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July 10, 2013

PG&E Letter DCL-13-070

10 CFR 50.55a

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

Docket No. 50-323, OL-DPR-82
Diablo Canyon Power Plant (DCPP) Unit 2
ASME Section XI Inservice Inspection Program Request for Relief NDE-PNS-U2 to Allow Use of Alternate Examination Volume Coverage Requirements

Dear Commissioners and Staff:

Pursuant to 10 CFR 50.55a(g)(5)(iii), Pacific Gas and Electric Company (PG&E) hereby requests NRC approval of Inservice Inspection (ISI) Request for Relief NDE-PNS-U2 for the Diablo Canyon Power Plant Unit 2 third ISI Interval.

Relief is requested from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, for examination coverage of Class 1 pressurizer nozzle-to-head welds. The details of the proposed request are enclosed.

PG&E requests approval of NDE-PNS-U2 by July 10, 2014.

PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter.

If you have any questions regarding the information enclosed, or other ISI program activities, please contact Mr. Tom Baldwin at (805) 545-4720.

Sincerely,

Barry S. Allen

Barry S. Allen

rntt/4231/SAPN 50033145
Enclosure
cc: Diablo Distribution
cc/encl: Arthur T. Howell, III, NRC Region IV
Thomas R. Hipschman, NRC Senior Resident Inspector
James T. Polickoski, NRR Project Manager
State of California, Pressure Vessel Unit

10 CFR 50.55a Relief Request NDE-PNS-U2

Relief Request in Accordance with 10 CFR 50.55a(g)(5)(iii)

--Inservice Inspection Impracticality--

1. ASME Code Component(s) Affected

The Diablo Canyon Power Plant (DCPP), Unit 2, American Society of Mechanical Engineers (ASME) Section XI, Code Class 1 Pressurizer nozzle-to-head welds (three welds) are listed below:

Code Cat/Item	Description	Weld Number	Outage Examined
B-D/B3.110	Nozzle-to-Vessel (Head) Weld	WIB-346 (Spray Nozzle)	2R16
B-D/B3.110	Nozzle-to-Vessel (Head) Weld	WIB-422A (RV-8010B Inlet)	2R16
B-D/B3.110	Nozzle-to-Vessel (Head) Weld	WIB-368 (RV-8010A Inlet)	2R17

2. Applicable Code Edition and Addenda

The DCPP Unit 2 third Inservice Inspection (ISI) Interval Program Plan is based on the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition with 2003 Addenda.

3. Applicable Code Requirement

ASME Section XI, Table IWB-2500-1, Category B-D, Item B3.110 requires that pressurizer nozzle-to-head welds be volumetrically examined once during each ISI interval. Essentially 100 percent of the weld and adjacent base material is to be examined in accordance with the requirements of Appendix I, I-2100. The applicable examination volume is defined by Figure IWB-2500-7(b) and the examination is performed per the rules of ASME Section V, Article 4.

4. Impracticality of Compliance

The Unit 2 pressurizer nozzle-to-head weld configurations are such that essentially 100 percent coverage of the ASME Code required examination volume is not practicable, as determined during the third ISI interval examinations conducted in the DCPP Unit 2 sixteenth and seventeenth refueling outages (2R16 and 2R17).

Background Information

The Unit 2 pressurizer top head is of hemispherical design and is fabricated from SA-533 Grade A CL 2 material, while the nozzle forgings are SA-508 CL 2 material. The head is 2.50 inches nominal thickness and is clad on the inside surface with weld deposited stainless steel. The pressurizer nozzles are the "flange type" design with the weld extending concentrically around the nozzle forging and through the full thickness of the head. The weld joint design is an unequal depth double U – groove design with an included groove angle of 20°. Review of the available vendor records indicates that the nozzle to shell welds were made using filler metals whose composition and mechanical properties are similar to the joined base metals.

The WIB-346 and WIB-422A nozzle-to-head welds were examined in 2R16 to the extent practicable using a combination of 45°, 60° and 70° angled shear waves and 0° longitudinal waves. The 45° and 60° shear wave exams interrogate the full thickness, while the 70° shear wave is used to interrogate the region of the exam volume close to the outside surface (exam surface) to a depth of one inch.

WIB-368 nozzle-to-head weld was examined in 2R17 to the extent practicable using a combination of 45° and 60° angled shear waves and 0° longitudinal waves to interrogate the entire exam volume. Between the 2R16 and 2R17 refueling outages, the exam procedure was enhanced to include near surface calibrations for both the 45° and 60° search units to be used in place of the 70° search unit.

No flaws were detected in any of the exams on the subject welds.

The following table summarizes the estimated exam volume coverage attained for each weld in the four scan directions and a combined average value. Coverage values are based on 45° and 60° angles only since they interrogate the full part thickness and would be expected to detect service induced flaws emanating from the inside surface. Circumferential scan exam volume coverage is identical in clockwise and counter-clockwise directions; therefore identical values are reported in both columns. Figures 1 to 15 provide graphic representation of the exam extent for each of the inspection angles and directions used to determine coverage values. Exam volume and coverage is determined either from actual part measurements or design drawings.

