**PSEG Nuclear LLC**
P.O. Box 236, Hancocks Bridge, NJ 08038-0236

PSEG
*Nuclear LLC*

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

LR-N18-0087
September 24, 2018

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Hope Creek Generating Station
Renewed Facility Operating License No. NPF-57
NRC Docket No. 50-354

Subject: Submittal of Relief Request Associated with the Third Inservice Inspection (ISI) Interval

In accordance with 10 CFR 50.55a, "Codes and standards," paragraph (g)(5)(iii), PSEG Nuclear LLC (PSEG) hereby requests NRC approval of the attached request for the third 10-year inservice inspection (ISI) interval for the Hope Creek Generating Station which ended on December 12, 2017. The relief request addresses limitations for examinations performed in accordance with the requirements of the American Society of Mechanical Engineering (ASME) Boiler and Pressure Vessel Code, Section XI for Class 1 and 2 components.

There are no commitments in this letter or enclosure.

If you have any questions or require additional information, please contact Mr. Lee Marabella at 856-339-1208.

Sincerely,

Paul R. Duke, Jr.
Manager - Licensing
PSEG Nuclear LLC

Enclosure 1: American Society of Mechanical Engineers (ASME) Section XI
10 CFR 50.55a Request for Relief Number HC-I3R-08, Revision 0

cc: Regional Administrator – NRC Region I
Project Manager - USNRC
NRC Senior Resident Inspector - Hope Creek
P. Mulligan, Chief, NJBNE
Hope Creek Commitment Coordinator

Enclosure 1

American Society of Mechanical Engineers (ASME) Section XI
10 CFR 50.55a Request for Relief Number HC-I3R-08, Revision 0

**Enclosure 1**

**Hope Creek Generating Station (HCGS)**

**10 CFR 50.55a Request for Relief Number HC-I3R-08, Revision 0**

**In Accordance with 10 CFR 50.55a(g)(5)(iii)**

--Inservice Inspection Impracticality--

## 1. ASME Code Component(s) Affected

The Hope Creek Generating Station (HCGS) Class 1 and 2 components with limited examinations that are included in this request for relief are for the Third Ten-Year Inservice Inspection Interval. The content of this request includes the insights gained from guidance provided in Reference 1 and the following Code Classes, Examination Categories, and Item Numbers apply.

| | |
|---|---|
| Code Classes: | 1 and 2 |
| Examination Categories: | B-A, B-D, B-P, C-A, C-G, and R-A |
| Item Numbers: | B1.12, B1.30, B3.90, B3.100, B15.10, C1.10, C6.10, and R1.20-4 |

## 2. Applicable Code Edition and Addenda

The HCGS third interval Inservice Inspection (ISI) program was based on ASME Boiler and Pressure Vessel Code Section XI*, Rules for Inservice Inspection of Nuclear Power Plant Components,* 2001 Edition through 2003 Addenda (Reference 2), as modified by 10 CFR 50.55a. The Appendix VIII requirements and use of the Performance Demonstration Initiative (PDI) requirements at HCGS were in accordance with the 2001 Edition of Section XI (Reference 3) for the limited examinations contained in this request as conditioned by 10 CFR 50.55a(b)(2)(xv) and 10 CFR 50.55a(b)(2)(xxiv).

The HCGS Third Ten-Year ISI Interval ended on December 12, 2017.

## 3. Applicable Code Requirements

| Exam Cat. | Item No. | Class 1 Weld Examination Coverage Requirements |
|---|---|---|
| B-A | B1.12 | To include essentially 100% examination of the Reactor Vessel Longitudinal Shell Welds. |
| B-A | B1.30 | To include essentially 100% examination of the Reactor Vessel Shell-to-Flange Weld. |
| B-D | B3.90 | To include the examination volume of the Reactor Vessel Nozzle-to-Vessel weld as depicted in the applicable figure shown in Figures IWB-2500-7(a), (b), (c), or (d) |
| B-D | B3.100 | To include examination volume of the Reactor Vessel Nozzle-to Vessel Inner Radius Sections as depicted in the applicable figure shown in Figures IWB-2500-7(a), (b), (c), or (d). |
| B-P | B15.10 | To include all Class 1 pressure retaining components within the system boundary as specified in IWB-5222(b) |

| Exam Cat. | Item No. | Class 2 Weld Examination Coverage Requirements |
|---|---|---|
| C-A | C1.10 | To include essentially 100% examination of the Residual Heat Exchanger Shell-to-Flange Weld |
| C-G | C6.10 | To include 100% examination of the all welds in one pump of each group of pumps. |

| Exam Cat. | Item No. | Class 1 and Class 2 Piping Welds / Risk-Informed Inservice Inspection Program Coverage Requirements |
|---|---|---|
| R-A | R1.20-4 | To include essentially 100% of the examination location with no degradation mechanism. |

As previously defined in 10 CFR 50.55a(g)(6)(ii)(A)(2), now removed, and Regulatory Guide 1.147, Revision 17 (Reference 4), ASME Code Case N-460 (Reference 5) was invoked for the required coverage associated with the welds in this request and states that essentially 100% equates to more than 90% of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

Limited Class 1 and Class 2 Piping Welds / Risk-Informed Inservice Inspection Programs

Class 1 and Class 2 piping welds selected for examination during the third interval under the Risk-Informed Inservice Inspection (RI-ISI) Programs used for HCGS were examined in accordance with EPRI Topical Report TR-112657, Rev. B-A methodology (Reference 7) which was supplemented by ASME Code Case N-578-1 (Reference 8) and included the piping welds (elements) selected for examination under Examination Category R-A. The use of these documents for HCGS was based on a request for an alternative HC-I3R-01 that was authorized for use per Reference 9.

RI-ISI Program Limited Examination Evaluations

When limited piping weld examinations are identified under EPRI TR-112657 Rev. B-A supplemented by Code Case N-578-1 RI-ISI Programs, an evaluation is performed with consideration given to whether a new weld location should be selected for examination to make-up for these limited examinations. However, since the initial RI-ISI piping weld selections were based on consequence, failure probability, potential degradation mechanisms and the design of the welds were all similar (i.e., Fitting to Fitting, Fitting to Valve, Fitting to Pipe or located just inside a piping penetration) for examination under these parameters, it was determined that no or very little additional coverage could be obtained by selecting another weld with these same selection criteria. Thus, no other RI-ISI piping weld was selected for the limited examination identified in Attachment 1 for the RI-ISI piping weld examined in the third interval.

## 4. Impracticality of Compliance

The construction permit for HCGS was issued on November 4, 1974 and falls under the provisions of 10 CFR 50.55a(g)(3), which were applied to components (including supports) that must meet the requirements of paragraphs (g)(4) and (g)(5) to the extent practical. Components that are part of the reactor coolant pressure boundary and their supports must meet the requirements applicable to components that are classified as ASME Code Class 1. Components that are classified as ASME Code Class 2 and 3 must be designed and provided with access to enable the performance of inservice examination of these components and must meet the preservice examination requirements. Therefore, although the design of the plants has provided access for examinations to the extent practical, component design configurations resulting in examination limitations such as those from support interference, geometric configurations of welds and materials such as fitting or valve bodies made of cast stainless steel may not allow the full required examination volume or surface area coverage with the latest techniques available. A typical example of such a condition is a valve-to-pipe weld where essentially 100% of the code required volume cannot be examined from the valve side of the weld and where a plant modification would be needed to provide this coverage. Details of examination restrictions and reductions in required examination coverage are provided in Attachment 1.

When examined, the welds listed in Attachment 1 of this request did not receive the required code volume or surface area coverage due to their component design configurations or interference by other items. These conditions resulted in scanning or surface area access limitations that prohibited obtaining essentially 100% examination coverage of the required examination volumes or surface areas, but when this situation occurred 100% coverage of the accessible volumes or surface areas of each weld was obtained.

## 5. Burden Caused by Compliance

To comply with the code required examination volumes or surface areas for obtaining essentially 100% coverage for the welds listed in this request for relief, the welds and their

associated components would have to be physically modified and/or disassembled beyond their current design. Overall, components and fittings associated with the welds listed in this request are constructed of standard design items and materials meeting typical national standards that specify required configurations and dimensions. To replace these items with items of alternate configurations or materials to enhance examination coverage would require unique redesign and fabrication. Because these items are in the Class 1 and 2 boundaries and for the Class 1 items that form a part of the reactor coolant pressure boundary, their redesign and fabrication would be an extensive effort based on the limitations that exist.

For the Class 1, Examination Category B-A, Reactor Pressure Vessel Shell Welds, Item No. B1.12 (RPV1-W12-1, RPV1-W12-2, and RPV1-W12-3) limitations were caused by the internal piping in the reactor vessel. The volumetric examination was performed from the vessel ID and the feedwater sparger and core spray piping reduced the coverage. These internal piping configurations would require removing or redesigning to allow the additional coverage.

For the Class 1, Examination Category B-A, Reactor Pressure Vessel Shell-to-flange weld, Item No. B1.30 (RPV1-W3) limitation was caused by proximity of the main steam nozzle plugs, nozzle clad removal areas and the rod guides at 0° and 180°.

For the Class 1, Examination Category B-D, "Full Penetration Welded Nozzles in Vessels - Inspection Program B," Item No. B3.90 for the nine nozzle welds including the six feedwater nozzle welds, the volumetric examinations were limited due to plant design and to obtain the required coverage for each of these welds would require a design modification.

For the Class 1, Item No. B3.100, "Nozzle Inside Radius Section" limitations applied to the five inside radius sections. To obtain the required coverage, a design modification would have to be performed to remove or replace the thermal sleeves in these nozzles. Performing this type of modification is considered to be impractical. The structural integrity of the nozzle forgings themselves is not in question at this time because they were nondestructively examined during fabrication and have been previously examined using ultrasonic techniques specific to the nozzle configurations. No indications of fabrication or service related cracking have been observed as a result of these examinations.

For the Class 1, Item No. B15.10 "All Pressure Retaining Components" limitation applied to one root valve pair AE-V9989 and AE-V9995, the piping between the two root valves, 2.25 linear inches per FSK-P-1-AE-662, was not pressurized. Access to these two valves is limited due to location between main steam lines, which would require excessive scaffolding and poses radiological and personnel safety concerns. There were no indications of leakage identified in the area surrounding these valves during the system pressure test. Note that Code Case N-798, approved in revision 18 of RG 1.147, allows for the vent and drain inboard isolation valves to remain closed during the system pressure test.

For the Class 2 Examination Category C-A, Shell Circumferential Welds, Item No. C1.10, the volumetric examination limitations on the Vessel-to-Flange Weld on the "A" RHR Heat

Exchanger were due to the taper of the flange side of the weld, which would require a design modification to remove the taper.

For the Class 2 Examination Category C-G, Pump Casing Welds, the surface examination limitations were caused by the concrete pump pedestal obstructions. A design change would be required to remove the concrete pedestal.

The configuration of the Class 1 piping weld examined per the RI-ISI program only allowed ultrasonic examination from one side of the weld and limited coverage from specific areas on the far side of the weld and thus would require a design modification or replacement to obtain the required examination coverage.

Overall it is not possible to obtain interrogation of greater than 90% of the required code examination volume or surface areas for the welds in this request without extensive weld or component design modifications. Examinations have been performed to the maximum extent possible. Supplemental radiography is impractical due to the amount of work being performed in the areas on a 24-hour basis when the welds are available for examination. Using radiography would result in numerous work-related stoppages and increased exposure due to the shutdown and startup of other work in the areas. The water may need to be drained from systems or components where radiography is performed, which increases the radiation dose rates over a much broader area than the weld being examined.

The surface and volumetric examination techniques used for welds in this request for relief were reviewed to determine if additional coverage could be achieved by improving those techniques. None were identified and the examinations have been performed to the maximum extent possible. Therefore, HCGS has determined that obtaining essentially 100% coverage is not feasible without adding additional burden consisting of significant redesign work, increased radiation exposure, and/or potential damage to the plant or the component itself.

## 6. Proposed Alternative and Basis for Use

Proposed Alternative

1) Periodic system pressure test VT-2 visual examinations will continue to be performed in accordance with ASME Section XI, Examination Category B-P, for Class 1 pressure retaining welds and items each refueling outage and Examination Category C-H for Class 2 pressure retaining welds and items each inspection period of Table IWB-2500-1 and Table IWC-2500-1, respectively.

2) Conduct required surface and/or volumetric examinations to the maximum extent possible as required by ASME Section XI or the RI-ISI Programs.

Basis for Use

10 CFR 50.55a(g)(4) recognizes that throughout the service life of a nuclear power facility, components which are classified as ASME Code Class 1, Class 2 and Class 3 must meet the requirements set forth in the ASME Code to the extent practical within the limitations of design, geometry and materials of construction. When a component is found to have conditions which limit the required examination volume or surface area, HCGS is required to submit this information to the enforcement and regulatory authorities having jurisdiction at the plant site. This request for relief has been written to address areas where these types of conditions exist and where the required amount of coverage was reduced below the minimum acceptable. HCGS has performed the weld examinations to the maximum extent possible for each of the welds identified with limitations in Attachment 1.

The Class 1 Examination Category B-A, Head-to-Flange Welds, the Class 1 Examination Category B-D, Reactor Vessel Nozzle-to-Vessel Welds and Inside Radius Sections, the Class 1 Examination Category B-P, All Pressure Retaining Components, and the Class 1 Risk-Informed Piping Weld within the scope of this request are all located inside the containment. Even though their examination did not meet the essentially 100% code required volume coverage requirement, there is instrumentation in place to assure early detection of any Reactor Coolant System (RCS) pressure boundary leakage. The instrumentation consists of monitoring of drywell floor drain sump level to determine flow rate, drywell cooler condensate flow rate increases, and airborne gaseous radioactivity increases. HCGS Technical Specifications Limiting Condition for Operation (LCO) 3.4.3.2 requires that RCS leakage shall be limited to:

a. No PRESSURE BOUNDARY LEAKAGE.
b. 5 gpm UNIDENTIFIED LEAKAGE.
c. 25 gpm IDENTIFIED LEAKAGE averaged over any 24-hour period.
d. 0.5 gpm leakage per nominal inch of valve size up to a maximum of 5 gpm from any reactor coolant system pressure isolation valve specified in Table 3.4.3.2-1, at rated pressure.
e. 2 gpm increase in UNIDENTIFIED LEAKAGE within any period of 24 hours or less.

The Class 2 Examination Category C-A, RHR Heat Exchanger Shell-to-Flange Weld and the Class 2 Examination Category C-G, Pump Casing Welds within the scope of the request are outside containment. The RHR Heat Exchanger and the RHR Pumps are located in the RHR Pump Rooms while the Core Spray Pump is located in the Core Spray Pump Room. The Operations Department performs routine plant walkdowns to identify deficiencies and initiate corrective actions as appropriate. Any leaks identified are required to be reported to the Control Room. Note that HCGS will be implementing Code Case N-716-1 in the 4$^{th}$ Interval which evaluated the RHR Heat Exchangers and determined them to be classified as Low Safety Significant (LSS) which requires no examination with the exception of the VT-2 examination during the periodic pressure test. Category C-G was removed from ASME Section XI in the 2008 Addenda and therefore will no longer require examination.

Based upon the extent of the required surface examination area or volumetric examination volume achieved for each of the welds within this request for relief, applicable leakage monitoring, and required system pressure test VT-2 visual examinations, reasonable assurance of structural integrity is ensured.

## 7. Duration of Proposed Alternative

This request for relief is for HCGS, Third Ten-Year ISI Interval, which began on December 13, 2007 and ended on December 12, 2017.

## 8. Precedents

**Note**: Industry requests for relief due to impracticality associated with limited weld examinations are common and are filed by all licensees. Some recent NRC approvals of requested relief are:

1) NRC Safety Evaluation Report (SER) for Surry Power Station Unit No. 2 – Requests for Relief LMT-SS01, LMT-CS01, LMT-P01, LMT-C01, LMT-C02, LMT-C03, and LMT-C04 – For Limited Coverage Examinations Performed in the Fourth 10-Year Inservice Inspection Interval (CAC NOS., MF7718, MF-7719, MF7720, MF7721 MF7722, MF7723, MF7724 and MF7725), Dated: February 17, 2017, [ADAMS Accession No.: ML16365A118]

2) NRC Safety Evaluation Report (SER) for Diablo Canyon Power Plant, Unit No. 1 - Relief Request NDE-SIF-U1 To Allow Use of Alternate American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section XI Examination Requirements for the Third Inservice Inspection Interval (CAC NO. MF7552), Dated: July 27, 2016, [ADAMS Accession No.: ML16207A397]

3) NRC Safety Evaluation Report (SER) for Millstone Power Station, Unit No. 2 - Relief Requests For Limited Coverage Examinations Performed In The Fourth 10-Year Inservice Inspection Interval (CAC NOS. MF6567, MF6568, and MF6569), Dated: July 13, 2016, [ADAMS Accession No.: ML16172A135]

4) NRC Safety Evaluation Report (SER) for Susquehanna Steam Electric Station, Units 1 and 2 – Relief Requests for the Third 10-Year Inservice Inspection Interval (CAC NOS. MF6302, MF6303, MF6304, MF6305, MF6306, AND MF6307), Dated: May 10, 2016, [ADAMS Accession No.: ML16069A199]

5) NRC Safety Evaluation Report (SER) for Second 10-Year Interval for Inservice Inspection Program – Hope Creek Generating Station, Dated: February 3, 2000, (TAC No. MA2026), Dated: February 3, 2000, [ADAMS Accession No.: ML003680090]

6) NRC Safety Evaluation Report (SER) for Hope Creek Generating Station – Evaluation of Relief Request NC-RR-B11, Dated March 22, 2004, (TAC No. MB8408), Dated June 9, 2003, [ADAMS Accession No.: ML031600421]

## 9. References


1) NRC presentation “Coverage Relief Requests”, Industry/NRC NDE Technical Information Exchange Public Meeting January 13-15, 2015, [ADAMS Accession No.: ML15013A266].

2) ASME Section *XI, Rules for Inservice Inspection of Nuclear Power Plant Components,* 2001 Edition through 2003 Addenda.

3) ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components,* Appendix VIII, Performance Demonstration for Ultrasonic Examination Systems, 2001 Edition.

4) NRC Regulatory Guide 1.147, Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, Revision 17, Dated August 2014. [ADAMS Accession No.: ML13339A689]

5) ASME Code Case N-460, Alternative Examination Coverage for Class 1 and Class 2 Welds Section XI, Division 1.

6) ASME Code Case N-648-1, Alternative Requirements for Inner Radius Examinations of Class 1 Reactor Vessel Nozzles Section XI, Division 1

7) EPRI Topical Report TR-112657 Rev. B-A, Revised Risk-Informed Inservice Inspection Evaluation Procedure, Dated: December 1999, [ADAMS Accession No.: ML013470102]

8) ASME Code Case N-578-1, Risk-Informed Requirements for Class 1, 2, or 3 Piping, Method B Section XI, Division 1.

9) NRC SER Hope Creek Generating Station – “Submittal of Relief Requests Associated with the Third Inservice Inspection (ISI) Interval dated December 12, 2007 (this SER included authorization of HC-I3R-01 “Request for Relief for Alternate Risk-Informed Selection and Examination Criteria for Examination Category B-F, B-J, and C-F-2 Pressure Retaining Piping Welds” [ADAMS Accession No. ML082470063].

10) NRC Regulatory Guide 1.147, Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, Revision 18, Dated January 2018.

11) ASME Code Case N-716-1, Alternative Classification and Examination Requirements, Section XI, Division 1

**Attachment 1**

**PSEG Nuclear LLC**
**Hope Creek Generating Station (HCGS)**

**10 CFR 50.55a Request for Relief Number HC-I3R-08, Revision 0**

**In Accordance with 10 CFR 50.55a(g)(5)(iii)**

--Inservice Inspection Impracticality--

## Introduction

This attachment contains figures and tables as applicable that are used to depict the limitations and calculations used for obtained coverage, materials and product forms, with ultrasonic examination angles and wave modes used, any limited surface examinations and the examination results for the welds associated with this request for relief, including any applicable previous examination history used. The following Table 1 for HCGS identifies the welds within the scope of this request and summarizes the extent of examination coverage achieved for each weld.

Many of the welds listed were examined with different HCGS approved procedures and techniques during the span of the Third Ten-Year ISI Interval and therefore not all the coverage calculations used are identical, but they are based on the actual Non-Destructive Examination (NDE) data reports that were provided for the examinations completed.

| TABLE 1 – HCGS WELDS WITH LIMITED EXAMINATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Seq. Number / Weld Identification Number** | **Class, Category and Item No.** | **Weld Description** | **Material 1 and Product Form** | **Material 2 Weld** | **Material 3 and Product Form** | **Examination Code Coverage Obtained[2]** | **Examination Limitations and Results** | **Applicable Tables and Figures** |
| 1.1/RPV1-W12-1 | 1<br>B-A, B1.12 | RPV[1] Longitudinal Seam @ 110° | SA-533 Gr. B Cl. 1 Alloy Steel Plate | Weld Ferritic Steel | N/A | 72.40% | UT Limitations due to proximity of feedwater and core spray spargers | Tables 1.1-1, 1.1-2, and Figures 1.1-1, 1.1-2 |
| 1.2/RPV1-W12-2 | 1<br>B-A, B1.12 | RPV[1] Longitudinal Seam @ 230° | SA-533 Gr. B Cl. 1 Alloy Steel Plate | Weld Ferritic Steel | N/A | 71.70% | UT Limitations due to proximity of feedwater and core spray spargers | Tables 1.2-1, 1.2-2 and Figures 1.2-1, 1.2-2 |
| 1.3/RPV1-W12-3 | 1<br>B-A, B1.12 | RPV[1] Longitudinal Seam @ 350° | SA-533 Gr. B Cl. 1 Alloy Steel Plate | Weld Ferritic Steel | N/A | 72.40% | UT Limitations due to proximity of feedwater and core spray spargers | Tables 1.3-1, 1.3-2, and Figures 1.3-1, 1.3-2 |
| 1.4/RPV1-W3[3] | 1<br>B-A, B1.30 | RPV[1] Shell-to-Flange Weld | SA-533 Gr. B Cl.1 Alloy Steel Plate | Weld Ferritic Steel | SA-508 Cl. 2 Alloy Steel Forging | 86.20% | UT Limitations due to proximity of the N3 Main Steam nozzle plugs, N3 Nozzle clad removal areas and the rod guides at 0° and 180° | Tables 1.4-1, 1.4-2, and Figures 1.4-1, 1.4-2 |
| 1.5/RPV1-N3D | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Main Steam D) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 82.80% | UT Limitations due to nozzle configuration and proximity of N8 nozzle | Table 1.5-1 and Figures 1.5-1 to 1.5-3 |
| 1.6/RPV1-N4A | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Feedwater A) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 89.60% | UT Limitations due to nozzle configuration | Table 1.6-1 and Figures 1.6-1 to 1.6-3 |

| TABLE 1 – HCGS WELDS WITH LIMITED EXAMINATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Seq. Number / Weld Identification Number** | **Class, Category and Item No.** | **Weld Description** | **Material 1 and Product Form** | **Material 2 Weld** | **Material 3 and Product Form** | **Examination Code Coverage Obtained[2]** | **Examination Limitations and Results** | **Applicable Tables and Figures** |
| 1.7/RPV1-N4B | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Feedwater B) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 89.60% | UT Limitations due to nozzle configuration | Table 1.7-1 and Figures 1.7-1 to 1.7-3 |
| 1.8/RPV1-N4C | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Feedwater C) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 80.42% | UT Limitations due to nozzle configuration | Table 1.8-1 and Figures 1.8-1 to 1.8-3 |
| 1.9/RPV1-N4D | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Feedwater D) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 89.60% | UT Limitations due to nozzle configuration | Table 1.9-1 and Figures 1.9-1 to 1.9-3 |
| 1.10/RPV1-N4E | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Feedwater E) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 89.60% | UT Limitations due to nozzle configuration | Table 1.10-1 and Figures 1.10-1 to 1.10-3 |
| 1.11/RPV1-N4F | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Feedwater F) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 80.42% | UT Limitations due to nozzle configuration | Table 1.11-1 and Figures 1.11-1 to 1.11-3 |
| 1.12/RPV1-N8A | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Jet Pump Instrumentation A) | SA-508 Cl. 2 Alloy Steel Forging with Stainless Steel Cladding | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate with Stainless Steel Cladding | 87.80% | UT Limitations due to nozzle configuration | Table 1.12-1 and Figures 1.12-1 to 1.12-3 |
| 1.13/RPV1-N7 | 1<br>B-D<br>B3.90 | RPV[1] Nozzle-to-Vessel Weld (Head Vent) | SA-508 Cl. 2 Alloy Steel Forging | Weld: Ferritic Steel | SA-533 Gr. B Cl. 1 Alloy Steel Plate | 74.70% | UT Limitations due to nozzle configuration | Table 1.13-1 and Figures 1.13-1 to 1.13-3 |

| TABLE 1 – HCGS WELDS WITH LIMITED EXAMINATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Seq. Number / Weld Identification Number** | **Class, Category and Item No.** | **Weld Description** | **Material 1 and Product Form** | **Material 2 Weld** | **Material 3 and Product Form** | **Examination Code Coverage Obtained[2]** | **Examination Limitations and Results** | **Applicable Tables and Figures** |
| 1.14/<br><br>RPV1-N2AIR<br>RPV1-N2BIR<br>RPV1-N2KIR<br>RPV1-N5BIR<br>RPV1-N17AIR | 1<br>B-D<br>B3.100<br>B3.100<br>B3.100<br>B3.100<br>B3.100 | RPV[1] Nozzle-to-Vessel Weld<br>(Recirc. Inlet A)<br>(Recirc. Inlet B)<br>(Recirc. Inlet K)<br>(Core Spray B)<br>(LPCI A) | SA-508 Cl. 2 Alloy Steel Forging with Stainless Steel Cladding | N/A | N/A | <br><br>40.00%<br>25.00%<br>50.00%<br>25.00%<br>45.00% | Visual Limitations due to internal piping configuration | Table 1.14-1 and Figures 1.14-1 to 1.14-6 |
| 1.15/1-AE-205-RHX-W4[3] | 2<br>C-A<br>C1.10 | RHR Heat Exchanger Shell-to-Flange Weld | SA-516 Carbon Steel Plate | Weld Ferritic Steel | SA-105 Carbon Steel Forging | 88.10% | UT Limitation due to flange configuration | Table 1.15-1 and Figures 1.15-1 to 1.15-3 |
| 1.16/1-CP-206-CSP-W2[3] | 2<br>C-G<br>C6.10 | Core Spray Pump Casing-to-Flange Weld | A48 Cl. 30-B Gray Cast Iron | Weld Ferritic Steel | A350 LF1 or LF2 Carbon Steel Forging | 23.40% | PT Limitation due to concrete pump pedestal | Figures 1.16-1 to 1.16-4 |
| 1.17/1-CP-202-RHP-W2 | 2<br>C-G<br>C6.10 | RHR Pump Casing-to-Flange Weld (RHR "C" Pump) | A536 Gr. 65-45-12 Ductile Cast Iron | Weld Ferritic Steel | A516 Gr. 70 Carbon Steel Plate | 18.04% | PT Limitation due to concrete pump pedestal | Table 1.17-1 and Figure 1.17-1 |
| 1.18/1-DP-202-RHP-W2[3] | 2<br>C-G<br>C6.10 | RHR Pump Casing-to-Flange Weld (RHR "D" Pump) | A536 Gr. 65-45-12 Ductile Cast Iron | Weld Ferritic Steel | A516 Gr. 70 Carbon Steel Plate | 18.04% | PT Limitation due to concrete pump pedestal | Figures 1.18-1 and 1.18-2 |
| 1.19/1-DP-202-RHP-W3[3] | 2<br>C-G<br>C6.10 | RHR Pump Casing Suction Weld (RHR "D" Pump) | A536 Gr. 65-45-12 Ductile Cast Iron | Weld Ferritic Steel | A516 Gr. 70 Carbon Steel Plate | 29.90% | PT Limitation due to concrete pump pedestal | Figures 1.19-1 and 1.19-2 |
| 1.20/1-BG-6DBA-001-29 | 1<br>R-A<br>R1.20-4 | RWCU Pipe-to-Valve | SA-106 Gr. B | Weld Ferritic Steel | SA-216 Gr. WCB | 81.50% | UT No Exam downstream due to valve configuration | Table 1.20-1 and Figures 1.20-1 and to 1.20-2 |

