WASHINGTON PUBLIC POWER SUPPLY SYSTEM

DOCUMENT TRANSMITTAL

TO BE COMPLETED BY ORIGINATOR

To: Washington Public Power Supply System
P.O. Box 968
Richland, WA. 99352
Attention: Records Management M/D 964Y

1. Transmittal No.
2. Page 1 of
9. Initiating Doc. No. PER-298-0600
21. Priority
3. From Tom Erwin
4. Purchase Order/Contract No.
5. Supply System Cognizant Engineer Tom Erwin Tom Erwin 5/23/98
14. Receipt Acknowledged
6. Originator Remarks Provide Copy to Tom Erwin PE 27

7. ITEM NO.	8. DOCUMENT OR DRAWING NO.	6. SHEET NO.	6. REV. NO.	10. DOCUMENT TITLE OR ITEM SUBMITTED	Submitted For 11. APPROVE	12. RELEASE	13. INFO	15. OFFICIAL DISPOS.
1	ME-02-98-04		0	Fracture Mechanics Evaluation of N1 N022/e Safe End	X			

TO BE COMPLETED BY SUPPLY SYSTEM

16. Supply System Disposition

Engineering Manager — Plant Technical Services Manager (if required)

6. Engr. Req. Response Date / ACTION PARTIES	19. REQ APPROVE	19. REQ REVIEW	20. RESPONSE APPROVE	20. RESPONSE APPROVE AS NOTED	20. RESPONSE DISAPPROVE	SIGNATURE AND DATE	ACTION PARTIES	19. REQ APPROVE	19. REQ REVIEW	20. RESPONSE APPROVE	20. RESPONSE APPROVE AS NOTED	20. RESPONSE DISAPPROVE	SIGNATURE AND DATE
5. Cognizant Engineer	X		X			Tom Erwin 5/23/98	18. Design ALARA						
17. Component/System Anal.							18. Penetrations						
17. Mechanical Engineering							18. ASME Code Compliance						
17. Electrical/I&C Engineering							18. Control Sys. Failure						
18. Overall Design Verif.	X		X			GR Swilk 5/26/98	18. Pipe Break/Missile						
18. Equip. Engineering							18. App. R/Electrical Sep.						
18. Human Factors							18. Health Safety/Fire Prot.						
18. Emergency Prep.							18. Security						
18. Environmental							18. Quality Assurance						
18. MEL Input Coord.							18. Project Engineer						

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

CALCULATION COVER SHEET

BDC Page: NA

Equipment Piece No.	Project	Page / Cont'd on Page
MS-RPV-3	WNP-2	
	Discipline: MATERIAL AND WELDING	Calculation No.: ME-02-98-04
		Quality Class: 1
	Remarks:	

TITLE/SUBJECT/PURPOSE

Title/Subject

FRACTURE MECHANICS EVALUATION OF N1 SAFE END

Purpose

A fracture mechanics evaluation was performed to evaluate a planar indication found during in-service inspection of ISI weld number 24RRC(2)A-1. The indication is on the inside surface of the safe-end and is located at 5:00 o'clock when looking downstream. The indication measures 3.52 inches in length and 0.29 inches deep in a pipe wall that is 2.0 inches thick. The indication exists in SA 336 Class F8 forged type 304 stainless steel safe-end. The size of the defect exceeds the ASME Code Section XI Table IWB 3514-2 allowable and thus requires an evaluation per paragraph IWB 3640 of the Code. The following calculation provides a comprehensive presentation of the fracture mechanics model, applied loads (stresses),and Code evaluations.

There are No CMR's against this Calculation

CALCULATION REVISION RECORD

REV NO.	STATUS/ F,P, OR S	REVISION DESCRIPTION	INITIATING DOCUMENTS	TRANSMITTAL NO.
0	F	Initial Issue	PER 298-0600	

PERFORMANCE/VERIFICATION RECORD

REV NO.	PERFORMED BY/DATE	VERIFIED BY/DATE	APPROVED BY/DATE
0	Tom Erwin Tom Erwin 5/23/98	JR LaSalle 5/23/98	

* Study Calculations shall be used only for the purpose of evaluating alternate design options or assisting the engineer in performing assessments.