Weld Number	Radial-In Scan Exam Volume Coverage[1]	Radial-Out Scan Exam Volume Coverage[2]	Circumferential Scan (clockwise) Exam Volume Coverage[3]	Circumferential Scan (counter-clockwise) Exam Volume Coverage[3]	Average Combined Coverage[4]
WIB-346	82%	30%	76%	76%	66%
WIB-422A	94%	36%	77%	77%	71%
WIB-368	90%	26%	72%	72%	65%

[1] Combined coverage average for Radial-In scan for 45° and 60° angles.
[2] Combined coverage average for Radial-Out scan for 45° and 60° angles.
[3] Circumferential scan coverage is identical for 45° and 60° angles and for both clockwise and counter-clockwise scan directions.
[4] The reported combined coverage value is an equal weighted average of the coverage values from each of the four scan directions.

Impracticality

Compound curvatures of the nozzle forging to shell transition and the nozzle reinforcement constitute geometric obstructions that preclude full examination volume coverage from the outside surface. The coverage limitations are primarily associated with the radial-out oriented scans, and to a lesser extent the radial-in oriented scans and circumferential scans in both directions.

An inherent design characteristic of the DCPP nozzle configuration is that there is insufficient setback distance for the radial–out scan beam to reach the inside surface of the exam area. The nozzle reinforcement also prevents the positioning of circumferential scan search units to allow full coverage of the exam volume in the nozzle base material.

Additionally, the WIB-346 weld reinforcement causes search unit lift-off resulting in small reductions in coverage, primarily in the upper region of the examination volume.

Alternatives such as examination from the inside surface have been considered but are not deemed practical due the component internal configuration, extremely limited access, and environment.

5. Burden Caused by Compliance

"Essentially 100 percent" coverage of the exam volume would require redesign of the pressurizer to (a) machine away the nozzle reinforcement, (b) move the weld farther back from the nozzle reinforcement, or (c) eliminate the weld by integrally incorporating the nozzle into the head. Either of the latter two modifications would effectively result in having to replace the entire pressurizer to accommodate full coverage of the exam area as specified by ASME Code.

Removing the weld reinforcement on WIB-346 would result in only small incremental increases in exam volume coverage at the cost of reducing the pressurizer head structural margin, and significant personnel exposure. It is estimated that 20-30 man hours would be required to remove the reinforcement and produce a surface contour required to prevent lift-off of the search units. This effort in a 20 millirem (mR) dose rate field would result in total exposure of 400-600mR. Note that this estimate considers that shielding is employed to reduce exposure from the significant source term typically present at the top of the pressurizer.

6. Proposed Alternative and Basis for Use

PG&E proposes that the alternative ultrasonic examinations conducted to the maximum extent practicable provide reasonable assurance that the structural integrity of the subject welds remains intact.

The 2R16 and 2R17 examinations were implemented to the extent practicable using manual scan techniques and small footprint search units in an effort to attain the greatest possible coverage of the required examination volume. On all of the subject nozzle-to-head welds, the volume examined includes the weld and surrounding base material near the inside surface of the weld joint, which are typically the highest stress regions and where degradation would likely manifest should it occur.

Although the radial oriented scans are primarily performed from the head side of the nozzle, studies have found that inspections conducted on clad ferritic material are equally effective in detecting flaws whether the ultrasound has to propagate through the weldment or not (Reference 1). Therefore, it is expected that the ultrasonic techniques employed would have detected structurally significant flaws that may have occurred within the examination area.

The ultrasonic examinations, with estimated combined coverage values of 66, 71 and 65 percent for WIB-346, WIB-422A and WIB-368 respectively, provide reasonable assurance that the structural integrity of these welds remains intact and provides an acceptable level of quality and safety.

A failure of the pressurizer nozzle to shell weld could result in a loss of coolant accident. Depending on the size of the postulated break, the specific consequences will vary. At the smallest end of the break size spectrum, the charging system would be capable of maintaining reactor coolant system (RCS) pressure through normal makeup. Larger break sizes would result in depressurization of the RCS, a reactor trip, and a safety injection. The worst case consequence would occur if the nozzle-to-head welds were to suffer 360° circumferential cracking. In this case, the break size would be limited by the head penetration diameter which is less than pipe break diameter assumed in the DCPP design basis analysis.

Essentially no change to overall plant safety is expected due to implementation of the proposed alternative in lieu of the ASME Code requirement. This conclusion is based on the effectiveness of ultrasonic examination on clad ferritic material as previously described, and, little or no historical occurrence of large service induced planar flaws in this type of weldment.

7. Duration of Proposed Alternative

The proposed alternative will apply through the end of the third ISI interval which began on January 1, 2006, and is nominally scheduled to end March 12, 2016.

