



**Pacific Gas and
Electric Company®**

James M. Welsch
Site Vice President

Diablo Canyon Power Plant
Mail Code 104/6
P. O. Box 56
Avila Beach, CA 93424

805.545.3242
Internal: 691.3242
Fax: 805.545.4884

April 9, 2015

PG&E Letter DCL-15-048

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

10 CFR 50.55a

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-U2A 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-U2A 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 Request for Relief NDE-PNS-U2A by April 9, 2016. PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter.

If you have any questions or require additional information, please contact Mr. Philippe Soenen at (805) 545-6984.

Sincerely,

James M. Welsch

rntt/4231/50033145

Enclosure

cc: Diablo Distribution
cc/enc: Marc L. Dapas, NRC Region IV Administrator
Thomas R. Hipschman, NRC Senior Resident Inspector
Siva P. Lingam, NRC Project Manager
Gonzalo L. Perez, Branch Chief, California Department of Public Health
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-358 (RV-8010C Inlet)	2R18
B-D/B3.110	Nozzle-to-Vessel (Head) Weld	WIB-379 (Power RV Inlet)	2R18
B-D/B3.110	Nozzle-to-Vessel (Head) Weld	WIB-439A (Surge Line)	2R18

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 to be performed per the rules of ASME Section V, Article 4.

4. Impracticality of Compliance

The DCCP 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 DCCP Unit 2 eighteenth refueling outage (2R18).

Background Information

The Unit 2 pressurizer heads are of hemispherical design and are fabricated from SA-533 Grade A CL 2 material, while the nozzle forgings are SA-508 CL 2 material. The pressurizer top head is 2.50 inches nominal thickness and the bottom head is 3.0 inches nominal thickness; both are 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 degrees. 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-358, WIB-379, and WIB-439A nozzle-to-head welds were examined in 2R18 to the extent practicable using a combination of 35, 45, and 60 degree angled shear waves and 0 degree longitudinal waves. Where they can be applied, the 35, 45, and 60 degree shear wave exams interrogate the full thickness of the exam volume. Primarily, the 45 and 60 degree angles were used for the radial-in scans while the 35 and 45 degree angles were used for the radial-out scans to maximize coverage. The radial-in scans on WIB-439A (surge line nozzle) were supplemented with 35 degrees to obtain greater coverage in the area where access is limited by the heater tubes.

No reportable 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 the 35, 45, and 60 degree 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 limitations are the same in the clockwise and counter-clockwise directions resulting in identical exam volume coverage. Figures 1 to 14 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. Welds WIB-358 and WIB-379 are the same size and configuration and therefore have the same coverage values.

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-358	93.9%	54%	70.7%	70.7%	72.3%
WIB-379	93.9%	54%	70.7%	70.7%	72.3%
WIB-439A	75.9% ⁵	55.2%	82.1%	82.1%	73.8%

¹ Combined coverage for 45 and 60 degree angles, except that 35 degrees is also included on WIB-439A.

² Combined coverage for 35 and 45 degree angles.

³ Circumferential scan coverage is identical for 45 and 60 degree 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.

⁵ Radial-in scan coverage is the combined coverage of the unobstructed area (no heater tubes) and the obstructed areas.

Impracticality

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 DCPD nozzle configuration is that there is insufficient setback distance for the radial-out scan beam to reach the inside surface of the entire exam area. In the case of the surge line nozzle (Weld WIB-439A), the pressurizer heater tube penetrations also restrict the setback distance for the radial-in scans.

Alternatives such as examination from the inside surface have been considered but are not deemed practical due to 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 either: (a) change the nozzle forging design to move the weld farther from the nozzle boss, or; (b) eliminate the weld by integrally incorporating the nozzle into the head. Either of the 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.

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 2R18 examinations were implemented to the extent practicable using manual scan techniques and small footprint search units, supplemented with low examination angles 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 (with the exception of a very small area on the surge line nozzle), which are typically the highest stress regions and where degradation would likely manifest, should it occur.

Although the radial-in 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 72.3, 72.3, and 73.8 percent for WIB-358, WIB-379, and WIB-439A 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 a 360 degree circumferential break. In this case, the break size would be limited by the head penetration diameter, which is less than pipe break diameter assumed in the DCPD 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.

