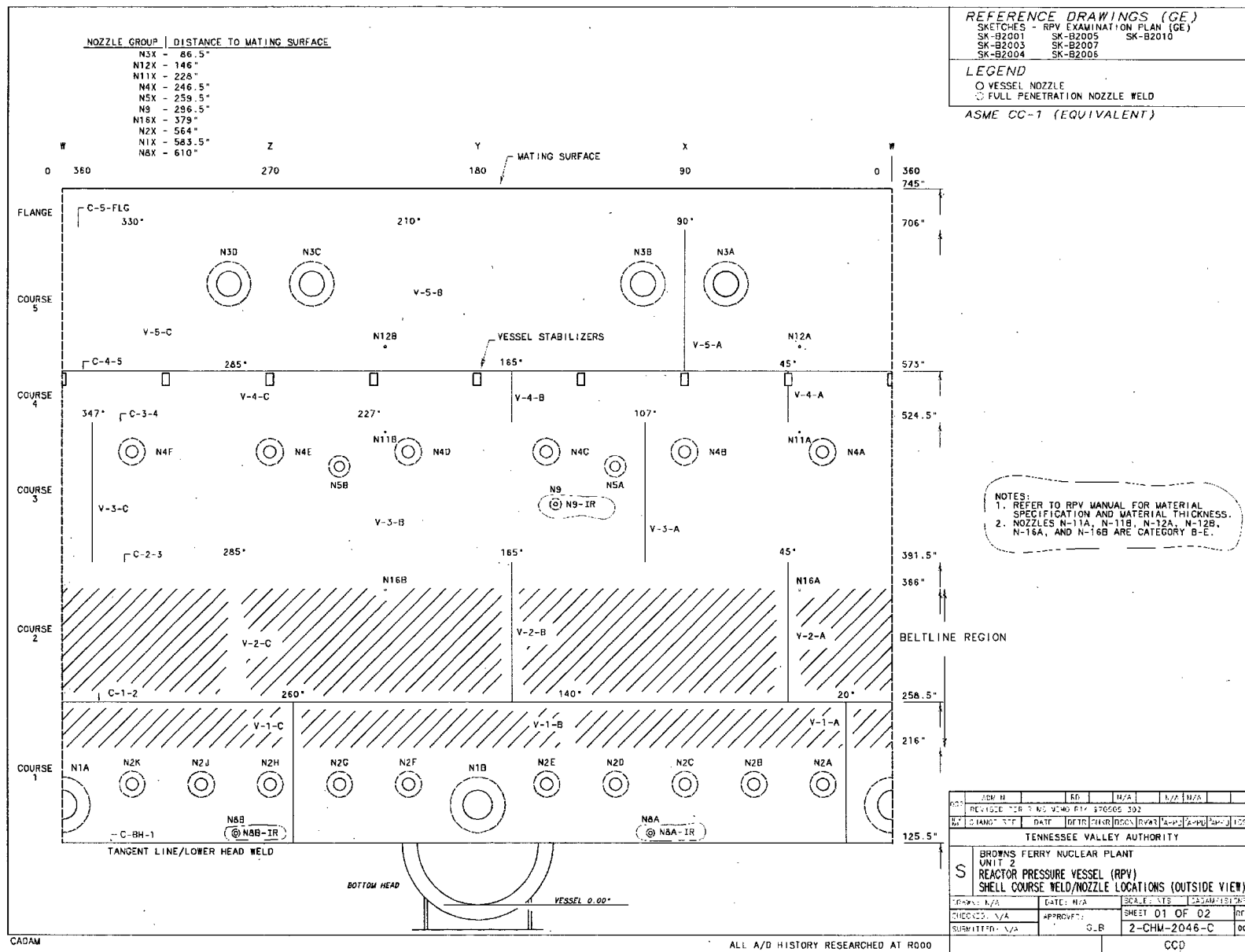
Note: The base material and weld filler material for each weld is provided in the respective examination report provided in Attachment B.

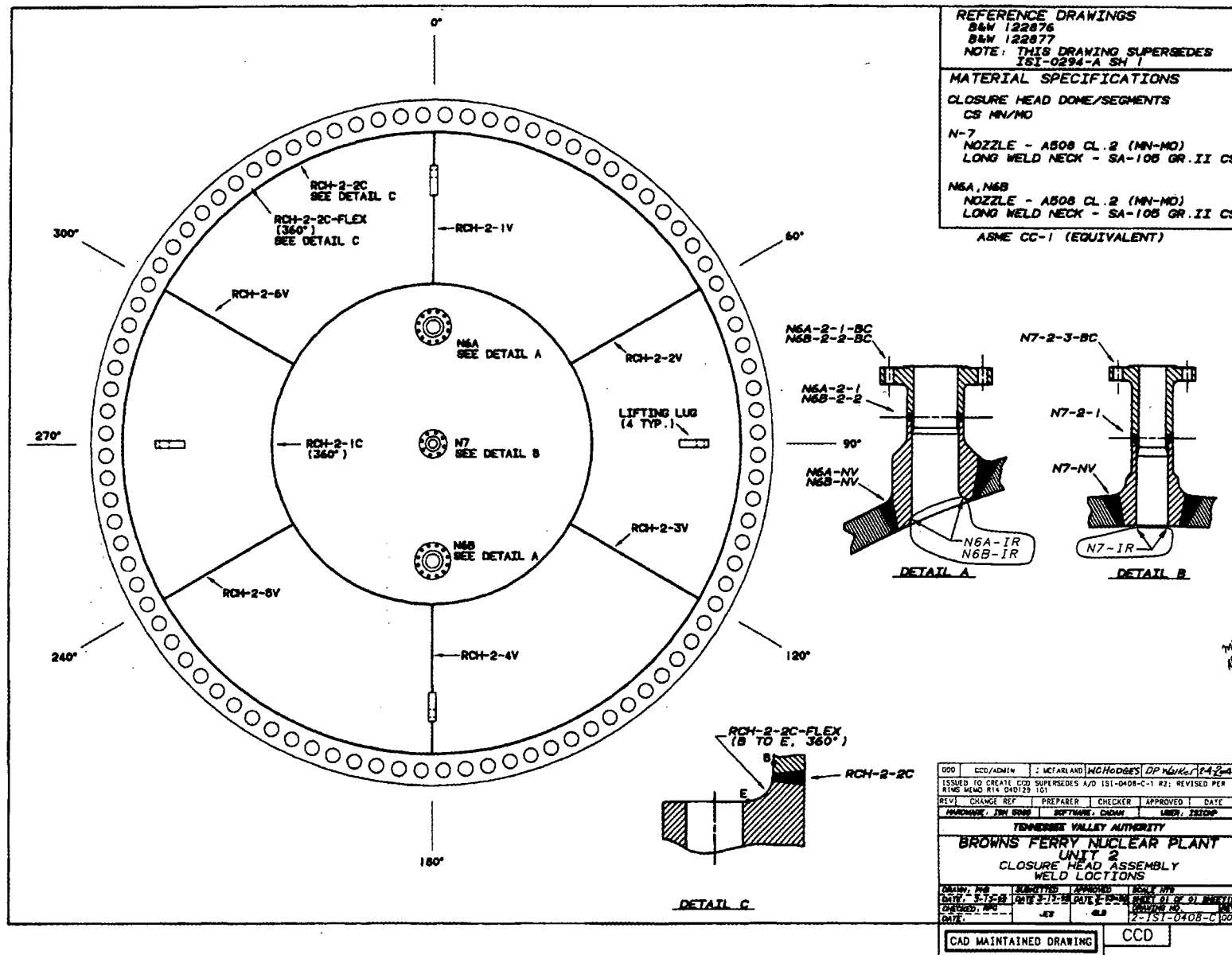
ATTACHMENT A

ISI SKETCH

2-CHM-2046-C

2-ISI-0408-C





ATTACHMENT B

Examination Reports

<u>Weld No.</u>	<u>Report No.</u>
N6A-NV	R110
N1B-NV	R137
N2A-NV	R138
N2B-NV	R142
N2C-NV	R139
N2D-NV	R173
N2G-NV	R136
N2H-NV	R143
N2K-NV	R174
N3A-NV	R151
N3B-NV	R175
N3C-NV	R152
N4B-NV	R176
N4C-NV	R177
N4E-NV	R178
N4F-NV	R179
N5A-NV	R156
N5B-NV	R157
N7-NV	R064
N9-NV	R117

Examination Report, R-110
N6A-NV, RPV Nozzle-To-Head Weld

00241

TENNESSEE VALLEY AUTHORITY		EXAMINATION SUMMARY AND RESOLUTION SHEET		REPORT NUMBER: R-110	
PROJECT: BFN UNIT: 2		CYCLE: 12		COMPONENT ID: N6A-NV	
EXAMINATION METHOD				SYSTEM: RPV ISI DWG. NO. ISI-0408-C-01	
MT <input type="checkbox"/>	PT <input type="checkbox"/>	UT <input checked="" type="checkbox"/>	VT <input type="checkbox"/>	CODE CLASS:	CATEGORY: B-D
PROCEDURE: N-UT-78		REV: 2	TC: N/A	COFIG.:	NOZZEL TO CLOSURE HEAD
EXAMINER: DOUGLAS GRONEWOLD		EXAMINER: TIM BRELJE		EXAMINER:	EXAMINER:
LEVEL: II		LEVEL: TR		LEVEL:	LEVEL:

This report contains the data associated with the manual ultrasonic examination of the N6A-NV nozzle to RPV closure head weld.

The weld was examined with a 60deg. RL from the head side.

Also, due to the configuration and location of the weld near the inner radius the inner radius was modeled and additional shearwave angles were used.

A 55deg. , a 45deg. from the head side and a 26deg. in the radius blend for the circ scans.

A spot indication was observed with the 55deg. shearwave out of it's exam area. The same spot indication was seen, recorded and plotted with the 60deg. RL. This indication is mid wall and not ID connected, it exhibits no length and therefore is not reportable as stated by the procedure N-UT-78 Rev 2 paragraph 9.2.1.b.

7827 1/23/04 BJR 1/23/04
Coverage with the 60degRL calculated to be approximately 81%

Coverage with the modeled shearwaves was 100% of the lower 15% of the exam volume.

Total coverage was approximately 90.5%

N-UT-78 utilized for outer 85%
upper 15% 3-24-03

ISI-PDI-210-MA utilized for inner 15%
Brenn Dwyer 3-24-03

RESOLUTION BY:

D. Gronewold

LEVEL: II DATE: 2-28-03

REVIEWED BY: 4/21/23/04

Brenn Dwyer

LEVEL: IV DATE: 3-3-03

ANII: B. J. Rice

DATE: 3-24-03

PG. 1 OF 10

September 5, 2006

ISI Report Number: R-110

Unit/Cycle: U2/C12

Component: N6A-NV

Subject: Coverage Calculations

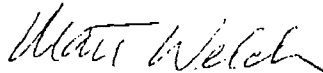
This memo is generated to address the achieved ASME Section XI Code Coverage for RPV Nozzle to Vessel welds, examination category B-D, Item B3.90, documented on this ISI Report.

The method of calculation previously used did not provide for a consistent and representative approach. Problem Evaluation Report, PER 99581, was generated to address this issue. As a result, a standard methodology, established in TVA ISO Procedure N-GP-31 (titled "Calculation of ASME Code Coverage for Section XI, Appendix VIII Ultrasonic Examinations"), has been developed, utilizing the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) methodology, to calculate the achieved ASME Section XI Code Coverage.

In regard to this report, had the method established in ISO Procedure N-GP-31 been applied to this examination, the achieved coverage would have been reported as 36.6%.

This examination was performed in accordance with the criteria of 10CFR50.55a(b)(2)(xv)(G) for maximum achievable coverage requirements and 10CFR50.55a(b)(2)(xv)(K)(3) for RPV Nozzle to Vessel welds examined from the outside of the vessel. This examination utilized personnel, equipment and procedures qualified in accordance with the requirements of ASME Section XI, Appendix VIII in effect at that time.

This memo is for information only purposes and is not intended to change, nor alter, the originally reported coverage values.



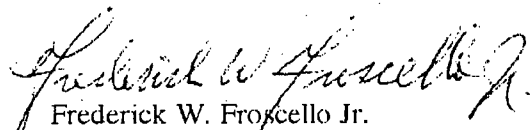
Matt Welch
TVA/ISO
NDE Level III

PER # 110164 (N6A-NV)

This PER (Problem Evaluation Report) # 110164 is being generated as a level "D" PER to document a change in the corrective action of PER# 99581 after the PER was closed and archived. PER# 99581 was generated on March 20, 2006 to document the inconsistency with the methodology for calculating the ultrasonic examination volume coverage for ASME Section XI Code examination volumes obtained on the Unit 3 RPV Nozzle-to-Shell Welds during the Unit 3 Cycle 12 Refueling Outage versus UT examination volume coverages obtained, calculated, and reported in previous outages in Unit 2 and 3.

The methodology for calculating the the code coverage obtained for ASME Section XI code examination volume was discussed on March 20, 2006 with TVA, EPRI, and AREVA. From this discussion, TVA, and AREVA agreed to a methodology based upon guidance from EPRI. The methodology has become standard for TVA and required for all future RPV examinations. TVA NDE Procedure N-GP-31, "CALCULATION OF ASME CODE COVERAGE FOR SECTION XI, APPENDIX VIII ULTRASONIC EXAMINATIONS" was developed.

PER 99581-004 Corrective Action Item description stated, "If calculations in Corrective Action Item # 99581-003 reveal that ASME Code coverage percentages are less than 90%, TVA will submit Request For Relief # 2-ISI-19, Revision 01 (N6A-NV) and Request For Relief # 3-ISI-7, Revision 03 (N4D-NV, N4E-NV, and N6B-NV) to BFN Licensing. This was completed on July 25, 2006. The PER was closed on July 25, 2006. A meeting was conducted on August 30, 2006 between BFN Licensing and Component Engineering to discuss the submittal of the requests for relief to the NRC. Through further discussions it was determined that the RFR's were not necessary as the previously calculated coverage were calculated with the method accepted at that time. A letter would be written for each RPV Nozzle and attached to the existing UT examination reports explaining the new methodology and what the coverages would be under the new methodology so future reviewers would understand the reason for the coverage differences. This letter was attached to the affected UT examination reports; R-110 (N6A-NV), Unit 2 Cycle 12 Outage and Unit 3 Cycle 11 Outage; R-182 (N4D-NV), R-183 (N4E-NV), and R-186 (N6B-NV) and sent to Document Control Records Management lifetime storage. This was completed on September 06, 2006.


Frederick W. Froscello Jr.
BFN ISO NDE Specialist, ISI

00242

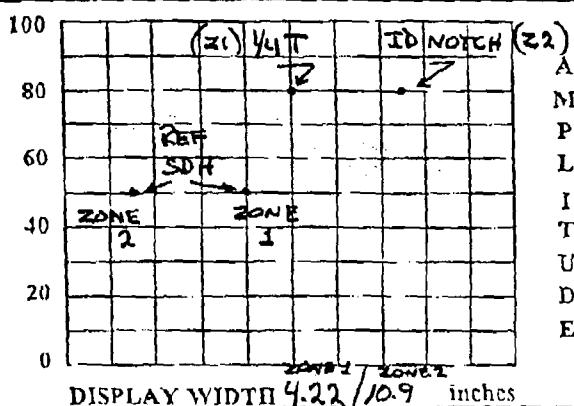
TENNESSEE VALLEY
AUTHORITYDIGITAL ULTRASONIC
CALIBRATION
DATA SHEET

REPORT NUMBER

R-110

PROJECT BFN UNIT/CYCLE 2/12
PROCEDURE: N-UT-78 REV: 2 TC: N/ATRANSDUCER
MANUFACTURER RTD
MODEL: TR12 S/N 01-887
SIZE: 2 (24x42) FREQ: 2 MHz
SHAPE: REC # ELEMENTS: 2 # CONS: 0
CABLE TYPE RG-174 LENGTH: 6'MODE: ☐ SHEAR ☐ LONG ☒ RL

DAC

CALIBRATION DATE: 2-28-03
CALIBRATION BLOCK NO. 3F19 TEMP: 77 °F
SIMULATOR BLOCK: RompasTHERMOMETER S/N 558274 DUE DATE 12-6-03
COUPLANT: ULTRAGEL BATCH: 02/25ANGLE VERIFICATION
BLOCK TYPE: ITW S/N: 5307
NOMINAL ANGLE 60° ACTUAL ANGLE 61°INSTRUMENT
MANUFACTURER KB DUE DATE 6-5-03
MODEL NO.: 4SN 52 S/N: E26409

INSTRUMENT SETTINGS

REFLECTOR			REFERENCE SENSITIVITY	MEMORY NUMBER
SCAN DIRECT.	NTC	SDH		
ZONE 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	79 dB	10
ZONE 1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	80 dB	11
FREQ: <u>3-4</u>	MHz		REJECT: <u>0</u>	%
ANGLE: <u>61</u>	deg		DAMPING: <u>1000</u>	ohms
DELAY: <u>0.969</u>	msec		PULSER: <u>DUAL</u>	*
ZERO: <u>14.172</u>	msec		PRR/PRE: <u>LOW</u>	
VELOCITY: <u>2283</u>	msec		TOF: <u>N/A</u>	
RANGE: <u>4.22/10.9</u>	inches		POWER: <u>SC</u>	
DISP. MODE: <u>FULL WAVE</u>				

REF. REFLECTOR: Rompas SDH GAIN: 77 dBAMPLITUDE: 50 % METAL PATH: 157°VERIFICATION TIMES 1) 1140 2) 1415 3) 1700 4) N/A 5) 6) 7) 8) 9) N/A

*PDI QUALIFIED INSTRUMENT SETTINGS:

VERIFY INSTRUMENT SETTINGS AND CALIBRATION SEQUENCE ARE IN ACCORDANCE WITH TABLE 2 OF THE APPLICABLE PDI QUALIFICATION IMPLEMENTATION PROCEDURE!

LINEARITY CHECK

VERTICAL	SIGNAL 1		100	90	80	70	60	50	40	30	20		
	SIGNAL 2		50	45	40	35	30	25	20	15	10		
ATTENUATOR	GAIN	SET	-6 dB		-12 dB		SET		+12		SET		+6
	AMP	80%	32 TO 48		16 TO 24		20%		64 TO 96		40%		64 TO 96
			40		20				80				80

COMMENTS

WELD / ITEMS EXAMINED

NGA-NV
REN-2-1E V/A 28.3.03EXAMINER: Doug Arneson LVL: IIEXAMINER: Tom Bueh LVL: IRREVIEWER: Debra Duley LVL: IVDATE: 3-3-03ANIL: B. J. P. P.DATE: 3-24-03PAGE 2 OF 10

R-110

00243

Table 1. Browns Ferry Closure Head Instrumentation Nozzle (N6)
Geometry Inputs to Spreadsheet Model for Nozzle-to-Shell Weld Examination

Inside Surface Dimensions	(inches)	Outside Surface Dimensions	(inches)
Weld Start R	4.94	Weld End R	9.08
Rbore	3.11	Rnozzle	5.72
Rbi	1.5	Rbo	2
Rvi	125.69	Rvo	129.69
Xoff	48	Yoff	0

Table 2. Spreadsheet Model Techniques for Instrumentation Nozzle-to-Shell Weld.

Probe Angle	Probe Skew	Scan Surface	Mode of Propagation
45	$\pm(25 \text{ to } 80)$	Vessel	Shcar Wave
55	$\pm(20 \text{ to } 60)$	Vessel	Shear Wave
26	± 90	Blend	Shear Wave

Table 3. Spreadsheet Model Techniques for Instrumentation Nozzle-to-Shell Weld.

Probe Angle	Probe Skew	Scan Surface	Min R	Max R	Min MP	Max MP	Max Misorientation
45	$\pm(25 \text{ to } 80)$	Vessel	6.89	12.0	4.67	6.16	0
55	$\pm(20 \text{ to } 60)$	Vessel	7.17	8.66	5.78	7.60	18
26	± 90	Blend	5.94	7.10	4.89	7.44	20

EPRI- Modeling

3 of 10

00244

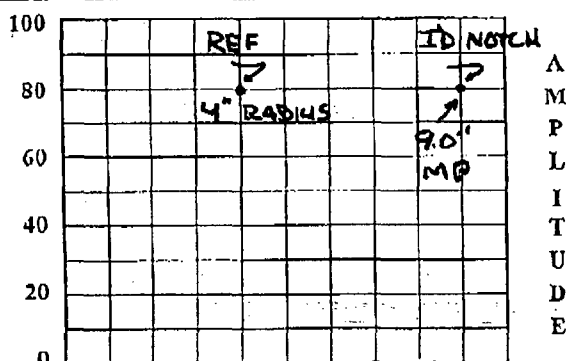
TENNESSEE VALLEY
AUTHORITYDIGITAL ULTRASONIC
CALIBRATION
DATA SHEET

REPORT NUMBER

R.110

PROJECT BFN UNIT/CYCLE 21/12
 PROCEDURE: 51-PAL-210-MD REV: 21 TC: N/A
 DATE: 3-24-03 TRANSDUCER
 MANUFACTURER KB
 MODEL: COMP S/N 0099HX
 SIZE: .5" FREQ: 2.25 MHz
 SHAPE: RND # ELEMENTS: 1 # CONS: 0
 CABLE TYPE RG174 LENGTH: 6'
 MODE: ☒ SHEAR ☐ LONG ☐ RL

DAC

DISPLAY WIDTH 10.00 inches

REF. REFLECTOR: PIW 4\"/>

VERIFICATION TIMES

1) 1045 2) 1055 3) ---

*PDI QUALIFIED INSTRUMENT SETTINGS:

VERIFY INSTRUMENT SETTINGS AND CALIBRATION SEQUENCE ARE IN ACCORDANCE WITH TABLE 2
 OF THE APPLICABLE PDI QUALIFICATION IMPLEMENTATION PROCEDURE!

LINEARITY CHECK

VERTICAL	SIGNAL 1		100	90	80	70	60	50	40	30	20		
	SIGNAL 2		50	45	40	35	30	25	20	15	10		
ATTENUATOR	GAIN	SET	-6 dB	-12dB	SET		+12		SET	+6			
	AMP	80%	32 TO 48	16 TO 24	20%		64 TO 96		40%	64 TO 96			
			<u>40</u>	<u>20</u>			<u>80</u>			<u>80</u>			

COMMENTS

WELD ITEMS EXAMINED

N6A-NV

EXAMINER: Joseph Ironswood LVL: IIEXAMINER: Tom Beckley LVL: TRREVIEWER: Arline Duley LVL: III DATE: 3-3-03ANII: B. J. RiceDATE: 3-24-03PAGE 4 OF 10

ACCESS: FORMS DATABASE 10-27-01

00246

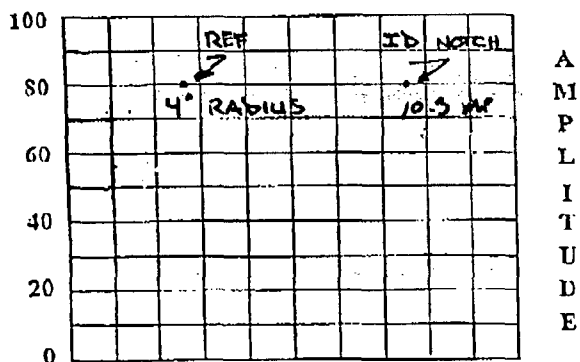
TENNESSEE VALLEY
AUTHORITYDIGITAL ULTRASONIC
CALIBRATION
DATA SHEET

REPORT NUMBER

P-110

PROJECT BFN UNIT/CYCLE 2/12
PROCEDURE: 501-210 REV: 2.1 TC: N/A
TRANSDUCERMANUFACTURER KBA
MODEL: GAMMA S/N E25215
SIZE: 5x1.0 FREQ: 2.25 MHz
SHAPE: REC. # ELEMENTS: 1 # CONS: 0
CABLE TYPE RG 58 LENGTH: 6'MODE: ☒ SHEAR ☐ LONG ☐ RL

DAC

DISPLAY WIDTH 15.00 inchesREF. REFLECTOR: IIW 4\" RADIUS GAIN: 38 dBAMPLITUDE: 80 % METAL PATH: 4.00 "VERIFICATION TIMES 1) 1110 2) 1135 3)CALIBRATION DATE: 2-28-03
CALIBRATION BLOCK NO: BF-1B TEMP: 75 °F
SIMULATOR BLOCK: IIW 4\" RADIUS
THERMOMETER S/N: 558274 DUE DATE: 12-6-03
COUPLANT: ULTRAGEL BATCH: 02125BLOCK TYPE: IIW S/N: 5307
NOMINAL ANGLE 55 ACTUAL ANGLE 56 °MANUFACTURER KB DUE DATE 6-5-03
MODEL NO.: USN 52 S/N: E26409

INSTRUMENT SETTINGS

REFLECTOR			REFERENCE SENSITIVITY	MEMORY NUMBER
SCAN DIRECT.	NTC	SDH		
AXIAL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>56</u> dB	<u>16</u>
CIRC.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>70</u> dB	<u>16</u>
FREQ: <u>3-4</u> MHz	REJECT: <u>0</u> %			
ANGLE: <u>56</u> deg	DAMPING: <u>1000</u> ohms			
DELAY: <u>-0.594</u> msec	PULSER: <u>SINGLE</u> *			
ZERO: <u>14.98</u> msec				
VELOCITY: <u>1290</u> msec	PRR/PRF: <u>HIGH</u>			
RANGE: <u>15.00</u> inches	TOF: <u>N/A</u>			
DISP. MODE: <u>FULL WAY</u>	POWER: <u>DC</u>			

CALIBRATION TIMES

INITIAL TIME: 0920 FINAL TIME 1712

4) 5) 6) 7) 8) 9)

*PDI QUALIFIED INSTRUMENT SETTINGS:

VERIFY INSTRUMENT SETTINGS AND CALIBRATION SEQUENCE ARE IN ACCORDANCE WITH TABLE 2 OF THE APPLICABLE PDI QUALIFICATION IMPLEMENTATION PROCEDURE!

LINEARITY CHECK

VERTICAL	SIGNAL 1		100	90	80	70	60	50	40	30	20		
	SIGNAL 2		50	45	40	35	30	25	20	15	10		
ATTENUATOR	GAIN	SET	-6 dB		-12dB		SET		+12		SET	+6	
	AMP	80%	32 TO 48		16 TO 24		20%		64 TO 96		40%	64 TO 96	
			40		20				80			80	

COMMENTS

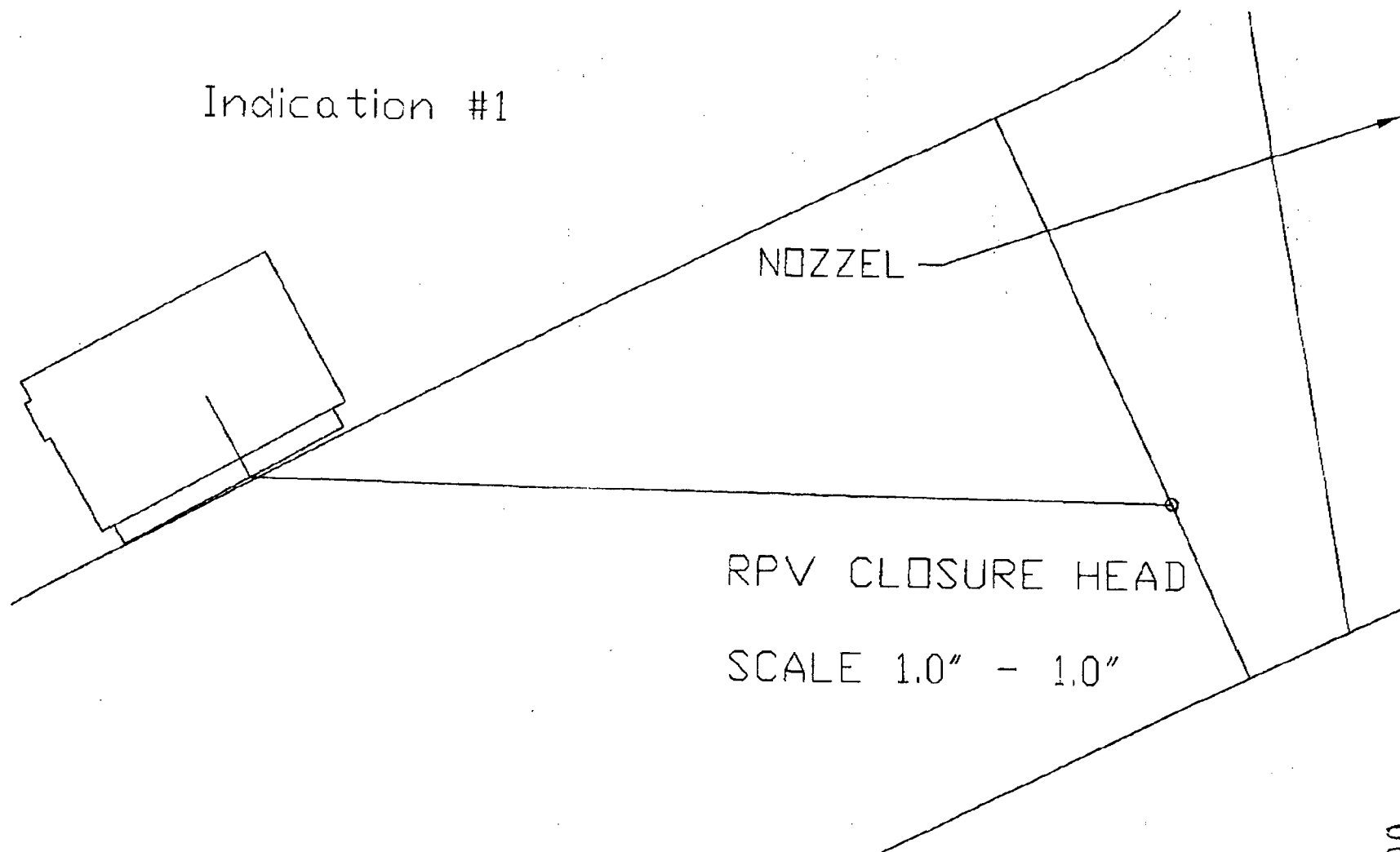
WEED/ITEMS EXAMINED

N6A-NV

EXAMINER: Douglas Honeveld LVL: IIEXAMINER: Tom Bely LVL: TRREVIEWER: Darlene Dineen LVL: III DATE: 3-3-03ANII: R. F. RiceDATE: 3-24-03PAGE 6 OF 10

2.110

Indication #1



James D. Kelly III 3.3.03

James D. Kelly III
2-28-03

00249

page 9 of 10

TVA

Office of Nuclear Power

PROJECT: BEN

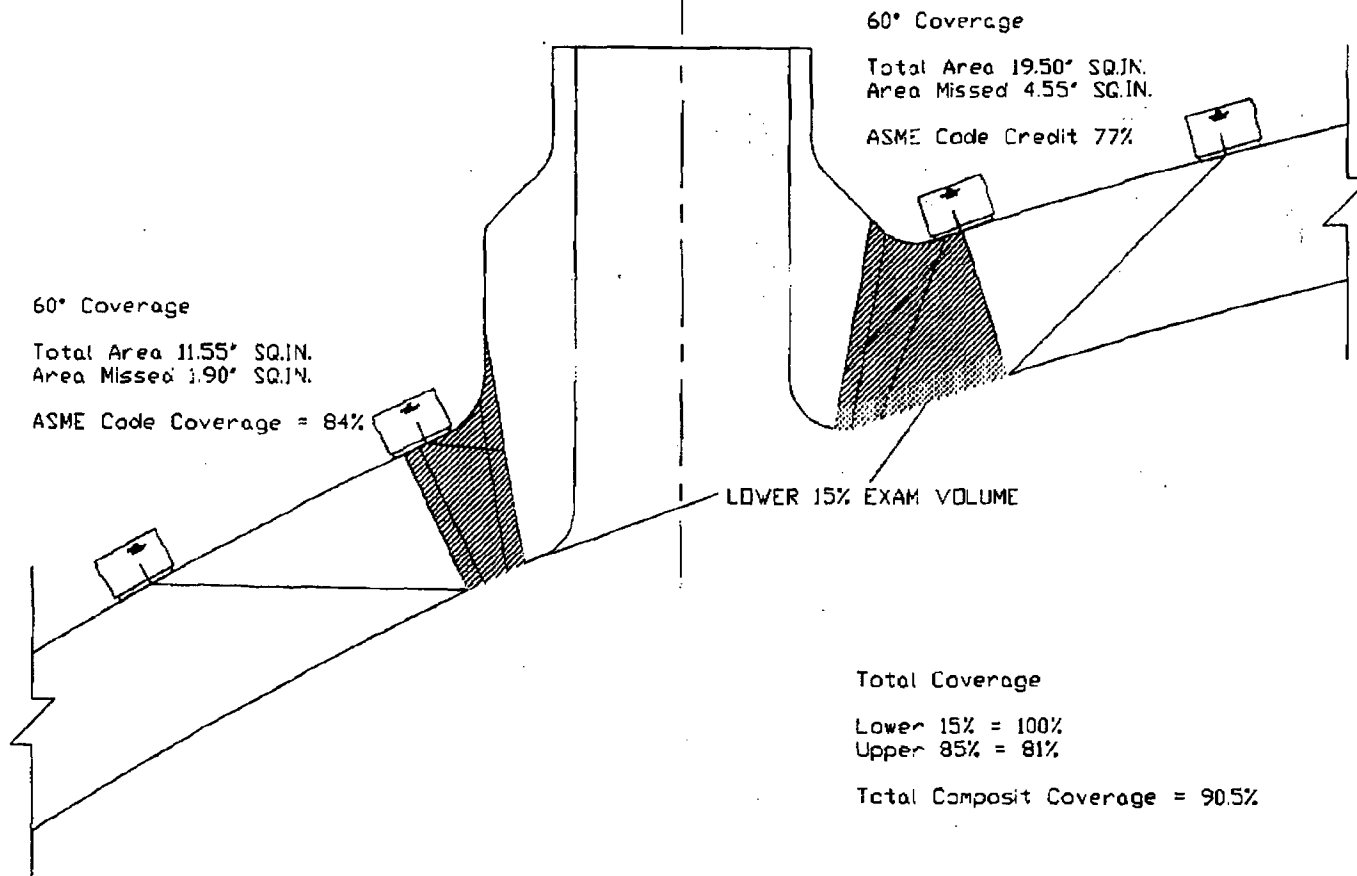
SYSTEM: RPV

Unit: 2

WELD NO.: NGA-NV

REPORT NO.:

R110



BY: David H. Honevold

LEVEL: III

DATE: 2-28-03

PAGE 10 OF 10

Examination Report, R-137
N1B-NV, RPV Nozzle-To-Head Weld

RPV Nozzle Ultrasonic Examination Summary Sheet

000192

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R137
Component Number: N1B-NV		Component Description: N1 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-02				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 2 EPRI Letter dated 3/13/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N1BNV-CDS1		N1BNV-EDS1	NA	<input checked="" type="checkbox"/> No Recordable Indications <input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation) <input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N1BNV-CDS2				
N1BNV-CDS3				
N1BNV-CDS4				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
43°S	-106°	Blend Radius
43°S	+106°	Blend Radius

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 31%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: George Chapman Signature: <i>George Chapman</i>	Date: 3/18/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 3/19/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 3/20/07	ANII: Signature: <i>Paul Flann</i>	Date: 5/18/07

Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
 Examination Data Sheet Number: N1BNV-EDS1 ISI Report Number: 1237
 Component ID: N1B-NV Component Description: N1 Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0270-C-02 W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC
 Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N1BNV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
43°S	-106°	N1BNV-CDS1		03/09/07	1810	83°F	VH-9525	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
43°S	+106°	N1BNV-CDS2		03/09/07	1830	83°F	VH-9525	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*60°S	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: N-UT-78 rev.4				Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell		
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N1BNV-CDS3	03/09/07	1720	83°F	VH-9525	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
60°RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N1BNV-CDS4	03/09/07	1620	83°F	VH-9525	80.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
60°RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N1BNV-CDS3	03/09/07	1720	83°F	VH-9525	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
60°RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N1BNV-CDS4	03/09/07	1620	83°F	VH-9525	80.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC

Comments:

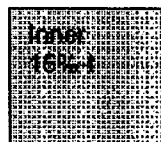
*The 60° shear modeled scan from the vessel shell could not be performed due to the as-found dimension of the blend radius. Table 2-1 of the modeling report lists the dimension as 5.75" however it actually measures ~7.0". Since the blend radius is larger than as listed on design drawings, and thus expected during the modeling process, scanning from the vessel shell could not be performed since the modeled scan area is in the blend region rather than on the vessel shell surface. TVA contacted the EPRI NDE Center for revised modeling to obtain the examination coverage missed by eliminating the 60°s scans. The revised modeling increased the scan area of the 43°, ±106° skew examinations to obtain 100% circumferential scan coverage of the inner 15%-t.

Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/09/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/19/07			



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N1B-NV	Coverage Worksheet #: N1BNV-CWS1	ISI Report #: R137
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Outer 85%-t

Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 95.6 ² inches	^D Inner 15%-t Examination Volume: 9.9 ² inches	^G Outer 85%-t Examination Volume: 85.7 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 31.5 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 16.7 ² inches
^C Percentage of Axial Coverage: 33%	^F Inner 15%-t Volume Achieved: 9.9 ² inches	^J Total Circumferential Examination Coverage: 28%
$B + A \times 100 = C$	$(F + H) + A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage		
^L Total Examination Coverage: 31%		
$(C + J) + 2 \times 100 = L$		
Prepared by: Bret Flesner <i>Bret Flesner</i>	Date: 03/19/07	Reviewed by: Adam Corti <i>Adam Corti</i>
		Date: 03/19/07

	DESCRIPTION			
	Browns Ferry N1B Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/19/07	N1BNV-CPS1	4 OF 10	

R137

000195

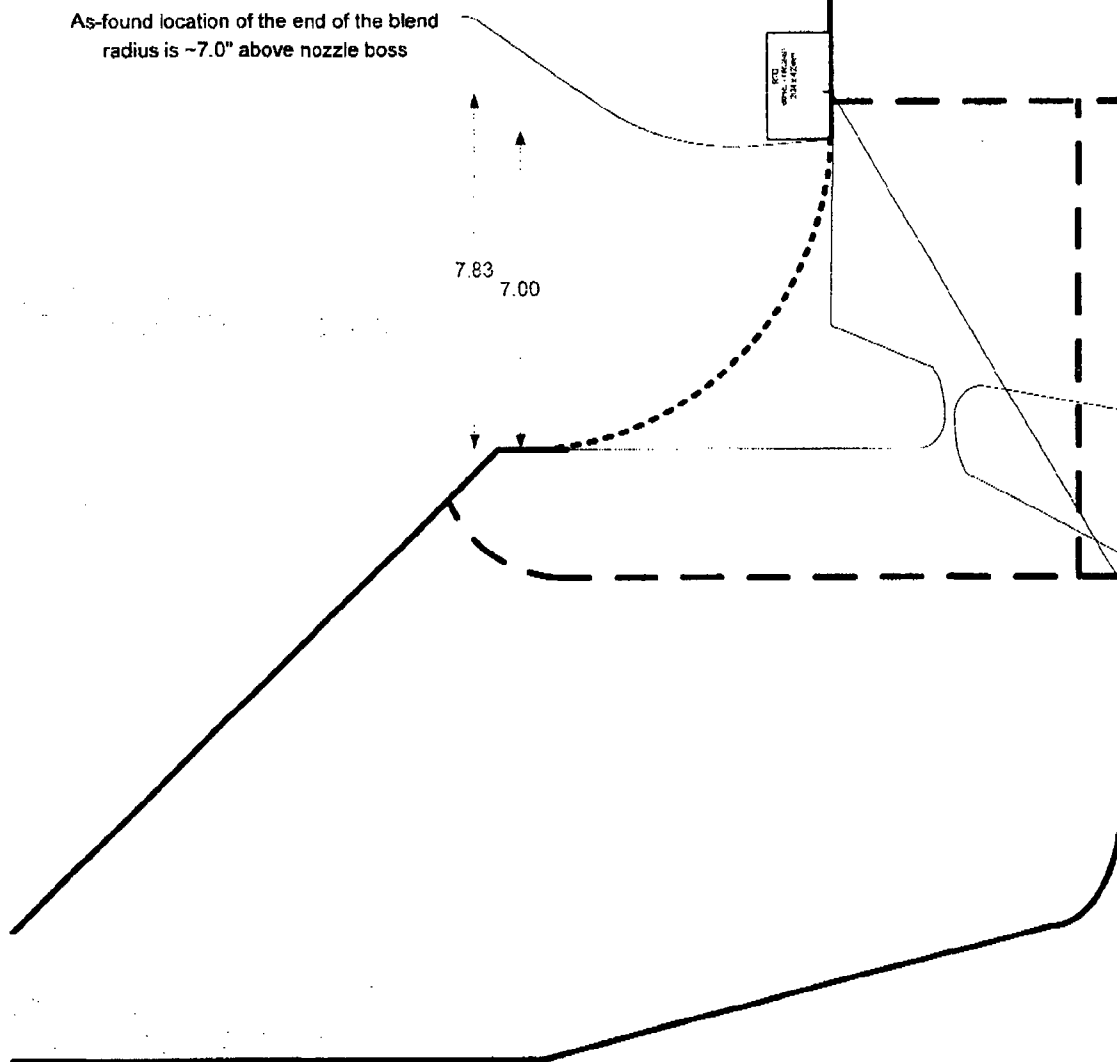
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total examination volume: 95.6 sq. in.
Total examination volume achieved: 31.5 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report, design drawings, and as-found
measurements performed prior to examination.
End of blend radius measured to be ~7" from "Rnozzle"

As-found location of the end of the blend
radius is ~7.0" above nozzle boss



A	DESCRIPTION			
	Browns Ferry N1B Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/19/07	N1BNV-CPS2	5 OF 10	

000196

2137

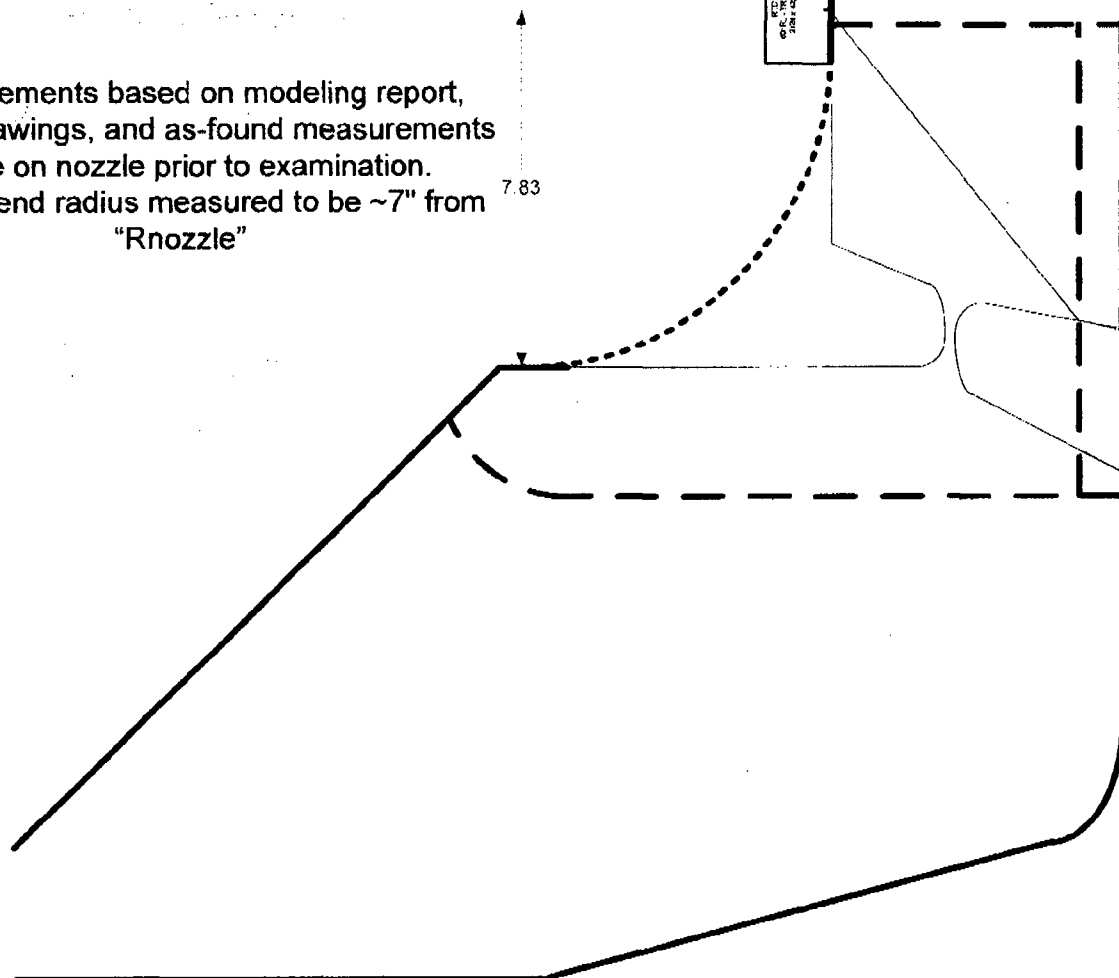
Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 95.6 sq. in.
Area of inner 15%-t examination volume: 9.9 sq. in.
Area of inner 15%-t examination volume achieved: 9.9 sq. in.
Area of outer 85%-t examination volume: 85.7 sq. in.
Area of outer 85%-t examination volume achieved: 16.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

Measurements based on modeling report,
design drawings, and as-found measurements
made on nozzle prior to examination.
End of blend radius measured to be ~7" from
"Rnozzle"



DESCRIPTION			
Browns Ferry N1B Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/19/07	N1BNV-CPS3	6 OF 10

R137

000197

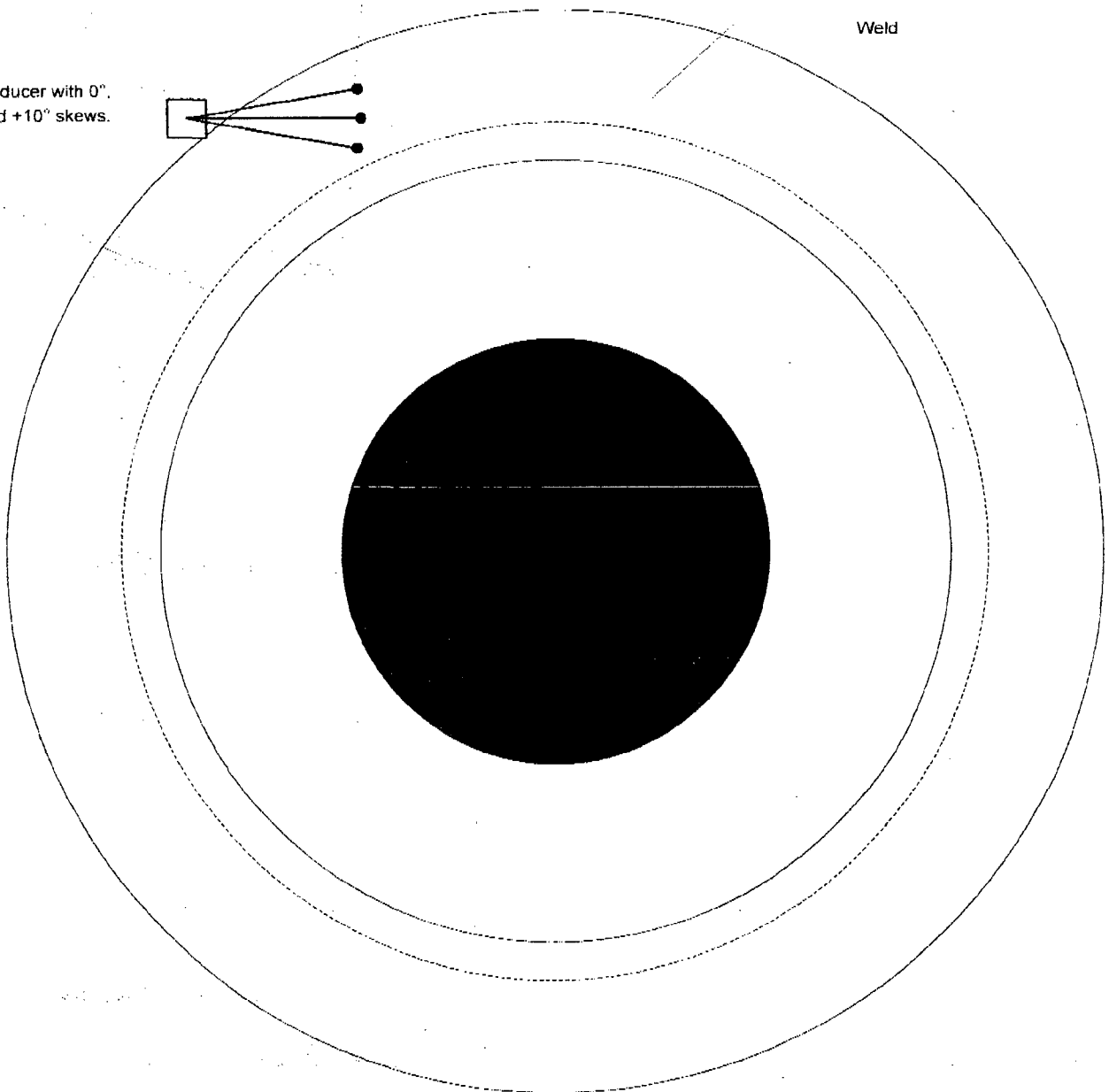
Top View
Measurements based on modeling report, design
drawings, and as-found measurements.
End of blend radius measured to be ~7" from "Rnozzle"

Point where sound beam intercepts the ID.

Weld

Transducer with 0°,
-10° and +10° skews.

R-Nozzle





Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

C00198

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N1BNV-CDS1				ISI Report Number: R137			
Component ID: N1B-NV				Component Description: N1 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PK		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.50" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 43°		Measured Angle: 47°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -106°		Measured Skew Angle: * +106°	
	Delay: 0.658"			Mode: Shear		Radius: 5.75"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Fill2			Verification Block			
	Frequency: 2.25MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Reflector		2" Reflector	
PULSER	Pulse Width: 222nS			Sweep: 0.6 div.		1.1 div.	
	Damping: 500 Ω			Amplitude: 70% FSH		80% FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 28.2 dB		28.2 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 68 °F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 4.4 div		Amplitude: 80 %FSH		Gain: 53.4 dB	
Cal In: Date 03/09/07 Time 1515		Check: Date 03/09/07 Time 1808		Check: Date N/A Time N/A		Out: Date 03/09/07 Time 1900	
Comments							
Wedge skew incorrectly labeled on wedge, actual skew is +106°.							
Examiner: George Chapman Signature:		Level: II	Date: 03/09/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature:		Level: III	Date: 03/19/07	Page 7 of 10			

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000199

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N1BNV-CDS2				ISI Report Number: R137			
Component ID: N1B-NV				Component Description: N1 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XC		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.50" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 43°		Measured Angle: 43°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +106°		Measured Skew Angle: * -106°	
	Delay: 0.658"			Mode: Shear		Radius: 5.75"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Reflector 2" Reflector	
PULSER	Pulse Width: 222nS			Sweep:		0.6 div. 1.1 div.	
	Damping: 500 Ω			Amplitude:		70% FSH 80% FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		27.0 dB 27.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 68 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 4.1 div		Amplitude: 80 %FSH		Gain: 53.0 dB	
Cal In: Date 03/09/07 Time 1525		Check: Date 03/09/07 Time 1828		Check: Date N/A Time N/A		Out: Date 03/09/07 Time 1855	
Comments							
Wedge skew incorrectly labeled on wedge, actual skew is -106°.							
Examiner: George Chapman		Level: II	Date: 03/09/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>[Signature]</i>				Signature			
AREVA Review: Adam Comp		Level: III	Date: 03/19/07				
Signature: <i>[Signature]</i>							



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000200

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N1BNV-CDS3				ISI Report Number: R137			
Component ID: N1B-NV				Component Description: N1 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081455				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS1				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:	1" Reflector	2" Reflector	
	Reject: Off			Sweep:	1.3 div.	2.5 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25% FSH	80% FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 Instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 68 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.8 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 03/09/07 Time 1535		Check: Date 03/09/07 Time 1717		Check: Date N/A Time N/A		Out: Date 03/09/07 Time 1905	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II	Date: 03/09/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Cotti Signature: <i>Adam Cotti</i>		Level: III	Date: 03/19/07				

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000201

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N1BNV-CDS4		ISI Report Number: R137	
Component ID: N1B-NV		Component Description: N1 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: RTD		Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304		Frequency: 2 MHz
Serial Number: 136P1200G081455		Angle: 60°		Measured Angle: 61°
Linearity Sheet No.: LDS1		Mode: Refracted Longitudinal		Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm		Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS
	Delay: 1.38"	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0		
	Velocity: 0.230 in / μ S	Verification Block		
RCVR	Display: Filt 2	Type: CS Rompas		S/N: 99-6251
	Frequency: 2.25 MHz	Reflector:	1" Reflector	2" Reflector
	Reject: Off	Sweep:	0.6 div.	1.1 div.
PULSER	Pulse Width: 222 nS	Amplitude:	25% FSH	80% FSH
	Damping: 500 Ω	Gain:	52.0 dB	52.0 dB
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block		
	Rep Rate: 2kHz	Block ID: BF-18		Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad		Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 68 °F		Therm. SN: VH-9525
		Couplant: Ultragel II		Batch No.: 05325

Reference Sensitivity Information

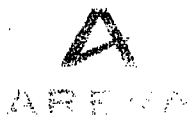
Reflector: ID Notch	Sweep: 6.2 div	Amplitude: 80 %FSH	Gain: 73.2 dB
Cal In: Date 03/09/07 Time 1545	Check: Date 03/09/07 Time 1618	Check: Date N/A Time N/A	Out: Date 03/09/07 Time 1910

Comments

Zone 2 - Full Volume calibration.

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/09/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/19/07			

Examination Report, R-138
N2A-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000202

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R138
Component Number: N2A-NV	Component Description: N2 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-02				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N2ANV-CDS1		N2ANV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications <input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation) <input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N2ANV-CDS2				
N2ANV-CDS3				
N2ANV-CDS4				
N2ANV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

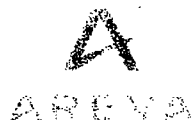
N2 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus ½" on each side.

Prepared by: George Chapman Signature:	Date: 3/19/07	Reviewed by: Adam Conti Signature:	Date: 3/20/07
Customer: Matt Welch Signature:	Date: 3/20/07	ANII: Signature:	Date: 5/18/07



Ultrasonic Examination Data Sheet

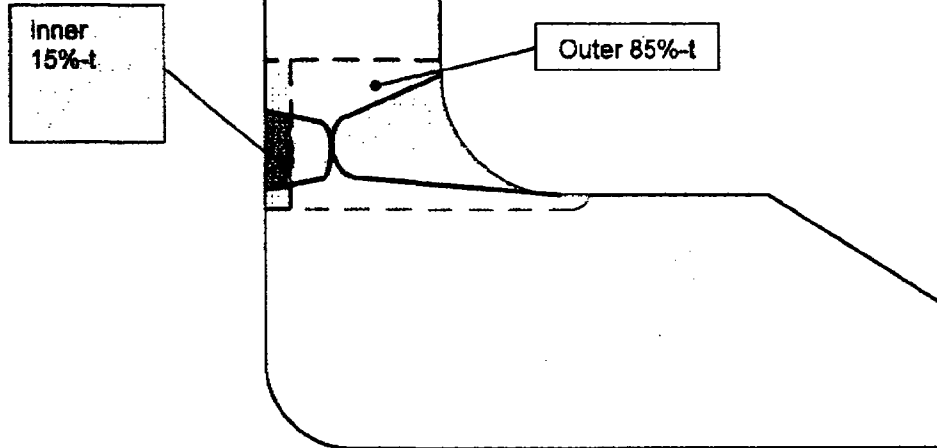
Nozzle-to-Shell Weld Examination

Utility: TVA		Site: Browns Ferry Nuclear Plant				Unit: 2		Outage: Cycle 14 RFO					
Examination Data Sheet Number: N2ANV-EDS1						ISI Report Number: 12138							
Component ID: N2A-NV						Component Description: N2 Nozzle-to-Vessel Weld							
Examination Information													
ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0270-C-02						W ₀ Location: Nozzle Boss (Rnozzle)			L ₀ Location: Nozzle TDC				
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No						Coverage Sheet Number(s): N2ANV-CWS1							
Scan Information													
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000				Scan Surface: OD Blend Radius					
Angle/ Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials		
*50° / s	+120°	N2ANV-CDS1	3/11/07	1321	84° F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC		
40° / s	-120°	N2ANV-CDS2	3/11/07	1301	84° F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC		
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A		
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A		
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000				Scan Surface: OD Vessel Shell					
Angle/ Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials		
60° / s	±33° to 66°	N2ANV-CDS3	3/11/07	1241	84° F	VH-9525	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC		
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A		
Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell					
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2ANV-CDS4	3/11/07	1211	84° F	VH-9525	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2ANV-CDS5	3/11/07	1136	84° F	VH-9525	82.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2ANV-CDS4	3/11/07	1211	84° F	VH-9525	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2ANV-CDS5	3/11/07	1136	84° F	VH-9525	82.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
Comments:													
* See calibration data sheet for additional details on the 50° shear examination.													
Examiner: George Chapman Signature:				Level: II		Date: 03/11/07		Examiner: N/A Signature:				Level: N/A Date: N/A	
Examiner: N/A Signature:				Level: N/A		Date: N/A		Examiner: N/A Signature:				Level: N/A Date: N/A	
AREVA Review: Adam Conti Signature:				Level: III		Date: 03/20/07							

RPV Nozzle-To-Shell Weld

Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA Plant: Browns Ferry Unit: 2 Weld ID: N2A-NV Coverage Worksheet #: N2ANV-CWS1 ISI Report #: R138



Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t	
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4	
^A Required Examination Volume: 47.5 ² inches	^B Inner 15%-t Examination Volume: 5.7 ² inches	^C Outer 85%-t Examination Volume: 41.8 ² inches	
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius	
^B Total Axial Volume Achieved: 24.3 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.5 ² inches	
	^F Inner 15%-t Volume Achieved: 5.7 ² inches		
^C Percentage of Axial Coverage: 51%	^J Total Circumferential Examination Coverage: 36%		
$B + A \times 100 = C$	$(F + H) + A \times 100 = J$		
Combined Axial and Circumferential Weld Coverage			
^L Total Examination Coverage: 44%			
$(C + J) + 2 \times 100 = L$			
Prepared by: Bret Flesner	Date: 03/20/07	Reviewed by: Adam Conti	Date: 03/20/07
<i>Bret Flesner</i>		<i>Adam Conti</i>	

R138

A	DESCRIPTION			
	Browns Ferry N2A Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY	DATE	TITLE	PAGE
	Bret Flesner	03/20/07	N2ANV-CPS1	4 OF 11

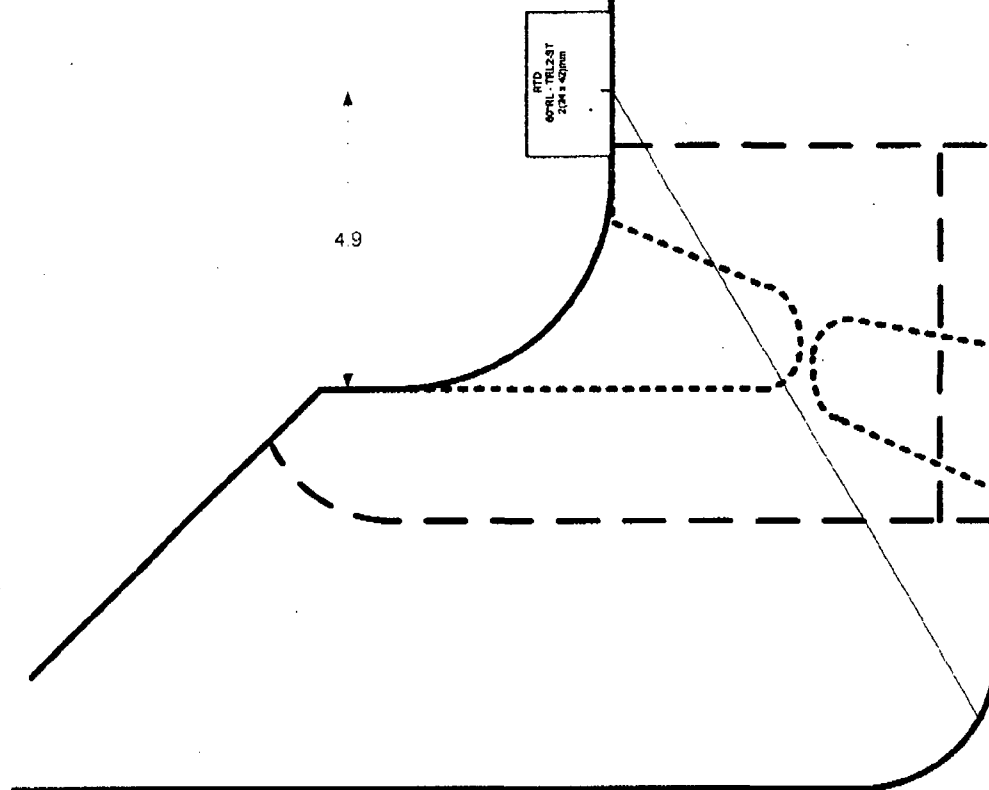
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



A	DESCRIPTION			
	Browns Ferry N2A Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY		DATE	TITLE
	Bret Flesner		03/20/07	N2ANV-CPS2
				PAGE
				5 OF 11

R138

000206

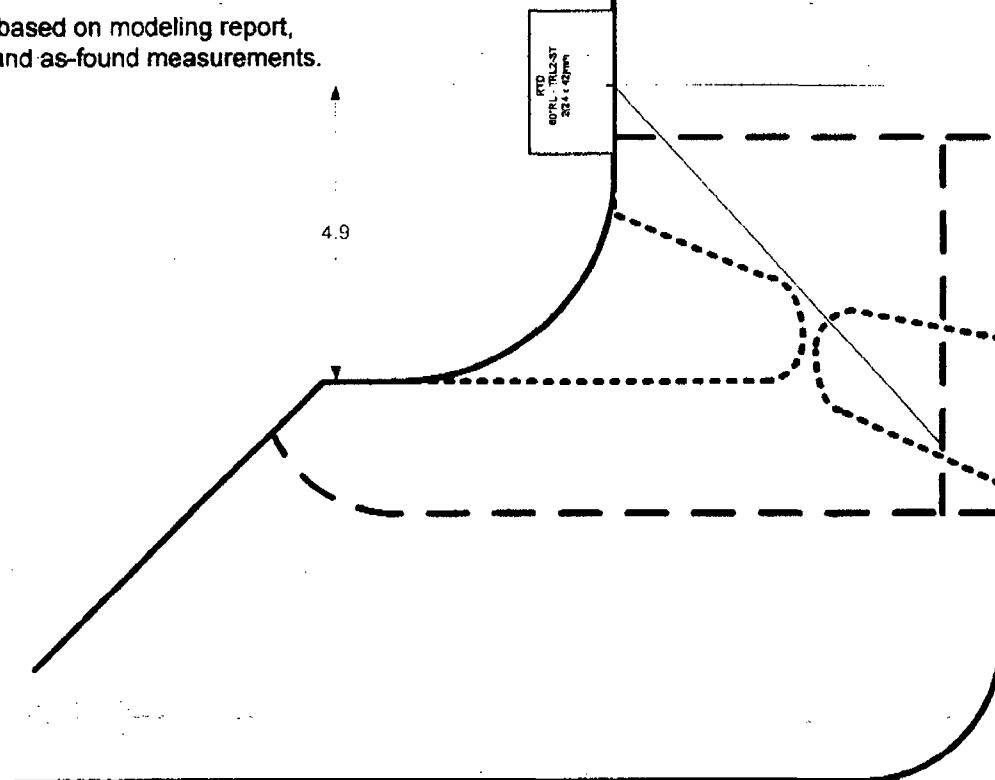
Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 47.5 sq. in.
 Total area of outer 85%-t exam volume achieved: 11.5 sq. in.
 Total area of inner 15%-t volume: 5.7 sq. in.
 Total area of inner 15%-t exam volume achieved: 5.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
 100% of the accessible surface scanned.