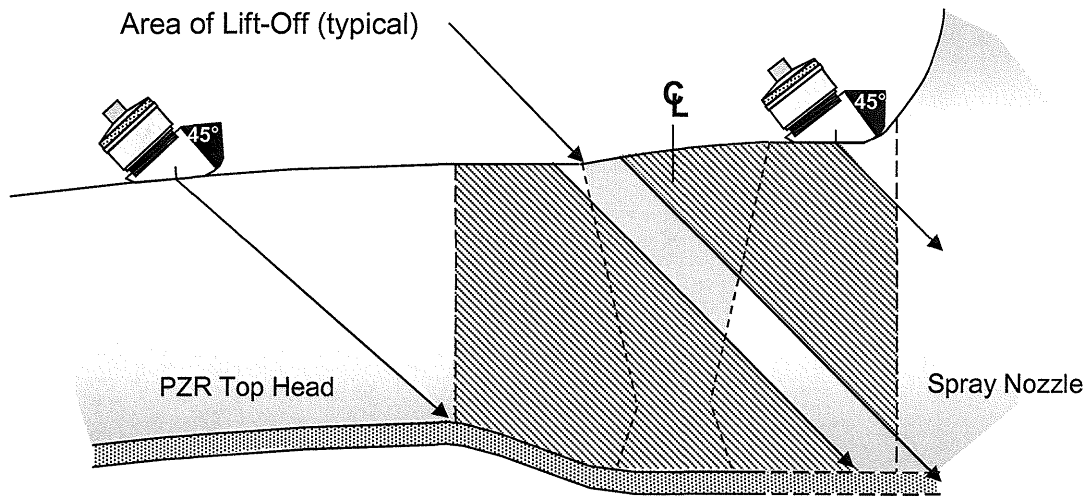
8. Precedents

This request is similar to relief ISI-6 approved for Calvert Cliffs Nuclear Power Plant (TAC numbers MA-9404 and MA-9405) and other comparable requests.

9. References

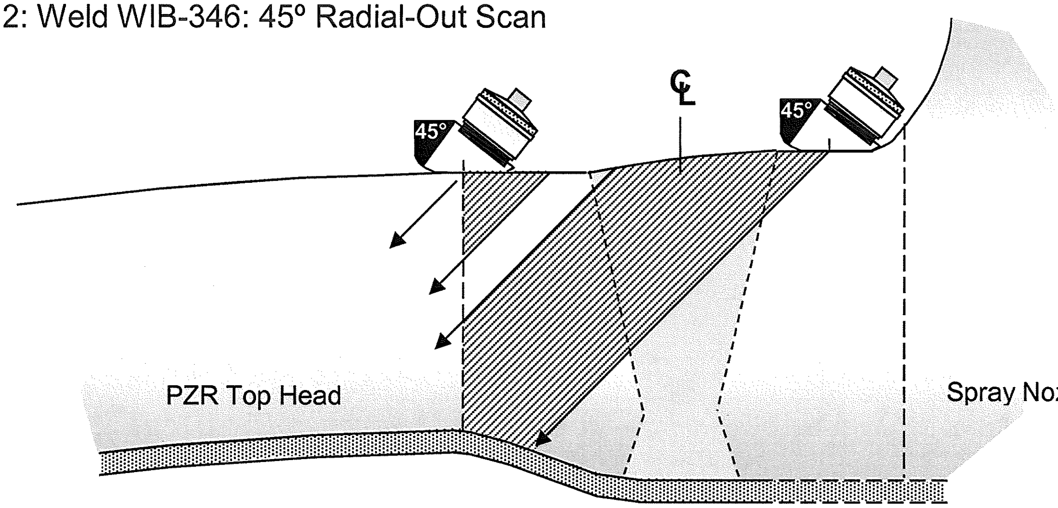
1. P.G. Heasler and S.R. Doctor, 1996. Piping Inspection Round Robin, NUREG/CR-5068, PNNL-10475, U.S. Nuclear Regulatory Commission, Washington, DC.

Figure 1: Weld WIB-346: 45° Radial-In Scan



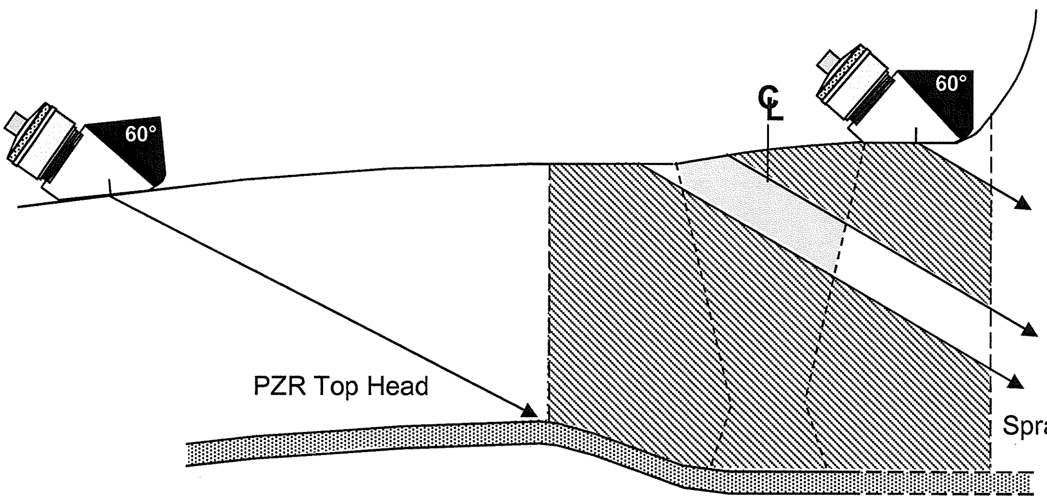
Exam Area = 14.8 in²
Area Examined = 12 in²
Full Length Examined
Coverage: 12 / 14.8 = <u>81.8%</u>

