Northern States Power Company Operations & Maintenance Supt Materials & Special Processes	Prairie Island Unit 2 45° ULTRASONIC EXAMINATION REPORT (3rd 10yr)	Report# 97-0136R1 Source Doc=B 2. 40 S/N 2618

System	ISO	Item	Item Description
Steam Generator 22	2-ISI- 37B	W-A	Tube Sheet to Head

Material	Size/Length	Thick/Dia	Temp	Surface Condition
SA216 WCC / SA508 CL2	135"	5.160	75°F	BLENDED

Procedure	W R Number	ISI Contractor	Exam Date
ISI-UT-3 Rev 7 Field Change N/A	9612227		03/07/97

Calibration Report Nmbr	Beam Angle	Temp Gauge S/N	Exam Start @ / Exam End @
TWT-002	45° (Nominal)	NSP-049	* hours / * hours

Evaluation Level	Reporting Level	Cal Block / Ref Std	Ref Sensitivity / Scan Sensitivity
20% DAC	20% DAC	25A / LMT-109	20/7 dB / 20/16 dB

RESULTS NAD = No Apparent Discontinuities; L = Linear; S = Spot; M = Multiple
GEO = Geometry Visual = Non-Section XI Visual Examination

Scan Nmbr	Results	Indication Type	Sweep Loc'n	Metal Path	Surf Dist	Circ Location	Axial Location	Indication Length	Amp %DAC

LIMITATIONS: Refer to RPT No. 97-0136.

REMARKS. Refer to RPT No. 97-0136. See attached Flaw Evaluation. This report will be issued as NAD.
Review Signature at Item 17 of original ISI Flaw Sizing worksheet reflects later date than the previous fax copy. TJH 4/4/97 4-28-97

SKETCH

PERSONNEL

Examiner: N/A Level

Examiner: N/A Level

Contractor Review: N/A / / Date

NSP Review: [signature] 3/7/97 Date

ANII Review: [signature] 3/7/97 Date

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PT2 97-0136	1	B 2.40	1

4. ISI Interval ☒ OK Reviewer ___
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ___
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ___
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ___

From attached ISI Flaw Sizing Worksheet : $\ell = 0.80"$ $a = 0.2510"$

Flaw Type : Subsurface planar $t_{nom} = 5.160"$ $S = 0.7689"$

$$\frac{a}{\ell} = \frac{0.2510}{0.80} = 0.3138 \text{ Round to } 0.31$$

Use 4 to 12 Subsurface Flaw :

$$\frac{a}{t}\% = \frac{0.2510}{5.160} = 0.0486 \text{ Round to } 4.9\%$$

From Table IWB-3510-1 :

a/ℓ	a/t %
0.30	4.4 Y
0.35	5.1 Y

$$Y = \frac{S}{a} = \frac{0.7689}{0.2510} = 3.1 \Rightarrow Y = 1$$

} Interpolation $a/\ell = 0.31$, $a/t\% = 4.5\%$

8. Results ☒ OK Reviewer ___

a/ℓ = 0.31
calculated a/t % = 4.9%
Code allowable a/t % = 4.5%
laminar flaw surface area: $(0.75 \cdot \ell \cdot w)$ = NA

9. Table used for analysis ☒ OK Reviewer ___

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☒ yes ☐ no If no, why?

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ___ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer ___

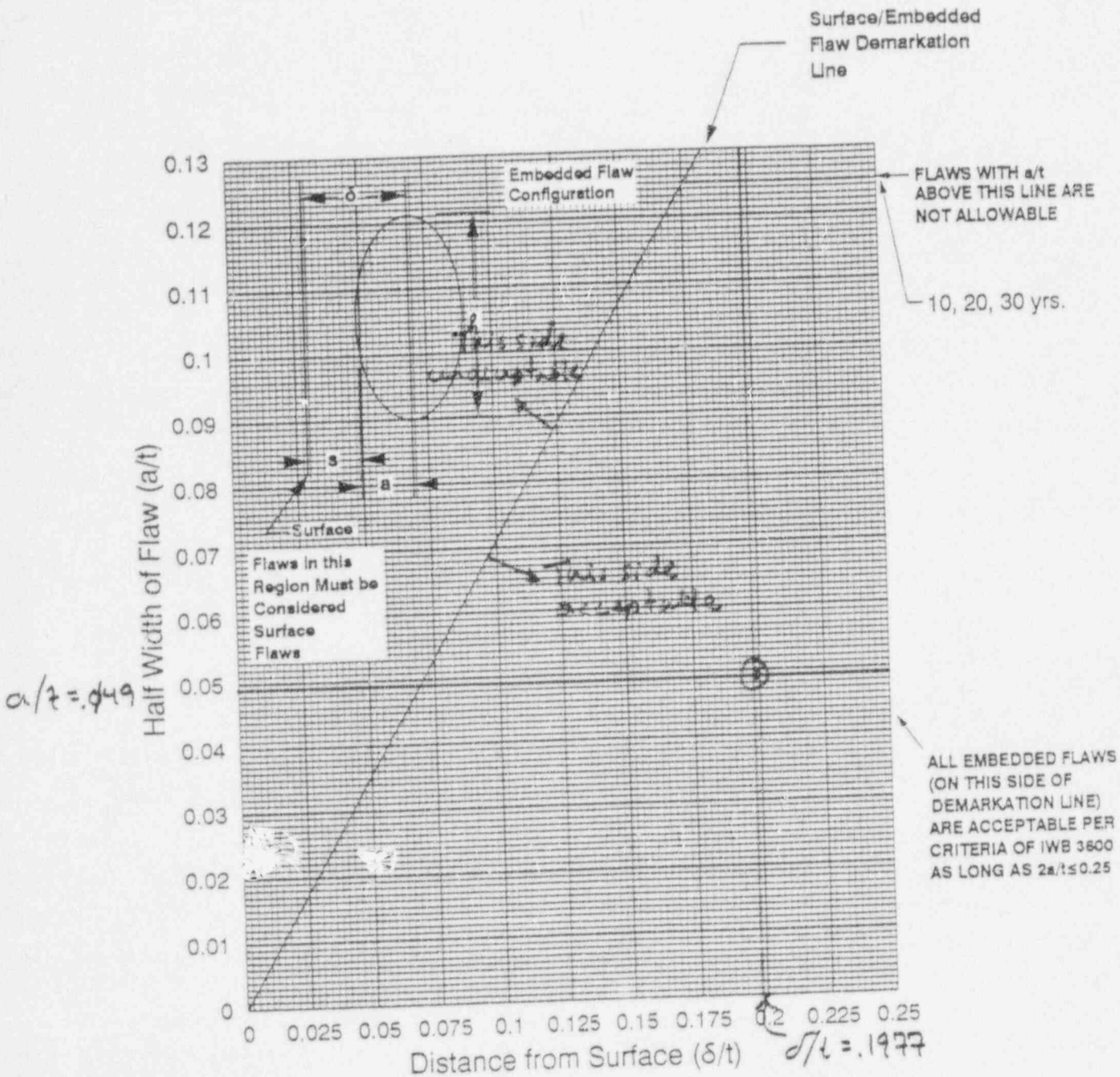
13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ___

☒ *Accept.* ☐ (a/t)Code allowable ≥ (a/t)calculated

~~☒ Reject.~~ TM 3/28/97 ~~☒~~ (a/t)Code allowable < (a/t)calculated

☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
TM Traw 2/25/97	03/03/97	4 Mar 97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	*This review certifies that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.*



a/t = .049

δ/t = .1977

δ = a + s = .251ϕ" + .7689" = 1.ϕ199"

t = 5.16ϕ" s = .7689"

a = .251ϕ"

Figure A-2.4 Flaw Evaluation Chart for the Tubesheet-Channel Head Junction for Prairie Island Units 1 and 2

X Inside Surface
X Outside Surface

___ Surface Flaw
X Embedded Flaw

X Longitudinal Flaw
X Circumferential Flaw

ISI report # 97-0136, Flaw #1, O.K. Gyfordbook, Mark Hug 3/4/97

1299w.wpf:1b/011995

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Report # 97-0136R1

OK 03/06/97

ISI Flaw Sizing Worksheet

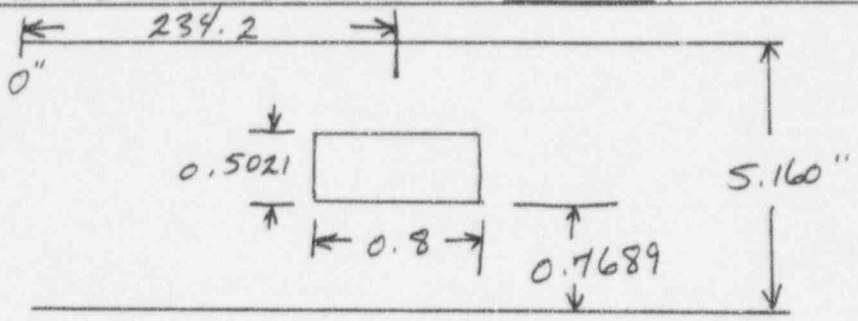
1. ISI Report Number	2. Flaw Number	3. Item Number
PI2 97-0136	1	B 2.40

4. ISI Interval ☑ OK Reviewer [ ]
☐ 2nd interval ☒ 3rd interval ☐ preservice

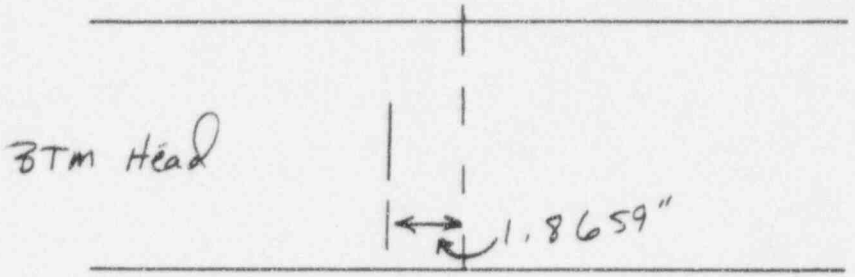
5. Code Edition and Addenda ☑ OK Reviewer [ ]
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Method ☒ UT ☐ RT ☐ PT ☐ MT

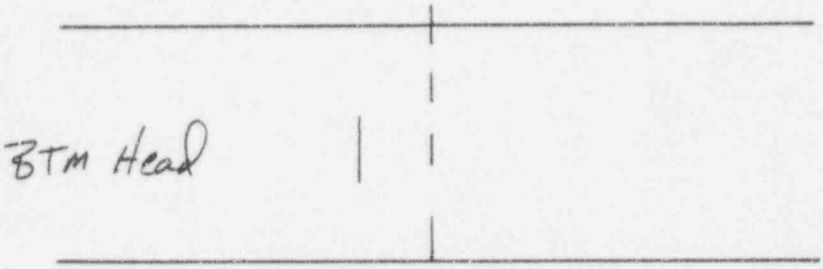
7. Flaw Sketch ☑ OK Reviewer [ ]
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer [ ]
Show determination of surface or subsurface
see attached

Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☑ yes Preparer [ ] ☑ OK Reviewer [ ]

10. Code Flaw Dimensions ☑ OK Reviewer [ ]
"ℓ" = 0.8000" "a" = 0.2510" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 0.7689" "w" = N/A

11. Flaw Type ☑ OK Reviewer [ ]
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer [ ]

☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number ☑ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☑ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☑ yes Preparer [ ] ☑ OK Reviewer [ ]

16. Prepared by and date
Tom Sarles 2/23/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E.J. Thom 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~TLC~~ **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: TLC Date: 2/23/97
Flaw # 1 Reviewed By: E.J. Date: 3-14-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = 234.6 (L2) - 233.8 (L1) = **0.8** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = **5.160** inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **1**

The flaw exhibited 20% DAC at 5.50 and 6.21 inches MP. Max amplitude is at 5.75 inches MP with the transducer exit point at 2.2 inches (W) from the centerline of the weld and 234.2 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
5.50 (metal path at 20% upper) * COS of the measured angle .0.7071 = **3.8890** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
6.21 (metal path at 20% lower) * COS of the measured angle .0.7071 = **4.3911** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
5.75 (metal path at maximum amplitude point) * COS of the measured angle .0.7071 = **4.0658** inches depth.

4) Determine the distance from the center line of the weld to the maximum amplitude point of the flaw.
5.75 (metal path at maximum amplitude point) squared = **33.0625** (a^2)
4.0658 (depth at maximum amplitude point) squared = **16.5307** (b^2)
$\sqrt{a^2 - b^2}$ = **4.0659** inches of surface distance to the flaw from the transducer exit point.
2.2 (Wmax) - 4.0659 (surf dist) = **-1.8659** inches to the centerline of the weld.

5) Determine S by picking the smaller of the following;
S = 3.8890 (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 4.3911 (result of 2) = **0.7689** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
4.3911 (from step 2) - 3.8890 (from step 1) = **0.5021** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.1004**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = ___ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.2510** inches.

l = **0.8** (for a/*l* > 0.5, *l* = 2a) **t = 5.160** (part thickness)
a = 0.2510 (surf or **sub surf**, circle one) **S = 0.7689**

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Report # 97-0136R1

flawtrig (for perpendicular scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CHC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CHC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 Jeff Ricker Ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number PI2 97-0136 | 2. Flaw Number 2 | 3. Item Number B2.40 | 14. Total Number of Pages 1

ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw sizing worksheet: $l = 0.80"$ $a = 0.0636"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $S = 1.2233"$

$\frac{a}{l} = \frac{0.0636}{0.80} = 0.0795$ Round to 0.08

Use 4 to 12 Subsurface Flaw:

$\frac{a}{t}\% = \frac{0.0636}{5.160} = 0.0123$ Round to 1.2%

From Table IWB-3510-1:

a/l	a/t %
0.05	2.2Y
0.10	2.5Y

$Y = \frac{S}{a} = \frac{1.2233}{0.0636} = 19.2 \Rightarrow Y = 1$

By observation, since $\frac{a}{t}$ calculated equals 1.2% which is less than 2.2%. Indication is Acceptable.

8. Results ☒ OK Reviewer ____

a/l = 0.08

calculated a/t % = 1.2%

Code allowable a/t % = 2.2% < a/t % < 2.5%

laminar flaw surface area: (0.75 • l • w) = NA

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1	
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6	
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2		
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ WC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2	
☐ IWC-3513-1						

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer ____ ☒ OK Reviewer ____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ *Accept.*
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date
2/25/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date
03/03/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date
4 Mar 97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	
PI2 97-0136	2	B 2.40	

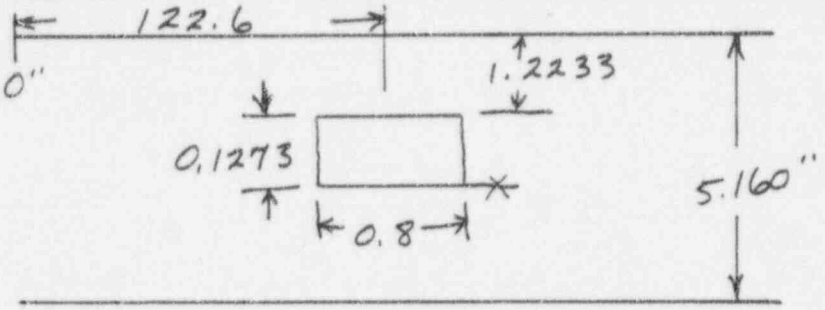
4. ISI Interval ☑ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

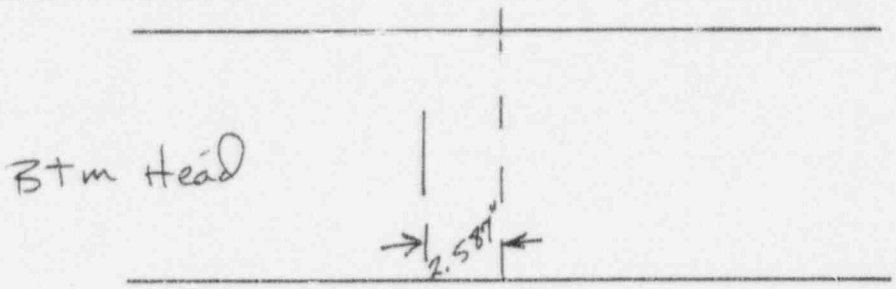
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

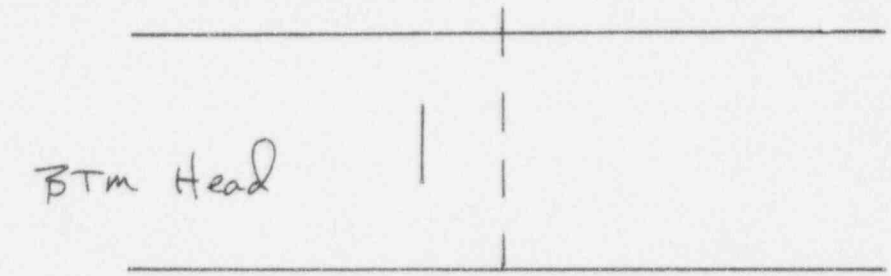
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"ℓ" = 0.8000" "a" = 0.0636" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 1.2233" "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☑ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TJ ☑ OK Reviewer EJ

16. Prepared by and date

Tom Jones 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E.J. Thom 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~TWS~~ **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/23/97

Flaw # 2 Reviewed By: [signature] Date: 3-12-97

Length

Length of the flaw "" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.