Inner 15%-t area examined from the
 blend with Supplement 5 techniques.

Measurements based on modeling report,
 design drawings, and as-found measurements.



A	DESCRIPTION Browns Ferry N2A Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/20/07	TITLE N2ANV-CPS3	PAGE 6 OF 11

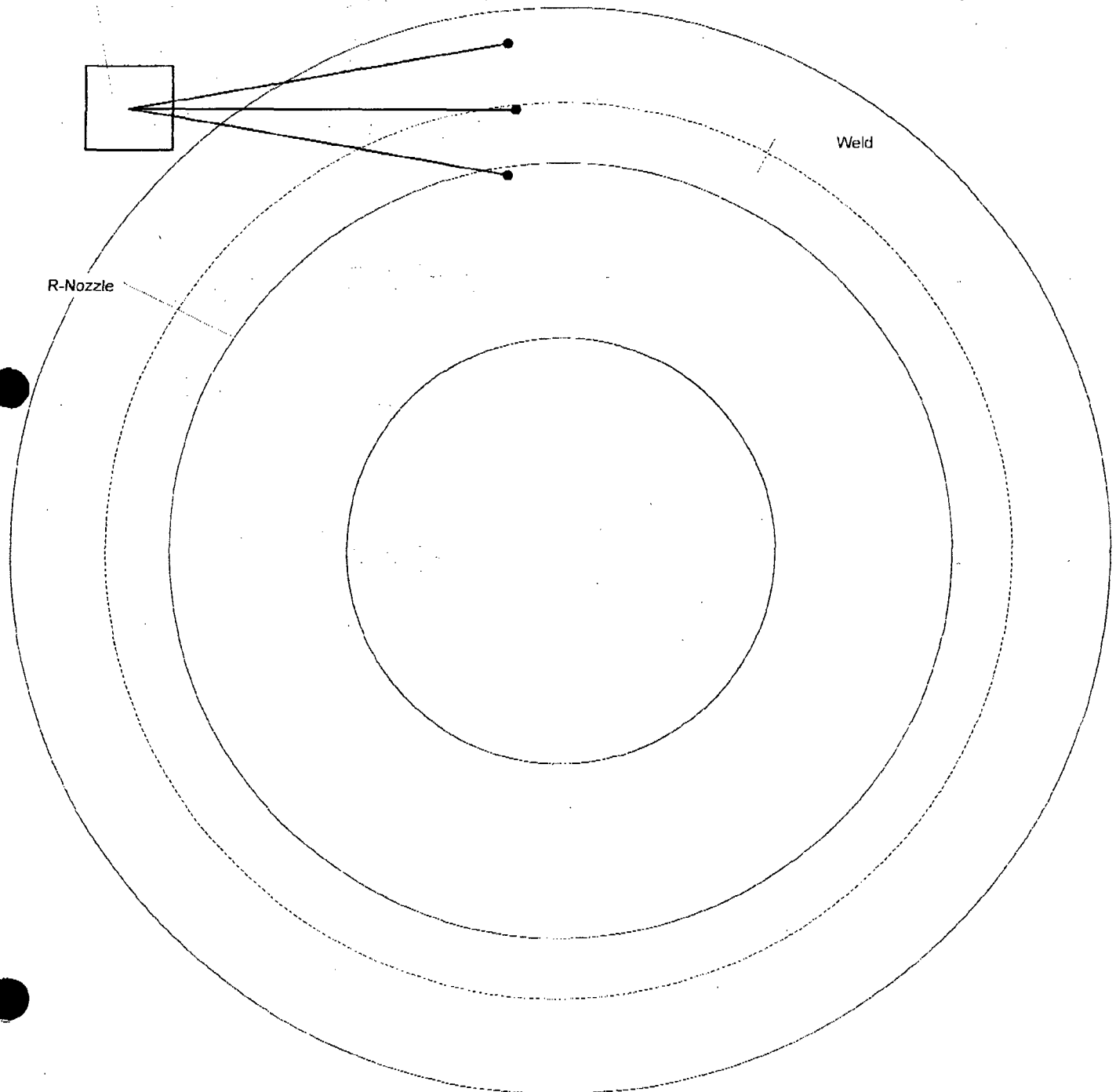
R138

000207

Top View
Measurements based on modeling report,
design drawings, and as-found measurements.

Point where sound beam intercepts the ID.

Transducer with 0°,
-10° and +10° skews.





AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000208

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2ANV-CDS1		ISI Report Number: <i>R138</i>	
Component ID: N2A-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 0111PR	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°	Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: -120°	Measured Skew Angle: **120°	
	Delay: 0.587"	Mode: Shear	Radius: 3.5"	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	29.8 dB	29.8 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 69° F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.1 div	Amplitude: 80 %FSH	Gain: 58.2 dB
Cal In: Date 03/11/07 Time 1115	Check: Date 03/11/07 Time 1320	Check: Date N/A Time N/A	Out: Date 03/11/07 Time 1437

Comments

*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge (product code 365-043-122). The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/20/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000209

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2ANV-CDS2				ISI Report Number: R138			
Component ID: N2A-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 01C4NX		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0° <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: *-120°	
	Delay: 0.587"			Mode: Shear		Radius: 3.5"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.6 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 28.0 dB		28.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 69° F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 48.0 dB	
Cal In: Date 03/11/07 Time 1110		Check: Date 03/11/07 Time 1300		Check: Date N/A Time N/A		Out: Date 03/11/07 Time 1432	
Comments							
*Transducer incorrectly labeled +120° skew by the manufacturer; however actual skew is -120°.							
Examiner: George Chapman Signature:		Level: II		Date: 03/11/07		Examiner: N/A Signature:	
AREVA Review/Adam Conti Signature:		Level: III		Date: 03/20/07		Page 8 of 11	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000210

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2ANV-CDS3				ISI Report Number: <i>R138</i>			
Component ID: N2A-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XB		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±33° to 66°		Measured Skew Angle: N/A	
	Delay: 0.813"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-8251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.6 div. 1.1 div.	
	Damping: 500 Ω			Amplitude:		70 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		27.6 dB 27.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 69° F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.8 div		Amplitude: 80 %FSH		Gain: 60.8 dB	
Cal In: Date 03/11/07 Time 1105		Check: Date 03/11/07 Time 1240		Check: Date N/A Time N/A		Out: Date 03/11/07 Time 1440	
Comments							
Examiner: George Chapman		Level: II		Date: 03/11/07		Examiner: N/A	
Signature: <i>[Signature]</i>						Level: N/A Date: N/A	
AREVA Review: Adam Conti		Level: III		Date: 03/20/07			
Signature: <i>[Signature]</i>						Page 9 of 11	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000211

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2ANV-CDS4		ISI Report Number: R138	
Component ID: N2A-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304	Frequency: 2 MHz
Serial Number: 136P1200G081455		Angle: 60°	Measured Angle: 61°
Linearity Sheet No.: LDS1		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.38"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.230 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: CS Rompas	S/N: 99-6251
	Frequency: 2.25 MHz	Reflector:	1" Radius 2" Radius
	Reject: Off	Sweep:	1.2 div. 2.5 div.
PULSER	Pulse Width: 222 nS	Amplitude:	25 %FSH 80 %FSH
	Damping: 500 Ω	Gain:	52.0 dB 52.0 dB
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 69 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: 1/4-t SDH	Sweep: 3.8 div	Amplitude: 80 %FSH	Gain: 58.4 dB
Cal In: Date 3/11/07 Time 1100	Check: Date 3/11/07 Time 1210	Check: Date N/A Time N/A	Out: Date 3/11/07 Time 1430

Comments

Zone 1 - Near Surface calibration.

Examiner: George Chapman Signature:	Level: II	Date: 03/11/07	Examiner: N/A Signature: _____	Level: N/A	Date: N/A
AREVA Review: Adam Cotti Signature:	Level: III	Date: 03/20/07	Page 10 of 11		



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000212

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2ANV-CDS5				ISI Report Number: R138			
Component ID: N2A-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081455				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS1				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	0.5 div.	1.1 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 69 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 73.2 dB	
Cal In: Date 3/11/07 Time 1055		Check: Date 3/11/07 Time 1135		Check: Date N/A Time N/A		Out: Date 3/11/07 Time 1435	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: George Chapman Signature:		Level: II	Date: 03/11/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature:		Level: III	Date: 03/20/07	Page 11 of 11			

Examination Report, R-142
N2B-NV, RPV Nozzle-To-Head Weld

A
ARERPV Nozzle Ultrasonic Examination
Summary Sheet

000213

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R142
Component Number: N2B-NV	Component Description: N2 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-02				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N2BNV-CDS1		N2BNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N2BNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N2BNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N2BNV-CDS4				
N2BNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus ½" on each side.

Prepared by: Thomas Brown Signature: <i>Thomas Brown</i>	Date: 3/19/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 3/20/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 3/22/07	ANII: Signature: <i>Adam Conti</i>	Date: 5/18/07

Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO

Examination Data Sheet Number: N2BNV-EDS1 ISI Report Number: *R142*

Component ID: N2B-NV Component Description: N2 Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0270-C W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC

Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N2BNV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06 Applicable SDCN's: 30-9044520-000 Scan Surface: OD Blend Radius

Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*50°S	-120°	N2BNV-CDS1	03/19/07	1410	88°F	VH-9520	61.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
40°S	+120°	N2BNV-CDS2	03/19/07	1418	88°F	VH-9520	61.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: 54-ISI-850-06 Applicable SDCN's: 30-9044520-000 Scan Surface: OD Vessel Shell

Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°S	±33° to 66°	N2BNV-CDS3	03/19/07	1440	88°F	VH-9520	67.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 revision 4 Applicable SDCN's: N/A Scan Surface: OD Vessel Shell

Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2BNV-CDS4	03/19/07	1345	88°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2BNV-CDS5	03/19/07	1357	88°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2BNV-CDS4	03/19/07	1345	88°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2BNV-CDS5	03/19/07	1357	88°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

* See note on calibration data sheet for details relating to the 50° measured angle.

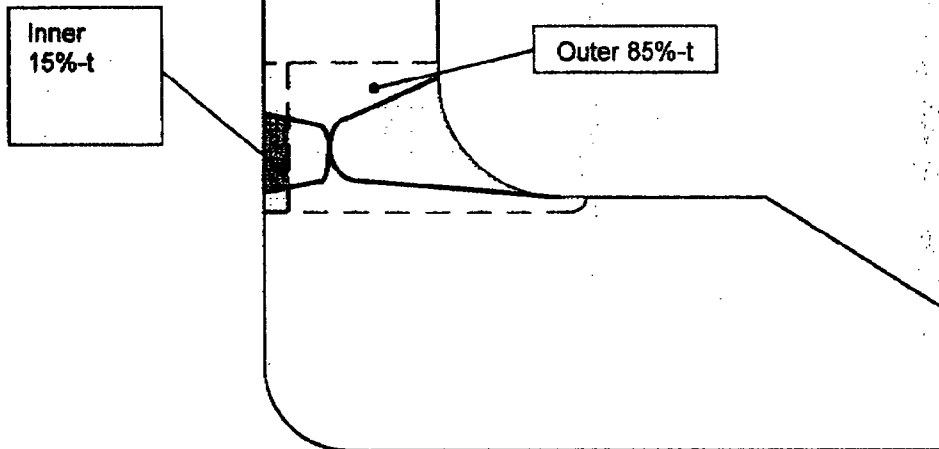
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/19/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/20/07			

000214

RPV Nozzle-To-Shell Weld

Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA Plant: Browns Ferry Unit: 2 Weld ID: N2B-NV Coverage Worksheet #: N2BNV-CWS1 ISI Report #: R142




Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t	
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4	
^A Required Examination Volume: 47.5 ² inches	^D Inner 15%-t Examination Volume: 5.7 ² inches	^G Outer 85%-t Examination Volume: 41.8 ² inches.	
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius	
^B Total Axial Volume Achieved: 24.3 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.5 ² inches	
	^F Inner 15%-t Volume Achieved: 5.7 ² inches		
^C Percentage of Axial Coverage: 51% $B + A \times 100 = C$	^J Total Circumferential Examination Coverage: 36% $(F + H) + A \times 100 = J$		
Combined Axial and Circumferential Weld Coverage			
^L Total Examination Coverage: 44% $(C + J) + 2 \times 100 = L$			
Prepared by: Bret Flesner <i>Bret Flesner</i>	Date: 03/20/07	Reviewed by: Adam Contreras <i>Adam Contreras</i>	Date: 03/20/07
			Page 3 of 11

000215

000216

	DESCRIPTION Browns Ferry N2B Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/20/07	TITLE N2BNV-CPS1	PAGE 4 OF 11

2142

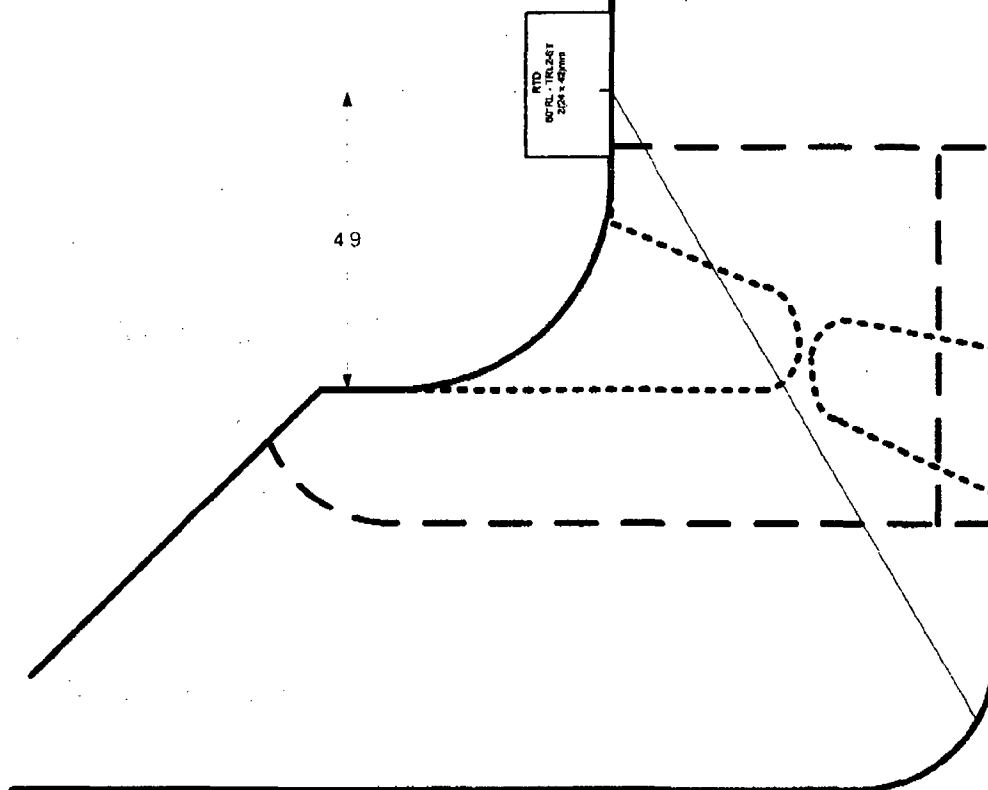
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



A	DESCRIPTION Browns Ferry N2B Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/20/07	TITLE N2BNV-CPS2	PAGE 5 OF 11

R142

000217

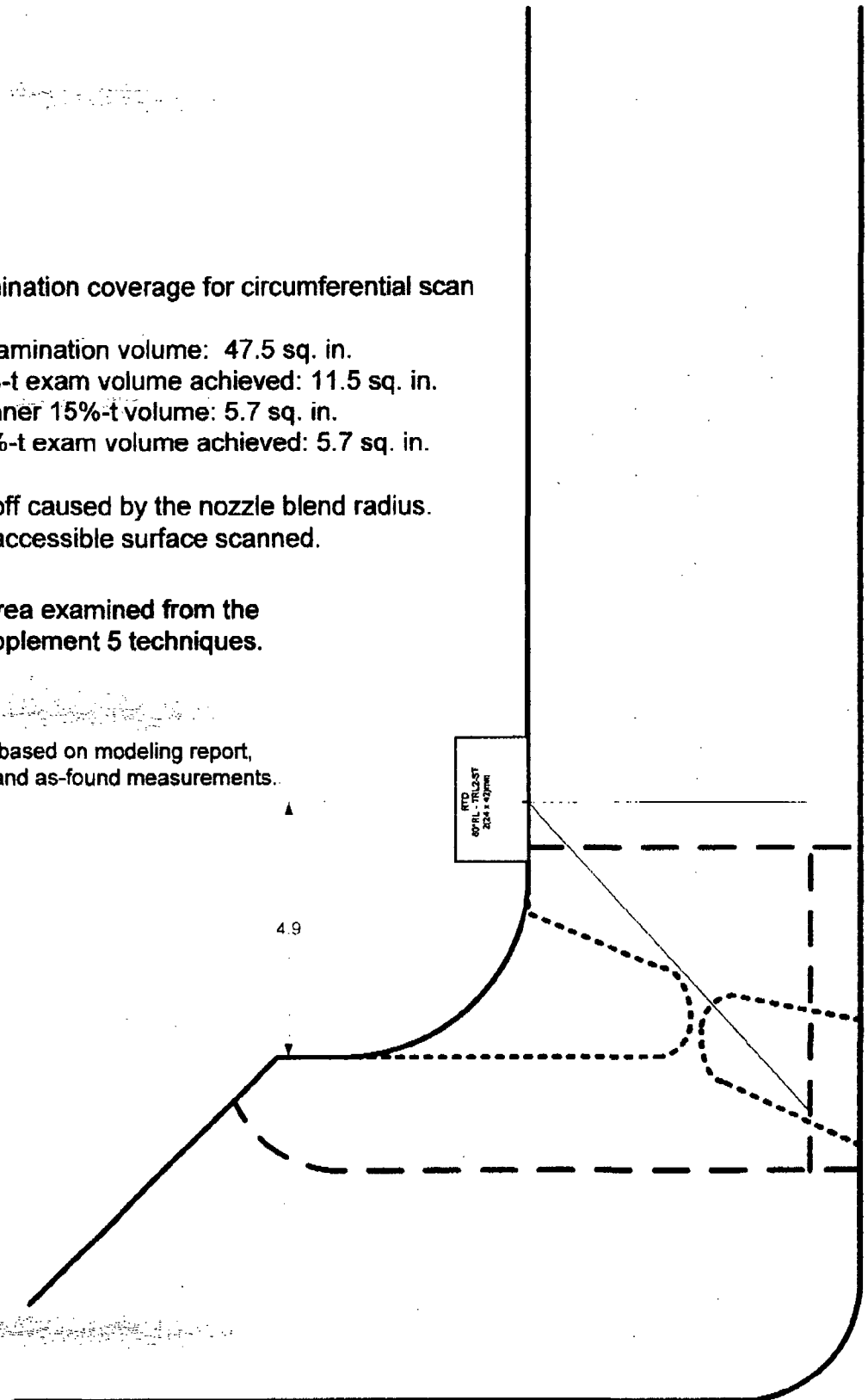
Nozzle-to-Shell weld examination coverage for circumferential scan


Total area of examination volume: 47.5 sq. in.
 Total area of outer 85%-t exam volume achieved: 11.5 sq. in.
 Total area of inner 15%-t volume: 5.7 sq. in.
 Total area of inner 15%-t exam volume achieved: 5.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
 100% of the accessible surface scanned.

Inner 15%-t area examined from the
 blend with Supplement 5 techniques.

Measurements based on modeling report,
 design drawings, and as-found measurements.



	DESCRIPTION			
	Browns Ferry N2B Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/20/07	N2BNV-CPS3	6 OF 11	

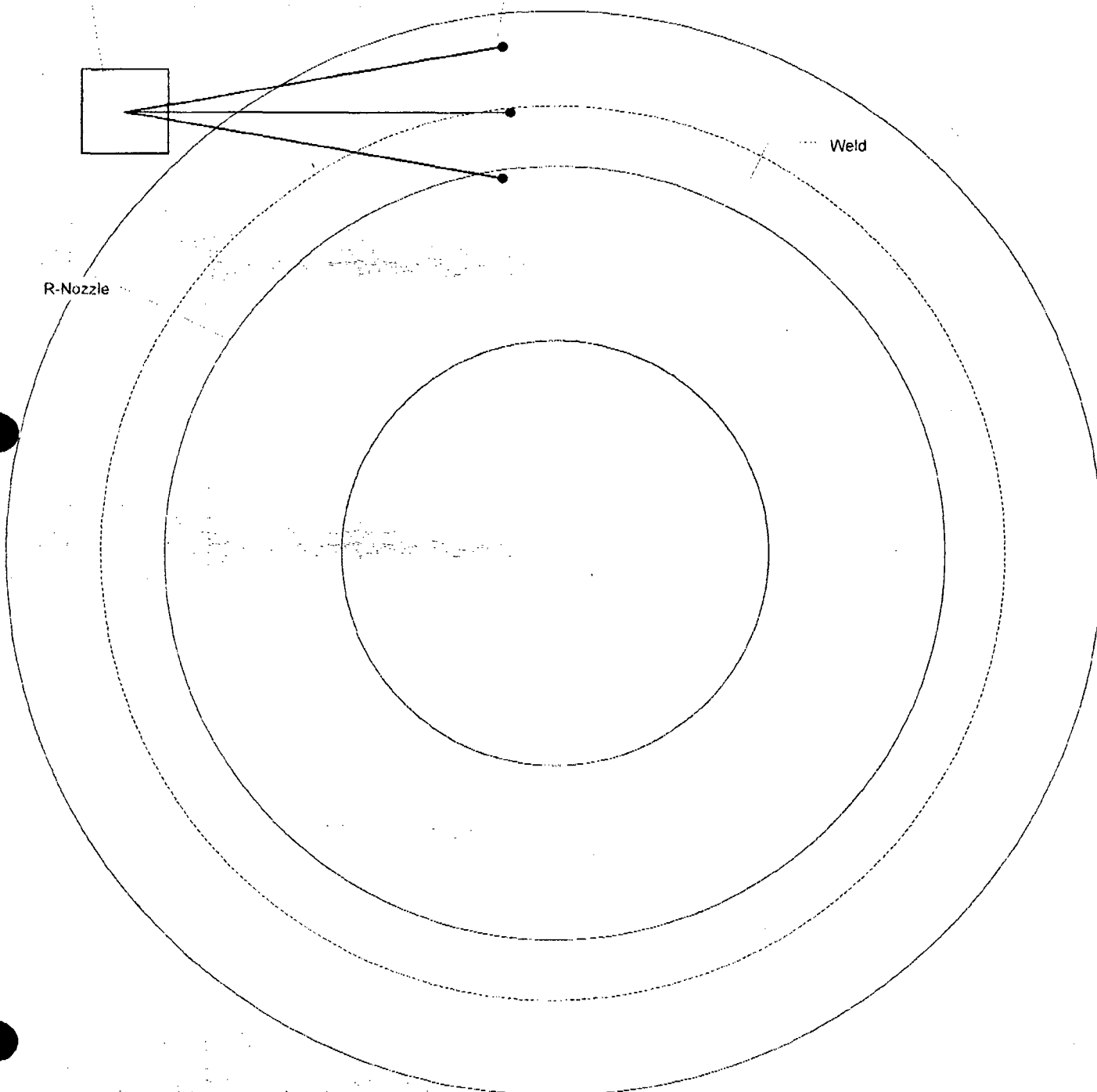
R142

000218

Top View
Measurements based on modeling report,
design drawings, and as-found measurements.

Point where sound beam intercepts the ID.

Transducer with 0°,
-10° and +10° skews.





Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000219

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
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Calibration Data Sheet Number: N2BNV-CDS1

ISI Report Number: R142

Component ID: N2B-NV

Component Description: N2 Nozzle-to-Vessel weld

Examination Procedure: 54-ISI-850-06

Applicable SDCN(s): 30-9044520-000

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 0111PR	Frequency: 2.25 MHz	
Serial Number: 7031		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°	Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: -120°	Measured Skew Angle: *+120°	
	Delay: 0.517"	Mode: Shear	Radius: 3.5"	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 791413	
	Reject: Off	Reflector:	1" Reflector	2" Reflector
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	36.4 dB	36.4 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 72 °F	Therm. SN: VH-9520	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.1 div	Amplitude: 80 %FSH	Gain: 58.2 dB
Cal In: Date 03/19/07 Time 1150	Check: Date 03/19/07 Time 1409	Check: Date N/A Time N/A	Out: Date 03/19/07 Time 1512

Comments

*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge (product code 365-043-122). The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.

Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/19/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/20/07			

A

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000220

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2BNV-CDS2		ISI Report Number: R142	
Component ID: N2B-NV		Component Description: N2 Nozzle-to-Vessel weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 01C4NX	Frequency: 2.25 MHz	
Serial Number: 703 I		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°	Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: +120°	Measured Skew Angle: *-120°	
	Delay: 0.519"	Mode: Shear	Radius: 3.5"	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 791413	
	Reject: Off	Reflector:	1" Reflector	2" Reflector
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	36.0 dB	36.0 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 72 °F	Therm. SN: VH-9520	
		Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 5.2 div	Amplitude: 80 %FSH	Gain: 58.0 dB
Cal In: Date 03/19/07 Time 1145	Check: Date 03/19/07 Time 1417	Check: Date N/A Time N/A	Out: Date 03/19/07 Time 1517

Comments

*Transducer incorrectly labeled +120° skew by the manufacturer; however actual skew is -120°.

Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/19/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Centi Signature: <i>Adam Centi</i>	Level: III	Date: 03/20/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000221

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2BNV-CDS3				ISI Report Number: <i>R142</i>			
Component ID: N2B-NV				Component Description: N2 Nozzle-to-Vessel weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XB		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±33° to 66°		Measured Skew Angle: N/A	
	Delay: 0.842"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 1" Reflector		2" Reflector	
PULSER	Pulse Width: 222 nS			Sweep: 0.6 div.		1.1 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 33.8 dB		33.8 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 72 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
	Reference Sensitivity Information						
Reflector: ID Notch		Sweep: 5.8 div		Amplitude: 80 %FSH		Gain: 60.8 dB	
Cal In: Date 03/19/07 Time 1200		Check: Date 03/19/07 Time 1439		Check: Date N/A Time N/A		Out: Date 03/19/07 Time 1519	
Comments							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>		Level: II		Date: 03/19/07		Examiner: N/A Signature:	
AREVA Review: Adam Cont Signature: <i>Adam Cont</i>		Level: III		Date: 03/20/07		Page 9 of 11	



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2BNV-CDS4				ISI Report Number: R142			
Component ID: N2B-NV				Component Description: N2 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 791413	
	Frequency: 2.25 MHz			Reflector:	1" Reflector	2" Reflector	
	Reject: Off			Sweep:	1.2 div.	2.5 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 72 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.8 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 03/19/07 Time 1233		Check: Date 03/19/07 Time 1344		Check: Date N/A Time N/A		Out: Date 03/19/07 Time 1520	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Thomas Brown		Level: II	Date: 03/19/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>[Signature]</i>				Signature			
AREVA Review: Adam Conti		Level: III	Date: 03/20/07				
Signature: <i>[Signature]</i>							

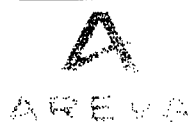
Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000223

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2BNV-CDS5				ISI Report Number: R142			
Component ID: N2B-NV				Component Description: N2 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 791413	
	Frequency: 2.25 MHz			Reflector:	1" Reflector	2" Reflector	
	Reject: Off			Sweep:	0.5 div.	1.1 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 72 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05320	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 73.2 dB	
Cal In: Date 03/19/07 Time 1230		Check: Date 03/19/07 Time 1356		Check: Date N/A Time N/A		Out: Date 03/19/07 Time 1520	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Thomas Brown Signature: <i>[Signature]</i>		Level: II	Date: 03/19/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>		Level: III	Date: 03/20/07				

Examination Report, R-139
N2C-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000224

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R139
Component Number: N2C-NV	Component Description: N2 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-02				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N2CNV-CDS1		N2CNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N2CNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N2CNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N2CNV-CDS4				
N2CNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: George Chapman Signature: <i>George Chapman</i>	Date: 3/19/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 3/20/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 3/20/07	ANII: Signature: <i>Adam Conti</i>	Date: 3/18/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N2CNV-EDS1		ISI Report Number: R139	
Component ID: N2C-NV		Component Description: Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0270-C-02	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N2CNV-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
*50°S	-120°	N2CNV-CDS1	03/11/07	1321	84°F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
40°S	+120°	N2CNV-CDS2	03/11/07	1356	84°F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60°S	±33° to 66°	N2CNV-CDS3	03/11/07	1405	84°F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: N-UT-78 revision 4			Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell			
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2CNV-CDS4	03/11/07	1525	82°F	VH-9520	78.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2CNV-CDS5	03/11/07	1605	82°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2CNV-CDS4	03/11/07	1525	82°F	VH-9520	78.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2CNV-CDS5	03/11/07	1605	82°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments:

* See Note 1 on attached calibration data sheet for details relating to the 50° measured angle.

Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: Bret Plesner Signature: <i>Bret Plesner</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/20/07			

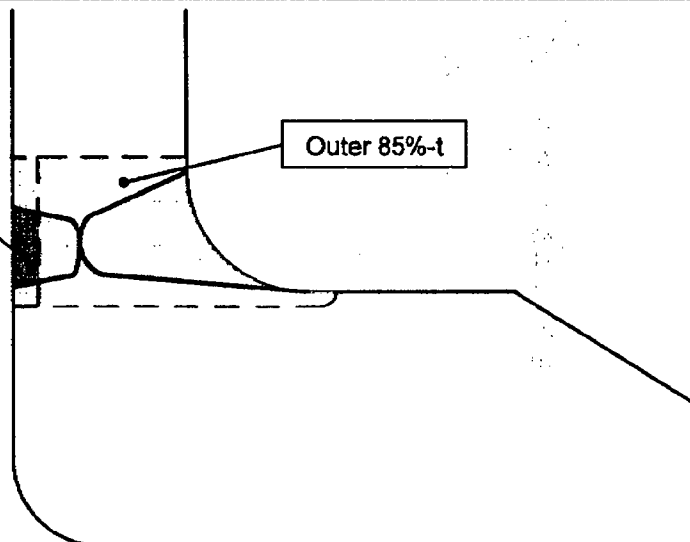
000225

RPV Nozzle-To-Shell Weld

Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N2C-NV	Coverage Worksheet #: N2CNV-CWS1	ISI Report #: R139
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Inner
15%-t




Outer 85%-t

Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 47.5 ² inches	^D Inner 15%-t Examination Volume: 5.7 ² inches	^G Outer 85%-t Examination Volume: 41.8 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.5 ² inches
	^F Inner 15%-t Volume Achieved: 5.7 ² inches	
^C Percentage of Axial Coverage: 51%	^J Total Circumferential Examination Coverage: 36%	
$B + A \times 100 = C$	$(F + H) + A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage		
^L Total Examination Coverage: 44%		
$(C + J) + 2 \times 100 = L$		
Prepared by: Bret Flesner	Date: 03/20/07	Reviewed by: Adam Conti
		Date: 03/20/07

000227

	DESCRIPTION Browns Ferry N2C Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/20/07	TITLE N2CNV-CPS1	PAGE 4 OF 11

R139

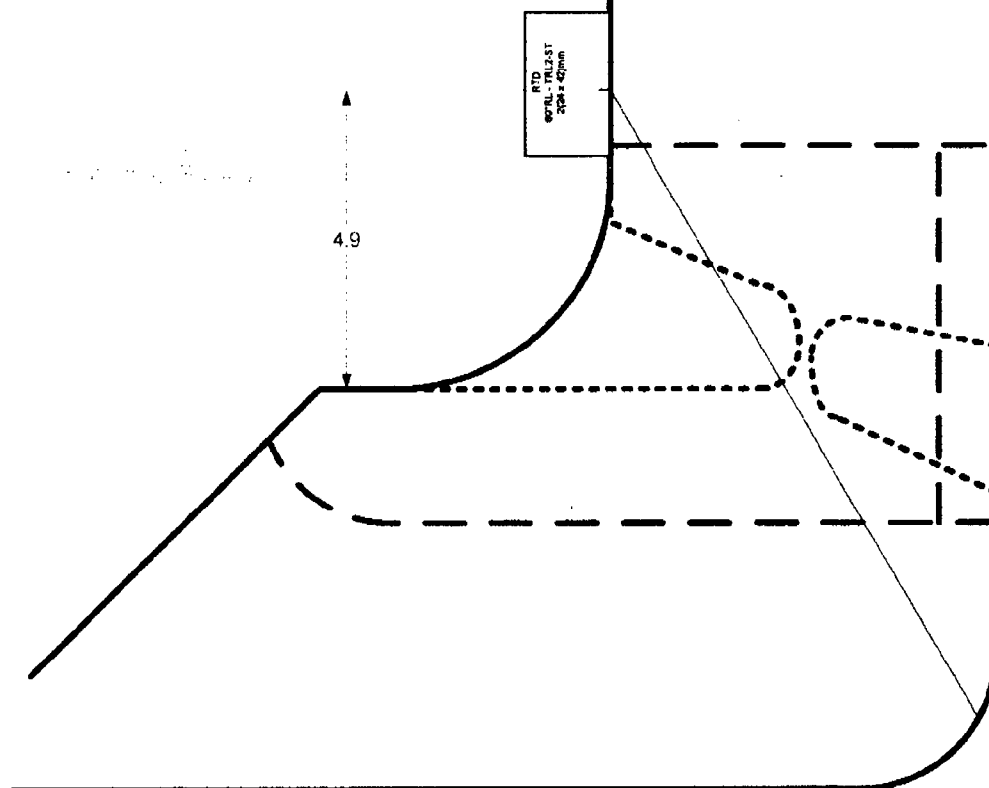
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



A	DESCRIPTION			
	Browns Ferry N2C Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY	DATE	TITLE	PAGE
	Bret Flesner	03/20/07	N2CNV-CPS2	5 OF 11

R139

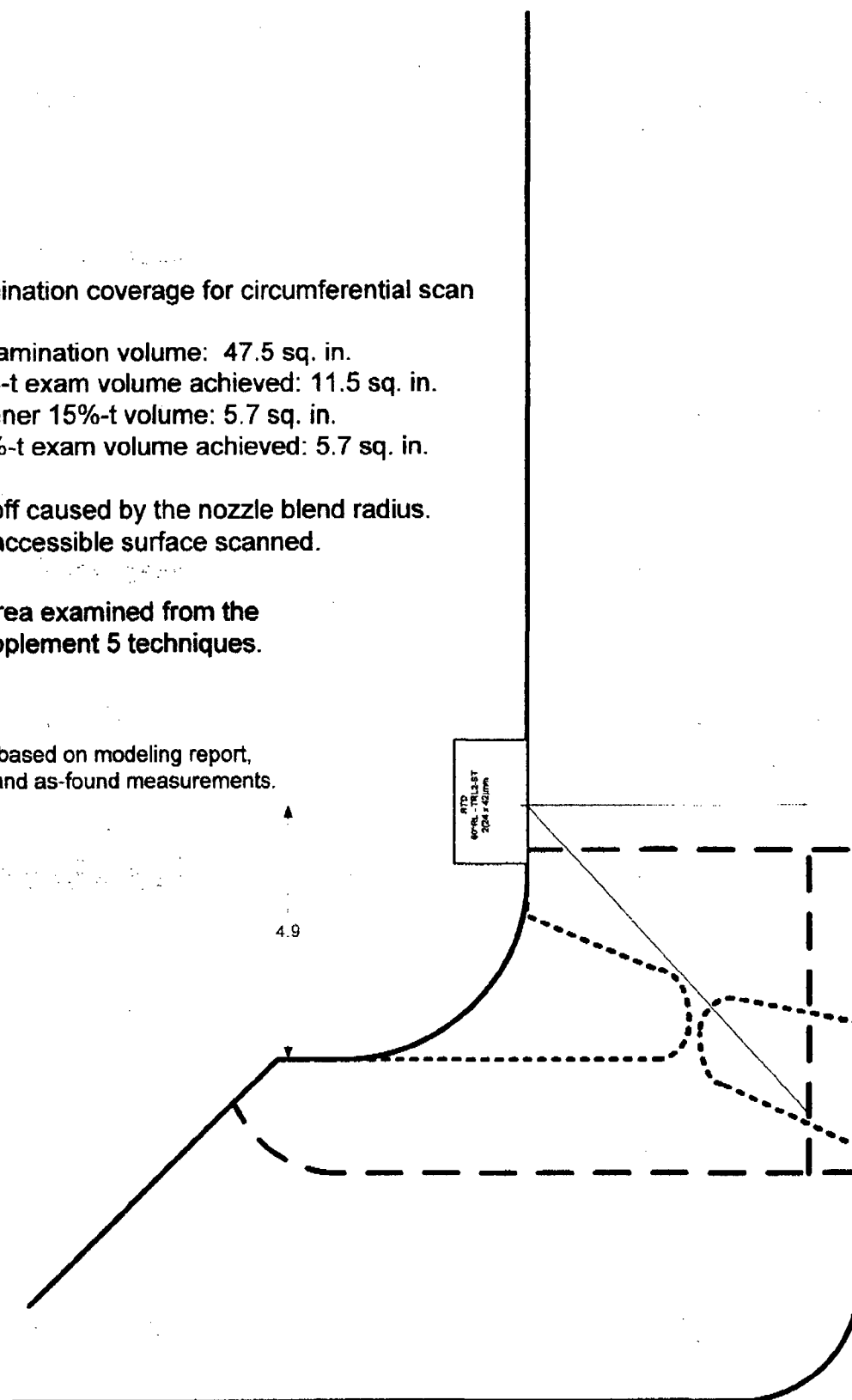
Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 47.5 sq. in.
Total area of outer 85%-t exam volume achieved: 11.5 sq. in.
Total area of inner 15%-t volume: 5.7 sq. in.
Total area of inner 15%-t exam volume achieved: 5.7 sq. in.


Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

Measurements based on modeling report,
design drawings, and as-found measurements.



000229

	DESCRIPTION	Browns Ferry N2C Nozzle-to-Shell Weld Coverage Plot		
	DRAWN BY	DATE	TITLE	PAGE
	Bret Flesner	03/20/07	N2CNV-CPS3	6 OF 11

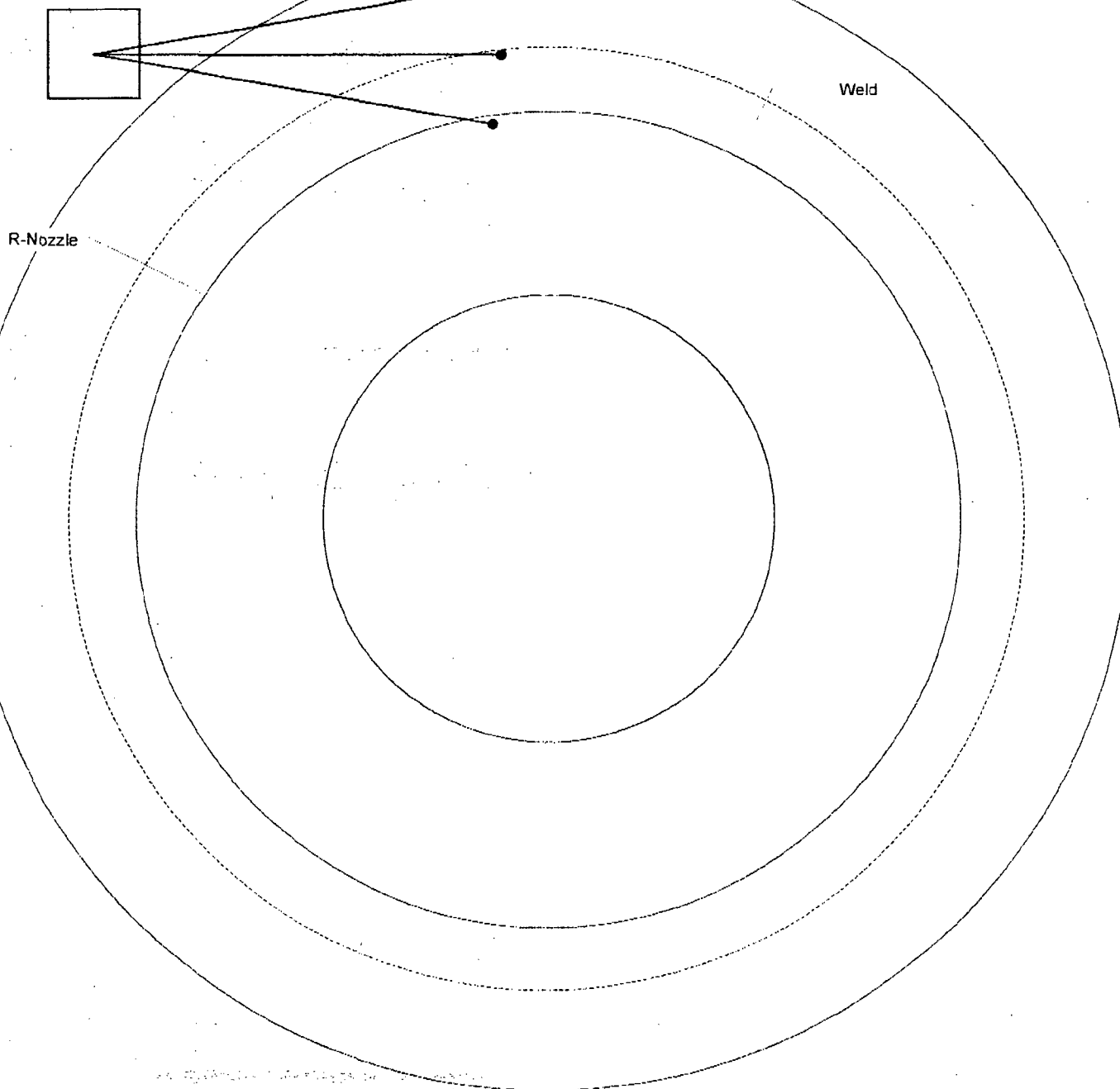
R139

Top View

Measurements based on modeling report,
design drawings, and as-found measurements.

Transducer with 0°,
-10° and +10° skews.

Point where sound beam intercepts the ID



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000230

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2CNV-CDS1		ISI Report Number: <i>R139</i>	
Component ID: N2C-NV		Component Description: N2 Nozzle-to-Vessel weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 0111PR	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°		
Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth		Measured Angle: * 50°		
Delay: 0.587"		Skew Angle: -120°	Measured Skew Angle: *+120°	
Velocity: 0.127 in / μ S		Mode: Shear	Radius: 3.5"	
		Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RANGE	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	29.8 dB	29.8 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input checked="" type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 69° F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 6.1 div	Amplitude: 80 %FSH	Gain: 58.2 dB
Cal In: Date 03/11/07 Time 1115	Check: Date 03/11/07 Time 1320	Check: Date N/A Time N/A	Out: Date 03/11/07 Time 1437

Comments

*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge (product code 365-043-122). The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Cotti Signature: <i>[Signature]</i>	Level: III	Date: 03/20/07			

Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000231

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2CNV-CDS2		ISI Report Number: <i>R139</i>	
Component ID: N2C-NV		Component Description: N2 Nozzle-to-Vessel weld	
Examination Procedure: 54-ISI-850-08		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 01C4NX	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°		
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: +120°	Measured Angle: 40°	
	Delay: 0.587"	Mode: Shear	Measured Skew Angle: *-120°	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	28.0 dB	28.0 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 69° F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 5.2 div	Amplitude: 80 %FSH	Gain: 48.0 dB
Cal In: Date 03/11/07 Time 1110	Check: Date 03/11/07 Time 1355	Check: Date N/A Time N/A	Out: Date 03/11/07 Time 1432

Comments
*Transducer incorrectly labeled +120° skew by the manufacturer; however actual skew is -120°.

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/20/07			

Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000232

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2CNV-CDS3		ISI Report Number: <i>R139</i>	
Component ID: N2C-NV		Component Description: N2 Nozzle-to-Vessel weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 60°	Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±33° to 66°	Measured Skew Angle: N/A	
	Delay: 0.813"	Mode: Shear	Radius: Flat	
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.1 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	27.6 dB	27.6 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 69° F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 5.8 div	Amplitude: 80 %FSH	Gain: 60.8 dB
Cal In: Date 03/11/07 Time 1105	Check: Date 03/11/07 Time 1404	Check: Date N/A Time N/A	Out: Date 03/11/07 Time 1440

Comments			

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/20/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000233

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2CNV-CDS4				ISI Report Number: <i>R139</i>			
Component ID: N2C-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A	S/N: N/A		
	Frequency: 2.25 MHz			Reflector:	N/A		N/A
	Reject: Off			Sweep:	N/A		N/A
PULSER	Pulse Width: 222 nS			Amplitude:	N/A		N/A
	Damping: 500 Ω			Gain:	N/A		N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 68 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 03/11/07 Time 1220		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/11/07 Time 1720	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/11/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Corti Signature: <i>Adam Corti</i>		Level: III	Date: 03/20/07				



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000234

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2CNV-CDS5		ISI Report Number: <i>R139</i>	
Component ID: N2C-NV		Component Description: N2 Nozzle-to-Shell Weld.	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: RTD		Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-305		Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°		Measured Angle: 61°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal		Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm		Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0		
	Velocity: 0.227 in / μ S	Verification Block		
RCVR	Display: Filt 2	Type: N/A		S/N: N/A
	Frequency: 2.25 MHz	Reflector:	N/A	N/A
	Reject: Off	Sweep:	N/A	N/A
PULSER	Pulse Width: 222 nS	Amplitude:	N/A	N/A
	Damping: 500 Ω	Gain:	N/A	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block		
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 68 °F	Therm. SN: VH-9520	
		Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 73.2 dB
Cal In: Date 03/11/07 Time 1224	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/11/07 Time 1722

Comments

Zone 2 - Full Volume calibration.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/11/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Coati Signature: <i>Adam Coati</i>	Level: III	Date: 03/20/07	Page 11 of 11		

Examination Report, R-173
N2D-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000235

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: <i>12173</i>
Component Number: N2D-NV	Component Description: N2 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	

ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-02

Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07

Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N2DNV-CDS1		N2DNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N2DNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N2DNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N2DNV-CDS4				
N2DNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters

Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Thomas Brown Signature: <i>Thomas Brown</i>	Date: 3/22/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 4/11/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 4/15/07	ANII: Signature: <i>Adam Conti</i>	Date: 5/21/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
Examination Data Sheet Number: N2DNV-EDS1 ISI Report Number: **R173**
Component ID: N2D-NV Component Description: Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0270-C-01 W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC
Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N2DNV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Blend Radius			
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited		Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*50° / s	-120°	N2DNV-CDS1		03/22/07	1230	78°F	VH-9525	70.4 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
40° / s	+120°	N2DNV-CDS2		03/22/07	1250	78°F	VH-9525	70.8 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
NA /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Vessel Shell			
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited		Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60° / s	±33° to 66°	N2DNV-CDS3		03/22/07	1310	78°F	VH-9525	67.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
N/A /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell					
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited		Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2DNV-CDS4	03/22/07	1332	78°F	VH-9525	79.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2DNV-CDS5	03/22/07	1403	78°F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2DNV-CDS4	03/22/07	1332	78°F	VH-9525	79.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2DNV-CDS5	03/22/07	1403	78°F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	

Comments:

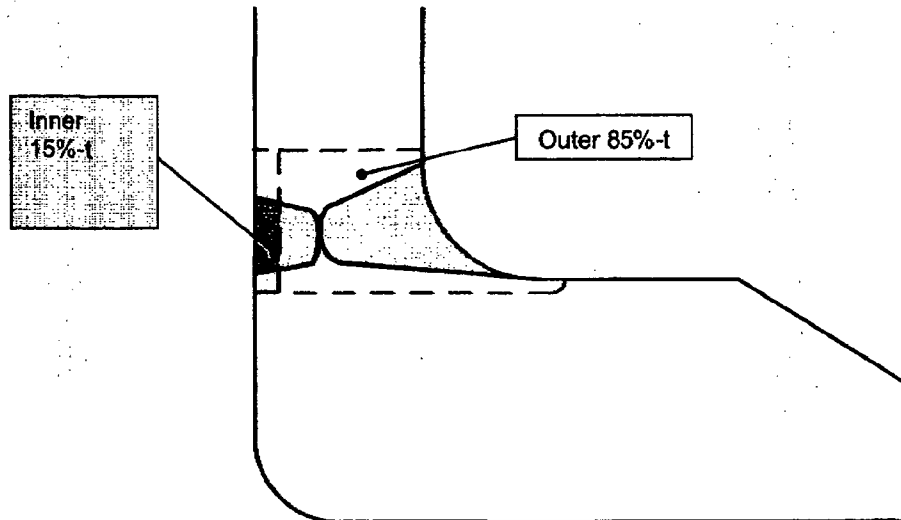
* See calibration data sheet for additional details on the 50° shear examination.

Examiner: Thomas Brown Signature:	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature:	Level: III	Date: 4/11/07			



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N2D-NV	Coverage Worksheet #: N2DNV-CWS1	ISI Report #: <i>12173</i>
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 47.5 ² inches	^D Inner 15%-t Examination Volume: 5.7 ² inches	^G Outer 85%-t Examination Volume: 41.8 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.5 ² inches
	^F Inner 15%-t Volume Achieved: 5.7 ² inches	
^C Percentage of Axial Coverage: 51% $B \div A \times 100 = C$	^J Total Circumferential Examination Coverage: 36% $(F + H) \div A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage		
^LTotal Examination Coverage: 44%		
$(C + J) \div 2 \times 100 = L$		
Prepared by: Bret Flesner <i>Bret Flesner</i>	Date: 03/22/07	Reviewed by: Adam Conti <i>Adam Conti</i>
		Date: 04/11/07

C00237

000238

R173

AREVA	DESCRIPTION			
	Browns Ferry N2D Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY		DATE	TITLE	PAGE
Bret Flesner		03/22/07	N2DNV-CPS1	4 OF 11

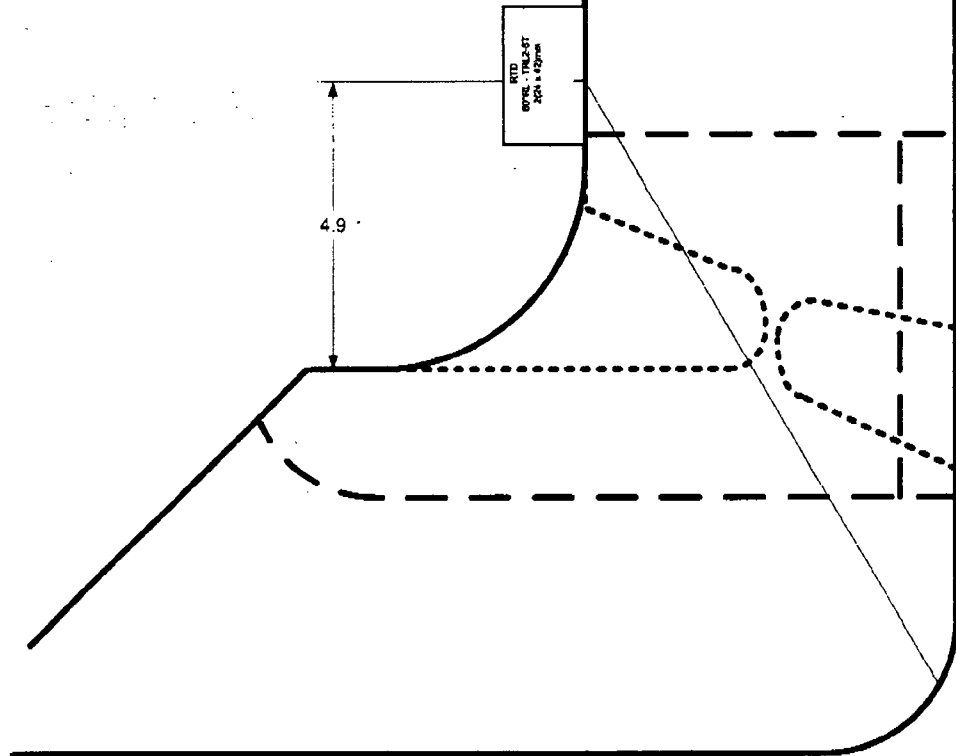
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.


Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



000239 12173

 AREVA	DESCRIPTION Browns Ferry N2D Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/22/07	TITLE N2DNV-CPS2	PAGE 5 OF 11

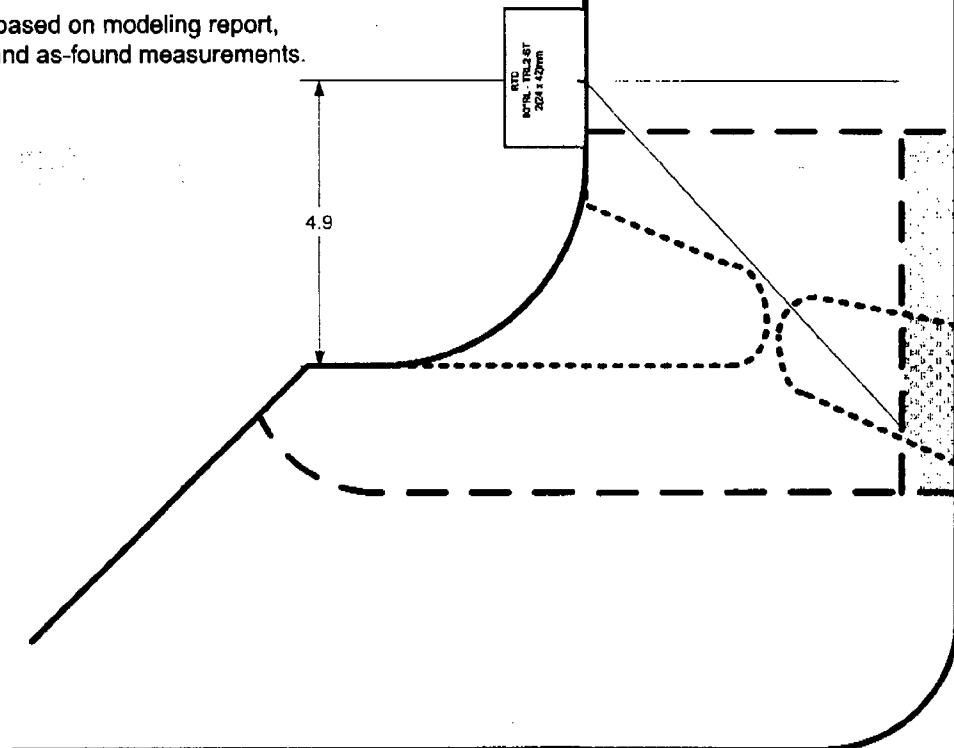
Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 47.5 sq. in.
Total area of outer 85%-t exam volume achieved: 11.5 sq. in.
Total area of inner 15%-t volume: 5.7 sq. in.
Total area of inner 15%-t exam volume achieved: 5.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

Measurements based on modeling report,
design drawings, and as-found measurements.



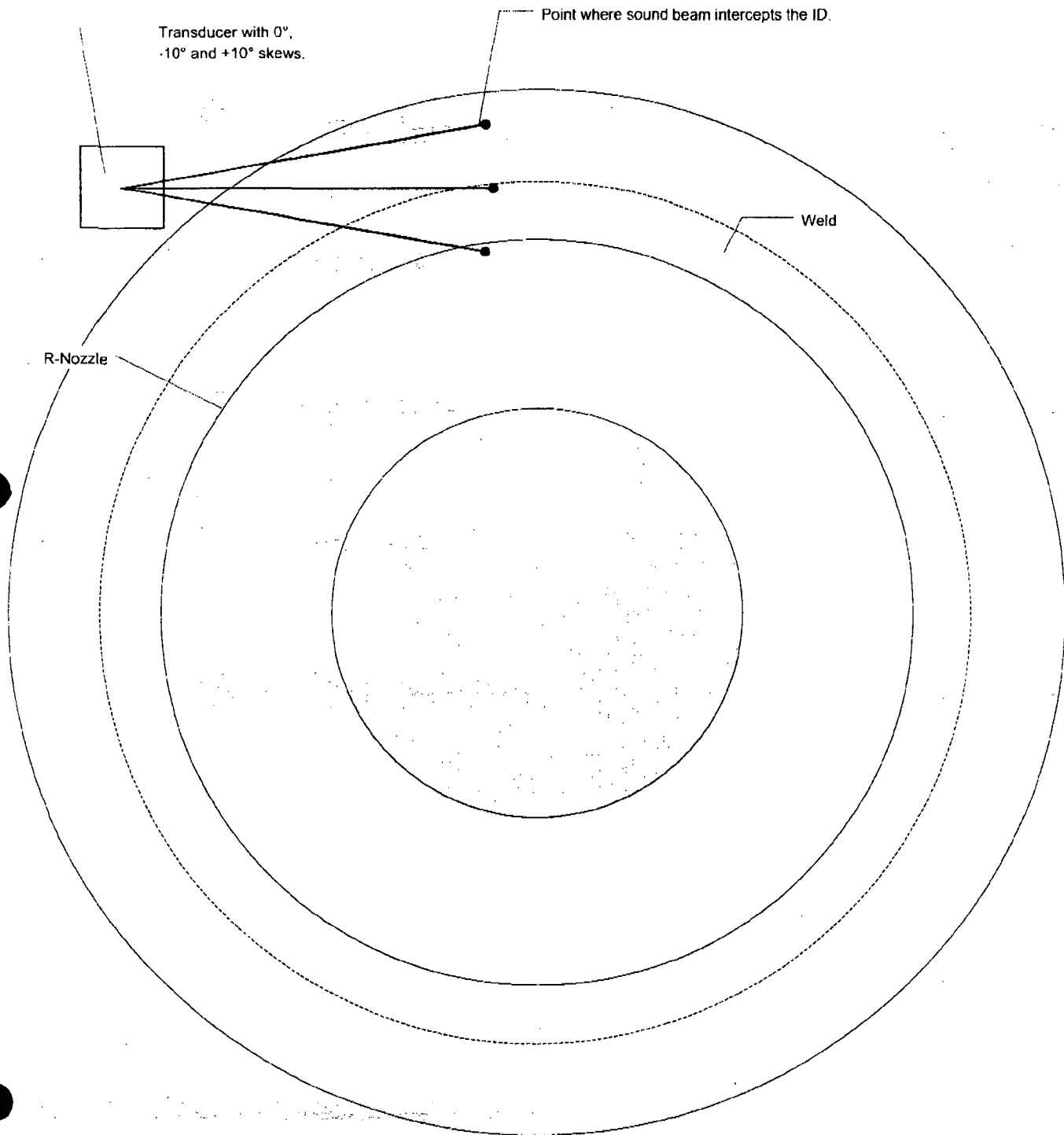
C00240

R173

AREVA	DESCRIPTION Browns Ferry N2D Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/22/07	TITLE N2DNV-CPS3	PAGE 6 OF 11

Top View

Measurements based on modeling report,
design drawings, and as-found measurements.





Reactor Pressure Vessel 000241

Manual Ultrasonic Calibration Data Sheet

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2DNV-CDS1				ISI Report Number: R173			
Component ID: N2D-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PR		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -120°		Measured Skew Angle: * +120°	
	Delay: 0.519"			Mode: Shear		Radius: 3.5"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
	Display: Filt2			Verification Block			
RCVR	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector:	1" Radius	2" Radius	
	Pulse Width: 222 nS			Sweep:	0.6 div.	1.3 div.	
	Damping: 500 Ω			Amplitude:	70 %FSH	80 %FSH	
PULSER	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:	36.4 dB	36.4 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
Temperature: 74 °F				Therm. SN: VH-9525			
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.1 div		Amplitude: 80 %FSH		Gain: 62.6 dB	
Cal In: Date 03/22/07 Time 1100		Check: Date 03/22/07 Time 1229		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1625	
Comments							
<p>* During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge. The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.</p>							
Examiner: Thomas Brown Signature: <i>[Signature]</i>		Level: II	Date: 3/22/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Coni Signature: <i>[Signature]</i>		Level: III	Date: 4/11/07				



Reactor Pressure Vessel 000242

Manual Ultrasonic Calibration Data Sheet

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2DNV-CDS2

ISI Report Number: R173

Component ID: N2D-NV

Component Description: N2 Nozzle-to-Vessel Weld

Examination Procedure: 54-ISI-850-06

Applicable SDCN(s): 30-9044520-000

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 01C4NX	Frequency: 2.25 MHz
Serial Number: 703 I		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 40°	Measured Angle: 40°
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: +120°	Measured Skew Angle: * -120°
	Delay: 0.519"	Mode: Shear	Radius: 3.5"
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 791413
	Reject: Off	Reflector: 1" Reflector	2" Reflector
PULSER	Pulse Width: 222 nS	Sweep: 0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude: 70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: 36.0 dB	36.0 dB
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	Temperature: 74°F	Therm. SN: VH-9525	
	Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 5.2 div	Amplitude: 80 %FSH	Gain: 58.0 dB
Cal In: Date 03/22/07 Time 1104	Check: Date 03/22/07 Time 1249	Check: Date N/A Time N/A	Out: Date 03/22/07 Time 1627

Comments

* The transducer wedge is incorrectly labeled -120° skew by the manufacturer; however actual skew is +120°.

Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conroy Signature: <i>Adam Conroy</i>	Level: III	Date: 4/11/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000243

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2DNV-CDS3				ISI Report Number: <i>R173</i>			
Component ID: N2D-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PL		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±33° to 66°		Measured Skew Angle: N/A	
	Delay: 0.842"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μs			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector:		1" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.6 div.	
	Damping: 500 Ω			Amplitude:		70 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		33.8 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
				Reference Sensitivity Information			
	Reflector: ID Notch		Sweep: 5.8 div		Amplitude: 80 %FSH		Gain: 65.8 dB
Cal In: Date 03/22/07 Time 1107		Check: Date 03/22/07 Time 1309		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1629	
Comments							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>				Level: II		Date: 03/19/07	
AREVA Review: Adam Con...				Level: III		Date: 4/11/07	
Signature: <i>Adam Con...</i>				Examiner: N/A Signature:		Level: N/A Date: N/A	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000244

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2DNV-CDS4

ISI Report Number:

R173

Component ID: N2D-NV

Component Description: N2 Nozzle-to-Vessel Weld.

Examination Procedure: N-UT-78 Revision 4

Applicable SDCN(s): N/A

Ultrasonic Instrument**Transducer**

Manufacture: Staveley

Manufacture: RTD

Model: TRL2-ST

Model: Sonic 136

Serial Number: 07-305

Frequency: 2 MHz

Serial Number: 7031

Angle: 60°

Measured Angle: 61°

Linearity Sheet No.: LDS4

Mode: Refracted Longitudinal

Size: 2(24x42)mm

Instrument Settings

Focus: FS~125mm

Squint Angle: 5°

RANGE

Range: 8.00" ☒ Sound Path ☐ Depth

of Elements: 2

Shape: Rect.

Configuration: Dual - SBS

Delay: 1.38"

Cable Type: RG-174 Length: 12' Intermediate Connectors: 0

Velocity: 0.230 in / μ S**Verification Block**

RCVR

Display: Filt 2

Type: CS Rompas

S/N: 791413

Frequency: 2.25 MHz

Reflector:

1" Radius

2" Radius

Reject: Off

Sweep:

1.2 div.

2.5 div.

Pulse Width: 222 nS

Amplitude:

25 %FSH

80 %FSH

Damping: 500 Ω

Gain:

52.0 dB

52.0 dB

PULSER

Mode: ☐ Pulse Echo ☒ Dual**Basic Calibration Block**

Rep Rate: 2kHz

Block ID: BF-18

Material: Clad CS

Pulser: ☐ 150V ☐ 300V (*Sonic 137 only)

Thickness: 6.0" with 0.125" Clad

Diameter: Flat

*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.

Temperature: 74 °F

Therm. SN: VH-9525

Couplant: Ultragel II

Batch No.: 05325

Reference Sensitivity Information

Reflector: 1/4-t SDH

Sweep: 3.8 div

Amplitude: 80 %FSH

Gain: 62.8 dB

Cal In: Date 03/22/07 Time 1115

Check: Date 03/22/07 Time 1331

Check: Date N/A Time N/A

Out: Date 03/22/07 Time 1620

Comments

Zone 1 - Near Surface calibration.

Examiner: Thomas Brown

Level: II

Date: 03/22/07

Examiner: N/A
Signature

Level: N/A

Date: N/A

AREVA Review: Adam Conti
Signature:

Level: III

Date: 4/11/07



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000245

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2DNV-CDS5				ISI Report Number: <i>R173</i>			
Component ID: N2D-NV				Component Description: N2 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 791413	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	0.5 div.	1.1 div.	
	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 74 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05320	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 77.2 dB	
Cal In: Date 03/22/07 Time 1117		Check: Date 03/22/07 Time 1402		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1622	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Thomas Brown		Level: II	Date: 03/22/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>[Signature]</i>				Signature			
AREVA Review: Adam Conti		Level: III	Date: 4/11/07				
Signature: <i>[Signature]</i>							

Examination Report, R-136
N2G-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000246

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R136
Component Number: N2G-NV		Component Description: N2 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07	
Calibration Sheets			Exam Data Sheets	Indication Data Sheets
N2GNV-CDS1	N2GNV-CDS6	N2GNV-CDS11	N2GNV-EDS1	N2GNV-IDS1
N2GNV-CDS2	N2GNV-CDS7	N2GNV-CDS12	N2GNV-EDS2	N2GNV-IDS2
N2GNV-CDS3	N2GNV-CDS8			
N2GNV-CDS4	N2GNV-CDS9			
N2GNV-CDS5	N2GNV-CDS10			
Exam Results <input type="checkbox"/> No Recordable Indications <input checked="" type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation) <input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in the recording of 1 acceptable flaw indication. Subsequent indication dimensioning was performed using UT procedure N-UT-79 Revision 1. Final indication characterization and acceptance evaluation is provided on the examination and indication data sheets along with the flaw characterization and evaluation worksheet for this ISI report.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner	Date: 3/18/07	Reviewed by: Adam Cont	Date: 3/18/07
Signature: <i>Bret Flesner</i>		Signature: <i>Adam Cont</i>	
Customer: Matt Welch	Date: 3/20/07	ANII:	Date: 5/21/07
Signature: <i>Matt Welch</i>		Signature: <i>Carl Stuehl</i>	



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N2GNV-EDS1		ISI Report Number: <i>R136</i>	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0270-C-01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N2G-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06	Applicable SDCN's: 30-9044520-000	Scan Surface: OD Blend Radius
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Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*50°S	+120°	N2GNV-CDS1	03/13/07	1400	83°F	VH-9520	70.2 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
40°S	-120°	N2GNV-CDS2	03/13/07	1415	83°F	VH-9520	65.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: 54-ISI-850-06	Applicable SDCN's: 30-9044520-000	Scan Surface: OD Vessel Shell
--------------------------------------	-----------------------------------	-------------------------------

Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°S	±33° to 66°	N2GNV-CDS3	03/13/07	1425	83°F	VH-9520	70.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 rev.4	Applicable SDCN's: N/A	Scan Surface: OD Vessel Shell
--------------------------------------	------------------------	-------------------------------

Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2GNV-CDS4	03/13/07	1435	83°F	VH-9520	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N2GNV-IDS1	BF
60°RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2GNV-CDS5	03/13/07	1500	83°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N2GNV-IDS1	BF
60°RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2GNV-CDS4	03/13/07	1435	83°F	VH-9520	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2GNV-CDS5	03/13/07	1500	83°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments: Initial detection examination. A non-surface connected fabrication flaw was recorded during the 60°RL examination. See sizing and flaw evaluation worksheets for additional details.

*See note on calibration data sheet relating to 50°, +120° skew measured angle.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/13/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/18/07			

000247



Ultrasonic Examination Data Sheet **Nozzle-to-Shell Weld Examination**

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N2GNV-EDS2		ISI Report Number: <i>R136</i>	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0270-C-01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Coverage Sheet Number(s): N/A		

Scan Information

Examination Procedure:				Applicable SDCN's:				Scan Surface: OD Vessel Shell			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
45°S	N/A	N2GNV-CDS6, N2GNV-CDS7	03/14/07	1122	81°F	VH-9520	N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N2GNV-IDS2	BF
60°S	N/A	N2GNV-CDS8, N2GNV-CDS9	03/14/07	1140	81°F	VH-9520	N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N2GNV-IDS2	BF
0°I	N/A	N2GNV-CDS10	03/14/07	1120	81°F	VH-9520	N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N/A				Applicable SDCN's: N/A				Scan Surface: N/A			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 rev.4				Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell				
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2GNV-CDS11	03/14/07	1100	81°F	VH-9520	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N2GNV-IDS1	BF
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2GNV-CDS12	03/14/07	1110	81°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N2GNV-IDS1	BF
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2GNV-CDS11	03/14/07	1100	81°F	VH-9520	72.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2GNV-CDS12	03/14/07	1110	81°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments: Sizing examination.

0° used to measure thickness in the region of the flaw indication. 60°RL examination performed prior to sizing.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/18/07			

000248

Indication Recording (Detection Examination)

Scan Direction	Amplitude	L ₁	L _{max}	L ₂	Metal Path (W ₁)	Metal Path (W _{max})	Metal Path (W ₂)	W ₁	W _{max}	W ₂
Radial	115 % FSH	48.6"	49.0"	49.4"	4.80"	5.04" (2.52" depth)	5.2"	4.5"	5.0"	5.4"

Examiner Notes:

- Echo-dynamic characteristics typical of a fabrication type discontinuity (Slag)
 - Broad - wide signal presentation
- Recorded length position provided unique and defined start and end positions with >10:1 S/N ratio. Similar responses observed intermittently 360° below recordable levels (≤ 20% FSH)
- "W" dimensions measured from nozzle boss (Rnozzle)
- Indication amplitude recorded at Zone 2 scanning sensitivity
- Indication confirmed with Zone 1 calibration (> 100% FSH)
- No distinct tip diffracted signals
- Nozzle blend radius interference prevents confirmation with 28° shear component or 0° transducer
- Length Sizing information is an estimate only. See indication data sheet N2GNV-IDS2 for length and depth sizing information

Prepared By: Bret Flesner

Signature: *Bret Flesner*

Level: II

Date: 03/13/07

Reviewed by: Adam Conti

Signature: *Adam Conti*

Level: III

Date: 03/18/07

Page: 4 of 25

C00249

N2G Nozzle-to-Shell Weld
45° & 60° Shear Wave Indication Data Sheet (N2GNV-IDS2)

R136

Indication Length Information (Note 1)				Indication Depth Information (Note 2)		
Probe	L ₁	L ₂	Total Length	Upper Tip Signal (depth)	Lower Tip Signal (depth)	Through Wall Extension (TWE) (Note 3)
45° shear	49.0"	49.7"	0.70"	2.43"	2.77"	0.34"
60° shear	48.8"	49.7"	0.90"	2.54"	2.70"	0.34"

Note 1: Indication length information from 45° shear wave was limited due to nozzle blend radius interference. 60° shear wave data used for flaw length evaluation purposes.

Note 2: This indication does not provide typical upper and lower tip signal responses. It provided signal responses indicative of a fabrication type defect.

Note 3: Flaw depth identifies the shallowest and deepest extremities of the bounded flaw as defined in ASME Section XI, IWA-3000.

Prepared By: Bret Flesner

Signature: *Bret Flesner*

Level: II

Date: 03/14/07

Reviewed by: Adam Conti

Signature: *Adam Conti*

Level: III

Date: 03/18/07

Page: 5 of 25

000250

N2G Nozzle-to-Shell Weld
Flaw Characterization and Evaluation Worksheet

R136

Flaw Evaluation Parameters	
Nozzle ID	N2G
*Thickness (UT measured OD to clad base metal interface)	6.50"
S1 dimension (OD to upper flaw tip)	2.43"
S2 dimension (clad base metal interface to lower flaw tip)	3.73"
*d	.18"
Flaw Characterization	Subsurface Planar Flaw ($S > 0.4d$)
*Flaw Length (ℓ)	0.90"
Flaw Depth ($2a$)	.35"
a / ℓ	0.20
* a / t %	2.8%
*Allowable a / t % ($0.20 a / \ell$)	3.3%

Code Year Used: ASME Code, Section XI, 2001 with Addenda thru 2003

*Rounded in accordance with IWA-3200.

This indication is an allowable planar flaw in accordance with the acceptance criteria defined in IWB-3512-1.

The flaw dimensions identified above define the bounding rectangle that fully contains the area of the flaw in accordance with IWA-3300 and Fig. IWA-3310 through IWA-3390.

Prepared by: Adam Conti
Signature: *Adam Conti*

Level: III

Date: 03/18/07

Reviewed By: Bret Flesner
Signature: *Bret Flesner*

Level: II

Date: 03/18/07

Page: 6 of 25

C00251

000252

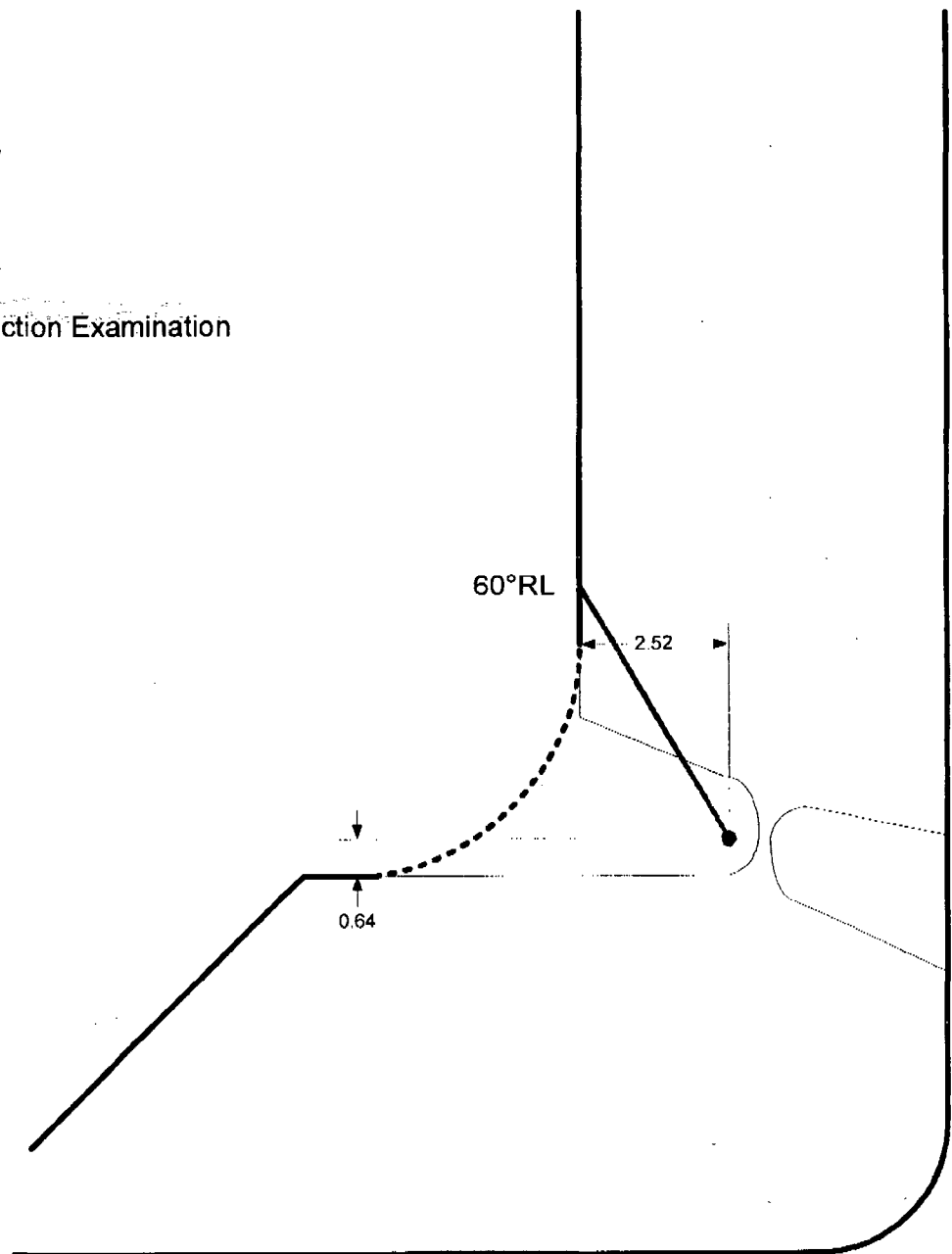
A AREVA	DESCRIPTION Browns Ferry N2G Indication Plot Sheet			
	DRAWN BY Bret Flesner	DATE 03/13/06	TITLE N2GNV-IPS1	PAGE 7 OF 25

R136

Measurements based on modeling report, design drawings, and as-found measurements.

Weld profile is a best effort rendering.

60°RL Detection Examination



000253

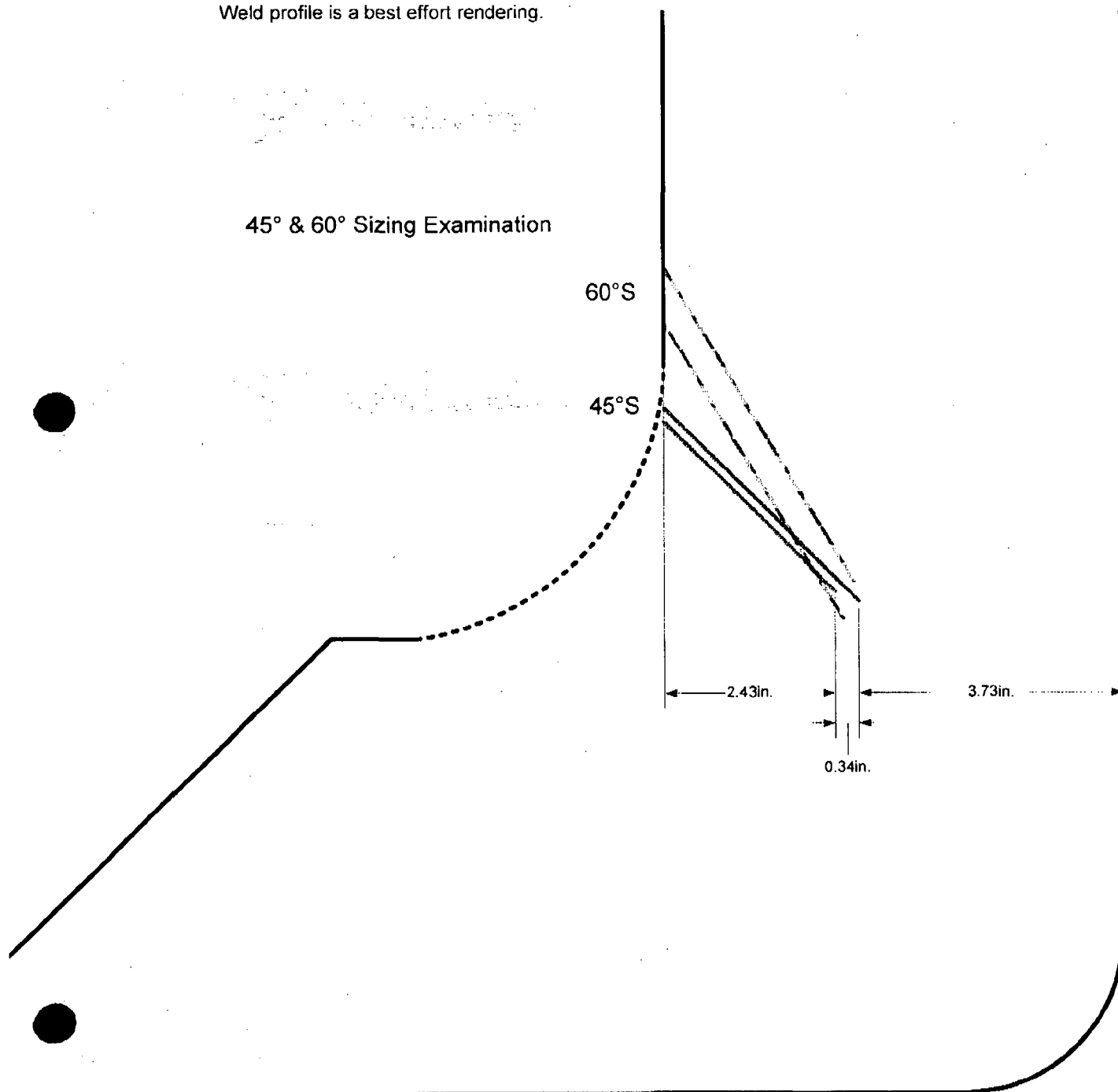
R136


A AREVA	DESCRIPTION Browns Ferry N2G Indication Plot Sheet			
	DRAWN BY Bret Flesner	DATE 03/14/06	TITLE N2GNV-IPS2	PAGE 8 OF 25

Measurements based on modeling report, design drawings, and as-found measurements.

Weld profile is a best effort rendering.

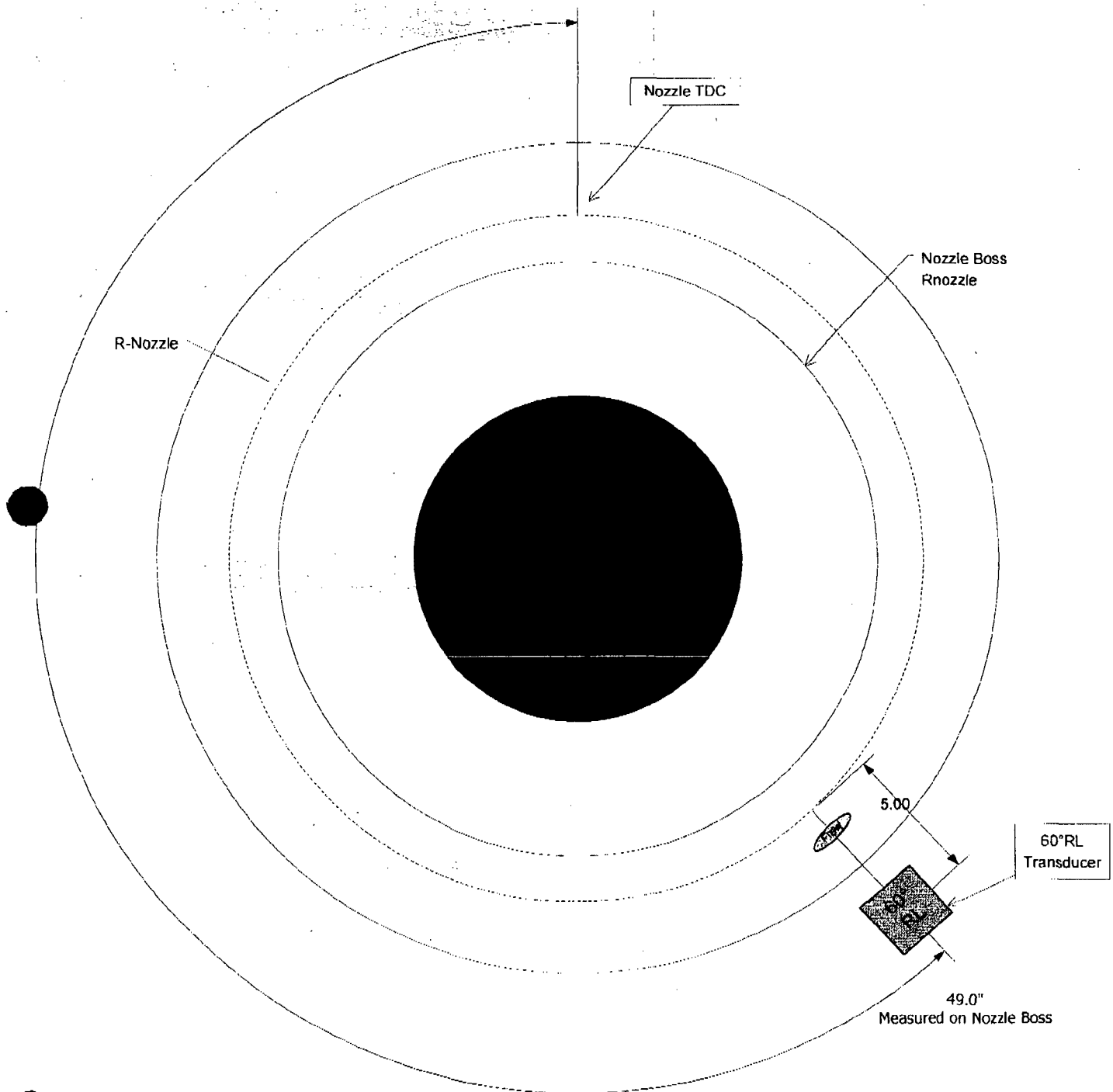
45° & 60° Sizing Examination



	DESCRIPTION Browns Ferry N2G Indication Plot Sheet			
	DRAWN BY Bret Flesner	DATE 03/14/07	TITLE N2GNV-IPS3	PAGE 9 OF 25

R136

000254

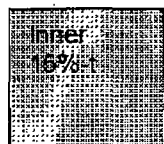


View looking towards nozzle



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N2G-NV	Coverage Worksheet #: N2GNV-CWS1	ISI Report #: R136
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Outer 85%-t

Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 47.5 ² inches		^D Inner 15%-t Examination Volume: 5.7 ² inches	^G Outer 85%-t Examination Volume: 41.8 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.5 ² inches
^C Percentage of Axial Coverage: 51%		^F Inner 15%-t Volume Achieved: 5.7 ² inches	^J Total Circumferential Examination Coverage: 36%
$B \div A \times 100 = C$		$(F + H) \div A \times 100 = J$	

Combined Axial and Circumferential Weld Coverage

^LTotal Examination Coverage: 44%

$$(C+J) \div 2 \times 100 = L$$

Prepared by: Bret Flesner

Date: 03/13/07

Reviewed by: Adam Conti

Date: 03/18/07

Page 10 of 25

000255

AREVA	DESCRIPTION			
	Browns Ferry N2G Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/13/07	N2GNV-CPS1	11 OF 25	

R136

000256

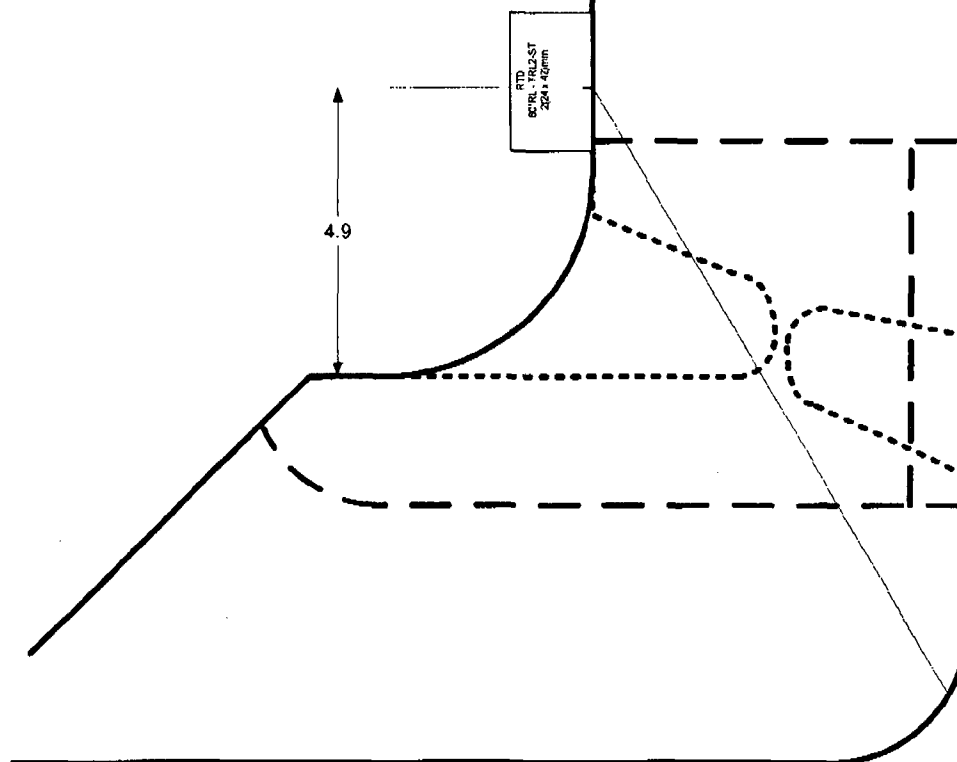
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



A AREVA	DESCRIPTION Browns Ferry N2G Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/13/07	TITLE N2GNV-CPS2	PAGE 12 OF 25

R136

000257

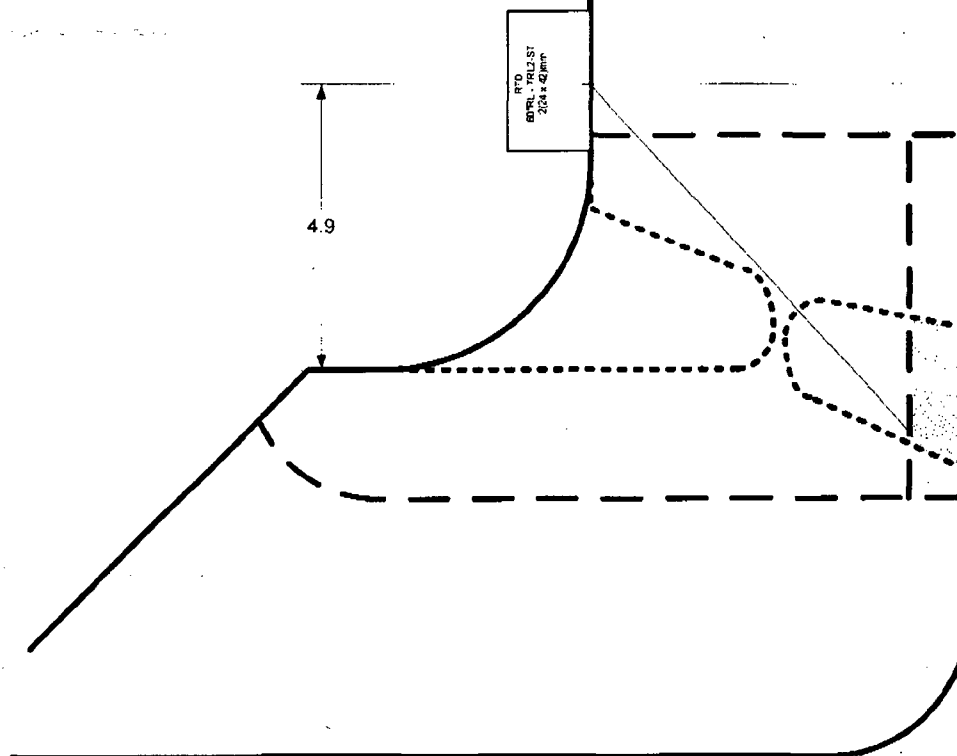
Nozzle-to-Shell weld examination coverage for circumferential scan


Total area of examination volume: 47.5 sq. in.
Total area of outer 85%-t exam volume achieved: 11.5 sq. in.
Total area of inner 15%-t volume: 5.7 sq. in.
Total area of inner 15%-t exam volume achieved: 5.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

Measurements based on modeling report,
design drawings, and as-found measurements.



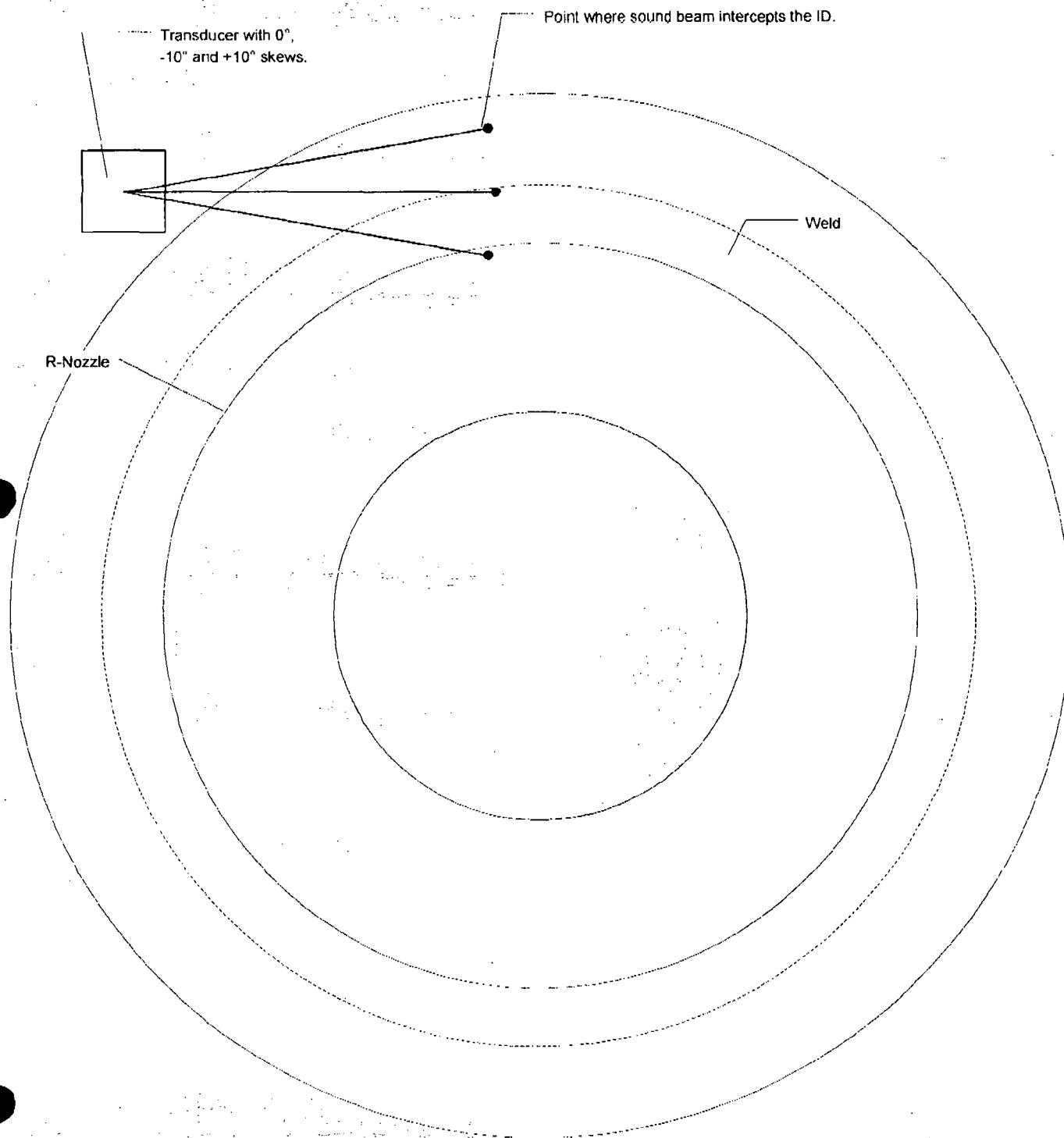
	DESCRIPTION		
	Browns Ferry N2G Nozzle-to-Shell Weld Coverage Plot		
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/13/07	N2GNV-CPS3	13 OF 25

R136

000258

Top View

Measurements based on modeling report,
design drawings, and as-found measurements.





AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000259

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2GNV-CDS1				ISI Report Number: <i>R136</i>			
Component ID: N2G-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PR		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: *50°	
RANGE	Range: 7.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -120°		Measured Skew Angle: *+120°	
	Delay: 7.77"			Mode: Shear		Radius: 3.5"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: N/A		S/N: N/A	
	Reject: Off			Reflector: N/A		N/A	
	Pulse Width: 222nS			Sweep: N/A		N/A	
	Damping: 500 Ω			Amplitude: N/A		N/A	
PULSER	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: N/A		N/A	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 71 °F		Therm. SN: VH-9520	
			Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 3.6 div	Amplitude: 80 %FSH	Gain: 60.2 dB
Cal In: Date 03/13/07 Time 1143	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/13/07 Time 1602

Comments

7" of soundpath delayed off screen to display 7" to 14" on A-scan.

*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge (product code 365-043-122). The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II Date: 03/13/07	Examiner: N/A Signature:	Level: N/A Date: N/A
AREVA Review: Adam Coniff Signature: <i>Adam Coniff</i>	Level: III Date: 03/18/07	Page 14 of 25	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000260

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2GNV-CDS2		ISI Report Number: R136	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer	
Manufacture: Slaveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 01C4NX	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 40°	Measured Angle: 39°
RANGE	Range: 7.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: +120°	Measured Skew Angle: *-120°
	Delay: 6.71"	Mode: Shear	Radius: 3.5"
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25MHz	Type: N/A	S/N: N/A
	Reject: Off	Reflector: N/A	N/A
	Pulse Width: 222nS	Sweep: N/A	N/A
	Damping: 500 Ω	Amplitude: N/A	N/A
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: N/A	N/A
PULSER	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat
		Temperature: 71 °F	Therm. SN: VH-9520
Couplant: Ultragel II		Batch No.: 05325	

Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 2.7 div	Amplitude: 80 %FSH	Gain: 55.0 dB
Cal In: Date 03/13/07 Time 1152	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/13/07 Time 1555

Comments
6" of soundpath delayed off screen to display 6" to 13" on A-scan.
*Transducer incorrectly labeled +120° skew by the manufacturer; however actual skew is -120°.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/13/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Con Signature: <i>Adam Con</i>	Level: III	Date: 03/18/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000261

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2GNV-CDS3

ISI Report Number: R136

Component ID: N2G-NV

Component Description: N2 Nozzle-to-Vessel Weld

Examination Procedure: 54-ISI-850-06

Applicable SDCN(s): 30-9044520-000

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 0111PL	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 60°	Measured Angle: 59°
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±(33° to 66°)	Measured Skew Angle: N/A
	Delay: 9.22"	Mode: Shear	Radius: N/A
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25MHz	Type: N/A	S/N: N/A
	Reject: Off	Reflector: N/A	N/A
	Pulse Width: 222nS	Sweep: N/A	N/A
	Damping: 500Ω	Amplitude: N/A	N/A
PULSER	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: N/A	N/A
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat
		Temperature: 71 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 4.5 div	Amplitude: 80 %FSH	Gain: 59.2 dB
Cal In: Date 03/13/07 Time 1131	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/13/07 Time 1603

Comments

8" soundpath delayed off screen to display from 8" to 16" on the A-scan.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/13/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/18/07			



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

C00262

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2GNV-CDS4		ISI Report Number: R136	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-305	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 60°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS-125mm	Squint Angle: 5°
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect.
	Delay: 1.34"	Cable Type: RG-174	Length: 12'
	Velocity: 0.227 in / μ S	Intermediate Connectors: 0	Configuration: Dual - SBS
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector: N/A	N/A
	Reject: Off	Sweep: N/A	N/A
	Pulse Width: 222 nS	Amplitude: N/A	N/A
PULSER	Damping: 500 Ω	Gain: N/A	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 71 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: 1/4-t SDH	Sweep: 3.7 div	Amplitude: 80 %FSH	Gain: 58.4 dB
Cal In: Date 03/13/07 Time 1158	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/13/07 Time 1557

Comments

Zone 1 - Near Surface calibration.

Examiner: Bret Flesner	Level: II	Date: 03/13/07	Examiner: N/A	Level: N/A	Date: N/A
Signature: <i>Bret Flesner</i>			Signature		
AREVA Review: Adam Conti	Level: III	Date: 03/18/07			
Signature: <i>Adam Conti</i>					



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000263

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2GNV-CDS5		ISI Report Number: R136	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-305	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 60°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.227 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector:	N/A
	Reject: Off	Sweep:	N/A
	Pulse Width: 222 nS	Amplitude:	N/A
	Damping: 500 Ω	Gain:	N/A
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 71 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 73.2 dB
Cal In: Date 03/13/07 Time 1158	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/13/07 Time 1557

Comments

Zone 2 - Full Volume calibration.

Examiner: Bret Flesner	Level: II	Date: 03/13/07	Examiner: N/A	Level: N/A	Date: N/A
Signature: <i>Bret Flesner</i>			Signature		
AREVA Review: Adam Conto	Level: III	Date: 03/18/07			
Signature: <i>Adam Conto</i>					



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000264

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2GNV-CDS6		ISI Report Number: R136	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-79 Revision 1		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 113-242-591
Model: Sonic 136		Serial Number: 00XT7F	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 45°	Measured Angle: 45°
RANGE	Range: 10.0° <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: N/A	Measured Skew Angle: N/A
	Delay: 0.380"	Mode: Shear	Radius: Flat
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 6'	Intermediate Connectors: 0
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25MHz	Type: CS Rompas	S/N: 791413
	Reject: Off	Reflector:	2" Reflector 8" Reflector
	Pulse Width: 222nS	Sweep:	2.0 div. 8.0 div.
	Damping: 500 Ω	Amplitude:	80 %FSH 80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	19.4 dB 45.2 dB
PULSER	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat
		Temperature: 70 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: (See Verification)	Sweep: (See Verification)	Amplitude: N/A	Gain: N/A
Cal In: Date 03/14/07 Time 0938	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/14/07 Time 1208

Comments

This full volume calibration used to locate and characterize flaw indication prior to sizing.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/18/07	Page 19 of 25		



AREVA

Reactor Pressure Vessel
Manual Ultrasonic Calibration Data Sheet

000265

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2GNV-CDS7				ISI Report Number: <u>R136</u>			
Component ID: N2G-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-79 Revision 1				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 113-242-591	
Model: Sonic 136				Serial Number: 00XT7F		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50"		Shape: Round	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 45°		Measured Angle: 45°	
RANGE	Range: 4.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: N/A		Measured Skew Angle: N/A	
	Delay: 2.38"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 2" Reflector		5" Reflector	
	Pulse Width: 222nS			Sweep: 0.0 div.		7.5 div.	
PULSER	Damping: 500 Ω			Amplitude: 80 %FSH		20 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 23.4 dB		34.4 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 70 °F		Therm. SN: VH-9520	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: (See Verification)		Sweep: (See Verification)		Amplitude: N/A		Gain: N/A	
Cal In: Date 03/14/07 Time 0941		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/14/07 Time 1211	
Comments							
This "depth zone" calibration used for sizing information. 2" soundpath delayed off screen to display 2" to 6" on A-scan. 1/2-t SDH in basic calibration block 5.2 divisions @ 40.4 dB.							
Examiner: Bret Flesner Signature: <u>Bret Flesner</u>		Level: II		Date: 03/14/07		Examiner: N/A Signature:	
AREVA Review: Adam Cont Signature: <u>Adam Cont</u>		Level: III		Date: 03/18/07		Level: N/A Date: N/A	



AREVA

Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000266

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2GNV-CDS8				ISI Report Number: <i>R136</i>			
Component ID: N2G-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-79 Revision 1				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 113-242-591	
Model: Sonic 136				Serial Number: 006YLP		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50"		Shape: Round	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 14.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: N/A		Measured Skew Angle: N/A	
	Delay: 0.594"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 2" Reflector		14" Reflector	
PULSER	Pulse Width: 222nS			Sweep: 1.4 div.		10.0 div.	
	Damping: 500 Ω			Amplitude: 80 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 25.2 dB		48.2 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 70 °F		Therm. SN: VH-9520	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: (See Verification)		Sweep: (See Verification)		Amplitude: N/A		Gain: N/A	
Cal In: Date 03/14/07 Time 0955		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/14/07 Time 1214	
Comments							
This full volume calibration used to locate and characterize flaw indication prior to sizing.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II		Date: 03/14/07		Examiner: N/A Signature:	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III		Date: 03/18/07		Level: N/A Date: N/A	



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000267

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2GNV-CDS9		ISI Report Number: R136		
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld		
Examination Procedure: N-UT-79 Revision 1		Applicable SDCN(s): N/A		
Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 113-242-591	
Model: Sonic 136		Serial Number: 006YLP	Frequency: 2.25 MHz	
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round	
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 60°	Measured Angle: 59°	
RANGE	Range: 6.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: N/A	Measured Skew Angle: N/A	
	Delay: 2.44"	Mode: Shear	Radius: Flat	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 6'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25MHz	Type: CS Rompas	S/N: 791413	
PULSER	Reject: Off	Reflector:	2" Reflector	8" Reflector
	Pulse Width: 222nS	Sweep:	0.0 div.	10.0 div.
	Damping: 500 Ω	Amplitude:	80 %FSH	15 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	26.6 dB	40.8 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat	
		Temperature: 70 °F	Therm. SN: VH-9520	
Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information				
Reflector: (See Comments)	Sweep: (See Comments)	Amplitude: (See Comments)	Gain: (See Comments)	
Cal In: Date 03/14/07 Time 1000	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/14/07 Time 1216	
Comments				
This "depth zone" calibration used for sizing information. 2" soundpath delayed off screen to display 2" to 8" on A-scan.				
1/4-t SDH in basic calibration block 1.3 divisions @ 42.8 dB.				
1/2-t SDH in basic calibration block 6.0 divisions @ 51.0 dB.				
Examiner: Bret Flesner	Level: II	Date: 03/14/07	Examiner: N/A	
Signature: <i>Bret Flesner</i>			Signature	
AREVA Review: Adam Conti	Level: III	Date: 03/18/07		
Signature: <i>Adam Conti</i>				

**AREVA**

Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000263

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2GNV-CDS10		ISI Report Number: <i>R136</i>	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-79 Revision 1		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Gamma RHP 242-043
Model: Sonic 136		Serial Number: 00YH67	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 0°	Measured Angle: N/A
RANGE	Range: 10.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: N/A	Measured Skew Angle: N/A
	Delay: 0.101"	Mode: Longitudinal	Radius: N/A
	Velocity: 0.229 in / μ S	Cable Type: RG-174 Length: 6'	Intermediate Connectors: 0
RCVR	Verification Block		
	Type: CS Rompas		S/N: 791413
	Reflector:	1" Backwall	10" Backwall
	Sweep:	1.0 div.	10.0 div.
	Amplitude:	N/A	N/A
	Gain:	N/A	N/A
PULSER	Basic Calibration Block		
	Block ID: BF-18		Material: Clad CS
	Thickness: 6.0" with 0.125" clad		Diameter: Flat
	Temperature: 70 °F		Therm. SN: VH-9520
	Couplant: Ultragel II		Batch No.: 05325
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.		

Reference Sensitivity Information

Reflector: N/A	Sweep: N/A	Amplitude: N/A	Gain: N/A
Cal In: Date 03/14/07 Time 1005	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/14/07 Time 1218

Comments

Calibration used for thickness measurements only.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/18/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000269

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2GNV-CDS11		ISI Report Number: R136	
Component ID: N2G-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-305	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 60°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS-125mm	Squint Angle: 5°
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.227 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector: N/A	N/A
	Reject: Off	Sweep: N/A	N/A
	Pulse Width: 222 nS	Amplitude: N/A	N/A
PULSER	Damping: 500 Ω	Gain: N/A	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 70 °F	Therm. SN: VH-9520
	Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information

Reflector: 1/4-t SDH	Sweep: 3.7 div	Amplitude: 80 %FSH	Gain: 58.4 dB
Cal In: Date 03/14/07 Time 0932	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/14/07 Time 1222

Comments

Zone 1 - Near Surface calibration.

This calibration used to locate flaw prior to sizing.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/18/07	Page 24 of 25		



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000270

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2GNV-CDS12

ISI Report Number: R136

Component ID: N2G-NV

Component Description: N2 Nozzle-to-Vessel Weld.

Examination Procedure: N-UT-78 Revision 4

Applicable SDCN(s): N/A

Ultrasonic Instrument

Manufacture: Staveley

Model: Sonic 136

Serial Number: 136P1200G081456

Linearity Sheet No.: LDS2

Transducer

Manufacture: RTD

Serial Number: 07-305

Angle: 60°

Mode: Refracted Longitudinal

Focus: FS~125mm

Model: TRL2-ST

Frequency: 2 MHz

Measured Angle: 60°

Size: 2(24x42)mm

Squint Angle: 5°

Instrument SettingsRange: 18.0" ☒ Sound Path ☐ Depth

Delay: 1.34"

Velocity: 0.227 in / μ S

of Elements: 2

Shape: Rect.

Configuration: Dual - SBS

Cable Type: RG-174 Length: 12' Intermediate Connectors: 0

Verification Block

Display: Filt 2

Frequency: 2.25 MHz

Reject: Off

Pulse Width: 222 nS

Damping: 500 Ω Mode: ☐ Pulse Echo ☒ Dual

Rep Rate: 2kHz

Pulser: ☐ 150V ☐ 300V (*Sonic 137 only)

Type: N/A

S/N: N/A

Reflector:

N/A

N/A

Sweep:

N/A

N/A

Amplitude:

N/A

N/A

Gain:

N/A

N/A

Basic Calibration Block

Block ID: BF-18

Material: CS

Thickness: 6.0" with 0.125" Clad

Diameter: Flat

Temperature: 70 °F

Therm. SN: VH-9520

Couplant: Ultragel II

Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch

Sweep: 6.3 div

Amplitude: 80 %FSH

Gain: 73.2 dB

Cal In: Date 03/14/07 Time 0934

Check: Date N/A Time N/A

Check: Date N/A Time N/A

Out: Date 03/14/07 Time 1225

Comments

Zone 2 - Full Volume calibration.

This calibration used to locate flaw prior to sizing.

Examiner: Bret Flesner

Signature:

Level: II

Date: 03/14/07

Examiner: N/A

Signature

Level: N/A

Date: N/A

AREVA Review: Adam Conti

Signature:

Level: III

Date: 03/18/07

Examination Report, R-143
N2H-NV, RPV Nozzle-To-Head Weld

RPV Nozzle Ultrasonic Examination Summary Sheet

000271

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R143
Component Number: N2H-NV		Component Description: N2 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N2ANV-CDS1		N2ANV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N2ANV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N2ANV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N2ANV-CDS4				
N2ANV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 50%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner	Date: 3/20/07	Reviewed by: Adam Con...	Date: 3/21/07
Signature: <i>Bret Flesner</i>		Signature: <i>Adam Con...</i>	
Customer: Matt Welch	Date: 3/22/07	ANII:	Date: 5/21/07
Signature: <i>Matt Welch</i>		Signature: <i>Adam Con...</i>	



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N2HNV-EDS1		ISI Report Number: R143	
Component ID: N2H-NV		Component Description: N2 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0270-C-01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N2HNV-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000					Scan Surface: OD Blend Radius			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
*50°S	-120°	N2HNV-CDS1	03/12/07	1101	84°F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
40°S	+120°	N2HNV-CDS2	03/12/07	1031	84°F	VH-9525	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000					Scan Surface: OD Vessel Shell			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60°S	±33° to 66°	N2HNV-CDS3	03/12/07	1421	82°F	VH-9520	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	

Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A					Scan Surface: OD Vessel Shell			
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2HNV-CDS4	03/12/07	1525	82°F	VH-9520	78.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2HNV-CDS5	03/12/07	1605	82°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2HNV-CDS4	03/12/07	1525	82°F	VH-9520	78.4 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2HNV-CDS5	03/12/07	1605	82°F	VH-9520	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments:

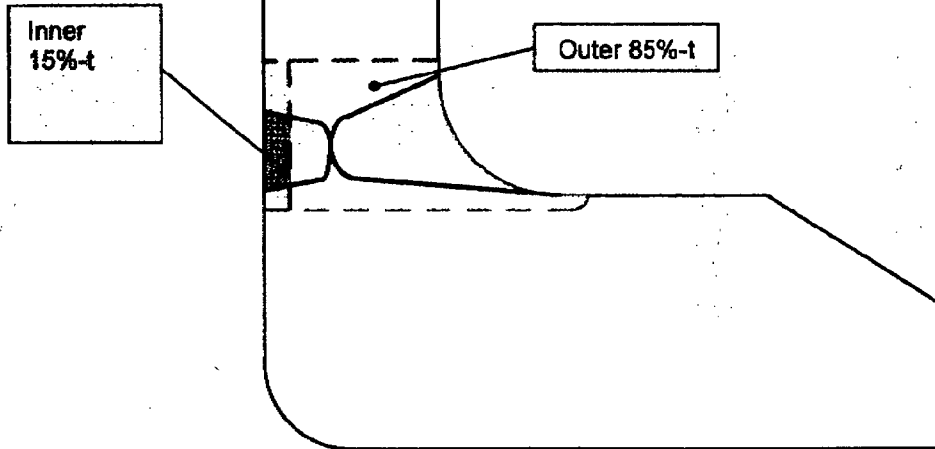
* See note on calibration data sheet for details relating to the 50° measured angle.

Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/12/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: Bret Fleisher Signature: <i>Bret Fleisher</i>	Level: II	Date: 03/12/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Costi Signature: <i>Adam Costi</i>	Level: III	Date: 03/21/07			

000272

RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N2H-NV	Coverage Worksheet #: N2HNV-CWS1	ISI Report #: R143
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 47.5 ² inches	^D Inner 15%-t Examination Volume: 5.7 ² inches	^G Outer 85%-t Examination Volume: 41.8 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 27.1 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 14.9 ² inches
^C Percentage of Axial Coverage: 57%	^F Inner 15%-t Volume Achieved: 5.7 ² inches	^J Total Circumferential Examination Coverage: 43%
$B + A \times 100 = C$	$(F + H) + A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage		
^L Total Examination Coverage: 50%		
$(C + J) + 2 \times 100 = L$		
Prepared by: Bret Flesner	Date: 03/21/07	Reviewed by: Adam Conti
		Date: 03/21/07

A	DESCRIPTION			
	Browns Ferry N2H Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/20/07	N2HNV-CPS1	4 OF 11	

000274

R143

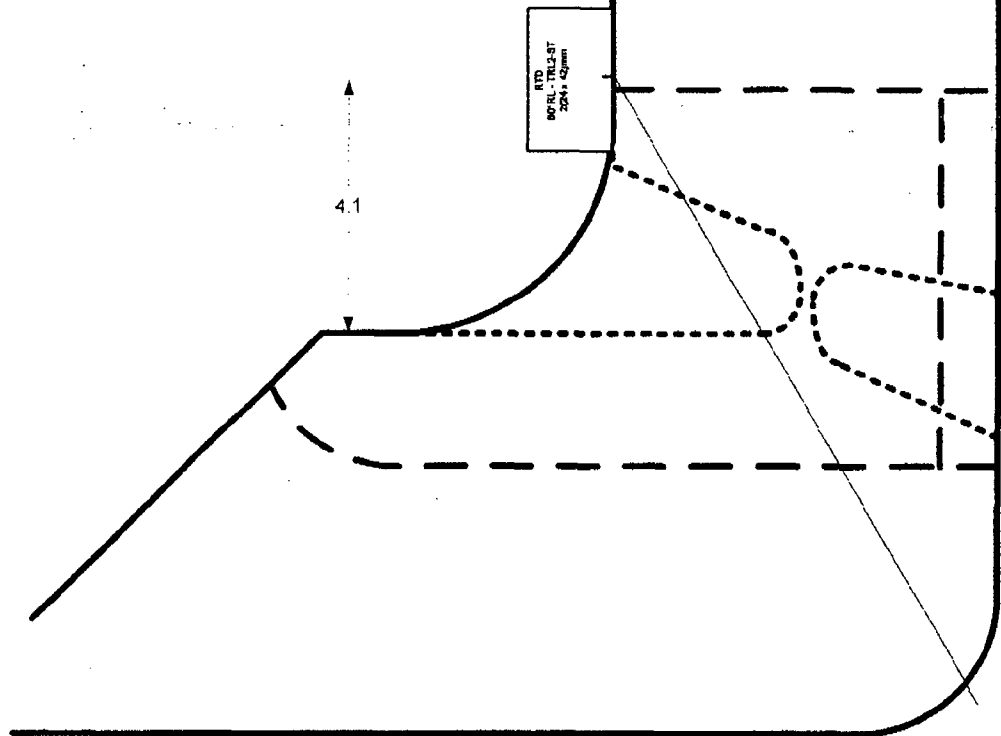
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.

Total area of examination volume achieved: 27.1 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



A	DESCRIPTION			
	Browns Ferry N2H Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/20/07	N2HNV-CPS2	5 OF 11	

R143

000275

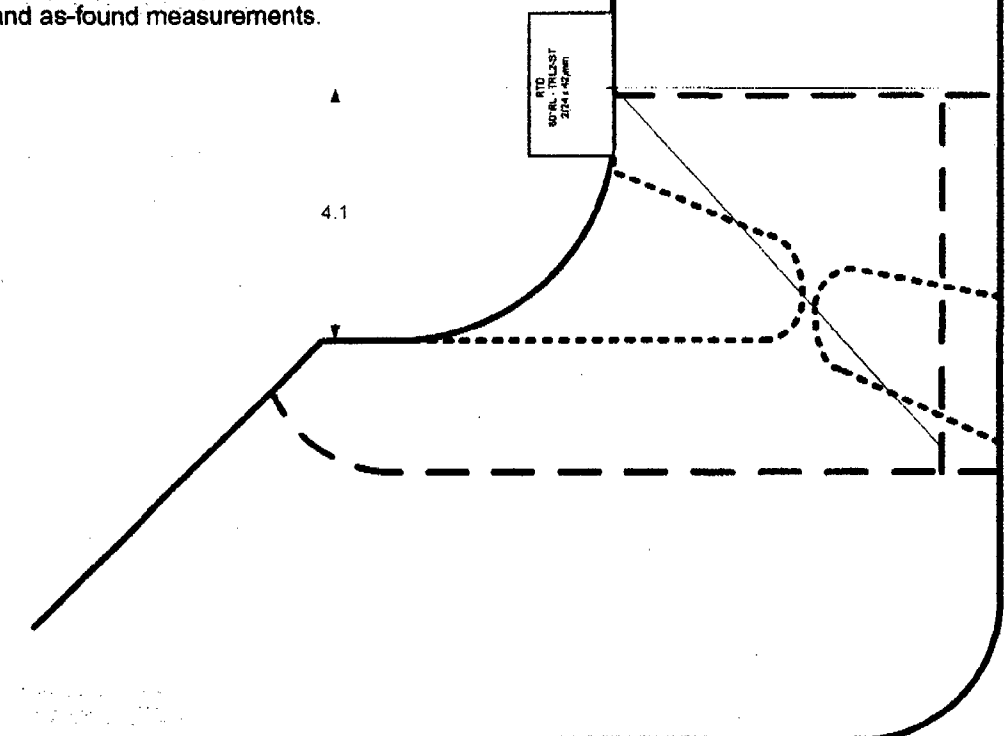
Nozzle-to-Shell weld examination coverage for circumferential scan


Total area of examination volume: 47.5 sq. in.
 Total area of outer 85%-t exam volume achieved: 14.9 sq. in.
 Total area of inner 15%-t volume: 5.7 sq. in.
 Total area of inner 15%-t exam volume achieved: 5.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
 100% of the accessible surface scanned.

Inner 15%-t area examined from the
 blend with Supplement 5 techniques.

Measurements based on modeling report,
 design drawings, and as-found measurements.



	DESCRIPTION Browns Ferry N2H Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/20/07	TITLE N2HNV-CPS3	PAGE 6 OF 11

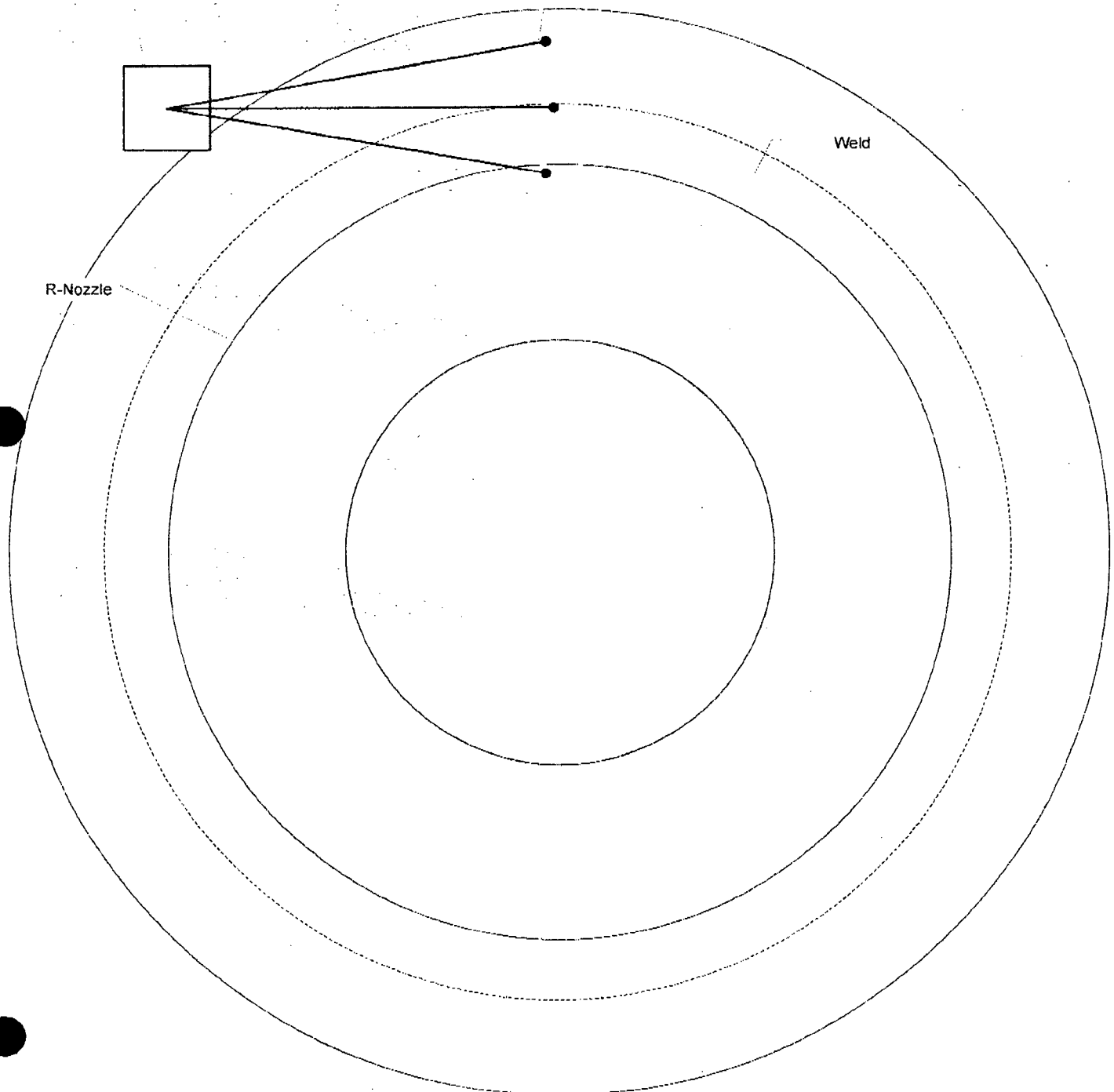
000276

R143

Top View
Measurements based on modeling report,
design drawings, and as-found measurements.

Transducer with 0°,
-10° and +10° skews.