CALCULATION PREPARTION

rev. 1

Observer/Org: _____/_____ Observed/Org: _____/_____

Date: 5/26/98 Verifier: JR Lasalle Calculation No: ME-02-98-04

Requirements Based on Initial Submittal of Calculation for Verification	Points Scored (0-10)	Importance Factor	Total Points
Legibility (clarity, reproducible), Grammar, Spelling and use/definition of abbreviations**	8	1	8
Adequate Detail in discussions (understandablitity)**	7	3	21
Clear statements of Purpose, Methodology, Output Summary**	7	2	14
Relies on previously approved analysis to reduce work and review requirements (Deduct 5 points if previously approved analysis is repeated)	6	3	18
Inputs fully referenced or described, external references and internal cross-references are correct and Inputs/Outputs are properly identified on "Reference Cross-Index RMCS Input Sheet"**	10	3	30
All assumptions clearly stated and, as appropriate, explained**	10	2	20
Accuracy/Consistency of data and information throughout calculation (units supplied and conversions of data correct)**	7	3	21
Computer codes identified (names, revisions, V&V status, source Listing as appropriate), Computer outputs included and readable (microfiche is readable)** [If N/A, score as a 10]	10	2	20
Analysis complete and technically adequate**	10	3	30
EDP 2.15 Requirements (Administrative Requirements) Satisfied	10	2	20
Impacted calcs are properly identified on the "Calculation Output Interface Documents Revision Index" form**	10	3	30
Total of column	95	27	232

** Deduct one point for each item requiring correction

Scoring: 7-8 considered acceptable, 5 major problem area

Percent Score	
$\frac{(\text{Total Points})*100}{(\text{Total Possible})*10}$	86

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

CALCULATION INDEX

Page 1.000 Cont'd on Page 1.200

Calculation No. ME-02-98-04

Revision No. 0

ITEM	PAGE NO. SEQUENCE	
Calculation Cover Sheet	1.000 -	—
Calculation Index	1.100 -	—
Verification Checklist for Calculation and CMR's	1.200 -	—
Calculation Reference List	1.300 -	—
Calculation Output Interface Document Revision Index	1.400 -	—
Calculation Output Summary	2.000 -	—
Calculation Method	3.000 -	3.002
Sketches	4.000 -	4.003
Manual Calculation	5.000 -	5.012

APPENDICES:

Computer Outputs	Appendix	A	122	Pages
	Appendix	B		Pages
	Appendix	C		Pages
	Appendix	D		Pages
	Appendix			Pages
	Appendix			Pages
	Appendix			Pages
	Appendix			Pages

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

VERIFICATION CHECKLIST FOR CALCULATIONS AND CMRs

Calculation/CMR ME-02-98-04 Revision 0 was verified using the following methods:

☐ Checklist Below ☐ Alternate Calculations

Checklist Item	Initial
Clear Statement of purpose of analysis	JRL
Methodology clearly stated and sufficiently detailed and appropriate to proposed application	JRL
Logical consistency of analysis	JRL
• Completeness of documenting references	JRL
• Completeness of documenting and updating output interface documents	JRL
Completeness of input	JRL
Accuracy of input data	JRL
Consistency of input data with approved criteria	JRL
Completeness in stating assumptions	JRL
Validity of assumptions	JRL
Calculation sufficiently detailed	JRL
• Arithmetical accuracy	JRL
• Physical units specified and correctly used	JRL
Reasonableness of output conclusion	JRL
Supervisor independency check (if acting as Verifier)	JRL
- Did not specify analysis approach	
- Did not rule out specific analysis options	
- Did not establish analysis inputs	
• If a computer program was used:	
- Is the program appropriate for the proposed application?	JRL
- Have the program error notices been reviewed to determine if they pose any limitations for this application?	
- Is the program name, revision number and date of run inscribed on the output?	
- Is the program identified on the Calculation Method form? If so, is it listed in chapter 10 of the Engineering Standards Manual?	
Other Elements Considered	JRL

• If a separate verifier was used for validating these functions or a portion of these functions, sign and initial below.

Based on the foregoing, the calculation is adequate for the purpose intended.