NOTES:
1. Containment RCS Leakage Detection Applies
2. Ultrasonic (UT) Examination, Phased Array UT Examination (PAUT) and Surface Examination by Liquid Penetrant (PT) or Magnetic Particle (MT).
3. These limited examinations had received pre-approval during the 2nd Ten-Year Interval (Precedent 5)

## 1.1 Weld RPV1-W12-1 – RPV Longitudinal Seam @ 110°

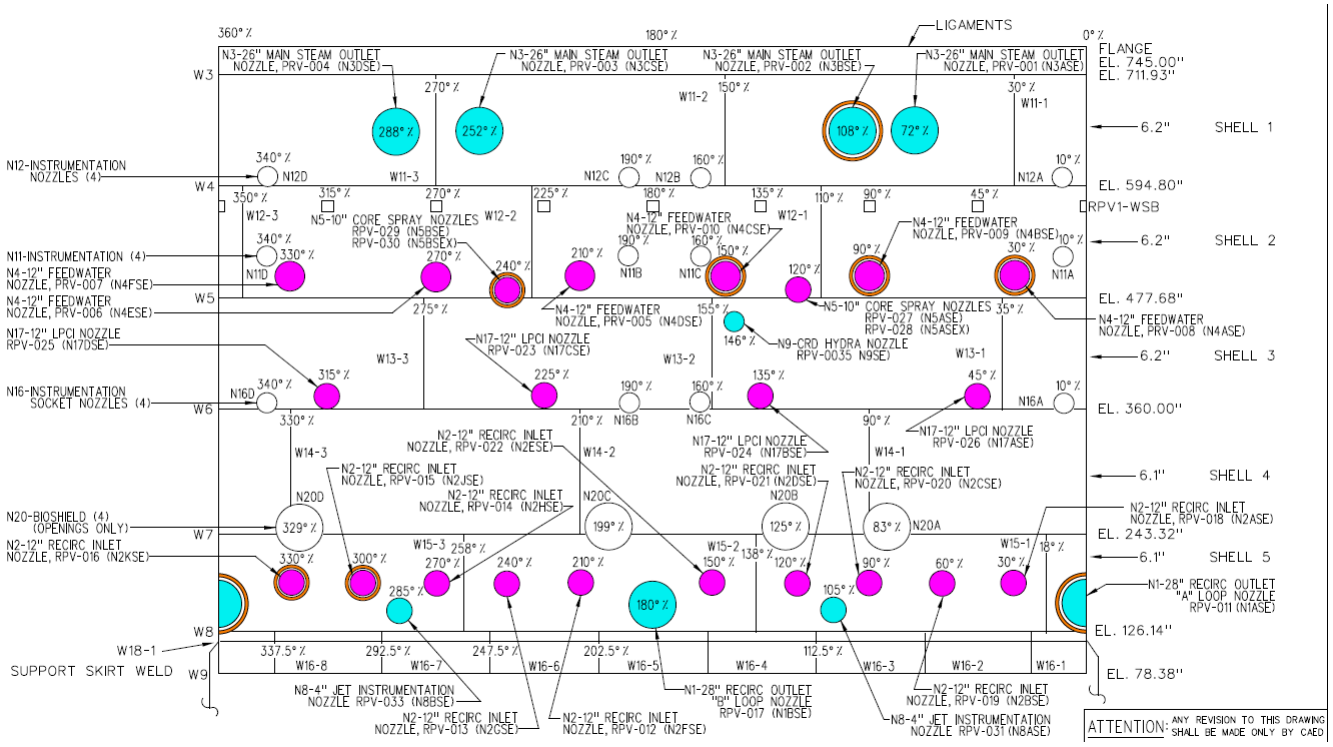



**Figure 1.1-1 Weld RPV1-W12-1 (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 3, during the RFO20 refueling outage in 2016. The NDE data came from UT Report No.: VEN-16-032. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-2. The corresponding CRV as shown on that Figure is A-B-C-D. The UT examination was limited by the proximity of the feedwater and core spray spargers resulting in total UT coverage of **72.40%** as described in Tables 1.1-1 and 1.1-2 and shown on Figure 1.1-2. No recordable indications were detected during this scan.

Section XI Appendix VIII and Supplements 4 and 6 used for this UT examination were implemented using ISwT-PDI-AUT5, Rev. 2, "Automated Inside Surface Ultrasonic Examination of Pressure Vessel Welds Using Phased Array".

**Note:** No laminations exist on the RPV shell that could interfere with the angle beam examinations performed on this weld.

## Table 1.1-1 Weld RPV1-W12-1 Scan Coverage and Scan Summary

| Utility: PSEG Nuclear | Site: Hope Creek Nuclear Generating Station<br>Outage: H1R20 | | | Summary Sheet No. 100055 | | | |
|---|---|---|---|---|---|---|---|
| System: Reactor Pressure Vessel | | Line Subassembly: Vertical Weld @ 110° | | | | Identification: RPV1-W12-1 | |
| NDE Method | Proc/Rev/Chg/ICN | NDE Examination | Calibration Sheet No. | Exam Sheet No. | NRI | Other | Remarks |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100009 | 19 | - | - | Examination #19 was not performed |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100010 | 19 | - | - | due to proximity of core spray sparger. |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100011 | 19 | - | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100012 | 19 | - | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100005 | 20 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100006 | 20 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100007 | 20 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100008 | 20 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100001 | 21 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100002 | 21 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100003 | 21 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100004 | 21 | X | - | |

**Examination Summary:**

This weld was examined from the inside surface using AIRIS-21 and Dynaray examination equipment.
No recordable indications were detected during this examination.
The examination was limited due to the proximity of the feedwater and core spray spargers. The examination coverage was 72.4%.
Examination Angles for each probe included: PA60°-80°L, PA40°-50°S, PA30°-60°L, & PA0°L.

**Indication Summary:**

No recordable indications were detected during this examination.

**Limitation Summary:**

The examination was limited due to the proximity of the core spray and feedwater sparger piping. The examination coverage was 72.4%. Total Weld Length = 117.1" Total Weld Length Examined = 84.8"

## Table 1-1-2 Weld RPV1-W12-1 Individual Scan Results

| Exam No. | Beam Direction | No. of Scans[1] | Lower Limit Increment Axis/Device (in.) | | Upper Limit Increment Axis/Device (in.) | | Lower Limit Scan Axis/Arm (in.) | | Upper Limit Scan Axis/Arm (in.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| ID-19 | CW DN. CCW UP | 27 | 468.68 | 0.00 | 492.08 | 0.00 | 234.71 | 0.00 | 249.71 | 0.00 |
| No examination due to the proximity of the Core Spray Spargers | | | | | | | | | | |
| ID-20 | CW DN. CCW UP | 64 | 491.08 | 510.00 | 547.78 | 547.78 | 234.71 | 234.71 | 249.71 | 249.71 |
| Limited examination due to the proximity of the Core Spray Spragers | | | | | | | | | | |
| ID-21 | CW DN. CCW UP | 65 | 546.78 | 546.78 | 604.38 | 608.38 | 234.71 | 234.71 | 249.71 | 249.71 |

**Notes:**

1. **The weld was examined from the inside surface using the AIRIS-21 and Dynaray examinations equipment.**
2. **Probe Information**

| Probe | Channel/Angles | | Skew | Scan Offset | Step Offset |
|---|---|---|---|---|---|
| **Probe 1** | **1-(60-80°L)** | **2-(40-50°S)** | **0°** | **-175(in)** | **+1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 2** | **1-(60-80°L)** | **2-(40-50°S)** | **270°** | **+3.00(in)** | **+0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 3** | **1-(60-80°L)** | **2-(40-50°S)** | **180°** | **+1.75(in)** | **-1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 4** | **1-(60-80°L)** | **2-(40-50°S)** | **90°** | **-3.00(in)** | **-0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |

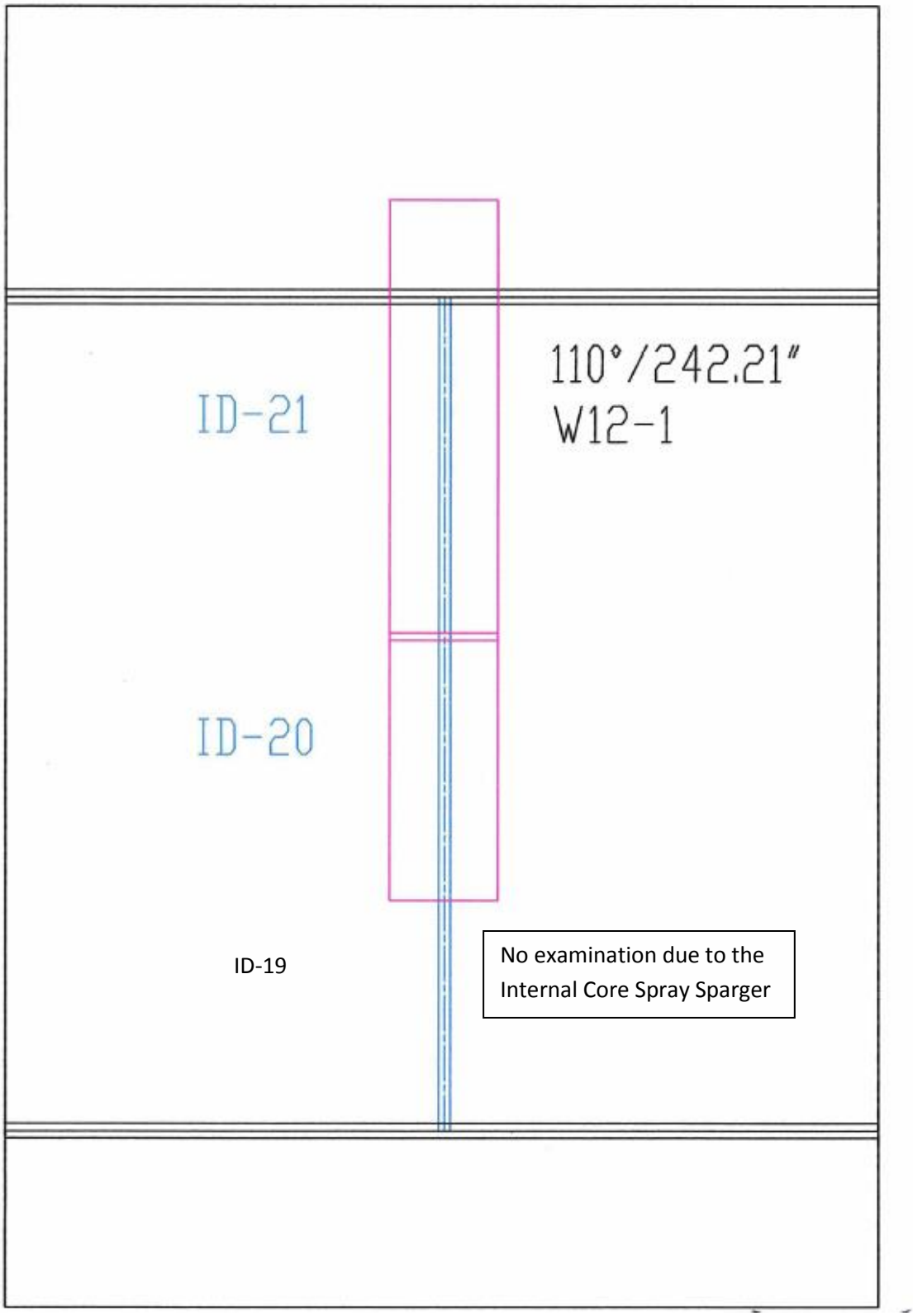



**Figure 1.1-2 Weld RPV1-W12-1 (Examination Location and Coverage Map)**

## 1.2 Weld RPV1-W12-2 – RPV Longitudinal Seam @230°

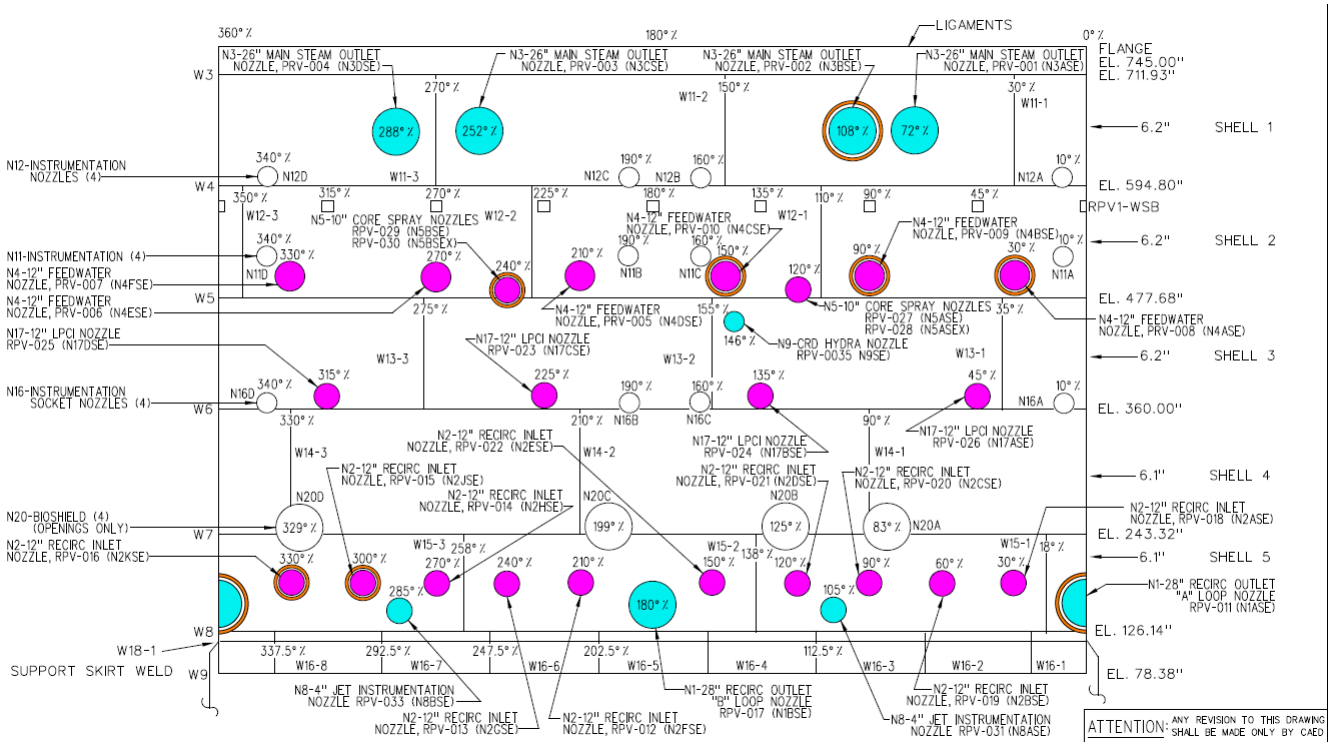



**Figure 1.2-1 Weld RPV1-W12-2 (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 3, during the RFO20 refueling outage in 2016. The NDE data came from UT Report No.: VEN-16-033. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-2. The corresponding CRV as shown on that Figure is A-B-C-D. The UT examination was limited by the proximity of the feedwater and core spray spargers resulting in total UT coverage of **71.70%** as described in Tables 1.2-1 and 1.2-2 and combined with Figure 1.2-2. No recordable indications were detected during this examination.

Section XI Appendix VIII and Supplements 4 and 6 used for this UT examination were implemented using ISwT-PDI-AUT5, Rev. 2, “Automated Inside Surface Ultrasonic Examination of Pressure Vessel Welds Using Phased Array”.

**Note:** No laminations exist on the RPV shell that could interfere with the angle beam examinations performed on this weld.

## Table 1.2-1 Weld RPV1-W12-2 Scan Coverage and Scan Summary

| Utility: PSEG Nuclear | Site: Hope Creek Nuclear Generating Station<br>Outage: H1R20 | | | Summary Sheet No. 100060 | | | |
|---|---|---|---|---|---|---|---|
| System: Reactor Pressure Vessel | | Line Subassembly: Vertical Weld @ 230° | | | | Identification: RPV1-W12-2 | |
| NDE Method | Proc/Rev/Chg/ICN | NDE Examination | Calibration Sheet No. | Exam Sheet No. | NRI | Other | Remarks |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100009 | 22 | - | - | Examination #22 was not performed |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100010 | 22 | - | - | due to proximity of core spray sparger. |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100011 | 22 | - | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100012 | 22 | - | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100013 | 23 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100014 | 23 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100015 | 23 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100016 | 23 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100009 | 24 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100010 | 24 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100011 | 24 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100012 | 24 | X | - | |

**Examination Summary:**

This weld was examined from the inside surface using AIRIS-21 and Dynaray examination equipment.
No recordable indications were detected during this examination.
The examination was limited due to the proximity of the feedwater and core spray spargers. The examination coverage was 71.7%.
Examination Angles for each probe included: PA60°-80°L, PA40°-50°S, PA30°-60°L, & PA0°L.

**Indication Summary:**

No recordable indications were detected during this examination.

**Limitation Summary:**

The examination was limited due to the proximity of the core spray and feedwater sparger piping. The examination coverage was 71.7%. Total Weld Length = 117.1" Total Weld Length Examined = 84.0"

## Table 1.2-2 Weld RPV1-W12-2 Individual Scan Results

| Exam No. | Beam Direction | No. of Scans[1] | Lower Limit Increment Axis/Device (in.) | | Upper Limit Increment Axis/Device (in.) | | Lower Limit Scan Axis/Arm (in.) | | Upper Limit Scan Axis/Arm (in.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| ID-22 | CW DN. CCW UP | 27 | 468.68 | 0.00 | 492.08 | 0.00 | 498.94 | 0.00 | 513.94 | 0.00 |
| No examination due to the proximity of the Core Spray Spargers | | | | | | | | | | |
| ID-23 | CW DN. CCW UP | 64 | 491.08 | 491.08 | 547.78 | 547.80 | 498.94 | 498.94 | 513.94 | 513.94 |
| Limited examination due to the proximity of the Core Spray Spragers | | | | | | | | | | |
| ID-24 | CW DN. CCW UP | 65 | 546.78 | 544.89 | 604.38 | 606.99 | 498.94 | 498.94 | 513.94 | 513.94 |
| Limited examination due to the proximity of the Core Spray Spragers | | | | | | | | | | |

**Notes:**

1. **The weld was examined from the inside surface using the AIRIS-21 and Dynaray examinations equipment.**
2. **Probe Information**

| Probe | Channel/Angles | | Skew | Scan Offset | Step Offset |
|---|---|---|---|---|---|
| **Probe 1** | **1-(60-80°L)** | **2-(40-50°S)** | **0°** | **-175(in)** | **+1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 2** | **1-(60-80°L)** | **2-(40-50°S)** | **270°** | **+3.00(in)** | **+0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 3** | **1-(60-80°L)** | **2-(40-50°S)** | **180°** | **+1.75(in)** | **-1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 4** | **1-(60-80°L)** | **2-(40-50°S)** | **90°** | **-3.00(in)** | **-0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |

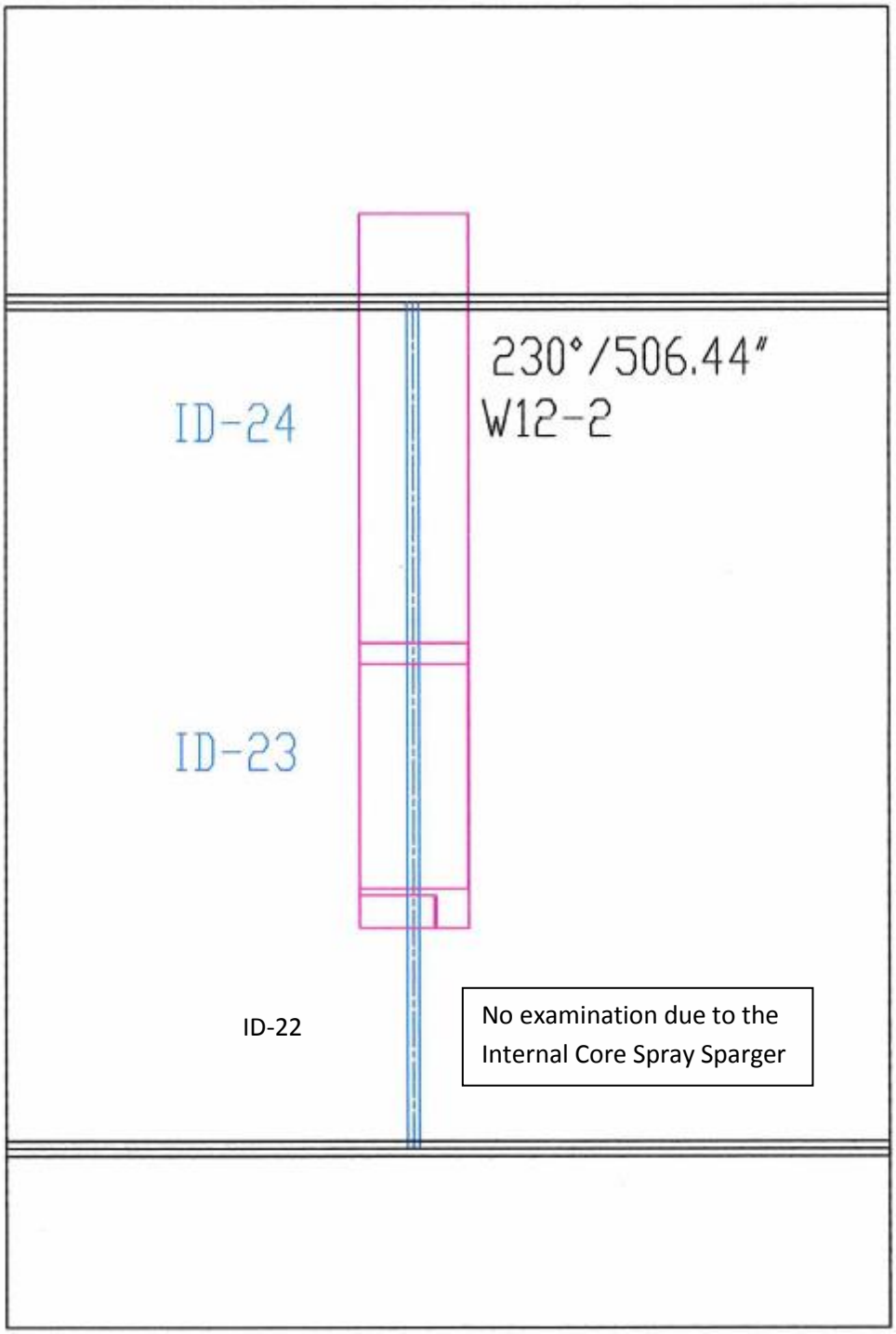



**Figure 1.2-2 Weld RPV1-W12-2 (Examination Location and Coverage Map)**

## 1.3 Weld RPV1-W12-3 – RPV Longitudinal Seam @350°

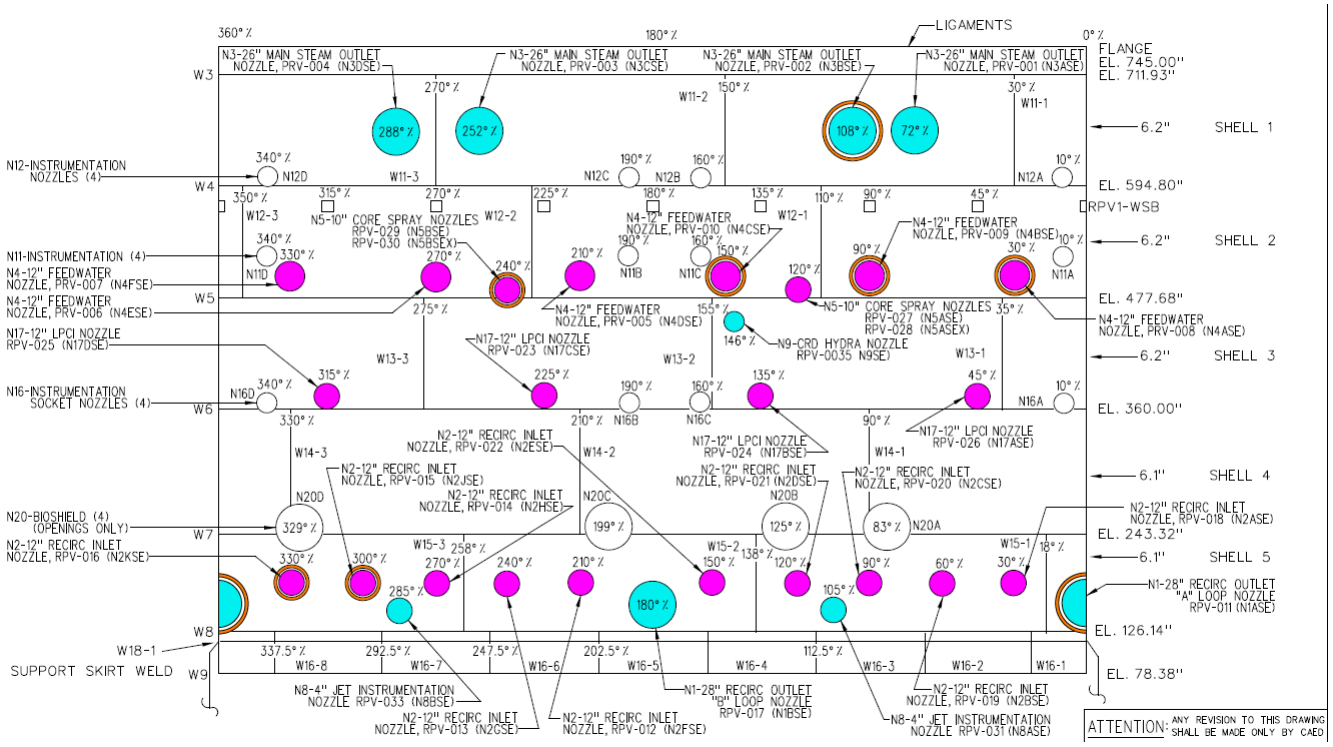



**Figure 1.3-1 Weld RPV1-W12-3 (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 3, during the RFO20 refueling outage in 2016. The NDE data came from UT Report No.: VEN-16-034. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-2. The corresponding CRV as shown on that Figure is A-B-C-D. The UT examination was limited by the proximity of the feedwater and core spray spargers resulting in total UT coverage of **72.40%** as described in Tables 1.3-1 and 1.3-2 and combined with Figure 1.3-2. No recordable indications were detected during this examination.