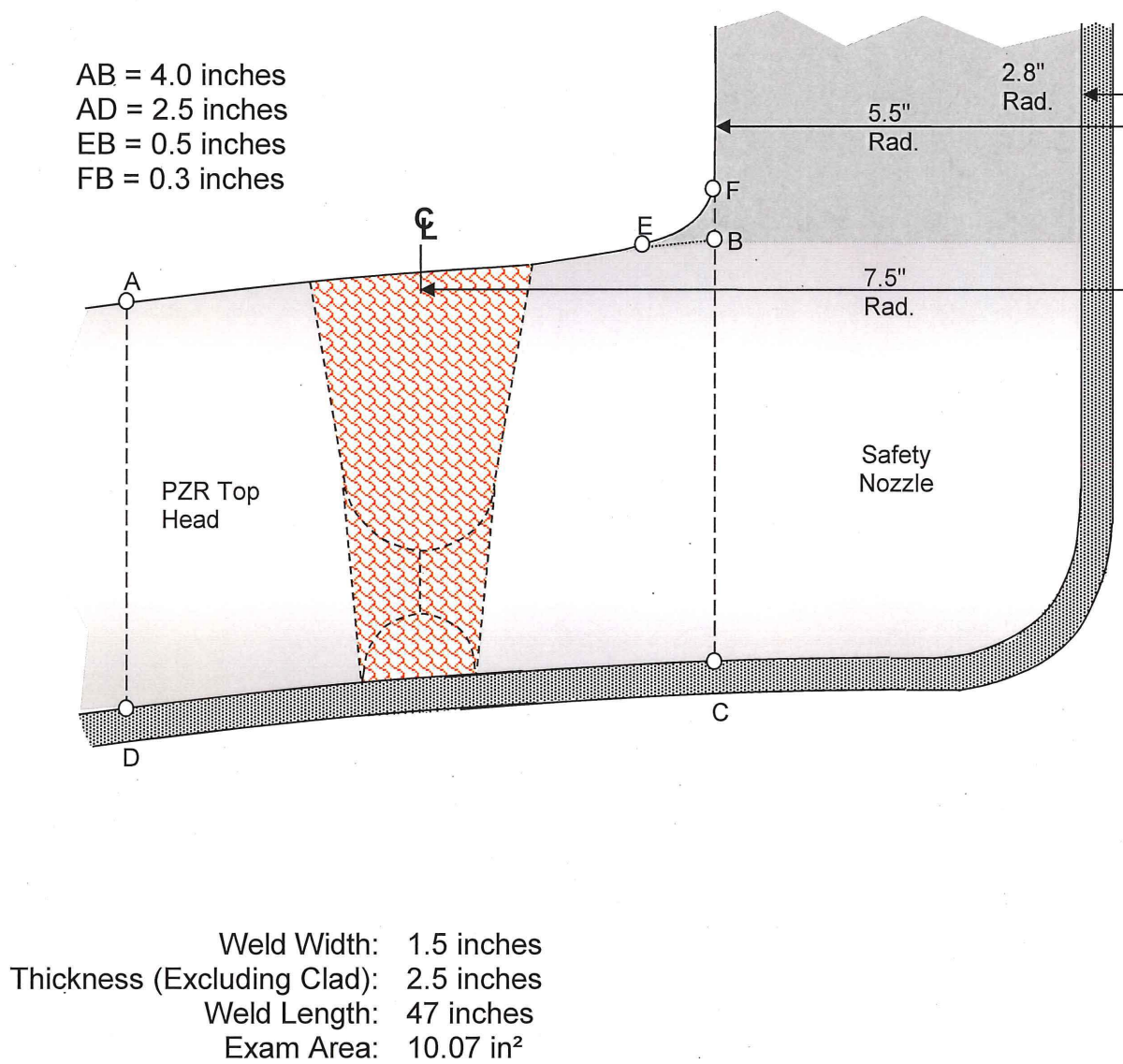
8. **Precedents**

This request is similar to Relief NDE-PNS-U2 approved for Diablo Canyon Power Plant Unit 2 Pressurizer Nozzles (ADAMS Accession number ML14104B613 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.

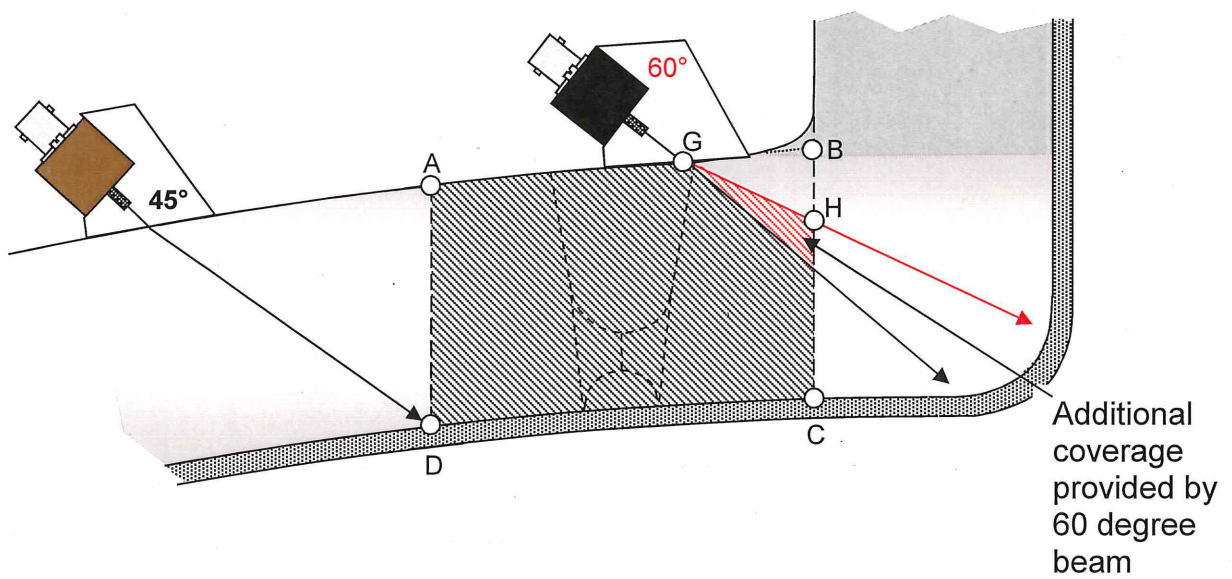
Figure 1: WIB-358 (RV-8010C Nozzle, Top Head) - Weld Configuration and Exam Area