Verifier Signature(s)/Date	Verifier Initials
JR Lubeck 5/25/98	5/25/98 JRL

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

CALCULATION REFERENCE LIST

CALCULATION NO. ME-02-98-04

REVISION NO. 0

SEQUENCE NO.	AUTHOR	ISSUE DATE, EDITION, OR REVISION	TITLE	DOCUMENT NO.
1	Failure Analysis Associates	2.23	NASCRAC Manual	-
2	Supply System	5-14-98	Ultrasonic Examination Data Sheet	R-R13-031
3	EPRI	1986	Evaluation of Flaws in Austenitic Steel Piping	NP-4690-SR
4	NRC	1988	Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping	NUREG-0313,Rev.2
5	ASME	1990	ASME Section XI, Nonmandatory Appendix C	Fig C-3210-1
6	Burns & Roe	5/7/76	Hanford II 251" BWR Vessel Stress Report T9,S9,F9 Recirculation Outlet Nozzle	T9,S9,F9
7	ASME	1989	ASME Section XI	IWB-3640
8	S.T. Rolfe J.M. Barsom	1977	Fracture and Fatigue Control in Structures	-
9	ASME	1986	ASME Section III, Appendices	Appendix I Table I-2.2
10	Structural Integrity	March 1998	The Effect of Radiation on the Fracture Toughness of Austenitic Stainless Steel Base and Weld Material	SIR-97_095
11	J.F.Harvey	1985	Theory and Design of Pressure Vessels	pg 61

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

CALCULATION OUTPUT INTERFACE DOCUMENT REVISION INDEX

Page 1.400 Cont'd On Page 2.000

Calculation No. ME-02098-04

Prepared By/Date Tom Erwin Tom Erwin 5/23/98

Verified by/Date [signature] 5/24/98

Revision No. 0

The below listed output interface calculations and/or documents are impacted by the current revision of the subject calculation. The listed output interfaces require revision as a result of this calculation. The documents have been revised, or the revision deferred with Manager approval, as indicated below.

AFFECTED DOCUMENT NO.	CHANGED BY (e.g., BDC, SCN, CMR, Rev.)	CHANGED DEFERRED (e.g., RFTS, LETTER NO.)	DEPT. MANAGER *
None			

* Required for deferred changes only.

Discussion of Results

Three computer runs were used to evaluate the indication in the N1 nozzle safe-end. The first modeled the indication using the normal operational loads of the system.

The second model used three transients that could possibly occur in one year interval. These transients were the thermal discontinuity stress, OBE and SSE. This model was used to determine the crack growth expected from the fatigue loading at different crack depths allowing determination of when the cracking would become a significant contributor to crack growth. This allowed the determination that the crack growth would only become significant at the end of the interval selected for the next inspection.

The third model used the adjusted crack length (20:1 ratio) as required by NUREG 0313 Rev. 2 for the end of the IGSCC crack growth at R 16 as input. The required fatigue cycles for OBE and SSE were than applied to this crack dimension to determine acceptability for the interval.

The results of the computer runs are as follows:

The indication will grow to a depth of 1.068" by R 16 if IGSCC is active and the fatigue cycles are experienced.

In comparing the results to the 1989 ASME Section XI Code Tables IWB-3641-5 and -6. Indication is acceptable for continued operation until R 16.

Conclusions

Taking into account the following conservatism's:

1. The weld residual stress distribution used is for an as welded component. The stainless steel safe-end to nozzle weld had MSIP performed on it during R 9. The distribution should be compressive at the ID.

2. The stresses are conservatively high due to the use of OBE stresses for steady state thermal. Also the pressure stress used is the hoop stress not the axial pressure stress.

3. No faucet are evident during the weld examination that would indicate IGSCC is active.

It has been determined that WNP-2 may operate until R16 before reexamination of the nozzle to safe-end weld is to occur. The evaluation demonstrates under the worst imposed loading conditions the flaw meets the acceptance criteria of the ASME Section XI IWB-3641-5 and 3641-6. The main fracture mechanism that will propagate the flaw is intergranular stress corrosion cracking. If the IGSCC phenomena is active the indication will increase in depth to 1.068" by R16. which is less than the ASME Code allowable.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

CALCULATION METHOD

Calculation No. ME-02-98-04

Prepared By/Date T.M.Erwin Tom Erwin 5/23/98 | Verified by/Date JR Fahlbusch 5/24/98 | Revision No. 0

Analysis Method (Check appropriate boxes)