Section XI Appendix VIII and Supplements 4 and 6 used for this UT examination were implemented using ISwT-PDI-AUT5, Rev. 2, “Automated Inside Surface Ultrasonic Examination of Pressure Vessel Welds Using Phased Array”.

**Note:** No laminations exist on the RPV shell that could interfere with the angle beam examinations performed on this weld.

## Table 1.3-1 Weld RPV1-W12-3 Scan Coverage and Scan Summary

| Utility: PSEG Nuclear | Site: Hope Creek Nuclear Generating Station<br>Outage: H1R20 | | | Summary Sheet No. 100065 | | | |
|---|---|---|---|---|---|---|---|
| System: Reactor Pressure Vessel | | Line Subassembly: Vertical Weld @ 350° | | | | Identification: RPV1-W12-3 | |
| NDE Method | Proc/Rev/Chg/ICN | NDE Examination | Calibration Sheet No. | Exam Sheet No. | NRI | Other | Remarks |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100001 | 25 | - | - | Examination #25 was not performed |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100002 | 25 | - | - | due to proximity of core spray sparger. |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100003 | 25 | - | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100004 | 25 | - | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100005 | 26 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100006 | 26 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100007 | 26 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100008 | 26 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100005 | 27 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100006 | 27 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100007 | 27 | X | - | |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100008 | 27 | X | - | |

**Examination Summary:**

This weld was examined from the inside surface using AIRIS-21 and Dynaray examination equipment.
No recordable indications were detected during this examination.
The examination was limited due to the proximity of the feedwater and core spray spargers. The examination coverage was 72.4%.
Examination Angles for each probe included: PA60°-80°L, PA40°-50°S, PA30°-60°L, & PA0°L.

**Indication Summary:**

No recordable indications were detected during this examination.

**Limitation Summary:**

The examination was limited due to the proximity of the core spray and feedwater sparger piping. The examination coverage was 72.4%. Total Weld Length = 117.1" Total Weld Length Examined = 84.8"

## Table 1.3-2 Weld RPV1-W12-3 Individual Scan Results

| Exam No. | Beam Direction | No. of Scans[1] | Lower Limit Increment Axis/Device (in.) | | Upper Limit Increment Axis/Device (in.) | | Lower Limit Scan Axis/Arm (in.) | | Upper Limit Scan Axis/Arm (in.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| ID-25 | CW DN. CCW UP | 27 | 468.68 | 0.00 | 492.08 | 0.00 | 763.17 | 0.00 | 778.17 | 0.00 |
| No examination due to the proximity of the Core Spray Spargers | | | | | | | | | | |
| ID-26 | CW DN. CCW UP | 64 | 491.08 | 511.73 | 547.78 | 547.78 | 763.17 | 763.17 | 778.17 | 778.19 |
| Limited examination due to the proximity of the Core Spray Spragers | | | | | | | | | | |
| ID-27 | CW DN. CCW UP | 65 | 546.78 | 546.78 | 604.38 | 608.38 | 763.17 | 763.17 | 778.17 | 778.17 |

**Notes:**

1. **The weld was examined from the inside surface using the AIRIS-21 and Dynaray examinations equipment.**
2. **Probe Information**

| Probe | Channel/Angles | | Skew | Scan Offset | Step Offset |
|---|---|---|---|---|---|
| **Probe 1** | **1-(60-80°L)** | **2-(40-50°S)** | **0°** | **-175(in)** | **+1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 2** | **1-(60-80°L)** | **2-(40-50°S)** | **270°** | **+3.00(in)** | **+0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 3** | **1-(60-80°L)** | **2-(40-50°S)** | **180°** | **+1.75(in)** | **-1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 4** | **1-(60-80°L)** | **2-(40-50°S)** | **90°** | **-3.00(in)** | **-0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |

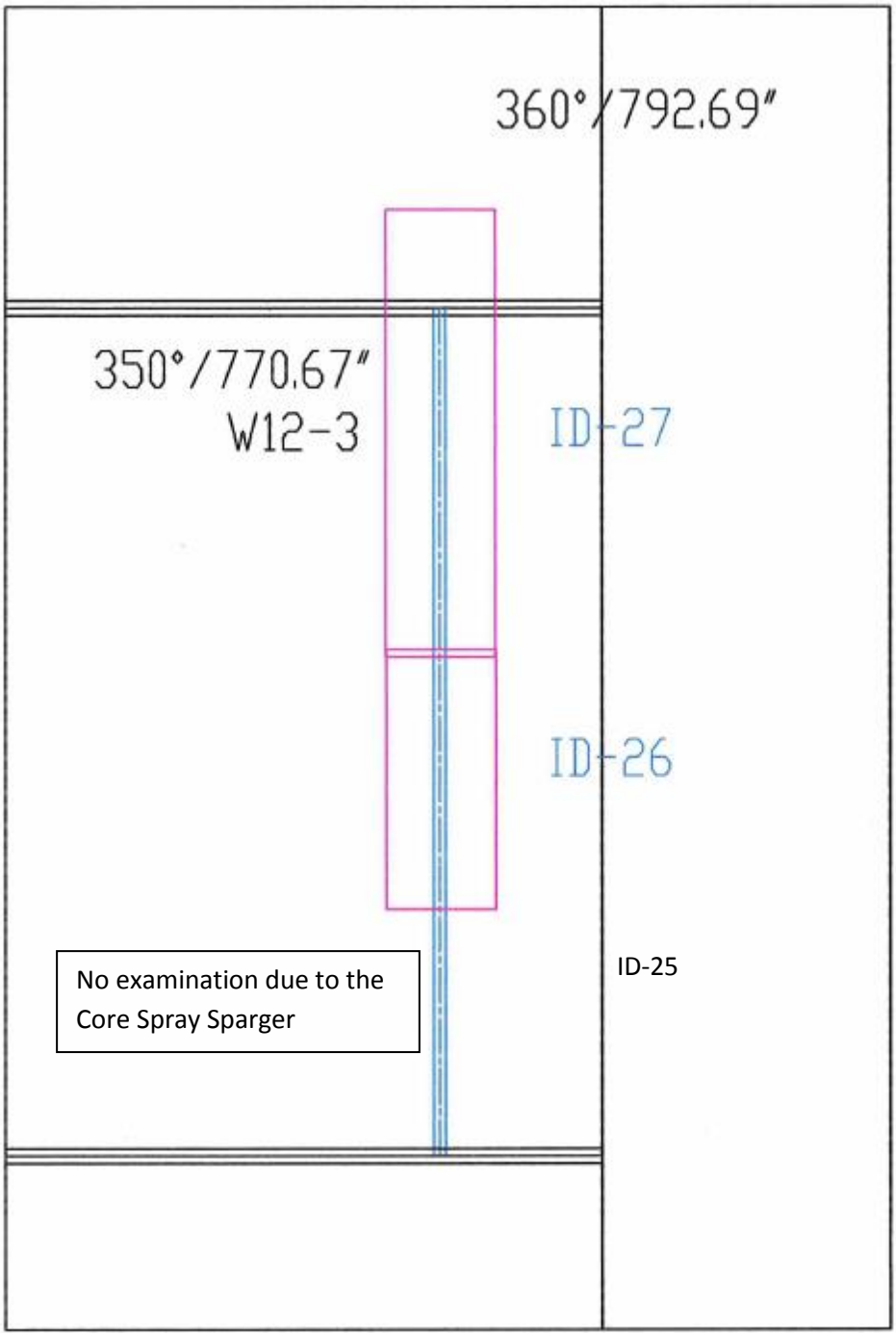



**Figure 1.3-2 Weld RPV1-W12-3 (Weld Profile) 45° & 60° deg. Scans**

## 1.4 Weld RPV1-W3 – RPV Shell-to-Flange Weld

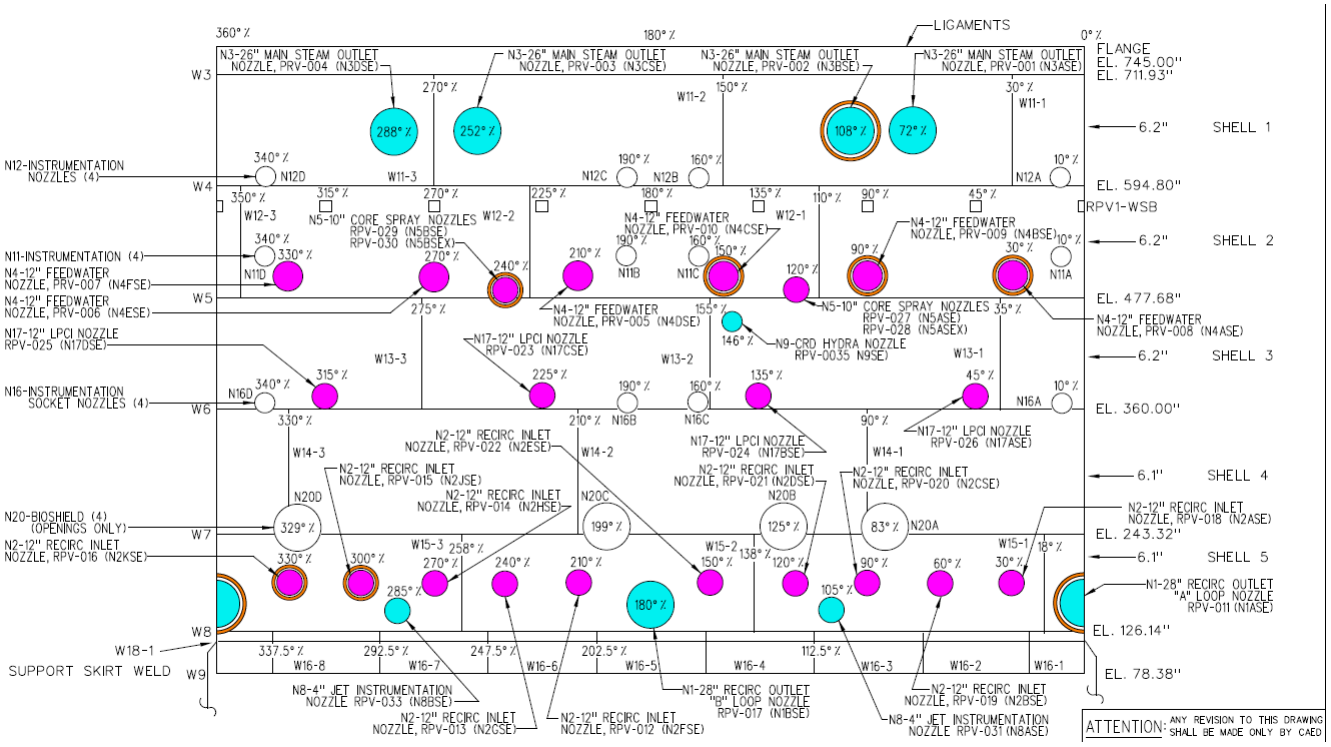



**Figure 1.4-1 Weld RPV1-W3 (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 3, during the RFO20 refueling outage in 2016. The NDE data came from UT Report No.: VEN-16-031. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-4. The corresponding CRV as shown on that Figure is A-B-C-D. The UT examination was limited due to the proximity of the N3 Main Steam Nozzle plugs, N3 clad removal areas and the Rod Guides at 0° and 180° resulting in total UT coverage of **86.20%** as described in Tables 1.4-1 and 1.4-2 combined with Figure 1.4-2. There were two recordable indications identified that were acceptable.

Section XI Appendix VIII and Supplements 4 and 6 used for this UT examination were implemented using ISwT-PDI-AUT5, Rev. 2, “Automated Inside Surface Ultrasonic Examination of Pressure Vessel Welds Using Phased Array”.

**Note:** No laminations exist on the RPV shell that could interfere with the angle beam examinations performed on this weld.

## Table 1.4-1 Weld RPV1-W3 Scan Summary

| Utility: PSEG Nuclear | Site: Hope Creek Nuclear Generating Station<br>Outage: H1R20 | | | Summary Sheet No. 100005 | | | |
|---|---|---|---|---|---|---|---|
| System: Reactor Pressure Vessel | | Line Subassembly: Upper Shell to Flange | | | | Identification: RPV1-W3 | |
| NDE Method | Proc/Rev/Chg/ICN | NDE Examination | Calibration Sheet No. | Exam Sheet No. | NRI | Other | Remarks |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100009 | 35 | X | - | exams #35 A-X, 35AA, 35AC-35AK |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100010 | 35 | X | - | exams #35 A-X, 35AA, 35AC-35AK,AW,AX |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100011 | 35 | X | - | exams #35 A-X, 35AA, 35AC-35AK,AW,AX |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100012 | 35 | X | - | exams #35 A-X, 35AA, 35AC-35AK,AW,AX |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100013 | 35 | X | - | exams #35 Y-Z |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100014 | 35 | X | - | exams #35 Y-Z, 35AW-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100015 | 35 | X | - | exams #35 Y-Z, 35AW-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100016 | 35 | X | - | exams #35 Y-Z, 35AW-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100001 | 35 | - | X | exams #35AB, 35AL-35AV |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100002 | 35 | X | - | exams #35AB, 35AL-35AV |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100003 | 35 | X | - | exams #35AB, 35AL-35AV |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100004 | 35 | X | - | exams #35AB, 35AL-35AV |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100005 | 35 | X | - | exams #35AV-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 2 | 1100006 | 35 | X | - | exams #35AV-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 3 | 1100007 | 35 | X | - | exams #35AV-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 4 | 1100008 | 35 | X | - | exams #35AV-B |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100017 | 35 | X | - | exams #35AW-A, 35AX |
| AUT | ISwT-PDI-AUT5/2/0/1 | Probe 1 | 1100018 | 35 | X | - | exams #35AW-B |

**Examination Summary:**

This weld was divided into sections. See remarks above for setion identification numbers.
This weld was examined from the inside surface using AIRIS-21 and Dynaray examination equipment.
Two (2) recordable indications were detected and determined to be allowable in accordance with the 2001 Edition of A3ME Section XI Code with 2003 Addenda.
The examination was limited due to the proximity of N3 mainsteam nozzle plugs, N3 nozzle clad removal areas, and the guide rods at 0° and 180°. The examination coverage was ~~85.0%~~. JM 12/19/16 86.2%
Examination Angles for each probe included: PA60°-80°L, PA40°-50°S, PA30°-60°L, & PA0°L.

**Indication Summary:**

| | | UT Results 2016 | | | | | UT Results 2007 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flaw Location | | | Flaw Dimension | | Flaw Location | | | Flaw Dimension | |
| Indication Number | Flaw Type | X Location (in) | Y Location (in.) | Z Location (in.) | L (in.) | T-Wall (a/t%) | X Location (in) | Y Location (in.) | Z Location (in.) | L (in.) | T-Wall (a/t%) |
| 35AB-RR-1-1 | subsurface | 597.6 | 705.0 | 1.7 | 1.3 | 1.6 | No Recordable Indications in this Area | | | | |
| 35AB-RR-1-2 | subsurface | 597.4 | 709.5 | 1.5 | 2.7 | 1.6 | No Recordable Indications in this Area | | | | |

**Limitation Summary:**

The examination was limited due to the proximity of N3 mainsteam nozzle plugs, N3 nozzle clad removal areas, and the guide rods at 0° and 180°. The examination coverage was 86.2%. Total weld length = 792.7" Examined = 683.0".

## Table 1.4-2 Weld RPV1-W3 Individual Scan Results

| Exam No. | Beam Direction | No. of Scans[1] | Lower Limit Increment Axis/Device (in.) | | Upper Limit Increment Axis/Device (in.) | | Lower Limit Scan Axis/Arm (in.) | | Upper Limit Scan Axis/Arm (in.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| ID-35A | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 171.30 | 793.69 | 186.30 |
| ID-35B | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 185.30 | 793.69 | 200.30 |
| ID-35C | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 199.30 | 793.69 | 214.30 |
| ID-35D | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 213.30 | 793.69 | 226.10 |
| Limited examination due to the proximity of the N3B Nozzle and the N3B plug. | | | | | | | | | | |
| ID-35E | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 245.60 | 793.69 | 260.60 |
| ID-35F | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 259.60 | 793.69 | 274.60 |
| ID-35G | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 273.60 | 739.69 | 288.60 |
| ID-35H | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0,00 | 287.60 | 793.69 | 302.60 |
| ID-35-I | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 301.60 | 793.69 | 316.60 |
| ID-35J | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 315.60 | 793.69 | 330.60 |
| ID-35K | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 329.60 | 793.69 | 344.60 |
| ID-35L | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 343.60 | 793.69 | 358.60 |
| ID-35M | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 357.60 | 793.69 | 372.60 |
| ID-35N | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 371.60 | 793.69 | 386.60 |
| ID-35O | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 385.60 | 793.69 | 400.60 |
| ID-35P | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 399.60 | 793.69 | 414.40 |
| ID-35Q | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 413.60 | 793.69 | 428.60 |
| ID-35R | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 427.60 | 793.69 | 442.60 |
| ID-35S | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 441.60 | 793.69 | 456.60 |
| ID-35T | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 455.60 | 793.69 | 470.60 |
| ID-35U | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 469.60 | 793.69 | 484.60 |
| ID-35V | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 483.60 | 793.69 | 498.60 |

| Exam No. | Beam Direction | No. of Scans[1] | Lower Limit Increment Axis/Device (in.) | | Upper Limit Increment Axis/Device (in.) | | Lower Limit Scan Axis/Arm (in.) | | Upper Limit Scan Axis/Arm (in.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| ID-35W | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 497.60 | 793.69 | 512.60 |
| ID-35X | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.22 | 0.00 | 511.60 | 793.69 | 526.60 |
| ID-35Y | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 727.63 | 0.00 | 525.25 | 793.69 | 540.25 |
| ID-35Z | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 722.55 | 0.00 | 569.50 | 793.69 | 583.50 |
| Limited examination due to the proximity of N3C nozzle & the N3C Plug. | | | | | | | | | | |
| ID-35AA | CW DN. CCW UP | 21 | 703.22 | 703.22 | 721.22 | 721.26 | 0.00 | 582.50 | 793.69 | 596.50 |
| ID-35AB _RR | CW DN. CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 590.50 | 793.69 | 605.50 |
| ID-35AB _RR_1 | CW DN CCW UP | 21 | 703.22 | 702.00 | 721.22 | 717.00 | 0.00 | 595.50 | 793.69 | 609.50 |
| ID-35AC | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 666.15 | 793.69 | 681.15 |
| ID-35AD | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 680.15 | 793.69 | 695.15 |
| ID-35AE | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 694.15 | 793.69 | 709.15 |
| ID-35AF | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 708.15 | 793.69 | 723.15 |
| ID-35AG | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 722.15 | 793.69 | 737.15 |
| ID-35AH | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 736.15 | 793.69 | 751.15 |
| ID-35AI | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 750.15 | 793.69 | 765.15 |
| ID-35AJ | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 764.15 | 793.69 | 779.15 |
| ID-35AK | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 778.15 | 793.69 | 793.15 |
| ID-35AL | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | -1.00 | 793.69 | 12.00 |
| ID-35AM | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 11.00 | 793.69 | 25.00 |
| ID-35AN | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 24.00 | 793.69 | 38.00 |
| ID-35AO | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 37.00 | 793.69 | 51.00 |
| ID-35AP | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 50.00 | 793.69 | 64.00 |
| ID-35AQ | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 63.00 | 793.69 | 77.00 |

| Exam No. | Beam Direction | No. of Scans[1] | Lower Limit Increment Axis/Device (in.) | | Upper Limit Increment Axis/Device (in.) | | Lower Limit Scan Axis/Arm (in.) | | Upper Limit Scan Axis/Arm (in.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| ID-35AR | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 76.00 | 793.69 | 90.00 |
| ID-35AS | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 89.00 | 793.69 | 103.00 |
| ID-35AT | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 102.00 | 793.69 | 116.00 |
| ID-35AU | CW DN CCW UP | 21 | 703.22 | 703.62 | 721.22 | 725.22 | 0.00 | 115.00 | 793.69 | 129.00 |
| ID-35AV -A | CW DN CCW UP | 21 | 703.22 | 712.63 | 721.22 | 725.22 | 0.00 | 128.00 | 793.69 | 143.00 |
| ID-35AV -B | CW DN CCW UP | 21 | 703.22 | 698.30 | 721.22 | 713.63 | 0.00 | 128.00 | 793.69 | 143.00 |
| ID-35AW -A | CW DN CCW UP | 21 | 703.22 | 707.22 | 721.22 | 725.22 | 0.00 | 642.30 | 793.69 | 657.30 |
| ID-35AW -B | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 708.23 | 0.00 | 642.30 | 793.69 | 657.30 |
| ID-35AX | CW DN CCW UP | 21 | 703.22 | 698.22 | 721.22 | 725.22 | 0.00 | 656.30 | 793.69 | 667.30 |

**Notes:**

1. **The weld was examined from the inside surface using the AIRIS-21 and Dynaray examinations equipment.**
2. **Probe Information**

| Probe | Channel/Angles | | Skew | Scan Offset | Step Offset |
|---|---|---|---|---|---|
| **Probe 1** | **1-(60-80°L)** | **2-(40-50°S)** | **0°** | **-175(in)** | **+1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 2** | **1-(60-80°L)** | **2-(40-50°S)** | **270°** | **+3.00(in)** | **+0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 3** | **1-(60-80°L)** | **2-(40-50°S)** | **180°** | **+1.75(in)** | **-1.50(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |
| **Probe 4** | **1-(60-80°L)** | **2-(40-50°S)** | **90°** | **-3.00(in)** | **-0.24(in)** |
| | **3-(30-60°L)** | **4-(0°)** | | | |