Point where sound beam intercepts the ID.





Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000277

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2HNV-CDS1				ISI Report Number: R143			
Component ID: N2H-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PR		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -120°		Measured Skew Angle: *+120°	
	Delay: 0.587"			Mode: Shear		Radius: 3.5"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.6 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		70 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		29.8 dB 29.8 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 69 °F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.1 div		Amplitude: 80 %FSH		Gain: 58.2 dB	
Cal In: Date 03/12/07 Time 0815		Check: Date 03/12/07 Time 1100		Check: Date N/A Time N/A		Out: Date 03/12/07 Time 1200	
Comments							
*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge (product code 365-043-122). The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II		Date: 03/12/07		Examiner: N/A Signature: _____	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III		Date: 03/21/07		Level: N/A Date: N/A	



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000278

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2HNV-CDS2				ISI Report Number: R143			
Component ID: N2H-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 01C4NX		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: *-120°	
	Delay: 0.587"			Mode: Shear		Radius: 3.5"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Fil2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.6 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		70 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		28.0 dB 28.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 69 °F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 49.2 dB	
Cal In: Date 03/12/07 Time 0810		Check: Date 03/12/07 Time 1030		Check: Date N/A Time N/A		Out: Date 03/12/07 Time 1155	
Comments							
*Transducer incorrectly labeled +120° skew by the manufacturer; however actual skew is -120°.							
Examiner: George Chapman Signature:		Level: II		Date: 03/12/07		Examiner: N/A Signature:	
AREVA Review: Adam Conti Signature:		Level: III		Date: 03/21/07		Level: N/A Date: N/A	

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000279

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2HNV-CDS3

ISI Report Number: *R143*

Component ID: N2H-NV

Component Description: N2 Nozzle-to-Vessel Weld

Examination Procedure: 54-ISI-850-06

Applicable SDCN(s): 30-9044520-000

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 60°	Measured Angle: 59°
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±33° to 66°	Measured Skew Angle: N/A
	Delay: 0.813"	Mode: Shear	Radius: Flat
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0	
RCVR	Display: Fill2	Verification Block	
	Frequency: 2.25 MHz	Type: N/A	S/N: N/A
	Reject: Off	Reflector:	N/A N/A
	Pulse Width: 222 nS	Sweep:	N/A N/A
	Damping: 500 Ω	Amplitude:	N/A N/A
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	N/A N/A
PULSER	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
		Temperature: 68 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 5.8 div	Amplitude: 80 %FSH	Gain: 60.8 dB
Cal In: Date 03/12/07 Time 1210	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/12/07 Time 1725

Comments

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/12/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conity Signature: <i>Adam Conity</i>	Level: III	Date: 03/21/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000280

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2HNV-CDS4		ISI Report Number: R143	
Component ID: N2H-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-305	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 60°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.227 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector: N/A	N/A
	Reject: Off	Sweep: N/A	N/A
PULSER	Pulse Width: 222 nS	Amplitude: N/A	N/A
	Damping: 500 Ω	Gain: N/A	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 68 °F	Therm. SN: VH-9520
	Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information

Reflector: 1/4-t SDH	Sweep: 3.7 div	Amplitude: 80 %FSH	Gain: 58.4 dB
Cal In: Date 03/12/07 Time 1220	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/12/07 Time 1720

Comments

Zone 1 - Near Surface calibration.

Examiner: Bret Flesner	Level: II	Date: 03/12/07	Examiner: N/A	Level: N/A	Date: N/A
Signature: <i>Bret Flesner</i>			Signature		
AREVA Review: Adam Cont	Level: III	Date: 03/21/07			
Signature: <i>Adam Cont</i>					



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000281

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2HNV-CDS5				ISI Report Number: R143			
Component ID: N2H-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 60°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A	S/N: N/A		
	Frequency: 2.25 MHz			Reflector:	N/A		N/A
	Reject: Off			Sweep:	N/A		N/A
	Pulse Width: 222 nS			Amplitude:	N/A		N/A
	Damping: 500 Ω			Gain:	N/A		N/A
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 68 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
	Reference Sensitivity Information						
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 73.2 dB	
Cal In: Date 03/12/07 Time 1224		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/12/07 Time 1722	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/12/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conth Signature: <i>Adam Conth</i>		Level: III	Date: 03/21/07				

Examination Report, R-174
N2K-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000282

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: <i>R174</i>
Component Number: N2K-NV		Component Description: N2 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0270-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 3 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N2KNV-CDS1		N2KNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N2KNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N2KNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N2KNV-CDS4				
N2KNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N2 Nozzle Modeling Parameters

Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
50°S	+120°	Blend Radius
60°S	±(33°-66°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Thomas Brown Signature: <i>Tom Brown</i>	Date: 3/21/07	Reviewed by: <i>Adam Conti</i> Signature: <i>Adam Conti</i>	Date: 4/11/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 4/16/07	ANII: <i>Sam Flank</i> Signature: <i>Sam Flank</i>	Date: 5/21/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
Examination Data Sheet Number: N2KNV-EDS1 ISI Report Number: R174
Component ID: N2K-NV Component Description: N2 Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0270-C-01 W_c Location: Nozzle Boss (Rnozzle) L₃ Location: Nozzle TDC
Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N2KNV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*50° / s	-120°	N2KNV-CDS1	3/21/07	1145	88°F	VH-9520	71.8 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
40° / s	+120°	N2KNV-CDS2	3/21/07	1127	88°F	VH-9520	71.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60° / s	±33° to 66°	N2KNV-CDS3	3/21/07	1107	88°F	VH-9520	72.6 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A						Scan Surface: OD Vessel/ Shell		
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2KNV-CDS4	3/21/07	1000	88°F	VH-9520	79.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N2KNV-CDS5	3/21/07	1032	88°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2KNV-CDS4	3/21/07	1000	88°F	VH-9520	79.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N2K NV-CDS5	3/21/07	1032	88°F	VH-9520	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

* See calibration data sheet for additional details on the 50° shear examination.

Examiner: Thomas Brown Signature: <i>Tom Brown</i>	Level: II	Date: 3/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 4/11/07			



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N2K-NV	Coverage Worksheet #: N2KNV-CWS1	ISI Report #: 15174
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Outer 85%-t


Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^a Required Examination Volume: 47.5 ² inches	^b Inner 15%-t Examination Volume: 5.7 ² inches	^c Outer 85%-t Examination Volume: 41.8 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^d Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^e Total Axial Volume Achieved: 24.3 ² inches	Description of Limitation: N/A	^f Outer 85%-t Volume Achieved: 11.5 ² inches
^g Percentage of Axial Coverage: 51%	^h Inner 15%-t Volume Achieved: 5.7 ² inches	ⁱ Total Circumferential Examination Coverage: 36%
$B + A \times 100 = C$	$(F + H) + A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage		
^jTotal Examination Coverage: 44%		
$(C + J) + 2 \times 100 = L$		
Prepared by: Bret Flesner <i>Bret Flesner</i>	Date: 03/21/07	Reviewed by: Adam Conti <i>Adam Conti</i>
		Date: 04/11/07
Page 3 of 11		

C00284

R174 000285

	DESCRIPTION			
	Browns Ferry N2K Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/21/07	N2KNV-CPS1	4 OF 11	

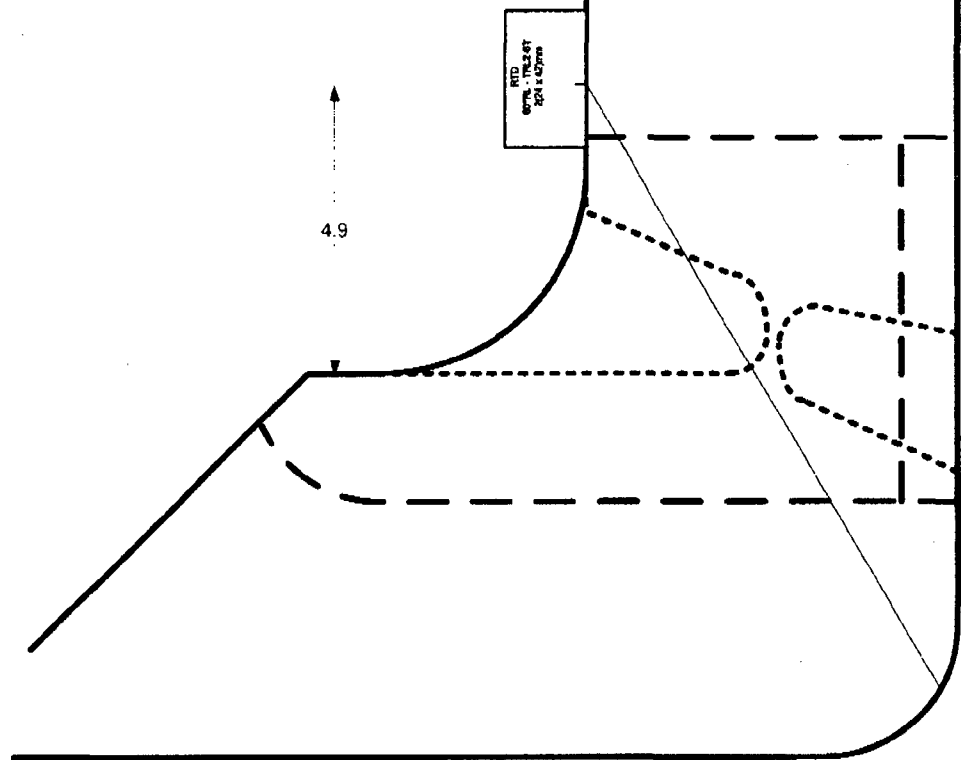
Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 47.5 sq. in.

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Measurements based on modeling report,
design drawings, and as-found measurements.



R174 000286

AREVA	DESCRIPTION			
	Browns Ferry N2K Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/21/07	N2KNV-CPS2	5 OF 11	

Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 47.5 sq. in.

Total area of outer 85%-t exam volume achieved: 11.5 sq. in.

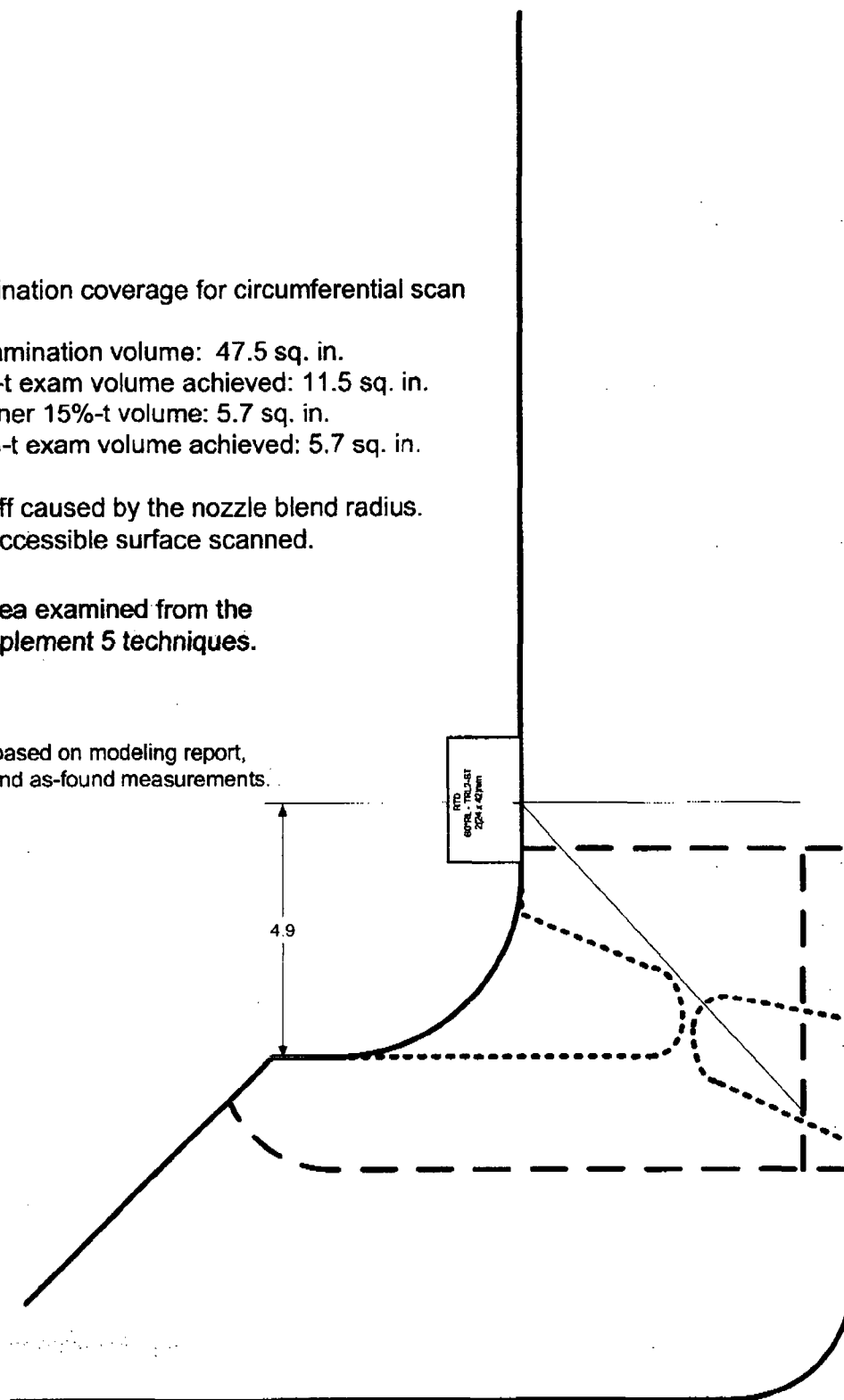
Total area of inner 15%-t volume: 5.7 sq. in.

Total area of inner 15%-t exam volume achieved: 5.7 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

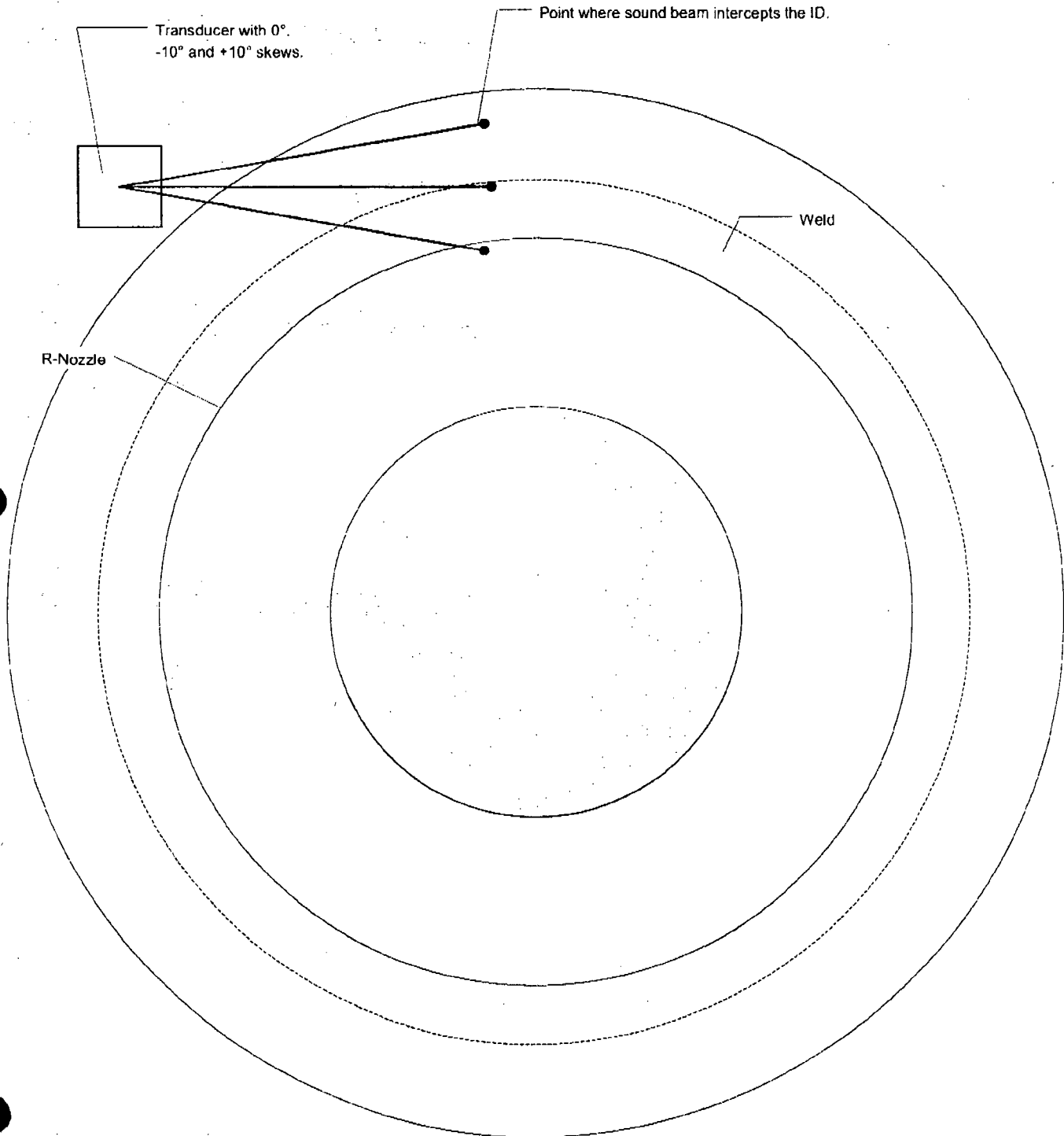
Measurements based on modeling report,
design drawings, and as-found measurements.



A AREVA	DESCRIPTION Browns Ferry N2K Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/21/07	TITLE N2KNV-CPS3	PAGE 6 OF 11

000287 R174

Top View
Measurements based on modeling report,
design drawings, and as-found measurements.





Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000288

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N2KNV-CDS1		ISI Report Number: <u>R174</u>	
Component ID: N2K-NV		Component Description: N2 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 0111PR	Frequency: 2.25 MHz	
Serial Number: 7031		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°	Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: -120°	Measured Skew Angle: * +120°	
	Delay: 0.519"	Mode: Shear	Radius: 3.5"	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 791413	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	36.4 dB	36.4 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 72 °F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.1 div	Amplitude: 80 %FSH	Gain: 62.6 dB
Cal In: Date 03/21/07 Time 0831	Check: Date 03/21/07 Time 1144	Check: Date N/A Time N/A	Out: Date 03/21/07 Time 1220

Comments

* During the calibration process a manufacturing error was discovered with the TVA supplied 40° -120° skew wedge. The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -120° skew but is actually +120°.

Examiner: Thomas Brown	Level: II	Date: 3/21/07	Examiner: N/A	Level: N/A	Date: N/A
Signature: <u>Thomas Brown</u>			Signature:		
AREVA Review: Adam Conti	Level: III	Date: 4/11/07			
Signature: <u>Adam Conti</u>			Page 7 of 11		



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000289

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2KNV-CDS2				ISI Report Number: <i>R174</i>			
Component ID: N2K-NV				Component Description: N2 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 01C4NX		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: * -120°	
	Delay: 0.519"			Mode: Shear		Radius: 3.5"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.6 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		70 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		36.0 dB 36.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 72°F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 58.0 dB	
Cal In: Date 03/21/07 Time 0834		Check: Date 03/21/07 Time 1126		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1222	
Comments							
* The transducer wedge is incorrectly labeled -120° skew by the manufacturer; however actual skew is +120°.							
Examiner: Thomas Brown		Level: II		Date: 03/21/07		Examiner: N/A	
Signature: <i>Thomas Brown</i>						Level: N/A Date: N/A	
AREVA Review: Adam Cotti		Level: III		Date: 4/11/07			
Signature: <i>Adam Cotti</i>						Page 8 of 11	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

600290

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2KNV-CDS3

ISI Report Number:

R174

Component ID: N2K-NV

Component Description: N2 Nozzle-to-Vessel Weld

Examination Procedure: 54-ISI-850-06

Applicable SDCN(s): 30-9044520-000

Ultrasonic Instrument

Manufacture: Staveley

Model: Sonic 136

Serial Number: 7031

Linearity Sheet No.: LDS4

Transducer

Manufacture: KBA

Serial Number: 0111PL

Size: 0.5" x 1.0"

of Elements: 1

Model: Benchmark 892-600

Frequency: 2.25 MHz

Shape: Rectangle

Configuration: Single

Instrument SettingsRange: 20.0" ☒ Sound Path ☐ Depth

Delay: 0.842"

Velocity: 0.127 in / μ S

Refracted Angle: 60°

Skew Angle: $\pm 33^\circ$ to 66°

Mode: Shear

Measured Angle: 59°

Measured Skew Angle: N/A

Radius: Flat

Cable Type: RG-174 Length: 12' Intermediate Connectors: 0

RANGE

RCVR

Display: Filt2

Frequency: 2.25 MHz

Reject: Off

Pulse Width: 222 nS

Damping: 500 Ω Mode: ☒ Pulse Echo ☐ Dual

Rep Rate: 2kHz

Pulser: ☐ 150V ☐ 300V (*Sonic 137 only)*Pulser voltage adjustable with the Sonic 137 instrument only.
The Sonic 136 has a fixed pulser voltage.**Verification Block**

Type: CS Rompas

S/N: 791413

Reflector: 1" Radius

2" Radius

Sweep: 0.6 div.

1.1 div.

Amplitude: 70 %FSH

80 %FSH

Gain: 33.8 dB

33.8 dB

PULSER

Basic Calibration Block

Block ID: BF-18

Material: Clad CS

Thickness: 6.0" with 0.125" Clad

Diameter: Flat

Temperature: 72 °F

Therm. SN: VH-9525

Couplant: Ultragel II

Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch

Sweep: 5.8 div

Amplitude: 80 %FSH

Gain: 65.8 dB

Cal In: Date 03/21/07 Time 0827

Check: Date 03/21/07 Time 1106

Check: Date N/A Time N/A

Out: Date 03/21/07 Time 1224

Comments

Examiner: Thomas Brown

Level: II

Date: 03/21/07

Examiner: N/A

Level: N/A

Date: N/A

Signature: *Thomas Brown*

Signature

AREVA Review: Adam Conti
Signature: *Adam Conti*

Level: III

Date: 4/11/07



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000291

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N2KNV-CDS4

ISI Report Number:

R174

Component ID: N2K-NV

Component Description: N2 Nozzle-to-Vessel Weld.

Examination Procedure: N-UT-78 Revision 4

Applicable SDCN(s): N/A

Ultrasonic Instrument

Manufacture: Staveley

Model: Sonic 136

Serial Number: 7031

Linearity Sheet No.: LDS4

Transducer

Manufacture: RTD

Serial Number: 07-305

Angle: 60°

Mode: Refracted Longitudinal

Focus: FS~125mm

Model: TRL2-ST

Frequency: 2 MHz

Measured Angle: 61°

Size: 2(24x42)mm

Squint Angle: 5°

Instrument SettingsRange: 8.00" ☒ Sound Path ☐ Depth

Delay: 1.38"

Velocity: 0.230 in / μ S

of Elements: 2

Shape: Rect.

Configuration: Dual - SBS

Cable Type: RG-174 Length: 12' Intermediate Connectors: 0

Verification Block

Display: Filt 2

Frequency: 2.25 MHz

Reject: Off

Pulse Width: 222 nS

Damping: 500 Ω Mode: ☐ Pulse Echo ☒ Dual

Type: CS Rompas

S/N: 791413

Reflector:

1" Radius

2" Radius

Sweep:

1.2 div.

2.5 div.

Amplitude:

25 %FSH

80 %FSH

Gain:

52.0 dB

52.0 dB

Basic Calibration Block

Rep Rate: 2kHz

Pulser: ☐ 150V ☐ 300V (*Sonic 137 only)

*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.

Block ID: BF-18

Material: Clad CS

Thickness: 6.0" with 0.125" Clad

Diameter: Flat

Temperature: 72 °F

Therm. SN: VH-9525

Couplant: Ultragel II

Batch No.: 05325

Reference Sensitivity Information

Reflector: 1/4-t SDH

Sweep: 3.8 div

Amplitude: 80 %FSH

Gain: 62.8 dB

Cal In: Date 03/21/07 Time 0823

Check: Date 03/21/07 Time 0959

Check: Date N/A Time N/A

Out: Date 03/21/07 Time 1226

Comments

Zone 1 - Near Surface calibration.

Examiner: Thomas Brown

Level: II

Date: 03/21/07

Examiner: N/A

Level: N/A

Date: N/A

Signature: *Thomas Brown*

Signature

AREVA Review: Adam Cop

Level: III

Date: 4/11/07

Signature: *Adam Cop*



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000292

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N2KNV-CDS5				ISI Report Number: <i>R174</i>			
Component ID: N2K-NV				Component Description: N2 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS-125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 791413	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	0.5 div.	1.1 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 72 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05320	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 77.2 dB	
Cal In: Date 03/21/07 Time 0824		Check: Date 03/21/07 Time 1031		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1228	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>		Level: II		Date: 03/21/07		Examiner: N/A Signature	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III		Date: 4/11/07		Level: N/A Date: N/A	

Examination Report, R-151
N3A-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000293

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R151
Component Number: N3A-NV	Component Description: N3 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0222-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 4 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N3ANV-CDS1		N3ANV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N3ANV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N3ANV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N3ANV-CDS4				
N3ANV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N3 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
50°S	-115°	Blend Radius
40°S	+115°	Blend Radius
60°S	±(52°-74°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 41%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus ½" on each side.

Prepared by: Bret Flesner Signature: <i>Bret Flesner</i>	Date: 3/22/07	Reviewed by: Adam Conitt Signature: <i>Adam Conitt</i>	Date: 3/23/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 3/27/07	ANII: Signature: <i>Adam Conitt</i>	Date: 5/24/07

A
AREVA

Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N3ANV-EDS1		ISI Report Number: <i>P151</i>	
Component ID: N3A-NV		Component Description: N3 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0222-C-01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N3A-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000				Scan Surface: OD Blend Radius			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*50°S	-115°	N3ANV-CDS1	03/22/07	1042	82° F	VH-8937	70.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
40°S	+115°	N3ANV-CDS2	03/22/07	1022	82° F	VH-8937	70.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000				Scan Surface: OD Vessel Shell			
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°S	±52° to 74°	N3ANV-CDS3	03/22/07	1000	82° F	VH-8937	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 rev.4				Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell				
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N3ANV-CDS4	03/22/07	1110	82° F	VH-8937	73.8 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N3ANV-CDS5	03/22/07	1140	82° F	VH-8937	84.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N3ANV-CDS4	03/22/07	1110	82° F	VH-8937	73.8 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N3ANV-CDS5	03/22/07	1140	82° F	VH-8937	75.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments:

* See calibration data sheet for additional details on the 50° shear examination.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/23/07			

000294

RPV Nozzle-To-Shell Weld

Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA

Plant: Browns Ferry

Unit: 2

Weld ID: N3A-NV

Coverage Worksheet #: N3ANV-CWS1

ISI Report #: R151

Inner
15%-t

Outer 85%-t

Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 60.2 ² inches		^D Inner 15%-t Examination Volume: 6.8 ² inches	^G Outer 85%-t Examination Volume: 53.4 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 29.6 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 12.9 ² inches
^C Percentage of Axial Coverage: 49%		^J Total Circumferential Examination Coverage: 33%	
$B \div A \times 100 = C$		$(F + H) \div A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage			
^LTotal Examination Coverage: 41%			
$(C + J) \div 2 \times 100 = L$			
Prepared by: Bret Flesner	Date: 03/22/07	Reviewed by: Adam Conti	Date: 03/23/07

00295

DESCRIPTION

Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot

DRAWN BY
Bret FlesnerDATE
03/22/07TITLE
N3ANV-CPS1PAGE
4 OF 11

R151

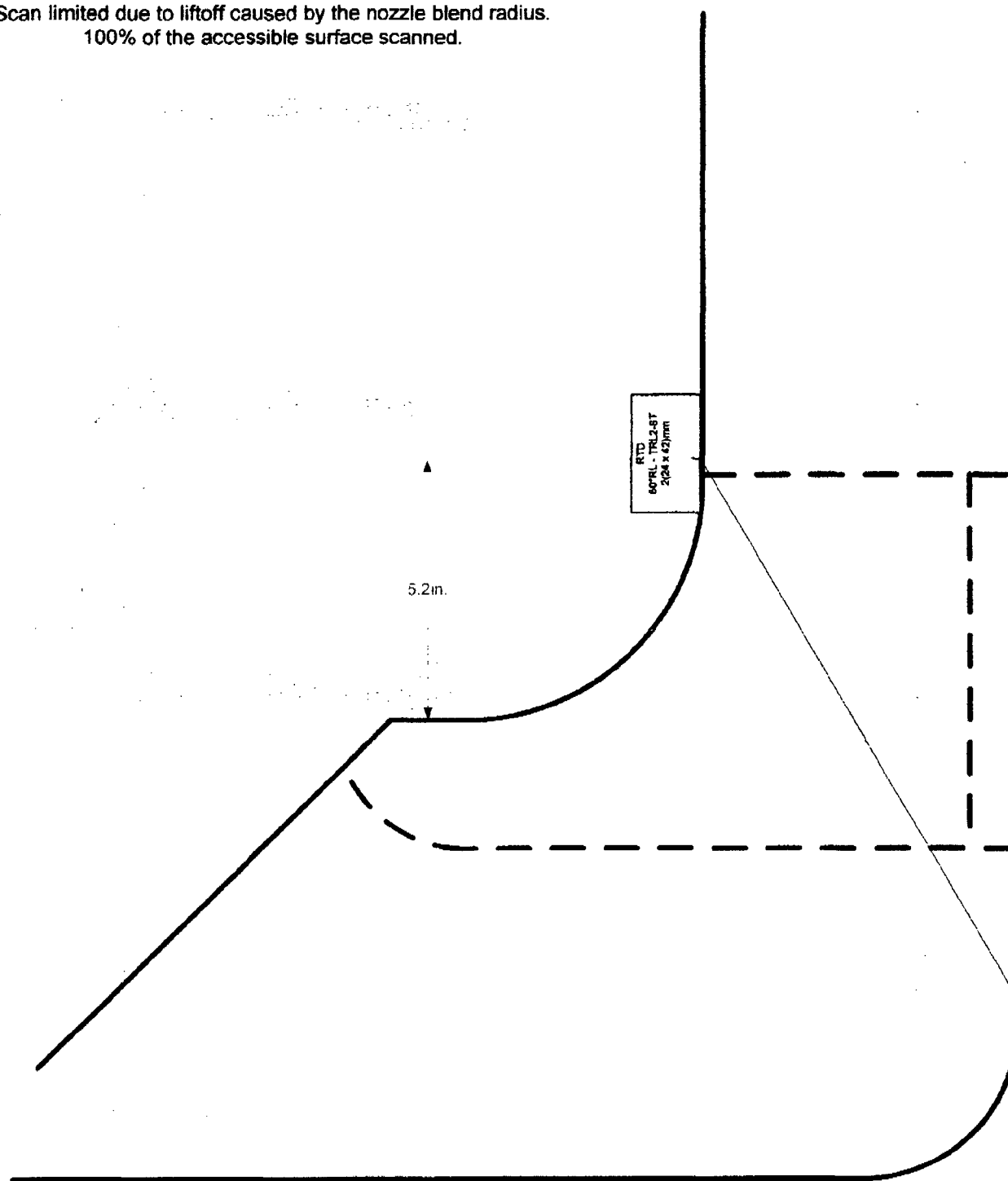
C00296


Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 60.2 sq. in. (TVA supplied)

Total area of examination volume achieved: 29.6 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.



			
DESCRIPTION			
Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/22/07	N3ANV-CPS2	5 OF 11

R151

000297

Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 60.2 sq. in. (TVA Supplied)

Total area of outer 85%-t exam volume achieved: 12.9 sq. in.

Total area of inner 15%-t volume: 6.8 sq. in.

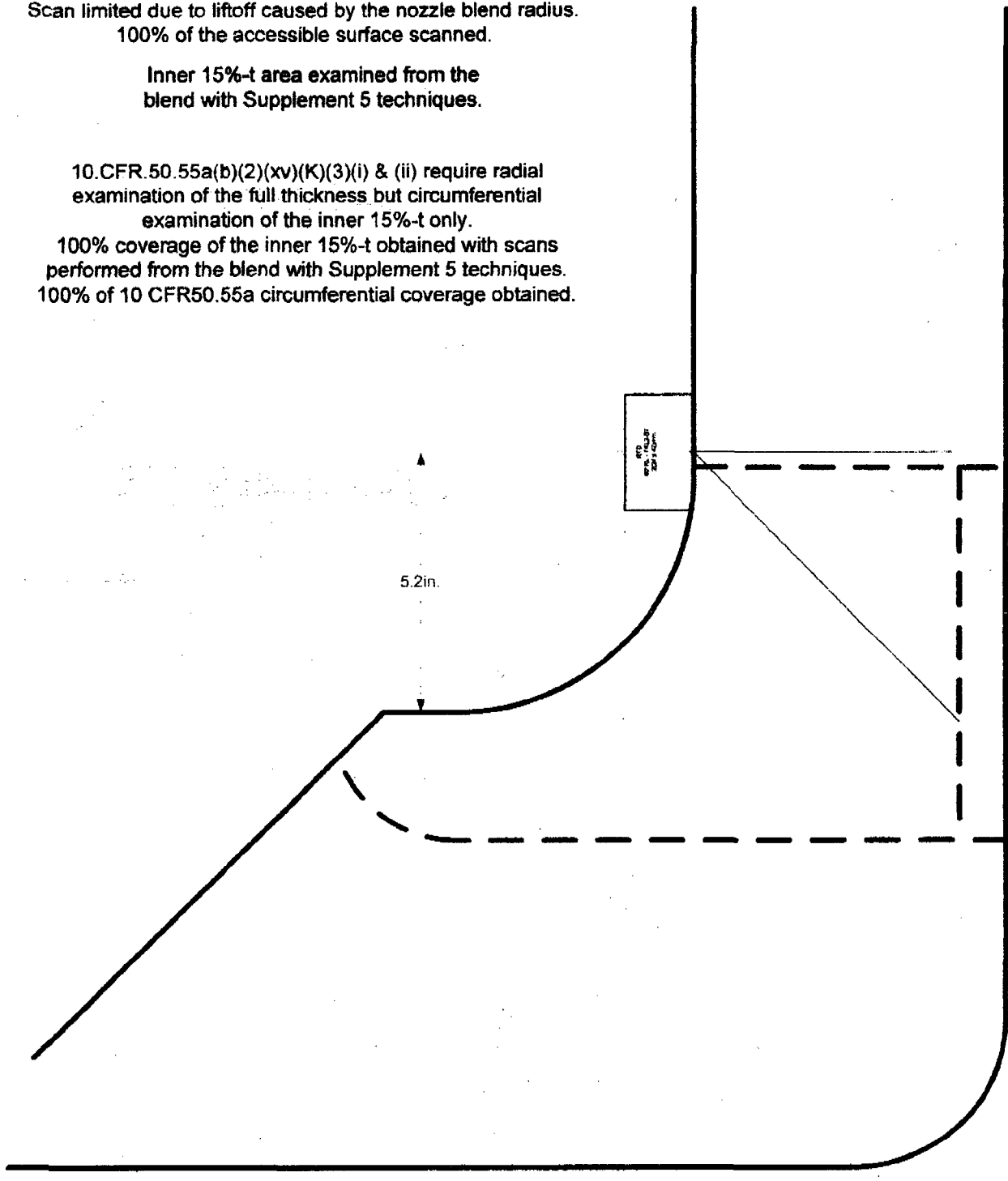
Total area of inner 15%-t exam volume achieved: 6.8 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

10.CFR.50.55a(b)(2)(xv)(K)(3)(i) & (ii) require radial
examination of the full thickness but circumferential
examination of the inner 15%-t only.

100% coverage of the inner 15%-t obtained with scans
performed from the blend with Supplement 5 techniques.
100% of 10 CFR50.55a circumferential coverage obtained.





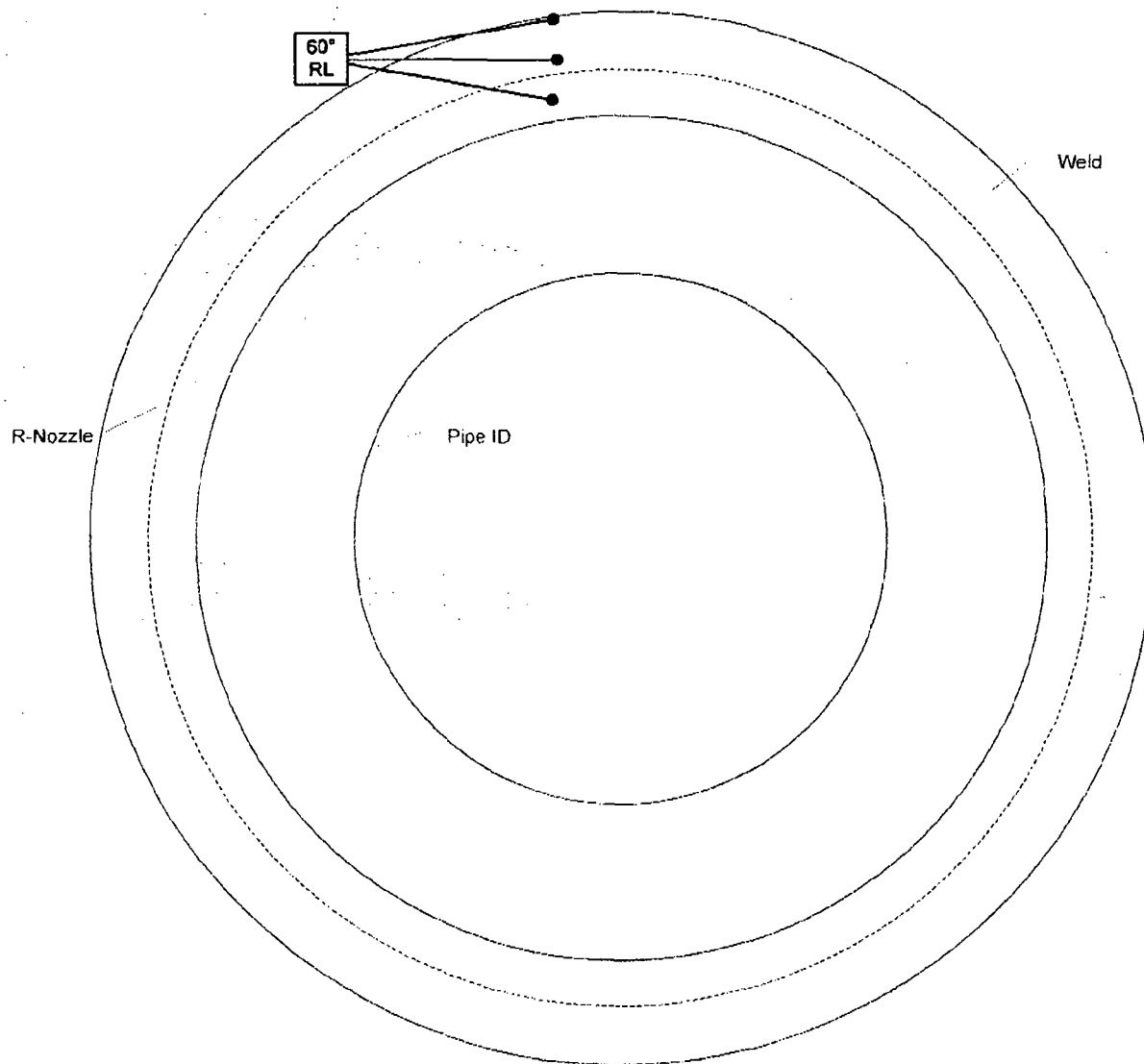
DESCRIPTION			
Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE
Bret Fiesner	03/22/07	N3ANV-CPS3	6 OF 11

R151

000298

Top View
Measurements based on modeling report, design
drawings, and as-found measurements.

Transducer showing - & + 10° skew angles





Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000299

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3ANV-CDS1				ISI Report Number: <i>R151</i>			
Component ID: N3A-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PV		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -115°		Measured Skew Angle: * +115°	
	Delay: .604"			Mode: Shear		Radius: 4.75"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.65 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		75 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		29.0 dB 29.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05125	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.1 div		Amplitude: 80 %FSH		Gain: 58.6 dB	
Cal In: Date 03/22/07 Time 0905		Check: Date 03/22/07 Time 1041		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1230	
Comments							
*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -115° skew wedge. The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -115° skew but is actually +115°.							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II		Date: 03/22/07		Examiner: N/A Signature: _____	
AREVA Review: Adam Condit Signature: <i>Adam Condit</i>		Level: III		Date: 03/23/07		Level: N/A Date: N/A	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000300

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3ANV-CDS2				ISI Report Number: <i>R151</i>			
Component ID: N3A-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PM		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +115°		Measured Skew Angle: * -115°	
	Delay: .604"			Mode: Shear		Radius: 4.75"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
PULSER	Reject: Off			Reflector: 1" Radius		2" Radius	
	Pulse Width: 222 nS			Sweep: 0.65 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 27.8 dB		27.8 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74°F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05125	
				Reference Sensitivity Information			
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 48.6 dB	
Cal In: Date 03/22/07 Time 0908		Check: Date 03/22/07 Time 1021		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1235	
Comments							
*Transducer incorrectly labeled -115° skew by the manufacturer; however actual skew is +115°.							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II		Date: 03/22/07		Examiner: N/A Signature: _____	
AREVA Review: Adam Sonti Signature: <i>Adam Sonti</i>		Level: III		Date: 03/23/07		Level: N/A Date: N/A	

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000301

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO

Calibration Data Sheet Number: N3ANV-CDS3

ISI Report Number: *R151*

Component ID: N3A-NV

Component Description: N3 Nozzle-to-Vessel Weld

Examination Procedure: 54-ISI-850-06

Applicable SDCN(s): 30-9044520-000

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 60°	Measured Angle: 60°
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±52° to 74°	Measured Skew Angle: N/A
	Delay: 1.17"	Mode: Shear	Radius: Flat
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 6'	Intermediate Connectors: 0
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251
	Reject: Off	Reflector:	1" Radius 2" Radius
	Pulse Width: 222 nS	Sweep:	0.5 div. 1.0 div.
	Damping: 500 Ω	Amplitude:	70 %FSH 80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	21.4 dB 21.4dB
PULSER	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
		Temperature: 74 °F	Therm. SN: VH-8937
		Couplant: Ultragel II	Batch No.: 05125

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.0 div	Amplitude: 80 %FSH	Gain: 58.2 dB
Cal In: Date 03/22/07 Time 0915	Check: Date 03/22/07 Time 0959	Check: Date N/A Time N/A	Out: Date 03/22/07 Time 1233

Comments

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/23/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000302

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3ANV-CDS4				ISI Report Number: <i>R151</i>			
Component ID: N3A-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A	N/A	
	Reject: Off			Sweep:	N/A	N/A	
PULSER	Pulse Width: 222 nS			Amplitude:	N/A	N/A	
	Damping: 500 Ω			Gain:	N/A	N/A	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 74 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05125	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 59.8 dB	
Cal In: Date 03/22/07 Time 0850		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1252	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Bret Flesner		Level: II		Date: 03/22/07		Examiner: N/A	
Signature: <i>Bret Flesner</i>						Level: N/A	
AREVA Review: Adam Conti		Level: III		Date: 03/23/07		Date: N/A	
Signature: <i>Adam Conti</i>						Page 10 of 11	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000303

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N3ANV-CDS5		ISI Report Number: <i>R151</i>	
Component ID: N3A-NV		Component Description: N3 Nozzle-to-Vessel Weld.	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: RTD		Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304		Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°		Measured Angle: 61°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal		Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm		Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0
	Velocity: 0.227 in / μ S	Verification Block		
RCVR	Display: Filt 2	Type: N/A		S/N: N/A
	Frequency: 2.25 MHz	Reflector:	N/A	N/A
	Reject: Off	Sweep:	N/A	N/A
	Pulse Width: 222 nS	Amplitude:	N/A	N/A
PULSER	Damping: 500 Ω	Gain:	N/A	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block		
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 74 °F	Therm. SN: VH-8937	
		Couplant: Ultragel II	Batch No.: 05125	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 74.6 dB
Cal In: Date 03/22/07 Time 0852	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/22/07 Time 1250

Comments

Zone 2 - Full Volume calibration.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Carr Signature: <i>Adam Carr</i>	Level: III	Date: 03/27/07			

Examination Report, R-175
N3B-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

C00304

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: <i>R175</i>
Component Number: N3B-NV		Component Description: N3 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS

ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0222-C-02

Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 4 EPRI Letter dated 3/5/07

Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N3BNV-CDS1		N3BNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications <input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation) <input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N3BNV-CDS2				
N3BNV-CDS3				
N3BNV-CDS4				
N3BNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N3 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
50°S	-115°	Blend Radius
40°S	+115°	Blend Radius
60°S	±(52°-74°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 41%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Thomas Brown Signature: <i>Thomas Brown</i>	Date: 3/15/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 4/11/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 4/18/07	ANII: Signature: <i>Adam Conti</i>	Date: 5/22/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N3BNV-EDS1		ISI Report Number: 12175	
Component ID: N3B-NV		Component Description: N3 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0222-C-02	W _c Location: Nozzle Boss (Rnozzle)	L _c Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N3BNV-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Blend Radius		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
*50° / s	-115°	N3BNV-CDS1	03/15/07	1222	80° F	VH-9525	68.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
40° / s	+115°	N3BNV-CDS2	03/15/07	1250	80° F	VH-9525	65.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	

Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Vessel Shell		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60° / s	±52° to 74°	N3BNV-CDS3	03/15/07	1315	80° F	VH-9525	68.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	

Examination Procedure: N-UT-78 revision 4						Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell		
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N3BNV-CDS4	03/15/07	1142	80° F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N3BNV-CDS5	03/15/07	1100	80° F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N3BNV-CDS4	03/15/07	1142	80° F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N3BNV-CDS5	03/15/07	1100	80° F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

* See calibration data sheet for additional details on the 50° shear examination.

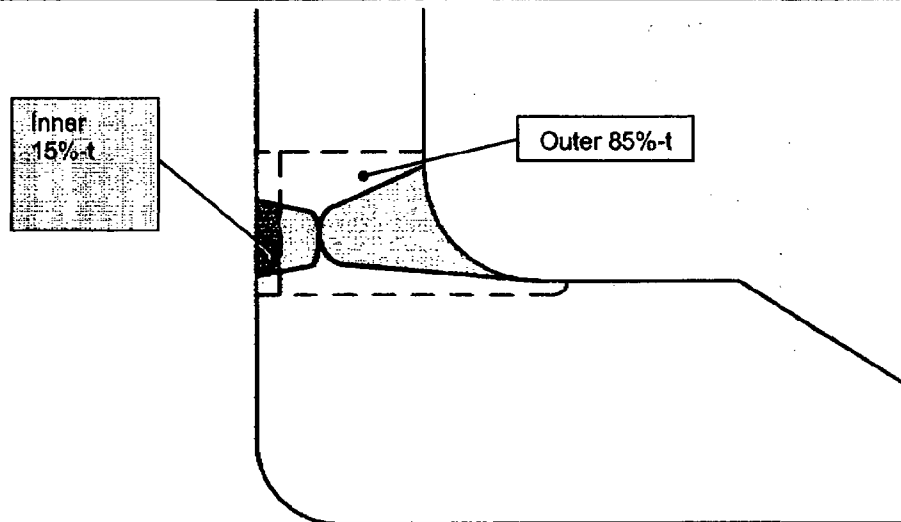
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 4/11/07			

000305



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N3B-NV	Coverage Worksheet #: N3BNV-CWS1	ISI Report #: 2775
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 60.2 ² inches	^D Inner 15%-t Examination Volume: 6.8 ² inches	^G Outer 85%-t Examination Volume: 53.4 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 29.6 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 12.9 ² inches
^C Percentage of Axial Coverage: 49%	^F Inner 15%-t Volume Achieved: 6.8 ² inches	^J Total Circumferential Examination Coverage: 33%
$B \div A \times 100 = C$		$(F + H) \div A \times 100 = J$
Combined Axial and Circumferential Weld Coverage		
^LTotal Examination Coverage: 41%		
$(C + J) \div 2 \times 100 = L$		
Prepared by: Bret Flesner	Date: 03/15/07	Reviewed by: Adam Conti
		Date: 04/11/07

000006



DESCRIPTION			
Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/15/07	N3BNV-CPS1	4 OF 11

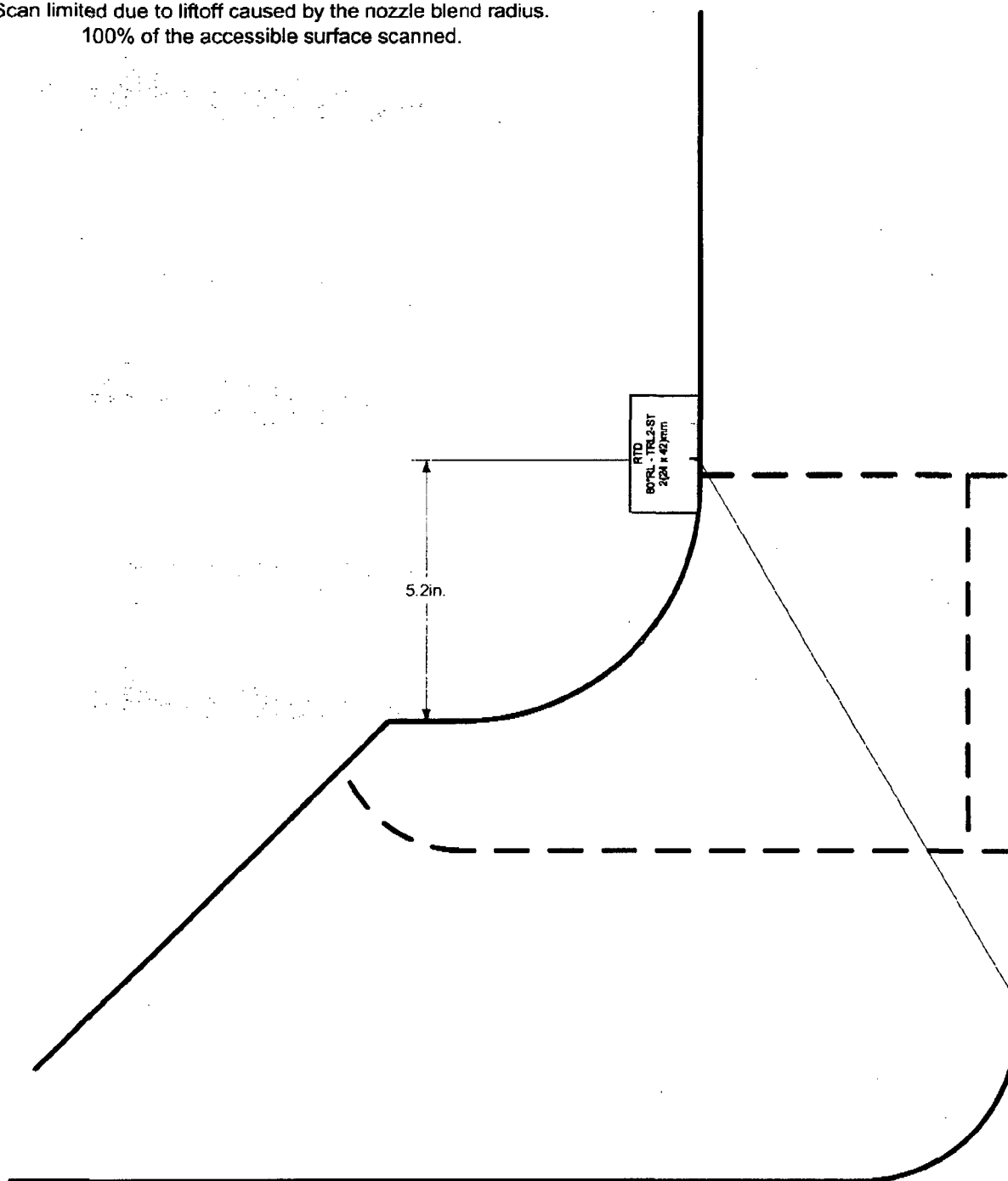
R175
000307

Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 60.2 sq. in. (TVA supplied)

Total area of examination volume achieved: 29.6 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.





DESCRIPTION			
Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/15/07	N3BNV-CPS2	5 OF 11

R175

000308

Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 60.2 sq. in. (TVA Supplied)

Total area of outer 85%-t exam volume achieved: 12.9 sq. in.

Total area of inner 15%-t volume: 6.8 sq. in.

Total area of inner 15%-t exam volume achieved: 6.8 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.

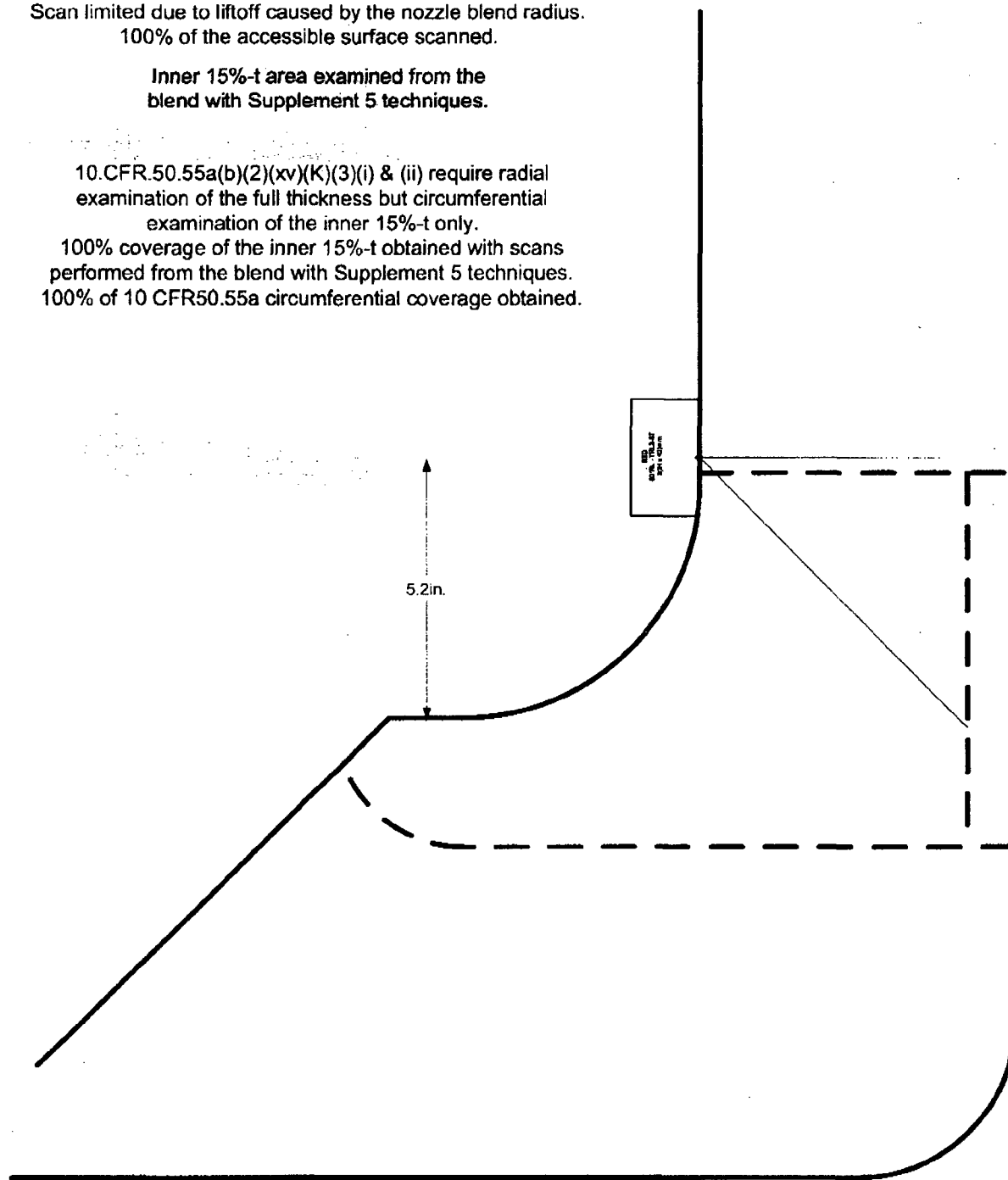
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

10.CFR.50.55a(b)(2)(xv)(K)(3)(i) & (ii) require radial
examination of the full thickness but circumferential
examination of the inner 15%-t only.

100% coverage of the inner 15%-t obtained with scans
performed from the blend with Supplement 5 techniques.

100% of 10 CFR50.55a circumferential coverage obtained.

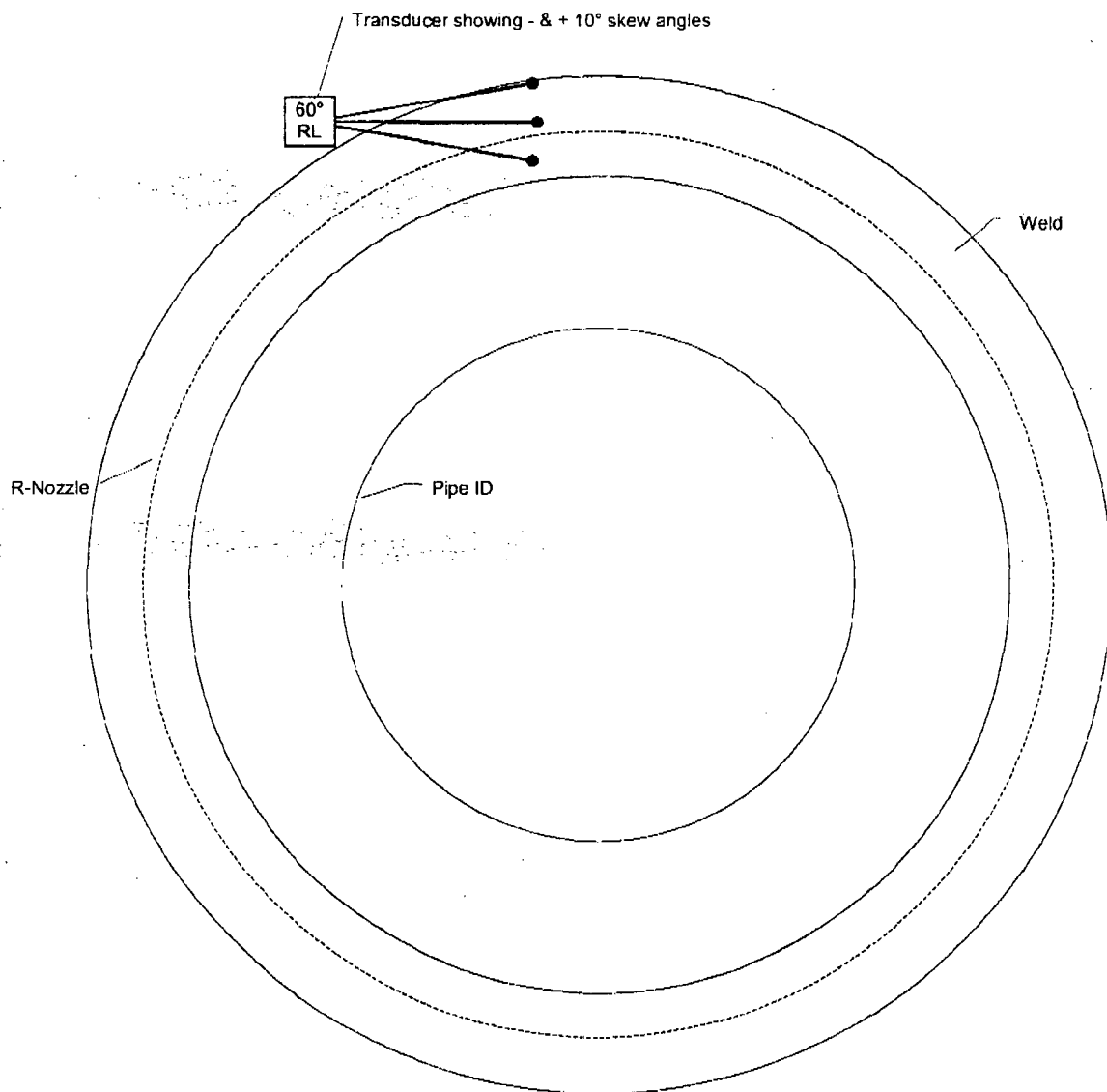


AREVA	DESCRIPTION		
	Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot		
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/15/07	N3BNV-CPS3	6 OF 11

R175

000309

Top View
Measurements based on modeling report, design drawings, and as-found measurements.





Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

00310

Utility: TVA	Site: Browns Ferry Nuclear Station	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N3BNV-CDS1		ISI Report Number: R175	
Component ID: N3B-NV		Component Description: N3 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 0111PV	Frequency: 2.25 MHz
Serial Number: 7031		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single
Instrument Settings		Verification Block	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Refracted Angle: 40°	
	Delay: 1.27"	Skew Angle: -115°	
RCVR	Velocity: 0.127 in / μS	Mode: Shear	
	Display: Filt2	Radius: 4.75"	
PULSER	Frequency: 2.25 MHz	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0	
	Reject: Off		
	Pulse Width: 222 nS		
	Damping: 500 Ω		
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual		
	Rep Rate: 2kHz		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)		
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.		
		Basic Calibration Block	
		Block ID: BF-18	Material: Clad CS
		Thickness: 6.0" with 0.125" Clad	Diameter: Flat
		Temperature: 76 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 6.1 div	Amplitude: 80 %FSH	Gain: 63.4 dB
Cal In: Date 3/15/07 Time 0907	Check: Date 3/15/07 Time 1221	Check: Date N/A Time N/A	Out: Date 03/15/07 Time 1410

Comments

* During the calibration process a manufacturing error was discovered with the TVA supplied 40° -115° skew wedge. The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -115° skew but is actually +115°.