- ☒ Manual (As required, document source of equations in Reference List)
- ☒ Computer ☐ Main Frame ☒ Personal
  - ☒ In-House Program
  - ☐ Computer Service Bureau Program
    - ☐ BCS ☐ CDC ☐ PCC ☐ OTHER _____
- ☒ Verified Program: Code name/Revision NASCRAC 2.23
- ☐ Unverified Program: Document in Appendix B _____

Approach/Methodology

REV. BAR

Flaw Evaluation

Problem

During the performance of Inservice Inspection of the reactor vessel RRC A loop an indication was discovered in the heat affected zone of the 24 inch RRC suction nozzle (N1A) to safe-end weld 24RRC(2)A-1. The indication is on the inside surface of the safe-end and is located at 5:00 o'clock when looking downstream. The indication measures 3.52 inches in length and 0.29 inches deep in a pipe wall that is 2.0 inches thick. The indication exists in ductile SA 336 Class F8 forged type 304 stainless steel. The design minimum wall based on faulted pressure is 1.01 inches. The remaining ligament in the safe-end is 1.71 inches.

The indication has existed for some time. Due to changes in the ultrasonic techniques and technology the ability to detect material variations and conditions has increased. An example of this increase in sensitivity is demonstrated in this examination. The same weld was examined during the R9 outage and no indication was detected at that time. However, using the new GE ultrasonic data system the same data tape was reviewed from the R9 outage and it was determined that the same indication existed at that time. The new R13 data output and the R9 data output were compared and the indication shows no change in depth or length that is not within the inaccuracies of the equipment. The indication has been in the system since at least R9 with no change in depth or length.

The indication is required to be evaluated as an IGSCC indication even though it shows no IGSCC charactreistics.

Flaw Evaluation

The linear indication was evaluated using the NASCRAC computer code developed by Failure Analysis Associates. This code uses stress field influence functions as the basis for flaw propagation. The NASCRAC model selected is a shell element containing an elliptically shaped circumferential flaw. The model is identified as 103 in the NASCRAC manual. This particular model includes three crack growth degrees of freedom encompassing the respective circumferential and crack depth coordinates. The evaluation was performed using conservative linear elastic fracture mechanics principles.

e modeling applies the requirements identified in NRC Generic Letter 88-01. The flaw was evaluated as an intergranular stress corrosion crack using the crack growth rate equation provided in the generic letter. The weld residual stress distribution provided in the letter was also used even though the weld in question had Mechanical Stress Improvement (MSIP) performed on it in 1994. The weld residual stresses are developed from room temperature yield for 304 material (30 ksi) as the normalization stress outlined in the generic letter. The flaw aspect ratio was reviewed and compared to the requirements of NUREG-0313, Rev. 2. The aspect ratio was determined to be 12:1 which requires correction in length as the crack grows until an aspect ratio of 20:1 is exceeded. Therefore, the final crack growth aspect ratio was corrected manually to comply with the requirements of NUREG-0313, Rev. 2. The correction for aspect ratio was performed at each Refueling outage time period based upon the computer output for the IGSCC model. These intervals were determined as follows: R 14 will occur in approximately 260 days , R15 will occur 260 days, R16 will occur 500 days after startup from R15 based on 18 month reload. The flaw length and depth from the R16 corrected value was then used as input into the fatigue model. The fatigue model used one year of expected upset and faulted conditions as required by the Code to assure that the crack will remain within the Code allowable limits and NRC requirements.

Three input files were used to perform the IGSCC and fatigue evaluations. These files were:

N1IGSCC.IN IGSCC for normal operations
N1FAT.IN Fatigue including one year of OBE (300 cycles), SSE (1cycle) and thermal discontinuity (1cycle)
N1FAT1.IN Fatigue incorporating R16 corrected crack length

The following assumptions and inputs were used in developing each of the models.

All Models: The flaw model used was 703 for a semi-elliptical (circumferential) surface crack in a cylinder. (1)

Flaw Dimensions

N1IGSCC.IN The crack used was 3.52" long and 0.29" deep. The half crack was calculated taking 3.52" and
N1FAT.IN dividing it by 2 to yield 1.76". (2)

N1FAT1.IN The crack length for this model was the results of the 20:1 aspect ratio required by the NRC for IGSCC cracks. The value used is from the crack depth for 1020 days of IGSCC growth that would occur by R16. The values used in the model were a length of 19.14" and a depth of 0.957". The half crack was determined by dividing the length by 2 that results in a value of 9.57".