Figure 2: Weld WIB-346: 45º Radial-Out Scan



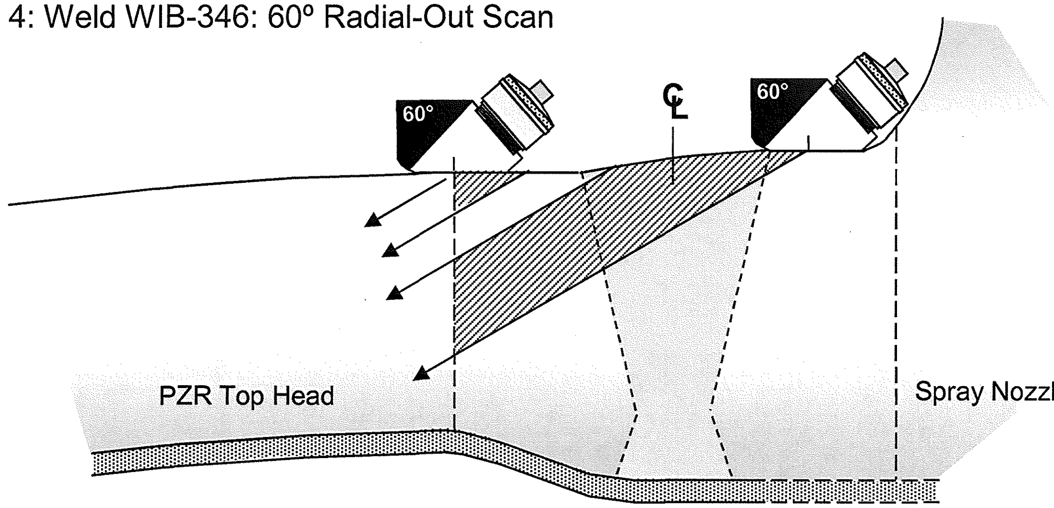
Exam Area = 14.8 in²
Area Examined: = 5.9 in²
Full Length Examined
Coverage: 5.9 / 14.8 = <u>39.9%</u>

Figure 3: Weld WIB-346: 60º Radial-In Scan



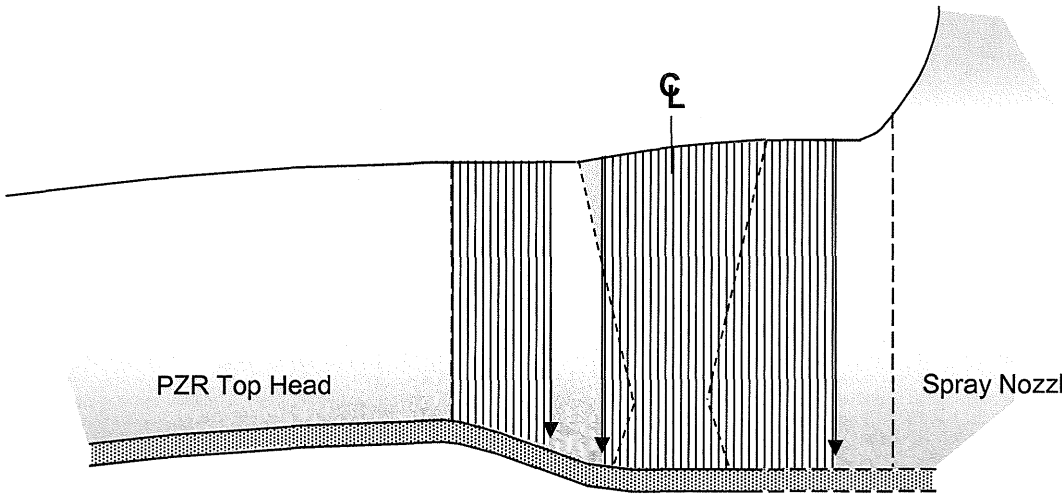
Exam Area = 14.8in²
Area Examined = 12.3 in²
Full Length Examined
Coverage: 12.3 / 14.8 = <u>83.1%</u>

Figure 4: Weld WIB-346: 60° Radial-Out Scan



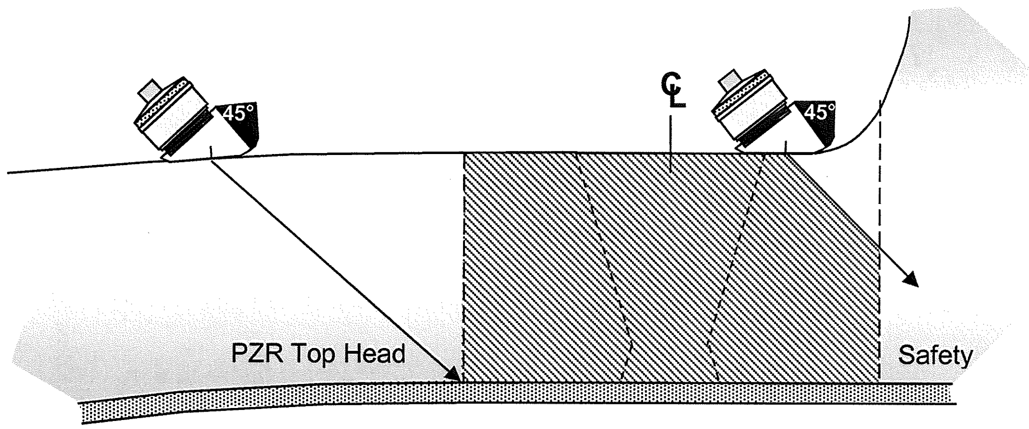
Exam Area = 14.8 in²
Area Examined = 3.0 in²
Full Length Examined
Coverage: 3.0 / 14.8 = 20.3%