Not to Scale

**Figure 2: WIB-358 (RV-8010C Nozzle, Top Head) - 45 and 60 Degree
Radial-In Scans**

AB = 4.0 inches
AD = 2.5 inches
GB = 1.35 inches
HB = 0.8 inches

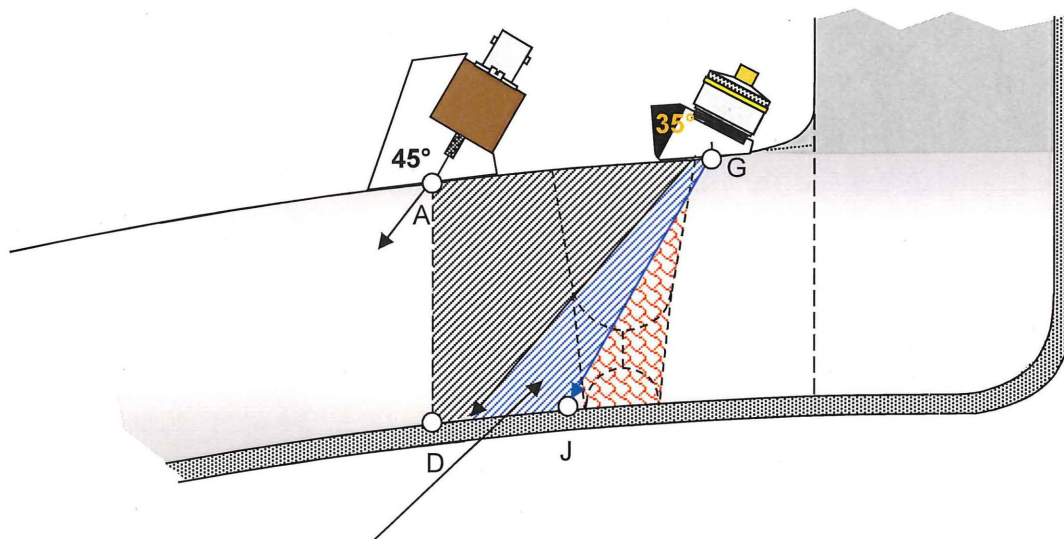


Exam Area: 10.07 in²
Examined: 9.46 in²
Coverage: 93.9 percent

Not to Scale

**Figure 3: WIB-358 (RV-8010C Nozzle, Top Head) - 35 and 45 Degree
Radial-Out Scans**

AG = 2.95 inches
AD = 2.5 inches
DJ = 1.4 inches



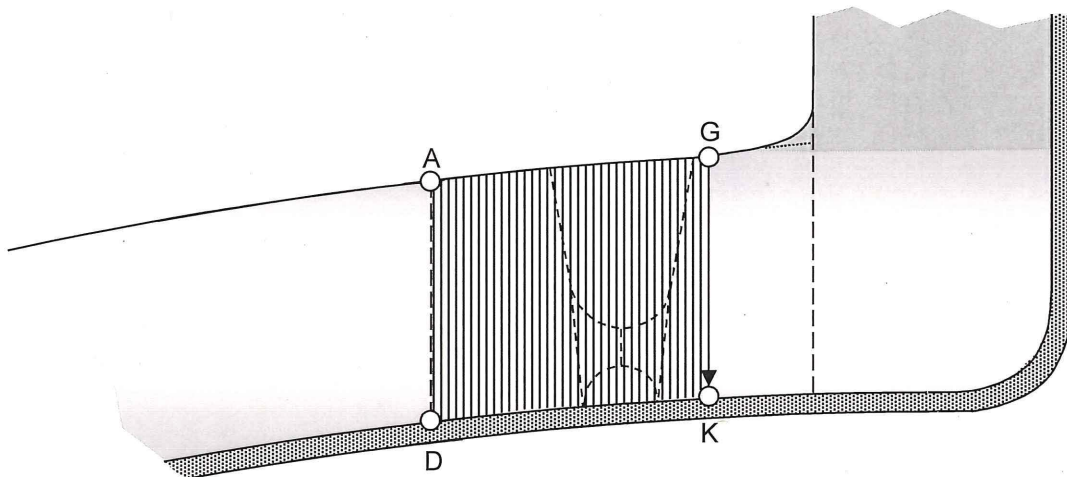
Additional coverage
provided by 35 degree
beam