L and W values are from page ___ of the UT report.

l = 123.2 (L2) - 122.4 (L1) = **0.8** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).

This value is from page 1 of the UT report.

"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **1**

The flaw exhibited 20% DAC at 1.73 and 1.91 inches MP. Max amplitude is at 1.82 inches MP with the transducer exit point at -1.3 inches (W) from the centerline of the weld and 122.6 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
   1.73 (metal path at 20% upper) * COS of the measured angle .7071 = **1.2233** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
   1.91 (metal path at 20% lower) * COS of the measured angle .7071 = **1.3506** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
   1.82 (metal path at maximum amplitude point) * COS of the measured angle .7071 = **1.2869** inches depth.

4) Determine the distance from the center line of the weld to the maximum amplitude point of the flaw.
   1.82 (metal path at maximum amplitude point) squared = **3.3124** (a^2)
   1.2869 (depth at maximum amplitude point) squared = **1.6561** (b^2)
   $\sqrt{a^2 - b^2}$ = **1.2870** inches of surface distance to the flaw from the transducer exit point.
   -1.3 (Wmax) - 1.2870 (surf dist) = **-2.587** inches to the centerline of the weld.

5) Determine S by picking the smaller of the following;
   S = **1.2233** (result of 1) = distance between exam surface and the upper flaw tip
   >> OR <<
   S = 5.160 (part "t") - 1.3506 (result of 2) = **3.8094** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
   1.3506 (from step 2) - 1.2233 (from step 1) = **0.1273** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0254**

Compare to S (from step 5)

If S is less than 0.4d, the flaw is **surface**. a = 2d + S = ___ inches.

If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.0636** inches.

l = **0.8** (for a/*l* > 0.5, *l* = 2a)

a = 0.0636 (surf or (sub surf) circle one)

t = 5.160 (part thickness)

S = 1.2233

flawtrig (for perpendicular scans) Rev 0

Internal Correspondence

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Thomas Jones 3/5/97 Tin Tran 3/6/97 Jeff Ricker Ob March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

Page 10 of 70
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI2 97-0136	3	B2.40	1

ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☐ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw Sizing Worksheet: $l = 0.8"$ $a = 0.3006"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $S = 0.9598"$

$\frac{a}{l} = \frac{0.3006}{0.8} = 0.3758$ Round to 0.38

Use 4 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.3006}{5.160} = 0.0583$ Round to 5.8%

From Table IWB-3510-1:

a/l	a/t %
0.35	5.1 Y
0.40	5.8 Y

$Y = \frac{S}{a} = \frac{0.9598}{0.3006} = 3.2 \Rightarrow Y = 1$

8. Results ☒ OK Reviewer ____

a/l = 0.38

calculated a/t % = 5.8%

Code allowable a/t % = 5.1% < 5.8% < 5.8%

laminar flaw surface area: (0.75 • l • w) = NA

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer CHK If no, why? PER John Johnston 3/7/97

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer CHK

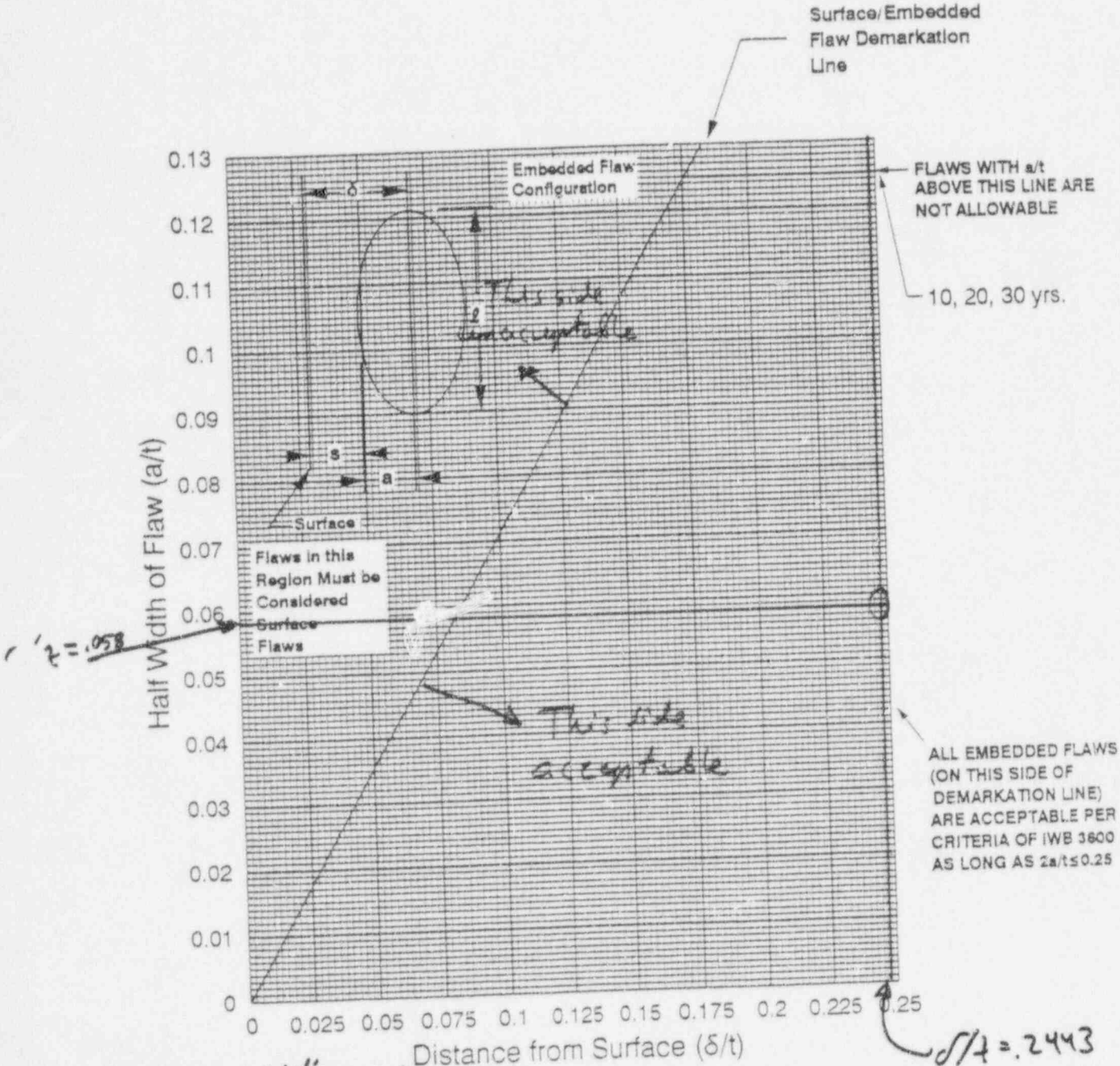
13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ *Accept.* ☐ (a/t)Code allowable ≥ (a/t)calculated

~~☒ Reject.~~ TM 2/25/97 ☒ (a/t)Code allowable < (a/t)calculated

☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
2/25/97	03/03/97	9/12/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	*This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.*



a/t = .058

σ = a + s = .3006" + .9598" = 1.2604

t = 5.160"

a = .3006"

s = .9598"

Figure A-2.4 Flaw Evaluation Chart for the Tubesheet-Channel Head Junction for Prairie Island Units 1 and 2

X	Inside Surface		Surface Flaw	X	Longitudinal Flaw
X	Outside Surface	X	Embedded Flaw	X	Circumferential Flaw

ISI Report # 97-0136, Flaw #3, O.K. by Handbook. Mark Hedger 3/4/97

Page 12 of 70
Report # 97-0136R1

OK 03/04/97

ISI Flaw Sizing Worksheet

1. ISI Report Number PI-2 97-0136 | 2. Flaw Number 3 | 3. Item Number B 2.40

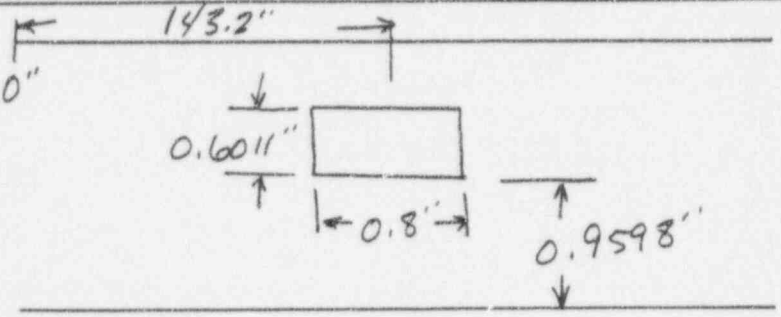
4. ISI Interval ☑ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

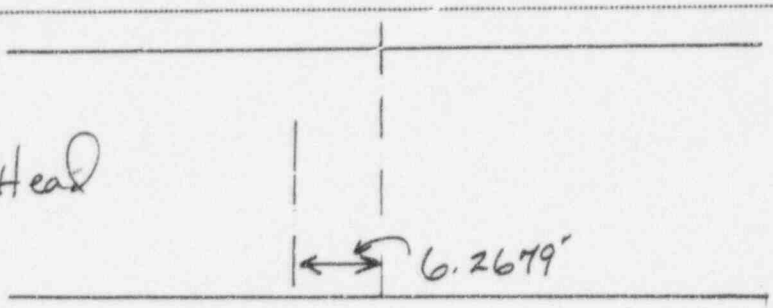
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

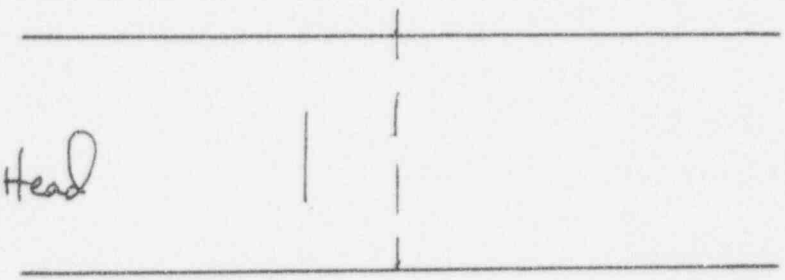
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ
Show determination of surface or subsurface
see attached

Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TJS ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ
"ℓ" = 0.8 " "a" = 0.3006 " $t_{nominal}$" = 5.160 " $t_{measured}$" = N/A "S" = 0.9598 " "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ
☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TJS ☑ OK Reviewer EJ

16. Prepared by and date
Tom Sould 2/28/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E.J. Thoma 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA INITIAL TO VERIFY

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/23/97

Flaw # 3 Reviewed By: E.J. Thom Date: 3-12-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.

L and W values are from page ___ of the UT report.

l = 143 . 8 (L2) - 143 . 0 (L1) = **0 . 8** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).

This value is from page 1 of the UT report.

"t" = 5 . 160 inches

Calibration

The measured angle in the calibration block was **45 . 0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 1

The flaw exhibited 20% DAC at 5 . 09 and 5 . 94 inches MP. Max amplitude is at 5 . 47 inches MP with the transducer exit point at -2 . 4 inches (W) from the centerline of the weld and 143 . 2 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
5 . 09 (metal path at 20% upper) * COS of the measured angle 0 . 7071 = **3 . 5991** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
5 . 94 (metal path at 20% lower) * COS of the measured angle 0 . 7071 = **4 . 2002** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
5 . 47 (metal path at maximum amplitude point) * COS of the measured angle 0 . 7071 = **3 . 8678** inches depth.

4) Determine the distance from the center line of the weld to the maximum amplitude point of the flaw.
5 . 47 (metal path at maximum amplitude point) squared = **29 . 9209** (a^2)
3 . 8678 (depth at maximum amplitude point) squared = **14 . 9599** (b^2)
$\sqrt{a^2 - b^2}$ = **3 . 8679** inches of surface distance to the flaw from the transducer exit point.
-2 . 4 (Wmax) - 3 . 8679 (surf dist) = **-6 . 2679** inches to the centerline of the weld.

5) Determine S by picking the smaller of the following:
S = **3 . 5991** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5 . 160 (part "t") - 4 . 2002 (result of 2) = **0 . 9598** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
4 . 2002 (from step 2) - 3 . 5991 (from step 1) = **0 . 6011** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0 . 1202**

Compare to S (from step 5)

If S is less than 0.4d, the flaw is **surface**. a = 2d + S = ___ . ___ inches.

If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0 . 3006** inches.

l = 0 . 8 (for a/l > 0.5, l = 2a) **t = 5 . 160** (part thickness)

a = 0 . 3006 (surf or (sub surf) circle one) **S = 0 . 9598**

flawtrig (for perpendicular scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CHC TM 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CHC 3/7/97

Tom Jones 3/5/97 Tim Law 3/6/97 J. Ricker 06 March 97

Thomas Jones Lvl III Tim Law ISI Program Mngr Jeff Ricker Supt M&SP

Page 15 of 20
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	4. Total Number of Pages
PI2 97-0136R1	5	B2.40	1

ISI Interval ☒ OK Reviewer ___
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ___
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ___
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ___

From attached ISI Flaw Sizing Worksheet: $\ell = 1.0''$ $a = 0.1626''$

Flaw Type: Subsurface Planar $t_{nom} = 5.160''$ $S = 1.3576''$

$\frac{a}{\ell} = \frac{0.1626}{1.0} = 0.1626$ Round to 0.16

Use 4 to 12 Subsurface Flaw:

$\frac{a}{t}\% = \frac{0.1626}{5.160} = 0.0315$ Round to 3.2%

From Table IWB-3510-1:

a/ℓ	a/t %
0.15	2.9Y
0.20	3.3Y

$Y = \frac{S}{a} = \frac{1.3576}{0.1626} = 8.3 \Rightarrow Y = 1$

Interpolation $a/\ell = 0.16$, $a/t\% = 3.0\%$

8. Results ☒ OK Reviewer ___

$a/\ell =$ 0.16
calculated $a/t\% =$ 3.2%
Code allowable $a/t\% =$ 3.0%
laminar flaw surface area: $(0.75 \cdot \ell \cdot w) =$ NA

9. Table used for analysis ☒ OK Reviewer ___
☒ IWB-3510-1 ☐ IWB-3510-2 ☐ IWB-3510-3 ☐ IWB-3511-1 ☐ IWB-3511-2 ☐ IWB-3512-1
☐ IWB-3512-2 ☐ IWB-3514-1 ☐ IWB-3514-2 ☐ IWB-3514-3 ☐ IWB-3514-4 ☐ IWB-3514-6
☐ IWB-3515-1 ☐ IWB-3516-1 ☐ IWB-3516-2 ☐ IWB-3518-1 ☐ IWB-3518-2
☐ IWC-3510-1 ☐ IWC-3510-2 ☐ IWC-3510-3 ☐ IWC-3511-1 ☐ IWC-3511-2 ☐ IWC-3512-2
☐ IWC-3513-1