Figure 5: Weld WIB-346: 45° and 60° CW/CCW Circumferential Scans



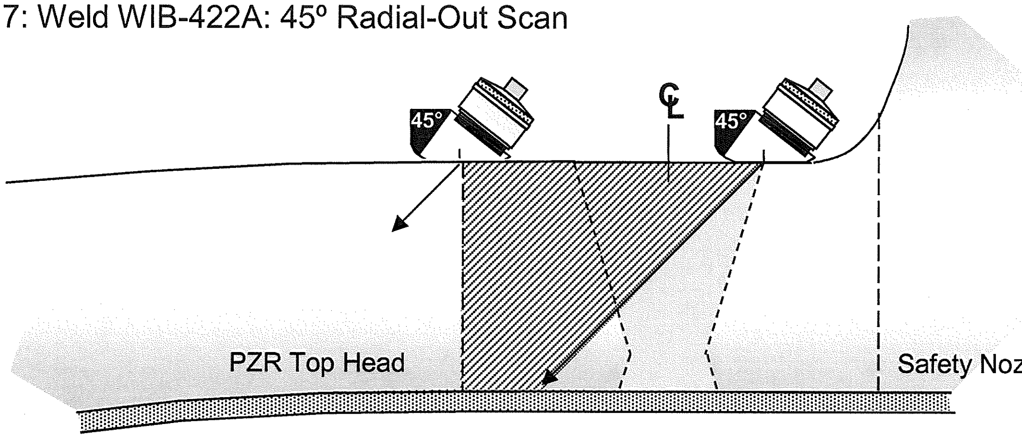
Exam Area = 14.8 in^2
Area Examined = 11.2 in^2
Full Length Examined
Coverage: 11.2 / 14.8 = 75.7%

Figure 6: Weld WIB-422A: 45º Radial-In Scan



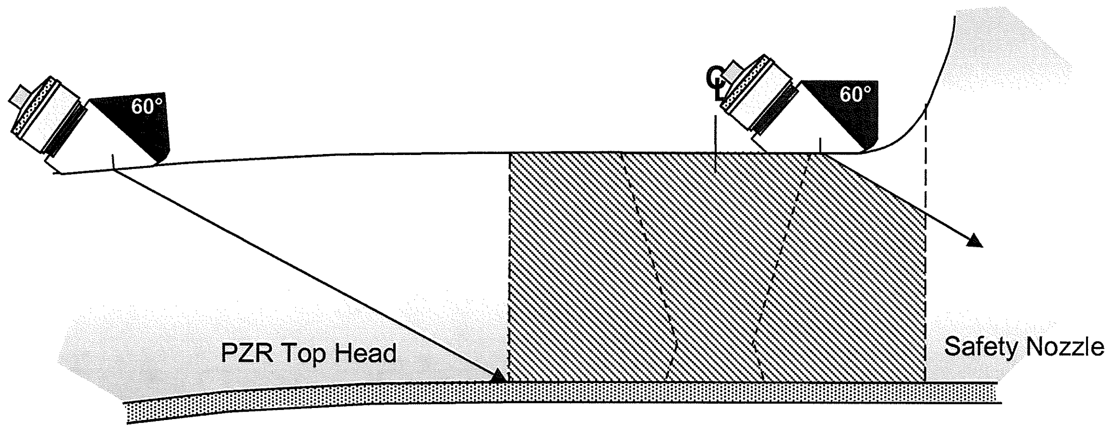
Exam Area = 10.7 in²
Area Examined = 10 in²
Full Length Examined
Coverage: 10 / 10.7= 93.5%

Figure 7: Weld WIB-422A: 45° Radial-Out Scan



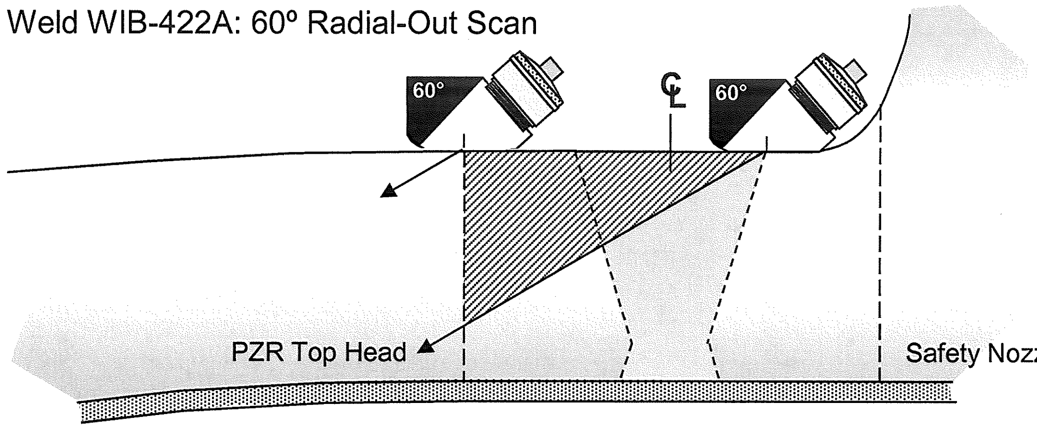
Exam Area = 10.7 in²
Area Examined = 4.8 in²
Full Length Examined
Coverage: 4.8 / 10.7 = 44.9%