Exam Area: 10.07 in²
Examined: 5.44 in²
Coverage: 54 percent

Not to Scale

Figure 4: WIB-358 (RV-8010C Nozzle, Top Head) – 45 Degree Circumferential Scans

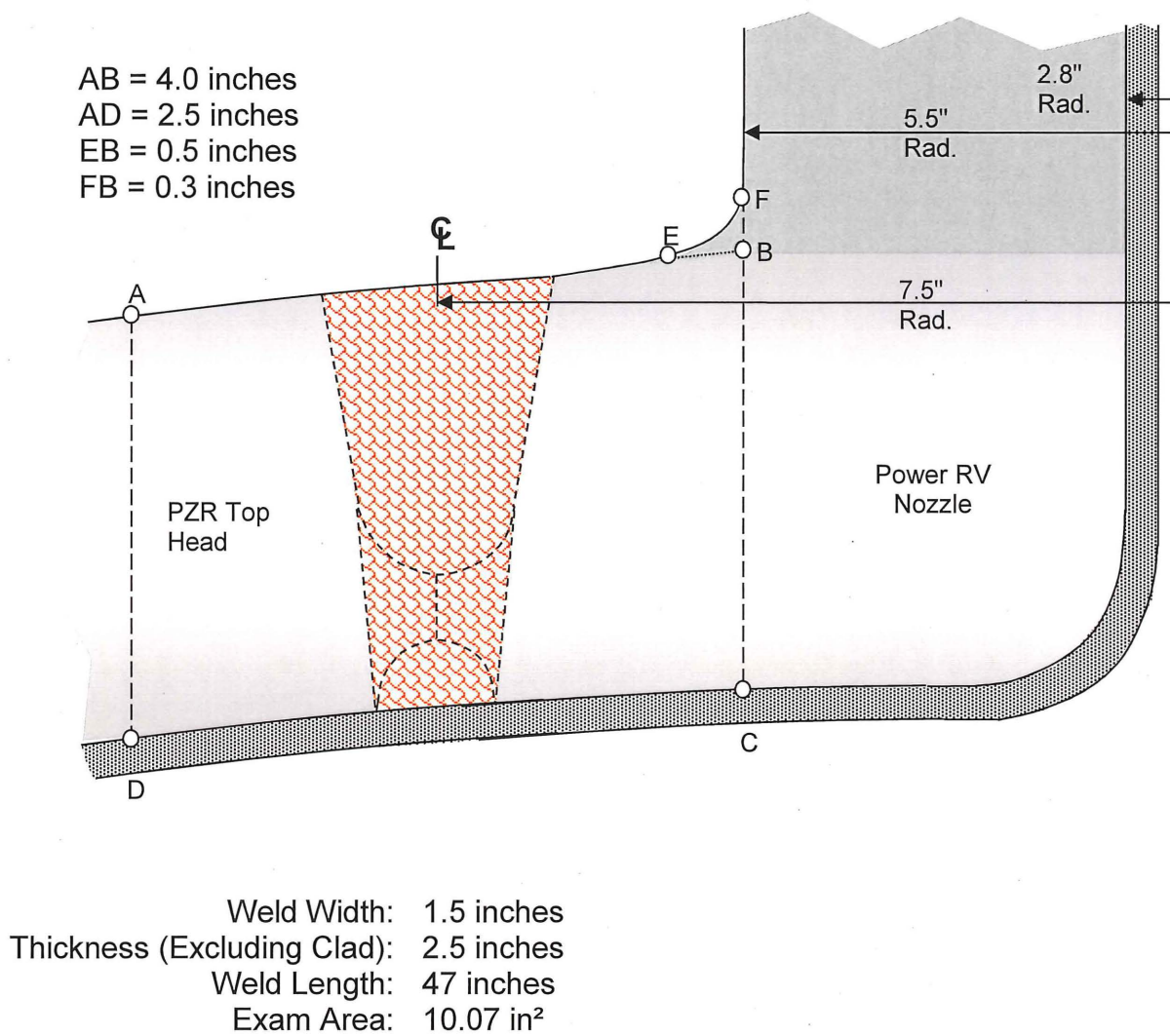
AG = 2.85 inches
AD = 2.5 inches



Exam Area: 10.07 in²
Examined: 7.12 in²
Coverage 70.7 percent

Not to Scale

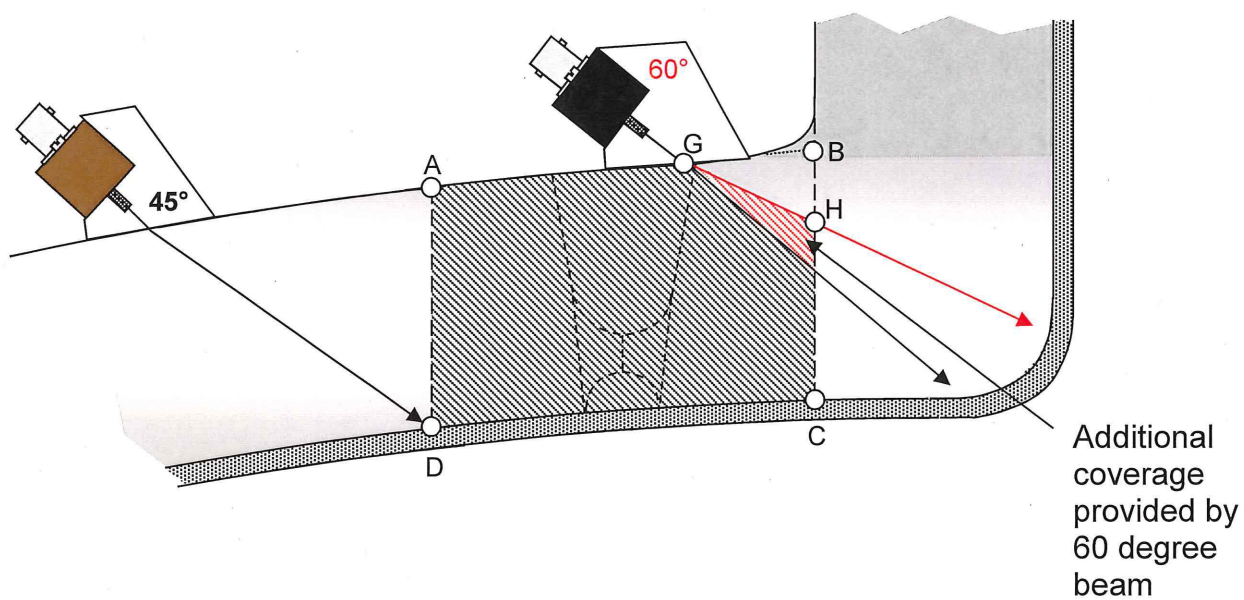
Figure 5: WIB-379 (Power Relief Nozzle, Top Head) - Weld Configuration and Exam Area



Not to Scale

Figure 6: WIB-379 (Power Relief Nozzle, Top Head) - 45 and 60 Degree Radial-In Scans