10. Was linear interpolation used? ☒ yes ☐ no If no, why?

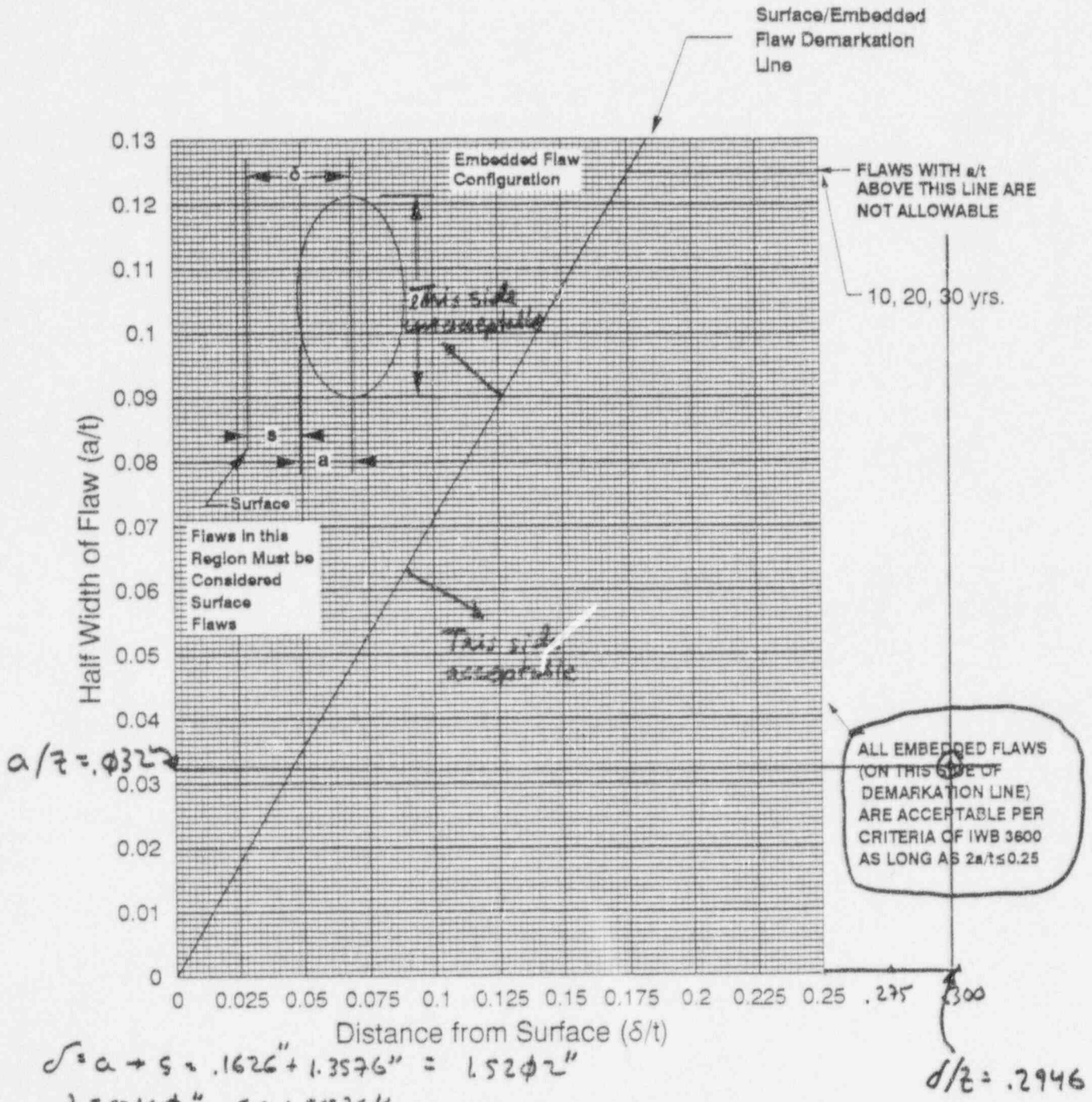
11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ___ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer ___

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer CRR For JGT on 4/28/97

☒ Accept. ☐ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☒ Reject. TM 2/28/97 ☒ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
2/25/97	03/07/97	4 Mar 97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures	*This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures*



$\delta = a + s = .1626" + 1.3576" = 1.5202"$

$t = 5.160"$ $s = 1.3576"$

$a = .1626"$

Figure A-2.4 Flaw Evaluation Chart for the Tubesheet-Channel Head Junction for Prairie Island Units 1 and 2

X	Inside Surface	___	Surface Flaw	X	Longitudinal Flaw
X	Outside Surface	X	Embedded Flaw	X	Circumferential Flaw

ISI Report #97-0136, Flaw #5, O.K. by handbook. Mark Heyzog 3/4/97

Page 17 of 70
Report # 97-0136R1

OK 03/06/97

ISI Flaw Sizing Worksheet

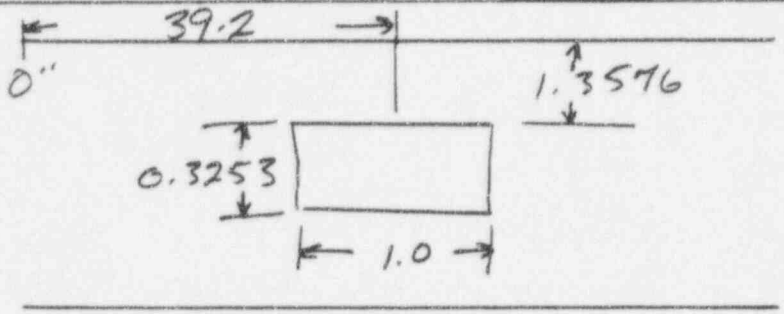
1. ISI Report Number PI-2 97-0136 | 2. Flaw Number 5 | 3. Item Number B2.40

4. ISI Interval ☑ OK Reviewer [ ]
☐ 2nd interval ☒ 3rd interval ☐ preservice

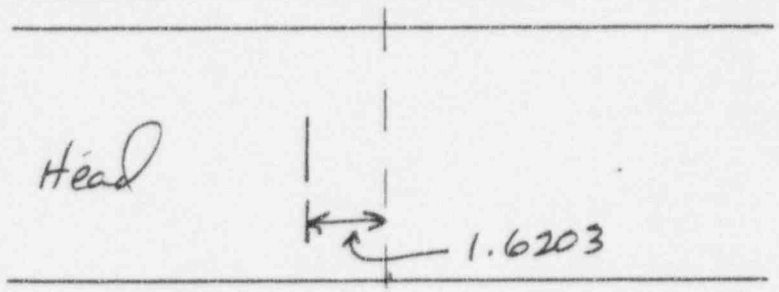
5. Code Edition and Addenda ☑ OK Reviewer [ ]
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Method ☒ UT ☐ RT ☐ PT ☐ MT

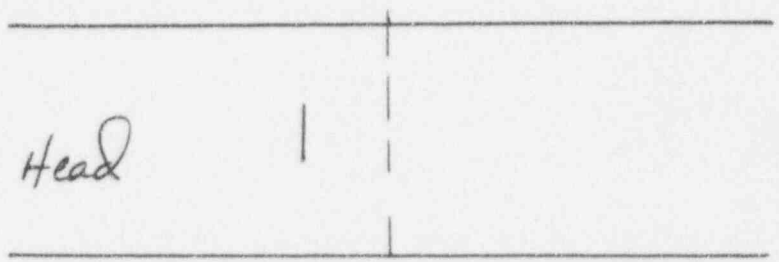
7. Flaw Sketch ☑ OK Reviewer [ ]
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer [ ]
Show determination of surface or subsurface
see attached

Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer [ ] ☑ OK Reviewer [ ]

10. Code Flaw Dimensions ☑ OK Reviewer [ ]
"l" = 1.0 "a" = 0.1626 "$t_{nominal}$" = 5.160 "$t_{measured}$" = N/A "S" = 1.3576 "W" = N/A

11. Flaw Type ☑ OK Reviewer [ ]
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer [ ]
☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer [ ] ☑ OK Reviewer [ ]

16. Prepared by and date
Tom Sears 2/27/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E. J. Thorne 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA TM S **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/23/97
Flaw # 5 Reviewed By: S. D. Thom Date: 3-12-97

Length
Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = 39 . 5 (L2) - 38 . 5 (L1) = **1 . 0** inches.

Thickness
Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = **5 . 160** inches

Calibration
The measured angle in the calibration block was **45 . 0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **1**
The flaw exhibited 20% DAC at 1 . 92 and 2 . 38 inches MP. Max amplitude is at 2 . 15 inches MP with the transducer exit point at -0 . 1 inches (W) from the centerline of the weld and 39 . 2 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
1 . 92 (metal path at 20% upper) * COS of the measured angle 0 . 7071 = **1 . 3576** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
2 . 38 (metal path at 20% lower) * COS of the measured angle 0 . 7071 = **1 . 6829** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
2 . 15 (metal path at maximum amplitude point) * COS of the measured angle 0 . 7071 = **1 . 5203** inches depth.

4) Determine the distance from the center line of the weld to the maximum amplitude point of the flaw.
2 . 15 (metal path at maximum amplitude point) squared = **4 . 6225** (a^2)
1 . 5203 (depth at maximum amplitude point) squared = **2 . 3113** (b^2)
$\sqrt{a^2 - b^2}$ = **1 . 5203** inches of surface distance to the flaw from the transducer exit point
-0 . 1 (Wmax) - 1 . 5203 (surf dist) = **-1 . 6203** inches to the centerline of the weld.

5) Determine S by picking the smaller of the following:
S_1 = **1 . 3576** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5 . 160 (part "t") - 1 . 6829 (result of 2) = **3 . 4771** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
1 . 6829 (from step 2) - 1 . 3576 (from step 1) = **0 . 3253** inches.

Determination of surface or subsurface
0.4d = (2d / 2) * 0.4 = **0 . 0650**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = ___ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0 . 1626** inches.

l = **1 . 0** (for a/l > 0.5, l = 2a) t = **5 . 160** (part thickness)
a = **0 . 1626** (surf or (sub surf) circle one) **S** = **1 . 3576**

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-4 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CMC M 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.1721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 Jeff Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

Page 20 of 70
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number PI2 97-0136 | 2. Flaw Number 6 | 3. Item Number B2.40 | 14. Total Number of Pages 1

7. ISI Interval ☒ OK Reviewer ___
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ___
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ___
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ___

From attached ISI Flaw sizing Worksheet: $\ell = 0.3"$ $a = 0.0071"$

Flaw Type: Subsurface Planar $T_{nom} = 5.160"$ $S = 0.6204"$

$$\frac{a}{\ell} = \frac{0.0071}{0.3} = 0.0237 \text{ Round to } 0.02$$

Use 4 to 12 Subsurface Flaw:

$$a/t\,\% = \frac{0.0071}{5.160} = 0.0014 \text{ Round to } 0.14\,\%$$

From Table IWB-3510-1:

a/ℓ	a/t %
0.0	2.0Y
0.05	2.2Y

$$Y = \frac{S}{a} = \frac{0.6204}{0.0071} = 87.4 \Rightarrow Y = 1$$

By observation, since $\frac{a}{t}$ calculated equals 0.14% which is less than 2.0%. Indication is acceptable.

8. Results ☒ OK Reviewer ___

a/ℓ = 0.02

calculated a/t % = 0.14%

Code allowable a/t % = 2.0% < a/t % < 2.2

laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer ___

☒ IWB-3510-1 ☐ IWB-3510-2 ☐ IWB-3510-3 ☐ IWB-3511-1 ☐ IWB-3511-2 ☐ IWB-3512-1
☐ IWB-3512-2 ☐ IWB-3514-1 ☐ IWB-3514-2 ☐ IWB-3514-3 ☐ IWB-3514-4 ☐ IWB-3514-6
☐ IWB-3515-1 ☐ IWB-3516-1 ☐ IWB-3518-2 ☐ IWB-3518-4 ☐ IWB-3518-2
☐ IWC-3510-1 ☐ IWC-3510-2 ☐ IWC-3510-3 ☐ IWC-3511-1 ☐ IWC-3511-2 ☐ IWC-3512-2
☐ IWC-3513-1

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By Observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ___ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TH ☒ OK Reviewer ___

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ___

☒ **Accept.** ☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ **Reject.** ☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date: Tim Rau 2/25/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

16. Engineering review by and date: 03/07/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

17. Approved by and date: 4 Mar 97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures

ISI Flaw Sizing Worksheet

1. ISI Report Number PT2 97-0136 | 2. Flaw Number 6 | 3. Item Number B2.40

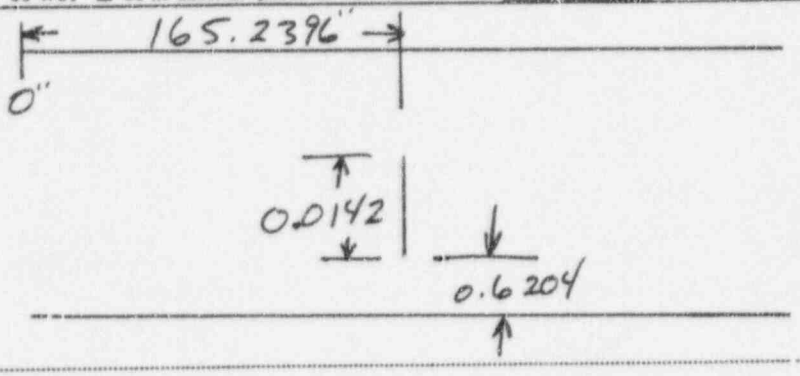
4. ISI Interval ☑ OK Reviewer ___ ☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer ___ ☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other ___

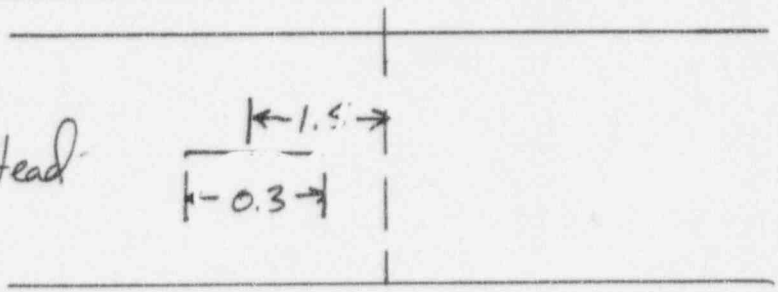
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer ___

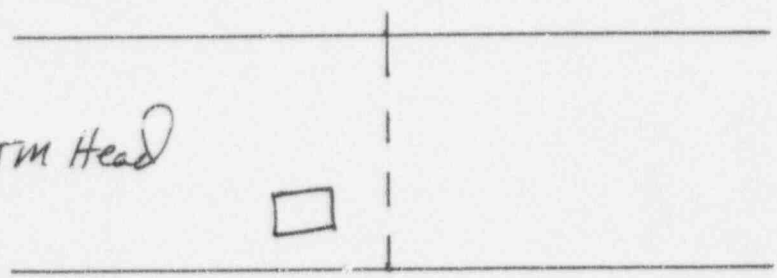
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer ___

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-PE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer ___ ☑ OK Reviewer ___

10. Code Flaw Dimensions ☑ OK Reviewer ___

"ℓ" = 0.3 "a" = 0.0071 "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 0.6204 "W" = N/A

11. Flaw Type ☑ OK Reviewer ___

☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer ___

☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1

☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer ___ ☑ OK Reviewer ___

16. Prepared by and date

Tom Jones 2/23/97

The results are ... and the methodology used is in accordance with applicable codes, standards, specification... and procedures.

17. Review by and date

E. J. Throm 3-14-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ____ **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/23/97
Flaw # 6 Reviewed By: [signature] Date: 3-12-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -1.7 (W2) - -1.4 (W1) = **0.3** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 3
The flaw exhibited 20% DAC at 6.40 and 6.42 inches MP. Max amplitude is at 6.42 inches MP with the transducer exit point at -1.5 inches (W) from the centerline of the weld and 160.7 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
6.40 (metal path at 20% upper) * COS of the measured angle 0.7071 = **4.5254** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
6.42 (metal path at 20% lower) * COS of the measured angle 0.7071 = **4.5396** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
6.42 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **4.5396** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
6.42 (metal path at maximum amplitude point) squared = **41.2164** (a^2)
4.5396 (depth at maximum amplitude point) squared = **20.6080** (b^2)
$\sqrt{a^2 - b^2}$ = **4.5396** inches of surface distance to the flaw from the transducer exit point.
160.7 (Lmax) + 4.5396 (surf dist) = **165.2396** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **4.5254** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 4.5396 (result of 2) = **0.6204** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
4.5396 (from step 2) - 4.5254 (from step 1) = **0.0142** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0028**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.0071** inches.

l = **0.3** (for a/l > 0.5, l = 2a)
a = 0.0071 (surf or (sub surf) circle one)
t = **5.160** (part thickness)
S = 0.6204

flawtrig (for parallel scans) Rev 0

Internal Correspondence

Date March 5, 1997

From Ad Hoc Evaluation Group

Location CSC-2

To File

Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-4 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CHC TM 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.5758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CHC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 Jeff Ricker 06 March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

ISI Flaw Disposition Worksheet

1. ISI Report Number PI 2 97-0136 | 2. Flaw Number 7 | 3. Item Number B2.40 | 14. Total Number of Pages 1

4. ISI Interval ☒ OK Reviewer ___
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ___
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other ___

6. Acceptance Standard ☒ OK Reviewer ___
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ___

From attached ISI Flaw Sizing Worksheet: $\ell = 0.6"$ $a = 0.1803"$

Flaw Type: subsurface planar $t_{nom} = 5.160"$ $S = 2.1407"$

$$\frac{a}{\ell} = \frac{0.1803}{0.6} = 0.3005 \text{ Round to } 0.30$$

Use 4 to 1 subsurface Flaw:

$$\frac{a}{t}\% = \frac{0.1803}{5.160} = 0.0349 \text{ Round to } 3.5\%$$

From Table IWB-3510-1:

a/ℓ	a/t %
0.30	4.4Y

$$Y = \frac{S}{a} = \frac{2.1407}{0.1803} = 11.9 \Rightarrow Y = 1$$

By observation, since $\frac{a}{t}$ calculated equals 3.5% which is less than 4.4%. Indication is Acceptable

8. Results ☒ OK Reviewer ___

a/ℓ = 0.30
calculated a/t % = 3.5%
Code allowable a/t % = 4.4%
laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer ___

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1	
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6	
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2		
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2	
☐ IWC-3513-1						

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ___ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TYI ☒ OK Reviewer ___

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ___

☒ **Accept.**
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date
TYI 2/25/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date
03/03/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date
4/7/97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number PI2 97-0136 | 2. Flaw Number 7 | 3. Item Number B 2.40