Crack Growth Laws

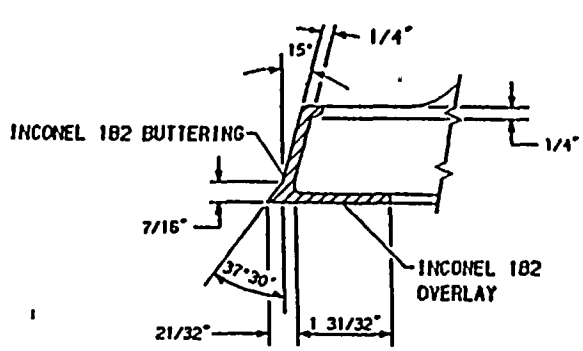
N1IGSCC.IN The Paris equation used for IGSCC growth was that provided in NUREG-0313 Rev. 2. The (4)
equation used :

$$3.59E-8(\Delta K)^{2.161} \text{ in ksi}\sqrt{in}$$

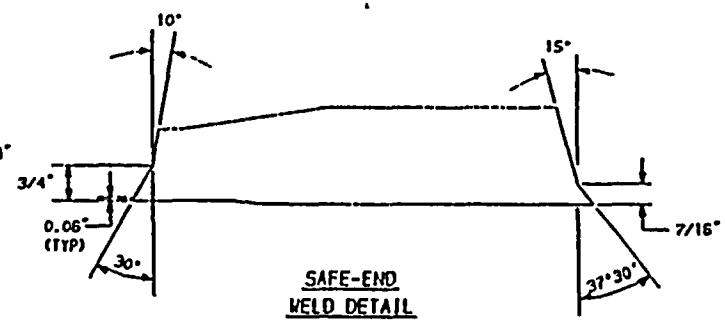
N1FAT.IN The crack growth rate for fatigue in BWR water environment was determined using the following
N1FAT1.IN Paris equation: (3)

$$6.155E-18(\Delta K)^{3.302} \text{ in psi}\sqrt{in}$$

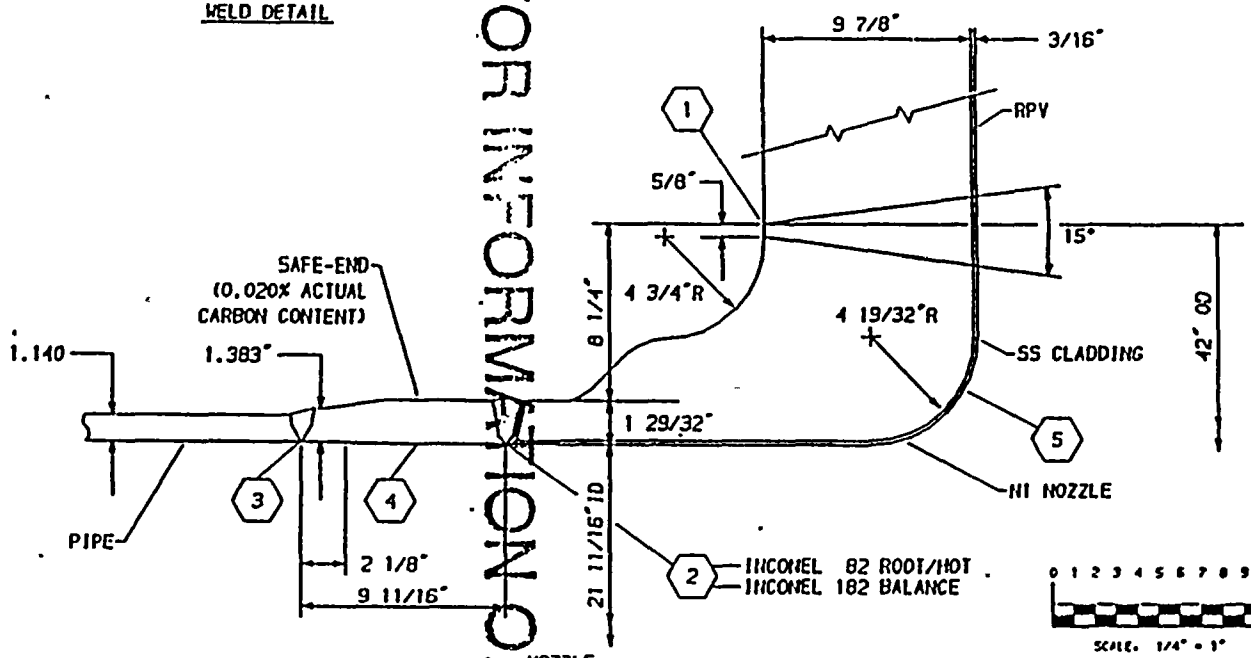
N1IGSCC.IN The ΔK_{th} value used was 10.0 or 10000 for the fatigue
N1FAT.IN
N1FAT1.IN