Examiner: Thomas Brown Signature: <i>[Signature]</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Con Signature: <i>[Signature]</i>	Level: III	Date: 4/11/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000311

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N3BNV-CDS2		ISI Report Number: <i>R175</i>	
Component ID: N3B-NV		Component Description: N3 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 0111PM	Frequency: 2.25 MHz
Serial Number: 7031		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 40°	Measured Angle: 40°
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: +115°	Measured Skew Angle: * -115°
	Delay: 1.27"	Mode: Shear	Radius: 4.75"
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0
	Display: Filt2	Verification Block	
RCVR	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251
	Reject: Off	Reflector:	1" Radius 2" Radius
	Pulse Width: 222 nS	Sweep:	0.65 div. 1.3 div.
	Damping: 500 Ω	Amplitude:	80 %FSH 65 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	32.2 dB 32.2 dB
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
		Temperature: 76 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325
PULSER			

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 5.2 div	Amplitude: 80 %FSH	Gain: 57.0 dB
Cal In: Date 3/15/07 Time 0909	Check: Date 3/15/07 Time 1249	Check: Date N/A Time N/A	Out: Date 03/15/07 Time 1412

Comments

* The transducer wedge is incorrectly labeled -115° skew by the manufacturer; however actual skew is +115°.

Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Com Signature: <i>Adam Com</i>	Level: III	Date: 4/11/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet 000312

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3BNV-CDS3				ISI Report Number: <i>R175</i>			
Component ID: N3B-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XB		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±52° to 74°		Measured Skew Angle: N/A	
	Delay: 0.813"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
	Display: Filt2			Verification Block			
RCVR	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
	Pulse Width: 222 nS			Sweep: 0.6 div.		1.1 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
PULSER	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 27.6 dB		27.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 76 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.8 div		Amplitude: 80 %FSH		Gain: 60.8 dB	
Cal In: Date 3/15/07 Time 0850		Check: Date 3/15/07 Time 1314		Check: Date N/A Time N/A		Out: Date 03/15/07 Time 1414	
Comments							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>				Level: II		Date: 03/15/07	
AREVA Review: Adam Cann Signature: <i>Adam Cann</i>				Level: III		Date: 04/11/07	
				Examiner: N/A Signature:		Level: N/A Date: N/A	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000813

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3NV-CDS4				ISI Report Number: <i>R175</i>			
Component ID: N3B-NV				Component Description: N3 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	1.2 div.	2.5 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 76 °F		Therm. SN: VH-9525	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.8 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 3/15/07 Time 0929		Check: Date 3/15/07 Time 1141		Check: Date N/A Time N/A		Out: Date 3/15/07 Time 1416	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>		Level: II		Date: 03/15/07		Examiner: N/A Signature:	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III		Date: 4/11/07		Level: N/A Date: N/A	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000314

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N3BNV-CDS5

ISI Report Number:

R175

Component ID: N3B-NV

Component Description: N3 Nozzle-to-Vessel Weld

Examination Procedure: N-UT-78 Revision 4

Applicable SDCN(s): N/A

Ultrasonic Instrument		Transducer	
Manufacture: Staveley	Model: Sonic 136	Manufacture: RTD	Model: TRL2-ST
Serial Number: 7031	Linearity Sheet No.: LDS4	Serial Number: 07-304	Frequency: 2 MHz
		Angle: 60°	Measured Angle: 61°
		Mode: Refracted Longitudinal	Size: 2(24x42)mm
		Focus: FS-125mm	Squint Angle: 5°
Instrument Settings		Verification Block	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.38"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.230 in / μ S		
RCVR	Display: Filt 2	Type: CS Rompas	S/N: 99-6251
	Frequency: 2.25 MHz	Reflector:	1" Radius 2" Radius
	Reject: Off	Sweep:	0.5 div. 1.1 div.
	Pulse Width: 222 nS	Amplitude:	25 %FSH 80 %FSH
	Damping: 500 Ω	Gain:	52.0 dB 52.0 dB
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 76 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 73.2 dB
Cal In: Date 3/15/07 Time 0927	Check: Date 3/15/07 Time 1059	Check: Date N/A Time N/A	Out: Date 3/15/07 Time 1418

Comments

Zone 2 - Full Volume calibration.

Examiner: Thomas Brown

Level: II

Date: 03/15/07

Examiner: N/A

Level: N/A

Date: N/A

Signature: *[Signature]*

Signature

AREVA Review: Adam Cant

Level: III

Date: 4/11/07

Page 11 of 11

Examination Report, R-152
N3C-NV, RPV Nozzle-To-Head Weld

RPV Nozzle Ultrasonic Examination Summary Sheet

000815

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R152
Component Number: N3C-NV		Component Description: N3 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0222-C-02				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 4 EPRI Letter dated 3/5/07	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N3CNV-CDS1		N3CNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N3CNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N3CNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N3CNV-CDS4				
N3CNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N3 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
50°S	-115°	Blend Radius
40°S	+115°	Blend Radius
60°S	±(52°-74°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 41%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner Signature: <i>Bret Flesner</i>	Date: 3/22/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 3/23/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 3/27/07	ANII: Signature: <i>Paul Flood</i>	Date: 3/22/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
Examination Data Sheet Number: N3CNV-EDS1 ISI Report Number: R152
Component ID: N3C-NV Component Description: N3 Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01 & 2-ISI-0222-C-02 W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC
Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N3C-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
*50°S	-115°	N3CNV-CDS1	03/22/07	1109	82° F	VH-8937	70.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
40°S	+115°	N3CNV-CDS2	03/22/07	1132	82° F	VH-8937	70.0 db	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°S	±52° to 74°	N3CNV-CDS3	03/22/07	1157	82° F	VH-8937	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

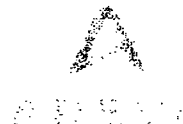
Examination Procedure: N-UT-78 rev.4				Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell		
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N3CNV-CDS4	03/22/07	1015	82° F	VH-8937	73.8 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N3CNV-CDS5	03/22/07	1040	82° F	VH-8937	84.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N3CNV-CDS4	03/22/07	1015	82° F	VH-8937	73.8 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N3CNV-CDS5	03/22/07	1040	82° F	VH-8937	75.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments:

* See calibration data sheet for additional details on the 50° shear examination.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/23/07			

000816



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA

Plant: Browns Ferry

Unit: 2

Weld ID: N3C-NV

Coverage Worksheet #: N3CNV-CWS1

ISI Report #: R152

Inner
15%-t

Outer 85%-t

Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans

100%-t

Examination Procedure: N-UT-78 Revision 4

^ARequired Examination Volume: 60.2²inches

60°RL axial scan limited: ☒Yes ☐No

Description of Limitation: Nozzle Blend Radius

^BTotal Axial Volume Achieved: 29.6²inches

^CPercentage of Axial Coverage: 49%

$$B \div A \times 100 = C$$

Circumferential Scans

Inner 15%-t

Examination Procedure: 54-ISI-850-06

^DInner 15%-t Examination Volume: 6.8²inches

^ECoverage Obtained by Modeling: 100%

Inner 15%-t Exam Limited: ☐Yes ☒No

Description of Limitation: N/A

^FInner 15%-t Volume Achieved: 6.8²inches

Outer 85%-t

Examination Procedure: N-UT-78 Revision 4

^GOuter 85%-t Examination Volume: 53.4²inches.

60°RL Outer 85%-t Exam Limited: ☒Yes ☐No

Description of Limitation: Nozzle Blend Radius

^HOuter 85%-t Volume Achieved: 12.9²inches

^ITotal Circumferential Examination Coverage: 33%

$$(F + H) \div A \times 100 = J$$

Combined Axial and Circumferential Weld Coverage

^KTotal Examination Coverage: 41%

$$(C + J) \div 2 \times 100 = L$$

Prepared by: Bret Flesner


Date: 03/22/07

Reviewed by: Adam Conti

Date: 03/23/07

Page 3 of 11

000317

	DESCRIPTION		
	Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot		
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/22/07	N3CNV-CPS1	4 OF 11

R152

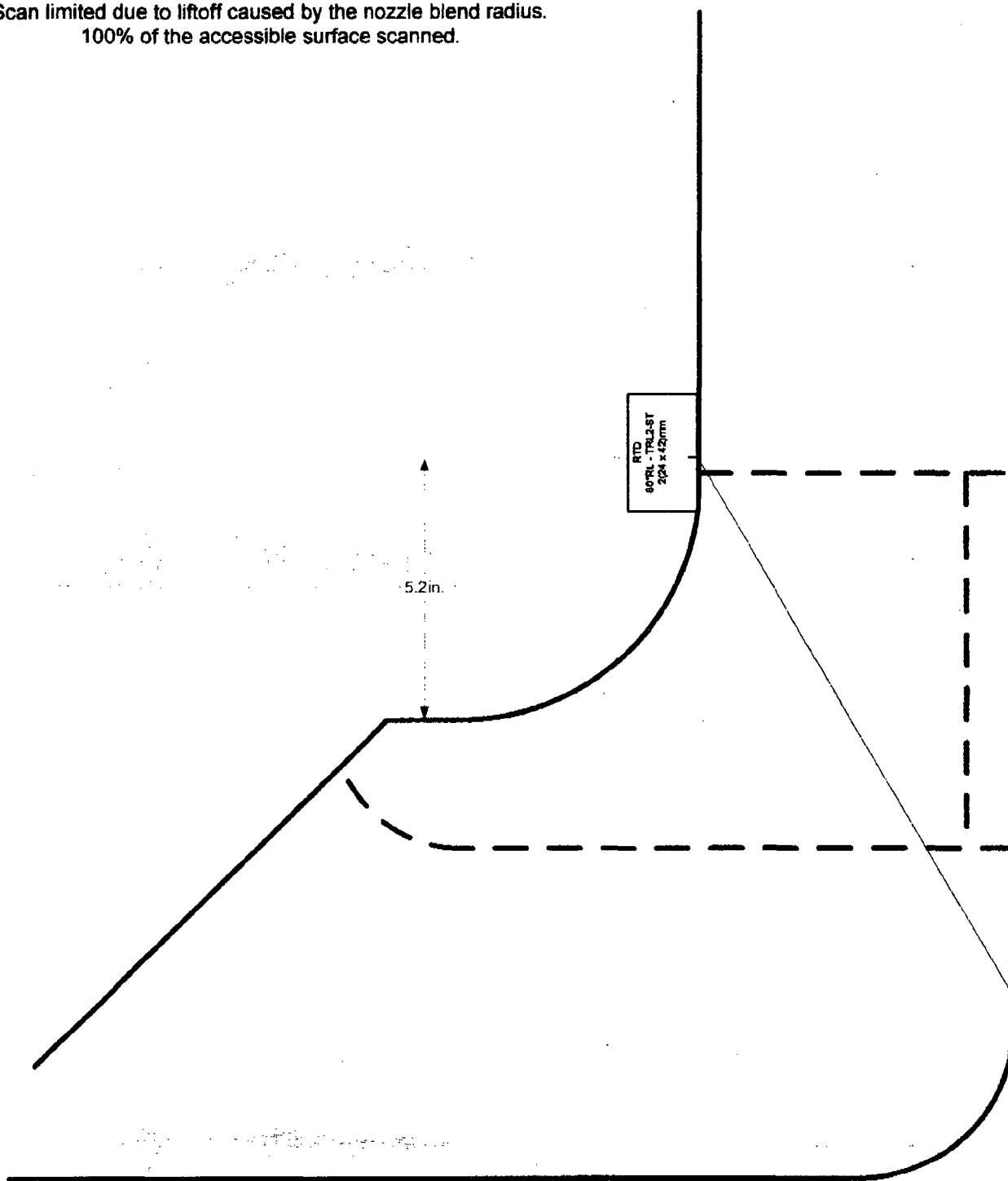
000318


Nozzle-to-Shell weld examination coverage for axial (radial) scan

Total area of examination volume: 60.2 sq. in. (TVA supplied)

Total area of examination volume achieved: 29.6 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.



	DESCRIPTION			
	Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/22/07	N3CNV-CPS2	5 OF 11	

R152

000819

Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination volume: 60.2 sq. in. (TVA Supplied)

Total area of outer 85%-t exam volume achieved: 12.9 sq. in.

Total area of inner 15%-t volume: 6.8 sq. in.

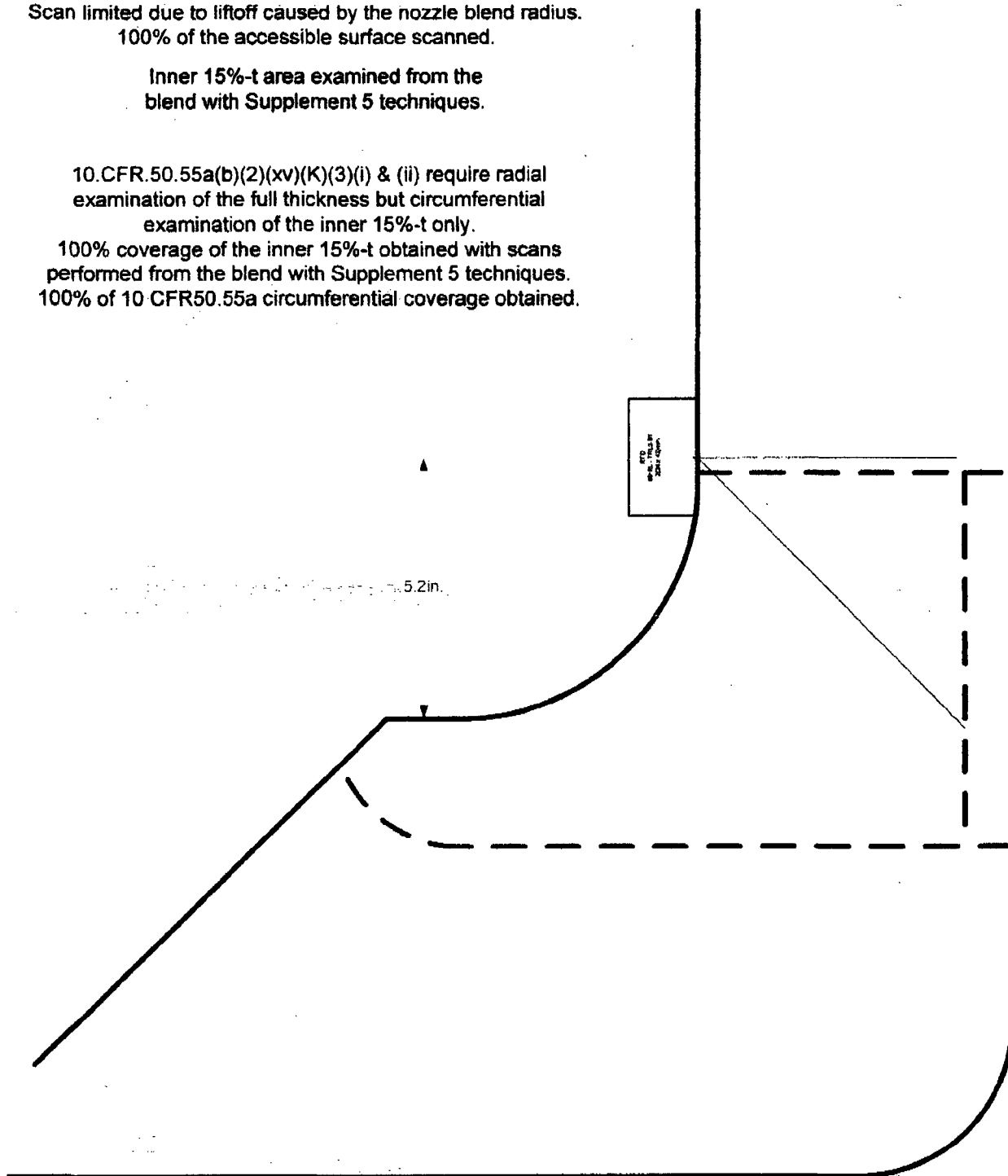
Total area of inner 15%-t exam volume achieved: 6.8 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

10.CFR.50.55a(b)(2)(xv)(K)(3)(i) & (ii) require radial
examination of the full thickness but circumferential
examination of the inner 15%-t only.

100% coverage of the inner 15%-t obtained with scans
performed from the blend with Supplement 5 techniques.
100% of 10 CFR50.55a circumferential coverage obtained.

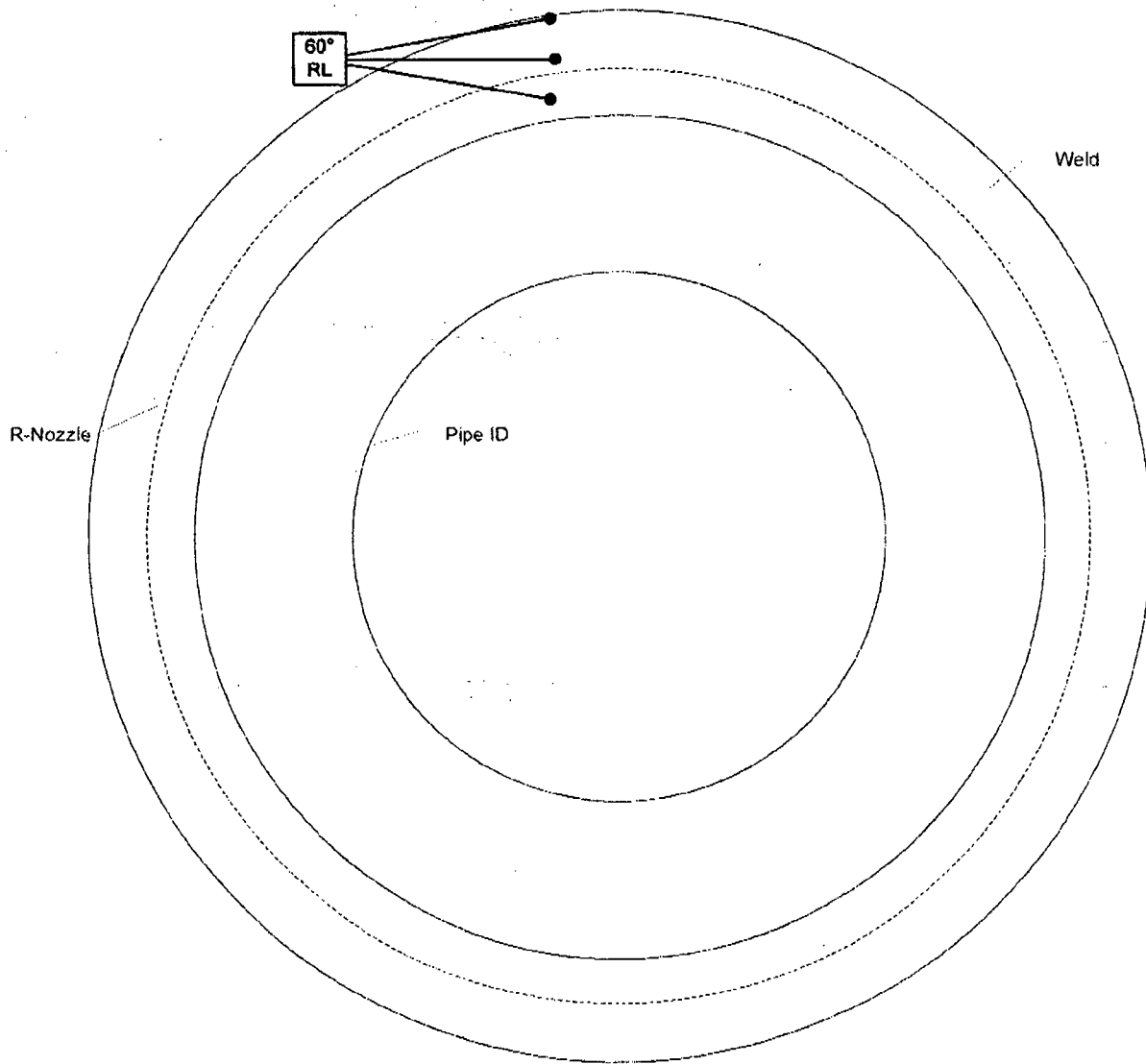


A	DESCRIPTION			
	Browns Ferry N3 Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY	DATE	TITLE	PAGE
	Bret Flesner	03/22/07	N3CNV-CPS3	6 OF 11

R152
000320

Top View
Measurements based on modeling report, design
drawings, and as-found measurements.

Transducer showing - & + 10° skew angles





Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000321

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3CNV-CDS1				ISI Report Number: <i>R152</i>			
Component ID: N3C-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PV		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: * 50°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -115°		Measured Skew Angle: * +115°	
	Delay: .604"			Mode: Shear		Radius: 4.75"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.65 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		75 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		29.0 dB 29.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
Couplant: Ultragel II				Batch No.: 05125			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.1 div		Amplitude: 80 %FSH		Gain: 58.6 dB	
Cal In: Date 03/22/07 Time 0905		Check: Date 03/22/07 Time 1041		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1230	
Comments							
*During the calibration process a manufacturing error was discovered with the TVA supplied 40° -115° skew wedge. The wedge incident angle is cut such that a 50° refracted shear wave is generated rather than the specified 40°. To assure examination coverage TVA contacted the EPRI NDE Center for additional modeling using the actual manufactured 50° angle. Additionally the wedge is also incorrectly labeled -115° skew but is actually +115°.							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II		Date: 03/22/07		Examiner: N/A Signature:	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III		Date: 03/23/07		Page 7 of 11	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000822

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3CNV-CDS2				ISI Report Number: <i>R152</i>			
Component ID: N3C-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PM		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +115°		Measured Skew Angle: * -115°	
	Delay: .604"			Mode: Shear		Radius: 4.75"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Fil2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.65 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 27.8 dB		27.8 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74°F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05125	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 48.6 dB	
Cal In: Date 03/22/07 Time 0908		Check: Date 03/22/07 Time 1131		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1235	
Comments							
*Transducer incorrectly labeled +115° skew by the manufacturer; however actual skew is -115°.							
Examiner: George Chapman Signature: <i>[Signature]</i>		Level: II	Date: 03/22/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Comp Signature: <i>[Signature]</i>		Level: III	Date: 03/23/07				



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000823

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N3CNV-CDS3		ISI Report Number: R152	
Component ID: N3C-NV		Component Description: N3 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 60°	Measured Angle: 60°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±52° to 74°	Measured Skew Angle: N/A	
	Delay: 1.17"	Mode: Shear	Radius: Flat	
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 6'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.5 div.	1.0 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	21.4 dB	21.4dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 74 °F	Therm. SN: VH-8937	
Couplant: Ultragel II		Batch No.: 05125		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.0 div	Amplitude: 80 %FSH	Gain: 58.2 dB
Cal In: Date 03/22/07 Time 0915	Check: Date 03/22/07 Time 1156	Check: Date N/A Time N/A	Out: Date 03/22/07 Time 1233

Comments

Examiner: George Chapman Signature:	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Condi Signature:	Level: III	Date: 03/23/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000324

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N3CNV-CDS4				ISI Report Number: <i>R152</i>			
Component ID: N3C-NV				Component Description: N3 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A	N/A	
	Reject: Off			Sweep:	N/A	N/A	
PULSER	Pulse Width: 222 nS			Amplitude:	N/A	N/A	
	Damping: 500 Ω			Gain:	N/A	N/A	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 74 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05125	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 59.8 dB	
Cal In: Date 03/22/07 Time 0850		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/22/07 Time 1252	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Bret Flesner		Level: II	Date: 03/22/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>Bret Flesner</i>				Signature			
AREVA Review: Adam Conti		Level: III	Date: 03/23/07				
Signature: <i>Adam Conti</i>							



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000325

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N3CNV-CDS5		ISI Report Number: <i>R152</i>	
Component ID: N3C-NV		Component Description: N3 Nozzle-to-Vessel Weld.	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 61°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0	
	Velocity: 0.227 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector:	N/A N/A
	Reject: Off	Sweep:	N/A N/A
	Pulse Width: 222 nS	Amplitude:	N/A N/A
	Damping: 500 Ω	Gain:	N/A N/A
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 74 °F	Therm. SN: VH-8937
		Couplant: Ultragel II	Batch No.: 05125

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 74.6 dB
Cal In: Date 03/22/07 Time 0852	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/22/07 Time 1250

Comments

Zone 2 - Full Volume calibration.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/22/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/27/07			

Examination Report, R-176
N4B-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000326

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: <i>R176</i>
Component Number: N4B-NV		Component Description: N4 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0269-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19, Section 5	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N4BNV-CDS1		N4BNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N4BNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N4BNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N4BNV-CDS4				
N4BNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

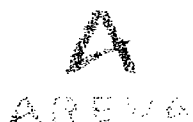
N4 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
40°S	+120°	Blend Radius
60°S	±(35°-67°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner Signature: <i>Bret Flesner</i>	Date: 4/17/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 4/17/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 4/17/07	ANII: <i>Carol F. Ford</i> Signature: <i>Carol F. Ford</i>	Date: 5/22/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N4BNV-EDS1		ISI Report Number: R176	
Component ID: N4B-NV		Component Description: N4 Nozzle-to-Vessel Weld	
Examination Information			
ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0269-C-01		W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Coverage Sheet Number(s): N4BNV-CWS1	

Scan Information												
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
40° / s	-120 °	N4BNV-CDS1		03/21/07	1110	77°F	VH-8937	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
40° / s	+120 °	N4BNV-CDS2		03/21/07	1127	77°F	VH-8937	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60° / s	±35° to 67°	N4BNV-CDS3		03/21/07	1145	77°F	VH-8937	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell		
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4BNV-CDS4	03/21/07	1215	77°F	VH-8937	74.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4BNV-CDS5	03/21/07	1250	77°F	VH-8937	82.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4BNV-CDS4	03/21/07	1215	77°F	VH-8937	74.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4BNV-CDS5	03/21/07	1250	77°F	VH-8937	82.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments:

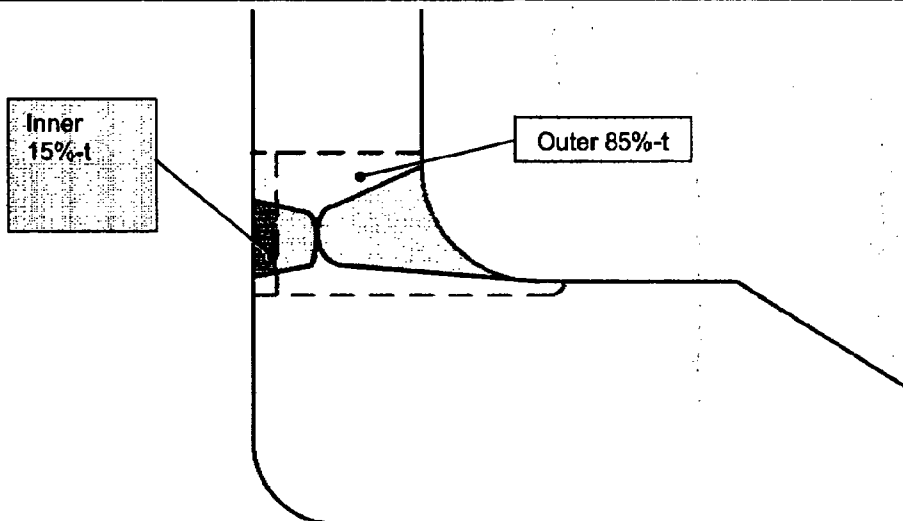
Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: Bret Fiesner Signature: <i>Bret Fiesner</i>	Level: II	Date: 03/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/22/07			

000327



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet


Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N4B-NV	Coverage Worksheet #: N4BNV-CWS1	ISI Report #: <i>R176</i>
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 45.0 ² inches	^D Inner 15%-t Examination Volume: 5.8 ² inches	^G Outer 85%-t Examination Volume: 39.2 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius	Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches	Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.2 ² inches
^C Percentage of Axial Coverage: 54% / (49%)* $B + A \times 100 = C$	^F Inner 15%-t Volume Achieved: 5.8 ² inches	^I Total Circumferential Examination Coverage: 38% $(F + H) + A \times 100 = J$
Combined Axial and Circumferential Weld Coverage		
^LTotal Examination Coverage: 44%		
$(C + J) + 2 \times 100 = L$		
NOTE: *Axial scan coverage of 49% includes the insulation support ring limitation. *Total Examination Coverage* of 44% also takes into account this limitation.		
Prepared by: Bret Flesner <i>Bret Flesner</i>	Date: 04/17/07	Reviewed by: Adam Conti <i>Adam Conti</i> Date: 04/17/07

	DESCRIPTION Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 04/17/07	TITLE N4BNV-CPS1	PAGE 4 OF 11

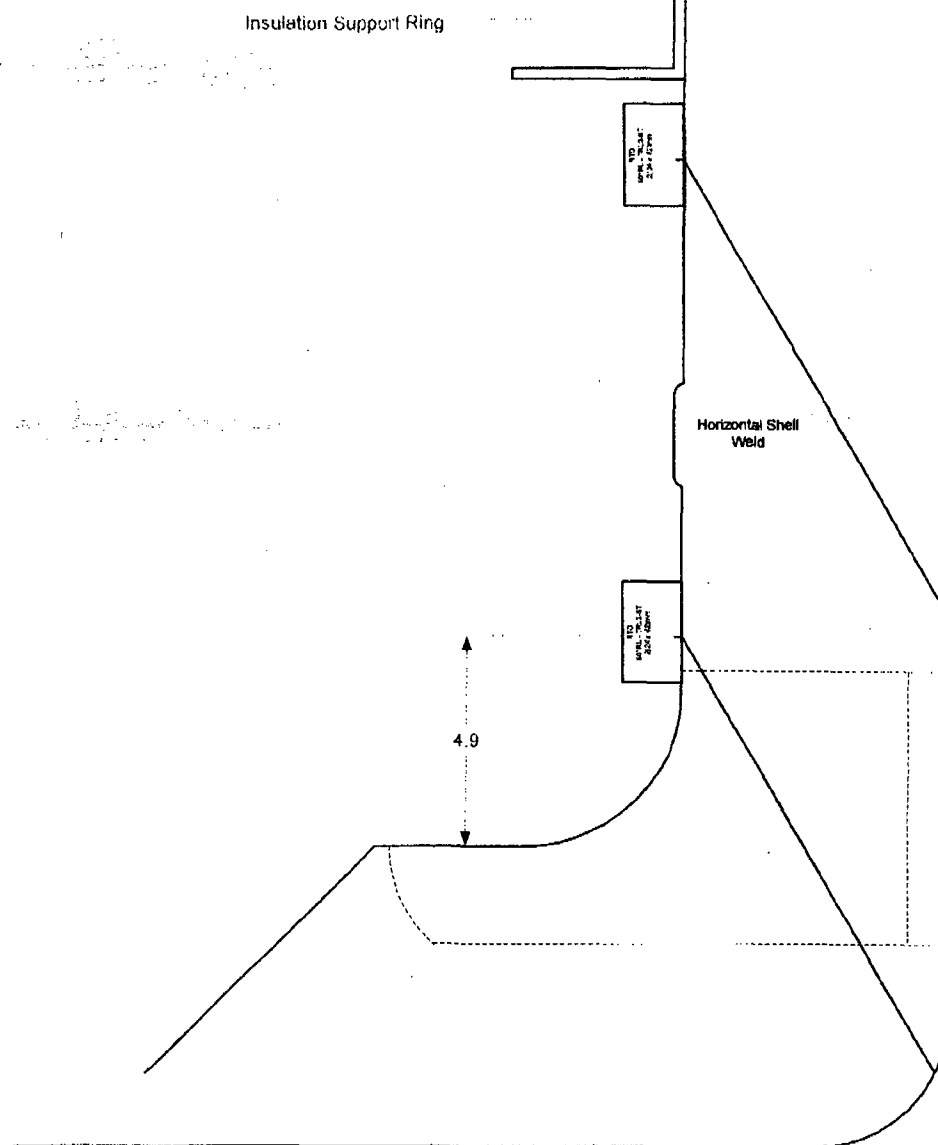
R176
000329


Nozzle-to-Vessel weld examination coverage for axial (radial) scan

Total area of examination volume: 45.0 sq. in. (TVA supplied)

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.



	DESCRIPTION			
	Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	04/17/07	N4BNV-CPS2	5 OF 11	

000330

R176

Insulation Support Ring

Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 45.0 sq. in. (TVA supplied)

Total area of outer 85%-t exam volume achieved: 11.2 sq. in.

Total area of inner 15%-t volume: 5.8 sq. in.

Total area of inner 15%-t exam volume achieved: 5.8 sq. in.

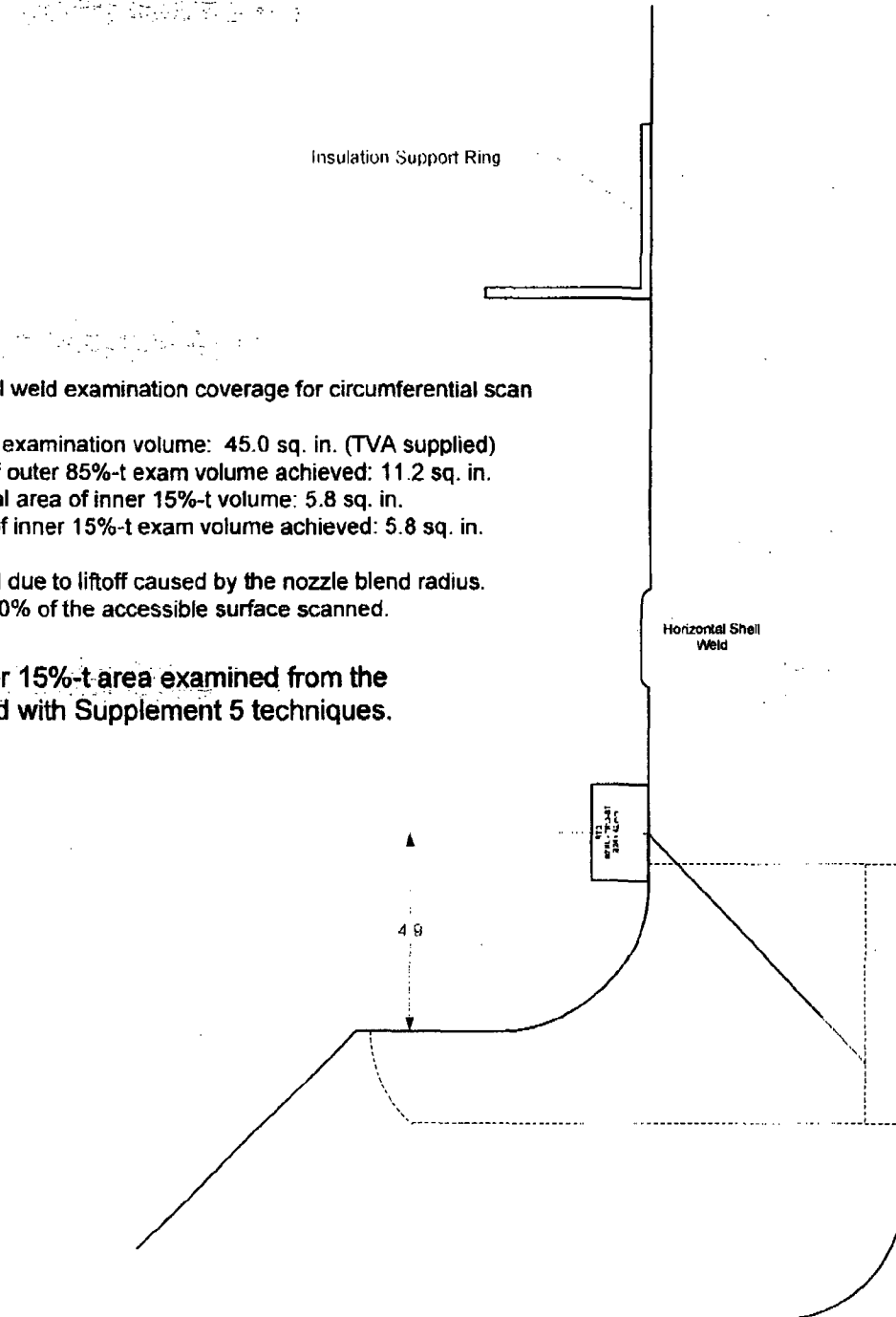
Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

Horizontal Shell
Weld

NO
WELD-TO-JOINT
SCAN

49



000331

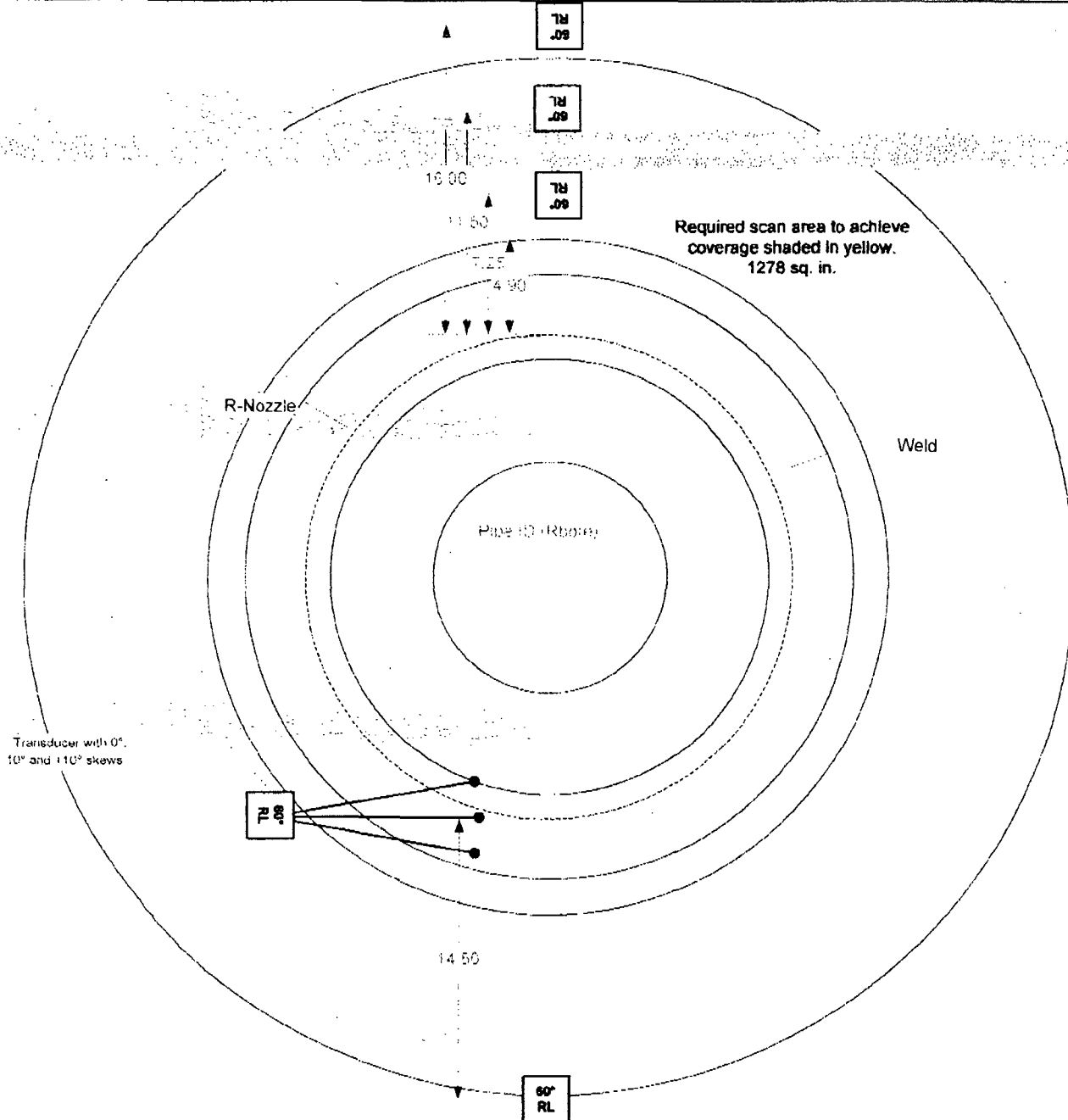
R176

A	DESCRIPTION Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/21/07	TITLE N4BNV-CPS3	PAGE 6 OF 11

Contact can not be maintained on horizontal weld due to weld crown.
This area = 61 sq. in. of limitation.

Area to be scanned (yellow area): 1278 sq. in.
66sq. in. of limitation = 5% limitation of radial coverage.
(66 / 1278 = 5%)

Insulation Support Ring



Insulation



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4BNV-CDS1				ISI Report Number:			
Component ID: N4B-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XC		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -120°		Measured Skew Angle: -120°	
	Delay: 1.76"			Mode: Shear		Radius: 3.8"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:	1" Radius	2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:	0.6 div.	1.3 div.	
	Damping: 500 Ω			Amplitude:	70 %FSH	80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:	28.6 dB	28.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 51.4 dB	
Cal In: Date 03/21/07 Time 0900		Check: Date 03/21/07 Time 1109		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1330	
<p style="text-align: center;">Comments</p> <p>Adam Conti For George Chapman</p>							
Examiner: George Chapman		Level: II	Date: 03/21/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>[Signature]</i>				Signature			
AREVA Review: Adam Conti		Level: III	Date: 03/22/07				
Signature: <i>[Signature]</i>							

000333



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4BNV-CDS2				ISI Report Number: <i>R176</i>			
Component ID: N4B-NV				Component Description: N4 Nozzle-to-Vessel weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PK		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: +120°	
	Delay: 1.76"			Mode: Shear		Radius: 3.8"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.6 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 75 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 29.0 dB		29.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 49.0 dB	
Cal In: Date 03/21/07 Time 0905		Check: Date 03/21/07 Time 1128		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1328	
Comments							
Examiner: George Chapman		Level: II		Date: 03/21/07		Examiner: N/A	
Signature: <i>[Signature]</i>						Signature	
AREVA Review: Adam Conti		Level: III		Date: 03/22/07			
Signature: <i>[Signature]</i>							



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000334

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N4BNV-CDS3		ISI Report Number: <i>R176</i>	
Component ID: N4B-NV		Component Description: N4 Nozzle-to-Vessel weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 60°	Measured Angle: 60°
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±35° to 67°	Measured Skew Angle: N/A
	Delay: 1.17"	Mode: Shear	Radius: Flat
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251
	Reject: Off	Reflector: 1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep: 0.5 div.	1.0 div.
	Damping: 500 Ω	Amplitude: 70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: 22.8 dB	22.8 dB
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
		Temperature: 74 °F	Therm. SN: VH-8937
Couplant: Ultragel II		Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.0 div	Amplitude: 80 %FSH	Gain: 61.0 dB
Cal In: Date 03/21/07 Time 0915	Check: Date 03/21/07 Time 1144	Check: Date N/A Time N/A	Out: Date 03/21/07 Time 1325

Comments

Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/22/07			

A

AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000835

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4BNV-CDS4				ISI Report Number: <i>R176</i>			
Component ID: N4B-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A	N/A	
	Reject: Off			Sweep:	N/A	N/A	
	Pulse Width: 222 nS			Amplitude:	N/A	N/A	
	Damping: 500 Ω			Gain:	N/A	N/A	
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 73 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 59.8 dB	
Cal In: Date 03/21/07 Time 1055		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1314	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/21/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III	Date: 03/22/07				

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000836

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N4BNV-CDS5		ISI Report Number: R176	
Component ID: N4B-NV		Component Description: N4 Nozzle-to-Vessel Weld.	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 61°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.227 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector:	N/A
	Reject: Off	Sweep:	N/A
	Pulse Width: 222 nS	Amplitude:	N/A
PULSER	Damping: 500 Ω	Gain:	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 73 °F	Therm. SN: VH-8937
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 74.6 dB
Cal In: Date 03/21/07 Time 1054	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/21/07 Time 1315

Comments

Zone 2 - Full Volume calibration.

Examiner: Bret Flesner Signature: <i>[Signature]</i>	Level: II	Date: 03/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/22/07			

Examination Report, R-177
N4C-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000337

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R177
Component Number: N4C-NV	Component Description: N4 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0269-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19, Section 5	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N4CNV-CDS1		N4CNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N4CNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N4CNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N4CNV-CDS4				
N4CNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N4 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
40°S	+120°	Blend Radius
60°S	±(35°-67°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus ½" on each side.

Prepared by: Bret Flesner Signature: <i>Bret Flesner</i>	Date: 4/17/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 4/17/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 4/18/07	ANII: Signature: <i>Paul Thord</i>	Date: 5/22/07

Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
 Examination Data Sheet Number: N4CNV-EDS1 ISI Report Number: 12177
 Component ID: N4C-NV Component Description: N4 Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0269-C-01 W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC
 Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N4CNV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
40° / s	-120 °	N4CNV-CDS1		03/21/07	1247	77°F	VH-8937	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
40° / s	+120 °	N4CNV-CDS2		03/21/07	1304	77°F	VH-8937	75.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
NA /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
NA /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60° / s	±35° to 67°	N4CNV-CDS3		03/21/07	1218	77°F	VH-8937	72.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A /	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell		
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4CNV-CDS4	03/21/07	1100	77°F	VH-8937	74.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4CNV-CDS5	03/21/07	1140	77°F	VH-8937	82.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4CNV-CDS4	03/21/07	1100	77°F	VH-8937	74.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4CNV-CDS5	03/21/07	1140	77°F	VH-8937	82.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

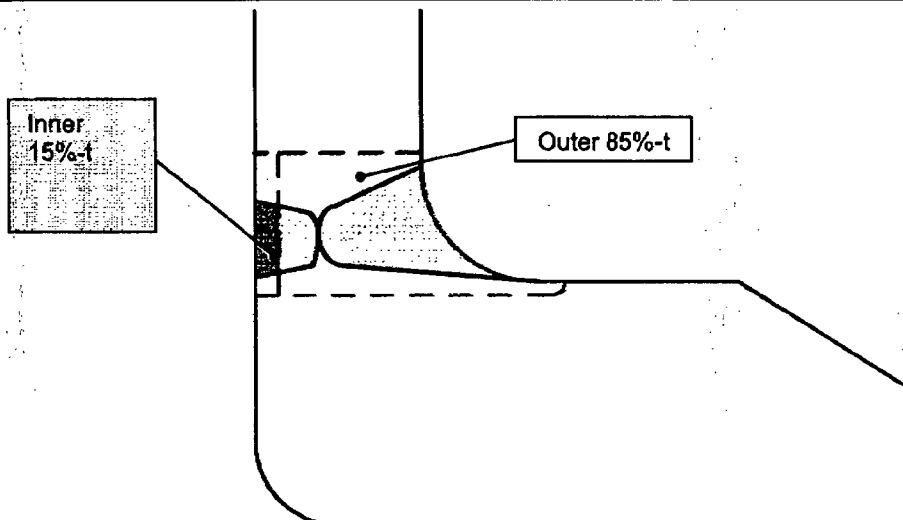
Comments:

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: Bret Flesner Signature: <i>[Signature]</i>	Level: II	Date: 03/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/22/07			



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N4C-NV	Coverage Worksheet #: N4CNV-CWS1	ISI Report #: <i>R177</i>
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 45.0 ² inches		^B Inner 15%-t Examination Volume: 5.8 ² inches	^C Outer 85%-t Examination Volume: 39.2 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.2 ² inches
		^F Inner 15%-t Volume Achieved: 5.8 ² inches	
^C Percentage of Axial Coverage: 54% / (49%)* B + A X 100 = C		^J Total Circumferential Examination Coverage: 38% (F + H) + A X 100 = J	

Combined Axial and Circumferential Weld Coverage


^LTotal Examination Coverage: 44%

$$(C+J) + 2 \times 100 = L$$

NOTE: *Axial scan coverage of 49% includes the insulation support ring limitation. "Total Examination Coverage" of 44% also takes into account this limitation.

Prepared by: Bret Flesner	Date: 04/17/07	Reviewed by: Adam Conti	Date: 04/17/07
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	DESCRIPTION		
	Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot		
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	04/17/07	N4CNV-CPS1	4 OF 11

R177
000340

Nozzle-to-Vessel weld examination coverage for axial (radial) scan

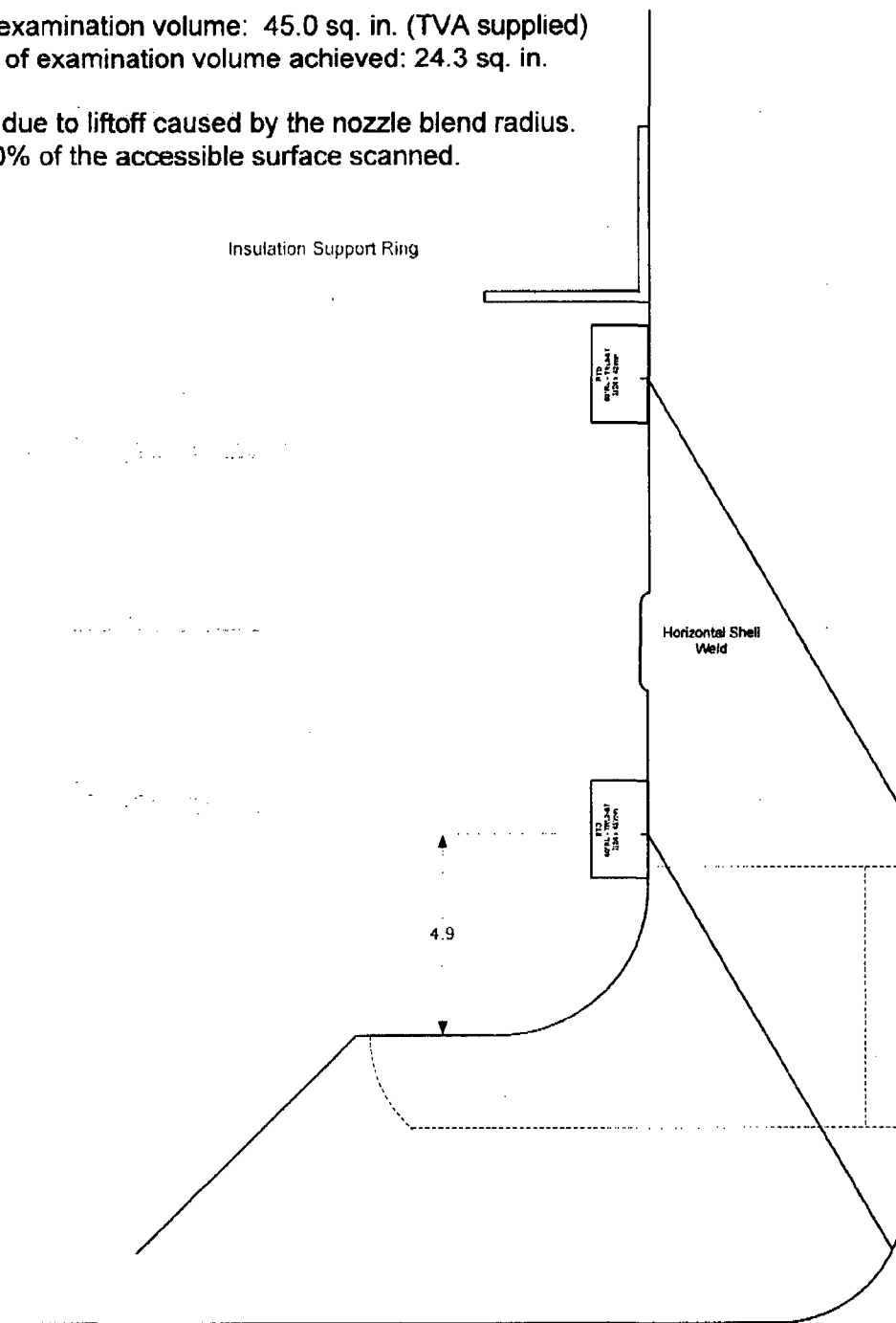
Total area of examination volume: 45.0 sq. in. (TVA supplied)


Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.

100% of the accessible surface scanned.

Insulation Support Ring



	DESCRIPTION Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 04/17/07	TITLE N4CNV-CPS2	PAGE 5 OF 11

R177

000341

Insulation Support Ring

Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 45.0 sq. in. (TVA supplied)

Total area of outer 85%-t exam volume achieved: 11.2 sq. in.

Total area of inner 15%-t volume: 5.8 sq. in.

Total area of inner 15%-t exam volume achieved: 5.8 sq. in.

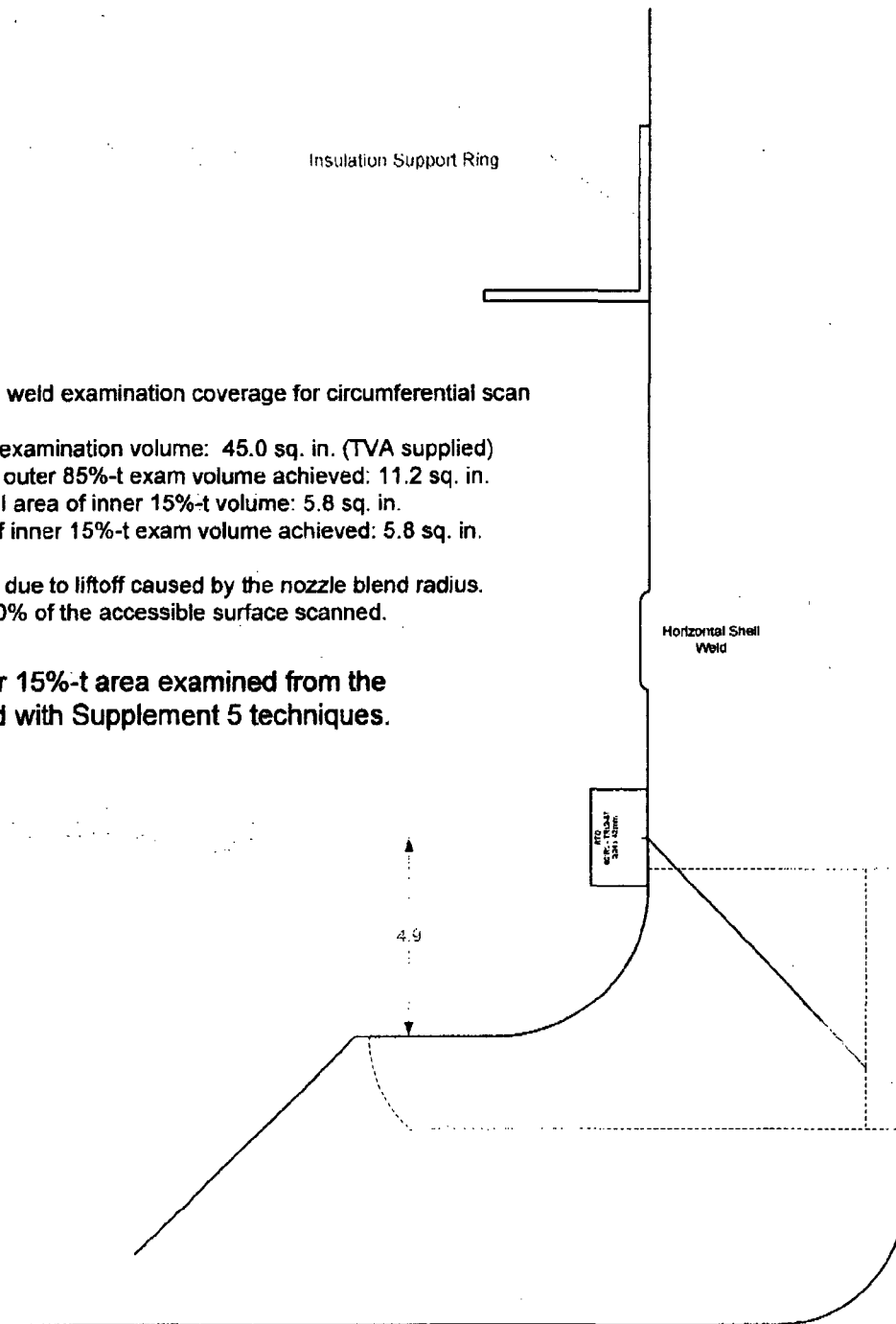
Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

**Inner 15%-t area examined from the
blend with Supplement 5 techniques.**


Horizontal Shell
Weld

FIG. 10
Scan Area
Scan Limit

4.9



R177

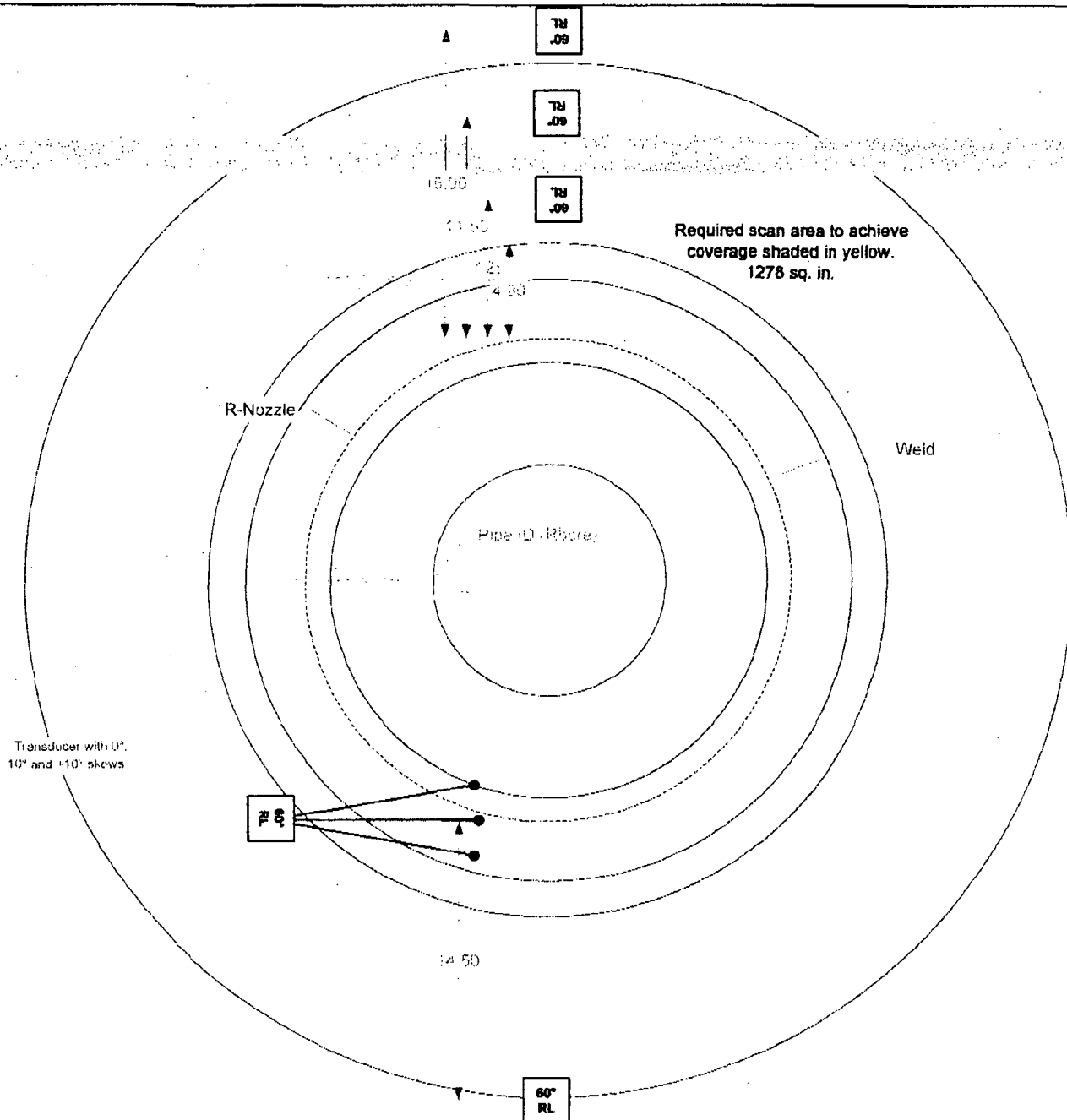
	DESCRIPTION			
	Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flesner	DATE 03/21/07	TITLE N4CNV-CPS3	PAGE 6 OF 11	

Contact can not be maintained on horizontal weld due to weld crown.
This area = 61 sq. in. of limitation.