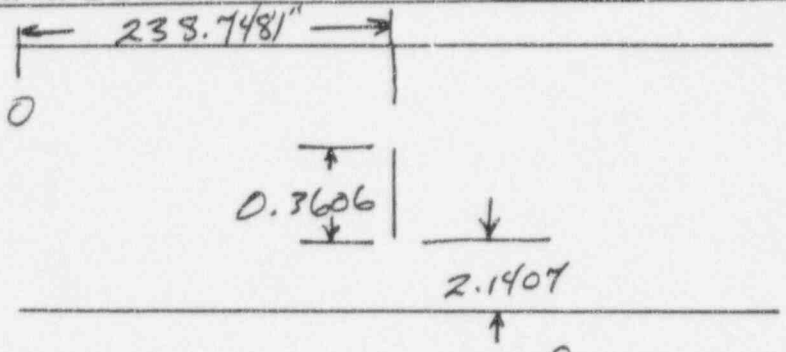
4. ISI Interval ☑ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

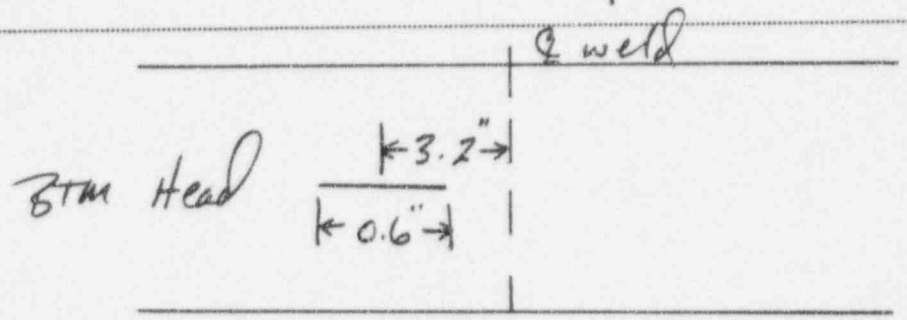
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

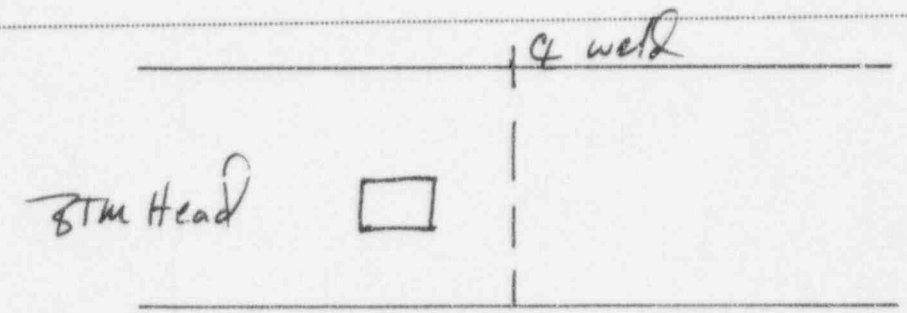
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ
Show determination of surface or subsurface
see attached

Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TMJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ
"ℓ" = 0.6 "a" = 0.1803 "$t_{nominal}$" = 5.160 "$t_{measured}$" = N/A "S" = 2.1407 "w" = N/A

11. Flaw Type ☑ OK Reviewer EJ
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ
☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TMJ ☑ OK Reviewer EJ

16. Prepared by and date
Tom Jones 2/23/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

17. Review by and date
E. J. Thorn 3-14-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~TM~~ S **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: Tom Sands Date: 2/23/97
Flaw # 7 Reviewed By: E. L. Thom Date: 3-IV-97

Length

Length of the flaw "*l*" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -3 . 5 (W2) - -2 . 9 (W1) = **0 . 6** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom w... (circle one).
This value is from page 1 of the UT report.
"t" = 5 . 160 inches

Calibration

The measured angle in the calibration block was **45 . 0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 3
The flaw exhibited 20% DAC at 3 . 76 and 4 . 27 inches MP. Max amplitude is at 3 . 92 inches MP with the transducer exit point at -3.2 inches (W) from the centerline of the weld and 235 . 5 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
3 . 76 (metal path at 20% upper) * COS of the measured angle 0 . 7071 = **2 . 6587** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
4 . 27 (metal path at 20% lower) * COS of the measured angle 0 . 7071 = **3 . 0193** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
3 . 92 (metal path at maximum amplitude point) * COS of the measured angle 0 . 7071 = **2 . 7718** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
4 . 27 (metal path at maximum amplitude point) squared = **18 . 2329** (a^2)
2 . 7718 (depth at maximum amplitude point) squared = **7 . 6829** (b^2)
$\sqrt{a^2 - b^2}$ = **3 . 2481** inches of surface distance to the flaw from the transducer exit point.
235 . 5 (Lmax) + 3 . 2481 (surf dist) = **238 . 7481** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **2 . 6587** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5 . 160 (part "t") - 3 . 0193 (result of 2) = **2 . 1407** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
3 . 0193 (from step 2) - 2 . 6587 (from step 1) = **0 . 3606** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0 . 0721**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0 . 1803** inches.

l = **0 . 6** (for a/*l* > 0.5, *l* = 2a) t = **5 . 160** (part thickness)
a = 0 . 1803 (surf or sub surf circle one) **S = 2 . 1407**

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Report # 97-0136.01

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 1:00 PM Tom Jones CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans. and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker 06 March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PT 2 97-0136	8	B2.40	1

4. ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw Sizing Worksheet: $l = 0.7"$ $a = 0.1695"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $S = 1.45"$

$\frac{a}{l} = \frac{0.1695}{0.7} = 0.2421$ Round to 0.24

Use 4 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.1695}{5.160} = 0.0328$ Round to 3.3%

From Table IWB-3510-1:

a/l	$a/t\%$
0.20	3.3Y
0.25	3.8Y

$Y = \frac{S}{a} = \frac{1.45}{0.1695} = 8.6 \Rightarrow Y = 1$

By observation, Since $\frac{a}{t}$ calculated equals 3.3% which is equals to code $\frac{a}{t}$ at 3.3% for a/l at 0.20. Indication is Acceptable.

8. Results ☒ OK Reviewer ____

$a/l =$ 0.24

calculated $a/t\% =$ 3.3%

Code allowable $a/t\% =$ 3.3% < a/t% < 3.8%

laminar flaw surface area: $(0.75 \cdot l \cdot w) =$ ____

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer ____ ☒ OK Reviewer ____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ **Accept.**
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date

2/25/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date

07/03/97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date

9 Mar 97

This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

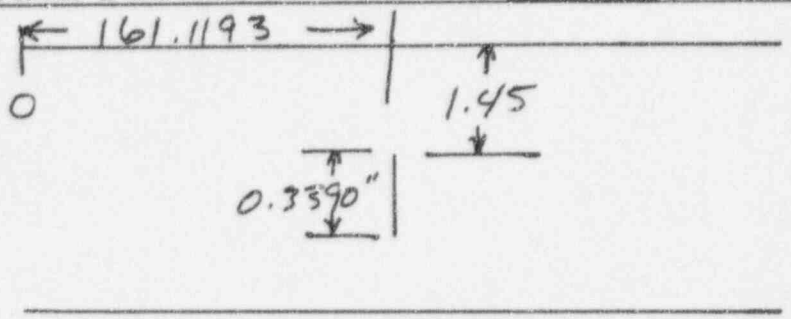
ISI Flaw Sizing Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number
RF2 97-0136	8	B 2.40

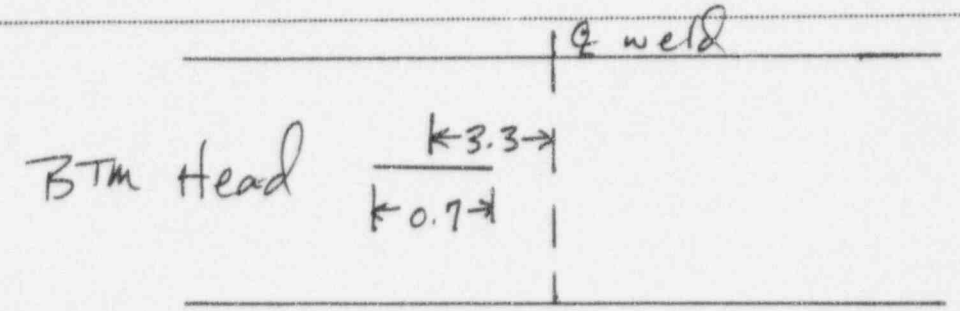
4. ISI Interval	5. Code Edition and Addenda	6. Method
☐ 2nd interval ☒ 3rd interval ☐ preservice	☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other	☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

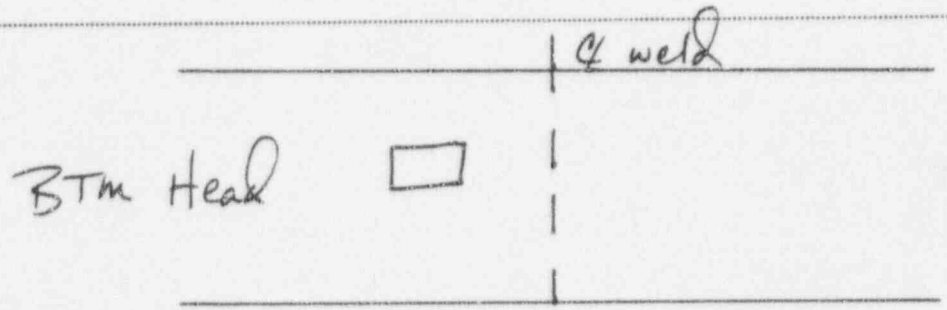
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Prepared Tom J ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"t" = 0.7 "a" = 0.1695 "$t_{nominal}$" = 5.160 "$t_{measured}$" = N/A "S" = 1.45 "w" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Prepared Tom J ☑ OK Reviewer EJ

16. Prepared by and date

Tom Jones 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E. J. Thom 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA TMS **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: TOM Sadd Date: 2/23/97
Flaw # 8 Reviewed By: E. Dufrom Date: 3-12-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -3.6 (W2) - -2.9 (W1) = **0.7** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 3
The flaw exhibited 20% DAC at 2.05 and 2.53 inches MP. Max amplitude is at 2.29 inches MP with the transducer exit point at -3.3 inches (W) from the centerline of the weld and 159.5 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
2.05 (metal path at 20% upper) * COS of the measured angle 0.7071 = **1.4500** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
2.53 (metal path at 20% lower) * COS of the measured angle 0.7071 = **1.7890** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
2.29 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **1.6193** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
2.29 (metal path at maximum amplitude point) squared = **5.2441** (a^2)
1.6193 (depth at maximum amplitude point) squared = **2.6221** (b^2)
$\sqrt{a^2 - b^2}$ = **1.6193** inches of surface distance to the flaw from the transducer exit point.
159.5 (Lmax) + 1.6193 (surf dist) = **161.1193** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **1.4500** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 1.7890 (result of 2) = **3.371** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
1.7890 (from step 2) - 1.4500 (from step 1) = **0.3390** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0678**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.1695** inches.

l = **0.7** (for a/l > 0.5, l = 2a) t = **5.160** (part thickness)
a = **0.1695** (surf or sub surf) circle one) S = **1.4500**

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-4 EXAM 97-0109. PER TELCON APPROVAL JEFF RICKER 3/7/97 TOM JONES 1:00 PM CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker 06 March 97 CMC 3/7/97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI2 97-013	9	B2.40	1

4. ISI Interval ☒ OK Reviewer _____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer _____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer _____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer _____

From attached ISI Flaw Sizing Worksheet: $\ell = 0.5798"$ $a = 0.2899$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $s = 2.1124"$

$$\frac{a}{\ell} = \frac{0.2899}{0.5798} = 0.50$$

Use 4 to 12 Subsurface Flaw:

$$\frac{a}{t}\% = \frac{0.2899}{5.160} = 0.0562 \text{ Round to } 5.6\%$$

From Table IWB-3510-1:

a/ℓ	a/t %
0.50	7.6 Y

$$Y = \frac{s}{a} = \frac{2.1124}{0.2899} = 7.3 \Rightarrow Y = 1$$

By observation, since $\frac{a}{t}$ calculated equals 5.6% which is less than 7.6%. Indication is Acceptable.

8. Results ☒ OK Reviewer _____

a/ℓ = 0.50

calculated a/t % = 5.6%

Code allowable a/t % = 7.6%

laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer _____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1	
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6	
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2		
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2	
☐ IWC-3513-1						

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer _____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer _____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer _____

☒ *Accept.*
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date

Tim Tran 2/25/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date

03/03/97

The review certifies that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date

4/2/97

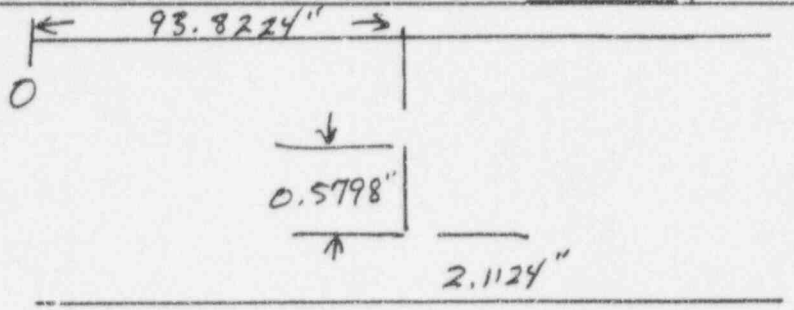
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

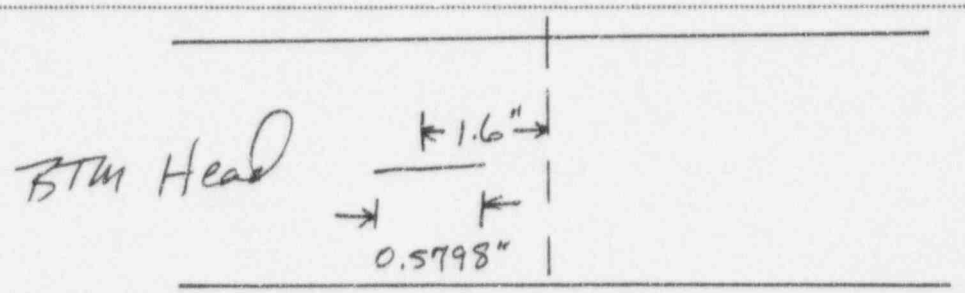
1. ISI Report Number PI/2 97-0136	2. Flaw Number 9	3. Item Number B 2.40
4. ISI interval ☑ OK Reviewer EJ ☐ 2nd interval ☒ 3rd interval ☐ preservice	5. Code Edition and Addenda ☑ OK Reviewer EJ ☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other	6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

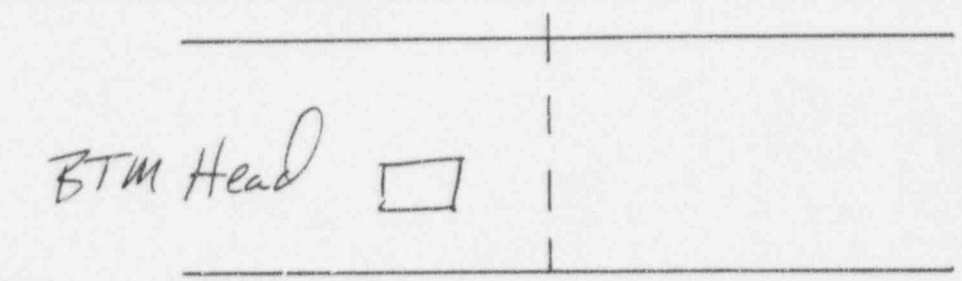
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TJS ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"ℓ" = 0.5798" "a" = 0.2899" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 2.1124" "w" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number ☐ Flaw 1 ☐ Flaw 2 ☒ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TJS ☑ OK Reviewer EJ

16. Prepared by and date

Tom Sorel 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E. J. Thorn 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA TH INITIAL TO VERIFY

ISI Report # 97-0136 Evaluation Performed By: Tom Lentz Date: 2/23/97

Flaw # 9 Reviewed By: E. J. Thom Date: 3-4-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.

L and W values are from page ___ of the UT report.

l = -1.8 (W2) - -1.5 (W1) = **0.3** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).

This value is from page 1 of the UT report.

"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 3

The flaw exhibited 20% DAC at 3.49 and 4.31 inches MP. Max amplitude is at 3.85 inches MP with the transducer exit point at -1.6 inches (W) from the centerline of the weld and 91.1 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
   3.49 (metal path at 20% upper) * COS of the measured angle 0.7071 = **2.4678** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
   4.31 (metal path at 20% lower) * COS of the measured angle 0.7071 = **3.0476** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
   3.85 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **2.7223** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
   3.85 (metal path at maximum amplitude point) squared = **14.8225** (a^2)
   2.7223 (depth at maximum amplitude point) squared = **7.4109** (b^2)
   $\sqrt{a^2 - b^2}$ = **2.7224** inches of surface distance to the flaw from the transducer exit point.
   91.1 (Lmax) + 2.7224 (surf dist) = **93.8224** inches from 0" reference.