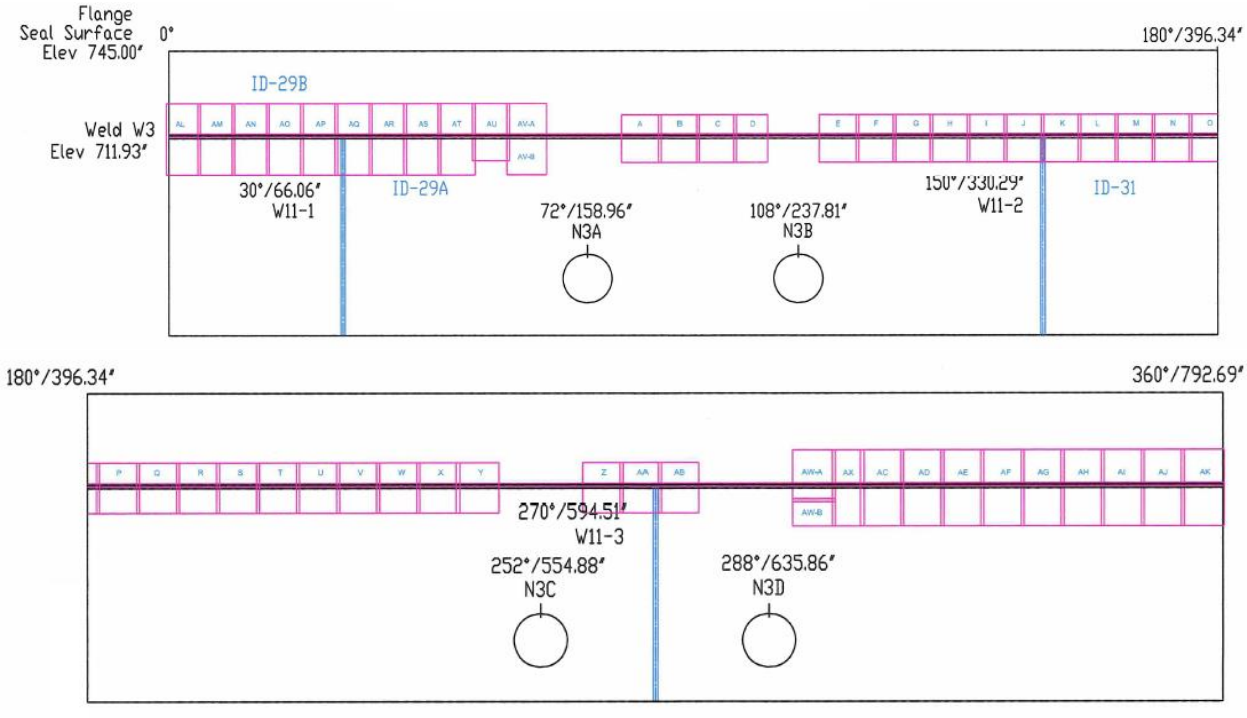



**Figure 1.4-2 Weld RPV1-W3 (Examination Location & Coverage Map)**

## 1.5 Weld RPV1-N3D – RPV Main Steam D Nozzle-to-Vessel Weld

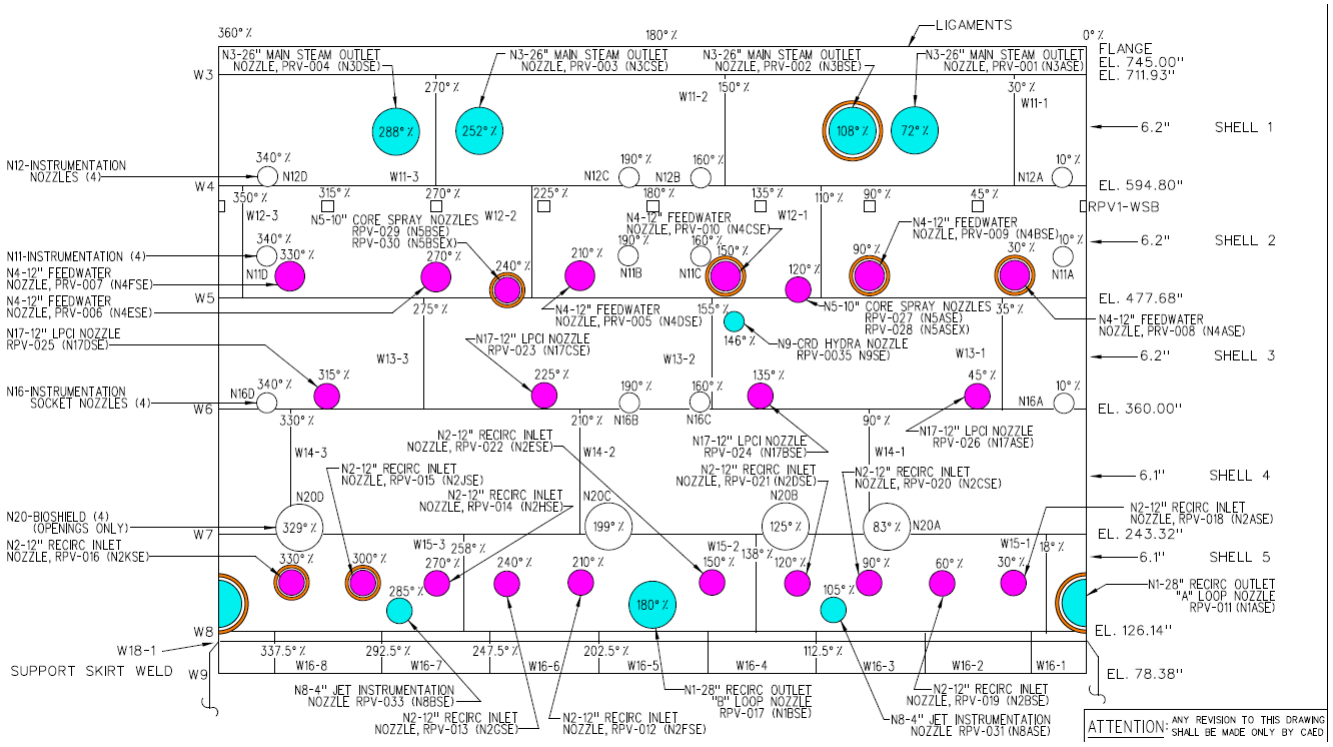



**Figure 1.5-1 Weld RPV1-N3D (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 3, during the RFO19 refueling outage in 2015. The NDE data came from UT Report No.: VEN-15-001. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle and the proximity of the N8 nozzle. The examination resulted in total UT coverage of **82.80%** as described in Table 1.5-1 and combined with Figures 1.5-2 and 1.5-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.5-1 Weld RPV1-N3D Scan Coverage and Scan Summary**

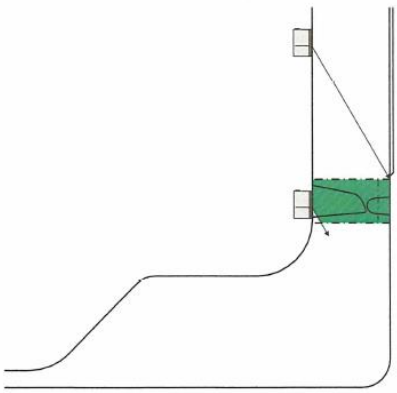
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 50° ±71° to 82° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.87 | Weld Width inches | 2.87 | Weld Width inches | 2.87 |
| Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 23.86 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 23.86 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 23.86 |
| Area Scanned Sq. inches | 23.40 | Upper 85% "T" Area Sq. inches | 20.26 | Inner 15% "T" Area Sq. inches | 3.60 |
| | | Area Scanned | 12.53 | Area Scanned | 3.60 |
| Percentage of Area Scanned | 98.0% | Percentage of Area Scanned | 61.8% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 98.0% | Percentage of Total Volume | 52.5% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 98.0% | Coverage Circ. Scan upper 85% t volume | 52.5% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (98.0% + 52.5% + 15.00%) ÷ 2 = 82.8%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2003-23.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO19 | Weld ID: RPV1-N3D | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|



**N3 Nozzle to Shell Weld Axial Scan Coverage Calculations**

***Total Area:* = 23.86 in²**

Total Area: 3.67" x 6.50" = 23.86 in²

***Lower 15% t of Vessel Shell Coverage:* = 15.0%**

0.98" x 3.67" = 3.60 in²

3.60 / 23.86 x 100 = 15.0% of Total Area

***Upper 85% t of Vessel Shell & Radius Coverage:* = 83.0%**

2.36" x 5.52" = 13.03 in²

1.31" x 4.78" = 6.26 in²

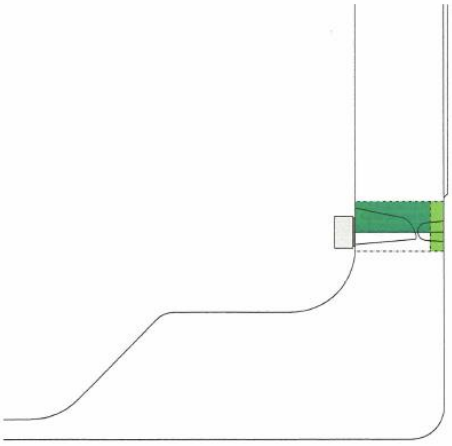
0.78" x 1.31" / 2 = 0.51 in²

(13.03 + 6.26 + 0.51) / 23.86 x100 =83.0%

***Total Axial Coverage:* = 83.0% + 15.0% = 98.0%**

**Figure 1.5-2 Weld RPV1-N3D (Axial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO19 | Weld ID: RPV1-N3D | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



**N3D Nozzle to Shell Weld Circumferential Scan Coverage Calculations**

***Total Area:* = 23.86 in²**

Total Area = 3.67" x 6.50" = 23.86 in²

***Upper 85% t of Vessel Shell & Radius Coverage:* = 52.5%**

2.27" x 5.52" = 12.53 in²

12.53 / 23.86 x 100 = 52.5%

***Lower 15% t of Vessel Shell Coverage:* = 15.0%**

0.98" x 3.67" = 3.60 in² (Modeled)

3.60 ÷ 23.86 x 100 = 15.0% of Total Area

***Total Circumferential Coverage:* = 52.5% + 15.0% = 67.5%**

**Figure 1.5-3 Weld RPV1-N3D (Circumferential Scans) Coverage Calculation**

## 1.6 Weld RPV1-N4A – RPV Feedwater A Nozzle-to-Shell Weld

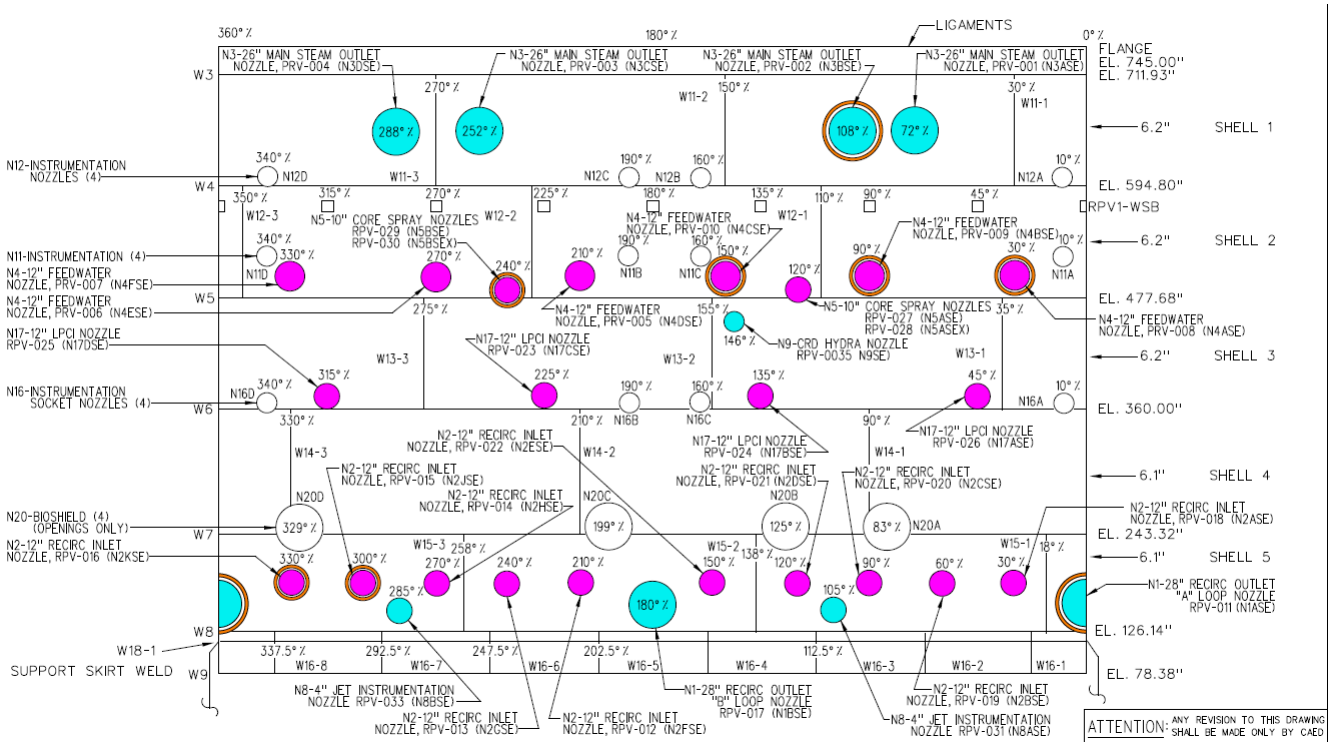



**Figure 1.6-1 Weld RPV1-N4A (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The NDE data came from UT Report No.: VEN-13-015. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **89.60%** as described in Table 1.6-1 and combined with Figures 1.6-2 and 1.6-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.6-1 Weld RPV1-N4A Volumetric Coverage and Limitation Summary**

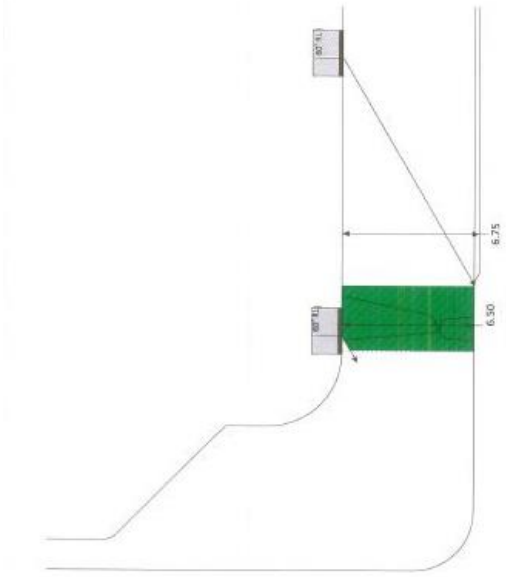
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.20 |
| Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 |
| Area Scanned Sq. inches | 20.68 | Upper 85% "T" Area Sq. inches | 17.70 | Inner 15% "T" Area Sq. inches | 3.14 |
| | | Area Scanned | 13.49 | Area Scanned | 3.14 |
| Percentage of Area Scanned | 99.33% | Percentage of Area Scanned | 76.21% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 99.33% | Percentage of Total Volume | 64.86% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 99.33% | Coverage Circ. Scan upper 85% t volume | 64.86% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (99.33% + 64.86% + 15.00%) ÷ 2 = 89.60%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2013-546 Rev. 2.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4A | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Radial Scan Coverage Calculations**

***Total Area:* = 20.80 in²**

***Total Area:*** 3.20" x 6.50" = 20.80 in²

***Lower 15% t of Vessel Shell Coverage:* = 15.00%**

3.20" x 0.98" = 3.14 in²

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Upper 85% t of Vessel Shell Coverage:* = 84.33%**

3.20" x 5.11" = 16.35 in²

0.42" x 2.48" = 1.04 in²

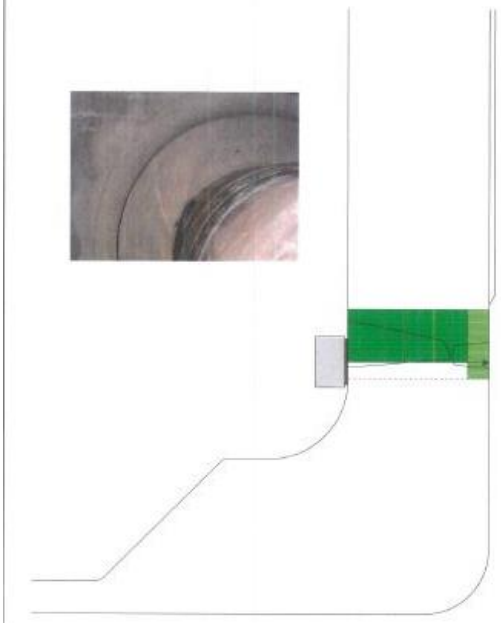
0.42" x 0.73" / 2 = 0.15 in²

(16.35 + 1.04 + 0.15 ) ÷ 20.80 x 100 = 84.33%

***Total Radial Exam Coverage:* = 84.33% + 15.00% = 99.33%**

**Figure 1.6-2 Weld RPV1-N4A (Radial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4A | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



**N4 Nozzle to Shell Weld Circumferential Scan Coverage Calculations**

***Total Area:* = 20.80 in²**

***Total Area:*** 3.20" x 6.50" = 20.80 in²

***Upper 85% t of Vessel Shell Coverage:* = 64.86%**

2.44" x 5.53" = 13.49 in²

13.49 ÷ 20.80 x 100 = 64.86

***Lower 15% t of Vessel Shell Coverage:* = 15.00%**

0.98" x 3.20" = 3.14 in² (Modeled)

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Total Circumferential Exam Coverage:* = 64.86% + 15.00% = 79.86%**

**Figure 1.6-3 Weld RPV1-N4A (Circumferential Scans) Coverage Calculation**

## 1.7 Weld RPV1-N4B – RPV Feedwater B Nozzle-to-Shell Weld

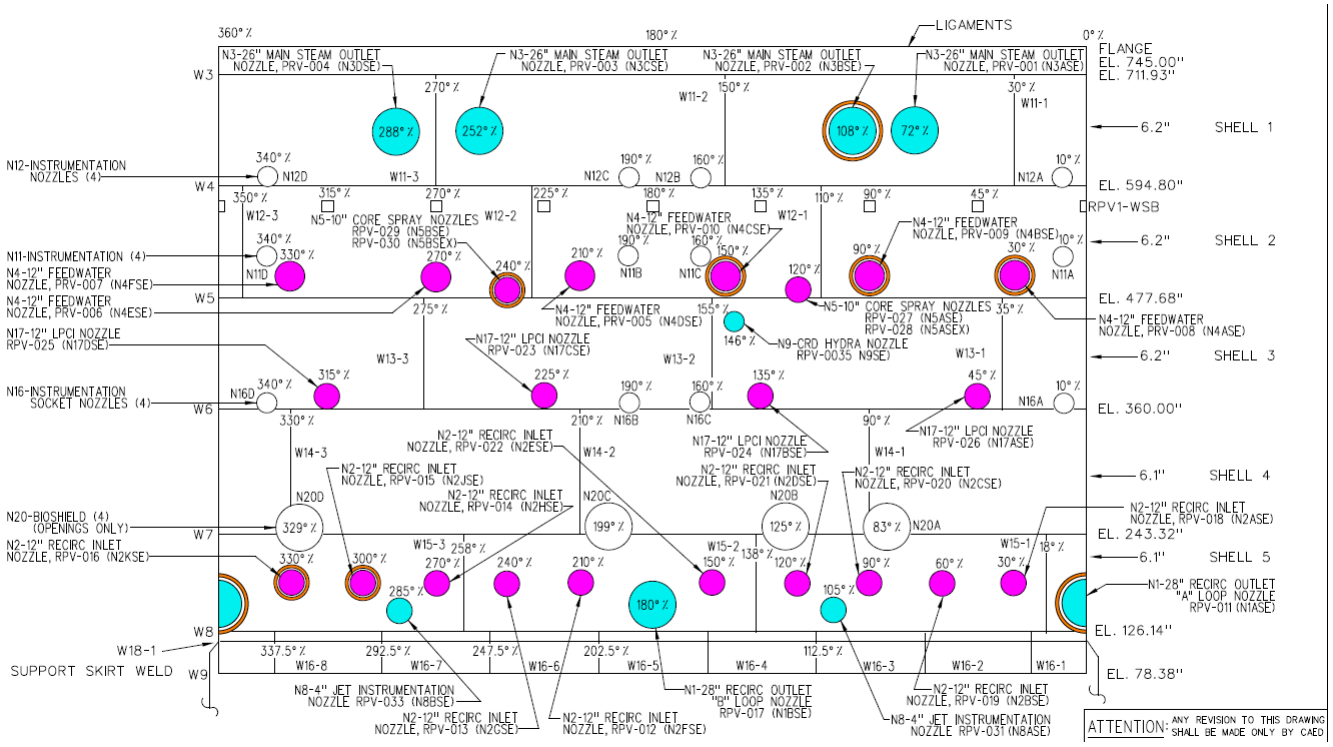



**Figure 1.7-1 Weld RPV1-N4B (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The NDE data came from UT Report No.: VEN-13-026. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **89.60%** as described in Table 1.7-1 and combined with Figures 1.7-2 and 1.7-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.7-1 Weld RPV1-N4B Volumetric Coverage and Limitation Summary**

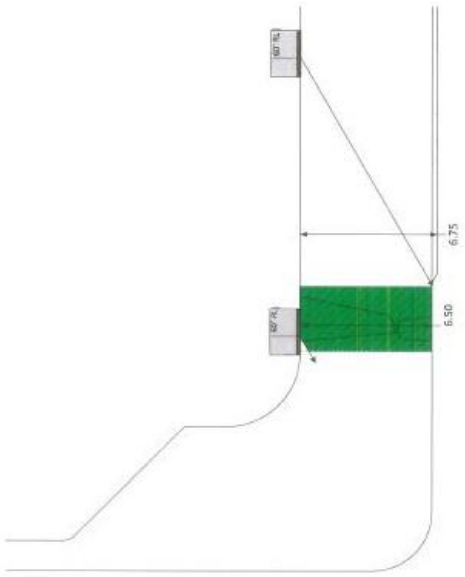
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.20 |
| Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 |
| Area Scanned Sq. inches | 20.68 | Upper 85% "T" Area Sq. inches | 17.70 | Inner 15% "T" Area Sq. inches | 3.14 |
| | | Area Scanned | 13.49 | Area Scanned | 3.14 |
| Percentage of Area Scanned | 99.33% | Percentage of Area Scanned | 76.21% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 99.33% | Percentage of Total Volume | 64.86% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 99.33% | Coverage Circ. Scan upper 85% t volume | 64.86% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (99.33% + 64.86% + 15.00%) ÷ 2 = 89.60%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2013-546 Rev.2.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4B | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Radial Scan Coverage Calculations**

***Total Area:* = 20.80 in²**

***Total Area:*** 3.20" x 6.50" = 20.80 in²

***Lower 15% t of Vessel Shell Coverage:* = 15.00%**

3.20" x 0.98" = 3.14 in²

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Upper 85% t of Vessel Shell Coverage:* = 84.33%**

3.20" x 5.11" = 16.35 in²

0.42" x 2.48" = 1.04 in²

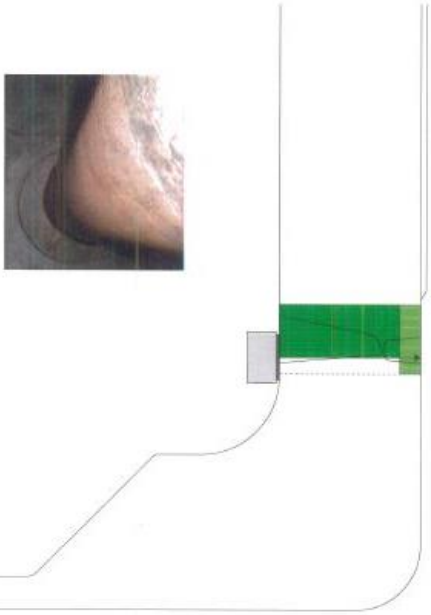
0.42" x 0.73" / 2 = 0.15 in²

(16.35 + 1.04 + 0.15 ) ÷ 20.80 x 100 = 84.33%

***Total Radial Exam Coverage:* = 84.33% + 15.00% = 99.33%**

**Figure 1.7-2 Weld RPV1-N4B (Radial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4B | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



**N4 Nozzle to Shell Weld Circumferential Scan Coverage Calculations**

***Total Area:* = 20.80 in²**

***Total Area:*** 3.20" x 6.50" = 20.80 in²

***Upper 85% t of Vessel Shell Coverage:* = 64.86%**

2.44" x 5.53" = 13.49 in²

13.49 ÷ 20.80 x 100 = 64.86

***Lower 15% t of Vessel Shell Coverage:* = 15.00%**

0.98" x 3.20" = 3.14 in² (Modeled)

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Total Circumferential Exam Coverage:* = 64.86% + 15.00% = 79.86%**

**Figure 1.7-3 Weld RPV1-N4B (Circumferential Scans) Coverage Calculation**

## 1.8 Weld RPV1-N4C – RPV Feedwater C Nozzle-to-Shell Weld

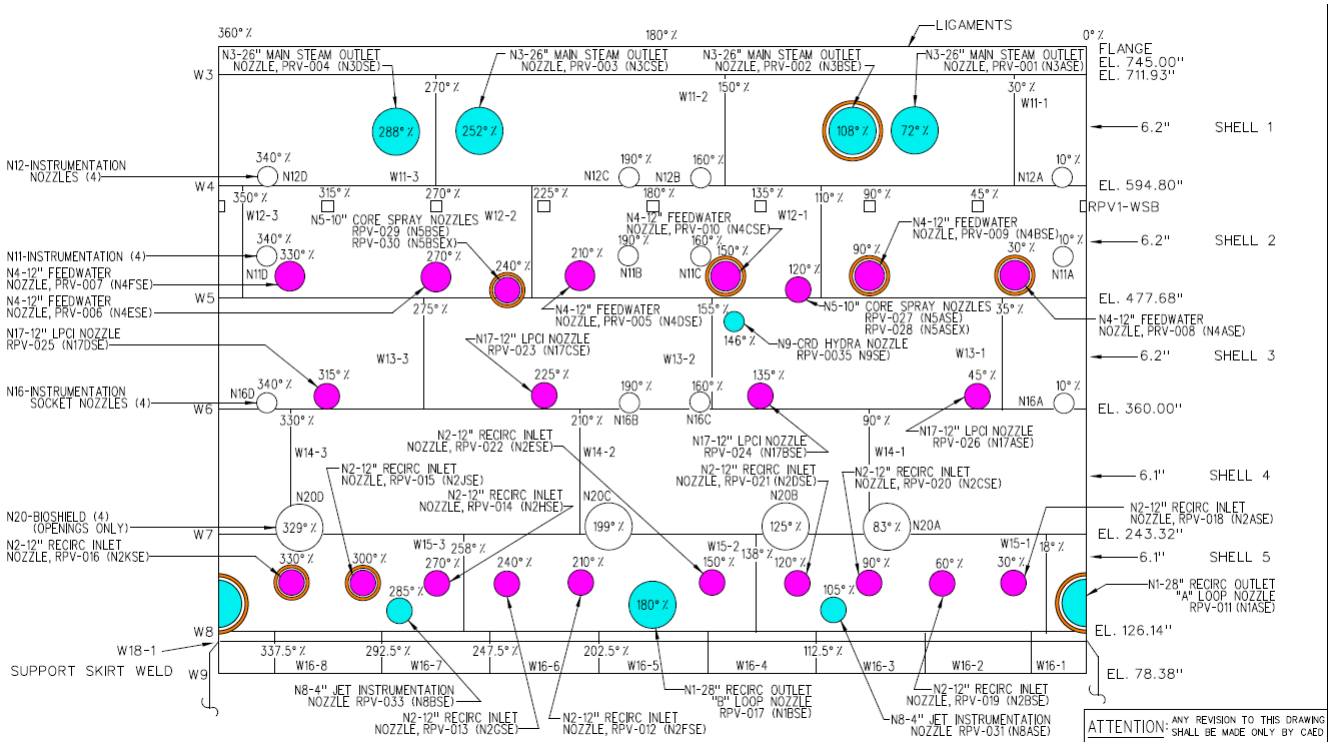



**Figure 1.8-1 Weld RPV1-N4C (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The NDE data came from UT Report No.: VEN-13-028. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **80.42%** as described in Table 1.8-1 and combined with Figures 1.8-2 and 1.8-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.8-1 Weld RPV1-N4C Volumetric Coverage and Limitation Summary**

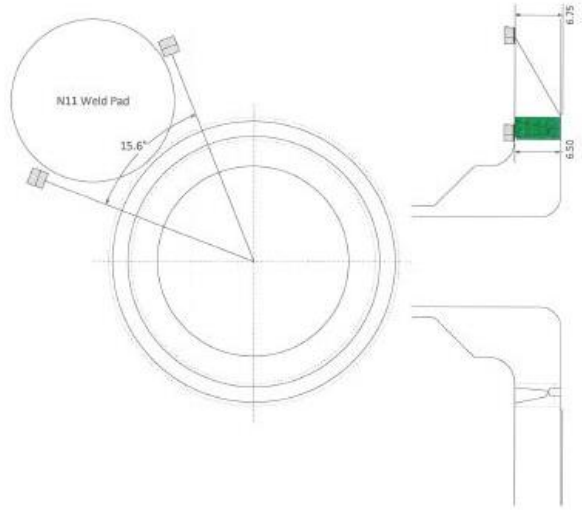
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.20 |
| Weld Length | 118.00 | Weld Length | 118.00 | Weld Length | 118.00 |
| Exam Volume (A-B-C-D-E-F-G-H) Cubic inches | 2454.40 | Exam Volume (A-B-C-D-E-F-G-H) Cubic inches | 2454.40 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 |
| Volume Scanned Cubic inches | 2114.56 | Upper 85% "T" Volume Cubic inches | 2088.13 | Inner 15% "T" Area Sq. inches | 3.14 |
| | | Volume Scanned Cubic inches | 1465.01 | Area Scanned | 3.14 |
| Percentage of Area Scanned | 86.15% | Percentage of Volume Scanned | 70.16% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 86.15% | Percentage of Total Volume | 59.69% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 86.15% | Coverage Circ. Scan upper 85% t volume | 59.69% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (86.15% + 59.69% + 15.00%) ÷ 2 = 80.42%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2013-546 Rev.2.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4C | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Radial Scan Coverage Calculations**