NOZZLE
WELD DETAIL



SAFE-END
WELD DETAIL



FOR INFORMATION ONLY

0 1 2 3 4 5 6 7 8 9 10

SCALE: 1/4" = 1"

THIS DRAWING IS INTENDED FOR USE IN PRESERVICE AND INSERVICE INSPECTIONS PROGRAMS ONLY.

WELDS

1	N1A	180°	LOOP A
	N1B	0°	LOOP B
2	24RRC(2)A-1	180°	LOOP A
	24RRC(2)B-1	0°	LOOP B
3	24RRC(2)A-2	180°	LOOP A
	24RRC(2)B-2	0°	LOOP B

NOTES

	CAL BLOCK	EXAMINATION
1	UT-119	NOZZLE TO SHELL WELD
2	UT-101	NOZZLE TO SAFE-END WELD
3	UT-7	SAFE-END TO PIPE WELD
4	UT-101	SAFE-END FORGING (IF EXAMINED)
5	UT-119	NOZZLE INNER RADIUS

REFERENCES:

CBI NUCLEAR CO. 205 AE 023
SHT 46 REV 4 N1 NOZZLE FORGING
SHT 47 REV 3 N1 SAFE-END FORGING
SHT 48 REV 4 N1 NOZZLE ASSEMBLY

ISI ISOMETRICS
RRC-101-1 REV 4
RRC-102-1 REV 3

PIPING SYSTEM	NOM DIA INCH	SCH	NOM WALL THICKNESS	MATERIAL SPEC	MAT'L TYPE	CAL BLOCK NUMBER
24"RRC(2)-45	24	XXS	1.140	SA 358 GR 304 CL 1	SS	SEE NOTES
SAFE-END	—	—	—	SA 336 CL F8	SS	SEE NOTES
N1 NOZZLE	—	—	—	SA 508 CL 2	CS	SEE NOTES
RPV	—	—	9 7/8	SA 533 GR B CL 1	CS	SEE NOTES

NO	DATE	REVISION	BY	CHKD	APVD
1	2-20-92	UPDATED TO DOCUMENT THE SAFE-END AND INCONEL INFORMATION FOR AS-BUILT CONDITION. MODIFIED BWOG PROGRAM	K-McA	DPR	DPR
0	7-31-79	ISSUED FOR USE	K-McA	LFB	LFB

QUALITY CLASS: 1	ASME CODE CLASS: 1
ENGR: T HOYLE	DRAWN: K-McA DATE: 5-10-79

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
RICHLAND, WASHINGTON 99352

WNP-2
WELD & COMPONENT IDENTIFICATION DIAGRAM

TITLE: RECIRC SUCTION
N1 NOZZLE AT 0° & 180°

DWG NO: RPV-105 REV 1

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
CALC: ME-02-88-04 REV: 0
PAGE: 4001 CONT. ON 4002
BY: [signature] DATE: 5/23/89

5.1.26 Semi-Elliptical (Circumferential) Surface Crack in a Cylinder

Model Feature	FORTRAN Variable	Option Featured
Model Index Number	KRKTYP	703
Number of Degrees of Freedom	KRKDOF	3
Crack Front Shape	—	Semi-Elliptical
Finite Width Effects	—	Yes
Influence Function	—	Yes
Variable Thickness Effects	IVTHIC	No
J-Integral Solutions	—	No