Figure 8: Weld WIB-422A: 60° Radial-In Scan



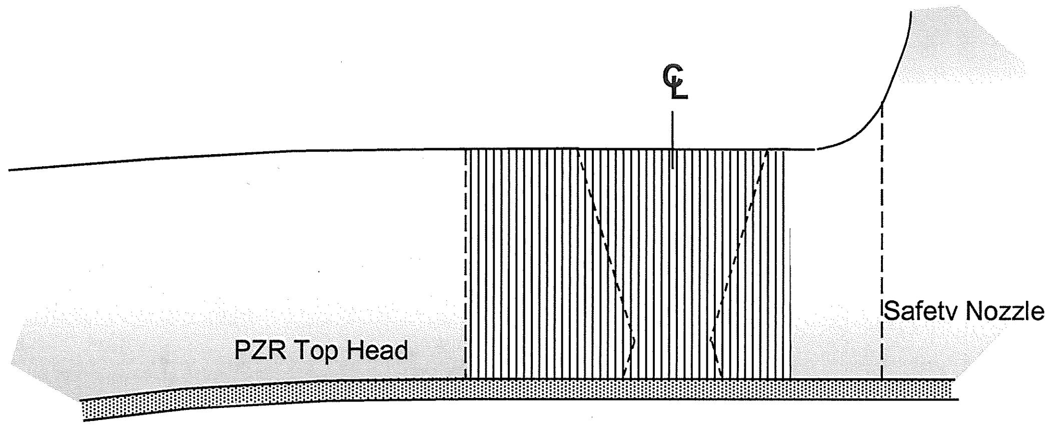
Exam Area = 10.7 in²
Area Examined = 10.2 in²
Full Length Examined
Coverage: 10.2 / 10.7= 95.3%

Figure 9: Weld WIB-422A: 60° Radial-Out Scan



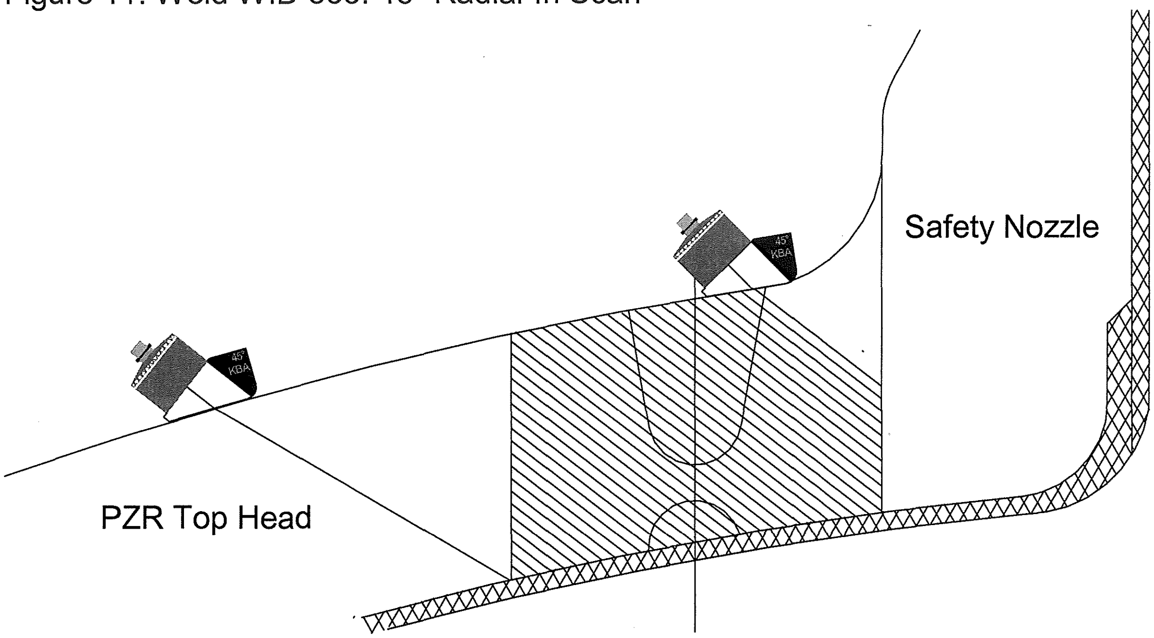
Exam Area = 10.7 in²
Area Examined = 3.0 in²
Full Length Examined
Coverage: 3.0 / 10.7= <u>28%</u>

Figure 10: Weld WIB-422A: 45° and 60° CW/CCW Circumferential Scans



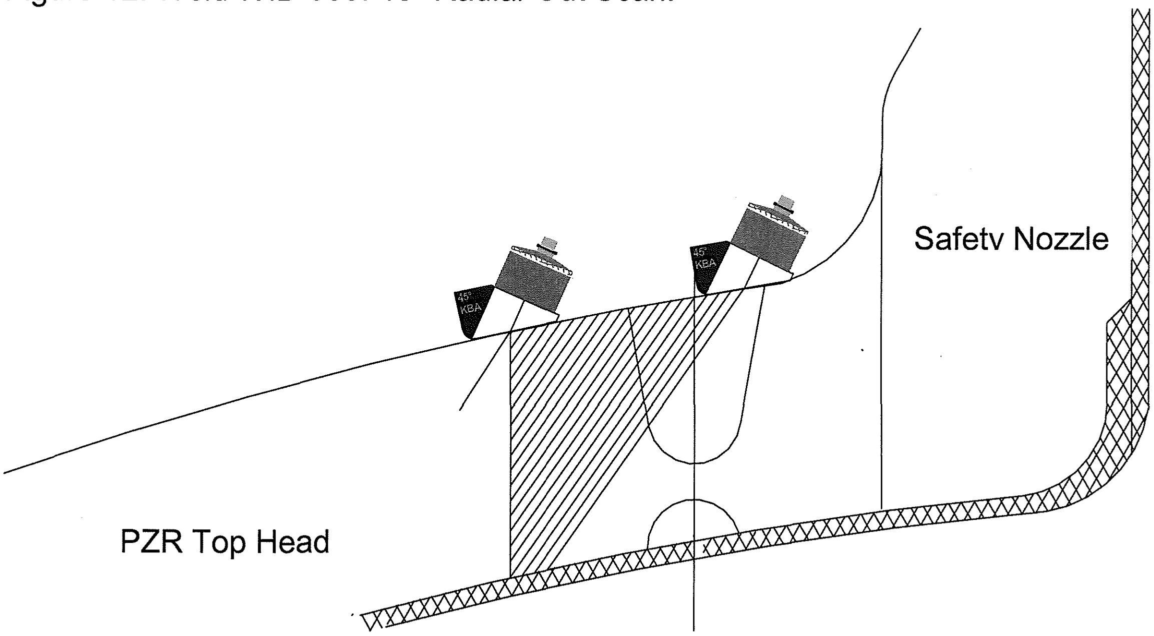
Exam Area = 10.7 in²
Area Examined = 8.3 in²
Full Length Examined
Coverage: 8.3 / 10.7 = 77.6%