***Total Volume:* = 2454.40 in³**

*Weld Length: = 118.0"*

Total Area: 3.20" x 6.50" = 20.80 in²

***Area of Obstruction ( N11 Weld Pad Area)***

20.80 in² x 15.6" = 324.48 in³

***Nozzle to Shell Obstruction (Non N11 Weld Pad Area)***

3.20" x 6.08" = 19.46 in²

0.42" x 2.48" = 1.04 in²

0.42" x 0.73" / 2 = 0.15 in²

19.46 + 1.04 + 0.15 = 20.65 in²

20.80 – 20.65 = 0.15 in²

0.15 in² x 102.4" = 15.36 in³

Total Obstructed Volume = 15.36 in³

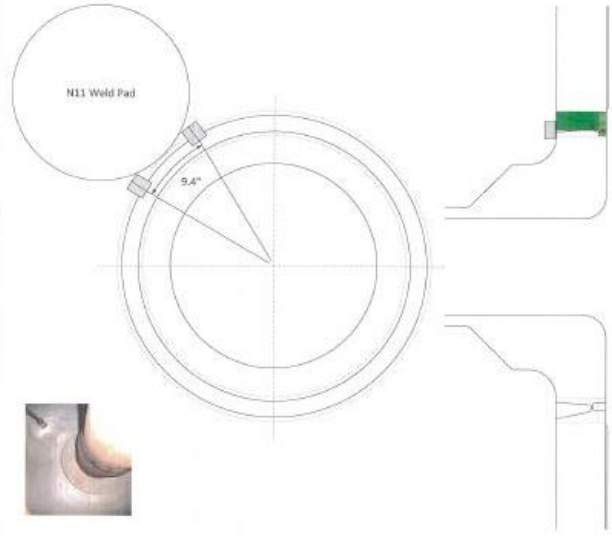
***Total Radial Exam Coverage***

2454.40 – 324.48 – 15.36 = 2114.56

***Total Radial Exam Coverage:* = 2114.56 / 2454.40 x 100 = 86.15%**

**Figure 1.8-2 Weld RPV1-N4C (Radial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4C | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|






**N4 Nozzle to Shell Weld Circ Scan Coverage Calculations**

***Total Volume:* = 2454.40 in³**

Weld Length: 118.0"

Total Area: 3.20" x 6.50" = 20.80 in²

***Area of Obstruction (N11 Weld Pad Area)***

20.80 in² x 9.4" = 195.52 in³

***Upper 85% t of Vessel Shell Coverage (Non N11 Weld Pad Area)***

2.44" x 5.53" = 13.49 in²

13.49 in² x 108.6" = 1465.01 in³

Total Achieved Volume = 1465.01 in³

***Lower 15% t of Vessel Shell Coverage***

0.98" x 3.20" = 3.14 in² (Modeled)

3.14 x 118.0 = 370.52 in³ *Lower 15% t not limited due to N11 weld pad obstruction

***Total Circ Exam Coverage***

1465.01 + 370.52 = 1835.53

1835.53 / 2454.40 x 100 = 74.79

***Total Circ Exam Coverage:* = 74.79%**

**Figure 1.8-3 Weld RPV1-N4C (Circumferential Scans) Coverage Calculation**

## 1.9 Weld RPV1-N4D – RPV Feedwater D Nozzle-to-Shell Weld

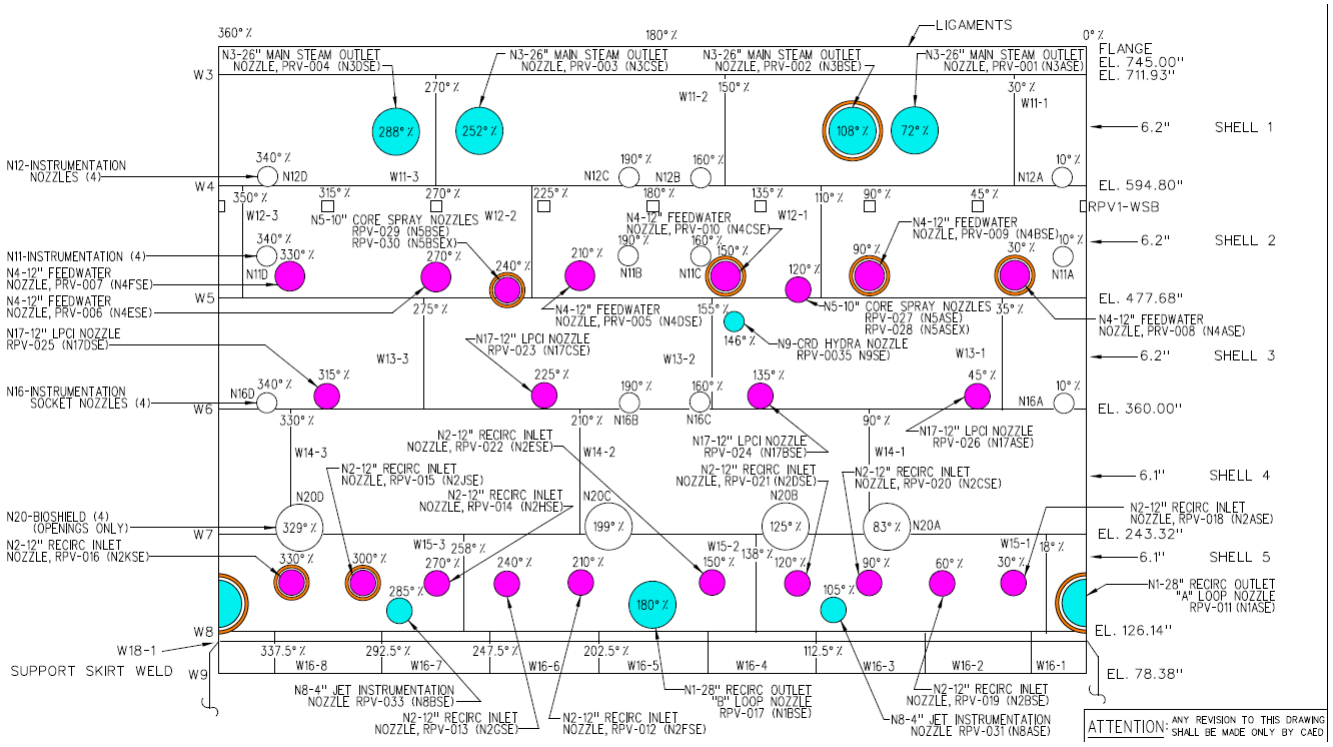



**Figure 1.9-1 Weld RPV1-N4D (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The NDE data came from UT Report No.: VEN-13-013. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **89.60%** as described in Table 1.9-1 and combined with Figures 1.9-2 and 1.9-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.9-1 Weld RPV1-N4D Volumetric Coverage and Limitation Summary**

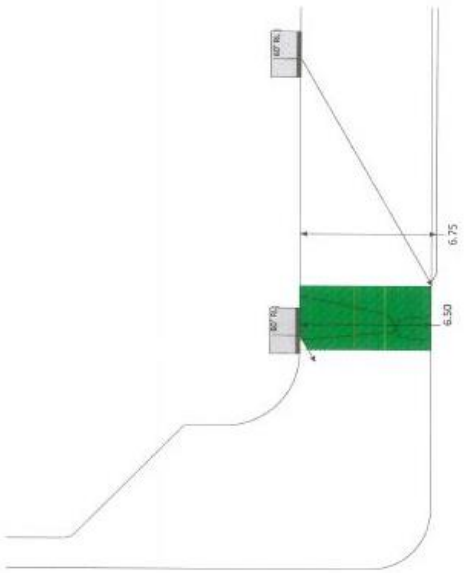
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.20 |
| Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 |
| Area Scanned Sq. inches | 20.68 | Upper 85% "T" Area Sq. inches | 17.70 | Inner 15% "T" Area Sq. inches | 3.14 |
| | | Area Scanned | 13.49 | Area Scanned | 3.14 |
| Percentage of Area Scanned | 99.33% | Percentage of Area Scanned | 76.21% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 99.33% | Percentage of Total Volume | 64.86% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 99.33% | Coverage Circ. Scan upper 85% t volume | 64.86% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (99.33% + 64.86% + 15.00%) ÷ 2 = 89.60%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2013-546 Rev.2.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4D | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Radial Scan Coverage Calculations**

***Total Area:* = 20.80 in²**

*Total Area:* 3.20" x 6.50" = 20.80 in²

***Lower 15% t of Vessel Shell Coverage:* = 15.00%**

3.20" x 0.98" = 3.14 in²

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Upper 85% t of Vessel Shell Coverage:* = 84.33%**

3.20" x 5.11" = 16.35 in²

0.42" x 2.48" = 1.04 in²

0.42" x 0.73" / 2 = 0.15 in²

(16.35 + 1.04 + 0.15 ) ÷ 20.80 x 100 = 84.33%

***Total Radial Exam Coverage:* = 84.33% + 15.00% = 99.33%**

**Figure 1.9-2 Weld RPV1-N4D (Radial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4D | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



**N4 Nozzle to Shell Weld Circumferential Scan Coverage Calculations**

***Total Area:* = 20.80 in²**

*Total Area:* 3.20" x 6.50" = 20.80 in²

***Upper 85% t of Vessel Shell Coverage:* = 64.86%**

2.44" x 5.53" = 13.49 in²

13.49 ÷ 20.80 x 100 = 64.86

***Lower 15% t of Vessel Shell Coverage:* = 15.00%**

0.98" x 3.20" = 3.14 in² (Modeled)

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Total Circumferential Exam Coverage:* = 64.86% + 15.00% = 79.86%**

**Figure 1.9-3 Weld RPV1-N4D (Circumferential Scans) Coverage Calculation**

## 1.10 Weld RPV1-N4E – RPV Feedwater E Nozzle-to-Shell Weld

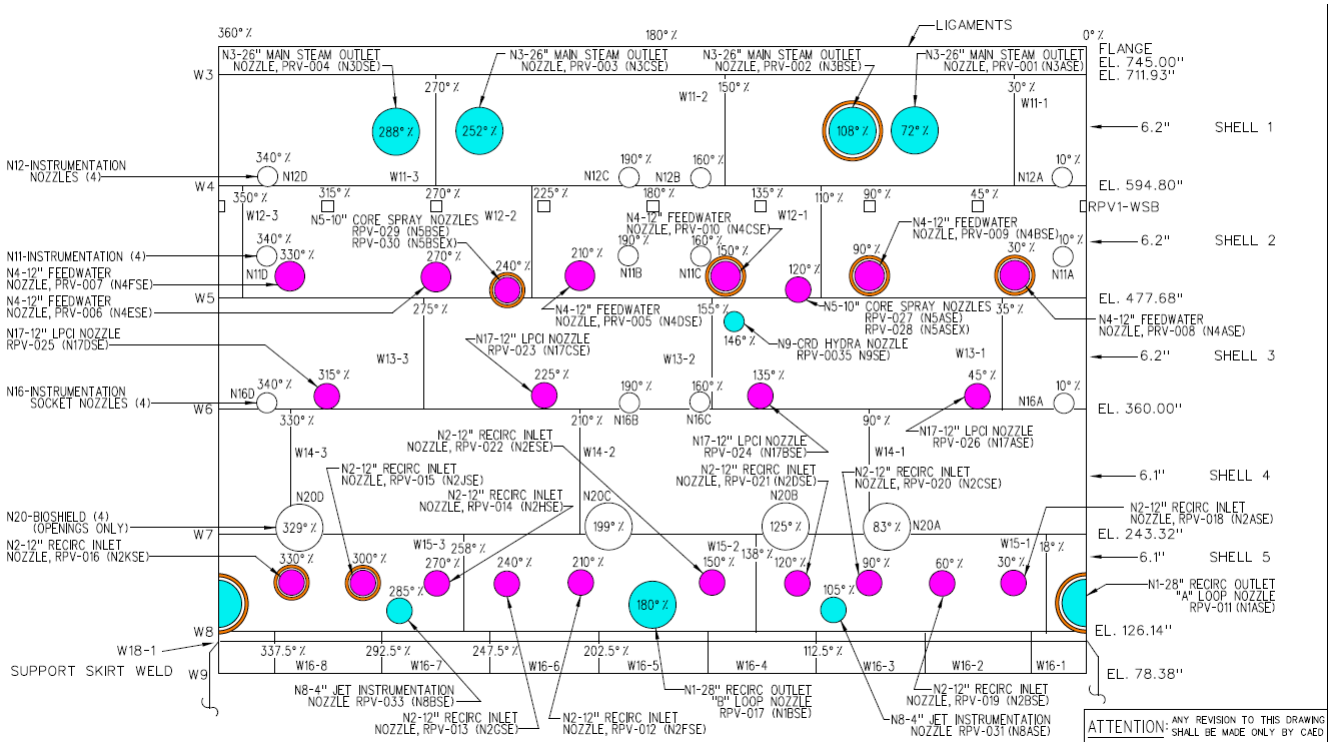



**Figure 1.10-1 Weld RPV1-N4E (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The NDE data came from UT Report No.: VEN-13-018. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **89.60%** as described in Table 1.10-1 and combined with Figures 1.10-2 and 1.10-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.10-1 Weld RPV1-N4E Volumetric Coverage and Limitation Summary**

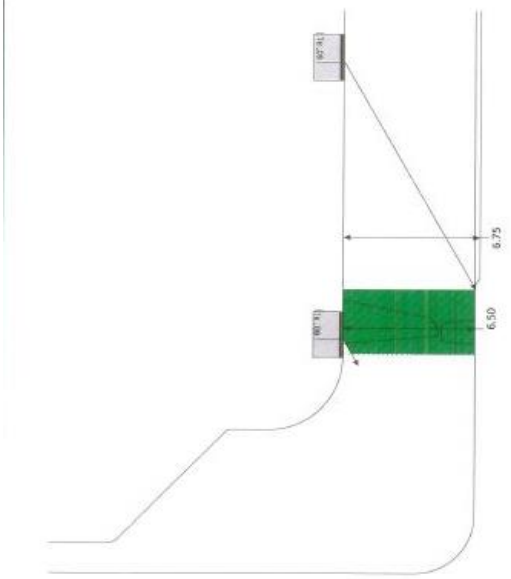
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.20 |
| Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 |
| Area Scanned Sq. inches | 20.68 | Upper 85% "T" Area Sq. inches | 17.70 | Inner 15% "T" Area Sq. inches | 3.14 |
| | | Area Scanned | 13.49 | Area Scanned | 3.14 |
| Percentage of Area Scanned | 99.33% | Percentage of Area Scanned | 76.21% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 99.33% | Percentage of Total Volume | 64.86% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 99.33% | Coverage Circ. Scan upper 85% t volume | 64.86% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (99.33% + 64.86% + 15.00%) ÷ 2 = 89.60%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2013-546 Rev.2.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4E | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Radial Scan Coverage Calculations**

*Total Area:* = 20.80 in²

*Total Area:* 3.20" x 6.50" = 20.80 in²

*Lower 15% t of Vessel Shell Coverage:* = 15.00%

3.20" x 0.98" = 3.14 in²

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

*Upper 85% t of Vessel Shell Coverage:* = 84.33%

3.20" x 5.11" = 16.35 in²

0.42" x 2.48" = 1.04 in²

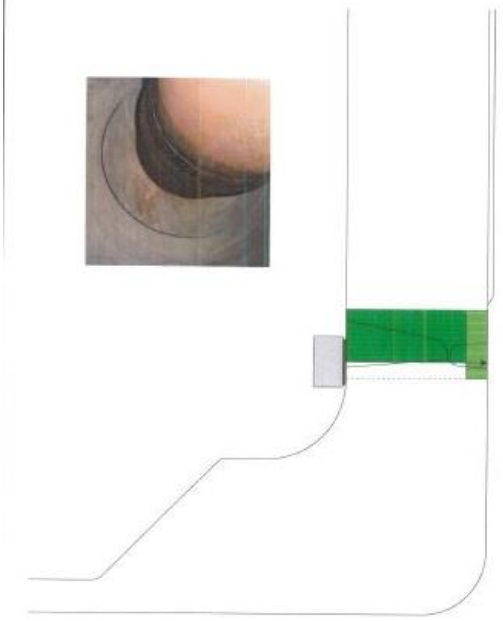
0.42" x 0.73" / 2 = 0.15 in²

(16.35 + 1.04 + 0.15 ) ÷ 20.80 x 100 = 84.33%

***Total Radial Exam Coverage:* = 84.33% + 15.00% = 99.33%**

**Figure 1.10-2 Weld RPV1-N4E (Radial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4E | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



**N4 Nozzle to Shell Weld Circumferential Scan Coverage Calculations**

*Total Area:* = 20.80 in²

*Total Area:* 3.20" x 6.50" = 20.80 in²

*Upper 85% t of Vessel Shell Coverage:* = 64.86%

2.44" x 5.53" = 13.49 in²

13.49 ÷ 20.80 x 100 = 64.86

*Lower 15% t of Vessel Shell Coverage:* = 15.00%

0.98" x 3.20" = 3.14 in² (Modeled)

3.14 ÷ 20.80 x 100 = 15.00% of Total Area

***Total Circumferential Exam Coverage:* = 64.86% + 15.00% = 79.86%**

**Figure 1.10-3 Weld RPV1-N4E (Circumferential Scans) Coverage Calculation**

## 1.11 Weld RPV1-N4F – RPV Feedwater F Nozzle-to-Shell Weld

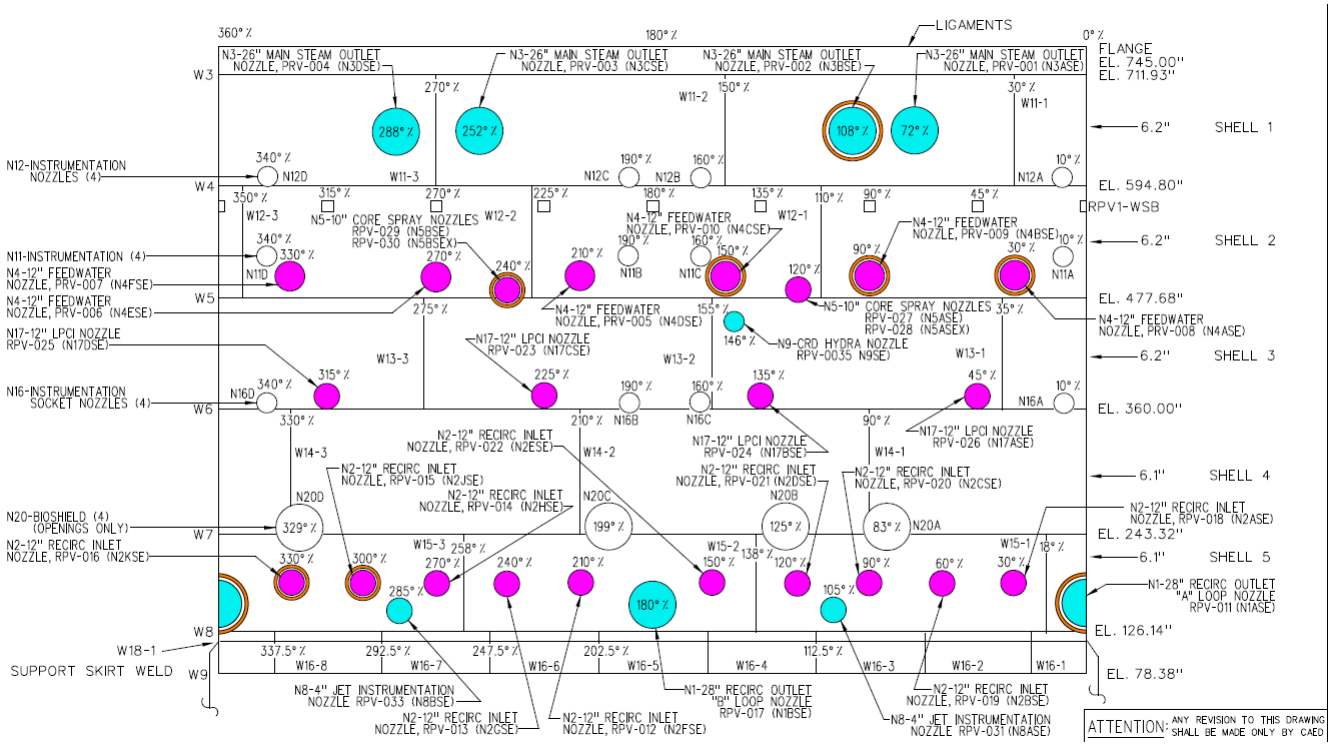



**Figure 1.11-1 Weld RPV1-N4F (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The NDE data came from UT Report No.: VEN-13-027. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **80.42%** as described in Table 1.11-1 and combined with Figures 1.11-2 and 1.11-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.11-1 Weld RPV1-N4F Volumetric Coverage and Limitation Summary**

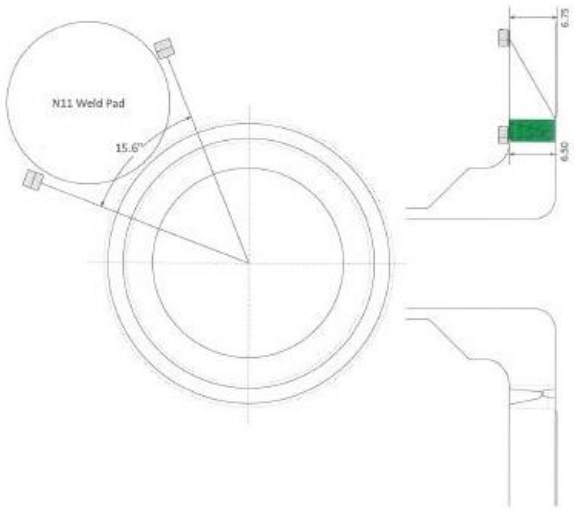
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.20 |
| Weld Length | 118.00 | Weld Length | 118.00 | Weld Length | 118.00 |
| Exam Volume (A-B-C-D-E-F-G-H) Cubic inches | 2454.40 | Exam Volume (A-B-C-D-E-F-G-H) Cubic inches | 2454.40 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 20.80 |
| Volume Scanned Cubic inches | 2114.56 | Upper 85% "T" Volume Cubic inches | 2088.13 | Inner 15% "T" Area Sq. inches | 3.14 |
| | | Volume Scanned Cubic inches | 1465.01 | Area Scanned | 3.14 |
| Percentage of Area Scanned | 86.15% | Percentage of Volume Scanned | 70.16% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 86.15% | Percentage of Total Volume | 59.69% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 86.15% | Coverage Circ. Scan upper 85% t volume | 59.69% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (86.15% + 59.69% + 15.00%) ÷ 2 = 80.42%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2013-546 Rev.2.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4F | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Radial Scan Coverage Calculations**

***Total Volume:* = 2454.40 in³**

*Weld Length:* = 118.0"

Total Area: 3.20" x 6.50" = 20.80 in²

***Area of Obstruction ( N11 Weld Pad Area)***

20.80 in² x 15.6" = 324.48 in³

***Nozzle to Shell Obstruction (Non N11 Weld Pad Area)***

3.20" x 6.08" = 19.46 in²

0.42" x 2.48" = 1.04 in²

0.42" x 0.73" / 2 = 0.15 in²

19.46 + 1.04 + 0.15 = 20.65 in²

20.80 – 20.65 = 0.15 in²

0.15 in² x 102.4" = 15.36 in³

Total Obstructed Volume = 15.36 in³

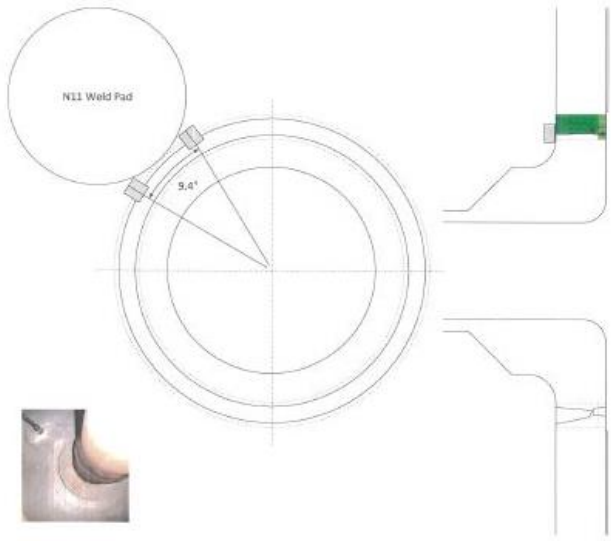
***Total Radial Exam Coverage***

2454.40 – 324.48 – 15.36 = 2114.56

***Total Radial Exam Coverage:* = 2114.56 / 2454.40 x 100 = 86.15%**

**Figure 1.11-2 Weld RPV1-N4F (Radial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO18 | Component ID: RPV1-N4F | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|




**N4 Nozzle to Shell Weld Circ Scan Coverage Calculations**

***Total Volume:* = 2454.40 in³**

Weld Length: 118.0"

Total Area: 3.20" x 6.50" = 20.80 in²

**Area of Obstruction (N11 Weld Pad Area)**

20.80 in² x 9.4" = 195.52 in³

***Upper 85% t of Vessel Shell Coverage (Non N11 Weld Pad Area)***

2.44" x 5.53" = 13.49 in²

13.49 in² x 108.6" = 1465.01 in³

Total Achieved Volume = 1465.01 in³

***Lower 15% t of Vessel Shell Coverage***

0.98" x 3.20" = 3.14 in² (Modeled)

3.14 x 118.0 = 370.52 in³ *Lower 15% t not limited due to N11 weld pad obstruction