AB = 4.0 inches
AD = 2.5 inches
GB = 1.35 inches
HB = 0.8 inches

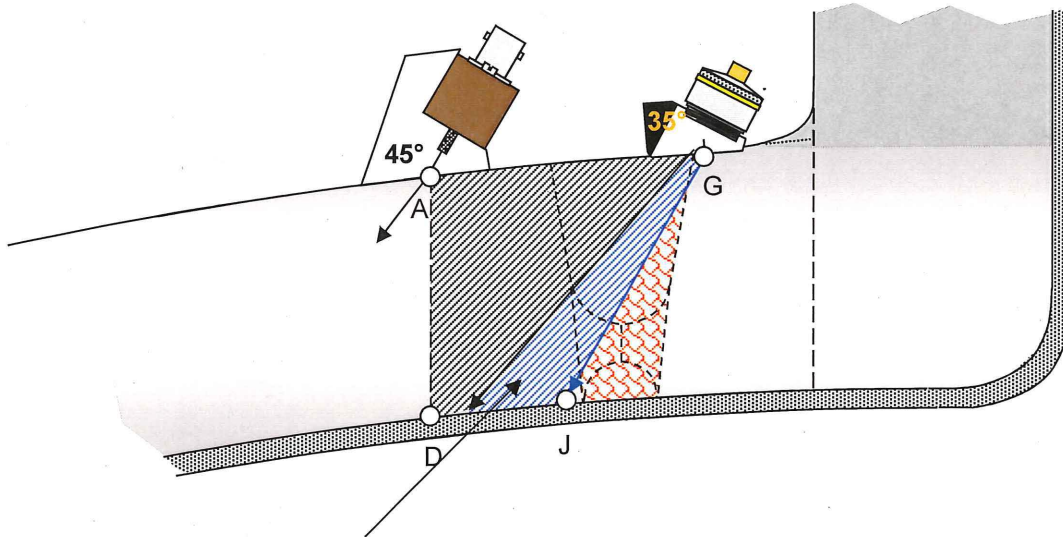


Exam Area: 10.07 in²
Examined: 9.46 in²
Coverage: 93.9 percent

Not to Scale

**Figure 7: WIB-379 (Power Relief Nozzle, Top Head) - 35 & 45 Degree
Radial-Out Scans**

AG = 2.95 inches
AD = 2.5 inches
DJ = 1.4 inches



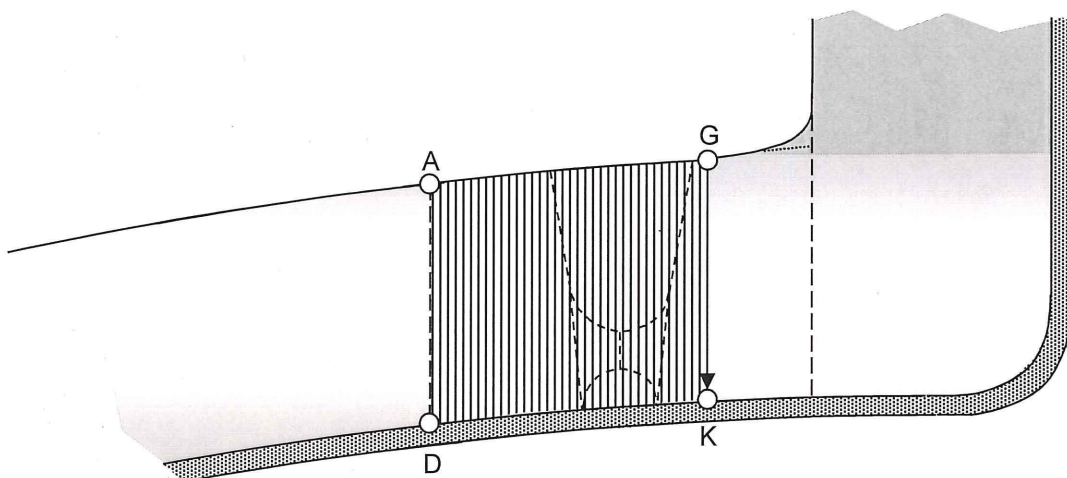
Additional coverage
provided by 35 degree beam

Exam Area: 10.07 in²
Examined: 5.44 in²
Coverage: 54 percent

Not to Scale

Figure 8: WIB-379 (Power Relief Nozzle, Top Head) – 45 Degree Circumferential Scans

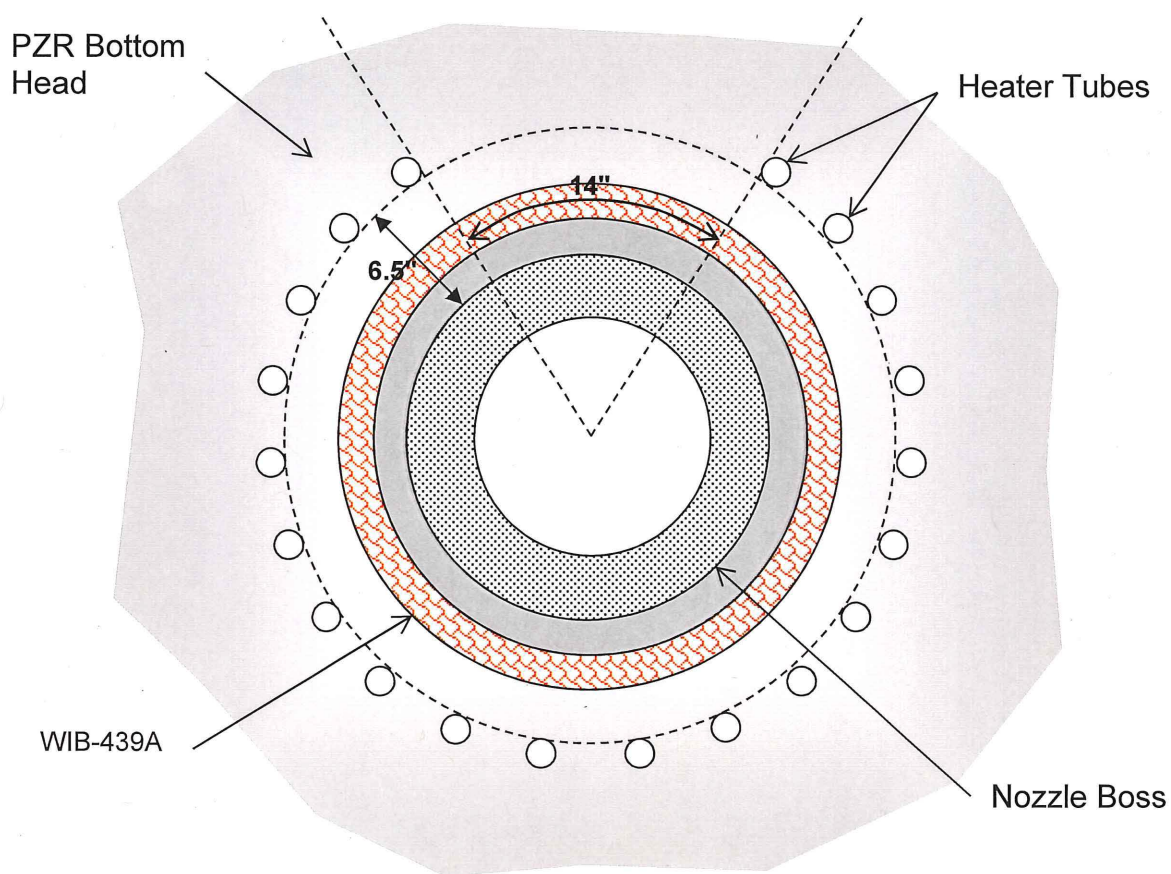
AG = 2.85 inches
AD = 2.5 inches



Exam Area: 10.07 in²
Examined: 7.12 in²
Coverage: 70.7 percent

Not to Scale

Figure 9: WIB-439A (Surge Line Nozzle, Bottom Head) - Configuration (plan view) and depiction of limitations