5) Determine S by picking the smaller of the following;
   S = **2.4678** (result of 1) = distance between exam surface and the upper flaw tip
   >> OR <<
   S = 5.160 (part "t") - 3.0476 (result of 2) = **2.1124** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
   3.0476 (from step 2) - 2.4678 (from step 1) = **0.5798** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.1160**

Compare to S (from step 5)

If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.

If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.2899** inches.

l = **0.5798** (for a/l > 0.5, **= 2a**) t = **5.160** (part thickness)

a = 0.2899 (surf or **sub surf**, circle one) S = **2.1124**

Internal Correspondence

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CMC TM 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.

The original worksheets did not consider curvature when determining indication depth on the circumferential scans.

The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Thomas Jones 3/5/97 Tin Tran 3/6/97 Jeff Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

Page 36 of 70
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number PI 2 97-0136 | 2. Flaw Number 10 | 3. Item Number B2.40 | 14. Total Number of Pages 1

4. ISI Interval ☒ OK Reviewer ___
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ___
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ___
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ___

From attached ISI Flaw sizing worksheet : $\ell = 0.6"$ $a = 0.251"$

Flaw Type : subsurface planar $t_{nom} = 5.160"$ $S = 1.5538"$

$\frac{a}{\ell} = \frac{0.251}{0.6} = 0.4183$ Round to 0.42

Use 1 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.251}{5.160} = 0.0486$ round to 4.9%

From Table IWB-3510-1 :

a/ℓ	a/t %
0.40	5.8Y
0.45	6.7Y

$Y = \frac{S}{a} = \frac{1.5538}{0.251} = 6.2 \Rightarrow Y = 1$

By observation, since $\frac{a}{t}$ calculated equals 4.9% which is less than 5.8%. Indication is Acceptable.

8. Results ☒ OK Reviewer ___

a/ℓ = 0.42

calculated a/t % = 4.9%

Code allowable a/t % = 5.8% < a/t % < 6.7%

laminar flaw surface area: (0.75 * ℓ * w) = NA

9. Table used for analysis ☒ OK Reviewer ___

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1	
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6	
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2		
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2	
☐ IWC-3513-1						

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ___ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TDJ ☒ OK Reviewer ___

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ___

☒ **Accept.**
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date
T. Inman 2/25/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date
03/03/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date
4 Mar 97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

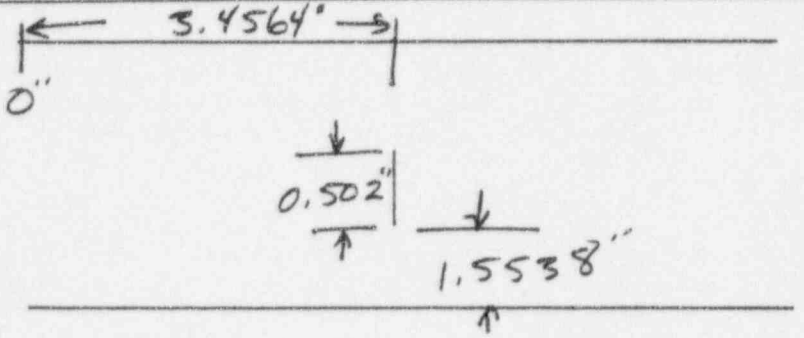
ISI Flaw Sizing Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number
RI2 97-0136	10	B 2.40

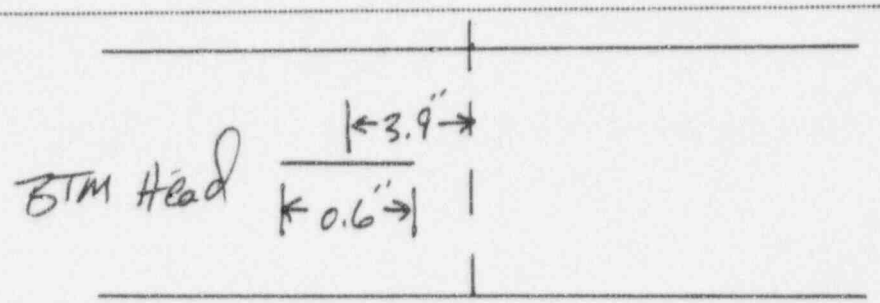
4. ISI Interval	5. Code Edition and Addenda	6. Method
☐ 2nd interval ☒ 3rd interval ☐ preservice	☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other	☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

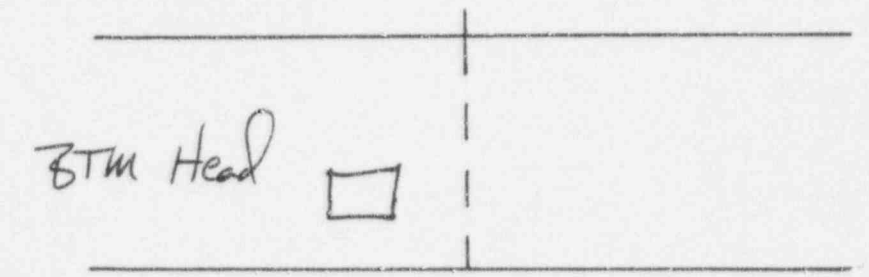
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used ☒ yes Preparer TMS ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"t" = 0.6" "a" = 0.251" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 1.5538" "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TMS ☑ OK Reviewer EJ

16. Prepared by and date

Tom Sobs 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E. J. Throm 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~The~~ J INITIAL TO VERIFY

ISI Report # 97-0136 Evaluation Performed By: Tom Sarb Date: 2/23/97
Flaw # 10 Reviewed By: E. J. Thom Date: 3-4-97

Length
Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -4.2 (W2) - -3.6 (W1) = **0.6** inches.

Thickness
Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = **5.160** inches

Calibration
The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 4
The flaw exhibited 20% DAC at 4.39 and 5.1 inches MP. Max amplitude is at 4.87 inches MP with the transducer exit point at -3.9 inches (W) from the centerline of the weld and 6.9 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
4.39 (metal path at 20% upper) * COS of the measured angle 0.7071 = **3.1042** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
5.1 (metal path at 20% lower) * COS of the measured angle 0.7071 = **3.6062** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
4.87 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **3.4436** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
4.87 (metal path at maximum amplitude point) squared = **23.7169** (a^2)
3.4436 (depth at maximum amplitude point) squared = **11.8584** (b^2)
$\sqrt{a^2 - b^2}$ = **3.4436** inches of surface distance to the flaw from the transducer exit point.
6.9 (Lmax) - 3.4436 (surf dist) = **3.4564** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **3.1042** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 3.6062 (result of 2) = **1.5538** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
3.6062 (from step 2) - 3.1042 (from step 1) = **0.502** inches.

Determination of surface or subsurface
0.4d = (2d / 2) * 0.4 = **0.1004**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.251** inches.

l = **0.6** (for a/l > 0.5, l = 2a) t = **5.160** (part thickness)
a = **0.251** (surf or (sub surf) circle one) S = **1.5538**

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 1:00 PM Tom Jones CMC TM 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

Page 40 of 70
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI 2 97-012	11	B2.40	1

4. ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw Sizing Worksheet: $\ell = 0.9"$ $a = 0.1944"$

Flaw Type: Subsurface planar $t_{nom} = 5.160"$ $s = \cancel{0.8132"}$ $0.8064"$ TM 3/6/97 ____ 3/6/97

$\frac{a}{\ell} = \frac{0.1944}{0.9} = 0.2160$ Round to 0.22

Use 4 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.1944}{5.160} = 0.0377$ Round to 3.8%

From Table IWB-3510-1:

a/ℓ	a/t %
0.20	3.3Y
0.25	3.8Y

$Y = \frac{s}{a} = \frac{0.8132}{0.1944} = \cancel{4.2 \Rightarrow Y = 1}$

TM 3/6/97 ____ 3/6/97

$= \frac{0.8064}{0.1944} = 4.1 \Rightarrow Y = 1$

8. Results ☒ OK Reviewer ____

a/ℓ = 0.22

calculated a/t % = 3.8%

Code allowable a/t % = 3.3% < a/t % < 3.8%

laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer ____
☒ IWB-3510-1 ☒ IWB-3510-2 ☐ IWB-3510-3 ☐ IWB-3511-1 ☐ IWB-3511-2 ☐ IWB-3512-1
☐ IWB-3512-2 ☐ IWB-3514-1 ☐ IWB-3514-2 ☐ IWB-3514-3 ☐ IWB-3514-4 ☐ IWB-3514-6
☐ IWB-3515-1 ☐ IWB-3516-1 ☐ IWB-3516-2 ☐ IWB-2518-1 ☐ IWB-3518-2
☐ IWC-3510-1 ☐ IWC-3510-2 ☐ IWC-3510-3 ☐ IWC-3511-1 ☐ IWC-3511-2 ☐ IWC-3512-2
☐ IWC-3513-1

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer ____

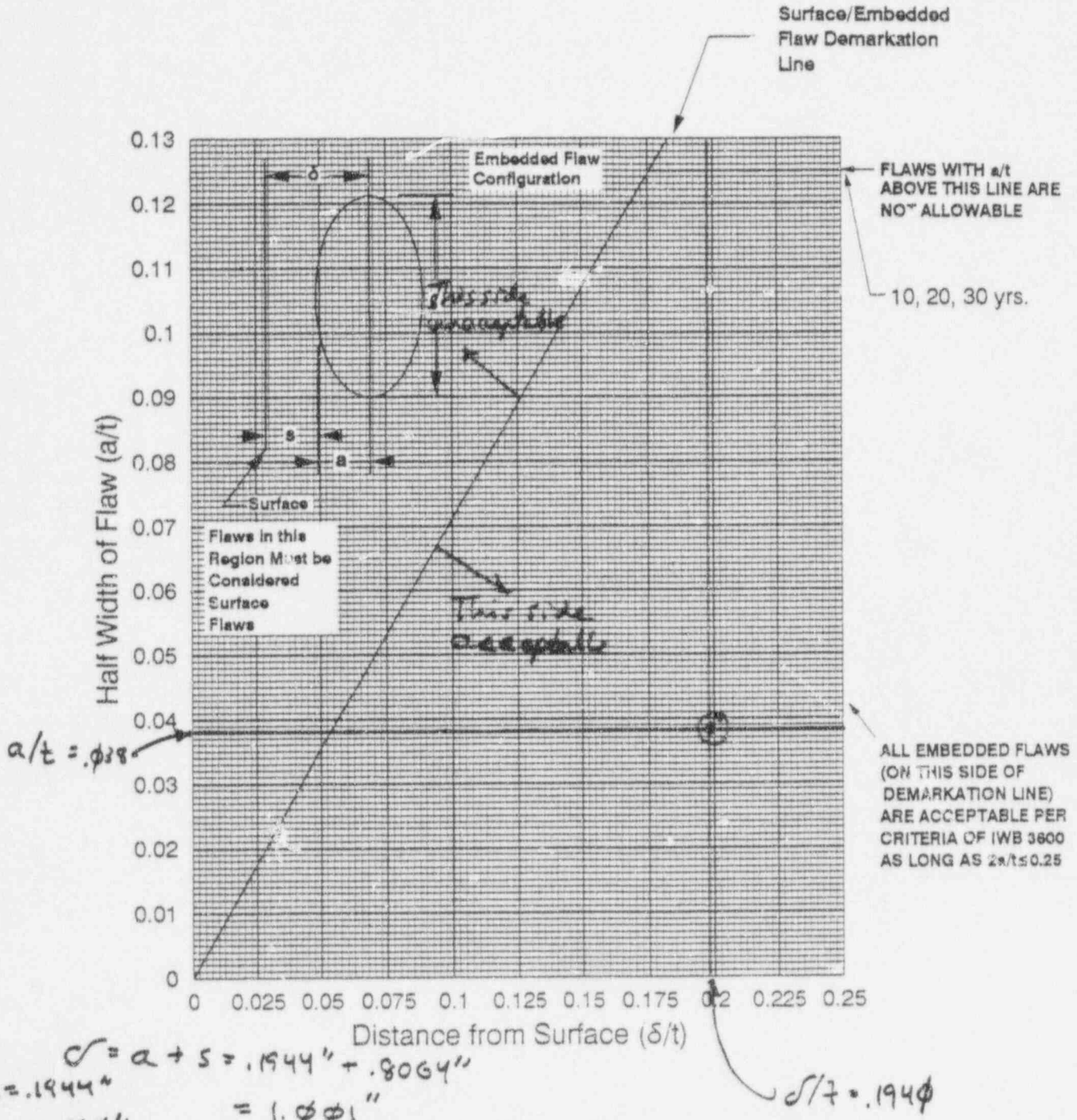
13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ *Accept.* ☐ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$

☒ **Reject.** TM 2/28/97 ☒ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$

☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
2/25/97	03/03/97	4 Mar 97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures	*This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures*



a/t = .038

δ/t = .194

δ = a + s = .1944" + .8064"
= 1.0001"

a = .1944"
t = 5.160"
s = .8064"

Figure A-2.4 Flaw Evaluation Chart for the Tubesheet-Channel Head Junction for Prairie Island Units 1 and 2

X	Inside Surface		Surface Flaw	X	Longitudinal Flaw
X	Outside Surface	X	Embedded Flaw	X	Circumferential Flaw

ISI Report # 97-0136, Flaw #11, O.K. by Handbook. Mark Hays 3/4/97

Page 42 of 70
Report # 97-0136R2

OK 03/06/97

ISI Flaw Sizing Worksheet

1. ISI Report Number PZ 2 97-0136 | 2. Flaw Number 11 | 3. Item Number B 2.40

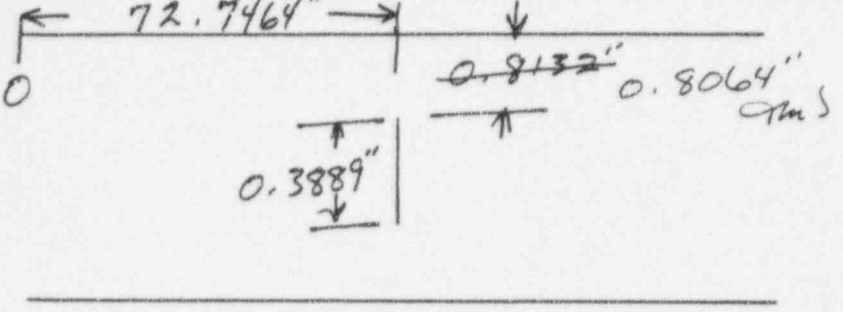
4. ISI Interval ☐ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

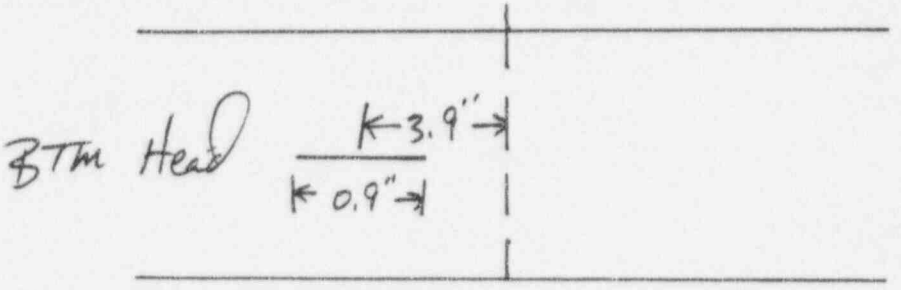
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☒ OK Reviewer EJ

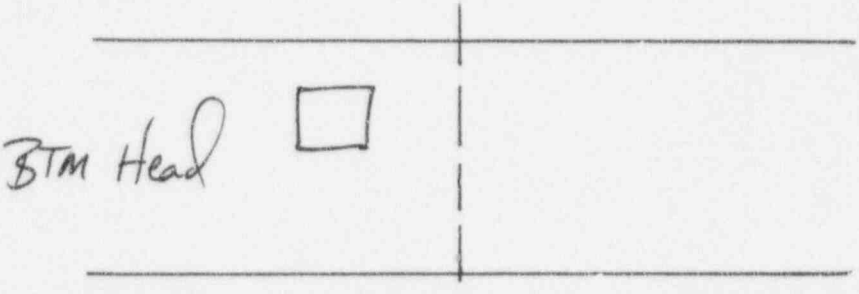
Front View



Top View



Side View



8. Calculations ☒ OK Reviewer EJ
Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TMS ☒ OK Reviewer EJ

10. Code Flaw Dimensions ☒ OK Reviewer EJ
"l" = 0.9" "a" = 0.1944" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = ~~0.8132~~ 0.8064" (TMS) "W" = N/A

11. Flaw Type ☒ OK Reviewer EJ
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☒ OK Reviewer EJ
☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TMS ☒ OK Reviewer EJ

16. Prepared by and date
Tom Scott 2/23/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E. J. Thurman 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~TH~~ INITIAL TO VERIFY

ISI Report # 97-0136 Evaluation Performed By: TOM JONES Date: 2/23/97
Flaw # 11 Reviewed By: E. J. Thom Date: 3-12-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -4.4 (W2) - -3.5 (W1) = **0.9** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **4**

The flaw exhibited 20% DAC at 1.15 and 1.70 inches MP. Max amplitude is at 1.49 inches MP with the transducer exit point at -3.9 inches (W) from the centerline of the weld and 73.8 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
1.15 (metal path at 20% upper) * COS of the measured angle 0.7071 = **0.8132** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
1.70 (metal path at 20% lower) * COS of the measured angle 0.7071 = **1.2021** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
1.49 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **1.0536** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
1.49 (metal path at maximum amplitude point) squared = **2.2201** (a^2)
1.0536 (depth at maximum amplitude point) squared = **1.1101** (b^2)
$\sqrt{a^2 - b^2}$ = **1.0536** inches of surface distance to the flaw from the transducer exit point.
73.8 (Lmax) - 1.0536 (surf dist) = **72.7464** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **0.8132** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 1.2021 (result of 2) = **3.9579** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
1.2021 (from step 2) - 0.8132 (from step 1) = **0.3889** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0778**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.1944** inches.

l = **0.9** (for a/*l* > 0.5, *l* = 2a)
a = **0.1944** (surf or (sub surf) circle one)
t = **5.160** (part thickness)
S = ~~0.8132~~ 0.8064 cm

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Report # 97-0136R1

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-L, EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CHC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CHC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

Page 45 of 70
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number PI2 97-0136 | 2. Flaw Number 12 | 3. Item Number B2.40 | 14. Total Number of Pages 1

4. ISI Interval ☒ OK Reviewer ___
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ___
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ___
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ___

From attached ISI Flaw Sizing Worksheet: $\ell = 0.6"$ $a = 0.2475"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $S = 0.9899"$

$\frac{a}{\ell} = \frac{0.2475}{0.6} = 0.4125$ Round to 0.41

Use 4 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.2475}{5.160} = 0.0480$ Round to 4.8%

From Table IWB-3510-1:

a/ℓ	a/t %
0.40	5.8Y
0.45	6.7Y

$Y = \frac{S}{a} = \frac{0.9899}{0.2475} = 4.0 \Rightarrow Y = 1$

By observation, since $\frac{a}{t}$ calculated equals 4.8% which is less than 5.8%. Indication is Acceptable.