Area to be scanned (yellow area): 1278 sq. in.
66sq. in. of limitation = 5% limitation of radial coverage.
(66 / 1278 = 5%)

000342

Insulation Support Ring



Insulation



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000843

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4CNV-CDS1				ISI Report Number: R177			
Component ID: N4C-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XC		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -120°		Measured Skew Angle: -120°	
	Delay: 1.76"			Mode: Shear		Radius: 3.8"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.6 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 28.6 dB		28.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
				Couplant: UltraGel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 51.4 dB	
Cal In: Date 03/21/07 Time 0900		Check: Date 03/21/07 Time 1246		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1330	
Comments							
Examiner: George Chapman		Level: II		Date: 03/21/07		Examiner: N/A	
Signature:						Level: N/A	
AREVA Review: Adam Gont		Level: III		Date: 03/22/07		Date: N/A	
Signature:						Page 7 of 11	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

600344

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4CNV-CDS2				ISI Report Number: <i>R177</i>			
Component ID: N4C-NV				Component Description: N4 Nozzle-to-Vessel weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PK		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: +120°	
	Delay: 1.76"			Mode: Shear		Radius: 3.8"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.6 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		75 %FSH 80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		29.0 dB 29.0 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
			Couplant: UltraGel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 49.0 dB	
Cal In: Date 03/21/07 Time 0905		Check: Date 03/21/07 Time 1303		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1328	
Comments							
Examiner: George Chapman		Level: II		Date: 03/21/07		Examiner: N/A	
Signature: <i>[Signature]</i>						Level: N/A Date: N/A	
AREVA Review: Adam Corn		Level: III		Date: 03/22/07			
Signature: <i>[Signature]</i>						Page 8 of 11	

A

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000945

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4CNV-CDS3				ISI Report Number: <i>R177</i>			
Component ID: N4C-NV				Component Description: N4 Nozzle-to-Vessel weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XB		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 60°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±35° to 67°		Measured Skew Angle: N/A	
	Delay: 1.17"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
	Pulse Width: 222 nS			Sweep: 0.5 div.		1.0 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
PULSER	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 22.8 dB		22.8 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-8937	
			Couplant: UltraGel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.0 div		Amplitude: 80 %FSH		Gain: 61.0 dB	
Cal In: Date 03/21/07 Time 0915		Check: Date 03/21/07 Time 1144		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1325	
Comments							
Examiner: George Chapman		Level: II		Date: 03/21/07		Examiner: N/A	
Signature: <i>[Signature]</i>						Level: N/A	
AREVA Review: Adam Gont		Level: III		Date: 03/22/07			
Signature: <i>[Signature]</i>							



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000346

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4CNV-CDS4				ISI Report Number: <i>R177</i>			
Component ID: N4C-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A		N/A
	Reject: Off			Sweep:	N/A		N/A
	Pulse Width: 222 nS			Amplitude:	N/A		N/A
	Damping: 500 Ω			Gain:	N/A		N/A
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 73 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 59.8 dB	
Cal In: Date 03/21/07 Time 1055		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1314	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/21/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III	Date: 03/22/07				



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000347

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4CNV-CDS5				ISI Report Number: <i>R177</i>			
Component ID: N4C-NV				Component Description: N4 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304 ✓		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A	N/A	
	Reject: Off			Sweep:	N/A	N/A	
	Pulse Width: 222 nS			Amplitude:	N/A	N/A	
PULSER	Damping: 500 Ω			Gain:	N/A	N/A	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V ("Sonic 137 only")			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 73 °F		Therm. SN: VH-8937	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 74.6 dB	
Cal In: Date 03/21/07 Time 1054		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1315	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/21/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III	Date: 03/22/07				

Examination Report, R-178
N4E-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000343

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R178
Component Number: N4E-NV	Component Description: N4 Nozzle to Vessel Weld			System: RPV
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS	
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0269-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19, Section 5	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N4ENV-CDS1		N4ENV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N4ENV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N4ENV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N4ENV-CDS4				
N4ENV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N4 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
40°S	+120°	Blend Radius
60°S	±(35°-67°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner	Date: 4/17/07	Reviewed by: Adam Conit	Date: 4/17/07
Signature:		Signature:	
Customer: Matt Welch	Date: 4/18/07	ANII:	Date: 5/22/07
Signature:		Signature:	



Ultrasonic Examination Data Sheet Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N4ENV-EDS1		ISI Report Number: <i>R178</i>	
Component ID: N4E-NV		Component Description: N4 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0269-C-01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N4ENV-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Blend Radius		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
40° / s	-120°	N4ENV-CDS1	3/21/07	1535	78°F	VH-9525	66.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
40° / s	+120°	N4ENV-CDS2	3/21/07	1555	78°F	VH-9525	66.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Vessel Shell		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60° / s	±35° to 67°	N4ENV-CDS3	3/21/07	1615	78°F	VH-9525	71.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: N-UT-78 revision 4						Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell		
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4ENV-CDS4	3/21/07	1645	78°F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4ENV-CDS5	3/21/07	1722	78°F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4ENV-CDS4	3/21/07	1645	78°F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4ENV-CDS5	3/21/07	1722	78°F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

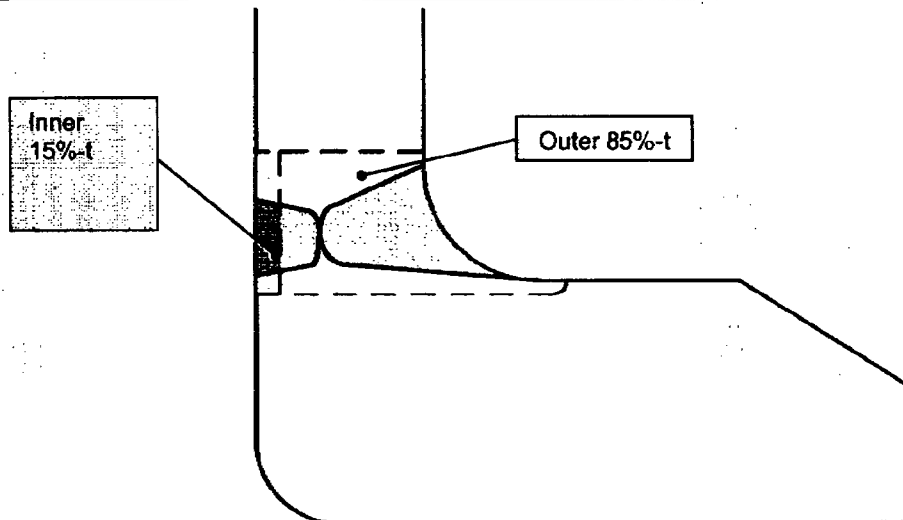
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 3/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 4/11/07			

C00349



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N4E-NV	Coverage Worksheet #: N4ENV-CWS1	ISI Report #: 12178
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 45.0 ² inches		^D Inner 15%-t Examination Volume: 5.8 ² inches	^G Outer 85%-t Examination Volume: 39.2 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.2 ² inches
		^F Inner 15%-t Volume Achieved: 5.8 ² inches	
^C Percentage of Axial Coverage: 54% / (49%)* B + A X 100 = C		^J Total Circumferential Examination Coverage: 38% (F + H) + A X 100 = J	

Combined Axial and Circumferential Weld Coverage


^LTotal Examination Coverage: 44%

$$(C+J) + 2 \times 100 = L$$

NOTE: *Axial scan coverage of 49% includes the insulation support ring limitation. *Total Examination Coverage* of 44% also takes into account this limitation.

Prepared by: Bret Flesner	Date: 04/17/07	Reviewed by: Adam Conti	Date: 04/17/07	Page 3 of 11
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000850

	DESCRIPTION Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flesner	DATE 04/17/07	TITLE N4ENV-CPS1	PAGE 4 OF 11	

R178
C00351

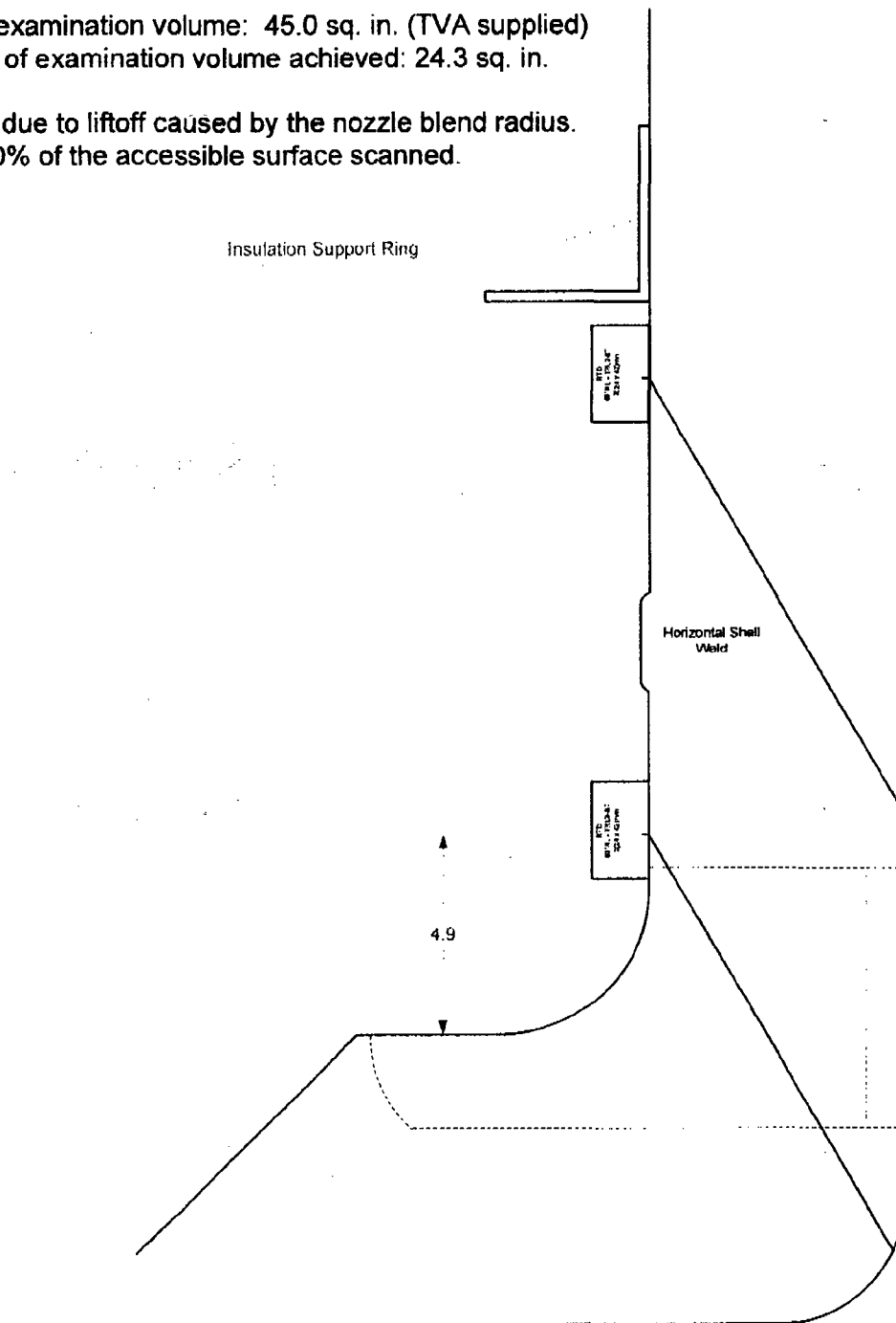
Nozzle-to-Vessel weld examination coverage for axial (radial) scan

Total area of examination volume: 45.0 sq. in. (TVA supplied)

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Insulation Support Ring



DESCRIPTION Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flesner	DATE 04/17/07	TITLE N4ENV-CPS2	PAGE 5 OF 11

R178
000352

Insulation Support Ring

Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 45.0 sq. in. (TVA supplied)

Total area of outer 85%-t exam volume achieved: 11.2 sq. in.

Total area of inner 15%-t volume: 5.8 sq. in.

Total area of inner 15%-t exam volume achieved: 5.8 sq. in.

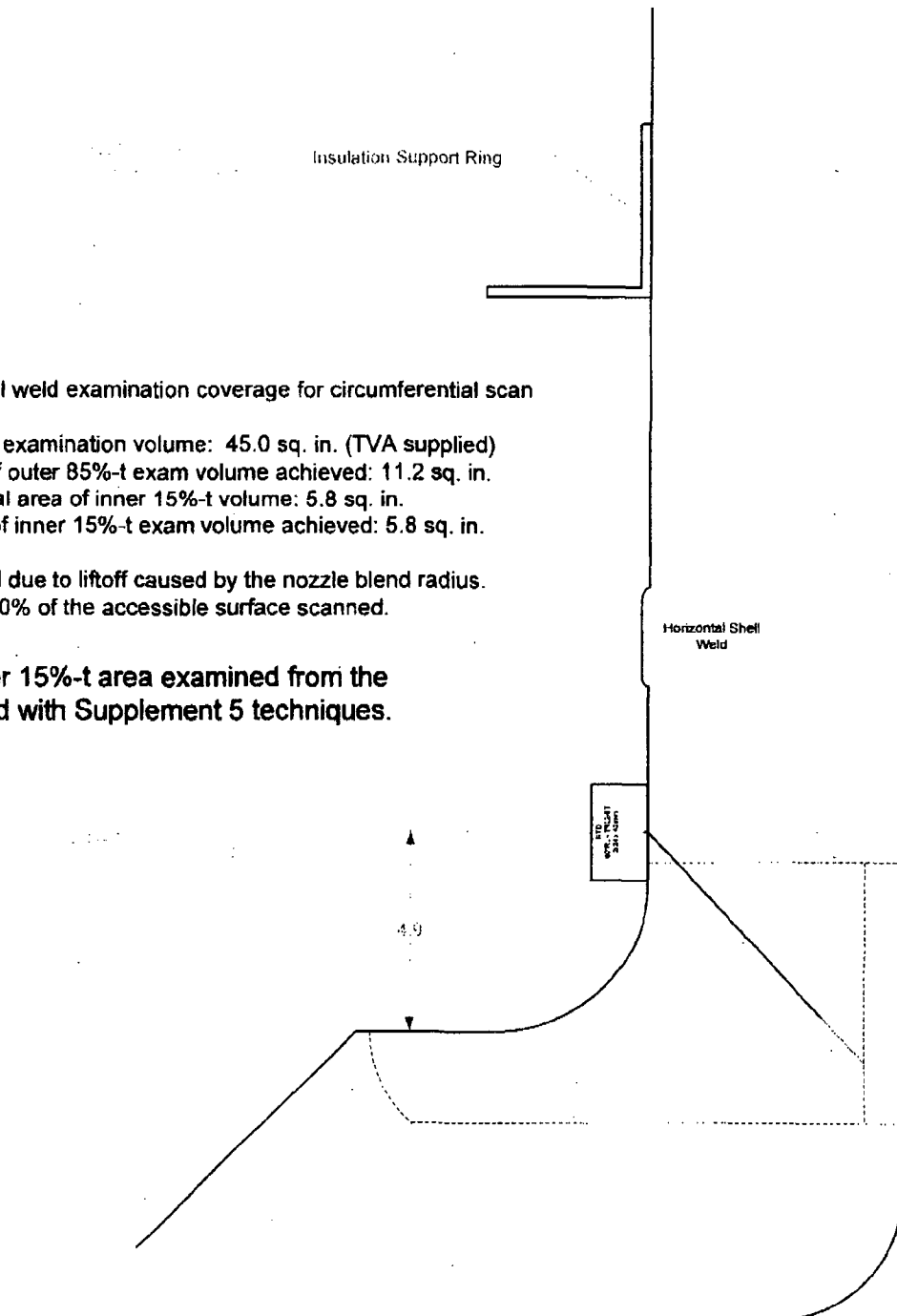
Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

**Inner 15%-t area examined from the
blend with Supplement 5 techniques.**

Horizontal Shell
Weld

INTO
WELD
WELD
WELD

4.9



R178

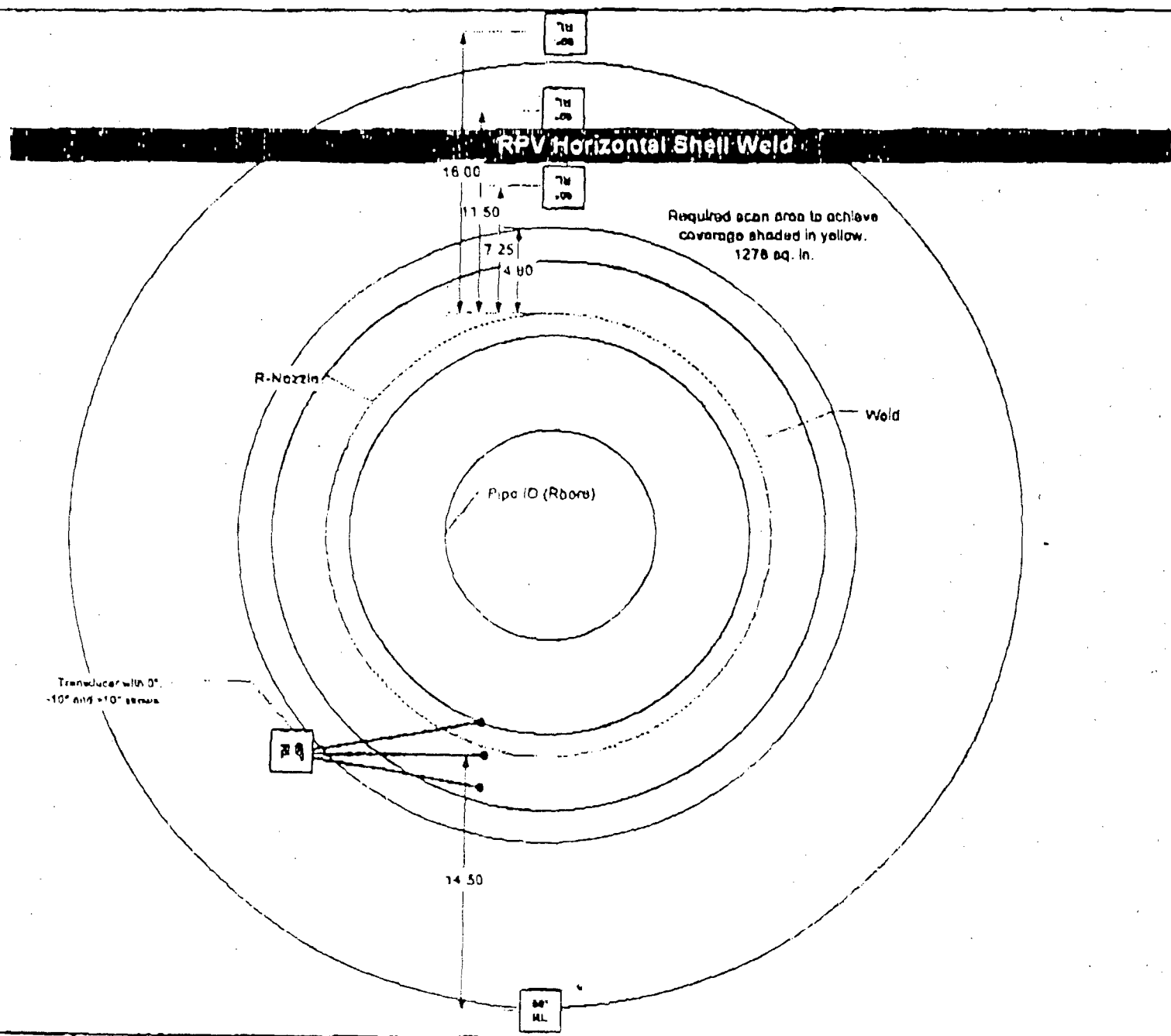
AREVA	DESCRIPTION			
	Brown's Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bob Fleener	04/17/07	N4ENV-CP63	8 OF 11	

Contact can not be maintained on horizontal weld due to weld crown.
This area = 81 sq. in. of limitation.

000353

Area to be scanned (yellow area): 1278 sq. in.
88 sq. in. of limitation = 5% limitation of radial coverage.
(88 / 1278 = 5%)

Insulation Support Ring



Insulation



Reactor Pressure Vessel 000354

Manual Ultrasonic Calibration Data Sheet

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N4ENV-CDS1		ISI Report Number: <i>R178</i>	
Component ID: N4E-NV		Component Description: N4 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 00X1XC	Frequency: 2.25 MHz	
Serial Number: 7031		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 40°	Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: -120°	Measured Skew Angle: -120°	
	Delay: 1.70"	Mode: Shear	Radius: 3.8"	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 791413	
PULSER	Reject: Off	Reflector:	1" Radius	2" Radius
	Pulse Width: 222 nS	Sweep:	0.6 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	30.6 dB	30.6 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 75 °F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 5.2 div	Amplitude: 80 %FSH	Gain: 58.0 dB
Cal In: Date 3/21/07 Time 1450	Check: Date 3/21/07 Time 1534	Check: Date N/A Time N/A	Out: Date 03/21/07 Time 1952

Comments			

Examiner: Thomas Brown Signature: <i>Tom Brown</i>	Level: II	Date: 3/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Corneli Signature: <i>Adam Corneli</i>	Level: III	Date: 4/11/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000355

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4ENV-CDS2				ISI Report Number: R178			
Component ID: N4E-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PK		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: +120°	
	Delay: 1.70"			Mode: Shear		Radius: 3.8"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.6 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 30.6 dB		30.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 58.0 dB	
Cal In: Date 3/21/07 Time 1454		Check: Date 3/21/07 Time 1554		Check: Date N/A Time N/A		Out: Date 3/21/07 Time 1954	
Comments							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>		Level: II		Date: 3/21/07		Examiner: N/A Signature:	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III		Date: 4/11/07		Level: N/A Date: N/A	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000356

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4ENV-CDS3				ISI Report Number: <i>R178</i>			
Component ID: N4E-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XB		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±35° to 67°		Measured Skew Angle: N/A	
	Delay: 1.09"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.5 div.		1.0 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 24.6 dB		24.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.8 div		Amplitude: 80 %FSH		Gain: 64.6 dB	
Cal In: Date 3/21/07 Time 1500		Check: Date 3/21/07 Time 1614		Check: Date N/A Time N/A		Out: Date 3/21/07 Time 1956	
Comments							
Examiner: Thomas Brown		Level: II		Date: 3/21/07		Examiner: N/A	
Signature: <i>Tom Brown</i>						Signature	
AREVA Review: Adam Cont		Level: III		Date: 4/11/07		Level: N/A	
Signature: <i>Adam Cont</i>						Date: N/A	



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000357

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4ENV-CDS4				ISI Report Number: R178			
Component ID: N4E-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS-125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 791413	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	1.2 div.	2.5 div.	
	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
PULSER	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 75 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.8 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 3/21/07 Time 1505		Check: Date 3/21/07 Time 1644		Check: Date N/A Time N/A		Out: Date 3/21/07 Time 1958	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Thomas Brown		Level: II	Date: 3/21/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>Thomas Brown</i>				Signature:			
AREVA Review: Adam Conti		Level: III	Date: 4/11/07				
Signature: <i>Adam Conti</i>							



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000358

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4ENV-CDS5				ISI Report Number: <i>R178</i>			
Component ID: N4E-NV				Component Description: N4 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS-125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 791413	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	0.5 div.	1.1 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 75 °F		Therm. SN: VH-9525	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 73.2 dB	
Cal In: Date 3/21/07 Time 1507		Check: Date 3/21/07 Time 1721		Check: Date N/A Time N/A		Out: Date 3/21/07 Time 2000	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Thomas Brown		Level: II		Date: 3/21/07		Examiner: N/A	
Signature: <i>Thomas Brown</i>						Level: N/A Date: N/A	
AREVA Review: Adam Conti		Level: III		Date: 4/11/07			
Signature: <i>Adam Conti</i>						Page 11 of 11	

Examination Report, R-179
N4F-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000359

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R179
Component Number: N4F-NV		Component Description: N4 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0269-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19, Section 5	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N4FNV-CDS1		N4FNV-EDS1		<input checked="" type="checkbox"/> No Recordable Indications
N4FNV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N4FNV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N4FNV-CDS4				
N4FNV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N4 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
40°S	-120°	Blend Radius
40°S	+120°	Blend Radius
60°S	±(35°-67°)	Vessel

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 44%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner	Date: 4/17/07	Reviewed by: Adam Conti	Date: 4/17/07
Signature: <i>Bret Flesner</i>		Signature: <i>Adam Conti</i>	
Customer: Matt Welch	Date: 4/17/07	ANII:	Date: 4/22/07
Signature: <i>Matt Welch</i>		Signature: <i>Sam Flood</i>	



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N4FNV-EDS1		ISI Report Number: <i>R179</i>	
Component ID: N4F-NV		Component Description: N4 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0269-C-01	W ₂ Location: Nozzle Boss (Rnozzle)	L ₂ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N4FNV-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius			
Angle/ Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
40° / s	-120°	N4FNV-CDS1	3/21/07	1755	78°F	VH-9525	66.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
40° / s	+120°	N4FNV-CDS2	3/21/07	1814	78°F	VH-9525	66.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: 54-ISI-850-06			Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell			
Angle/ Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60° / s	±35° to 67°	N4FNV-CDS3	3/21/07	1832	78°F	VH-9525	71.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB	
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
Examination Procedure: N-UT-78 revision 4			Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell			
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4FNV-CDS4	3/21/07	1903	78°F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N4FNV-CDS5	3/21/07	1936	78°F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4FNV-CDS4	3/21/07	1903	78°F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N4FNV-CDS5	3/21/07	1936	78°F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

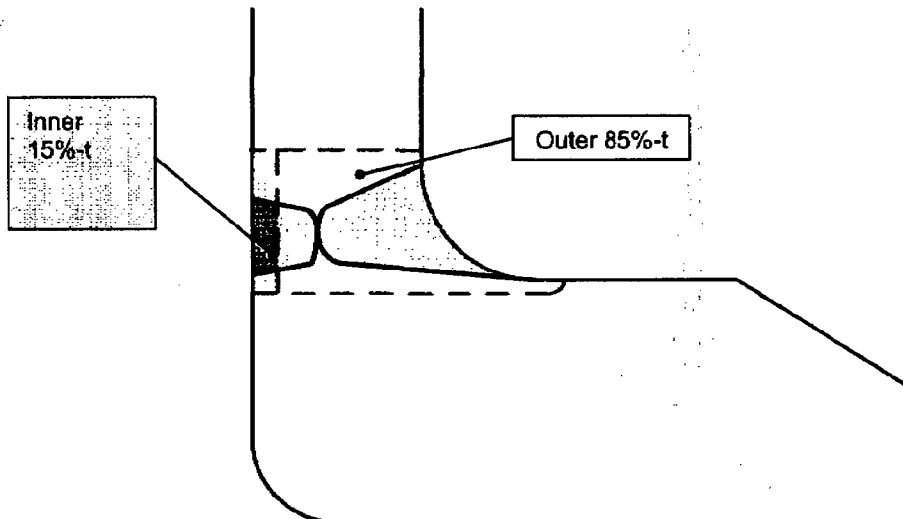
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 3/21/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 4/11/07			

000360



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N4F-NV	Coverage Worksheet #: N4FNV-CWS1	ISI Report #: R179
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 45.0 ² inches		^D Inner 15%-t Examination Volume: 5.8 ² inches	^G Outer 85%-t Examination Volume: 39.2 ² inches
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.3 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 11.2 ² inches
^C Percentage of Axial Coverage: 54% / (49%)* B + A X 100 = C		^F Inner 15%-t Volume Achieved: 5.8 ² inches	^J Total Circumferential Examination Coverage: 38% (F + H) + A X 100 = J

Combined Axial and Circumferential Weld Coverage

^LTotal Examination Coverage: 44%

$$(C+J) + 2 \times 100 = L$$

NOTE: *Axial scan coverage of 49% includes the insulation supporting ring limitation. ^LTotal Examination Coverage of 44% also takes into account this limitation.

Prepared by: Bret Flesner	Date: 04/17/07	Reviewed by: Adam Conti	Date: 04/17/07
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DESCRIPTION Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flesner	DATE 04/17/07	TITLE N4FNV-CPS1	PAGE 4 OF 11

R179
000362

Nozzle-to-Vessel weld examination coverage for axial (radial) scan

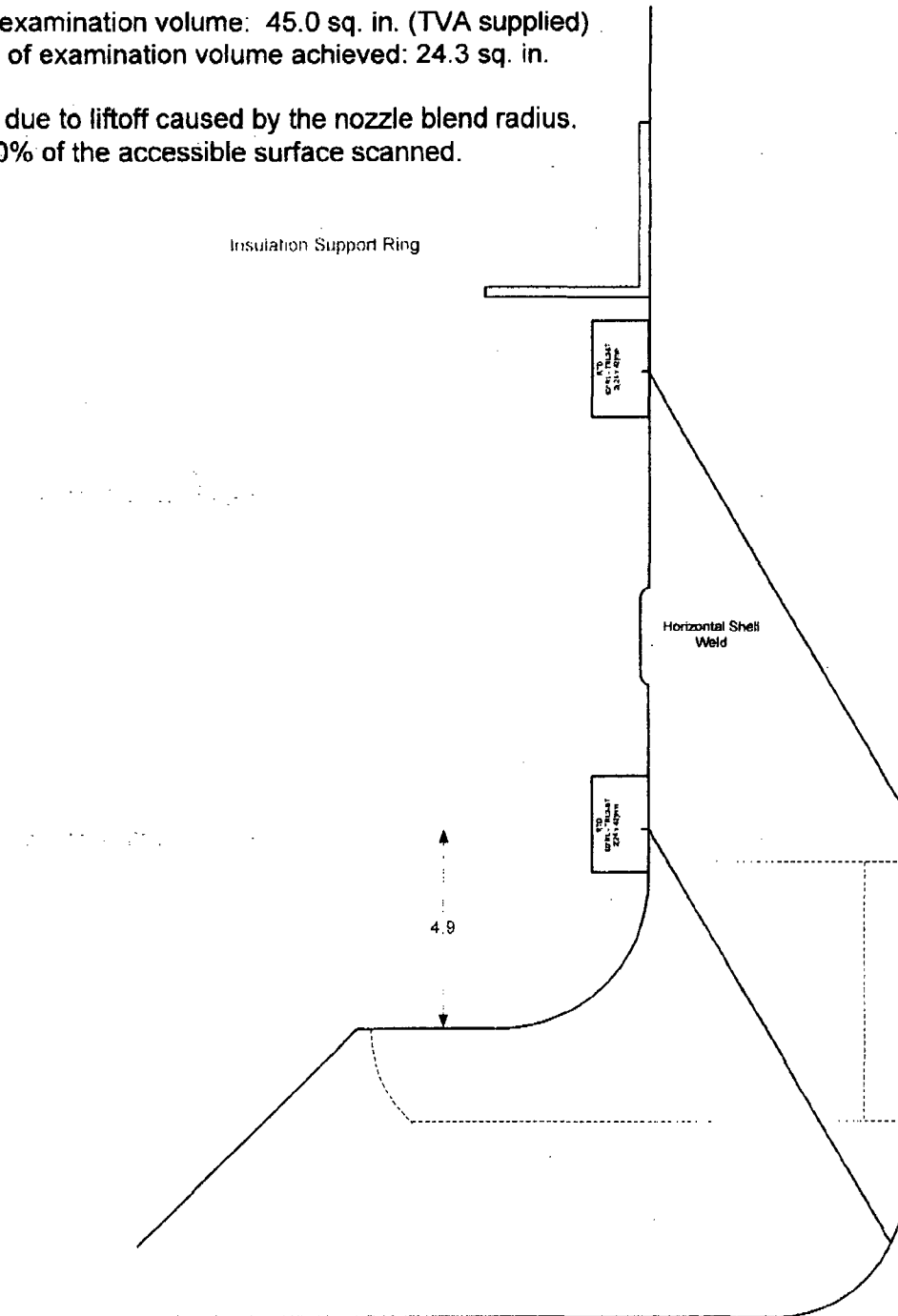
Total area of examination volume: 45.0 sq. in. (TVA supplied)

Total area of examination volume achieved: 24.3 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.

100% of the accessible surface scanned.

Insulation Support Ring





DESCRIPTION Brown Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flanner	DATE 04/17/07	TITLE N4FNV-CPS2	PAGE 5 OF 11

R179

000363

Insulation Support Ring

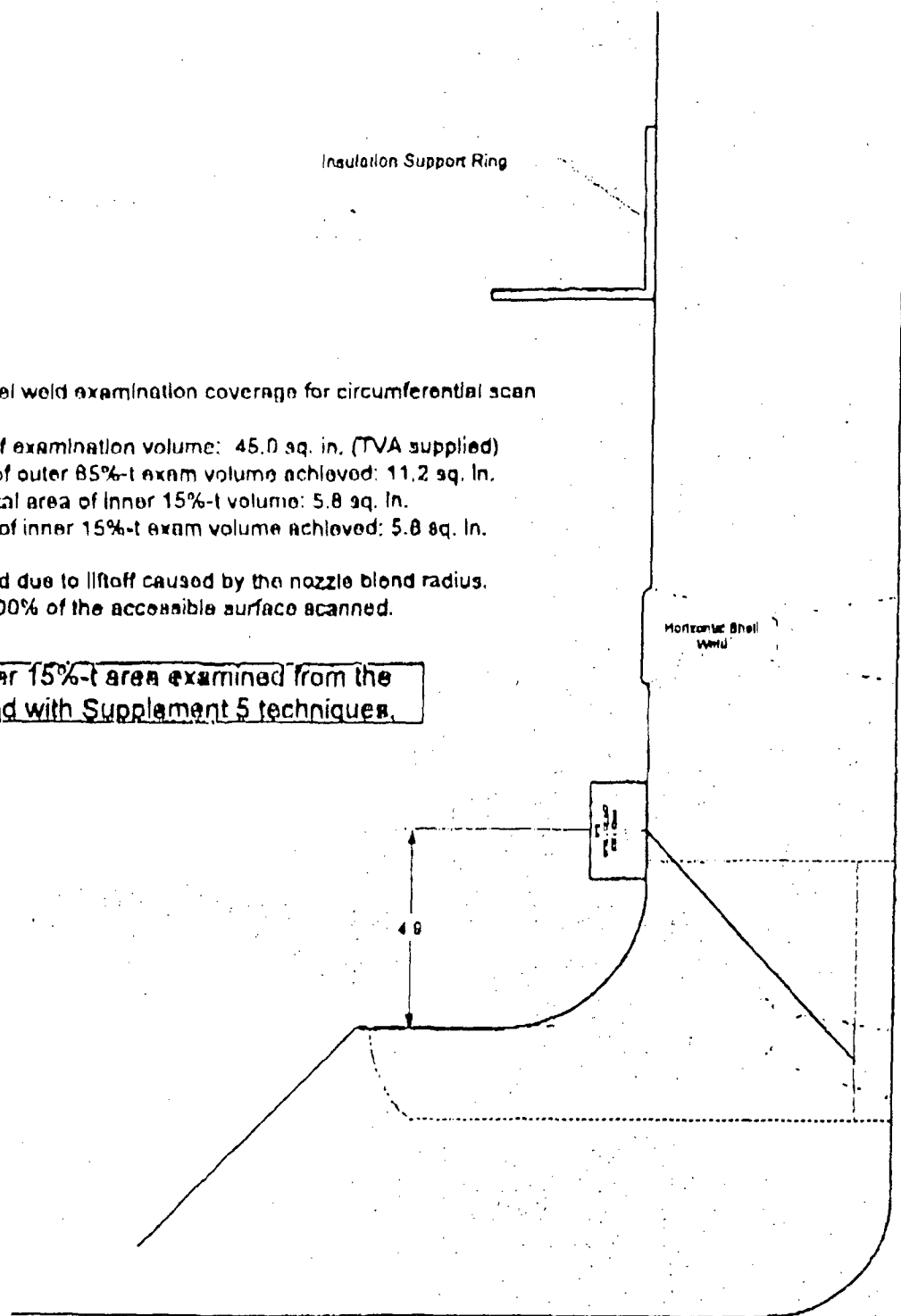
Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 45.0 sq. in. (TVA supplied)
Total area of outer 85%-t exam volume achieved: 11.2 sq. in.
Total area of inner 15%-t volume: 5.8 sq. in.
Total area of inner 15%-t exam volume achieved: 5.8 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.

Horizontal Shell
Weld



R179

AREVA	DESCRIPTION			
	Browns Ferry N4 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	04/17/07	N4FNV-CPS3	6 OF 11	

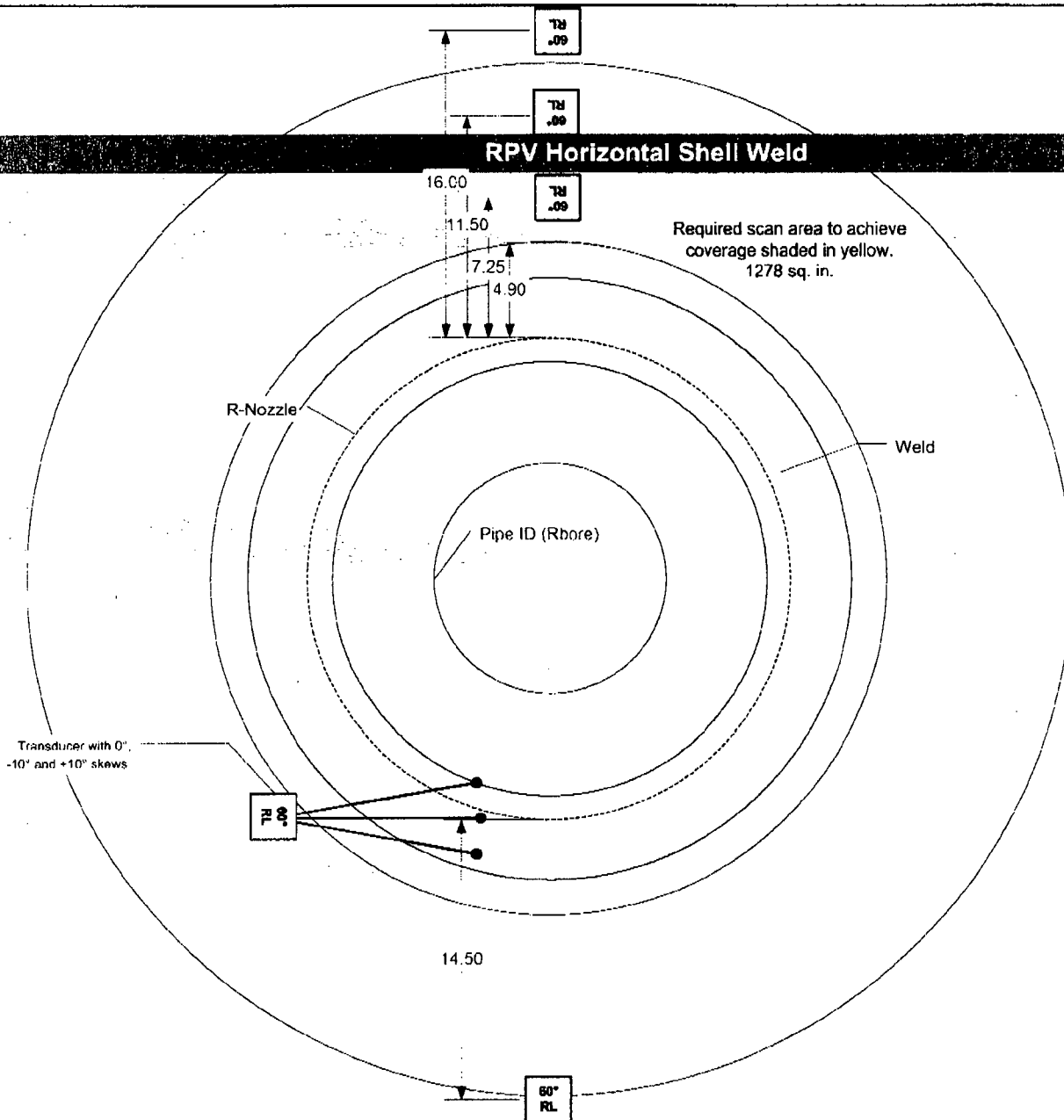
Contact can not be maintained on horizontal weld due to weld crown.

This area = 61 sq. in. of limitation.

Area to be scanned (yellow area): 1278 sq. in.
 66sq. in. of limitation = 5% limitation of radial coverage.
 (66 / 1278 = 5%)

000364

Insulation Support Ring





Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000365

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4FNV-CDS1				ISI Report Number: <i>RIM</i>			
Component ID: N4F-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XC		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -120°		Measured Skew Angle: -120°	
	Delay: 1.70"			Mode: Shear		Radius: 3.8"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.6 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 70 %FSH		80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 30.6 dB		30.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 58.0 dB	
Cal In: Date 3/21/07 Time 1450		Check: Date 3/21/07 Time 1754		Check: Date N/A Time N/A		Out: Date 03/21/07 Time 1952	
Comments							
Examiner: Thomas Brown		Level: II		Date: 3/21/07		Examiner: N/A	
Signature: <i>Thomas Brown</i>						Level: N/A	
AREVA Review: Adam Conly		Level: III		Date: 4/11/07		Date: N/A	
Signature: <i>Adam Conly</i>							



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000366

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N4FNV-CDS2				ISI Report Number: <i>R179</i>			
Component ID: N4F-NV				Component Description: N4 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PK		Frequency: 2.25 MHz	
Serial Number: 7031				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS4				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 40°		Measured Angle: 40°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +120°		Measured Skew Angle: +120°	
	Delay: 1.70"			Mode: Shear		Radius: 3.8"	
RCVR	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
	Display: Filt2			Verification Block			
PULSER	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector:	1" Radius	2" Radius	
	Pulse Width: 222 nS			Sweep:	0.6 div.	1.3 div.	
	Damping: 500 Ω			Amplitude:	70 %FSH	80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:	30.6 dB	30.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
Temperature: 75 °F				Therm. SN: VH-9525			
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.2 div		Amplitude: 80 %FSH		Gain: 58.0 dB	
Cal In: Date 3/21/07 Time 1454		Check: Date 3/21/07 Time 1813		Check: Date N/A Time N/A		Out: Date 3/21/07 Time 1954	
Comments							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>				Level: II		Date: 3/21/07	
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>				Level: III		Date: 4/11/07	
Examiner: N/A Signature:				Level: N/A		Date: N/A	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000367

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N4FNV-CDS3		ISI Report Number: <i>R179</i>	
Component ID: N4F-NV		Component Description: N4 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	
Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz
Serial Number: 7031		Size: 0.5" x 1.0"	Shape: Rectangle
Linearity Sheet No.: LDS4		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 60°	Measured Angle: 59°
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ±35° to 67°	Measured Skew Angle: N/A
	Delay: 1.09"	Mode: Shear	Radius: Flat
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0
RCVR	Display: Filt2	Verification Block	
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 791413
	Reject: Off	Reflector: 1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep: 0.6 div.	1.1 div.
	Damping: 500 Ω	Amplitude: 70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: 24.6 dB	24.6 dB
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
		Temperature: 75 °F	Therm. SN: VH-9525
Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information			
Reflector: ID Notch	Sweep: 5.8 div	Amplitude: 80 %FSH	Gain: 64.6 dB
Cal In: Date 3/21/07 Time 1500	Check: Date 3/21/07 Time 1831	Check: Date N/A Time N/A	Out: Date 3/21/07 Time 1956
Comments			
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>		Level: II	Date: 3/21/07
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III	Date: 4/11/07
Examiner: N/A Signature: _____		Level: N/A	Date: N/A



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000368

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N4FNV-CDS4		ISI Report Number: <i>R179</i>	
Component ID: N4F-NV		Component Description: N4 Nozzle-to-Vessel Weld.	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	
Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304	Frequency: 2 MHz
Serial Number: 7031		Angle: 60°	Measured Angle: 61°
Linearity Sheet No.: LDS4		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect.
	Delay: 1.38"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.230 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: CS Rompas	S/N: 791413
	Frequency: 2.25 MHz	Reflector:	1" Radius
	Reject: Off	Sweep:	1.2 div.
	Pulse Width: 222 nS	Amplitude:	25 %FSH
	Damping: 500 Ω	Gain:	52.0 dB
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 75 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325
Reference Sensitivity Information			
Reflector: 1/4-t SDH	Sweep: 3.8 div	Amplitude: 80 %FSH	Gain: 58.4 dB
Cal In: Date 3/21/07 Time 1505	Check: Date 3/21/07 Time 1902	Check: Date N/A Time N/A	Out: Date 3/21/07 Time 1958
Comments			
Zone 1 - Near Surface calibration.			
Examiner: Thomas Brown	Level: II	Date: 3/21/07	Examiner: N/A
Signature: <i>Thomas Brown</i>			Signature
AREVA Review: Adam Conti	Level: III	Date: 4/11/07	
Signature: <i>Adam Conti</i>			



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000369

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N4FNV-CDS5

ISI Report Number:

R179

Component ID: N4F-NV

Component Description: N4 Nozzle-to-Vessel Weld.

Examination Procedure: N-UT-78 Revision 4

Applicable SDCN(s): N/A

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-304	Frequency: 2 MHz
Serial Number: 7031		Angle: 60°	Measured Angle: 61°
Linearity Sheet No.: LDS4		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.38"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.230 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: CS Rompas	S/N: 791413
	Frequency: 2.25 MHz	Reflector:	1" Radius 2" Radius
	Reject: Off	Sweep:	0.5 div. 1.1 div.
	Pulse Width: 222 nS	Amplitude:	25 %FSH 80 %FSH
PULSER	Damping: 500 Ω	Gain:	52.0 dB 52.0 dB
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 75 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 73.2 dB
Cal In: Date 3/21/07 Time 1507	Check: Date 3/21/07 Time 1935	Check: Date N/A Time N/A	Out: Date 3/21/07 Time 2000

Comments

Zone 2 - Full Volume calibration.

Examiner: Thomas Brown

Level: II

Date: 3/21/07

Examiner: N/A

Level: N/A

Date: N/A

Signature: *Thomas Brown*

Signature

AREVA Review: Adam Con

Level: III

Date: 4/11/07

Signature: *Adam Con*

Examination Report, R-156
N5A-NV, RPV Nozzle-To-Head Weld

000370

Summary:

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL and 60°S examinations were limited due to the nozzle configuration, mirror insulation, and an insulation support ring which reduced the examination volume obtained to 27%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Page 1 of 12

Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
 Examination Data Sheet Number: N5ANV-EDS1 ISI Report Number: R156
 Component ID: N5A-NV Component Description: Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0271-C-01 W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC
 Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N5ANV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Blend Radius		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
35°S	-68°	N5ANV-CDS1	03/14/07	1807	80° F	VH-9525	65.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
35°S	+68°	N5ANV-CDS2	03/14/07	1752	80° F	VH-9525	65.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	
NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	

Examination Procedure: 54-ISI-850-06						Applicable SDCN's: 30-9044520-000				Scan Surface: OD Vessel Shell		
Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials	
60°S	±30° to 64°	N5ANV-CDS3	03/14/07	1725	80° F	VH-9525	70.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A	

Examination Procedure: N-UT-78 revision 4						Applicable SDCN's: N/A				Scan Surface: OD Vessel Shell		
Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N5ANV-CDS4	03/14/07	1638	80° F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N5ANV-CDS5	03/14/07	1715	80° F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N5ANV-CDS4	03/14/07	1638	80° F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N5ANV-CDS5	03/14/07	1715	80° F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

60°RL radial, 60°RL circumferential, and 60°S examinations limited due to insulation support ring below nozzle. See coverage plots and worksheet for additional details.

In-vessel feedwater piping end bracket attachment welds observed on the vessel ID surface during the 60°RL Zone 2 circumferential scans.

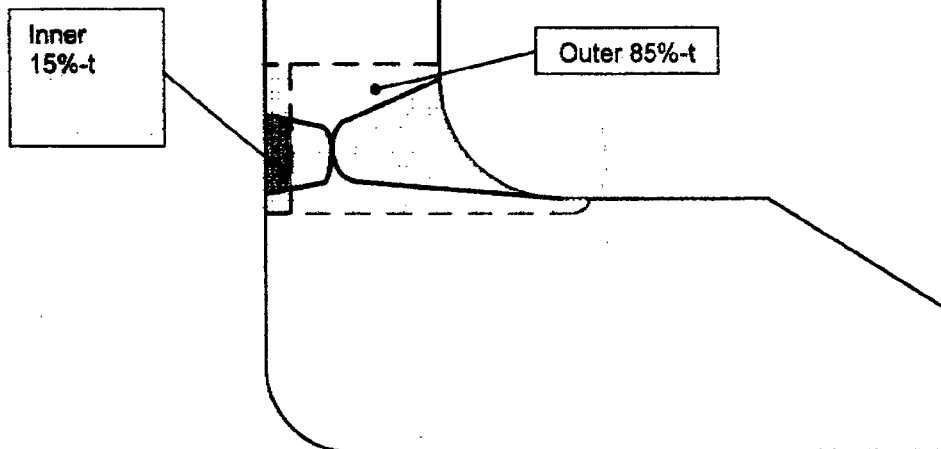
Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/23/07			

C00371

RPV Nozzle-To-Shell Weld


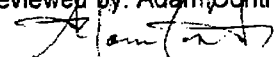
Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N5A-NV	Coverage Worksheet #: N5ANV-CWS1	ISI Report #: R156
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 44.9 ² inches		^D Inner 15%-t Examination Volume: 5.1 ² inches	^G Outer 85%-t Examination Volume: 39.8 ² Inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius & Insulation Support Ring		Inner 15%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.2 ² inches		Description of Limitation: Insulation Support Ring	^H Outer 85%-t Volume Achieved: 7.7 ² inches
		^F Inner 15%-t Volume Achieved: 5.1 ² inches	
^C Percentage of Axial Coverage: 54% *(36%) B + A X 100 = C		^I Total Circumferential Examination Coverage: 29% *(18%) (F + H) + A X 100 = J	
Combined Axial and Circumferential Weld Coverage			
^L Total Examination Coverage: 42% *(27%) (C+J) + 2 X 100 = L			
NOTE: *Scan coverages shown in parentheses include limitations caused by mirror insulation and insulation support ring.			
Prepared by: Bret Flesner	Date: 03/23/07	Reviewed by: Adam Conti	Date: 03/23/07
			
		Page 3 of 12	

000372

	DESCRIPTION		
	Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot		
DRAWN BY	DATE	TITLE	PAGE
Bret Flesner	03/23/07	N5ANV-CPS1	4 OF 12

R156
000373

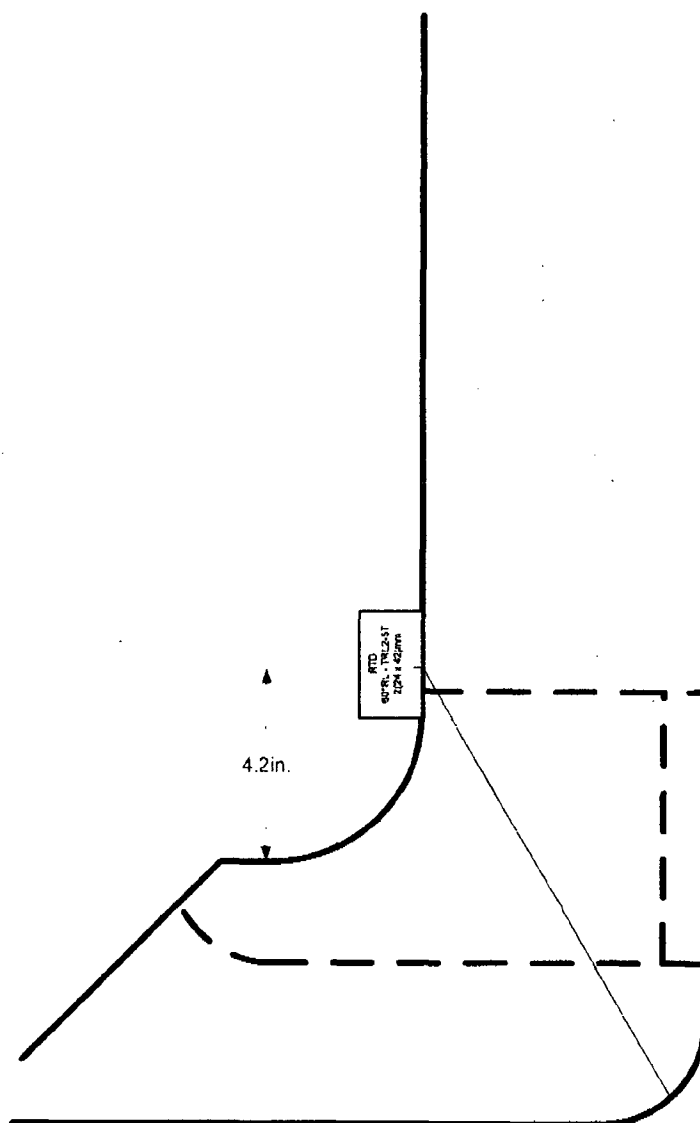
Nozzle-to-Vessel weld examination coverage for axial (radial) scan

Total area of examination volume: 44.9 sq. in. (TVA supplied)

Total area of examination volume achieved: 24.2 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.

100% of the accessible surface scanned.



	DESCRIPTION			
	Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/23/07	N5ANV-CPS2	5 OF 12	

R156

000374

Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 44.9 sq. in. (TVA supplied)

Total area of outer 85%-t exam volume achieved: 7.7 sq. in.

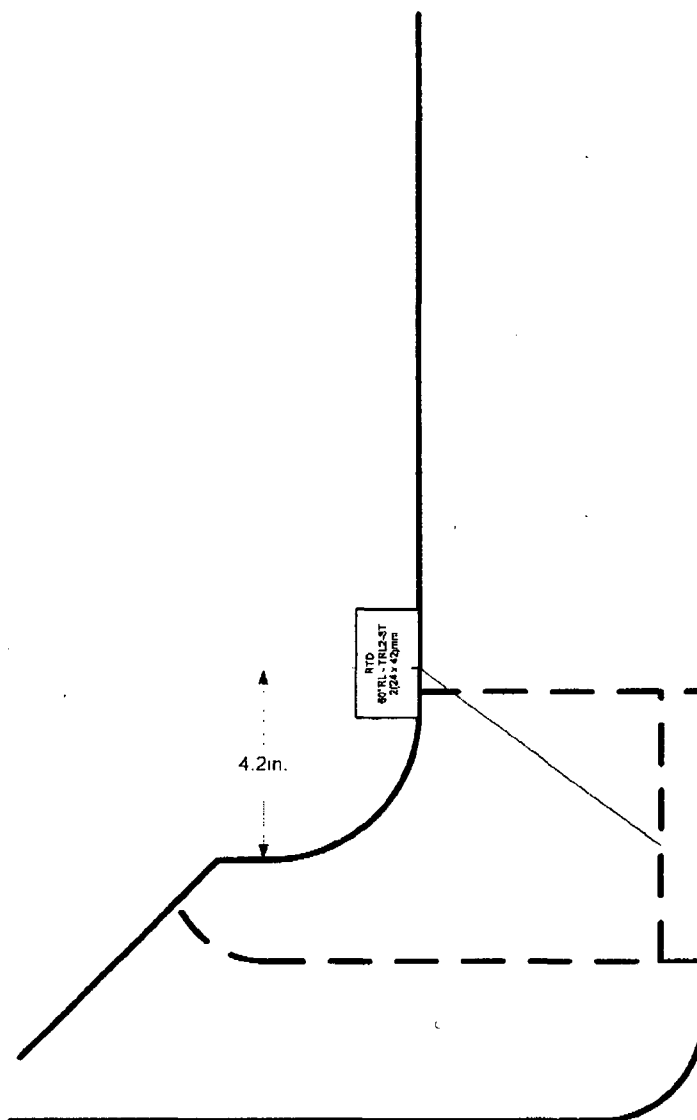
Total area of inner 15%-t volume: 5.1 sq. in.

Total area of inner 15%-t exam volume achieved: 5.1 sq. in.


Scan limited due to liftoff caused by the nozzle blend radius.

100% of the accessible surface scanned.

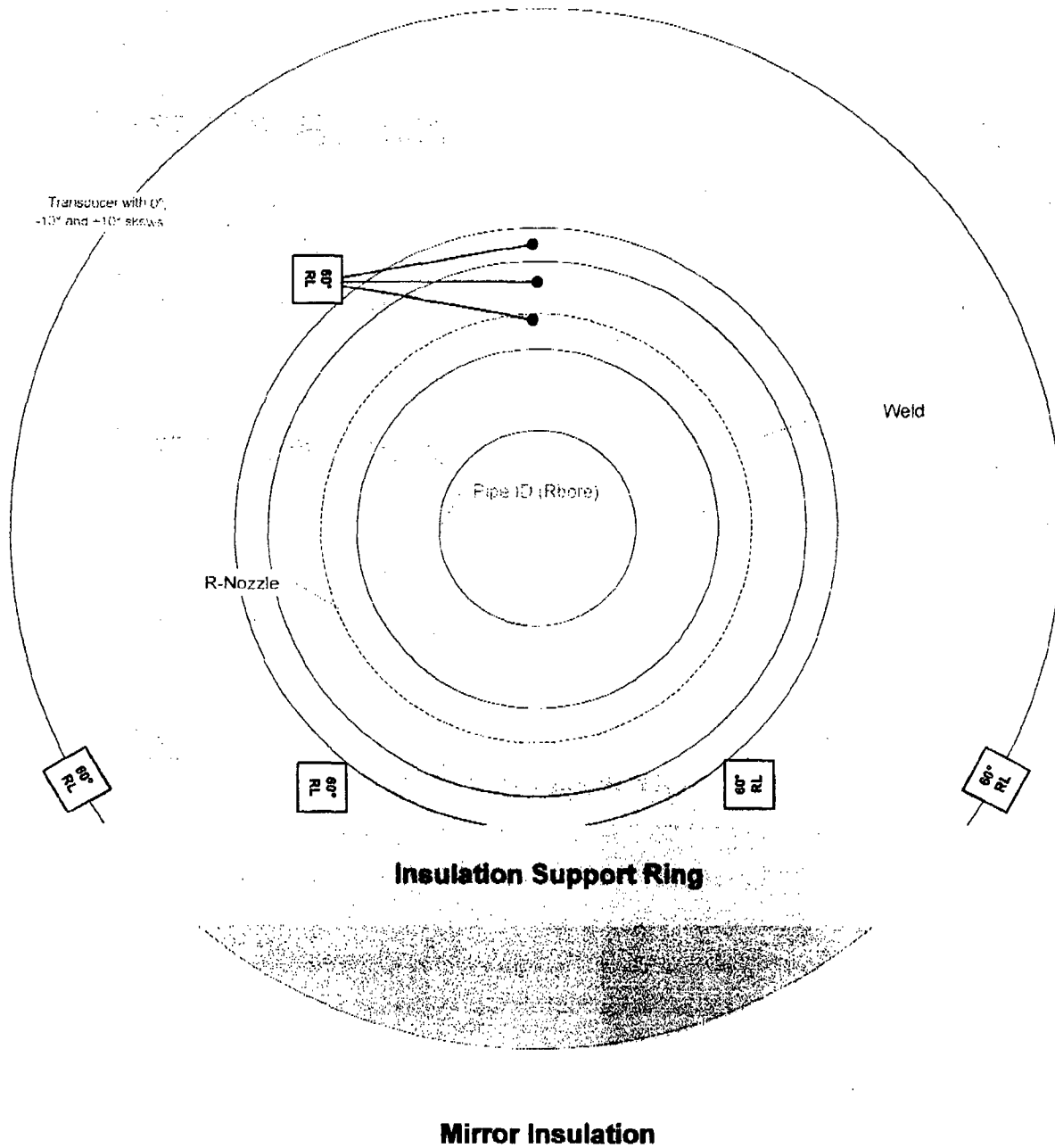
Inner 15%-t area examined from the
blend with Supplement 5 techniques.




R156

			
DESCRIPTION Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flesner	DATE 03/23/07	TITLE N5ANV-CPS3	PAGE 6 OF 12

60°RL Scan Limitations
 Radial Scan Area (Yellow) = 1365 sq. in.
 Area of radial scan limitation (Red) = 438 sq. in.
 Circ Scan Area = 229 sq. in.
 Area of circ scan limitation = 69 sq. in.
 $438 / 1365 = 32\%$ radial scan limitation
 $69 / 229 = 30\%$ circumferential scan limitation
**above percentages do not include the limitation caused by the nozzle configuration. The total examination coverage achieved combining all limitations is shown on the Coverage Calculation Worksheet.*



	DESCRIPTION			
	Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/23/07	N5ANV-CPS4	7 OF 12	

R156
000376

60°S Scan Limitation

60°S Scan area (Yellow) = 527 sq. in.

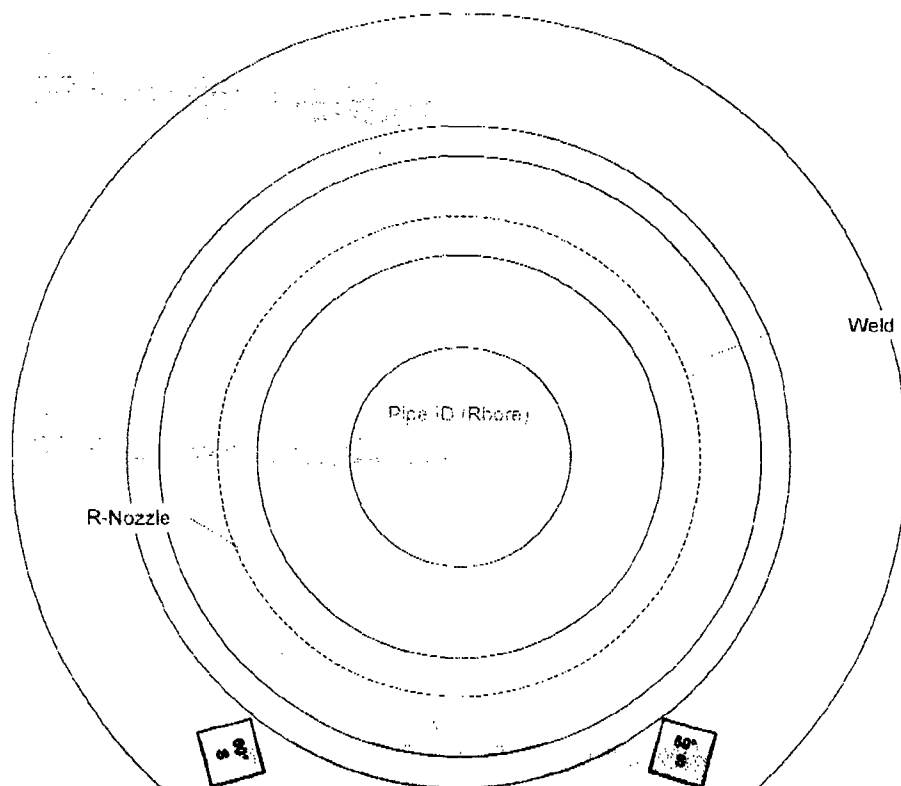
60°S Scan limitation (Red) = 141 sq. in.

$141 / 527 = *27\%$ 60°S scan limitation

Using Figures 6-3 & 6-4 of the modeling report it is estimated that the 60°S makes up 62% of the inner 15%-t coverage. The 35° S examination was not limited since scanning is performed from the blend.

$27 \times 62\% = *17\%$ combined 60°S and 35°S scan limitation.

**above percentages do not include the limitation caused by the nozzle configuration. The total examination coverage achieved combining all limitations is shown on the Coverage Calculation Worksheet.*



Insulation Support Ring

Mirror Insulation



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000877

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N5ANV-CDS1		ISI Report Number: <i>R156</i>	
Component ID: N5A-NV		Component Description: N5 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 0111PV	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 35°	Measured Angle: 35°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: -68°	Measured Skew Angle: -68°	
	Delay: 1.27"	Mode: Shear	Radius: 3.1"	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.65 div.	1.3 div.
	Damping: 500 Ω	Amplitude:	80 %FSH	65 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	32.4 dB	32.4 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 75 °F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 5.0 div	Amplitude: 80 %FSH	Gain: 48.2 dB
Cal In: Date 3/14/07 Time 1435	Check: Date 3/14/07 Time 1806	Check: Date N/A Time N/A	Out: Date 03/14/07 Time 1830

Comments

Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/23/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000378

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N5ANV-CDS2				ISI Report Number: R156			
Component ID: N5A-NV				Component Description: N5 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PM		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 35°		Measured Angle: 35°	
RANGE	Range: 15.0° <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +68° ✓		Measured Skew Angle: +68°	
	Delay: 1.27"			Mode: Shear		Radius: 3.1"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.65 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		80 %FSH 65 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		32.2 dB 32.2 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.0 div		Amplitude: 80 %FSH		Gain: 48.0 dB	
Cal In: Date 3/14/07 Time 1440		Check: Date 3/14/07 Time 1751		Check: Date N/A Time N/A		Out: Date 03/14/07 Time 1835	
Comments							
Examiner: George Chapman		Level: II		Date: 03/14/07		Examiner: N/A	
Signature: <i>George Chapman</i>						Level: N/A Date: N/A	
AREVA Review: Adam Cort		Level: III		Date: 03/23/07			
Signature: <i>Adam Cort</i>						Page 9 of 12	

A

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000379

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N5ANV-CDS3				ISI Report Number: <i>R156</i>			
Component ID: N5A-NV				Component Description: N5 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 00X1XB		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ± 30-64°		Measured Skew Angle: N/A	
	Delay: 0.813"			Mode: Shear		Radius: N/A	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:	1" Radius	2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:	0.6 div.	1.1 div.	
	Damping: 500 Ω			Amplitude:	70 %FSH	80 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:	27.6 dB	27.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
			Couplant: Ultragel II		Batch No.: 05325		
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.8 div		Amplitude: 80 %FSH		Gain: 62.2 dB	
Cal In: Date 3/14/07 Time 1430		Check: Date 3/14/07 Time 1724		Check: Date N/A Time N/A		Out: Date 3/14/07 Time 1840	
Comments							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II	Date: 3/14/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Corti Signature: <i>Adam Corti</i>		Level: III	Date: 03/23/07				

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000380

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO

Calibration Data Sheet Number: N5ANV-CDS4 ISI Report Number: *R156*

Component ID: N5A-NV Component Description: N5 Nozzle-to-Vessel Weld

Examination Procedure: N-UT-78 Revision 4 Applicable SDCN(s): N/A

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	
Model: Sonic 136		Model: TRL2-ST	
Serial Number: 703I		Serial Number: 07-304	
Linearity Sheet No.: LDS4		Angle: 60°	
		Measured Angle: 61°	
		Mode: Refracted Longitudinal	
		Size: 2(24x42)mm	
Instrument Settings		Focus: FS~125mm	
		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.38"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.230 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: CS Rompas	S/N: 99-6251
	Frequency: 2.25 MHz	Reflector:	1" Radius 2" Radius
	Reject: Off	Sweep:	1.2 div. 2.5 div.
PULSER	Pulse Width: 222 nS	Amplitude:	25 %FSH 80 %FSH
	Damping: 500 Ω	Gain:	52.0 dB 52.0 dB
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: Clad CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 75 °F	Therm. SN: VH-9525
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: 1/4-t SDH	Sweep: 3.8 div	Amplitude: 80 %FSH	Gain: 58.0 dB
Cal In: Date 3/14/07 Time 1400	Check: Date 3/14/07 Time 1637	Check: Date N/A Time N/A	Out: Date 3/14/07 Time 1850

Comments

Zone 1 - Near Surface calibration.