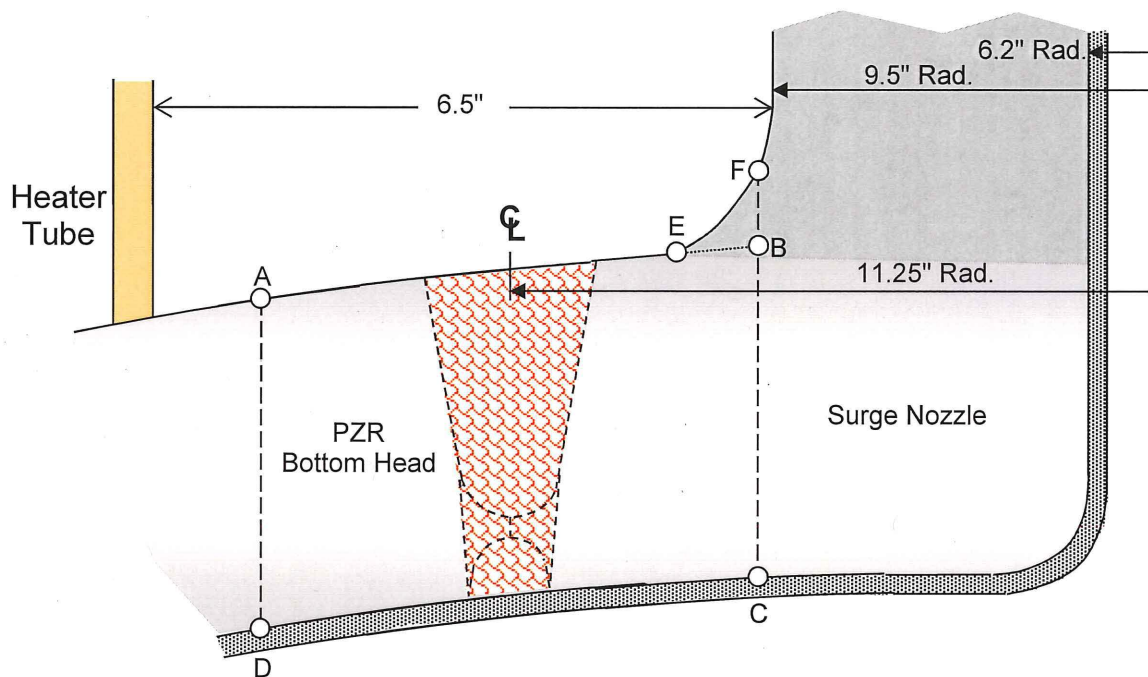


Limitation Description	Distance From Nz Boss	Length of Weld WIB-439A	Length of Weld Affected
Heater Tubes	6.5"	77"	63"

Not to Scale

Figure 10: WIB-439A (Surge Line Nozzle, Bottom Head) - Configuration and Exam Area