Figure 11: Weld WIB-368: 45° Radial-In Scan



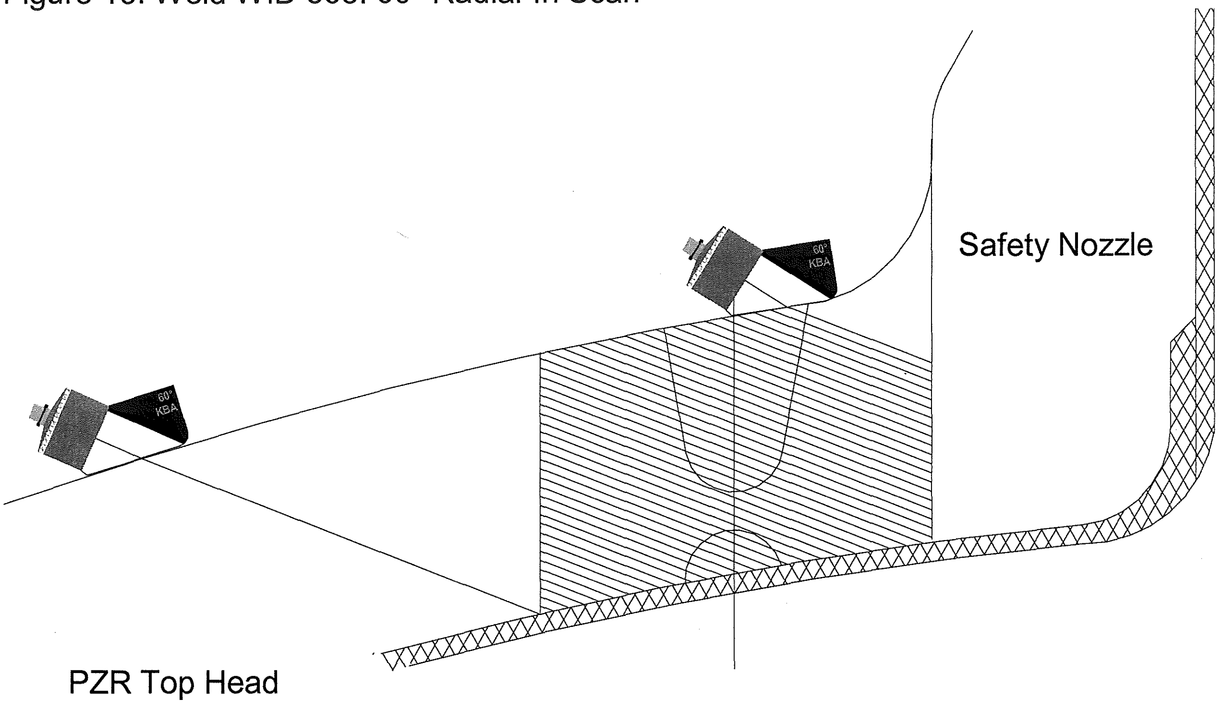
Exam Area = 10.59 in²
Area Examined = 9.38 in²
Full Length Examined
Coverage: 9.38/10.59 = <u>89%</u>

Figure 12: Weld WIB-368: 45° Radial-Out Scan.