***Total Circ Exam Coverage***

1465.01 + 370.52 = 1835.53

1835.53 / 2454.40 x 100 = 74.79

***Total Circ Exam Coverage:* = 74.79%**

**Figure 1.11-3 Weld RPV1-N4F (Circumferential Scans) Coverage Calculation**

## 1.12 Weld RPV1-N8A – RPV Jet Pump Instrumentation A Nozzle-to-Shell Weld

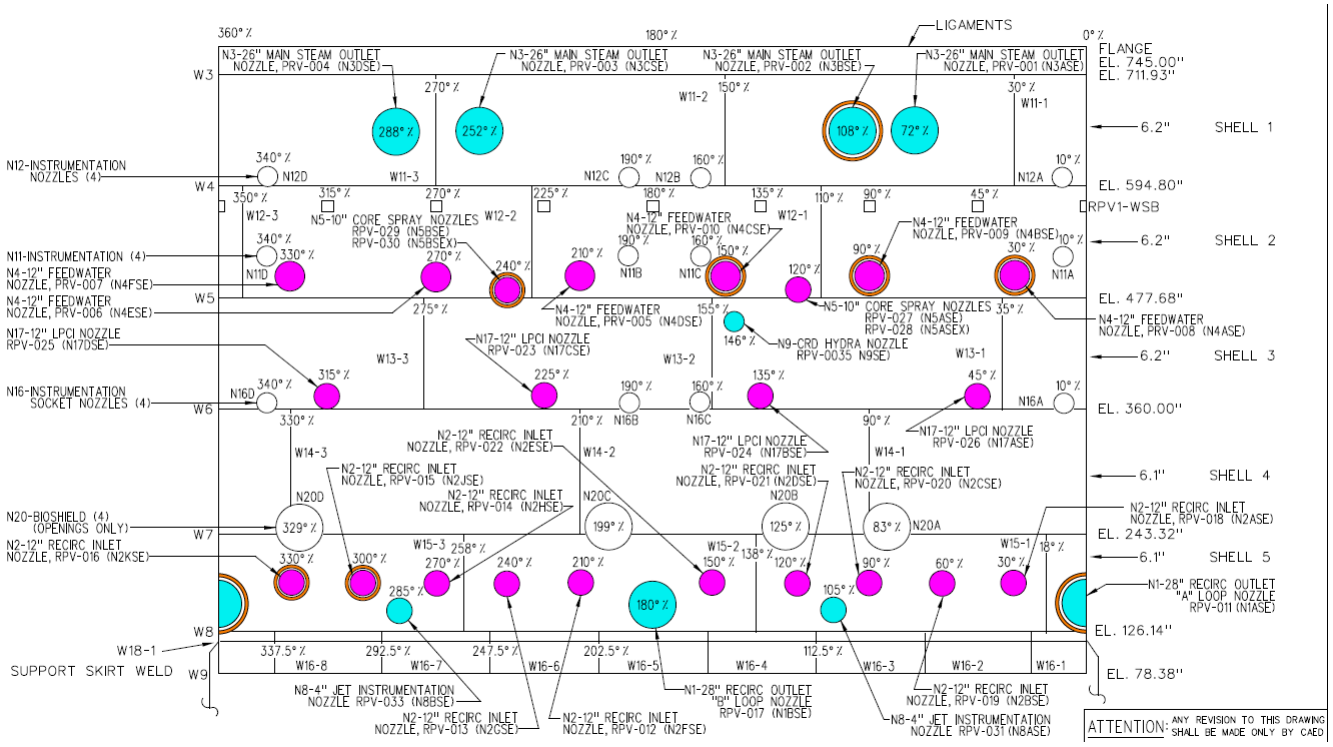



**Figure 1.12-1 Weld RPV1-N8A (Extracted from Reference DWG A-1)**

This weld was UT examined in Inspection Period 3, during the RFO19 refueling outage in 2015. The NDE data came from UT Report No.: VEN-15-004. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **87.80%** as described in Table 1.12-1 and combined with Figures 1.12-2 and 1.12-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.12-1 Weld RPV1-N8A Volumetric Coverage and Limitation Summary**

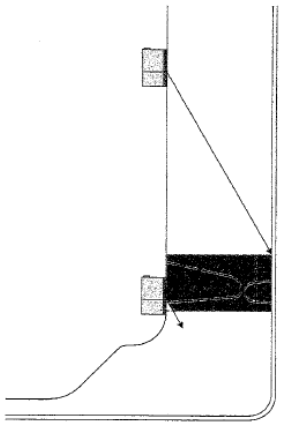
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 45° ±73° Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.20 | Weld Width inches | 2.20 | Weld Width inches | 2.50 |
| Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 22.75 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 22.75 | Exam Area (A-B-C-D-E-F-G-H) Sq. inches | 22.75 |
| Area Scanned Sq. inches | 22.66 | Upper 85% "T" Area Sq. inches | 19.32 | Inner 15% "T" Area Sq. inches | 3.43 |
| | | Area Scanned | 13.91 | Area Scanned | 3.43 |
| Percentage of Area Scanned | 99.5% | Percentage of Area Scanned | 72.0% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 99.5% | Percentage of Total Volume | 61.1% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 99.5% | Coverage Circ. Scan upper 85% t volume | 61.1% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (99.5% + 61.1% + 15.00%) ÷ 2 = 87.8%

Notes:

1. Radial scans were performed with a procedure qualified for the examination of vessel nozzle to shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during radial scans was limited due to the nozzle and weld configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination was performed with a procedure qualified for the nozzle to shell weld inner 15% thickness region (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle to shell weld inner 15% thickness examination techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2005-50.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.
4. The total examination coverage differs from the previous examination coverage due to variances in calculating the examination coverage and utilizing single-sided access techniques and personnel qualified for single sided examination.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO19 | Weld ID: RPV1-N8A | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|



**N8A Nozzle to Shell Weld Axial Scan Coverage Calculations**

***Total Area:* = 22.75 sq. in.**

Total Area: 3.50" x 6.50" = 22.75 in²

***Lower 15% t of Vessel Shell Coverage:* = 15.0%**

3.50" x 0.98" = 3.43 in²

3.43 ÷ 22.75 x 100 = 15.0% of Total Area

***Upper 85% t of Vessel Shell & Radius Coverage:* = 84.5%**

2.80" x 5.52" = 15.46 in²

0.71" x 5.10" = 3.62 in²

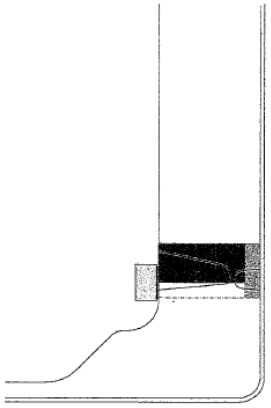
0.40" x 0.76" / 2 = 0.15 in²

(15.46 + 3.62 + 0.15) / 22.75 x 100 = 84.5%

***Total Axial Coverage:* = 84.5% + 15.0% = 99.5%**

**Figure 1.12-2 Weld RPV1-N8A (Axial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RFO19 | Weld ID: RPV1-N8A | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



**N8A Nozzle to Shell Weld Circumferential Scan Coverage Calculations**

***Total Area:* = 22.75 sq. in.**

Total Area: 3.50" x 6.50" = 22.75 in²

***Upper 85% t of Vessel Shell & Radius Coverage:* = 61.1%**

2.52" x 5.52" = 13.91 in²

13.91 / 22.75 x 100 = 61.1%

***Lower 15% t of Vessel Shell Coverage:* = 15.0%**

0.98" x 3.50" = 3.43 in² (Modeled)

3.43 ÷ 22.75 x 100 = 15.0% of Total Area

***Total Circumferential Exam Coverage:* = 61.1% + 15.0% = 76.1%**

**Figure 1.12-3 Weld RPV1-N8A (Circumferential Scans) Coverage Calculation**

## 1.13 Weld RPV1-N7 – RPV Head Vent Nozzle-to-Shell Weld

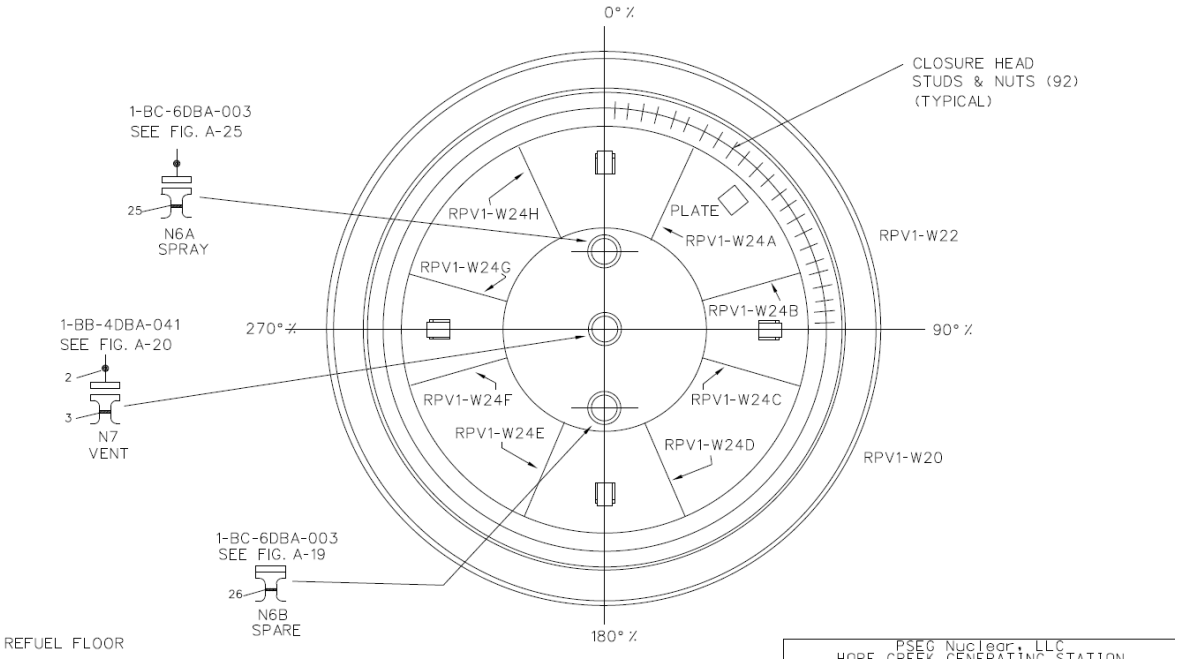



**Figure 1.13-1 Weld RPV1-N7 (Extracted from Reference DWG A-2)**

This weld was UT examined in Inspection Period 3, during the RFO19 refueling outage in 2015. The NDE data came from UT Report No.: VEN-15-010. The UT Code Required Volume (CRV) was determined based on Section XI, Figure IWB-2500-7(b). The corresponding CRV as shown on that Figure is A-B-C-D-E-F-G-H. The UT examination was limited from the nozzle side of the weld due to the geometric configuration of the nozzle. The examination resulted in total UT coverage of **74.70%** as described in Table 1.13-1 and combined with Figures 1.13-2 and 1.13-3. No recordable indications were detected during this examination.

The ultrasonic examination was performed in accordance with the criteria of 10 CFR 50.55a(b)(2)(xv)(G) and the minimum coverage requirements of 10 CFR 50.55a(b)(2)(xv)(K) was achieved to the maximum extent possible.

The examination satisfied the requirements of ASME Section XI, 2001 Edition with the 2003 Addenda for Category B-D, Item number B3.90, figure number IWB-2500-7(b) exam volume, and was performed using ASME Section XI, Appendix VIII qualified personnel, procedures and equipment to the 2001 Edition of Appendix VIII as conditioned by 10 CFR 50.55a(b)(2)(xv). Code Case N-613-1 was used to reduce the area to be examined to the weld plus a ½" on each side.

**Note:** No laminations exist on the shell that could interfere with the angle beam examinations performed on this weld.

**Table 1.13-1 Weld RPV1-N7 Volumetric Coverage and Limitation Summary**

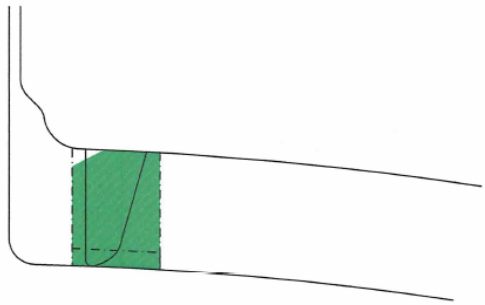
| 60°RL Radial Scan 100% t volume | | 60°RL Circ. Scan Upper 85% t volume | | 50° ±39° to 64°Circ. Scan Inner 15% t volume (Modeled) | |
|---|---|---|---|---|---|
| Thickness ($t_s$) inches | 4.30 | Thickness ($t_s$) inches | 4.30 | Thickness ($t_s$) inches | 6.50 |
| Weld Width inches | 2.28 | Weld Width inches | 2.28 | Weld Width inches | 2.50 |
| Exam Volume (A-B-C-D-E-F-G-H) Sq. inches | 14.29 | Exam Volume (A-B-C-D-E-F-G-H) Sq. inches | 14.29 | Exam Volume (A-B-C-D-E-F-G-H) Sq. inches | 14.29 |
| Area Scanned Sq. inches | 11.82 | Upper 85% "T" Volume Sq. inches | 12.18 | Inner 15% "T" Volume Sq. inches | 2.14 |
| | | Area Scanned | 7.39 | Area Scanned | 2.14 |
| Percentage of Area Scanned | 82.7% | Percentage of Area Scanned | 60.7% | Percentage of Area Scanned | 100% |
| Percentage of Total Volume | 82.7% | Percentage of Total Volume | 51.7% | Percentage of Total Volume | 15.00% |
| Coverage Radial Scan 100% t volume | 82.7% | Coverage Circ. Scan upper 85% t volume | 51.7% | Coverage Circ. Scan Inner 15% t volume | 15.00% |

Total Coverage Radial and Circ. Scans: (82.7% + 51.7% + 15.00%) ÷ 2 = 74.7%

Notes:

1. Axial scans were performed with a procedure qualified for the examination of vessel shell welds (54-ISI-805-008). This procedure has been demonstrated for detection of flaws located throughout the entire weld thickness. Coverage obtained during axial scans was limited due to the nozzle configuration.
2. In the circumferential scan direction the outer 85%-t is examined with the same vessel procedure as mentioned above and coverage was also limited due to the nozzle configuration. To achieve additional coverage in the circumferential scan direction a second examination is performed with a procedure qualified for the nozzle inside-radius examinations (54-ISI-850-008). This procedure has been demonstrated for detection of flaws in the inner 15%-t only. The nozzle inside-radius techniques were performed in accordance with the parameters identified in EPRI modeling report IR-2004-50.
3. Scanning was performed to the maximum extent possible. The total coverage achieved for scans performed in accordance with procedure 54-ISI-805-008 is a conservative estimate derived from the physical limitation caused by the nozzle configuration at the vertical sections of the nozzle and does not include additional volume obtained at the horizontal sections of the nozzle. Scanning with the 60°RL was also taken back to the limit of one half inch from the toe of the weld as measure from OD weld radius tip and projected to the ID perpendicular to the surface.

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RF19 | Weld ID: RPV1-N7 | Work Sheet Number: CWS-01 |
|---|---|---|---|---|---|



Scale: ¼:1

**N7 Nozzle to Head Weld Axial Scan Coverage Calculations**

***Total Area:* = 14.29 in²**

***Lower 15% t of Head Coverage:* = 15.0%**

Total Lower 15% Area: 2.14 in²

2.14 / 14.29 X 100 = 15.0%

***Upper 85% t of Head Coverage:* = 82.7%**

Total Upper 85% Area: 12.18 in²

Total Upper 85% Area Scanned: 11.82 in²

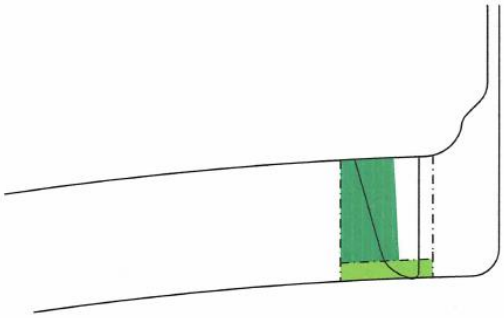
11.82 / 14.29 X 100 = 82.7%

***Total Axial Coverage:* = 82.7% + 15.0% = 97.7%**

*Due to curvature of head, areas were calculated using a CAD program.

**Figure 1.13-2 Weld RPV1-N7 (Axial Scans) Coverage Calculations from Shell Side**

| Utility: PSEG | Plant: HC | Unit: 1 | Outage: RF19 | Weld ID: RPV1-N7 | Work Sheet Number: CWS-02 |
|---|---|---|---|---|---|



Scale: ¼:1

**N7 Nozzle to Head Weld Circumferential Scan Coverage Calculations**

***Total Area:* = 14.29**

***Upper 85% t of Head Coverage:* = 51.7%**

Total Upper 85% Area: 12.18 in²

Total Upper 85% Area Scanned: 7.39 in²

7.39 / 14.29 X 100 = 51.7%

***Lower 15% t of Vessel Shell Coverage:* = 15.0%**

Total Lower 15% Area: 2.14 in²

2.14 / 14.29 / 100 = 15.0%

***Total Circumferential Coverage:* = 51.7% + 15.0% = 66.7%**

*Due to curvature of head, areas were calculated using a CAD program.

**Figure 1.13-3 Weld RPV1-N7 (Circumferential Scans) Coverage Calculation**

## 1.14 Inside Radius Sections for RPV1-N2AIR (Recirc. Inlet A), RPV1-N2BIR (Recirc. Inlet B), RPV1-N2KIR (Recirc. Inlet K), RPV1-N5BIR (Core Spray B) and RPV1-N17AIR (LPCI A)

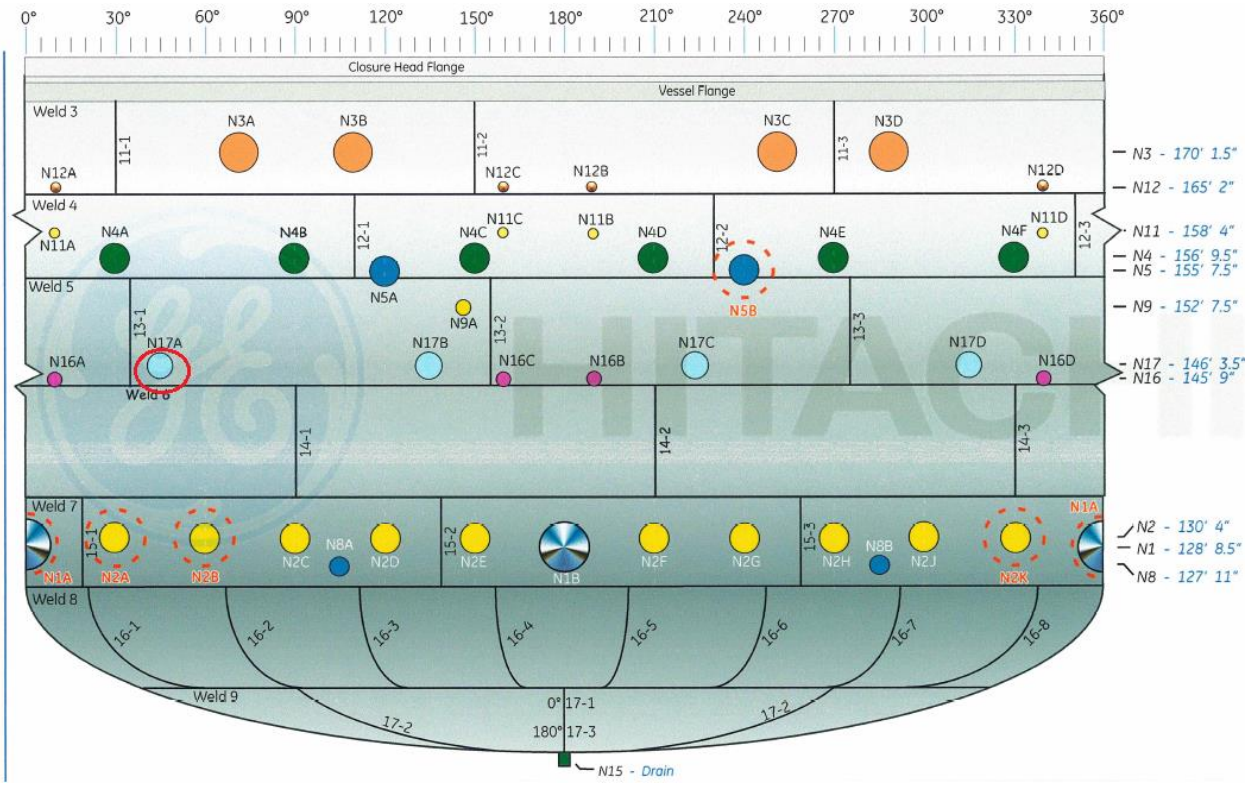



**Figure 1.14-1 Nozzle Inner Radii Sections**

Nozzle Inner Radii N2A, N2B, N2K and N5B were visually examined in Inspection Period 2, during the RFO17 refueling outage in 2012 in accordance with Code Case N-648-1. The NDE data came from In Vessel Visual Inspection Hope Creek Spring 2012 R17 Outage Report. The surface area was determined based on Section XI, Figure IWC-2500-7(b). The corresponding surface as shown on that Figure is M-N. Enhanced VT-1 (EVT-1) (0.44" resolution), was performed remotely using closed circuit television (CCTV) equipment. All EVT-1 examinations (where accessible) were brushed prior to performing inspection. Brushing was utilized to effectively discern the weld ripples and surface texture conditions. Cleaning was performed for those components being examined that exhibited surface conditions that restricted the examination as required by procedure. When cleaning was required, it was performed using a nylon bristle brush with the desired result of cleaning to a dull non-reflective surface in which primarily the oxide covering the surface was removed. The visual examination was limited due to the thermal sleeve configuration resulting in total visual coverage as described in Table 1.14-1 and Figures 1.14-2 through 1.14-4.

Nozzle Inner Radius N17A was visually examined in Inspection Period 3, during RFO20 refueling outage in 2016 in accordance with Code Case N-648-1. The NDE data came from the Visual Inspection of Vessel Interior Outage Report. A VT-1 (0.44" resolution) was performed

remotely using closed circuit television (CCTV) equipment. In addition, a VT-3 examination was used to supplement the VT-1 examination. The visual examination was limited due to the thermal sleeve configuration resulting in total visual coverage as described in Table 1.14-1..

**Table 1.14-1 Nozzle Inner Radii Coverage**

| | | | | | |
|---|---|---|---|---|---|
| Summary No. | 100410 | Component | RPV | Description | Recirc Inlet Inner Radius Section @ 30° |
| Component ID | RPV1 N2 A IR | Azimuth | 030 | Exam Type | EVT-1 |
| DVD 05 | Title 03 | Surface Condition | Brushed | | |
| Camera | RJ 2110 on Pole | Coverage | 40% | Limitation | Riser Thermal Sleeve |
| Examiner | Kulkoski, Daniel | Date | 4/19/2012 | Results | NRI |
| Examiner Comments | Heavy Grinding Marks, Deep Scratches, Pitting and Staining. All Non-Relevant. | | | | |
| Reviewer | Anderson, Edward | Date | 4/20/2012 | | |
| Reviewer Comments | NRI, Cladding is to the just inside of the nozzle. Lots of grinding mark and scratches | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Summary No. | 100415 | Component | RPV | Description | Recirc Inlet Inner Radius Section @ 60° |
| Component ID | RPV1 N2 B IR | Azimuth | 060 | Exam Type | EVT-1 |
| DVD 10 | Title 06 | Surface Condition | Brushed | | |
| Camera | RJ 2110 on Pole | Coverage | 25% | Limitation | Jet Pump Configuration |
| Examiner | Teodoro, Mikado | Date | 4/20/2012 | Results | NRI |
| Examiner Comments | Machine Marks, Scratches & Crud Lines. | | | | |
| Reviewer | Goss, Edward | Date | 4/21/2012 | | |
| Reviewer Comments | Heavy grinding and scratches noted. NRI. | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Summary No. | 100455 | Component | RPV | Description | Recirc Inlet Inner Radius Section @ 330° |
| Component ID | RPV1 N2 K IR | Azimuth | 330 | Exam Type | EVT-1 |
| DVD 33 | Title 02 | Surface Condition | Brushed | | |
| Camera | RJ 2110 on Pole | Coverage | 50% | Limitation | Jet Pump Configuration |
| Examiner | Elliot, Jarett | Date | 4/25/2012 | Results | NRI |
| Examiner Comments | DVD 32 had incorrect location started. DVD 33 is the correct exam. Noted grind, scratch and brush marks. | | | | |
| Reviewer | Goss, Edward | Date | 4/26/2012 | | |
| Reviewer Comments | DVD was N2J not N2K, DVD 33 is correct exam location. Grind marks and scratches noted. NRI | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Summary No. | 100515 | Component | RPV | Description | Core Spray Inner Radius Section @ 240° |
| Component ID | RPV1 N5 B IR | Azimuth | 240 | Exam Type | EVT-1 |
| DVD 13 | Title 06 | Surface Condition | Brushed | | |
| Camera | RJ 2110 on Pole | Coverage | 25% | Limitation | Bracket Configuration |
| Examiner | Stellanelli, Frank | Date | 4/21/2012 | Results | NRI |
| Examiner Comments | Grind marks and scratches. | | | | |
| Reviewer | Anderson, Edward | Date | 4/21/2012 | | |
| Reviewer Comments | NRI, can only see part of Inner Radius and HAZ. Changed percent coverage from 50 to 25 | | | | |

| Nozzle Inner Radius | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N17A-IR | 45° | VT-1<br>VT-3 | | No | | | Jacob Briggs (JLB) | III | NRI | 2016-10-26 22:32:52 | Sum. No. 100615. Performed a VT-1 of the N17A nozzle Inner Radius and a VT-3 of 12 inches of adjacent vessel surfaces and general overall condition. (ASME Section XI, Item #B3.100, Cat. B-D) Total Coverage 50% |
| | | VT-1<br>VT-3 | 21 | | | Vid_0087.mkv | Robert Whitehill (RDW) | II | NRI | 2016-10-26 14:23:15 | VT-1 portion. Limited access due to the LPCI assembly and piping. (ASME Section XI, Item #B3.100, Cat. B-D) Coverage 45% |
| | | VT-1<br>VT-3 | 22 | | | Vid_0091.mkv | Mathew Clemmons (MBC) | II | NRI | 2016-10-26 20:48:18 | Supplemental VT-3 Examination of the N17A-IR<br>Coverage 3% |