Examiner: Thomas Brown Signature: <i>[Signature]</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature	Level: N/A	Date: N/A
AREVA Review: Adam Conli Signature: <i>[Signature]</i>	Level: III	Date: 03/23/07			

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000381

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
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Calibration Data Sheet Number: N5ANV-CDS5	ISI Report Number: <i>R156</i>
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Component ID: N5A-NV	Component Description: N5A Nozzle-to-Vessel Weld
----------------------	--

Examination Procedure: N-UT-78 Revision 4	Applicable SDCN(s): N/A
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Ultrasonic Instrument	Transducer
Manufacture: Staveley	Manufacture: RTD
Model: Sonic 136	Model: TRL2-ST
Serial Number: 7031	Serial Number: 07-304
Linearity Sheet No.: LDS4	Frequency: 2 MHz
	Angle: 60°
	Measured Angle: 61°
	Mode: Refracted Longitudinal
	Size: 2(24x42)mm

Instrument Settings	Focus: FS~125mm
---------------------	-----------------

RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS
	Delay: 1.38"	Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0
	Velocity: 0.230 in / μ S	Verification Block		

RCVR	Display: Filt 2	Type: CS Rompas	S/N: 99-6251
	Frequency: 2.25 MHz	Reflector:	1" Radius
	Reject: Off	Sweep:	2" Radius
	Pulse Width: 222 nS	Amplitude:	0.5 div.
	Damping: 500 Ω	Gain:	1.1 div.
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual		25 %FSH
	Rep Rate: 2kHz		80 %FSH
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)		52.0 dB
			52.0 dB

PULSER		Basic Calibration Block	
	Block ID: BF-18	Material: Clad CS	
	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
	Temperature: 75 °F	Therm. SN: VH-9525	
	Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 73.0 dB
Cal In: Date 3/14/07 Time 1345	Check: Date 3/14/07 Time 1714	Check: Date N/A Time N/A	Out: Date 3/14/07 Time 1845

Comments

Zone 2 - Full Volume calibration.

Examiner: Thomas Brown Signature: <i>[Signature]</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature: _____	Level: N/A	Date: N/A
AREVA Review: Adam Confi Signature: <i>[Signature]</i>	Level: III	Date: 03/23/07			

Examination Report, R-157
N5B-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000882

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R157
Component Number: N5B-NV		Component Description: N5 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0271-C-01				
Procedure Number:	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2003-19 Section 6	
Calibration Sheets		Exam Data Sheets	Indication Data Sheets	Exam Results
N5ANV-CDS1		N5ANV-EDS1	NA	<input checked="" type="checkbox"/> No Recordable Indications
N5ANV-CDS2				<input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation)
N5ANV-CDS3				<input type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)
N5ANV-CDS4				
N5ANV-CDS5				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in no reportable indications.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N5 Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
35°S	-68°	Blend Radius
35°S	+68°	Blend Radius
60°S	±30° to 64°	Vessel Shell

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL and 60°S examinations were limited due to the nozzle configuration, mirror insulation, and an insulation support ring which reduced the examination volume obtained to 27%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus ½" on each side.

Prepared by: George Chapman Signature: <i>George Chapman</i>	Date: 3/23/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Date: 3/23/07
Customer: Matt Welch Signature: <i>Matt Welch</i>	Date: 3/31/07	ANII: Signature: <i>Paul Thorne</i>	Date: 5/22/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO
 Examination Data Sheet Number: N5BNV-EDS1 ISI Report Number: R157
 Component ID: N5B-NV Component Description: Nozzle-to-Vessel Weld

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0271-C-01 W₀ Location: Nozzle Boss (Rnozzle) L₀ Location: Nozzle TDC
 Examination Limited: ☒ Yes ☐ No Coverage Sheet Number(s): N5BNV-CWS1

Scan Information

Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Blend Radius		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
35°S	-68°	N5BNV-CDS1		03/14/07	1637	80° F	VH-9525	65.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
35°S	+68°	N5BNV-CDS2		03/14/07	1620	80° F	VH-9525	65.0 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
NA	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
NA	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: 54-ISI-850-06				Applicable SDCN's: 30-9044520-000						Scan Surface: OD Vessel Shell		
Angle/ Mode	Skew	Calibration Sheet #		Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°S	±30° to 64°	N5BNV-CDS3		03/14/07	1653	80° F	VH-9525	70.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
Examination Procedure: N-UT-78 revision 4				Applicable SDCN's: N/A						Scan Surface: OD Vessel Shell		
Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N5BNV-CDS4	03/14/07	1551	80° F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N5BNV-CDS5	03/14/07	1616	80° F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N5BNV-CDS4	03/14/07	1551	80° F	VH-9525	78.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N5BNV-CDS5	03/14/07	1616	80° F	VH-9525	76.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	TB

Comments:

60°RL radial, 60°RL circumferential, and 60°S examinations limited due to insulation support ring below nozzle. See coverage plots and worksheet for additional details.

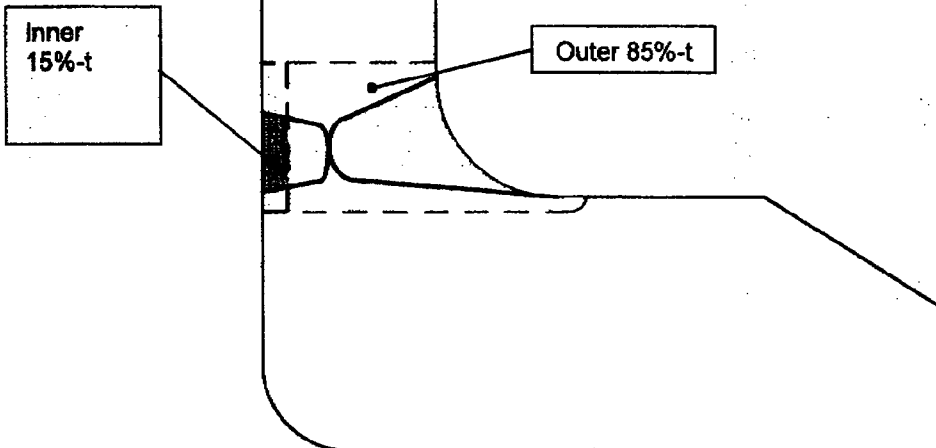
In-vessel feedwater piping end bracket attachment welds observed on the vessel ID surface during the 60°RL Zone 2 circumferential scans.

Examiner: George Chapman Signature: <i>[Signature]</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: Thomas Brown Signature: <i>[Signature]</i>	Level: II	Date: 03/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>[Signature]</i>	Level: III	Date: 03/23/07			

RPV Nozzle-To-Shell Weld

Ultrasonic Examination Coverage Calculation Worksheet


Utility: TVA Plant: Browns Ferry Unit: 2 Weld ID: N5B-NV Coverage Worksheet #: N5BNV-CWS1 ISI Report #: *R157*



Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans	Circumferential Scans	
100%-t	Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4	Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 44.9 ² inches	^D Inner 15%-t Examination Volume: 5.1 ² inches	^G Outer 85%-t Examination Volume: 39.8 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius & Insulation Support Ring	Inner 15%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 24.2 ² inches	Description of Limitation: Insulation Support Ring	^H Outer 85%-t Volume Achieved: 7.7 ² inches
	^F Inner 15%-t Volume Achieved: 5.1 ² inches	
^C Percentage of Axial Coverage: 54% *(36%) $B + A \times 100 = C$	^I Total Circumferential Examination Coverage: 29% *(18%) $(F + H) + A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage		
^L Total Examination Coverage: 42% *(27%) $(C + J) + 2 \times 100 = L$		
NOTE: *Scan coverages shown in parentheses include limitations caused by mirror insulation and insulation support ring.		
Prepared by: Bret Flesner <i>Bret Flesner</i>	Date: 03/23/07	Reviewed by: Adam Conti <i>Adam Conti</i> Date: 03/23/07

	DESCRIPTION Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/23/07	TITLE N5BNV-CPS1	PAGE 4 OF 12

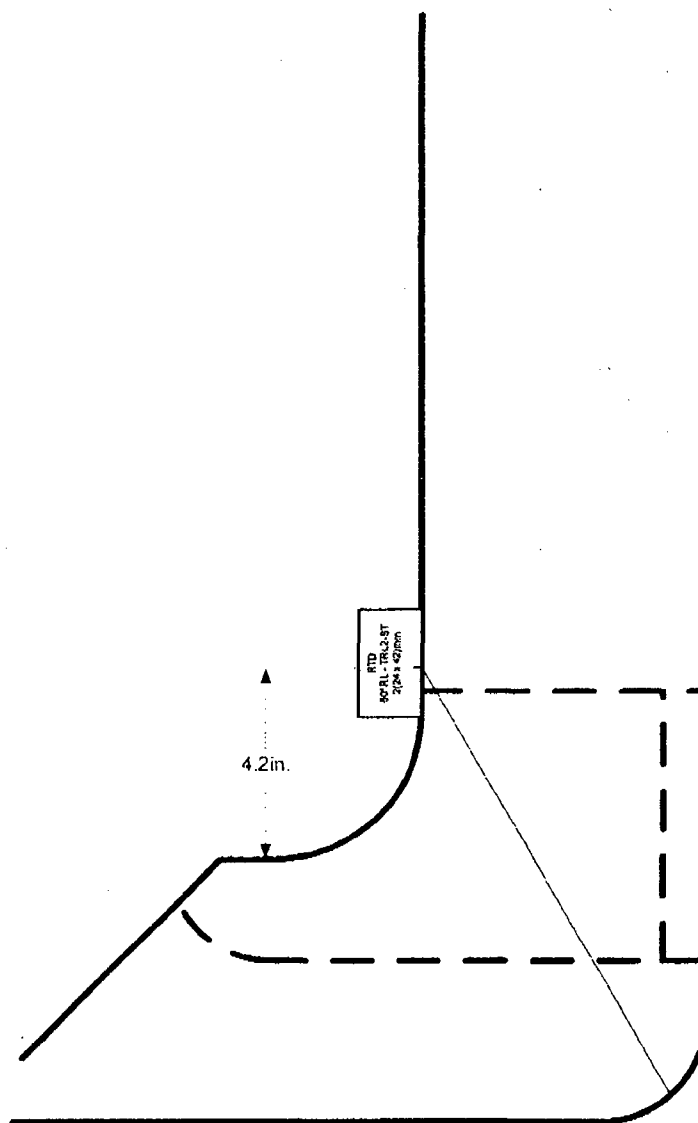
R157
000385


Nozzle-to-Vessel weld examination coverage for axial (radial) scan

Total area of examination volume: 44.9 sq. in. (TVA supplied)

Total area of examination volume achieved: 24.2 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.



 DESCRIPTION Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY Bret Flesner	DATE 03/23/07	TITLE N5BNV-CPS2	PAGE 5 OF 12

R157
000386

Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 44.9 sq. in. (TVA supplied)

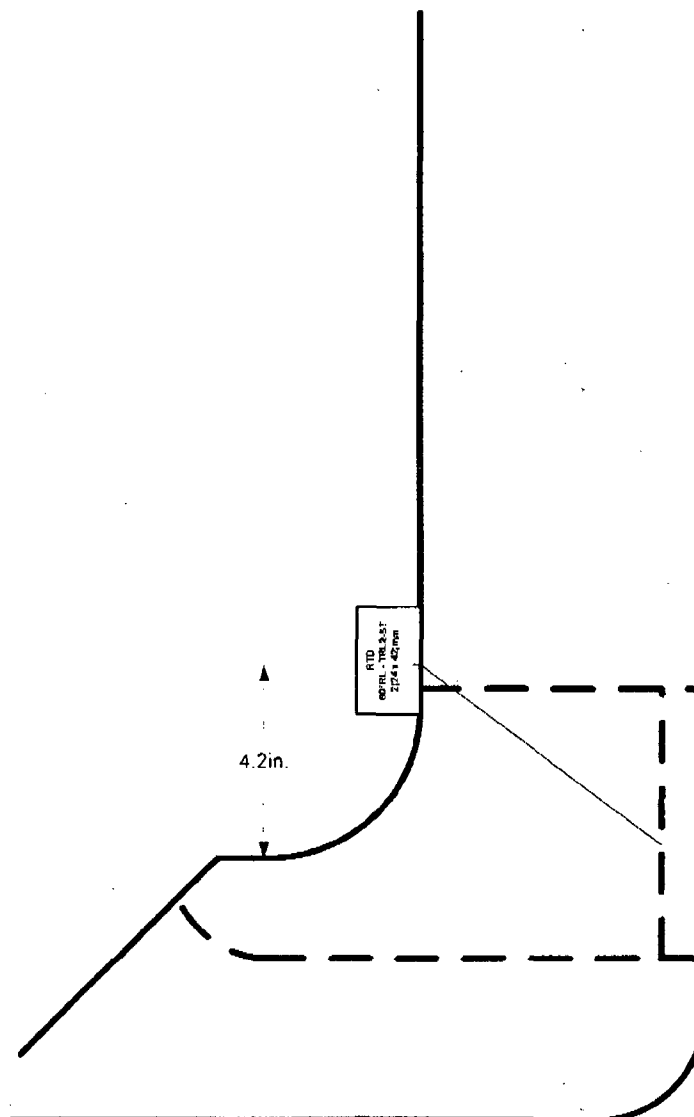
Total area of outer 85%-t exam volume achieved: 7.7 sq. in.

Total area of inner 15%-t volume: 5.1 sq. in.

Total area of inner 15%-t exam volume achieved: 5.1 sq. in.


Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.

Inner 15%-t area examined from the
blend with Supplement 5 techniques.



000387

R157

	DESCRIPTION Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/23/07	TITLE N5BNV-CPS3	PAGE 6 OF 12

60°RL Scan Limitations

Radial Scan Area (Yellow) = 1365 sq. in.

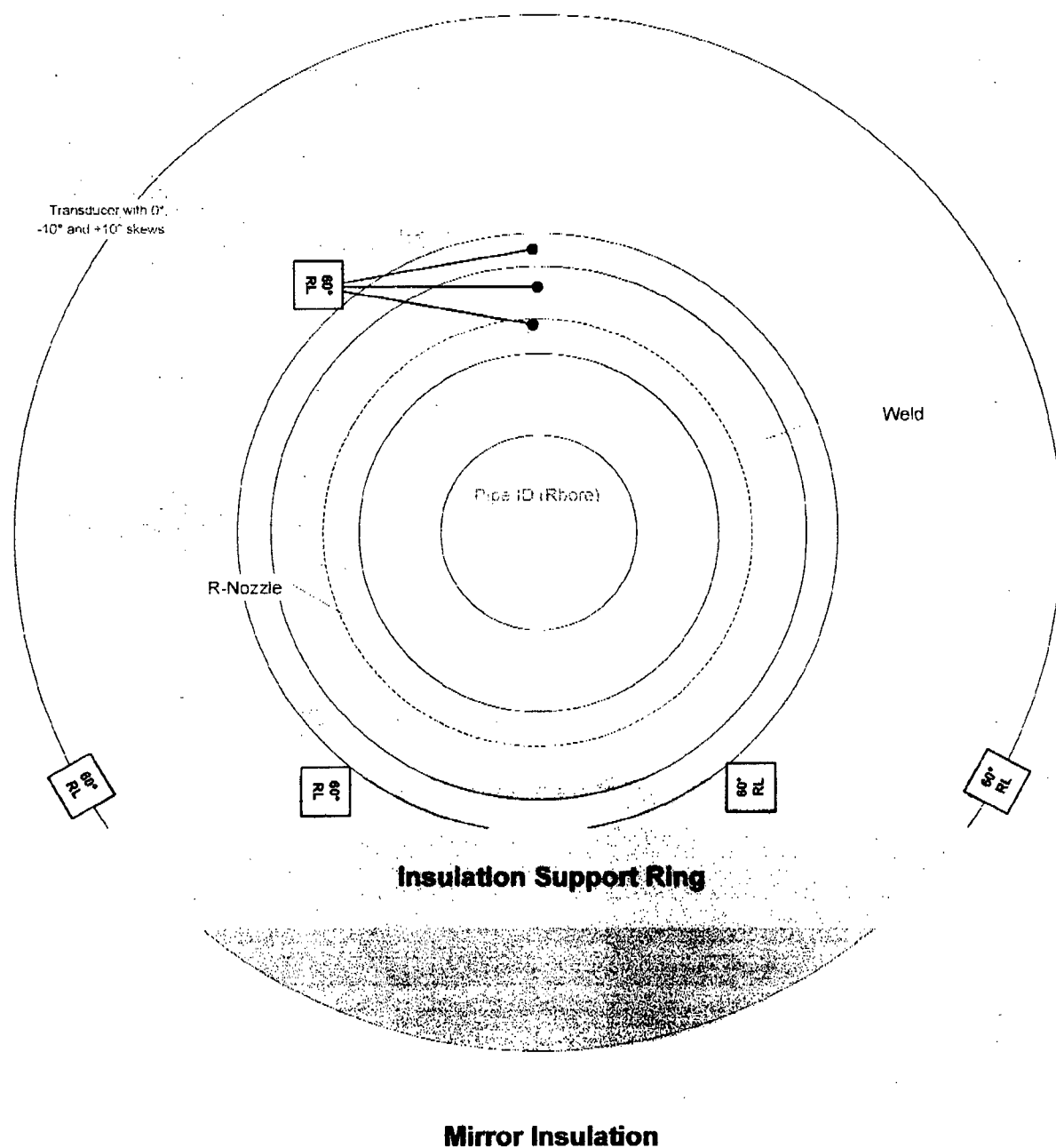
Area of radial scan limitation (Red) = 438 sq. in.

Circ Scan Area = 229 sq. in.

Area of circ scan limitation = 69 sq. in.

 $438 / 1365 = 32\%$ radial scan limitation $69 / 229 = 30\%$ circumferential scan limitation

*above percentages do not include the limitation caused by the nozzle configuration. The total examination coverage achieved combining all limitations is shown on the Coverage Calculation Worksheet.



A	DESCRIPTION			
	Browns Ferry N5 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/23/07	N5BNV-CPS4	7 OF 12	

R157

000388

60°S Scan Limitation

60°S Scan area (Yellow) = 527 sq. in.

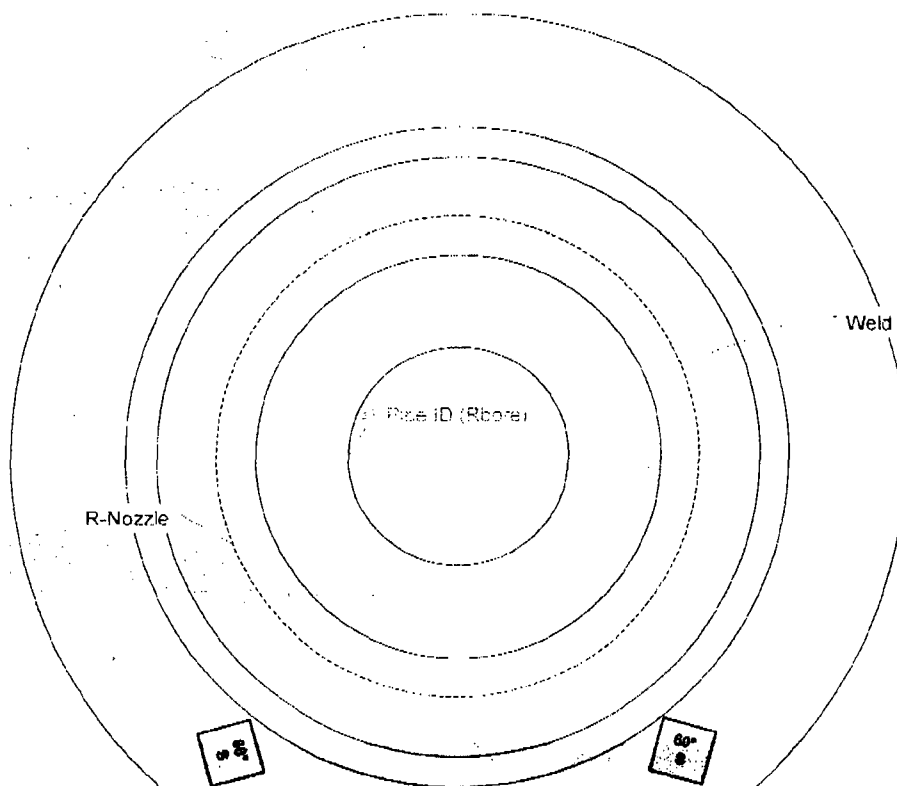
60°S Scan limitation (Red) = 141 sq. in.

$141 / 527 = *27\%$ 60°S scan limitation

Using Figures 6-3 & 6-4 of the modeling report it is estimated that the 60°S makes up 62% of the inner 15%-t coverage. The 35° S examination was not limited since scanning is performed from the blend.

$27 \times 62\% = *17\%$ combined 60°S and 35°S scan limitation.

**above percentages do not include the limitation caused by the nozzle configuration. The total examination coverage achieved combining all limitations is shown on the Coverage Calculation Worksheet.*



Insulation Support Ring

Mirror Insulation



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000389

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N5BNV-CDS1				ISI Report Number: <i>R157</i>			
Component ID: N5B-NV				Component Description: N5 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PV		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 35°		Measured Angle: 35°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -68°		Measured Skew Angle: -68°	
	Delay: 1.27"			Mode: Shear		Radius: 3.1"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius 2" Radius	
PULSER	Pulse Width: 222 nS			Sweep:		0.65 div. 1.3 div.	
	Damping: 500 Ω			Amplitude:		80 %FSH 65 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		32.4 dB 32.4 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.0 div		Amplitude: 80 %FSH		Gain: 48.2 dB	
Cal In: Date 3/14/07 Time 1435		Check: Date 3/14/07 Time 1636		Check: Date N/A Time N/A		Out: Date 03/14/07 Time 1830	
Comments							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II		Date: 03/14/07		Examiner: N/A Signature:	
AREVA Review: Adam Coniti Signature: <i>Adam Coniti</i>		Level: III		Date: 03/23/07		Level: N/A Date: N/A	

A

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

C00390

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N5BNV-CDS2				ISI Report Number: <i>R157</i>			
Component ID: N5B-NV				Component Description: N5 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600	
Model: Sonic 136				Serial Number: 0111PM		Frequency: 2.25 MHz	
Serial Number: 136P1200G081455				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 35°		Measured Angle: 35°	
RANGE	Range: 15.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +68°		Measured Skew Angle: +68°	
	Delay: 1.27"			Mode: Shear		Radius: 3.1"	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25 MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector: 1" Radius		2" Radius	
PULSER	Pulse Width: 222 nS			Sweep: 0.65 div.		1.3 div.	
	Damping: 500 Ω			Amplitude: 80 %FSH		65 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 32.2 dB		32.2 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
				Temperature: 75 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.0 div		Amplitude: 80 %FSH		Gain: 48.0 dB	
Cal In: Date 3/14/07 Time 1440		Check: Date 3/14/07 Time 1619		Check: Date N/A Time N/A		Out: Date 03/14/07 Time 1835	
Comments							
Examiner: George Chapman Signature: <i>[Signature]</i>		Level: II		Date: 03/14/07		Examiner: N/A Signature: _____	
AREVA Review: Adam Conti Signature: <i>[Signature]</i>		Level: III		Date: 03/23/07		Page 9 of 12	



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000391

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N5BNV-CDS3	ISI Report Number: R151		
Component ID: N5B-NV	Component Description: N5 Nozzle-to-Vessel Weld		
Examination Procedure: 54-ISI-850-06	Applicable SDCN(s): 30-9044520-000		

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 892-600	
Model: Sonic 136		Serial Number: 00X1XB	Frequency: 2.25 MHz	
Serial Number: 136P1200G081455		Size: 0.5" x 1.0"	Shape: Rectangle	
Linearity Sheet No.: LDS1		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 60°	Measured Angle: 59°	
RANGE	Range: 20.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: ± 30-64° /	Measured Skew Angle: N/A	
	Delay: 0.813"	Mode: Shear	Radius: N/A	
	Velocity: 0.127 in / μS	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25 MHz	Type: CS Rompas	S/N: 99-6251	
	Reject: Off	Reflector:	1" Radius	2" Radius
PULSER	Pulse Width: 222 nS	Sweep:	0.6 div.	1.1 div.
	Damping: 500 Ω	Amplitude:	70 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	27.6 dB	27.6 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" Clad	Diameter: Flat	
		Temperature: 75 °F	Therm. SN: VH-9525	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 5.8 div	Amplitude: 80 %FSH	Gain: 62.2 dB
Cal In: Date 3/14/07 Time 1430	Check: Date 3/14/07 Time 1652	Check: Date N/A Time N/A	Out: Date 3/14/07 Time 1840

Comments

Examiner: George Chapman Signature:	Level: II	Date: 3/14/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Corti Signature:	Level: III	Date: 03/23/07	Page 10 of 12		

A

AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000892

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N5BNV-CDS4				ISI Report Number: <i>R157</i>			
Component ID: N5B-NV				Component Description: N5 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	1.2 div.	2.5 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 75 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.8 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 3/14/07 Time 1400		Check: Date 3/14/07 Time 1550		Check: Date N/A Time N/A		Out: Date 3/14/07 Time 1829	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Thomas Brown		Level: II	Date: 3/14/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>Thomas Brown</i>				Signature			
AREVA Review: Adam Cont		Level: III	Date: 03/23/07				
Signature: <i>Adam Cont</i>							



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000893

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N5BNV-CDS5				ISI Report Number: <i>R157</i>			
Component ID: N5B-NV				Component Description: N5 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 7031				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS4				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off			Sweep:	0.5 div.	1.1 div.	
PULSER	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	52.0 dB	52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: Clad CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 75 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 73.2 dB	
Cal In: Date 3/14/07 Time 1355		Check: Date 3/14/07 Time 1615		Check: Date N/A Time N/A		Out: Date 3/14/07 Time 1837	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: Thomas Brown Signature: <i>Thomas Brown</i>		Level: II	Date: 03/14/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Coniff Signature: <i>Adam Coniff</i>		Level: III	Date: 03/23/07				

Examination Report, R-080
N7-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000394

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R080						
Component Number: N7-NV		Component Description: N7 Nozzle-to-Head Weld		System: RPV						
Examination Procedures & applicable SDCN's:		N-UT-78 rev 4 w/ revision 11 of the PDI-UT-6 qualified equipment table. 54-ISI-850-06 w/ SDCN 30-9044520-000.								
Modeling Report: IR-2003-17 Section 2			ISO / Drawing(s): ISI-0408-C01							
Calibration Data Sheets: N7NV-CDS1 N7NV-CDS2 N7NV-CDS3			Coverage sheets: N7NV-CWS1 N7NV-CPS1 N7NV-CPS2							
Examination Data Sheets: N7NV-EDS1			Exam Results: <input checked="" type="checkbox"/> No Reportable Indications <input type="checkbox"/> Reportable Indications <input type="checkbox"/> Geometric Indications							
Code Category: B-D	Code Item: B3.90	Code Class: 1	Material: CS							
<p>Summary:</p> <p>In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the head surface in both the radial and circumferential scan directions. These examinations resulted in no reportable indications.</p> <p>In accordance with UT procedure 54-ISI-850-06 with SDCN 30-9044520-000 and the referenced TVA / EPRI modeling report the following additional examination was performed. This examination resulted in no reportable indications.</p> <table border="1"><caption>N7 Vent Nozzle Modeling Parameters</caption><tr><td>Probe Refracted Angle</td><td>Probe Skew</td><td>Scan Surface</td></tr><tr><td>45°s</td><td>±33° to 71°</td><td>Shell (Head)</td></tr></table> <p>This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) were achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60° refracted longitudinal wave examinations were limited due to the nozzle configuration which reduced the examination coverage obtained to 69%. Refer to coverage sketches and worksheet for a description of the scanning volume, examination coverage, and scan limitations.</p> <p>This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment as amended by the Final Rule.</p> <p>Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.</p>					Probe Refracted Angle	Probe Skew	Scan Surface	45°s	±33° to 71°	Shell (Head)
Probe Refracted Angle	Probe Skew	Scan Surface								
45°s	±33° to 71°	Shell (Head)								
Prepared by: Bret Flesner	Date: 03/02/07	Reviewed by: George Chapman	Date: 03/02/07							
Signature: <i>Bret Flesner</i>		Signature: <i>George Chapman</i>								
Customer: Matt Welch	Date: 3/6/07	ANII:	Date: 4/10/07							
Signature: <i>Matt Welch</i>		Signature: <i>Earl Hunt</i>								



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

R080

Utility: TVA	Site: Browns Ferry	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N7NV-EDS1		ISI Report Number:	
Component ID: N7-NV		Component Description: N7 Nozzle-to-Head Weld	

Examination Information

ISO / Drawing Number: ISI-0408-C01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Head "0"
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N7NV-CPS1, N7NV-CPS2, & N7NV-CWS1	

Scan Information

Examination Procedure: N/A	Applicable SDCN's: N/A	Scan Surface: N/A
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Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: 54-ISI-850-06	Applicable SDCN's: 30-9044520-000	Scan Surface: OD Head Surface
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Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
45° / s	±33° - 71°	N7NV-CDS1	03/01/07	1341	73°F	VH-9525	61.6 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 Revision 4	Applicable SDCN's: N/A	Scan Surface: OD Head Surface
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Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N7NV-CDS2	03/01/07	1417	73°F	VH-9525	80.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N7NV-CDS3	03/01/07	1500	73°F	VH-9525	84.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N7NV-CDS2	03/01/07	1417	73°F	VH-9525	80.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N7NV-CDS3	03/01/07	1500	73°F	VH-9525	84.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	GC

Comments:

Examination limited due to nozzle configuration. See attached coverage sheets for details.

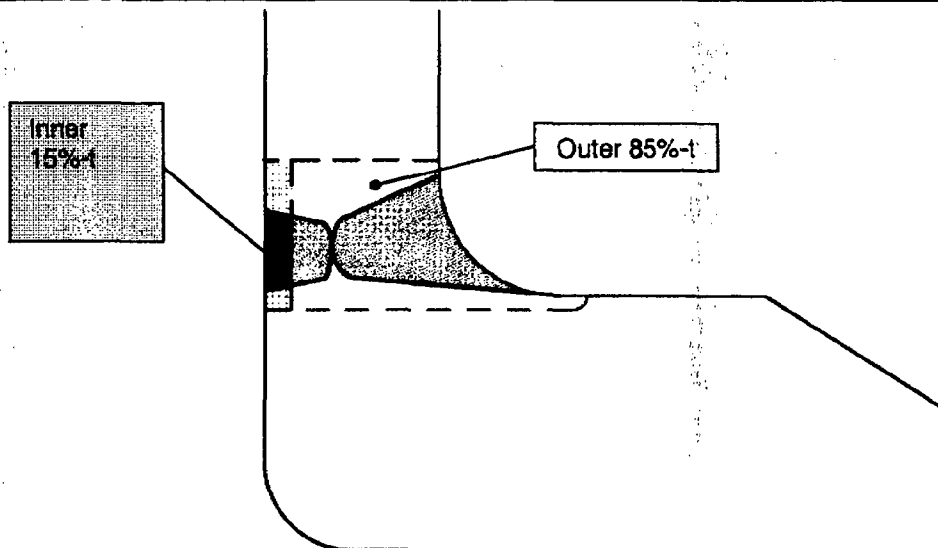
Examiner: George Chapman Signature: <i>George Chapman</i>	Level: II	Date: 03/01/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/01/07			



RPV Nozzle-To-Shell Weld **Ultrasonic Examination Coverage Calculation Worksheet**

RO80


Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N7-NV	Coverage Worksheet #: N7NV-CWS1	ISI Report #:
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 15.4 ² inches		^D Inner 15%-t Examination Volume: 1.8 ² inches	^G Outer 85%-t Examination Volume: 13.6 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^E Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 13.2 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 6.2 ² inches
^C Percentage of Axial Coverage: 86%		^F Inner 15%-t Volume Achieved: 1.8 ² inches	^J Total Circumferential Examination Coverage: 52%
$B \div A \times 100 = C$		$(F + H) \div A \times 100 = J$	
Combined Axial and Circumferential Weld Coverage			
^LTotal Examination Coverage: 69%			
$(C + J) \div 2 \times 100 = L$			
Prepared by: Bret Flesner	Date: 03/01/07	Reviewed by: George Chapman	Date: 03/01/07

	DESCRIPTION			
	Browns Ferry N7 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner <i>BF</i>	03/02/07	N7NV-CPS1	4 of 9	

Nozzle-to-Shell weld examination coverage for axial (radial) scan

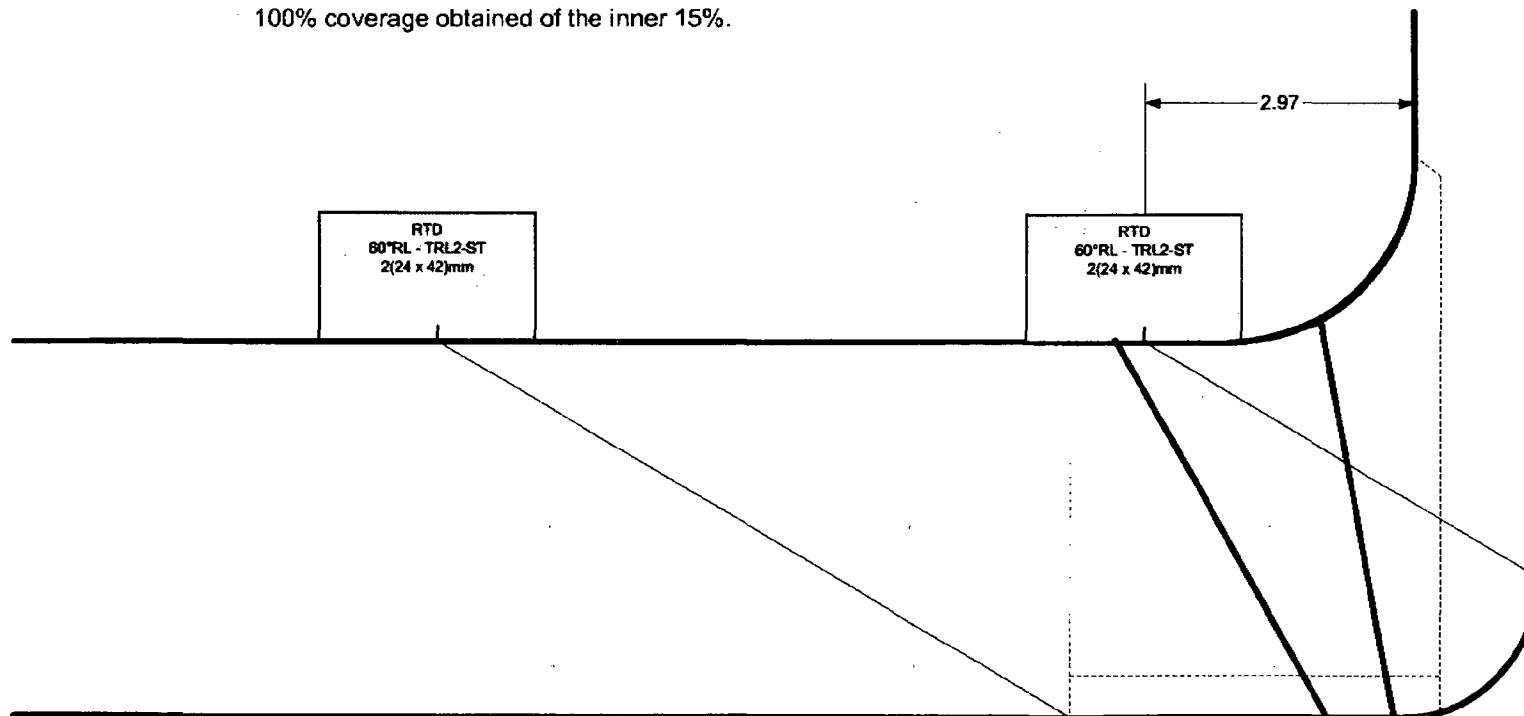
Total area of examination area: 15.4* sq. in. (*Provided by TVA)

Total area of examination area achieved: 13.2 sq. in.


Scan limited due to liftoff caused by the nozzle blend radius.

100% of the accessible surface scanned.

100% coverage obtained of the inner 15%.



R080
000397

	DESCRIPTION			
	Browns Ferry N7 Nozzle-to-Shell Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner <i>BF</i>	03/02/07	N7NV-CPS2	5 of 9	

Nozzle-to-Shell weld examination coverage for circumferential scan

Total area of examination area: 15.4* sq. in. (*Provided by TVA)

Total area of outer 85%-t exam area achieved: 6.2 sq. in.

Total area of inner 15%-t area: 1.8 sq. in.

Total area of inner 15%-t exam area achieved: 1.8 sq. in.

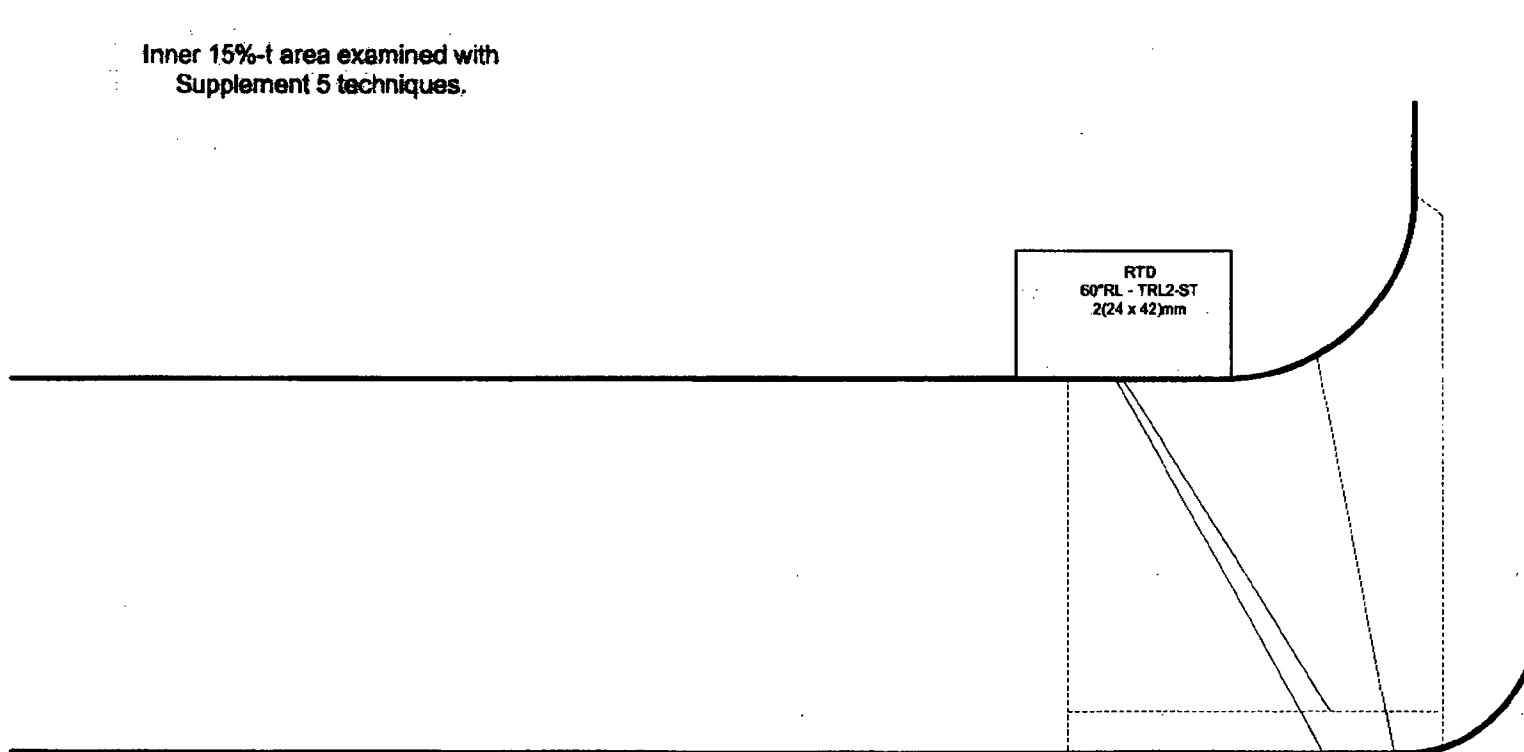
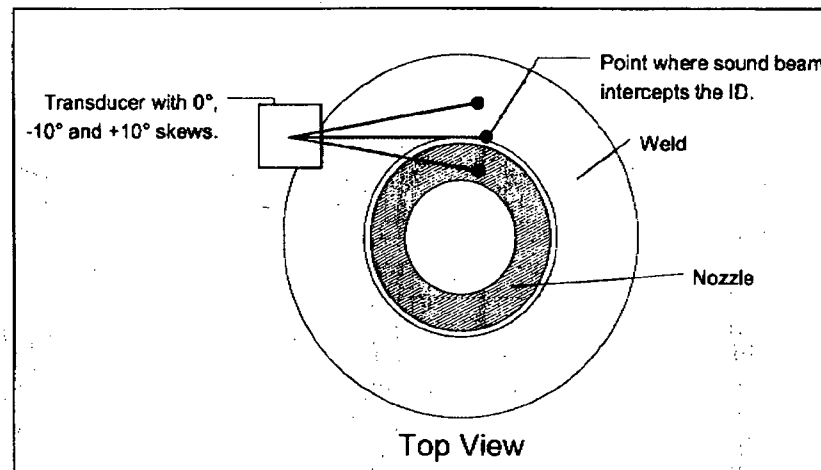
Total area of examination area achieved: 8.6 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.

100% of the accessible surface scanned.

100% coverage obtained of the inner 15%.

Inner 15%-t area examined with
Supplement 5 techniques.



R080
000893

000399



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

R080

Utility: TVA		Site: Browns Ferry		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N7NV-CDS1				ISI Report Number:			
Component ID: N7-NV				Component Description: N7 Nozzle-to-Head Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 892-600 ✓	
Model: Sonic 136				Serial Number: 0111PL ✓		Frequency: 2.25 MHz ✓	
Serial Number: 136P1200G081455 ✓				Size: 0.5" x 1.0"		Shape: Rectangle	
Linearity Sheet No.: LDS1				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 45°		Measured Angle: 45°	
RANGE	Range: 10.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: ±33° to 71°		Measured Skew Angle: N/A	
	Delay: 0.556"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μS			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: CS Rompas		S/N: 99-6251	
	Reject: Off			Reflector:		1" Radius	
PULSER	Pulse Width: 222nS ✓			Sweep:		1.0 div.	
	Damping: 500Ω			Amplitude:		60 %FSH	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain:		23.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-19		Material: CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 4.02"		Diameter: Flat	
				Temperature: 66 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 5.6 div ✓		Amplitude: 80 %FSH		Gain: 38.6 dB	
Cal In: Date 03/01/07 Time 0945		Check: Date 03/01/07 Time 1340		Check: Date N/A Time N/A		Out: Date 03/01/07 Time 1805	
Comments							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II		Date: 03/01/07		Examiner: N/A Signature	
AREVA Review: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II		Date: 03/01/07			

000400



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

R080

Utility: TVA		Site: Browns Ferry		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N7NV-CDS2				ISI Report Number:			
Component ID: N7-NV				Component Description: N7 Nozzle-to-Head Weld			
Examination Procedure: N-UT-78 Revision 4 ✓				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST ✓	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081455				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS1				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS-125mm		Squint Angle: 5°	
RANGE	Range: 5.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.38"			Cable Type: RG-174	Length: 12'	Intermediate Connectors: 0	
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:	1" Radius	2" Radius	
	Reject: Off ✓			Sweep:	2.0 div.	4.0 div.	
	Pulse Width: 222 nS			Amplitude:	25 %FSH	80 %FSH	
	Damping: 500 Ω			Gain:	51.4 dB	51.4 dB	
PULSER	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-19 ✓		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 4.02"		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 66 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 4.0 div		Amplitude: 80 %FSH		Gain: 65.2 dB	
Cal In: Date 03/01/07 Time 0905		Check: Date 03/01/07 Time 1416		Check: Date N/A Time N/A		Out: Date 03/01/07 Time 1755	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: George Chapman Signature: <i>George Chapman</i>		Level: II	Date: 03/01/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/01/07				



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

R080

Utility: TVA		Site: Browns Ferry		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N7NV-CDS3				ISI Report Number:			
Component ID: N7-NV				Component Description: N7 Nozzle-to-Head Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-304		Frequency: 2 MHz	
Serial Number: 136P1200G081455				Angle: 60°		Measured Angle: 61°	
Linearity Sheet No.: LDS1				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS-125mm		Squint Angle: 5°	
RANGE	Range: 12.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2		Shape: Rect.	
	Delay: 1.38"			Cable Type: RG-174		Length: 12' Intermediate Connectors: 0	
	Velocity: 0.230 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: CS Rompas		S/N: 99-6251	
	Frequency: 2.25 MHz			Reflector:		1" Radius	
	Reject: Off			Sweep:		0.8 div.	
PULSER	Pulse Width: 222 nS			Amplitude:		25 %FSH	
	Damping: 500 Ω			Gain:		52.0 dB	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-19		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 4.02"		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 66 °F		Therm. SN: VH-9525	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.2 div		Amplitude: 80 %FSH		Gain: 61.8 dB	
Cal In: Date 03/01/07 Time 0927		Check: Date 03/01/07 Time 1459		Check: Date N/A Time N/A		Out: Date 03/01/07 Time 1800	
Comments							
Zone 2 - Full Volume calibration.							
Examiner: George Chapman		Level: II	Date: 03/01/07	Examiner: N/A		Level: N/A	Date: N/A
Signature: <i>George Chapman</i>				Signature			
AREVA Review: Bret Flesner		Level: II	Date: 03/01/07				
Signature: <i>Bret Flesner</i>							



PROFILE AND THICKNESS

R080

Exam Date: 03/01/07

UT Calibration Sheet No.: N/A

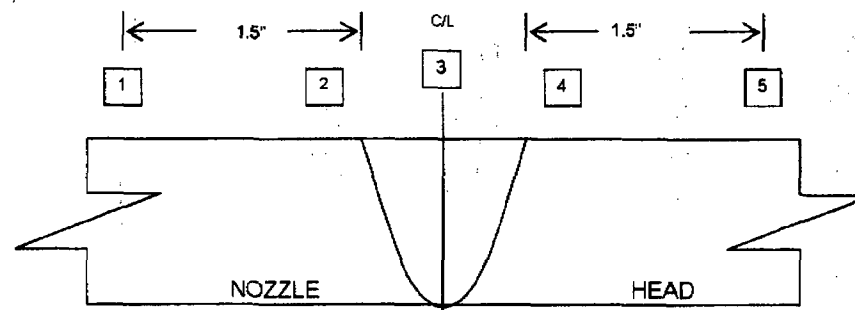
Site: Browns Ferry, Unit 2

ISI Report No.:

Component ID: N7 Nozzle

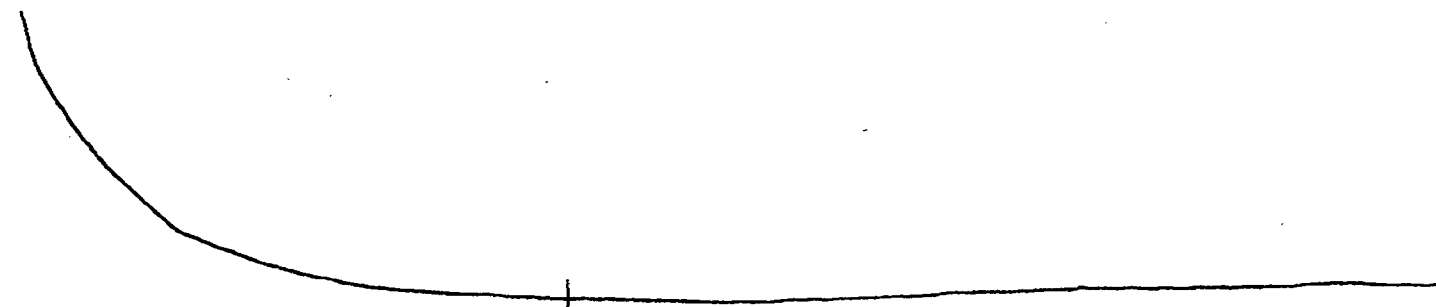
Component Description: N7 Nozzle-to-Head Weld

POSITION	0°	90°	180°	270°	
1	4.4"	N/A	N/A	N/A	CROWN HEIGHT: FLUSH
2	4.3"	N/A	N/A	N/A	WELD CROWN WIDTH: 2.2"
3	4.3"	N/A	N/A	N/A	NOMINAL DIAMETER: 4.25" I.D.
4	4.3"	N/A	N/A	N/A	
5	4.3"	N/A	N/A	N/A	



NOZZLE

HEAD



George Chapman 03/01/07
Prepared By Date

Bret Flesner *Bret Flesner*
Reviewed By 03/02/07
 Date

PAGE 9 OF 9

000402

Examination Report, R-117
N9-NV, RPV Nozzle-To-Head Weld



RPV Nozzle Ultrasonic Examination Summary Sheet

000430

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14	ISI Report #: R117
Component Number: N9-NV		Component Description: N9 Nozzle to Vessel Weld		System: RPV
Code Category: B-D		Code Item: B3.90	Code Class: 1	Material: CS
ISO / Drawing(s): 2-CHM-2046-C-01 & 2-ISI-0272-C-01				
Procedure Number	Procedure Revision	SDCN	Procedure Misc. Info	
N-UT-78	4	NA	Revision 11 of the PDI-UT-6 qualified equipment table	
N-UT-79	1	NA	Revision 5 of the PDI-UT-7 qualified equipment table	
54-ISI-850	06	30-9044520-000	Modeling Report: IR-2006-236 Section 2	
Calibration Sheets			Exam Data Sheets	Indication Data Sheets
N9NV-CDS1	N9NV-CDS6	N9NV-CDS11	N9NV-EDS1	N9NV-IDS1
N9NV-CDS2	N9NV-CDS7	N9NV-CDS12	N9NV-EDS2	N9NV-IDS2
N9NV-CDS3	N9NV-CDS8	N9NV-CDS13		
N9NV-CDS4	N9NV-CDS9			
N9NV-CDS5	N9NV-CDS10			
Exam Results <input type="checkbox"/> No Recordable Indications <input type="checkbox"/> Recordable Flaw Indications (acceptable flaw evaluation) <input checked="" type="checkbox"/> Reportable Flaw Indications (unacceptable flaw evaluation)				

Summary:

In accordance with UT procedure N-UT-78 Revision 4, 60° refracted longitudinal wave examinations were performed from the vessel surface in both the axial (radial) and circumferential scan directions. These examinations resulted in the recording of 1 reportable flaw indication. Subsequent indication dimensioning was performed using UT procedure N-UT-79 Revision 1. Final indication characterization and acceptance evaluation is provided on the examination and indication data sheets along with the flaw characterization and evaluation worksheet for this ISI report.

In accordance with UT procedure 54-ISI-850-06 and the referenced TVA / EPRI modeling report the following additional examinations were performed. These examinations resulted in no reportable indications.

N9 CRD-HYH System Return Nozzle Modeling Parameters		
Probe Refracted Angle	Probe Skew	Scan Surface
35°S	±35°	Blend Radius
35°S	±52°	Blend Radius

This ultrasonic examination was performed in accordance with the criteria of 10 CFR50.55a (b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR50.55a (b)(2)(xv)(K) was achieved to the maximum extent possible. The examination procedure requires an additional circumferential scan of the outer 85%-t which is not addressed in 10CFR 50.55a. The 60°RL examinations were limited due to the nozzle configuration which reduced the examination volume obtained to 40%. Refer to coverage sketch(s) and worksheet for a description of the scanning volume, examination coverage, and scan limitations.

This examination satisfies the requirements of ASME Section XI (2001 thru 2003 Addenda) and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures, and equipment.

Note: See TVA Request for Relief PDI-1 and PDI-2. Dockets No. 50-261/296, 50-327/328, and 50-0390. This relief request reduced the area to be examined per IWB-2500-7 (a) and (b) to the weld plus 1/2" on each side.

Prepared by: Bret Flesner	Date: 3/17/07	Reviewed by: Adam Conti	Date: 3/17/07
Signature: <i>Bret Flesner</i>		Signature: <i>Adam Conti</i>	
Customer: Matt Welch	Date: 3/19/07	ANII: <i>Sam Hurd</i>	Date: 3/17/07
Signature: <i>Matt Welch</i>		Signature: <i>Sam Hurd</i>	

reference NEI# 42014-049 4/7/07



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

R117

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N9NV-EDS1		ISI Report Number: R117	
Component ID: N9-NV		Component Description: N9 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0272-C-01	W ₂ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Coverage Sheet Number(s): N9NV-CWS1	

Scan Information

Examination Procedure: 54-ISI-850-06	Applicable SDCN's: 30-9044520-000	Scan Surface: OD Blend Radius
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Angle/ Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
35° / s	-35°	N9NV-CDS1	03/15/07	1210	81°F	VH-9520	85.6 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
35° / s	+35°	N9NV-CDS2	03/15/07	1220	81°F	VH-9520	85.6 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
35° / s	-50°	N9NV-CDS3	03/15/07	1230	81°F	VH-9520	80.6 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
35° / s	+50°	N9NV-CDS4	03/15/07	1240	81°F	VH-9520	80.6 dB	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Examination Procedure: N/A	Applicable SDCN's: N/A	Scan Surface: N/A
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Angle/ Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 Revision 4	Applicable SDCN's: N/A	Scan Surface: OD Vessel Shell
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Angle/ Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N9NV-CDS5	03/15/07	1250	81°F	VH-9520	80.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N9NV-IDS1	BF
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N9NV-CDS6	03/15/07	1330	81°F	VH-9520	84.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N9NV-IDS1	BF
60°/RL	1	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N9NV-CDS5	03/15/07	1250	81°F	VH-9520	80.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
60°/RL	2	<input type="checkbox"/> Radial <input checked="" type="checkbox"/> Circ	N9NV-CDS6	03/15/07	1330	81°F	VH-9520	84.0 dB	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF

Comments: (Detection Examination)

Recordable indication observed during the 60°RL examination. See indication data sheets for additional details.

In addition to the typical scan limitation caused by nozzle interference an insulation support ring and associated lug limited examination coverage. See attached coverage sheets for additional details.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: N/A Signature:	Level: N/A	Date: N/A	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/16/07			

000431



Ultrasonic Examination Data Sheet

Nozzle-to-Shell Weld Examination

R117

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Examination Data Sheet Number: N9NV-EDS2		ISI Report Number: R117	
Component ID: N9-NV		Component Description: N9 Nozzle-to-Vessel Weld	

Examination Information

ISO / Drawing Number: 2-CHM-2046-C-01, 2-ISI-0272-C-01	W ₀ Location: Nozzle Boss (Rnozzle)	L ₀ Location: Nozzle TDC
Examination Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Coverage Sheet Number(s): N9NV-CWS1	

Scan Information

Examination Procedure: N-UT-79 revision 1	Applicable SDCN's: N/A	Scan Surface: OD Vessel Shell
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Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
45° / s	N/A	N9NV-CDS7 / N9NV-CDS8	03/16/07	0940	79°	VH-9520	N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N9NV-IDS2	BF
60° / s	N/A	N9NV-CDS9 / N9NV-CDS10	03/16/07	1030	79°	VH-9520	N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N9NV-IDS2	BF
0° / L	N/A	N9NV-CDS11	03/16/07	0915	79°	VH-9520	N/A	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	N/A	BF
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N/A	Applicable SDCN's: N/A	Scan Surface: N/A
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Angle/Mode	Skew	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A /	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Examination Procedure: N-UT-78 revision 4	Applicable SDCN's: N/A	Scan Surface: OD Vessel Shell
---	------------------------	-------------------------------

Angle/Mode	Zone	Beam Direction	Calibration Sheet #	Date	Time	Temp	Thermometer S/N:	Scan Gain	Scan Limited	Recordable Indication(s)	Indication Data Sheet #	Examiner Initials
60°/RL	1	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N9NV-CDS12	03/16/07	0920	79°	VH-9520	80.0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N9NV-IDS1	GC
60°/RL	2	<input checked="" type="checkbox"/> Radial <input type="checkbox"/> Circ	N9NV-CDS13	03/16/07	0930	79°	VH-9520	84.0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	N9NV-IDS1	GC
N/A	N/A	<input type="checkbox"/> Radial <input type="checkbox"/> Circ	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A
N/A	N/A	<input type="checkbox"/> Radial <input type="checkbox"/> Circ	N/A	N/A	N/A	N/A	N/A	N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	N/A	N/A

Comments: (Sizing Examination)

0° examination was performed to verify component thickness in the area of the indication as required by the examination procedure.
60°RL examinations were performed to verify indication location prior to sizing.

Examiner: Bret Flesner Signature:	Level: II	Date: 03/16/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
Examiner: George Chapman Signature:	Level: II	Date: 03/16/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Cook Signature:	Level: III	Date: 03/16/06			

C00452

Indication Recording (Detection Examination)

Scan Direction	Amplitude	L ₁	L _{max}	L ₂	Metal Path (W ₁)	Metal Path (W _{max})	Metal Path (W ₂)	W ₁	W _{max}	W ₂
Radial	115 % FSH	12"	21.0"	22.2"	6.30"	6.84" (3.42" depth)	8.28"	4.5"	5.5"	6.6"

Examiner Notes:

- Echo-dynamic characteristics typical of a fabrication type discontinuity (Porosity / Slag)
 - Numerous peaks at varying depths
 - Broad - wide signal presentation
- Recorded length position provided unique and defined start and end positions with >10:1 S/N ratio. Similar responses observed intermittently 360° below recordable levels (≤ 20% FSH)
- "W" dimensions measured from nozzle boss (Rnozzle)
- "W" and metal path distances shifts slightly along length indicating potential misorientation.
- Indication amplitude recorded at Zone 2 scanning sensitivity
- Indication confirmed with Zone 1 calibration at ~ 125% FSH at scan sensitivity
- No distinct tip diffracted signals
- Nozzle blend radius interference prevents confirmation with 28° shear component or 0° transducer
- Length Sizing information is an estimate only. See indication data sheet N9NV-IDS2 for length and depth sizing information

Prepared By: Bret Flesner	Level: II	Date: 03/16/07	Reviewed by: Adam Conti	Level: III	Date: 03/16/07
Signature: <i>Bret Flesner</i>			Signature: <i>Adam Conti</i>		

N9 Nozzle-to-Shell Weld
45° & 60° Shear Wave Indication Data Sheet (N9NV-IDS2)

R117

Indication Length Information (Note 1)			Indication Depth Information (Note 2)			Through Wall Extension (TWE) (Note 3)
Probe	L ₁	L ₂	Total Length	Upper Tip Signal (depth)	Lower Tip Signal (depth)	
45° shear	12.1"	23.1"	11.0"	3.01 (Note 4)	4.07"	1.06"
60° shear	12.1"	22.2"	10.1"	2.97"	4.04"	1.07"

Note 1: Indication length information from 45° shear wave was limited due to nozzle blend radius interference. 60° shear wave data used for flaw length evaluation purposes.

Note 2: This indication does not provide typical upper and lower tip signal responses. It provided signal responses indicative of multiple small fabrication type defects. UT system resolution and indication proximity does not allow for separation measurements.

Note 3: Flaw depth identifies the shallowest and deepest extremities of the bounded flaw as defined in ASME Section XI, IWA-3000. "W" and metal path distances shift slightly along length of the indication indicating that the flaw orientation is slightly non-parallel with the pressure retaining surface. The flaw dimensions (length and TWE in bold) identified above define the bounding rectangle that fully contains the area of the flaw in accordance with IWA-3300 and Fig. IWA-3310 through IWA-3390. The TWE extremity (1.06") of this bounding rectangle is conservative compared to an estimated physical TWE of $\leq 0.40"$.

Note 4: Upper tip signal difficult to obtain with 45° shear due to nozzle blend radius interference. Upper tip extremity confirmed with 60° shear.

Prepared By: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/16/07	Reviewed by: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/16/07
					Page: 5 of 27

000434

**N9 Nozzle-to-Shell Weld
Flaw Characterization and Evaluation Worksheet**

R117

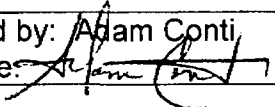
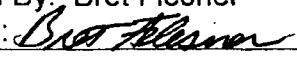
Flaw Evaluation Parameters	
Nozzle ID	N9
*Thickness (UT measured OD to clad base metal interface)	6.30"
S1 dimension (OD to upper flaw tip)	3.01"
S2 dimension (clad base metal interface to lower flaw tip)	2.23"
*d	0.55"
Flaw Characterization	Subsurface Planar Flaw ($S > 0.4d$)
*Flaw Length (ℓ)	10.10"
Flaw Depth (2α)	1.10"
α / ℓ	0.054
* α / t %	8.7%
*Allowable α / t % ($0.05 \alpha / \ell$)	2.2%

Code Year Used: ASME Code, Section XI, 2001 with Addenda thru 2003

*Rounded in accordance with IWA-3200.