8. Results ☒ OK Reviewer ___

a/ℓ = 0.41

calculated a/t % = 4.8%

Code allowable a/t % = $5.8\% < a/t\% < 6.7\%$

laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer ___
☒ IWB-3510-1 ☐ IWB-3510-2 ☐ IWB-3510-3 ☐ IWB-3511-1 ☐ IWB-3511-2 ☐ IWB-3512-1
☐ IWB-3512-2 ☐ IWB-3514-1 ☐ IWB-3514-2 ☐ IWB-3514-3 ☐ IWB-3514-4 ☐ IWB-3514-6
☐ IWB-3515-1 ☐ IWB-3516-1 ☐ IWB-3516-2 ☐ IWB-3518-1 ☐ IWB-3518-2
☐ IWC-3510-1 ☐ IWC-3510-2 ☐ IWC-3510-3 ☐ IWC-3511-1 ☐ IWC-3511-2 ☐ IWC-3512-2
☐ IWC-3513-1

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ___ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer ___

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ___

☒ *Accept.*
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation [illegible] book (see attached analysis)

15. Prepared by and date
tintraw 2/25/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date
03/03/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date
9 Mar 97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number
PI2 97-0136	12	B2.40

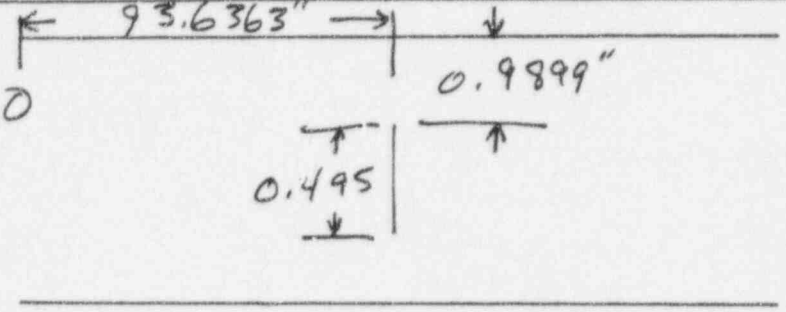
4. ISI Interval ☑ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

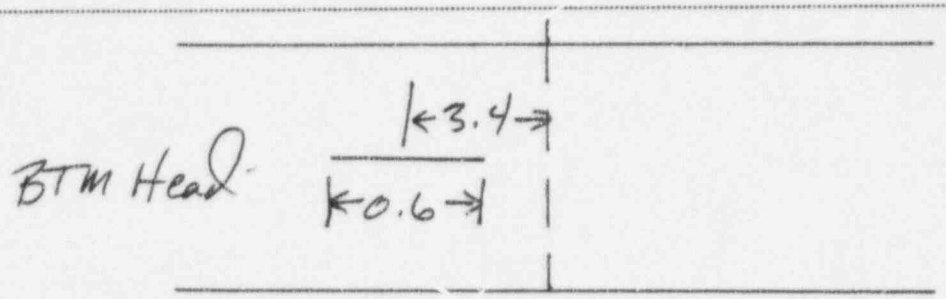
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

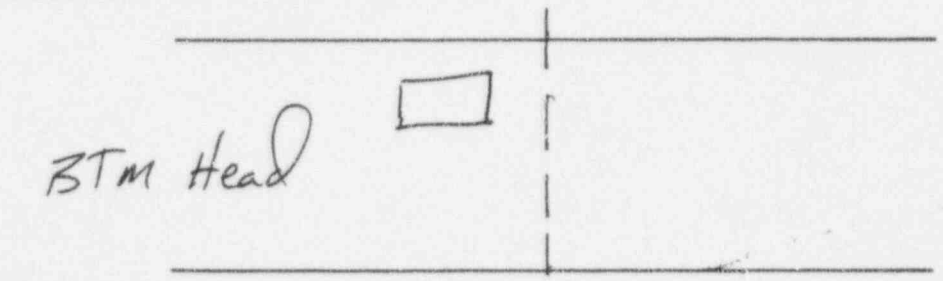
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ
Show determination of surface or subsurface
see attached
Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TMJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ
"ℓ" = 0.6 "a" = 0.2475 "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 0.9899 "w" = N/A

11. Flaw Type ☑ OK Reviewer EJ
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TMJ ☑ OK Reviewer EJ

16. Prepared by and date
Tom Jones 2/23/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E. J. Thoma 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~the~~ **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/27/97
Flaw # 12 Reviewed By: E. J. Thorn Date: 3-12-97

Length

Length of the flaw "*l*" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -3.7 (W2) - -3.1 (W1) = **0.6** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 4
The flaw exhibited 20% DAC at 1.40 and 2.10 inches MP. Max amplitude is at 2.07 inches MP with the transducer exit point at -3.4 inches (W) from the centerline of the weld and 95.1 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
1.40 (metal path at 20% upper) * COS of the measured angle .7071 = **0.9899** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
2.10 (metal path at 20% lower) * COS of the measured angle .7071 = **1.4849** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
2.07 (metal path at maximum amplitude point) * COS of the measured angle .7071 = **1.4637** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
2.07 (metal path at maximum amplitude point) squared = **4.2849** (a^2)
1.4637 (depth at maximum amplitude point) squared = **2.1424** (b^2)
$\sqrt{a^2 - b^2}$ = **1.4637** inches of surface distance to the flaw from the transducer exit point.
95.1 (Lmax) - 1.4637 (surf dist) = **93.6363** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **0.9899** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 1.4849 (result of 2) = **3.6751** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
1.4849 (from step 2) - 0.9899 (from step 1) = **0.495** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.099**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.2475** inches.

l = **0.6** (for a/*l* > 0.5, *l* = 2a) t = **5.160** (part thickness)
a = **0.2475** (surf or sub surf, circle one) **S** = **0.9899**

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

This Evaluation shall pertain to RV closure head W-6 Exam 97-0109. Per Telcon Approval Jeff Ricker 3/7/97 1:00 PM Tom Jones CMC TM 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker 06 March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI 2 97-0136	13	B2.40	1

4. ISI Interval ☒ OK Reviewer MH
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer MH
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer MH
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer MH

From attached ISI Flaw Sizing Worksheet: $\ell = 0.7"$ $a = 0.2122"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $S = 2.2627"$

$\frac{a}{\ell} = \frac{0.2122}{0.7} = 0.3031$ Round to 0.30

Use 4 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.2122}{5.160} = 0.0411$ Round to 4.1%

From Table IWB-3510-1:

$\frac{a}{\ell}$	$\frac{a}{t}\%$
0.30	4.4Y

$Y = \frac{S}{a} = \frac{2.2627}{0.2122} = 10.7 \Rightarrow Y = 1$

By observation, since $\frac{a}{t}$ calculated equals 4.1% which is less than 4.4%. Indication is Acceptable.

8. Results ☒ OK Reviewer MH

a/ℓ = 0.30
calculated a/t % = 4.1%
Code allowable a/t % = 4.4%
laminar flaw surface area: $(0.75 \cdot \ell \cdot w)$ = NA

9. Table used for analysis ☒ OK Reviewer MH

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1	
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6	
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2		
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2	
☐ IWC-3513-1						

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer MH If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TK ☒ OK Reviewer MH

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer MH

☒ *Accept.* ☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ **Reject.** ☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
Tim Traw 2/25/97	03/03/97	4 Mar 97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures	*This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures*

ISI Flaw Sizing Worksheet

1. ISI Report Number PI2 97-0136 | 2. Flaw Number 13 | 3. Item Number B 2.40

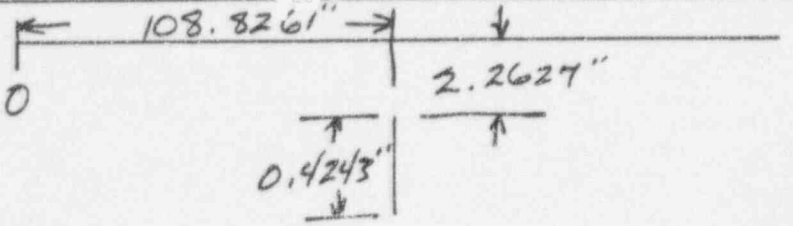
4. ISI Interval ☐ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

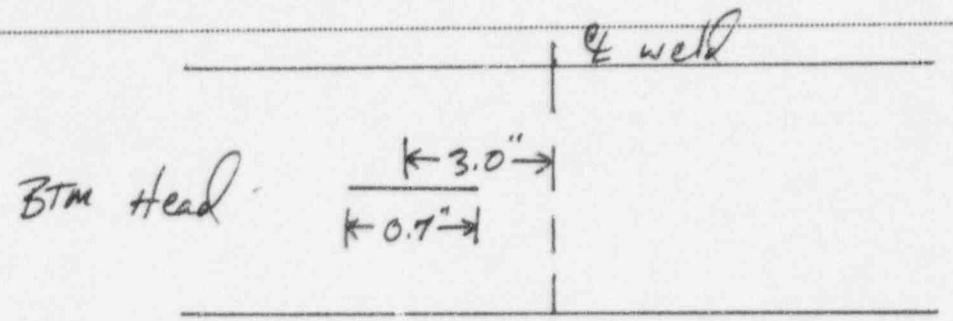
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

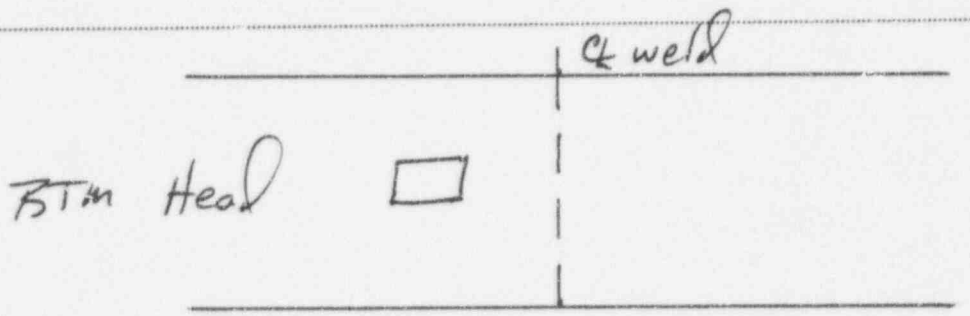
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ
Show determination of surface or subsurface
see attached

Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used ☒ yes Preparer TJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ
"t" = 0.7" "a" = 0.2122" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 2.2627" "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ
☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☑ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TJ ☑ OK Reviewer EJ

16. Prepared by and date
Tom Jones 2/23/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E. J. Thomas 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA INITIAL TO VERIFY

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/27/97
Flaw # 13 Reviewed By: E. J. Thom Date: 3-12-97

Length

Length of the flaw "*l*" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans
L and W values are from page ___ of the UT report.
l = -3.5 (W2) - -2.8 (W1) = **0.7** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **4**

The flaw exhibited 20% DAC at 3.20 and 3.80 inches MP. Max amplitude is at 3.64 inches MP with the transducer exit point at -3.0 inches (W) from the centerline of the weld and 111.4 inches (L) from the 0" reference. (Use of 20% DAC vs. 100% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
3.20 (metal path at 20% upper) * COS of the measured angle 0.7071 = **2.2627** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
3.80 (metal path at 20% lower) * COS of the measured angle 0.7071 = **2.6870** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
3.64 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **2.5738** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
3.64 (metal path at maximum amplitude point) squared = **13.2496** (a^2)
2.5738 (depth at maximum amplitude point) squared = **6.6244** (b^2)
$\sqrt{a^2 - b^2}$ = **2.5739** inches of surface distance to the flaw from the transducer exit point.
111.4 (Lmax) - 2.5739 (surf dist) = **108.8261** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **2.2627** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 2.6870 (result of 2) = **2.473** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
2.6870 (from step 2) - 2.2627 (from step 1) = **0.4243** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0849**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.2122** inches.

l = **0.7** (for a/*l* > 0.5, *l* = 2a)
a = **0.2122** (surf or (sub surf) circle one)
t = **5.160** (part thickness)
S = **2.2627**

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date March 5, 1997

From **Ad Hoc Evaluation Group**

Location **CSC-2**

To **File**

Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELECON APPROVAL Jeff Ricker 3/7/97 1:00 PM Tom Jones CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9645	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Thomas Jones 3/5/97 Tin Tran 3/6/97 J. Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number PI 2 97-0136 | 2. Flaw Number 14 | 3. Item Number B2.40 | 14. Total Number of Pages 1

4. ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw sizing worksheet: $\ell = 0.5444"$ $a = 0.2722$

Flaw Type: Subsurface planar $t_{nom} = 5.160"$ $s = 0.9970$

$$\frac{a}{\ell} = \frac{0.2722}{0.5444} = 0.50$$

Use 4 to 12 subsurface Flaw:

$$\frac{a}{t}\% = \frac{0.2722}{5.160} = 0.0528 \quad \text{Round to } 5.3\%$$

From Table IWB-3510-1:

a/ℓ	a/t %
0.5	7.6 Y

$$Y = \frac{s}{a} = \frac{0.9970}{0.2722} = 3.7 \Rightarrow Y = 1$$

By observation, since a/t calculated equals 5.3% which is less than 7.6%. Indication is Acceptable.