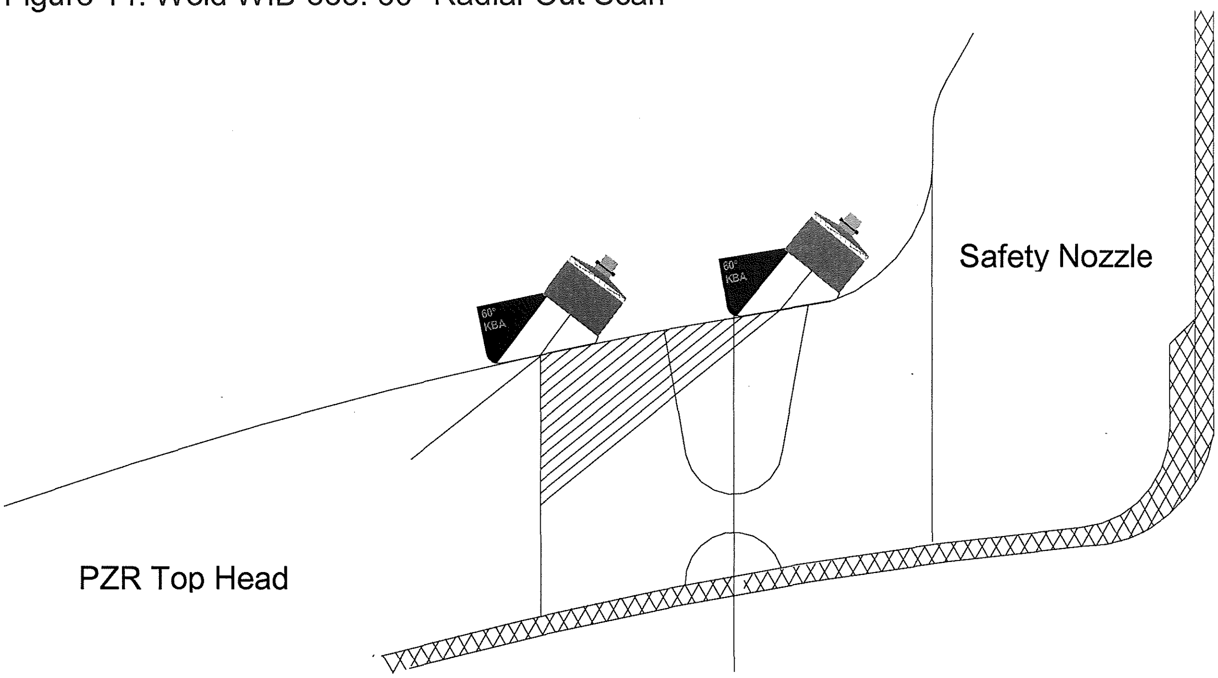
Exam Area = 10.59 in²
Area Examined = 3.73 in²
Full Length Examined
Coverage: 3.73/10.59 = 35%

Figure 13: Weld WIB-368: 60º Radial-In Scan



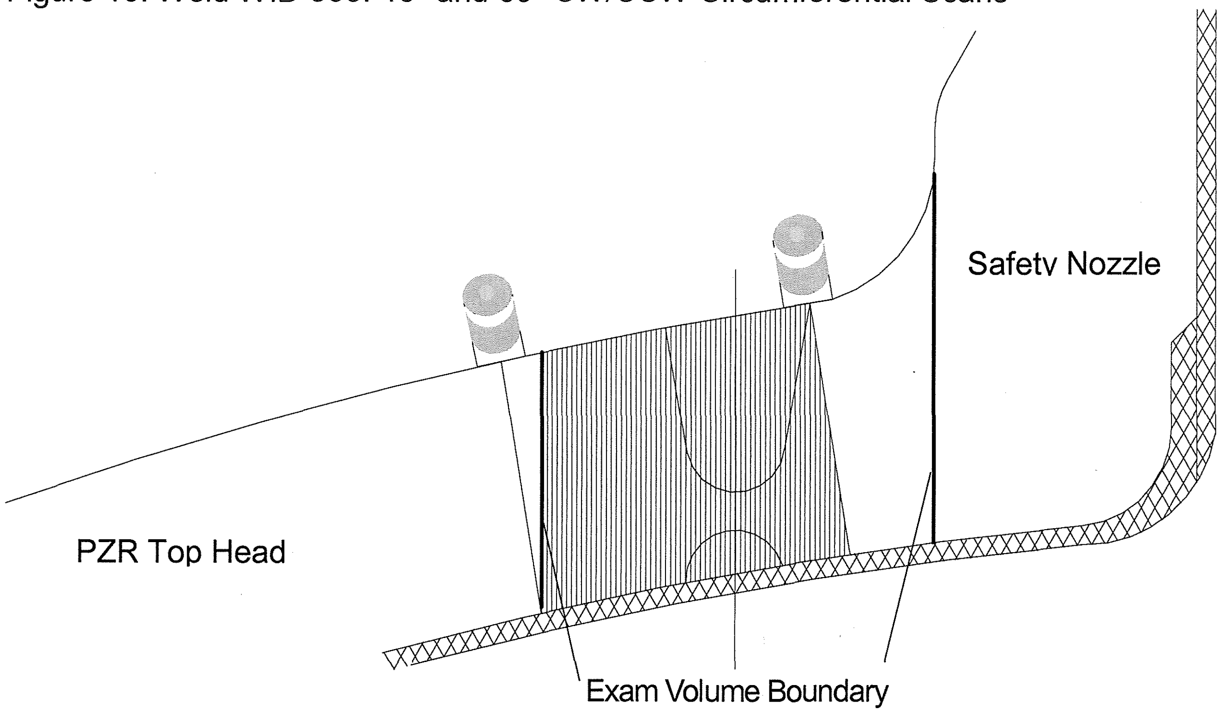
Exam Area = 10.59 in²
Area Examined = 9.62 in²
Full Length Examined
Coverage: 9.62/10.59 = 91%

Figure 14: Weld WIB-368: 60° Radial-Out Scan



Exam Area = 10.59 in²
Area Examined = 1.85 in²
Full Length Examined
Coverage: 1.85/10.59 = <u>17%</u>

Figure 15: Weld WIB-368: 45º and 60º CW/CCW Circumferential Scans



Exam Area = 10.59 in²
Area Examined = 7.67 in²
Full Length Examined
Coverage: 7.67/10.59 = 72%