This flaw exceeds the acceptance criteria defined in IWB-3512-1.

Flaw orientation is characterized as slightly non-parallel with the pressure retaining surface (see indication plot on page 9). The flaw dimensions identified above define the bounding rectangle that fully contains the area of the flaw in accordance with IWA-3300 and Fig. IWA-3310 through IWA-3390. The TWE extremity (1.06") of this bounding rectangle is conservative compared to an estimated physical TWE of ≤ 0.40 ".

Prepared by: Adam Conti Signature: 	Level: III	Date: 03/17/07	Reviewed By: Bret Flesner Signature: 	Level: II	Date: 03/17/07
Page: 6 of 27					

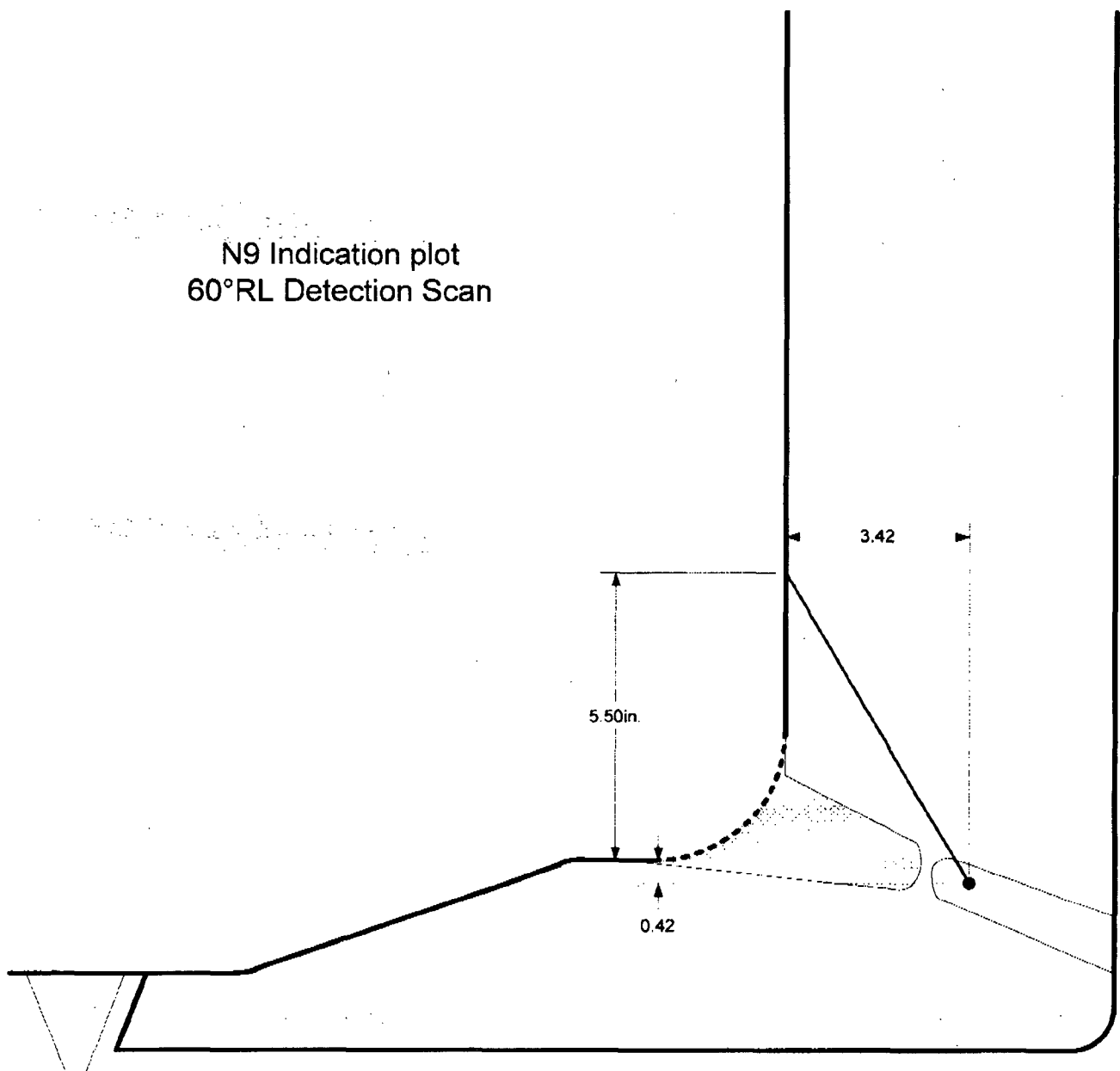
000465

AREVA	DESCRIPTION			
	Browns Ferry N9 Nozzle-to-Vessel Indication Plot <i>R117</i>			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/15/07	N9NV-IPS1	7 OF 27	

R117 000436

Weld profile is a best effort rendering.

N9 Indication plot
60°RL Detection Scan



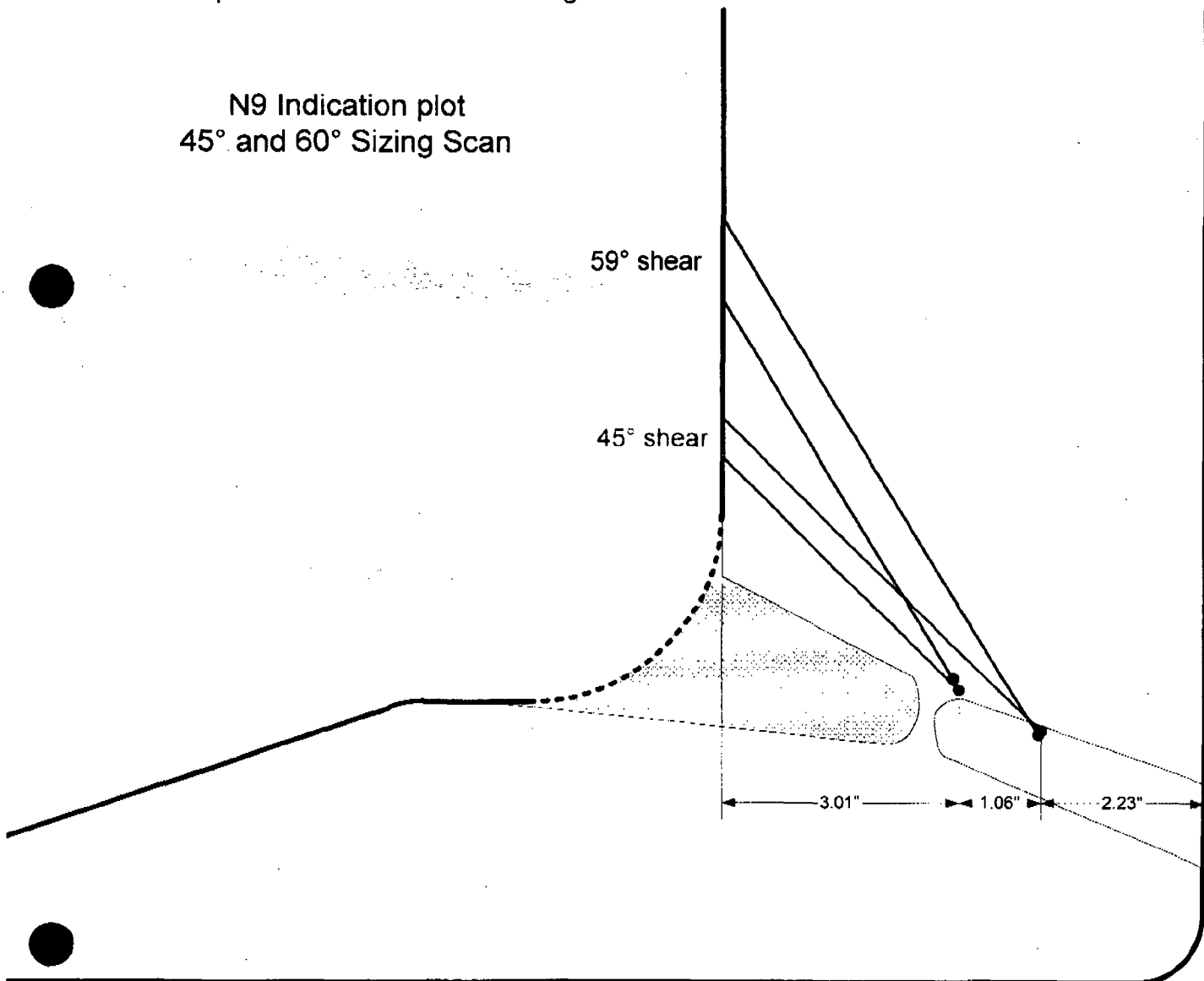
000437

R117

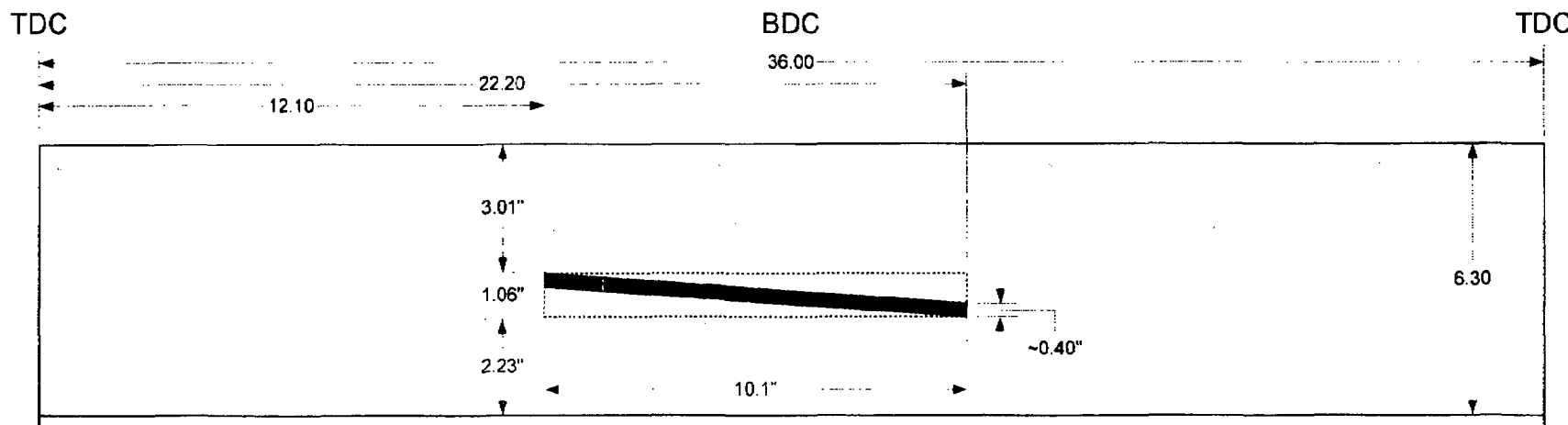
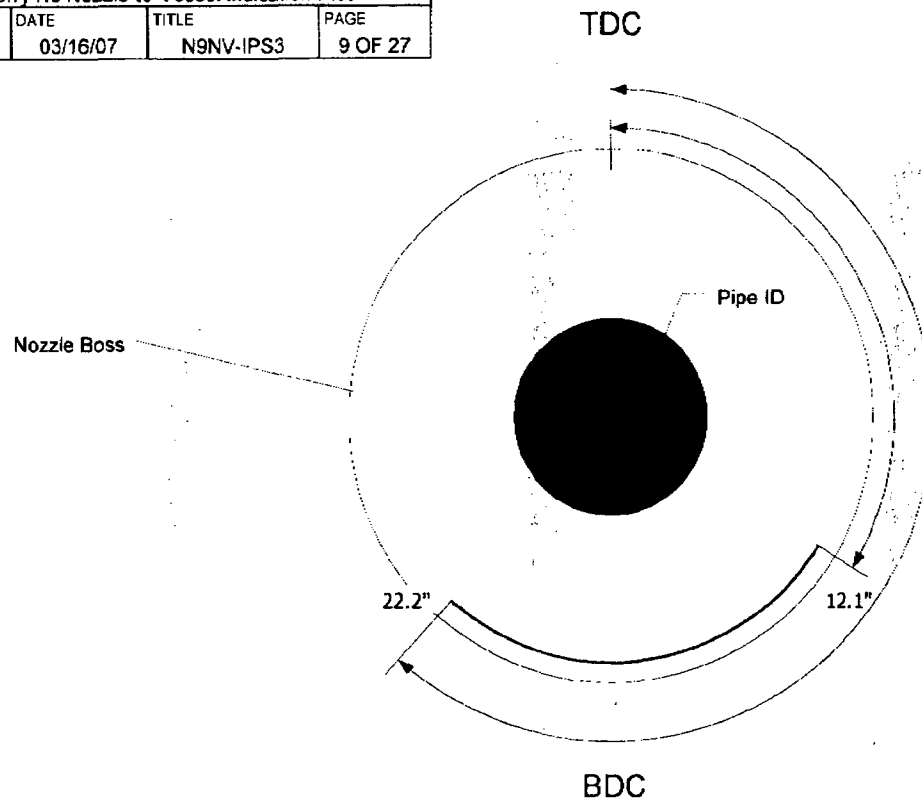
AREVA	DESCRIPTION Browns Ferry N9 Nozzle-to-Vessel Indication Plot R117			
	DRAWN BY Bret Flesner	DATE 03/16/07	TITLE N9NV-IPS2	PAGE 8 OF 27

Weld profile is a best effort rendering.

N9 Indication plot
45° and 60° Sizing Scan



AREVA	DESCRIPTION Browns Ferry N9 Nozzle-to-Vessel Indication Plot <i>R117</i>			
	DRAWN BY Bret Flesner	DATE 03/16/07	TITLE N9NV-IPS3	PAGE 9 OF 27

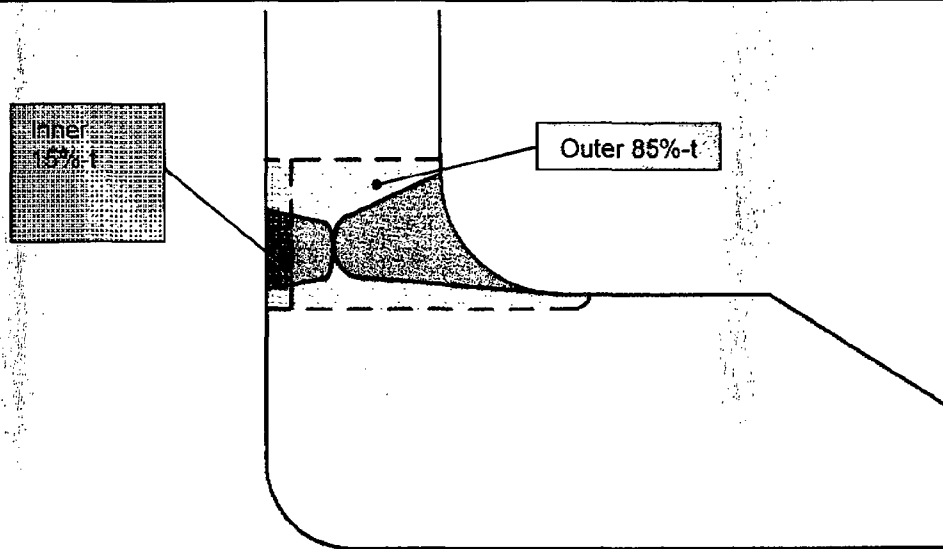


600438
R117



RPV Nozzle-To-Shell Weld Ultrasonic Examination Coverage Calculation Worksheet

Utility: TVA	Plant: Browns Ferry	Unit: 2	Weld ID: N9-NV	Coverage Worksheet #: N9NV-CWS1	ISI Report #: R117
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Axial scans are performed with a procedure for the examination of vessel shell welds. This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans is typically limited due to nozzle configuration.

In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as above and typically limited due to nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure demonstrated for nozzle inside-radius UT. This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius technique provides additional coverage since the component is modeled and scanning is performed with several search units from the nozzle blend.

Axial Scans		Circumferential Scans	
100%-t		Inner 15%-t	Outer 85%-t
Examination Procedure: N-UT-78 Revision 4		Examination Procedure: 54-ISI-850-06	Examination Procedure: N-UT-78 Revision 4
^A Required Examination Volume: 50.3 ² inches		^C Inner 15%-t Examination Volume: 4.6 ² inches	^E Outer 85%-t Examination Volume: 45.7 ² inches.
60°RL axial scan limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		^F Coverage Obtained by Modeling: 100%	60°RL Outer 85%-t Exam Limited: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Description of Limitation: Nozzle Blend Radius		Inner 15%-t Exam Limited: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Description of Limitation: Nozzle Blend Radius
^B Total Axial Volume Achieved: 23.2 ² inches		Description of Limitation: N/A	^H Outer 85%-t Volume Achieved: 13.7 ² inches
^G Percentage of Axial Coverage: 46% / (44%)* B ÷ A X 100 = C		^F Inner 15%-t Volume Achieved: 4.6 ² inches	^I Total Circumferential Examination Coverage: 36% (F + H) ÷ A X 100 = J

Combined Axial and Circumferential Weld Coverage


^L**Total Examination Coverage: 40%**

$$(C+J) \div 2 \times 100 = L$$

NOTE: *Axial scan coverage of 44% includes the insulation support ring limitation. "Total Examination Coverage" of 40% also takes into account this limitation.

Prepared by: Bret Flesner	Date: 03/17/07	Reviewed by: Adam Conti	Date: 03/17/07	Page 10 of 27
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000459

	DESCRIPTION			
	Browns Ferry N9 Nozzle-to-Vessel Weld Coverage Plot			
DRAWN BY	DATE	TITLE	PAGE	
Bret Flesner	03/15/07	N9NV-CPS1	11 OF 27	

000440

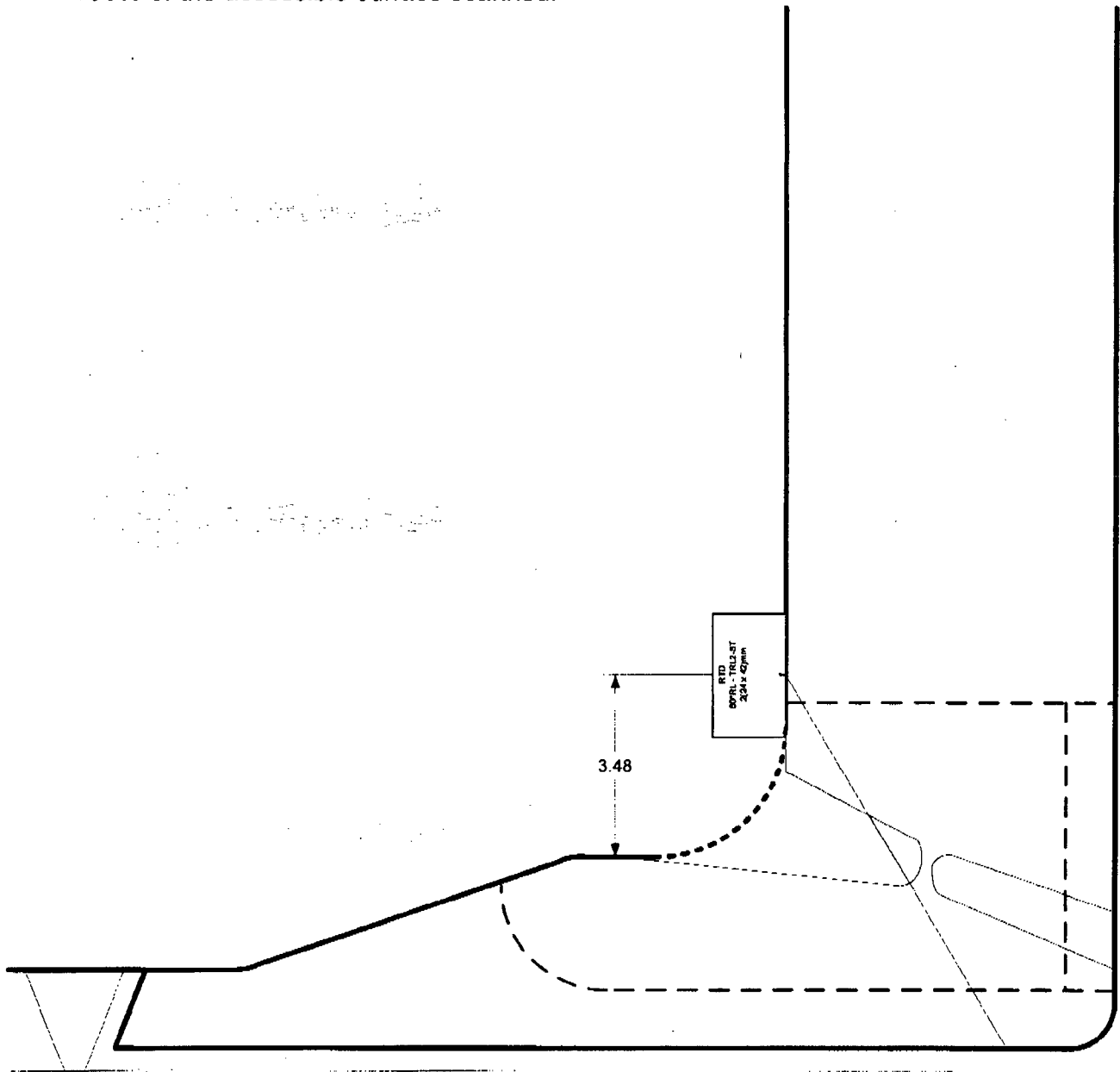
2117


Nozzle-to-Vessel weld examination coverage for axial (radial) scan

Total area of examination volume: 50.3 sq. in.

Total area of examination volume achieved: 23.2 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
100% of the accessible surface scanned.



	DESCRIPTION Browns Ferry N9 Nozzle-to-Vessel Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/15/07	TITLE N9NV-CPS2	PAGE 12 OF 27

000441

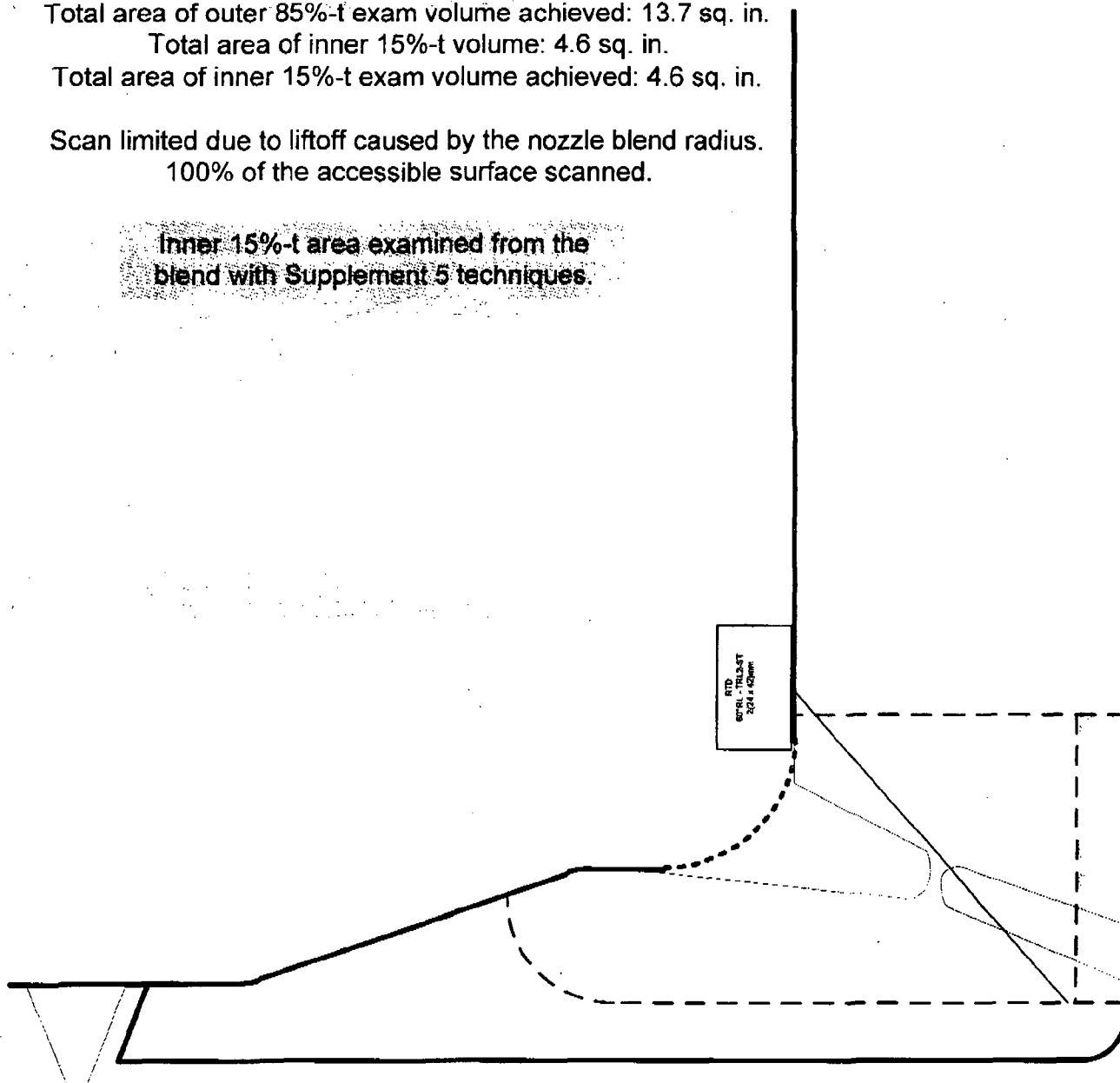
R117

Nozzle-to-Vessel weld examination coverage for circumferential scan

Total area of examination volume: 50.3 sq. in.
 Total area of outer 85%-t exam volume achieved: 13.7 sq. in.
 Total area of inner 15%-t volume: 4.6 sq. in.
 Total area of inner 15%-t exam volume achieved: 4.6 sq. in.

Scan limited due to liftoff caused by the nozzle blend radius.
 100% of the accessible surface scanned.

Inner 15%-t area examined from the
 blend with Supplement 5 techniques.

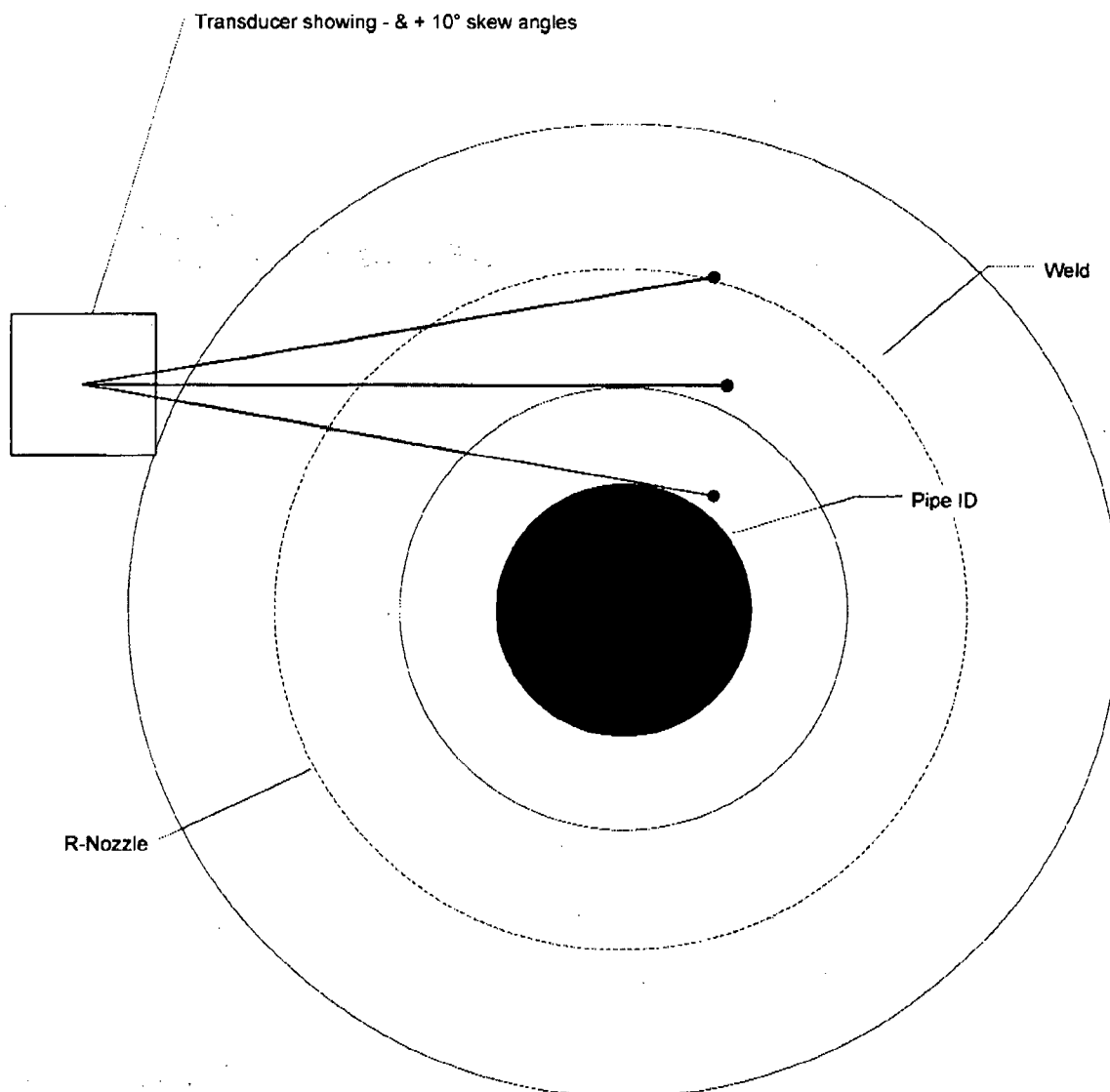


A AREVA	DESCRIPTION	Browns Ferry N9 Nozzle-to-Vessel Weld Coverage Plot		
	DRAWN BY	DATE	TITLE	PAGE
	Bret Flesner	03/15/07	N9NV-CPS3	13 OF 27

000442

R117

Top View
Measurements based on modeling report,
design drawings, and as-found measurements.



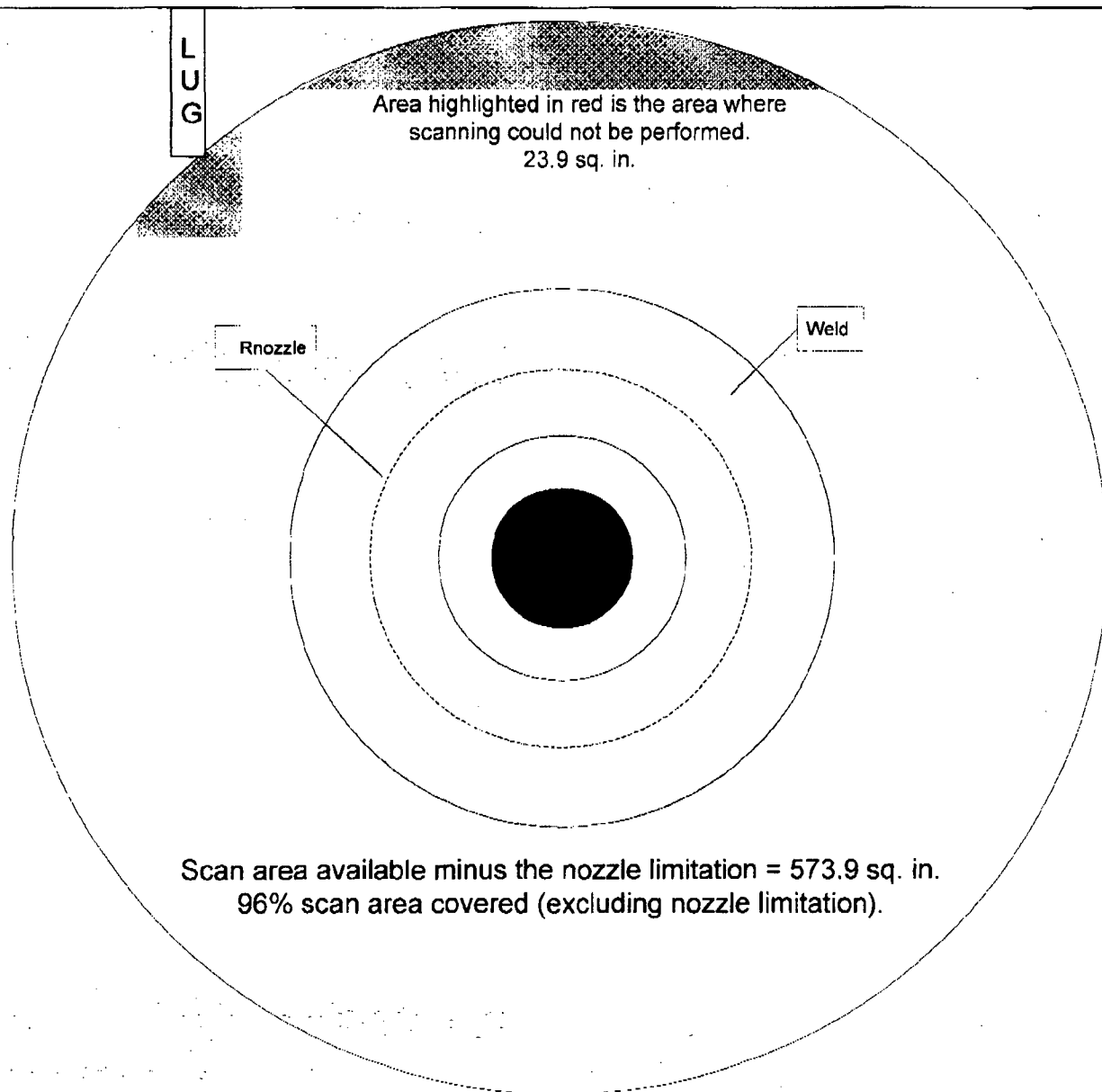
AREVA	DESCRIPTION Browns Ferry N9 Nozzle-to-Vessel Weld Coverage Plot			
	DRAWN BY Bret Flesner	DATE 03/15/07	TITLE N9NV-CPS4	PAGE 14 OF 27

R117

000443

Limitation sketch

Insulation Support Ring





Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000444

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS1				ISI Report Number: R117			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 842-600	
Model: Sonic 136				Serial Number: 015V98		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50"		Shape: Round	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 35°		Measured Angle: 37°	
RANGE	Range: 5.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: -35°		Measured Skew Angle: -35°	
	Delay: 8.07"			Mode: Shear		Radius: 3.0" R	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: N/A		S/N: N/A	
	Reject: Off			Reflector: N/A		N/A	
PULSER	Pulse Width: 222nS			Sweep: N/A		N/A	
	Damping: 500 Ω			Amplitude: N/A		N/A	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: N/A		N/A	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 74 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 1.4 div		Amplitude: 80 %FSH		Gain: 50.0 dB	
Cal In: Date 03/15/07 Time 1135		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/15/07 Time 1500	
Comments							
7" of soundpath delayed off screen to display from 7" to 12" on the A-scan.							
Examiner: Bret Flesner		Level: II		Date: 03/15/07		Examiner: N/A	
Signature: <i>Bret Flesner</i>						Level: N/A	
AREVA Review: Adam Conti		Level: III		Date: 03/16/07			
Signature: <i>Adam Conti</i>						Page 15 of 27	



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000445

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N9NV-CDS2		ISI Report Number: R117	
Component ID: N9-NV		Component Description: N9 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 842-600
Model: Sonic 136		Serial Number: 016BT1	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 35°	Measured Angle: 39°
RANGE	Range: 5.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: +35°	Measured Skew Angle: +35°
	Delay: 8.07"	Mode: Shear	Radius: 3.0" R
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12' Intermediate Connectors: 0	
RCVR	Display: Fil12	Verification Block	
	Frequency: 2.25MHz	Type: N/A	S/N: N/A
	Reject: Off	Reflector: N/A	N/A
PULSER	Pulse Width: 222nS	Sweep: N/A	N/A
	Damping: 500 Ω	Amplitude: N/A	N/A
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: N/A	N/A
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat
		Temperature: 74 °F	Therm. SN: VH-9520
Couplant: Ultrage1 II		Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 1.7 div	Amplitude: 80 %FSH	Gain: 52.0 dB
Cal In: Date 03/15/07 Time 1140	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/15/07 Time 1510

Comments

7" of soundpath delayed off screen to display from 7" to 12" on the A-scan.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/16/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000446

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N9NV-CDS3		ISI Report Number: R117	
Component ID: N9-NV		Component Description: N9 Nozzle-to-Vessel Weld	
Examination Procedure: 54-ISI-850-06		Applicable SDCN(s): 30-9044520-000	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 842-600
Model: Sonic 136		Serial Number: 01658N	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 35°	
RANGE	Range: 6.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: -50°	Measured Angle: 39°
	Delay: 6.28"	Mode: Shear	Radius: 3.1" R
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 12'	Intermediate Connectors: 0
RCVR	Display: Fil2	Verification Block	
	Frequency: 2.25MHz	Type: N/A	S/N: N/A
	Reject: Off	Reflector: N/A	N/A
PULSER	Pulse Width: 222nS	Sweep: N/A	N/A
	Damping: 500 Ω	Amplitude: N/A	N/A
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain: N/A	N/A
	Rep Rate: 2kHz	Basic Calibration Block	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat
		Temperature: 74 °F	Therm. SN: VH-9520
Couplant: Ultragel II		Batch No.: 05325	

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 4.6 div	Amplitude: 80 %FSH	Gain: 53.0 dB
Cal In: Date 03/15/07 Time 1143	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/15/07 Time 1505

Comments

5" of soundpath delayed off screen to display from 5" to 11" on the A-scan.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/16/07			



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000447

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS4				ISI Report Number: R117			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld			
Examination Procedure: 54-ISI-850-06				Applicable SDCN(s): 30-9044520-000			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 842-600	
Model: Sonic 136				Serial Number: 016BT1		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50"		Shape: Round	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 35°		Measured Angle: 38°	
RANGE	Range: 6.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: +50°		Measured Skew Angle: +54°	
	Delay: 6.28"			Mode: Shear		Radius: 3.1" R	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 12'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: N/A		S/N: N/A	
	Reject: Off			Reflector: N/A		N/A	
PULSER	Pulse Width: 222nS			Sweep: N/A		N/A	
	Damping: 500 Ω			Amplitude: N/A		N/A	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: N/A		N/A	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
Temperature: 74 °F				Therm. SN: VH-9520			
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 4.6 div		Amplitude: 80 %FSH		Gain: 51.0 dB	
Cal In: Date 03/15/07 Time 1145		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/15/07 Time 1503	
Comments							
5" of soundpath delayed off screen to display from 5" to 11" on the A-scan.							
Examiner: Bret Flesner		Level: II		Date: 03/15/07		Examiner: N/A	
Signature: <i>Bret Flesner</i>						Level: N/A Date: N/A	
AREVA Review: Adam Conti		Level: III		Date: 03/16/07			
Signature: <i>Adam Conti</i>						Page 18 of 27	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000443

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS5				ISI Report Number: <i>R117</i>			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 60°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A	N/A	
	Reject: Off			Sweep:	N/A	N/A	
	Pulse Width: 222 nS			Amplitude:	N/A	N/A	
PULSER	Damping: 500 Ω			Gain:	N/A	N/A	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 74 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 03/15/07 Time 1141		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/15/07 Time 1507	
Comments							
Zone 1 - Near Surface calibration.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II	Date: 03/15/07	Examiner: N/A Signature:		Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>		Level: III	Date: 03/16/07				



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

600449

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N9NV-CDS6		ISI Report Number: R117	
Component ID: N9-NV		Component Description: N9 Nozzle-to-Vessel Weld.	
Examination Procedure: N-UT-78 Revision 4		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: RTD	Model: TRL2-ST
Model: Sonic 136		Serial Number: 07-305	Frequency: 2 MHz
Serial Number: 136P1200G081456		Angle: 60°	Measured Angle: 60°
Linearity Sheet No.: LDS2		Mode: Refracted Longitudinal	Size: 2(24x42)mm
Instrument Settings		Focus: FS~125mm	Squint Angle: 5°
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	# of Elements: 2	Shape: Rect. Configuration: Dual - SBS
	Delay: 1.34"	Cable Type: RG-174	Length: 12' Intermediate Connectors: 0
	Velocity: 0.227 in / μ S	Verification Block	
RCVR	Display: Filt 2	Type: N/A	S/N: N/A
	Frequency: 2.25 MHz	Reflector: N/A	N/A
	Reject: Off	Sweep: N/A	N/A
	Pulse Width: 222 nS	Amplitude: N/A	N/A
PULSER	Damping: 500 Ω	Gain: N/A	N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual	Basic Calibration Block	
	Rep Rate: 2kHz	Block ID: BF-18	Material: CS
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Thickness: 6.0" with 0.125" Clad	Diameter: Flat
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.	Temperature: 74 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: ID Notch	Sweep: 6.3 div	Amplitude: 80 %FSH	Gain: 73.2 dB
Cal In: Date 03/15/07 Time 1142	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/15/07 Time 1508

Comments

Zone 2 - Full Volume calibration.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/15/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Corti Signature: <i>Adam Corti</i>	Level: III	Date: 03/16/07			



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000450

Utility: TVA Site: Browns Ferry Nuclear Plant Unit: 2 Outage: Cycle 14 RFO

Calibration Data Sheet Number: N9NV-CDS7 ISI Report Number: **R117**
 Component ID: N9-NV Component Description: N9 Nozzle-to-Vessel Weld
 Examination Procedure: N-UT-79 Revision 1 Applicable SDCN(s): N/A

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 113-242-591
Model: Sonic 136		Serial Number: 00XT7F	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single

Instrument Settings		Refracted Angle: 45°		Measured Angle: 45°
RANGE	Range: 10.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: N/A		Measured Skew Angle: N/A
	Delay: 0.380"	Mode: Shear		Radius: Flat
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 6' Intermediate Connectors: 0		
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25MHz	Type: CS Rompas	S/N: 791413	
	Reject: Off	Reflector:	2" Reflector	8" Reflector
PULSER	Pulse Width: 222nS	Sweep:	2.0 div.	8.0 div.
	Damping: 500 Ω	Amplitude:	80 %FSH	80 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	19.4 dB	45.2 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat	
		Temperature: 73 °F	Therm. SN: VH-9520	
		Couplant: Ultragel II	Batch No.: 05325	

Reference Sensitivity Information			
Reflector: (See Verification)	Sweep: (See Verification) div	Amplitude: N/A	Gain: N/A
Cal In: Date 03/16/07 Time 0835	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/16/07 Time 1130

Comments
 This full volume calibration used to locate and characterize flaw indication prior to sizing.

Examiner: Bret Flesner Level: II Date: 03/16/07 Examiner: N/A Level: N/A Date: N/A
 Signature: *[Signature]*
 AREVA Review: Adam Conti Level: III Date: 03/16/07
 Signature: *[Signature]* Page 21 of 27



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

00451

Utility: TVA

Site: Browns Ferry Nuclear Plant

Unit: 2

Outage: Cycle 14 RFO

Calibration Data Sheet Number: N9NV-CDS8

ISI Report Number: R117

Component ID: N9-NV

Component Description: N9 Nozzle-to-Vessel Weld

Examination Procedure: N-UT-79 Revision 1

Applicable SDCN(s): N/A

Ultrasonic Instrument		Transducer		
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 113-242-591	
Model: Sonic 136		Serial Number: 00XT7F	Frequency: 2.25 MHz	
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round	
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single	
Instrument Settings		Refracted Angle: 45°	Measured Angle: 45°	
RANGE	Range: 6.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Skew Angle: N/A	Measured Skew Angle: N/A	
	Delay: 3.380"	Mode: Shear	Radius: Flat	
	Velocity: 0.127 in / μ S	Cable Type: RG-174 Length: 6'	Intermediate Connectors: 0	
RCVR	Display: Filt2	Verification Block		
	Frequency: 2.25MHz	Type: CS Rompas	S/N: 791413	
	Reject: Off	Reflector:	5" Reflector	8" Reflector
PULSER	Pulse Width: 222nS	Sweep:	3.3 div.	8.3 div.
	Damping: 500 Ω	Amplitude:	80 %FSH	20 %FSH
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Gain:	33.4 dB	33.4 dB
	Rep Rate: 2kHz	Basic Calibration Block		
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	Block ID: BF-18	Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	Thickness: 6.0" with 0.125" clad	Diameter: Flat	
		Temperature: 73 °F	Therm. SN: VH-9520	
Couplant: Ultragel II		Batch No.: 05325		

Reference Sensitivity Information

Reflector: (See Comments)	Sweep: (See Comments)	Amplitude: N/A	Gain: N/A
Cal In: Date 03/16/07 Time 0836	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/16/07 Time 1131

Comments

This "depth zone" calibration used for sizing information. 3" soundpath delayed off screen to display 3" to 9" on A-scan.

1/2-t SDH in basic calibration block 1.7 divisions @ 39.2 dB.

3/4-t SDH in basic calibration block 5.2 divisions @ 45.4 dB.

Examiner: Bret Flesner Signature: <i>Bret Flesner</i>	Level: II	Date: 03/16/07	Examiner: N/A Signature:	Level: N/A	Date: N/A
AREVA Review: Adam Conti Signature: <i>Adam Conti</i>	Level: III	Date: 03/16/07			



Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000452

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS9				ISI Report Number: R117			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-79 Revision 1				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Benchmark 113-242-591	
Model: Sonic 136				Serial Number: 006YLP		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50"		Shape: Round	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 60°		Measured Angle: 59°	
RANGE	Range: 14.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			Skew Angle: N/A		Measured Skew Angle: N/A	
	Delay: 0.594"			Mode: Shear		Radius: Flat	
	Velocity: 0.127 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
	Display: Filt2			Verification Block			
RCVR	Frequency: 2.25MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 2" Reflector		14" Reflector	
	Pulse Width: 222nS			Sweep: 1.4 div.		10.0 div.	
	Damping: 500 Ω			Amplitude: 80 %FSH		80 %FSH	
PULSER	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: 26.2 dB		56.6 dB	
	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
Temperature: 73 °F				Therm. SN: VH-9520			
Couplant: Ultragel II				Batch No.: 05325			
Reference Sensitivity Information							
Reflector: (See Verification)		Sweep: (See Verification)		Amplitude: (See Verification)		Gain: (See Verification)	
Cal In: Date 03/16/07 Time 0830		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/16/07 Time 1133	
Comments							
This full volume calibration used to locate and characterize flaw indication prior to sizing.							
Examiner: Bret Flesner		Level: II		Date: 03/16/07		Examiner: N/A	
Signature: <i>Bret Flesner</i>						Level: N/A	
AREVA Review: Adam Conti		Level: III		Date: 03/16/07		Date: N/A	
Signature: <i>Adam Conti</i>						Page 23 of 27	



AREVA

Reactor Pressure Vessel

Manual Ultrasonic Calibration Data Sheet

000453

Utility: TVA	Site: Browns Ferry Nuclear Plant	Unit: 2	Outage: Cycle 14 RFO
Calibration Data Sheet Number: N9NV-CDS10		ISI Report Number: R117	
Component ID: N9-NV		Component Description: N9 Nozzle-to-Vessel Weld	
Examination Procedure: N-UT-79 Revision 1		Applicable SDCN(s): N/A	

Ultrasonic Instrument		Transducer	
Manufacture: Staveley		Manufacture: KBA	Model: Benchmark 113-242-591
Model: Sonic 136		Serial Number: 006YLP	Frequency: 2.25 MHz
Serial Number: 136P1200G081456		Size: 0.50"	Shape: Round
Linearity Sheet No.: LDS2		# of Elements: 1	Configuration: Single
Instrument Settings		Refracted Angle: 60°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth	Measured Angle: 59°	
	Delay: 4.44"	Skew Angle: N/A	
	Velocity: 0.127 in / μ S	Mode: Shear	
		Radius: Flat	
RCVR	Display: Filt2	Cable Type: RG-174 Length: 6' Intermediate Connectors: 0	
	Frequency: 2.25MHz	Type: CS Rompas	
	Reject: Off	S/N: 791413	
PULSER	Pulse Width: 222nS	Reflector:	5" Reflector
	Damping: 500 Ω	Sweep:	1.3 div.
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual	Amplitude:	80 %FSH
	Rep Rate: 2kHz	Gain:	39.8 dB
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)	11" Reflector	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.	8.8 div.	
		15 %FSH	
39.8 dB			
Basic Calibration Block			
		Block ID: BF-18	Material: Clad CS
		Thickness: 6.0" with 0.125" clad	Diameter: Flat
		Temperature: 73 °F	Therm. SN: VH-9520
		Couplant: Ultragel II	Batch No.: 05325

Reference Sensitivity Information

Reflector: (See Comments)	Sweep: (See Comments)	Amplitude: (See Comments)	Gain: (See Comments)
Cal In: Date 03/16/07 Time 0831	Check: Date N/A Time N/A	Check: Date N/A Time N/A	Out: Date 03/16/07 Time 1133

Comments

This "depth zone" calibration used for sizing information. 4" soundpath delayed off screen to display 4" to 12" on A-scan.

1/2-t SDH in basic calibration block 1.9 divisions @ 51.2 dB.

3/4-t SDH in basic calibration block 5.6 divisions @ 54.6 dB.

Examiner: Bret Flesner	Level: II	Date: 03/16/07	Examiner: N/A	Level: N/A	Date: N/A
Signature: <i>Bret Flesner</i>			Signature		
AREVA Review: Adam Conti	Level: III	Date: 03/16/07			
Signature: <i>Adam Conti</i>					



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000454

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS11				ISI Report Number: R117			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-79 Revision 1				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: KBA		Model: Gamma RHP 242-043	
Model: Sonic 136				Serial Number: 00YH67		Frequency: 2.25 MHz	
Serial Number: 136P1200G081456				Size: 0.50"		Shape: Round	
Linearity Sheet No.: LDS2				# of Elements: 1		Configuration: Single	
Instrument Settings				Refracted Angle: 0°		Measured Angle: N/A	
RANGE	Range: 10.0" <input type="checkbox"/> Sound Path <input checked="" type="checkbox"/> Depth			Skew Angle: N/A		Measured Skew Angle: N/A	
	Delay: 0.101"			Mode: Longitudinal		Radius: N/A	
	Velocity: 0.229 in / μ S			Cable Type: RG-174 Length: 6'		Intermediate Connectors: 0	
RCVR	Display: Filt2			Verification Block			
	Frequency: 2.25MHz			Type: CS Rompas		S/N: 791413	
	Reject: Off			Reflector: 1" Backwall		10" Backwall	
	Pulse Width: 222nS			Sweep: 1.0 div.		10.0 div.	
	Damping: 500 Ω			Amplitude: N/A		N/A	
	Mode: <input checked="" type="checkbox"/> Pulse Echo <input type="checkbox"/> Dual			Gain: N/A		N/A	
PULSER	Rep Rate: 2kHz			Basic Calibration Block			
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Block ID: BF-18		Material: Clad CS	
	*Pulser voltage adjustable with the Sonic 137 instrument only. The Sonic 136 has a fixed pulser voltage.			Thickness: 6.0" with 0.125" clad		Diameter: Flat	
				Temperature: 73 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: N/A		Sweep: N/A		Amplitude: N/A		Gain: N/A	
Cal In: Date 03/16/07 Time 0833		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/16/07 Time 1137	
Comments							
Calibration used for thickness measurments only.							
Examiner: Bret Flesner		Level: II		Date: 03/16/07		Examiner: N/A	
Signature: <i>Bret Flesner</i>						Level: N/A	
AREVA Review: Adam Corn		Level: III		Date: 03/16/07		Date: N/A	
Signature: <i>Adam Corn</i>						Page 25 of 27	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000455

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS12				ISI Report Number: R117			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 60°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 8.00" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A	S/N: N/A		
	Frequency: 2.25 MHz			Reflector:	N/A		N/A
	Reject: Off			Sweep:	N/A		N/A
PULSER	Pulse Width: 222 nS			Amplitude:	N/A		N/A
	Damping: 500 Ω			Gain:	N/A		N/A
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 73 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: 1/4-t SDH		Sweep: 3.7 div		Amplitude: 80 %FSH		Gain: 58.4 dB	
Cal In: Date 03/16/07 Time 0820		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/16/07 Time 1135	
Comments							
Zone 1 - Near Surface calibration.							
Prior to sizing.							
Examiner: Bret Flesner Signature: <i>Bret Flesner</i>		Level: II		Date: 03/16/07		Examiner: George Chapman Signature: <i>George Chapman</i>	
AREVA Review: Adam Corn Signature: <i>Adam Corn</i>		Level: III		Date: 03/16/07		Page 26 of 27	



Reactor Pressure Vessel Manual Ultrasonic Calibration Data Sheet

000456

Utility: TVA		Site: Browns Ferry Nuclear Plant		Unit: 2		Outage: Cycle 14 RFO	
Calibration Data Sheet Number: N9NV-CDS13				ISI Report Number: <u>R117</u>			
Component ID: N9-NV				Component Description: N9 Nozzle-to-Vessel Weld.			
Examination Procedure: N-UT-78 Revision 4				Applicable SDCN(s): N/A			
Ultrasonic Instrument				Transducer			
Manufacture: Staveley				Manufacture: RTD		Model: TRL2-ST	
Model: Sonic 136				Serial Number: 07-305		Frequency: 2 MHz	
Serial Number: 136P1200G081456				Angle: 60°		Measured Angle: 60°	
Linearity Sheet No.: LDS2				Mode: Refracted Longitudinal		Size: 2(24x42)mm	
Instrument Settings				Focus: FS~125mm		Squint Angle: 5°	
RANGE	Range: 18.0" <input checked="" type="checkbox"/> Sound Path <input type="checkbox"/> Depth			# of Elements: 2	Shape: Rect.	Configuration: Dual - SBS	
	Delay: 1.34"			Cable Type: RG-174 Length: 12' Intermediate Connectors: 0			
	Velocity: 0.227 in / μ S			Verification Block			
RCVR	Display: Filt 2			Type: N/A		S/N: N/A	
	Frequency: 2.25 MHz			Reflector:	N/A	N/A	
	Reject: Off			Sweep:	N/A	N/A	
	Pulse Width: 222 nS			Amplitude:	N/A	N/A	
PULSER	Damping: 500 Ω			Gain:	N/A	N/A	
	Mode: <input type="checkbox"/> Pulse Echo <input checked="" type="checkbox"/> Dual			Basic Calibration Block			
	Rep Rate: 2kHz			Block ID: BF-18		Material: CS	
	Pulser: <input type="checkbox"/> 150V <input type="checkbox"/> 300V (*Sonic 137 only)			Thickness: 6.0" with 0.125" Clad		Diameter: Flat	
	*Probe voltage is adjustable with the Sonic 137 instrument. The Sonic 136 has a fixed pulser voltage.			Temperature: 73 °F		Therm. SN: VH-9520	
				Couplant: Ultragel II		Batch No.: 05325	
Reference Sensitivity Information							
Reflector: ID Notch		Sweep: 6.3 div		Amplitude: 80 %FSH		Gain: 73.2 dB	
Cal In: Date 03/16/07 Time 0825		Check: Date N/A Time N/A		Check: Date N/A Time N/A		Out: Date 03/16/07 Time 1140	
Comments							
Zone 2 - Full Volume calibration.							
Prior to sizing.							
Examiner: Bret Flesner Signature: <u>Bret Flesner</u>		Level: II	Date: 03/16/07	Examiner: George Chapman Signature: <u>George Chapman</u>		Level: II	Date: 03/16/07
AREVA Review: Adam Corth Signature: <u>Adam Corth</u>		Level: III	Date: 03/16/07				

000457

Page 1 of 4

NOTIFICATION OF INDICATION FORM

NOI No. U2014-049 Plant/Unit BEN/2 **PART I - FINDINGS**
 ISI Dwg./Sh. No. 2-CHM-2046-C-01
 Examination Report No. R117 Component ID N9-NV
 Description of Indication (Sketch/Photograph if Required for Clarification): UNACCEPTABLE PLANER FLAW IN RPV N9 NOZZLE TO VESSEL WELD. PRELIMINARY AREVA REPORT ATTACHED.

Signature of Examiner/Certification Level:

Signature of ISO Coordinator (Field Supervisor):

Signature of ISI Program Owner:

Mark Weller for
BRET FLESNER /Date: 3/16/07

Mark Weller /Date: 3/16/07

Mark Weller /Date: 3/16/07

PART II - DISPOSITION

See attached.

Corrective Action Program or Administrative Control document number (PER, WO) if applicable:

121787

ASME XI Subsection IWE

☐ Yes☒ No

If Yes, complete the supplemental information Parts II and III of Page 2 of this form in addition to Parts II, III, and IV, of Page 1. If No, completion of Parts II and III of Page 2 of this form is not required and attachment of Page 2 with Page 1 is not required.

Disposition Prepared/Recorded By:

Victor D. JohnsonOrg. SE-M/NDate: 05-10-2007

PART III - ADDITIONAL EXAMINATIONS

Additional Sample Required [IW(X)-2430]:

☒ Yes☐ No

Page 2 of 2 additional samples attached?

☒ Yes☒ No

No
see 5/11/07

See attached.

(Attach list of items in additional sample, if yes.)

Stephen C. W. Wilhel /Date: 5/11/07
 ISI or CISI Program Owner

Successive Examination Required:

☐ Yes☒ NoRef. Code Case N-526

Stephen C. W. Wilhel /Date: 5/11/07
 ISI or CISI Program Owner

PART IV - VERIFICATION OF CLOSURE

Reexamination Report number, if Applicable:

N/A

Signature of ISO Coordinator:

Date:

Finding resulted from performance of the General visual Examination

☐ Yes☒ No

If Yes, concurrence of the Registered Professional Engineer (RPE) or Individual Responsible for performance is required (N/A otherwise):

N/A
 RPE/Responsible Engineer

Date:

Comments:

Verification of Complete Corrective Action Required by Disposition (Including Page 2, if applicable)

Signature of ISI or CISI Program Owner:

Date: 5/11/07

OK
5/17/07

600460

NOTIFICATION OF INDICATION FORM
SUBSECTION IWE

Complete this page in addition to Page 1 for findings affecting Class MC/Subsection IWE.

NOI No. U2C14-049Plant/Unit BFM/2Examination Report No. R-117Component ID N9-NV

PART II - DISPOSITION (Supplemental Information)

Evaluation of inaccessible areas as required by 10CFR50.55a(b)(2)(ix)(A)

(Include (1) A description of the type and estimated extent of degradation, and the conditions that led to the degradation; (2) An evaluation of each area, and the result of the evaluation; and (3) A description of necessary corrective actions) [additional separate continuation sheets may be attached, as necessary].

Corrective Action Program or Administrative Control document number
(PER, WO) if applicable: A

Disposition Prepared By: _____

Org. _____

Date 2007 6/7/07

PART III - ADDITIONAL EXAMINATIONS (Supplemental Information)

Additional examinations required per 10CFR50.55a(b)(2)(ix)(D) ☒ Yes ☐ No

If Yes, provide (1) A description of each flaw or area, including the extent of degradation, and the conditions that led to the degradation; (2) The acceptability of each flaw or area, and the need for additional examinations to verify that similar degradation does not exist in similar components; (3) A description of the necessary corrective actions; and (4) The number and type of additional examinations to ensure detection of similar degradation in similar components [additional separate continuation sheets may be attached, as necessary].

Specified By: _____

Org. _____

Date: _____

000458

Page 2 of 4

NOTIFICATION OF INDICATION FORM
ATTACHMENTNOI No. U2C14-049Plant/Unit BFN Unit 2Examination Report No. R-117Component ID N9-NV**Part II - Disposition**

This NOI documents indications in the vicinity of Control Rod Drive (CRD) Hydraulic System Return Nozzle N9 that were identified during ultrasonic (UT) examination performed during the Unit 2 Cycle 14 Refueling Outage. The indications were in the weld between the vessel shell and the CRD Nozzle, N9, and provided signal responses indicative of multiple small fabrication-type defects. This examination was performed in accordance with ASME Section XI, Appendix VIII as amended by 10CFR50.55a final rule (Report Number R-117). The indications were conservatively treated as a single composite indication which exceeded the appropriate acceptance standards of IWB-3512-1. Consequently, it was determined that this composite indication must be evaluated per the guidelines of IWB-3610.

Structural Integrity Associates (SIA) was contacted to perform the evaluation of the composite indication. SIA Calculation Number TVA-56Q-301r0 concluded that the indication was acceptable and met the requirements of ASME Code, Section XI, IWB-3610. In addition, successive examinations as required by ASME Section XI, IWB-2420 (b) and (c) were not required per ASME Code, Section XI, Code Case N-526. TVA Calculation Number MDQ-2068-2007-0013 (EDMS Reference R14 070328 105) was issued to document the SIA evaluation.

Prepared By: Victor D. Schumacher Org. SE-M/N Date 05-10-2007



000453 NoI#U2C14-049
Page 3 of 4

March 29, 2007

Victor Schiavone
Tennessee Valley Authority (TVA)
Browns Ferry Nuclear Plant
PO Box 2000
Decatur, AL 35609-2000

Subject: Ultrasonic Examination Results for the Manual ISI Expanded Scope of
(10) RPV Nozzle-to-Vessel Welds

Victor,

See the following table for the Ultrasonic Examination Results for the Expanded Scope
of (10) RPV Nozzle-to-Vessel Welds during the U2C14 at Browns Ferry Nuclear Plant.

Component Identification	Component Description	ISI Exam	Ultrasonic Examination Results
N2B (Recirc. Inlet Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N2D (Recirc. Inlet Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N2K (Recirc. Inlet Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N8B (Jet Pump Instr. Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N4B (Feedwater Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N4C (Feedwater Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N4E (Feedwater Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N4F (Feedwater Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N3A (Main Steam Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable
N3C (Main Steam Nozzle)	Nozzle to Vessel Weld	UT	No Recordable UT Indications Acceptable

Thanks,

Dan Langenfeld
Task Lead, MT/PT Level-III
AREVA NP, INC.