8. Results ☒ OK Reviewer ____

a/ℓ = 0.50
calculated a/t % = 5.3%
Code allowable a/t % = 7.6%
laminar flaw surface area: (0.75 * t * w) = NA

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer ____ ☒ OK Reviewer ____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ **Accept.**
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date
tintrau 2/25/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date
03/03/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date
9 Mar 97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number PI 2 97-0136 | 2. Flaw Number 14 | 3. Item Number B2.40

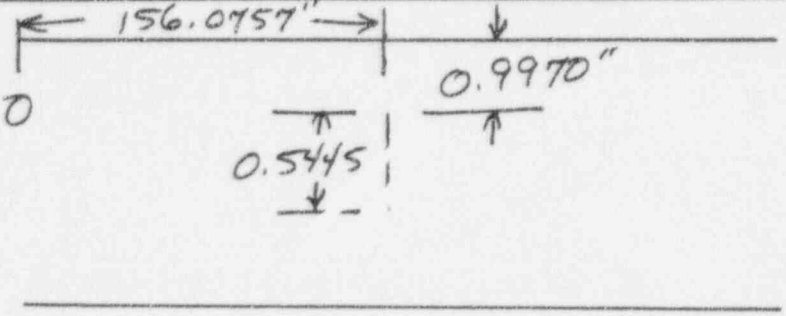
4. ISI Interval ☑ OK Reviewer EJ
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

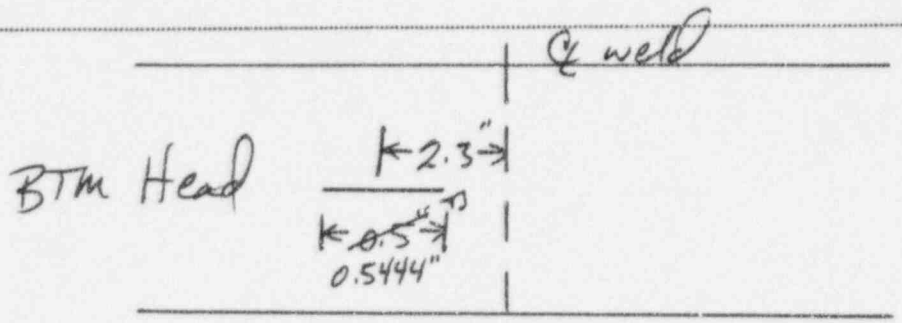
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

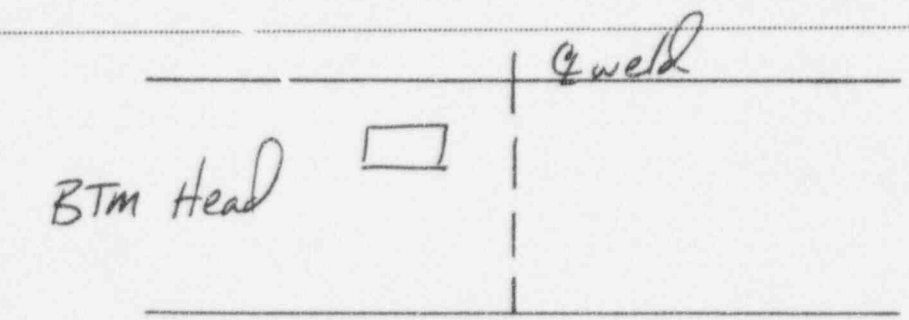
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer TMJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"ℓ" = 0.5444" "a" = 0.2722" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 0.9970" "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☐ Flaw 1 ☐ Flaw 2 ☒ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TMJ ☑ OK Reviewer EJ

16. Prepared by and date

Tom Jones 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E. L. Thomas 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA TMS **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: TM Scott Date: 2/23/97
Flaw # 14 Reviewed By: E.J. Thorn Date: 3-11-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -2.6 (W2) - -2.1 (W1) = **0.5** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **4**

The flaw exhibited 20% DAC at 1.41 and 2.18 inches MP. Max amplitude is at 1.59 inches MP with the transducer exit point at -2.3 inches (W) from the centerline of the weld and 157.2 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
1.41 (metal path at 20% upper) * COS of the measured angle 0.7071 = **0.9970** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
2.18 (metal path at 20% lower) * COS of the measured angle 0.7071 = **1.5415** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
1.59 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **1.1243** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
1.59 (metal path at maximum amplitude point) squared = **2.5281** (a^2)
1.1243 (depth at maximum amplitude point) squared = **1.2640** (b^2)
$\sqrt{a^2 - b^2}$ = **1.1243** inches of surface distance to the flaw from the transducer exit point.
157.2 (Lmax) - 1.1243 (surf dist) = **156.0757** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **0.9970** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5.160 (part "t") - 1.5415 (result of 2) = **3.6185** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
1.5415 (from step 2) - 0.9970 (from step 1) = **0.5445** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.1089**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _____ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.2722** inches.

l = **0.5444** (for a/l > 0.5 (l = 2a))
a = **0.2722** (surf or (sub surf) circle one)
t = **5.160** (part thickness)
S = **0.9970**

Page 56 of 70
Report # 97-0136R1

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-4 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 1:00 PM Tom Jones CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets. The original worksheets did not consider curvature when determining indication depth on the circumferential scans. The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

Page 57 of 70
Report # 97-0136R1

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI2 97-0136	15	B2.40	1

ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw Sizing Worksheet: $\ell = 0.3676"$ $a = 0.1838"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $S = 1.2144"$

$$\frac{a}{\ell} = \frac{0.1838}{0.3676} = 0.50$$

Use 4 to 12 subsurface Flaw:

$$\frac{a}{t}\% = \frac{0.1838}{5.160} = 0.0356 \text{ Round to } 3.6\%$$

From Table IWB-3510-1:

$\frac{a}{\ell}$	$\frac{a}{t}\%$
0.50	7.6 Y

$$Y = \frac{S}{a} = \frac{1.2144}{0.1838} = 6.6 \Rightarrow Y = 1$$

By observation, since a/t calculated equals 3.6% which is less than 7.6%. Indication is acceptable

8. Results ☒ OK Reviewer ____

a/ℓ = 0.50
calculated a/t % = 3.6%
Code allowable a/t % = 7.6%
laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer DJ ☒ OK Reviewer ____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ *Accept.*
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date
2/26/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

16. Engineering review by and date
03/03/97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Approved by and date
4 Mar 97
This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number PT2 97-0136 | 2. Flaw Number 15 | 3. Item Number B2.40

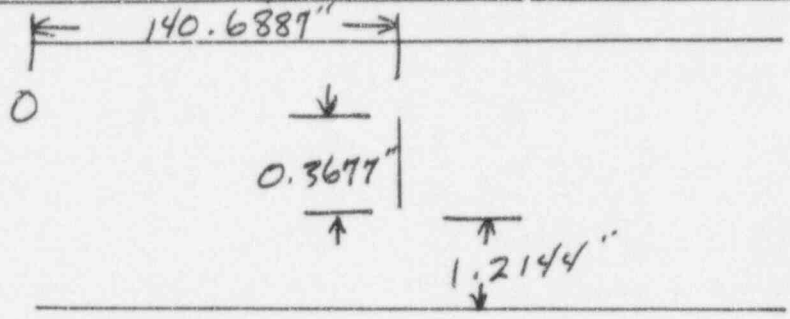
ISI Interval ☑ OK Reviewer [illegible]
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer [illegible]
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

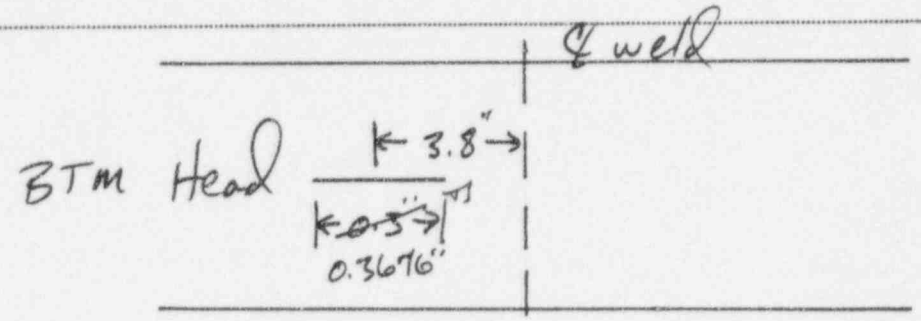
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer [illegible]

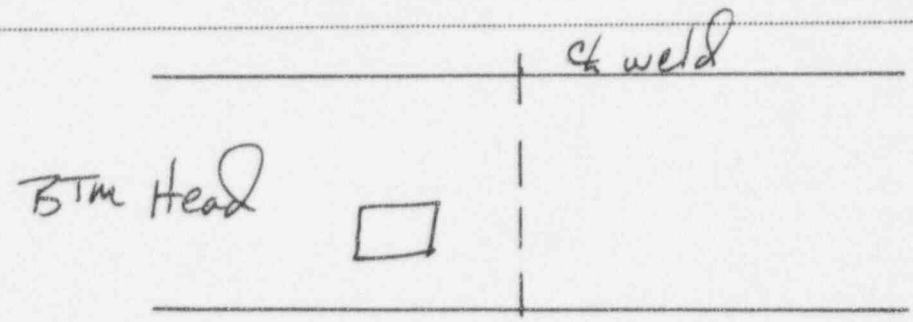
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer [illegible]
Show determination of surface or subsurface
see attached

Show determination of type of "a" to use
see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used ☒ yes Preparer [illegible] ☑ OK Reviewer [illegible]

10. Code Flaw Dimensions ☑ OK Reviewer [illegible]
"l" = 0.367 "a" = 0.1838" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 1.2144" "W" = N/A

11. Flaw Type ☑ OK Reviewer [illegible]
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer [illegible]
☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☐ Flaw 1 ☐ Flaw 2 ☒ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used ☒ yes Preparer [illegible] ☑ OK Reviewer [illegible]

16. Prepared by and date
Tom Jones 2/23/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date
E. L. Thomas 3-12-97
This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA MS **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: [signature] Date: 2/23/97

Flaw # 15 Reviewed By: E.J. Thom Date: 3-12-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.

L and W values are from page ___ of the UT report.

l = -3.9 (W2) - -3.6 (W1) = **0.3** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).

This value is from page 1 of the UT report

"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **4**

The flaw exhibited 20% DAC at 5.06 and 5.58 inches MP. Max amplitude is at 5.39 inches MP with the transducer exit point at -3.8 inches (W) from the centerline of the weld and 144.5 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
   5.06 (metal path at 20% upper) * COS of the measured angle 0.7071 = **3.5779** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
   5.58 (metal path at 20% lower) * COS of the measured angle 0.7071 = **3.9456** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
   5.39 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **3.8113** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
   5.39 (metal path at maximum amplitude point) squared = **29.0521** (a^2)
   3.8113 (depth at maximum amplitude point) squared = **14.5260** (b^2)
   $\sqrt{a^2 - b^2}$ = **3.8113** inches of surface distance to the flaw from the transducer exit point.
   144.5 (Lmax) - 3.8113 (surf dist) = **140.6887** inches from 0" reference.

5) Determine S by picking the smaller of the following;
   S = **3.5779** (result of 1) = distance between exam surface and the upper flaw tip
   >> OR <<
   S = 5.160 (part "t") - 3.9456 (result of 2) = **1.2144** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
   3.9456 (from step 2) - 3.5779 (from step 1) = **0.3677** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0735**

Compare to S (from step 5)

If S is less than 0.4d, the flaw is **surface**. a = 2d + S = ___ inches.

If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0.1838** inches.

l = **0.3676** (for a/l > 0.5, l = 2a) t = **5.160** (part thickness)

a = **0.1838** (surf or sub surf circle one) S = **1.2144**

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Report # 97-013ER1

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-4 EXAM 97-0109. PER TELCON APPROVAL JEFF RICKER 3/7/97 TOM JONES 1:00 PM CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets. The original worksheets did not consider curvature when determining indication depth on the circumferential scans. The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J Ricker ok March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PSI 2 97-0136	16	B2.40	1

ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw Sizing Worksheet: $\ell = 0.4"$ $a = 0.1485"$

Flaw Type: Subsurface planar $t_{nom} = 5.160"$ $S = 1.6758"$

$\frac{a}{\ell} = \frac{0.1485}{0.4} = 0.3713$ Round to 0.37

Use 4 to 12 subsurface flaw:

$\frac{a}{t}\% = \frac{0.1485}{5.160} = 0.0288$ Round to 2.9%

From Table IWB-3510-1:

a/ℓ	a/t%
0.35	5.1Y
0.40	5.8Y

$Y = \frac{S}{a} = \frac{1.6758}{0.1485} = 11.3 \Rightarrow Y = 1$

By observation, since a/t calculated equals 2.9% which is less than 5.1%. Indication is Acceptable

8. Results ☒ OK Reviewer ____

a/t = 0.37

calculated a/t % = 2.9%

Code allowable a/t % = 5.1% < a/t% < 5.8%

laminar flaw surface area: (0.75 • ℓ • w) = NA

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? By observation

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer ____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ *Accept.*
☐ **Reject.**

☒ $(a/t)_{Code\ allowable} \geq (a/t)_{calculated}$
☐ $(a/t)_{Code\ allowable} < (a/t)_{calculated}$
☐ OEM flaw evaluation handbook (see attached analysis)

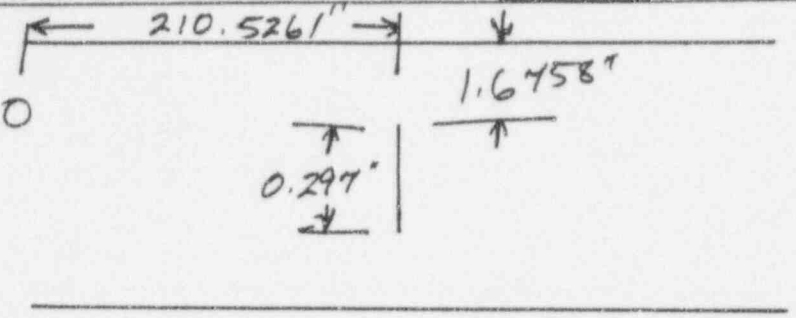
15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
T. Intrau 2/26/97	03/03/97	4 Mar 97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	*This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.*

ISI Flaw Sizing Worksheet

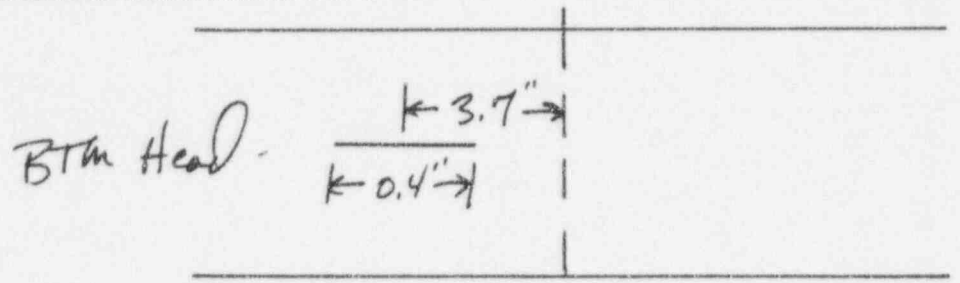
1. ISI Report Number PF2 97-0136	2. Flaw Number 16	3. Item Number B 2.40
ISI Interval ☑ OK Reviewer EJ ☐ 2nd interval ☑ 3rd interval ☐ preservice	5. Code Edition and Addenda ☑ OK Reviewer EJ ☐ 80 W81 ☐ 86 no addenda ☑ 89 no addenda ☐ other	6. Method ☑ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

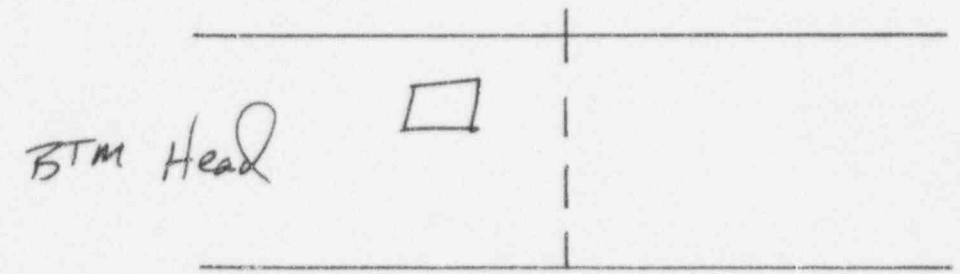
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☑ yes Preparer TJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"l" = 0.4" "a" = 0.1485" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = 1.6458" "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☑ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1
☑ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☑ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☑ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☑ yes Preparer TJ ☑ OK Reviewer EJ

16. Prepared by and date

Tom Jones 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E. J. Thom 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~TWS~~ **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: Tom Scott Date: 2/23/97
Flaw # 16 Reviewed By: E. J. Thum Date: 3-12-97

Length

Length of the flaw "l" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -3.9 (W2) - -3.5 (W1) = **0.4** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5.160 inches

Calibration

The measured angle in the calibration block was **45.0** degrees

Calculations using metal path From page ___ of the UT report, Scan # **4**

The flaw exhibited 20% DAC at 2.37 and 2.79 inches MP. Max amplitude is at 2.65 inches MP with the transducer exit point at -3.7 inches (W) from the centerline of the weld and 212.4 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
2.37 (metal path at 20% upper) * COS of the measured angle 0.7071 = **1.6758** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
2.79 (metal path at 20% lower) * COS of the measured angle 0.7071 = **1.9728** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
2.65 (metal path at maximum amplitude point) * COS of the measured angle 0.7071 = **1.8738** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
2.65 (metal path at maximum amplitude point) squared = **7.0225** (a^2)
1.8738 (depth at maximum amplitude point) squared = **3.5111** (b^2)
$\sqrt{a^2 - b^2}$ = **1.8739** inches of surface distance to the flaw from the transducer exit point.
212.4 (Lmax) - 1.8739 (surf dist) = **210.5261** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **1.6758** (result of 1) = distance between exam surface and the upper flaw tip
>< OR <<
S = 5.160 (part "t") - 1.9728 (result of 2) = **3.1872** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
1.9728 (from step 2) - 1.6758 (from step 1) = **0.297** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0.0594**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d ___ inches.
If S is greater than or equal to 0.4a the flaw is **subsurface**. a = 2a / 2 = **0.1485** inches.

l = **0.4** (for a/l > 0.5, l = 2a) **160** (part thickness)
a = **0.1485** (surf or sub surf circle one) S = **.6758**

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Report # 97-0136R1

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 Tom Jones 1:00 PM CHC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

- The determination of length varies with the direction of scan and is addressed by the new sheets. Length of the flaw is determined by finding the difference between L1 and L2 for perpendicular scans, and W1 and W2 for parallel scans.
- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
- The methodology to calculate depth is based on metal path and obviates the need to convert screen divisions into depth relating the calibration block to the component.