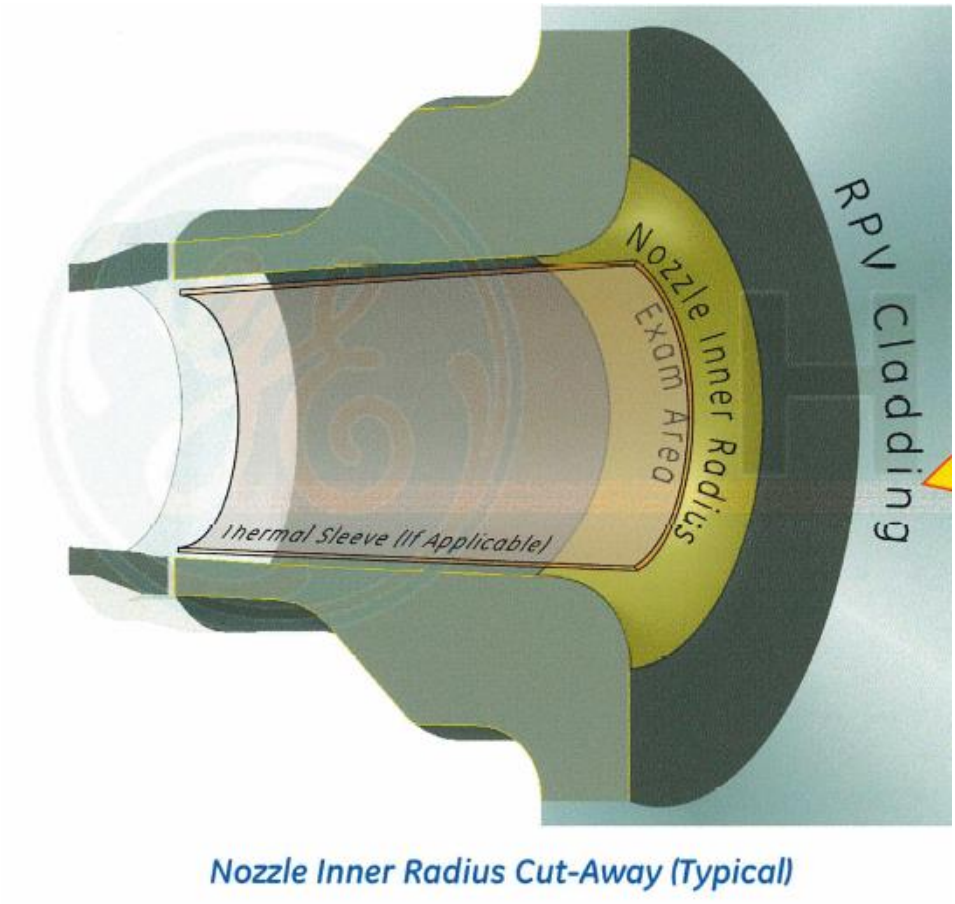



**Figure 1.14-2 Inner Radius RPV1-N2AIR Examination Area**

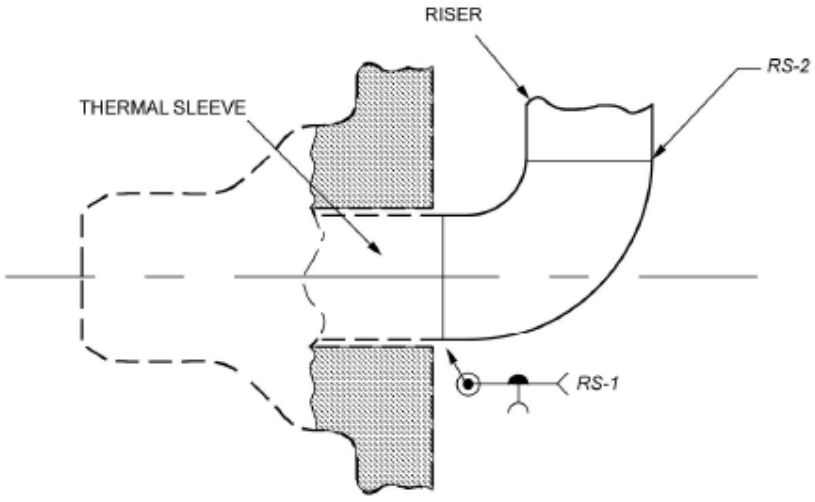



**Figure 1.14-3 Typical Recirculation Inlet Nozzle (Extracted from BWRVIP-41 Rev. 3)**

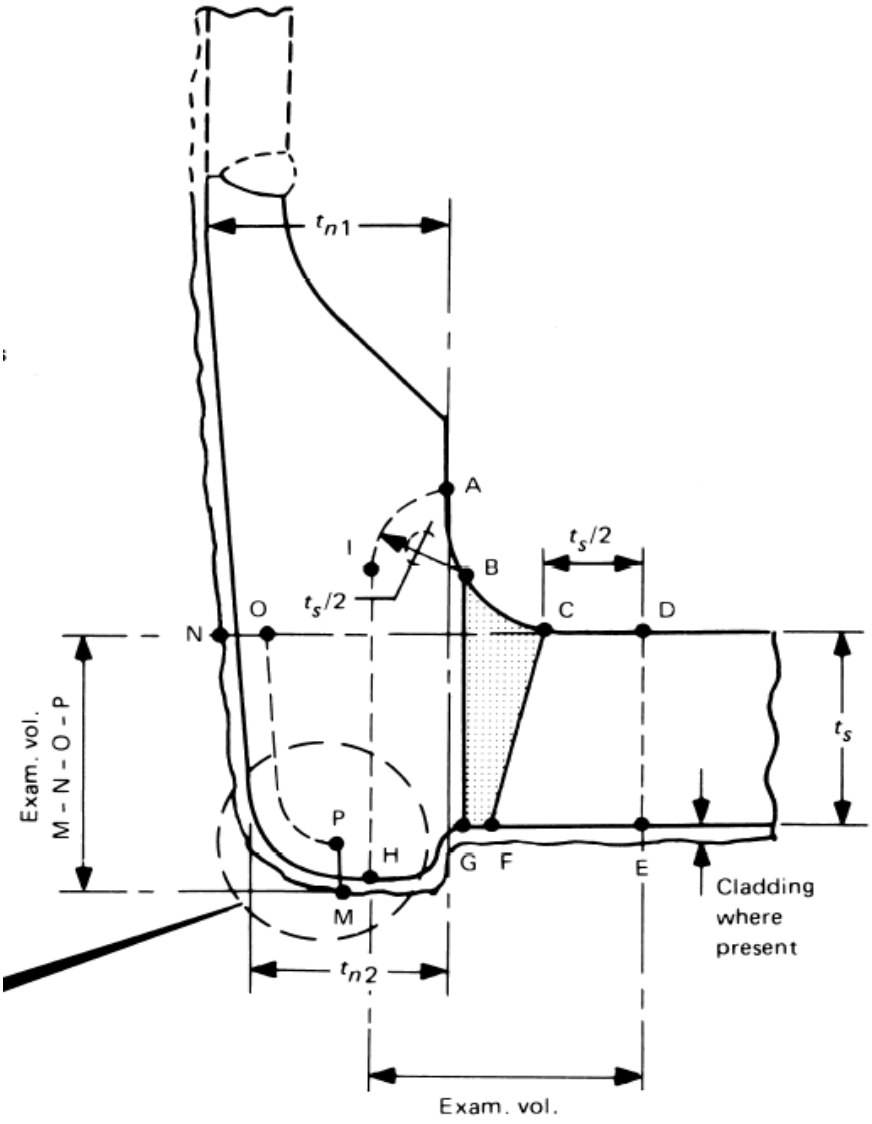



**Figure 1.14-4 Typical Examination coverage for nozzles with a thermal sleeve**

## 1.15 Weld 1-AE-205-RHX-W4 – Residual Heat Exchanger Shell-to-Flange Weld

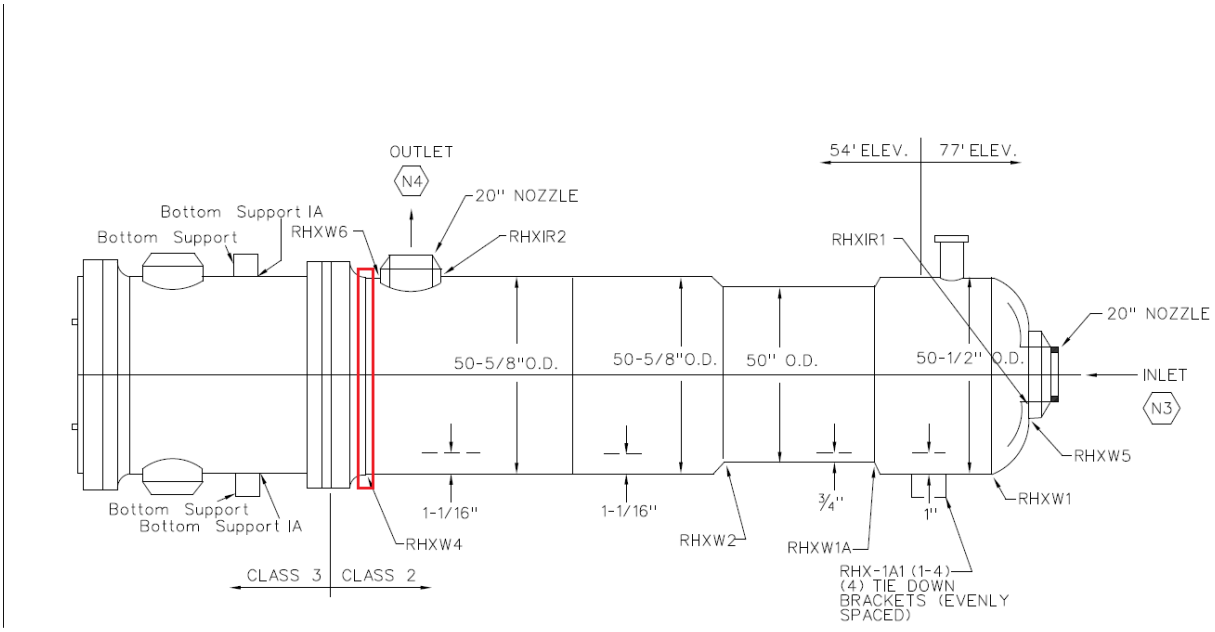



**Figure 1.15-1 Weld 1-AE-205-RHX-W4 (Extracted from Reference DWG B-1)**

This weld was UT examined in Inspection Period 2, during the RFO18 refueling outage in 2013. The weld was examined under Item No. C1.10 and the NDE data came from UT Report No.: UT-13-002. The UT Code Required Volume (CRV) was determined based on the requirements of Section XI, Figure IWC-2500-1. The corresponding CRV as shown on that Figure is A-B-C-D. However, the CRV for this weld could not be examined fully because the weld was located near the bolted flange studs limiting the examination coverage. The 45° circumferential scans were limited due to an obstruction from the bolted flange studs. The examination resulted in total UT coverage of **88.1%** as described in Table 1.15-1 and shown on Figures 1.15-2 and 1.15-3. No recordable indications were detected during this examination.

**Calculation Coverage Data**

Downstream Examination Volume = L x W x H
160.0" L x 1.05 W x 1.1" H = 184.8 cubic inches

Limitation Volume = L x W x H (Downsteam Limitation for Circumferential Scans)
160.0" L x 0.5" x 1.1" H = 88.0 cubic inches

Examination Coverage
Limitation ÷ Downstream Side of Weld Examination Volume x 100% = % Not Examined
88.0 ÷ 184.8 = 47.6% Not Examined
100% - 47.6% = 52.4% DS Circumferential Examination Coverage

| Table 1.15-1 – Weld 1-AE-205-RHX-W4, Examination Coverage Summary | | | | |
|---|---|---|---|---|
| **Angle and Wave Mode [1]** | **Upstream Axial** | **Upstream Circumferential** | **Downstream Axial** | **Downstream Circumferential** |
| 45°S | 100% | 100% | 100% | 52.4% |
| | | | **Code Coverage Total [2] =** | **88.1%** |
| Note: Exam volume is the full volume of the weld plus ½" on each side of the weld toes. | | | | |

**Customer:** PSEG **System:** RHR **Summary No.:** 200080

**Comp. Thickness:** 1.1"

**Component No.:** 1-AE-205-RHX-W4

0 Reference is located at the Longseam

| | | | | | |
|---|---|---|---|---|---|
| 1) Interfering Condition: | Bolted Flange Studs on DS side of weld | | | | |
| Distance From Centerline: | 0.5" | DS | To | 1.0" | DS |
| Distance From Ref. Point: | 0.0" | CW | To | 160" | CW |
| 2) Interfering Condition: | | | N/A | | |
| Distance From Centerline: | | N/A | To | N/A | |
| Distance From Ref. Point: | | N/A | To | N/A | |
| 3) Interfering Condition: | | | N/A | | |
| Distance From Centerline: | | N/A | To | N/A | |
| Distance From Ref. Point: | | N/A | To | N/A | |

(For All Measurements Indicate: US, DS, CW, CCW)

The 45 degree circumferential examination was limited due to an obstruction from the bolted flange studs on the downstream side of the weld.

See attached photos.

The axial examination coverage was obtained with the use of a 1/2 Vee and Full Vee path technique.

**100% Examination Volume = L x W x H**

160.0" L x 2.1 " W x 1.1" H = 369.6 cubic inches

Calculations Below:

Note: Exam volume is the full volume of the weld plus 1/2" on each side of the weld toes.

**Downstream Examination Volume = L x W x H**

160.0" L x 1.05 " W x 1.1" H = 184.8 cubic inches

**Limitation Volume = L x W x H (Downstream Limitation for Circumferential Scans)**

160.0" L x 0.5" W x 1.1" H = 88.0 cubic inches

**Examination Coverage**

Limitation ÷ Downstream Side of Weld Examination Volume x 100% = % Not Examined

88.0 ÷ 184.8 = 47.6% Not Examined

100% - 47.6% = 52.4% DS Circumferential Examination Coverage

**Examination Coverage Obtained** (Exam coverage differs from previous data due to small differences in measurements)

Upstream Axial Examination Coverage = 100% Downstream Axial Examination Coverage = 100%

Upstream Circumferential Examination = 100% Downstream Circumferential Examination = 52.4%

100% + 100% + 100% + 52.4% = 352.4% 352.4 ÷ 4 = 88.1% **Total Exam Coverage Achieved = 88.1%**

**Figure 1.15-2 Weld 1-AE-205-RHX-W4 (Weld Profile) Limitations**

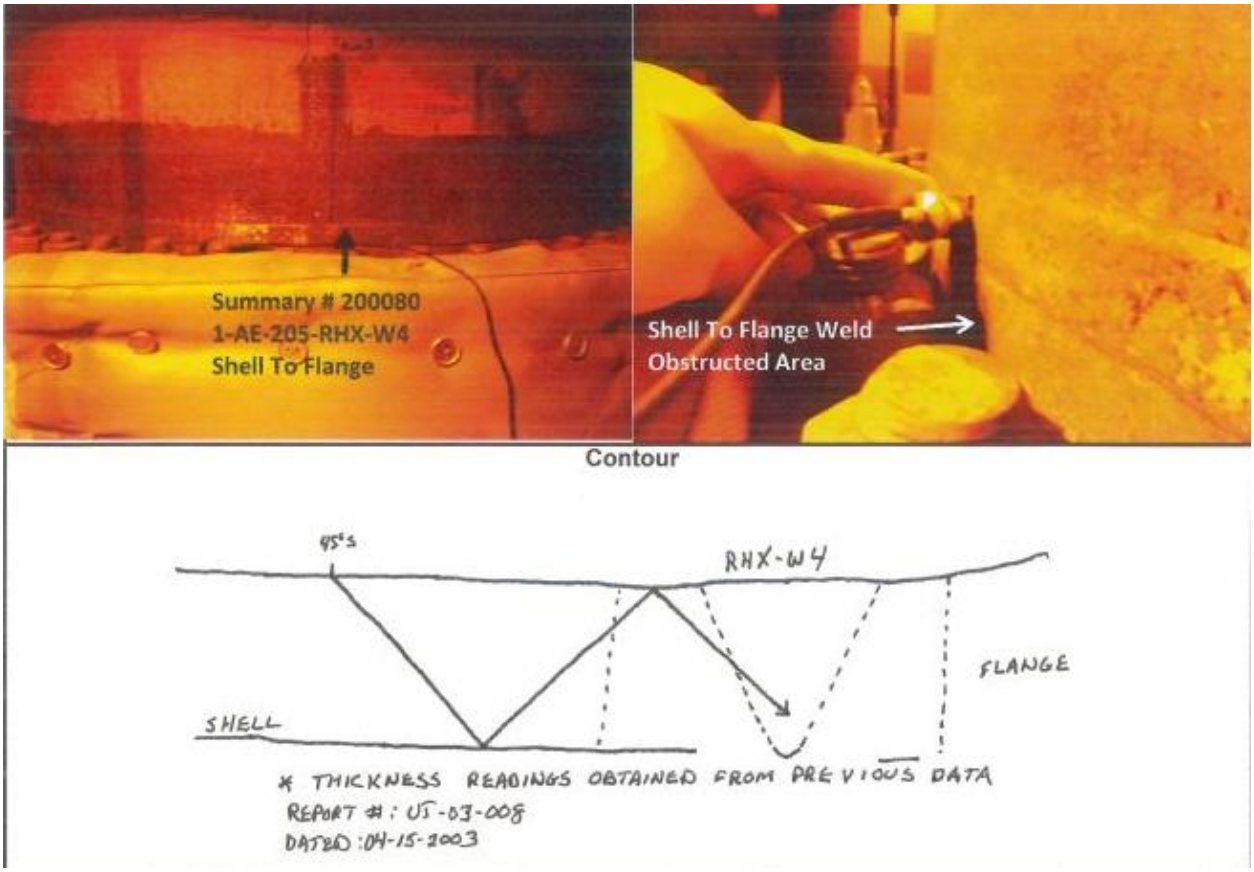



**Figure 1.15-3 Weld 1-AE-205-RHX-W4 (Weld Profile) Weld Thickness and Contour**

## 1.16 Weld 1-CP-206-CSP-W2 – "C" Core Spray Pump (CSP) Casing Weld

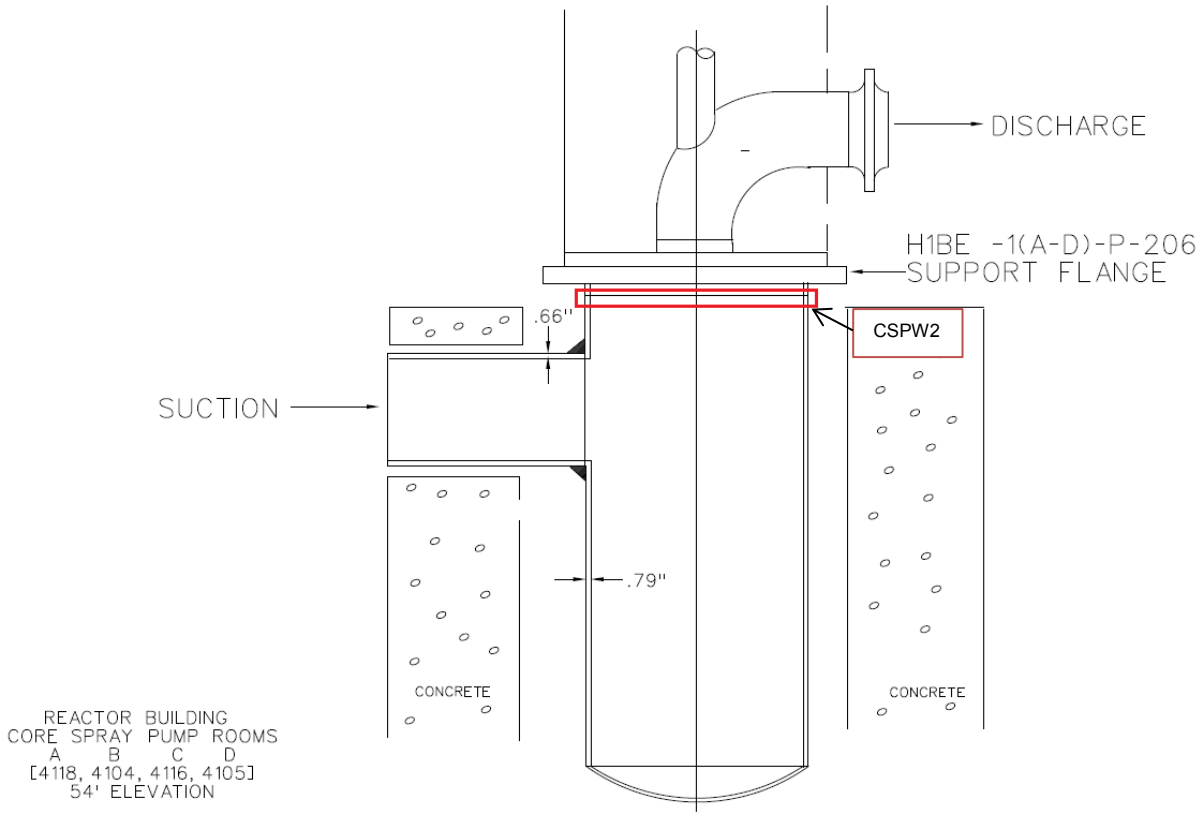



**Figure 1.16-1 Weld 1-CP-206-CSP-W2 (Extracted from Reference DWG B-2)**

This weld was Liquid Penetrant (PT) examined in Inspection Period 1, during the RFO16 refueling outage in 2010. The weld was examined under Item No. C6.10 and the NDE data came from Liquid Penetrant Report No.: PT-10-002. The Code Required Area (CRA) was determined based on the requirements of Section XI, Figure IWC-2500-8. The corresponding CRA as shown on that Figure is A-B. However, the CRA for this weld could not be examined fully because the pump was too close to the concrete pump pedestal. The coverage for the examination resulted in total PT coverage of **23.4%** as shown on Figures 1.16-2 through 1.16-4. No recordable indications were detected during this examination.

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FRAMATOME TECHNOLOGIES

# SURFACE EXAMINATION COVERAGE REPORT

| | |
|---|---|
| **CUSTOMER:** HOPE CREEK, RFO-09 | **SYSTEM:** CSP-W2 |
| **SUMMARY NO:** 250130 | **COMPONENT ID:** CSP-W2 |

## SURFACE EXAMINATIONS

**1.0 CALCULATE REQUIRED EXAMINATION AREA**

Calculate Examination Area (Length X Width = A1) : 94 X 2.5 = 235.000 sq.in.

**2.0 CALCULATE AREA NOT EXAMINED**

2.1

| | Length of Limitation | | Width of Limitation | | Area Not Examined | |
|---|---|---|---|---|---|---|
| A. | 72.00 | X | 2.50 | = | 180.000 | sq.in. |
| B. | | X | | = | | |
| C. | | X | | = | | |
| D. | | X | | = | | |

2.2 Calculate Total Area Not Examined

(The sum of Area: A + B + C + D = A2) 180.000

**3.0 CALCULATE PERCENT AREA NOT EXAMINED**

3.1 Calculate Percent of Area Not Examined (A2/A1 X 100 = LP): 76.596

**4.0 TOTAL EXAMINATION COVERAGE OBTAINED**

4.1 Calculate Percent of Total Area Examined (100 - LP): 23.404%

## LIMITATION EXPLANATION / REMARKS

DUE TO THE CONFIGURATION OF THE PUMP CASING, THE CONCRETE LIMITS THE AREA OF COVERAGE TO 23.4% OF THE ENTIRE WELD. ONLY THE AREA ABOVE CSPW3 IS VISABLE.