AB = 5.2 inches
AD = 3.4 inches
EB = 0.85 inches
FB = 0.8 inches

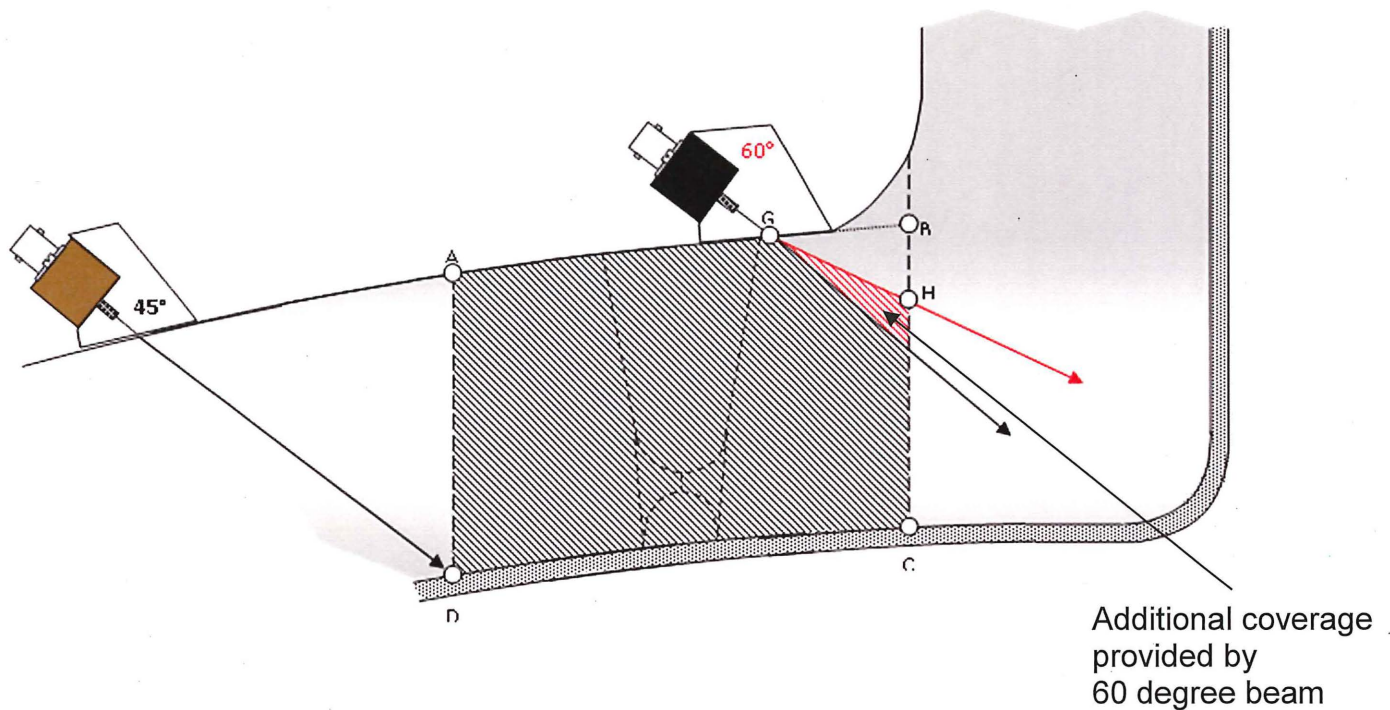


Weld Width: 1.8 inches
Thickness (Excluding Clad): 3.4 inches
Weld Length: 77 inches
Heater Tube Limitation: 63 inches
Exam Area: 18.02 in²

Not to Scale

Figure 11: WIB-439A (Surge Line Nozzle, Bottom Head) - 45 and 60 Degree Radial-in Scans (unobstructed region) (18.2 percent of total volume)

AB = 5.2 inches
AD = 3.4 inches
GB = 1.55 inches
HB = 0.9 inches

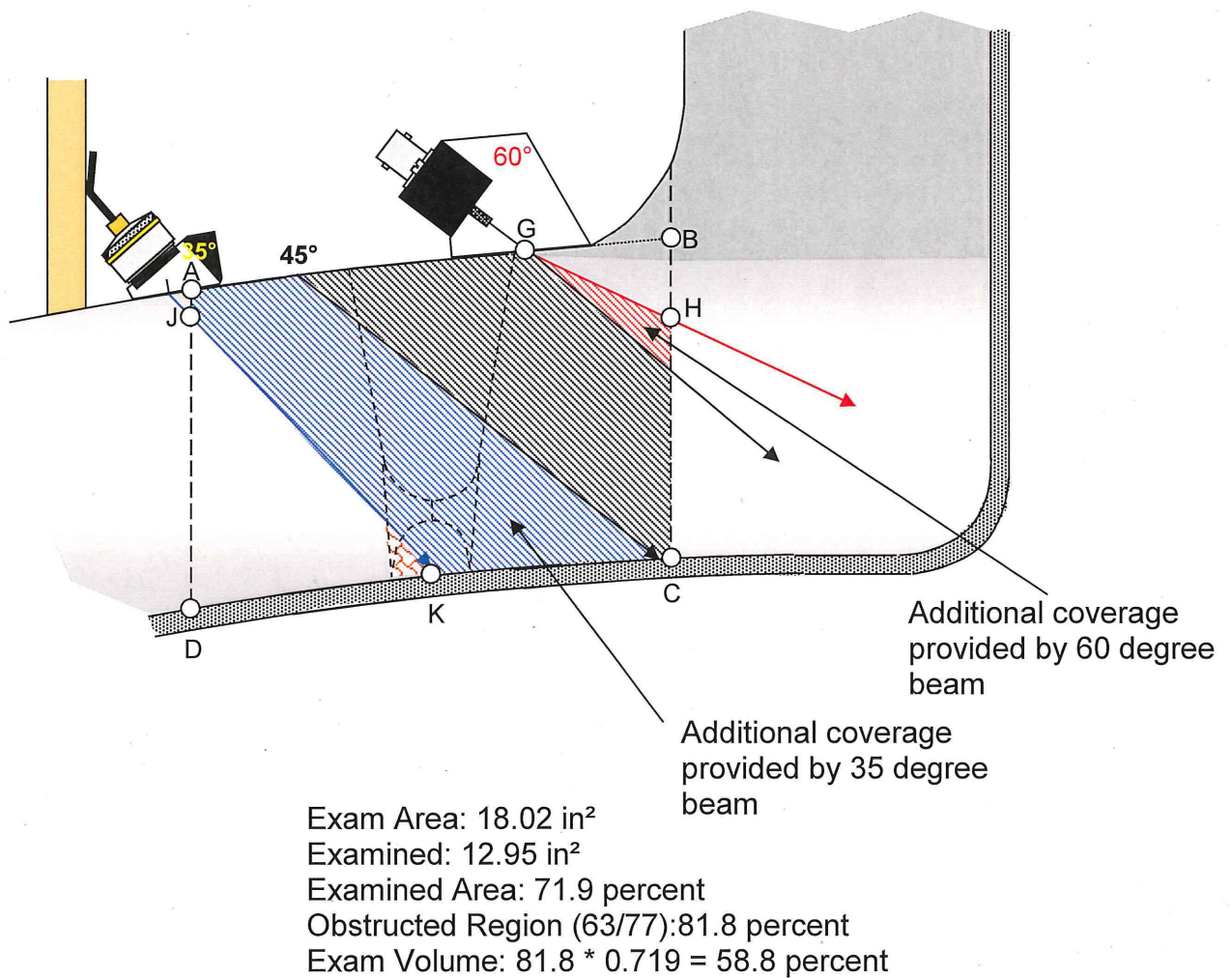


Exam Area: 18.02 in²
Examined: 16.98 in²
Examined Area: 94.2 percent
Unobstructed Region (14/77): 18.2 percent
Exam Volume: 18.2 * 0.942 = 17.1 percent