Consideration of the effect of the curvature of the vessel on depth determination for indications

Report	ind #	scan	type	Max MP	Radius	surf dist	diff	prev "S"	corr "S"	"S" from	0.4d
97-0136	6	3	circ	6.42	67.50	4.5396	0.1556	0.6204	0.7760	ID	0.0028
	7	3	circ	3.92	67.50	3.2481	0.0811	2.1407	2.2218	ID	0.0721
	8	3	circ	2.29	67.50	1.6193	0.0203	1.4500	1.4297	OD	0.0678
	9	3	circ	3.85	67.50	2.7224	0.0540	2.1124	2.1664	ID	0.1160
	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
The original worksheets did not consider curvature when determining indication depth on the circumferential scans.
The corrected values for "S" were reviewed against the calculations for surface proximity and value for "Y" and found to have no impact on the acceptability of the indications.

CHC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 Jeff Ricker Ob March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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Report # 97-013621

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI 2 97-0136	17	B2.40	1

ISI Interval ☒ OK Reviewer ____
☐ second interval ☒ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer ____
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other ____

6. Acceptance Standard ☒ OK Reviewer ____
☒ IWB-3510 ☐ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer ____

From attached ISI Flaw sizing worksheet: $\ell = 0.8"$ $a = 0.2581"$

Flaw Type: Subsurface Planar $t_{nom} = 5.160"$ $s = ~~1.9445~~$ 1.9040" TM 3/6/97

$\frac{a}{\ell} = \frac{0.2581}{0.8} = 0.3226$ Round to 0.32 ✓ 3/6/97

Use 4 to 12 subsurface Flaw:

$\frac{a}{t}\% = \frac{0.2581}{5.160} = 0.0500$ Round to 5.0% TM 3/6/97 ✓ 3/6/97

From Table IWB-3510-1:

a/l	a/t%
0.30	4.4Y
0.35	5.1Y

} Interpolation

$Y = \frac{s}{a} = \frac{~~1.9445~~ 1.9040}{0.2581} = ~~7.5~~ 7.4 \Rightarrow Y = 1$

$a/\ell = 0.32$, $a/t\% = ~~4.5\%~~$ 4.7% TM 3/3/97 ✓ 3/6/97

8. Results ☒ OK Reviewer ____

a/l = 0.32

calculated a/t % = 5.0%

Code allowable a/t % = ~~4.5%~~ 4.7% TM 3/3/97

laminar flaw surface area: (0.75 × l × w) = NA

9. Table used for analysis ☒ OK Reviewer ____

☒ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1	
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6	
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2		
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2	
☐ IWC-3513-1						

10. Was linear interpolation used? ☒ yes ☐ no If no, why?

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer ____ If no, why?

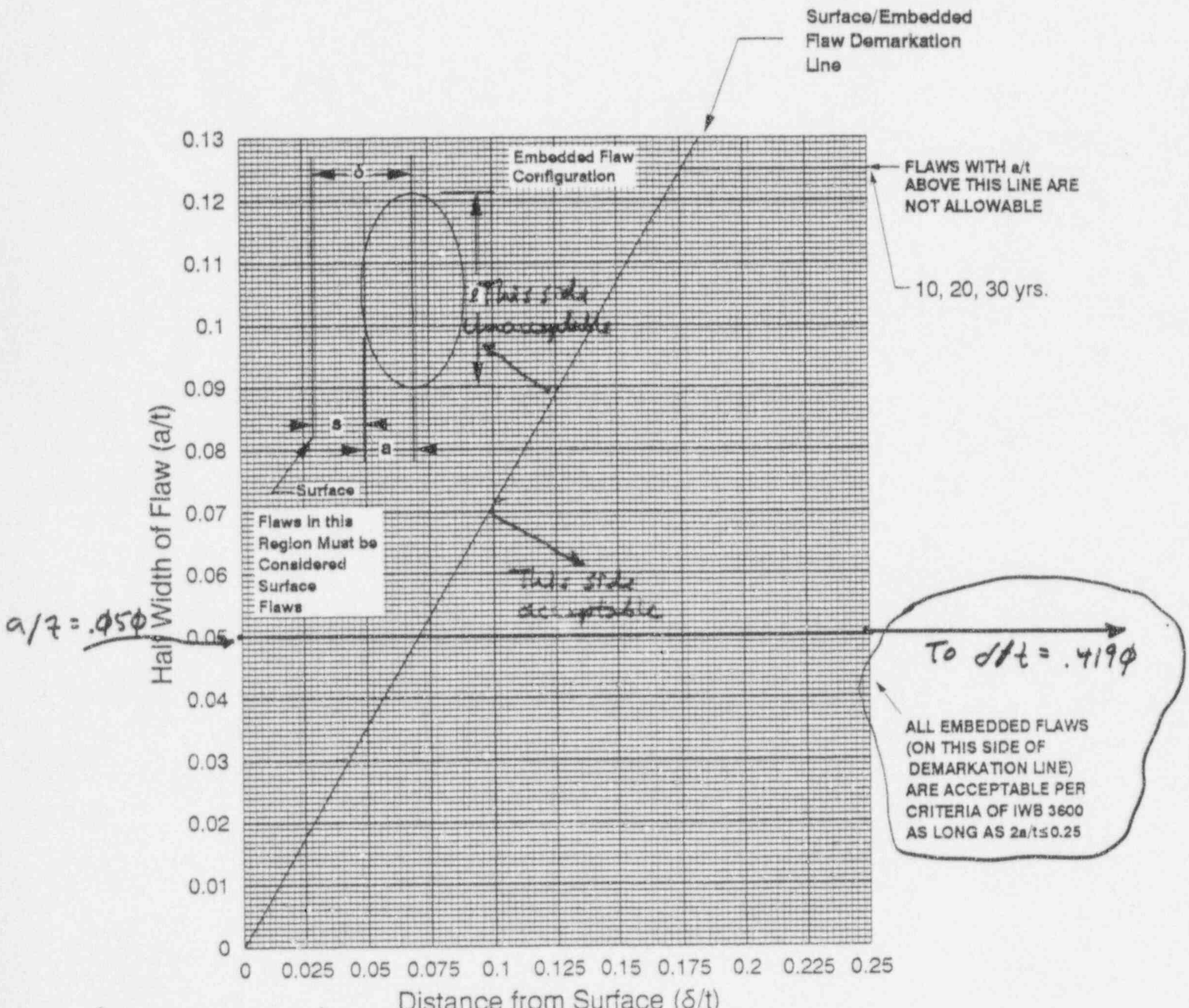
12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer TM ☒ OK Reviewer ____

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer ____

☒ Accept.
☒ Reject. TM 2/25/97

☐ (a/t)Code allowable ≥ (a/t)calculated
☒ (a/t)Code allowable < (a/t)calculated
☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
2/26/97	03/03/97	3/6/97
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	*This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.*	*This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.*



δ = a + s = .2581" + 1.9Ø4Ø" = 2.1621"

a = .2581" s = 1.9Ø4Ø"

t = 5.16Ø"

Figure A-2.4 Flaw Evaluation Chart for the Tubesheet-Channel Head Junction for Prairie Island Units 1 and 2

X	Inside Surface	___	Surface Flaw	X	Longitudinal Flaw
X	Outside Surface	X	Embedded Flaw	X	Circumferential Flaw

ISI Report # 97-Ø136, Flaw #17, O.K. by handbook, [signature] 3/4/97

OK [signature] 03/06/97

ISI Flaw Sizing Worksheet

1. ISI Report Number RE2 97-0136 | 2. Flaw Number 17 | 3. Item Number B 2.40

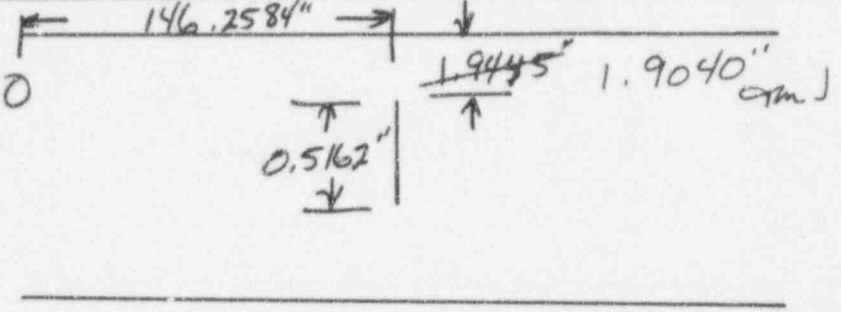
4. ISI Interval ☑ OK Reviewer EJ ☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer EJ ☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other

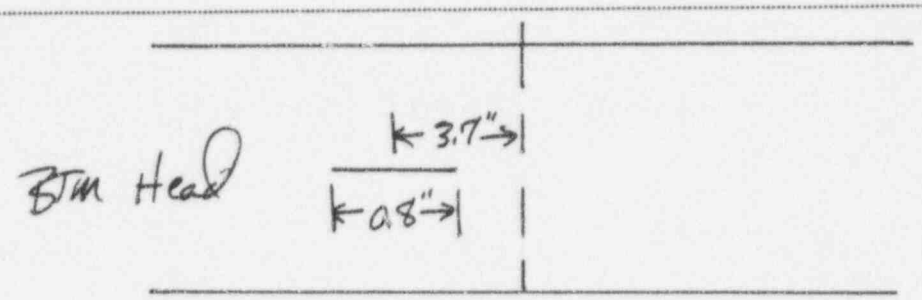
6. Method ☒ UT ☐ RT ☐ PT ☐ MT

7. Flaw Sketch ☑ OK Reviewer EJ

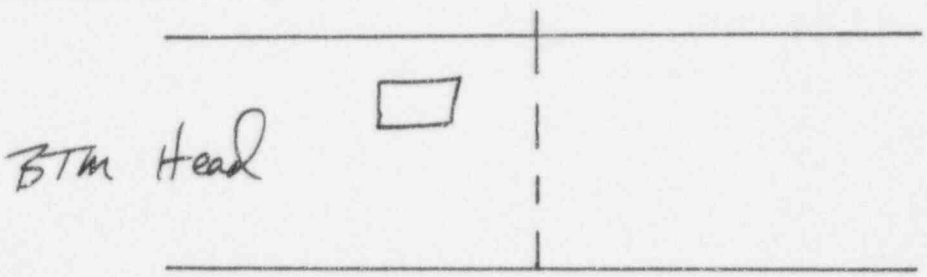
Front View



Top View



Side View



8. Calculations ☑ OK Reviewer EJ

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ Yes Preparer TMJ ☑ OK Reviewer EJ

10. Code Flaw Dimensions ☑ OK Reviewer EJ

"ℓ" = 0.8" "a" = 0.2581" "$t_{nominal}$" = 5.160" "$t_{measured}$" = N/A "S" = ~~1.9445~~ 1.9040" atm "W" = N/A

11. Flaw Type ☑ OK Reviewer EJ

☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☑ OK Reviewer EJ

☐ IWA-3310-1 ☐ IWA-3330-1 ☐ IWA-3350-1 ☐ IWA-3380-1 ☐ IWA-3400-1

☒ IWA-3320-1 ☐ IWA-3340-1 ☐ IWA-3360-1 ☐ IWA-3390-1

13. Flaw Characterization Figure Number ☒ Flaw 1 ☐ Flaw 2 ☐ Flaw 3 ☐ Flaw 4 ☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ Yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ Yes Preparer TMJ ☑ OK Reviewer EJ

16. Prepared by and date

Tom Jones 2/23/97

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

17. Review by and date

E. J. Thomas 3-12-97

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

Flaw Sizing Calculations Using Metal Path for Vessel Welds > 2"

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA ~~The~~ **INITIAL TO VERIFY**

ISI Report # 97-0136 Evaluation Performed By: T Ohm Date: 2/23/97
Flaw # 17 Reviewed By: E J Thom Date: 3-12-97

Length

Length of the flaw "*l*" is determined by finding the difference between L1 and L2 for perpendicular scans, W1 and W2 for parallel scans.
L and W values are from page ___ of the UT report.
l = -4 . 1 (W2) - -3 . 3 (W1) = **0 . 8** inches.

Thickness

Thickness of the component at the location of the flaw, using UT or nom wall (circle one).
This value is from page 1 of the UT report.
"t" = 5 . 160 inches

Calibration

The measured angle in the calibration block was **45 . 0** degrees

Calculations using metal path From page ___ of the UT report, Scan # 4
The flaw exhibited 20% DAC at 2 . 75 and 3 . 48 inches MP. Max amplitude is at 3 . 17 inches MP with the transducer exit point at -3 . 7 inches (W) from the centerline of the weld and 148 . 5 inches (L) from the 0" reference. (Use of 20% DAC vs. 50% max amp for indications > 100% DAC is conservative.)

1) Determine the upper depth of the flaw from the exam surface.
2 . 75 (metal path at 20% upper) * COS of the measured angle 0 . 7071 = **1 . 9445** inches depth.

2) Determine the lower depth of the flaw from the exam surface.
3 . 48 (metal path at 20% lower) * COS of the measured angle 0 . 7071 = **2 . 4607** inches depth.

3) Determine the depth of the flaw from the exam surface at the maximum amplitude point.
3 . 17 (metal path at maximum amplitude point) * COS of the measured angle 0 . 7071 = **2 . 2415** inches depth.

4) Determine the distance from 0" reference to the maximum amplitude point of the flaw.
3 . 17 (metal path at maximum amplitude point) squared = **10 . 0489** (a^2)
2 . 2415 (depth at maximum amplitude point) squared = **5 . 0243** (b^2)
$\sqrt{a^2 - b^2}$ = **2 . 2416** inches of surface distance to the flaw from the transducer exit point.
148 . 5 (Lmax) - 2 . 2416 (surf dist) = **146 . 2584** inches from 0" reference.

5) Determine S by picking the smaller of the following;
S = **1 . 9445** (result of 1) = distance between exam surface and the upper flaw tip
>> OR <<
S = 5 . 160 (part "t") - 2 . 4607 (result of 2) = **2 . 6993** distance between the side opposite exam surface and the lower flaw tip

6) Determine 2d in though wall thickness.
2 . 4607 (from step 2) - 1 . 9445 (from step 1) = **0 . 5162** inches.

Determination of surface or subsurface

0.4d = (2d / 2) * 0.4 = **0 . 1032**
Compare to S (from step 5)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = ___ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = **0 . 2581** inches.

l = **0 . 8** (for a/*l* > 0.5, *l* = 2a)
a = 0 . 2581 (surf or (sub surf) circle one)
t = 5 . 160 (part thickness)
S = 1 . 9445 ~~1.9040"~~ OM

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Report # 97-0136R1

flawtrig (for parallel scans) Rev 0

Internal Correspondence

NSP

Date **March 5, 1997**

From **Ad Hoc Evaluation Group** Location **CSC-2**

To **File** Location

Subject **Use of revised ISI calculation worksheets and correction for curvature**

THIS EVALUATION SHALL PERTAIN TO RV CLOSURE HEAD W-6 EXAM 97-0109. PER TELCON APPROVAL Jeff Ricker 3/7/97 1:00 PM Tom Jones CMC 3/7/97

During the 1997 inspection of Steam Generator 22, weld W-A, several indications were reported under reports 97-0136 and 97-0137. Using procedure ISI-FE-1 Rev 2 to perform the flaw evaluation, it was determined by the level III that the applicable worksheet (Figure 7) could be improved upon for these calculations. As a result, two new worksheets were developed that have the following benefits;

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- The level of recording in relation to DAC is corrected for flaws less than 100% DAC and also provides a conservative recording level for flaws in excess of 100% DAC.
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	10	4	circ	4.87	67.50	3.4436	0.0879	1.5538	1.6417	ID	0.1004
	11	4	circ	1.49	67.50	1.0536	0.0068	0.8132	0.8064	OD	0.0778
	12	4	circ	2.07	67.50	1.4637	0.0135	0.9899	0.9764	OD	0.0990
	13	4	circ	3.64	67.50	2.5739	0.0473	2.2627	2.2154	OD	0.0849
	14	4	circ	1.59	67.50	1.1243	0.0068	0.9970	0.9902	OD	0.1089
	15	4	circ	5.39	67.50	3.8113	0.1082	1.2144	1.3226	ID	0.0735
	16	4	circ	2.65	67.50	1.8739	0.0270	1.6758	1.6488	OD	0.0594
	17	4	circ	3.17	67.50	2.2416	0.0405	1.9445	1.9040	OD	0.1032

The information provided above was developed in response to comments from the reviewer of the ISI UT calculation worksheets.
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CMC 3/7/97

Tom Jones 3/5/97 Tin Tran 3/6/97 J. Ricker 06 March 97

Thomas Jones Lvl III Tin Tran ISI Program Mngr Jeff Ricker Supt M&SP

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