**Figure 1.16-2 Weld 1-CP-206-CSP-W2 Limitations**

**Figure 1.16-3 Weld 1-CP-206-CSP-W2 Limitations**

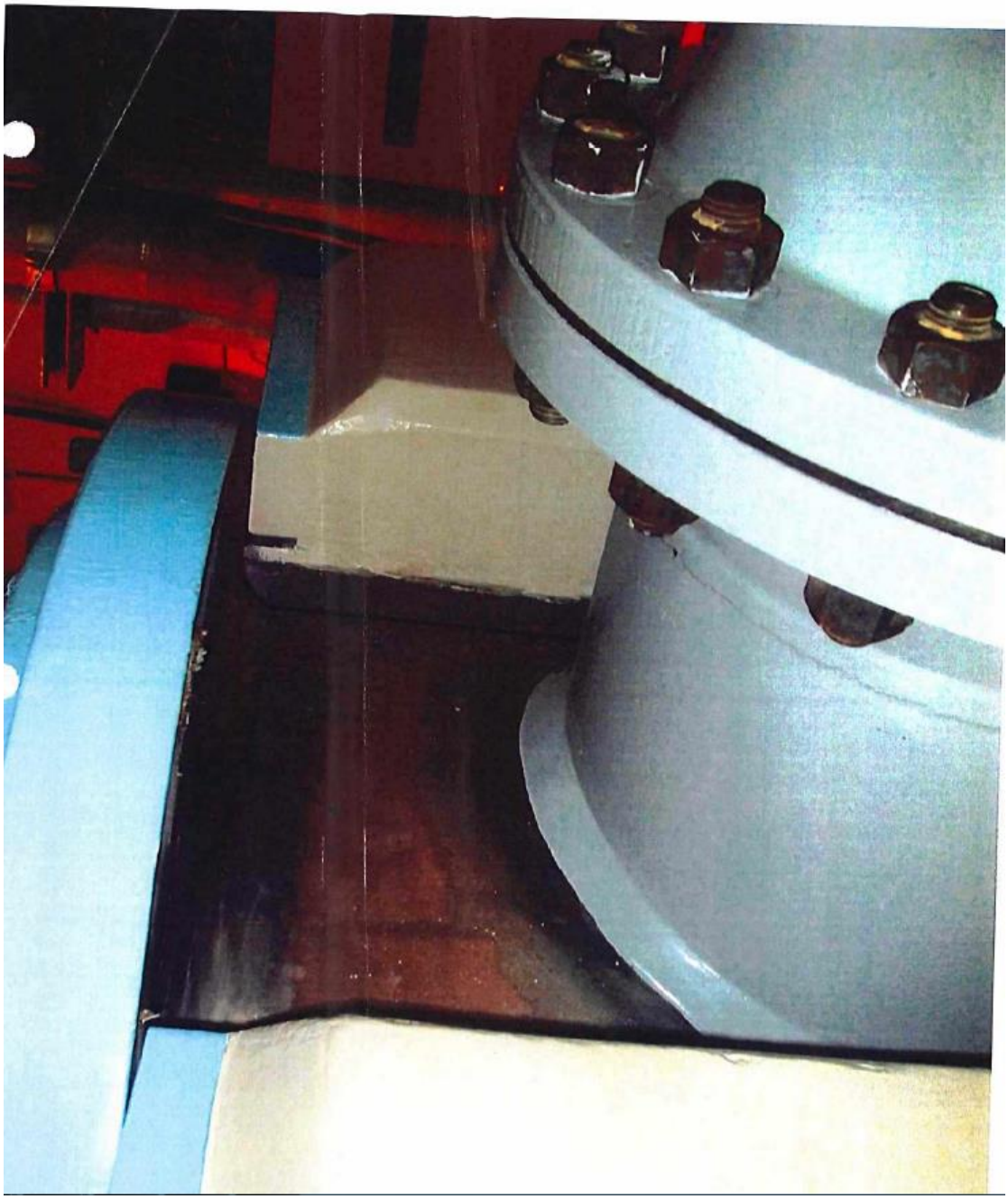

**Figure 1.16-4 Weld 1-CP-206-CSP-W2 Limitations**

## 1.17 Weld 1-CP-202-RHP-W2 – "C" Residual Heat Removal Pump (RHP) Casing Weld

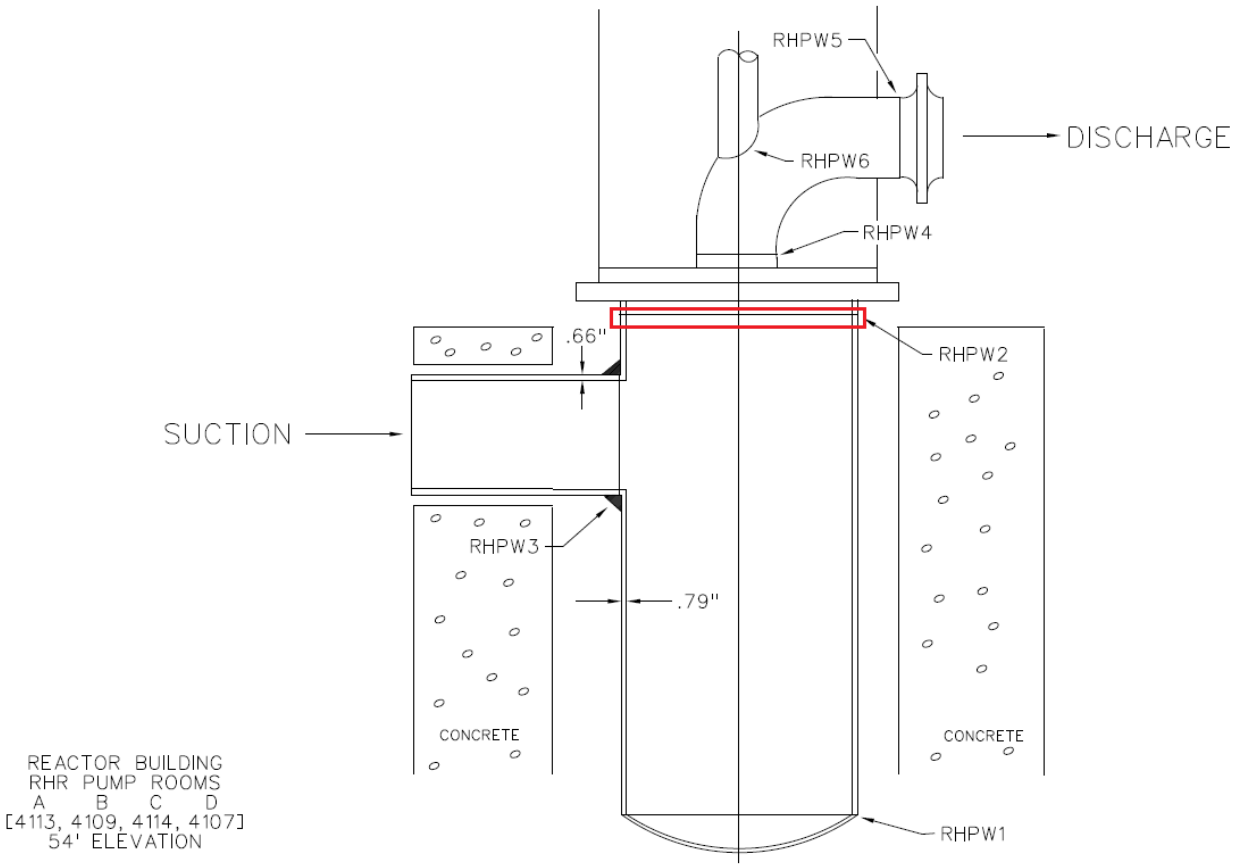


**Figure 1.17-1 Weld 1-CP-202-RHP-W2 (Extracted from Reference DWG B-3)**

This weld was Liquid Penetrant (PT) examined in Inspection Period 2, during the RFO17 refueling outage in 2010. The weld was examined under Item No. C6.10 and the NDE data came from Liquid Penetrant Report No.: PT-12-004. The Code Required Area (CRA) was determined based on the requirements of Section XI, Figure IWC-2500-8. The corresponding CRA as shown on that Figure is A-B. However, the CRA for this weld could not be examined fully because the pump was too close to the concrete pump pedestal. The coverage for the examination resulted in total PT coverage of **18.04%** as described in Table 1.17-1. No recordable indications were detected during this examination.

| Table 1.17-1 Weld 1-CP-202-RHP-W2, Examination Coverage Summary | |
|---|---|
| **Weld Circumference** | **149.67”** |
| **Weld Width** | **2.5”** |
| **Required Examination Area (L x W)** | **149.67 x 2.5 = 374.180 Sq. in.** |
| **Area not examined** | **306.675 Sq. in.** |
| **Total area examined** | **18.041%** |

## 1.18 Weld 1-DP-202-RHP-W2 – "D" Residual Heat Removal Pump (RHP) Casing Weld

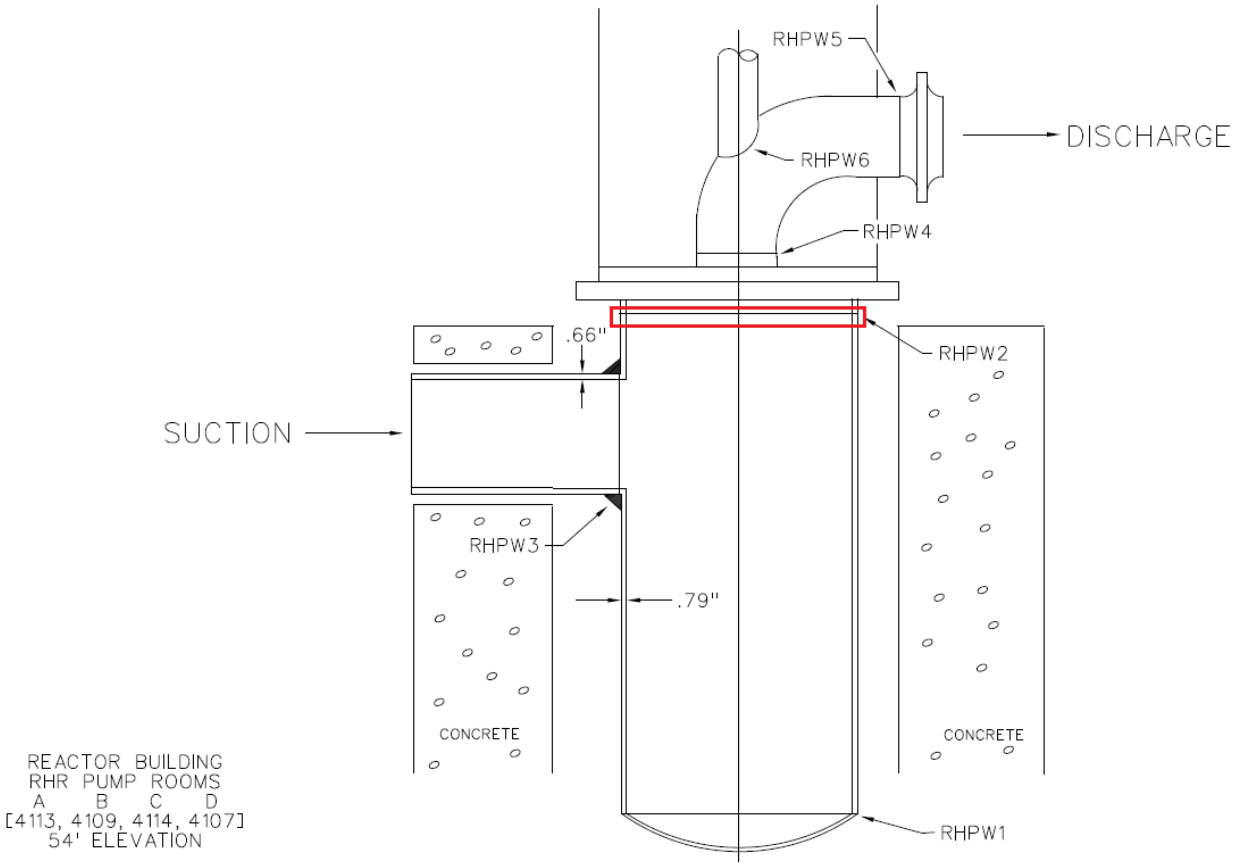


**Figure 1.18-1 Weld 1-DP-202-RHP-W2 (Extracted from Reference DWG B-3)**

This weld was Liquid Penetrant (PT) examined in Inspection Period 2, during the RFO17 refueling outage in 2012. The weld was examined under Item No. C6.10 and the NDE data came from Liquid Penetrant Report No.: PT-12-001. The Code Required Area (CRA) was determined based on the requirements of Section XI, Figure IWC-2500-8. The corresponding CRA as shown on that Figure is A-B. However, the CRA for this weld could not be examined fully because the pump was too close to the concrete pump pedestal. The coverage for the examination resulted in total PT coverage of **18.04%** as shown on Figure 1.18-2. No recordable indications were detected during this examination.

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FRAMATOME ANP

## SURFACE EXAMINATION COVERAGE REPORT

| | |
|---|---|
| **CUSTOMER:** HOPE CREEK, RFO 10 | **SYSTEM:** RESIDUAL HEAT REMOVAL SYSTEM PUMPS |
| **SUMMARY NO:** 250490 | **COMPONENT ID:** RHP-W2 |

### SURFACE EXAMINATIONS

**1.0 CALCULATE REQUIRED EXAMINATION AREA**

Calculate Examination Area (Length X Width = A1) : 149.67 **X** 2.5 **=** 374.180 sq.in.

**2.0 CALCULATE AREA NOT EXAMINED**

2.1

| | Length of Limitation | | Width of Limitation | | Area Not Examined | |
|---|---|---|---|---|---|---|
| A. | 122.67 | X | 2.50 | = | 306.675 | sq.in. |
| B. | | X | | = | | |
| C. | | X | | = | | |
| D. | | X | | = | | |

2.2 Calculate Total Area Not Examined

(The sum of Area: A + B + C + D = A2) 306.675

**3.0 CALCULATE PERCENT AREA NOT EXAMINED**

3.1 Calculate Percent of Area Not Examined (A2/A1 X 100 = LP): 81.959

**4.0 TOTAL EXAMINATION COVERAGE OBTAINED**

4.1 Calculate Percent of Total Area Examined (100 - LP): 18.041%

### LIMITATION EXPLANATION / REMARKS

Obstruction created by concrete pump foundation.

Examined from 15-1/2" CW to 0 to 11-1/2" CCW.

FACTORY MUTUAL
INSURANCE COMPANY
10-20-04

**Figure 1.18-2 Weld 1-DP-202-RHP-W2 Limitations**

## 1.19 Weld 1-DP-202-RHP-W3 – "D" Residual Heat Removal Pump (RHP) Casing Weld

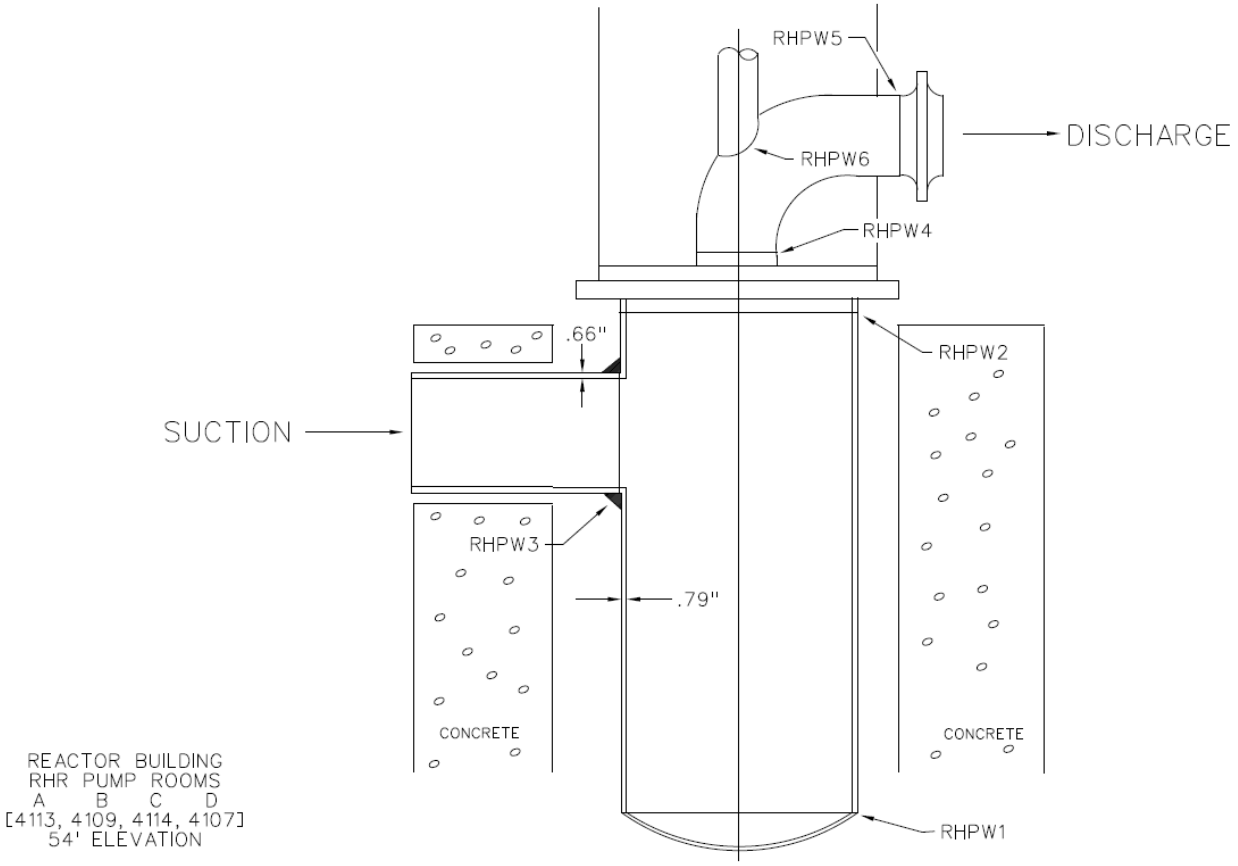


**Figure 1.19-1 Weld 1-DP-202-RHP-W3 (Extracted from Reference DWG B-3)**

This weld was Liquid Penetrant (PT) examined in Inspection Period 2, during the RFO17 refueling outage in 2012. The weld was examined under Item No. C6.10 and the NDE data came from Liquid Penetrant Report No.: PT-12-002. The Code Required Area (CRA) was determined based on the requirements of Section XI, Figure IWC-2500-8. The corresponding CRA as shown on that Figure is A-B. However, the CRA for this weld could not be examined fully because the pump was too close to the concrete pump pedestal. The coverage for the examination resulted in total PT coverage of **29.90%** as shown on Figure 1.19-2. No recordable indications were detected during this examination.

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FRAMATOME ANP

## SURFACE EXAMINATION COVERAGE REPORT

| | |
|---|---|
| **CUSTOMER:** HOPE CREEK, RFO 10 | **SYSTEM:** RESIDUAL HEAT REMOVAL SYSTEM PUMPS |
| **SUMMARY NO:** 250500 | **COMPONENT ID:** RHP-W3 |

### SURFACE EXAMINATIONS

**1.0 CALCULATE REQUIRED EXAMINATION AREA**

Calculate Examination Area (Length X Width = A1) : 97.0 X 2.25 = 218.250 sq.in.

**2.0 CALCULATE AREA NOT EXAMINED**

2.1

| | Length of Limitation | | Width of Limitation | | Area Not Examined | |
|---|---|---|---|---|---|---|
| A. | 68.00 | X | 2.25 | = | 153.000 | sq.in. |
| B. | | X | | = | | |
| C. | | X | | = | | |
| D. | | X | | = | | |

2.2 Calculate Total Area Not Examined

(The sum of Area: A + B + C + D = A2) 153.000

**3.0 CALCULATE PERCENT AREA NOT EXAMINED**

3.1 Calculate Percent of Area Not Examined (A2/A1 X 100 = LP): 70.103

**4.0 TOTAL EXAMINATION COVERAGE OBTAINED**

4.1 Calculate Percent of Total Area Examined (100 - LP): 29.897%

### LIMITATION EXPLANATION / REMARKS

Obstruction created by concrete pump foundation.

Examined from 17-1/2" CCW to 0 to 11-1/2" CW.

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**Figure 1.19-2 Weld 1-DP-202-RHP-W2 Limitations**

## 1.20 Weld 1-BG-6DBA-001-29 – Reactor Water Cleanup System (6”) Pipe–to-Valve Weld

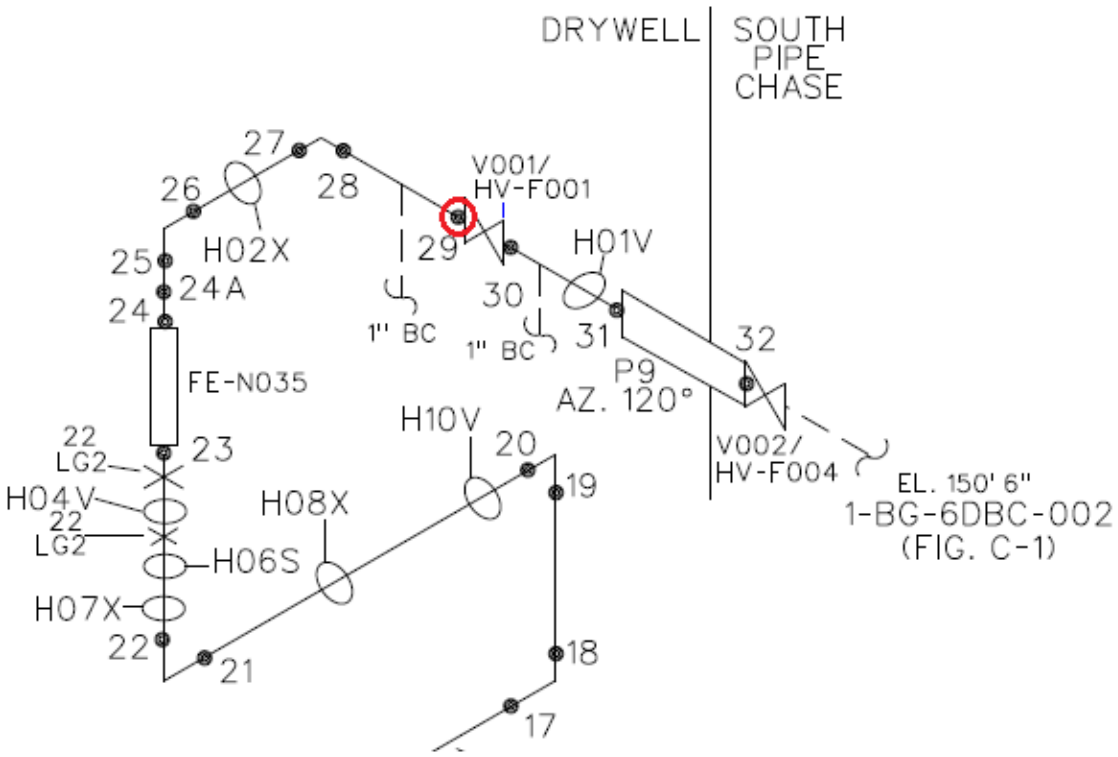


**Figure 1.20-1 Weld 1-BG-6DBA-001-29 (Extracted from Reference DWG A-36)**

This weld was UT examined using 45° and 60° shear waves in Inspection Period 3, during the RFO19 refueling outage in 2015 to meet the requirements of the RI-ISI Program under Request for Alternative HC-I3R-01, Reference 9 as supplemented by Code Case N-578-1. The weld was examined under Item No. R1.20-4, for welds that are not subject to a degradation mechanism and the NDE data came from UT Report No.: UT-15-035. The UT Code Required Volume (CRV) was determined based on the requirements of the RI-ISI Program and Section XI, Figure IWB-2500-8(c). The corresponding CRV as shown on that Figure is C-D-E-F and there is no increased volume requirement for this Item No. R1.20. However, the CRV for this weld could not be examined fully because of a limitation due to the valve configuration. The examination resulted in total UT coverage of **81.50%** as described in the Calculation Coverage Data section and shown on Figure 1.20-2. No recordable indications were detected during this examination.

Section XI Appendix VIII and Supplements used for this UT examination were implemented using procedure 54-ISI-835-14 Rev. 14 “Ultrasonic Examination of Ferritic Piping Welds”

## Calculation Coverage Data

| Table 1.20-1 – Weld 1-BG-6DBA-001-29, Examination Coverage Summary | | | | | |
|---|---|---|---|---|---|
| **Examination Volume & Weld Dimensions in Inches** | | | | | |
| **Length** = 20.8” | **Width** = 0.75” | **Height** = Not Determined | **Weld Thickness** = 0.432” | **Weld Length** = 20.8” | **Weld Width** = 0.75” |
| **Weld 1-BG-6DBA-001-29 – Branch Connection-to-Pipe Weld 4”** | | | | | |
| **Required Angles/Scans** | | | | | |
| **Angle and Wave Mode** [1] | **Upstream Axial** | **Upstream Circumferential** | **Downstream Axial** | **Downstream Circumferential** | |
| 45°S | 81.5% | 81.5% | 0% | 0% | |
| 60°S | 81.5% | N/A | 0% | N/A | |
| **Code Coverage Total** [2] **=** | | | | **81.5%** | |
| **Best Effort Coverage (Maximum 25%) Total** [3] **=** | | | | **N/A** | |

**NOTES:**

(1) L = Longitudinal Wave, S = Shear Wave, or RL = Refracted Longitudinal Wave.
(2) Code Coverage Total refers to the maximum percentage of the required examination volume that is effectively examined with the qualified examination procedures used.
(3) Best Effort Coverage refers to the required examination past the centerline of Austenitic or Dissimilar Metal Welds that are examined in the axial beam direction with an Appendix VIII demonstrated procedure for single sided access.

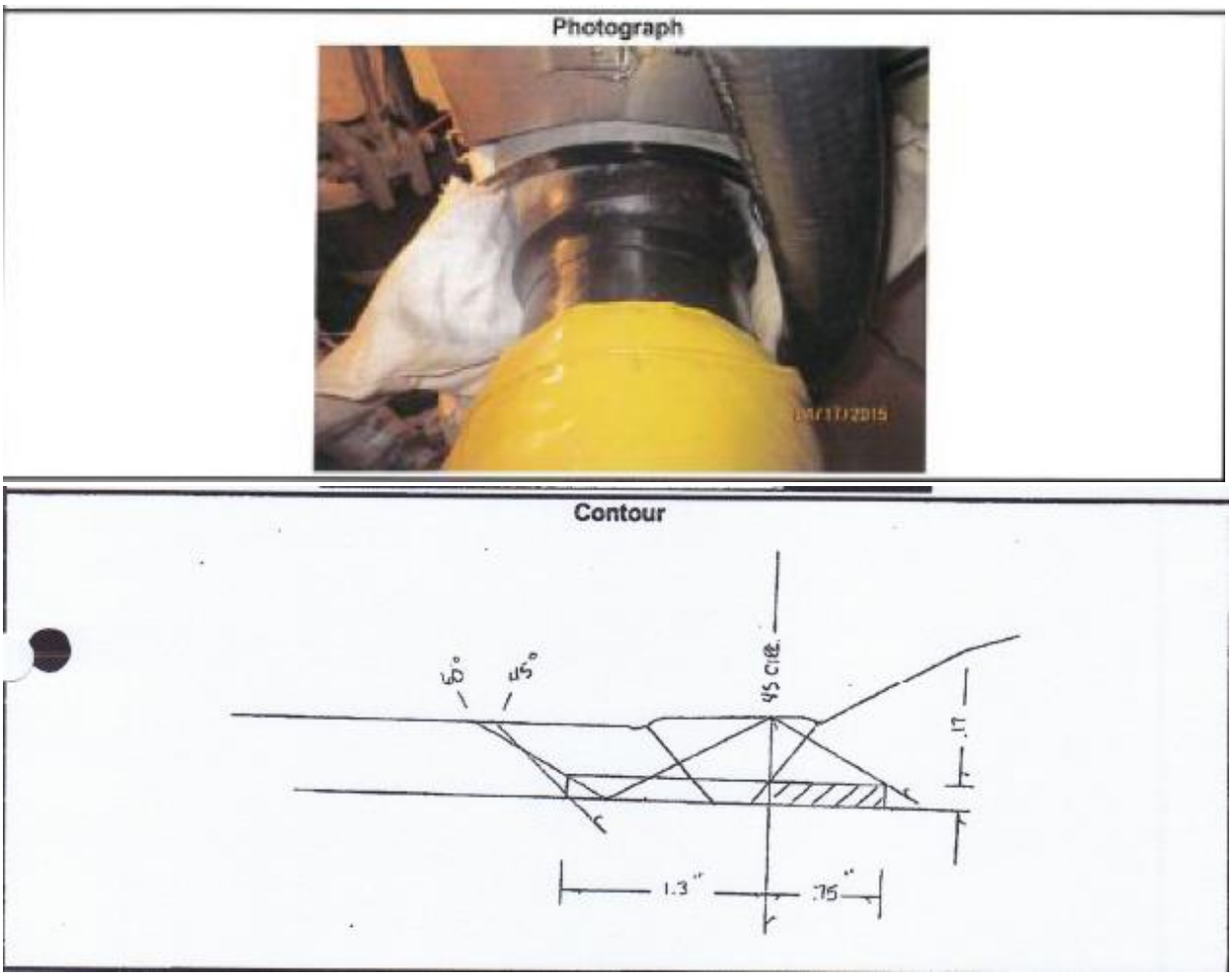


**Figure 1.20-2 Weld 1-BG-6DBA-001-29 Coverage Plot**