Not to Scale

Figure 12: WIB-439A (Surge Line Nozzle, Bottom Head) - 35, 45 and 60 Degree Radial-In Scans (area obstructed by heater tubes) (81.8 percent of total volume)

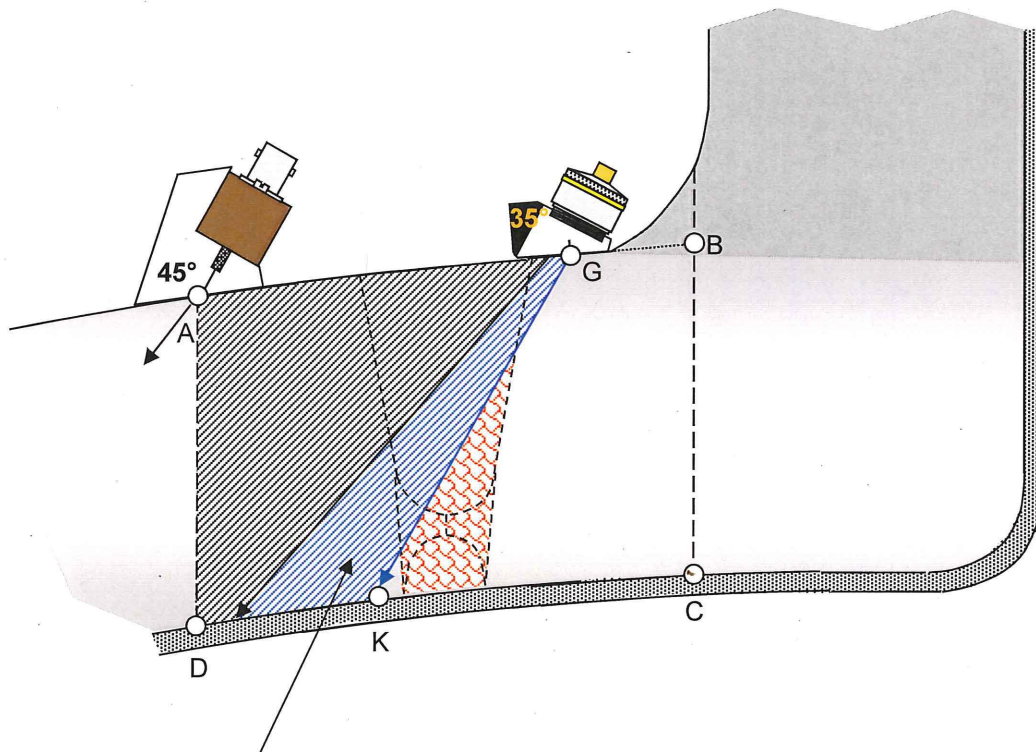
AB = 5.2 inches
AD = 3.4 inches
GB = 1.55 inches
HB = 0.9 inches
JD = 3.1 inches
DK = 2.6 inches



Not to Scale

Figure 13: WIB-439A (Surge Line Nozzle, Bottom Head) – 35 and 45 Degree Radial-Out Scans

AG = 3.95 inches
AD = 3.4 inches
DK = 1.9 inches



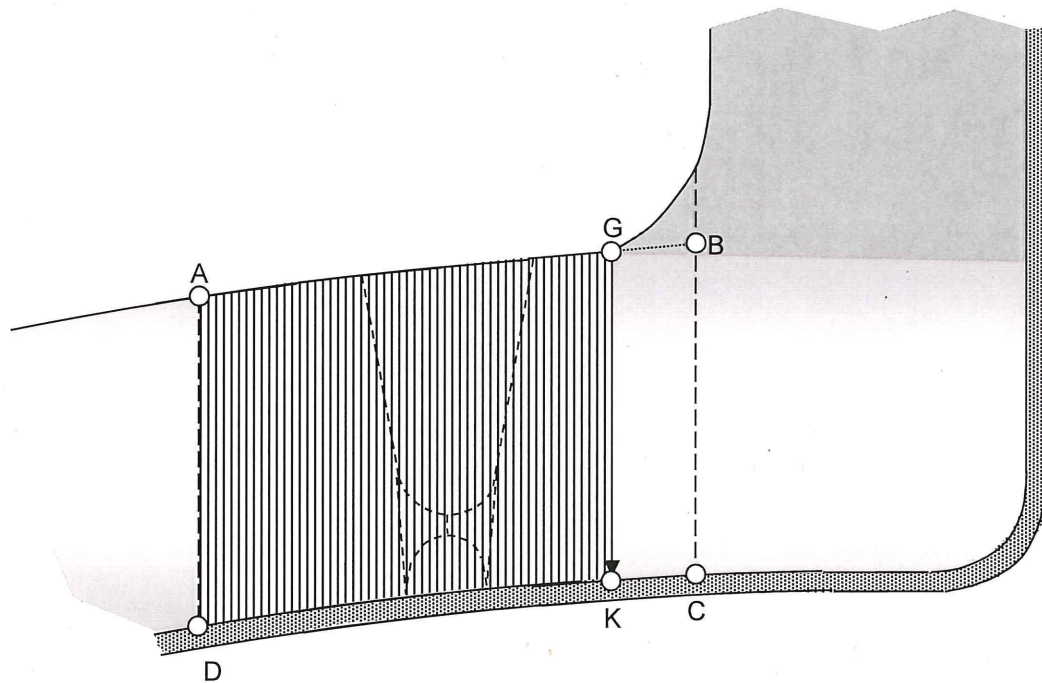
Additional coverage
provided by 35 degree
beam

Exam Area: 18.02 in²
Examined: 9.95 in²
Coverage: 55.2 percent

Not to Scale

Figure 14: WIB-439A (Surge Line Nozzle, Bottom Head) – 45 Degree CW and CCW Scans

AG = 4.35 inches
AD = 3.4 inches



Exam Area: 18.02 in²
Examined: 14.79 in²
Coverage: 82 percent

Not to scale