Data Input Description

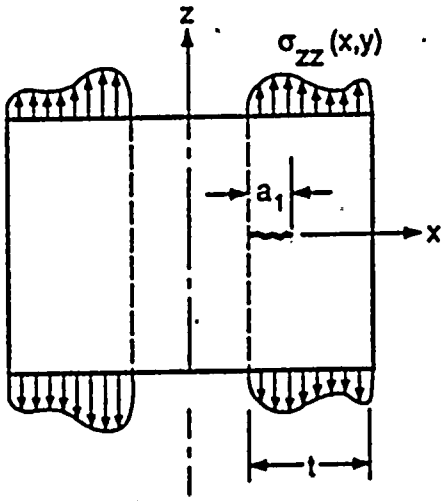
Input Description		FORTRAN Variable	Input Format	Remarks
Variable Thickness		IVTHIC	Tabular	Not Applicable
Initial Crack Size	$a1$	AINITL(1)	Constant	
	$a2$	AINITL(2)	Constant	
	$a3$	AINITL(3)	Constant	
Body Widths	t	WIDTHS(1)	Constant	
	W_2	WIDTHS(2)	Constant	) Terminate
	W_3	WIDTHS(3)	Constant	) Analysis Only
	r	WIDTHS(4)	Constant	
Crack Position	Xc	CENTER(1)	Constant	
	Yc	CENTER(2)	Constant	
Crack Orientation	ϕ	CRKANG	Constant	
Stress Input	$\sigma_{zz}(x)$		Equational	
			Tabular	
	$\sigma_{zz}(x,y)$		Equational	
			Tabular	

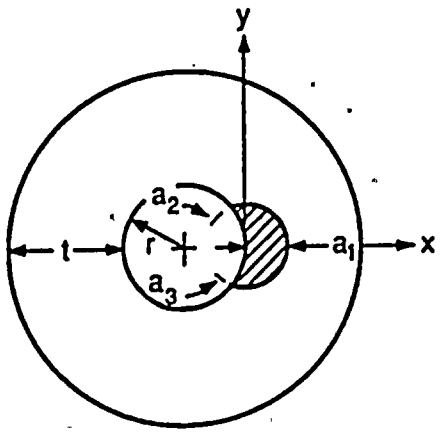
K-Solutions:

Limits : $1 \leq a_2 + a_3/a_1 \leq 20$; $0.0 \leq a_1/t \leq 1.0$

Accuracy : approximately 10% for $0.0 \leq a_1/t \leq 0.8$ and $1 \leq a_2 + a_3/a_1 \leq 12$

703





WASHINGTON PUBLIC POWER SUPPLY SYSTEM
CALC: MF-02-98-04 REV. 0
PAGE: 4.003 CONT. ON 5.00 b
BY: [signature] DATE: 5/23/98
VERIFIED: [signature] DATE: 5/25/98

FATIGUE CRACK GROWTH RATE BWR ENVIRONMENT (3)

$da/dn = C * E * S * (\Delta K)^n$

C,n = Material constants, C =2.0 E-19,n = 3.302

S = R-ratio correction factor = $(1.0 - 0.5\ R^2)^{-4}$

E = Environmental factor (1.0, 2.0 and 10.0 for air,PWR, and BWR environments, respectively).

ΔK = Kmax - Kmin, psi in

Assume R-ratio = .7

$C * E * S = 2.0\text{ E-}19 * 10.0\ [\ 1.0 - 0.5\ (.7)^2]^{-4}$

$= 2.0\text{ E-}18 * [1.0 - 0.5(.49)]^{-4}$

$= 2.0\text{ E-}18 * [.755]^{-4}$

$= 2.0\text{ E-}18 * 3.07$

$= 6.155\text{ E-}18$

THEREFORE $da/dn = 6.155\text{ E-}18\ (\Delta K)^{3.302}$ for psi$\sqrt{in}$

The purpose of the calculation is to determine the bounding stress in the Recirculation outlet nozzle N1 at safe end to nozzle weld.

Actual loads at the nozzle due to the pipe are lower than the allowable loads provided in the reference documents listed below. Actual pipe loads are available in calculation 8.14.107.

References:

1. Hanford II -251 " BWR Vessel Stress Report Sections T9,S9,F9 Recirculation Outlet Nozzle.

2. Drawing 732E143, Purchase part Reactor Vessel, MPL item No. B13-D003

3. Drawing 761E716, Reactor Vessel Loadings

Recirculation Outlet:
Maximum Allowable Nozzle Loads for Evaluation:

	H (kips)	M (inch kips)
Design Mech. Load	0.0	5850
Dead Wt.	58.50	1580
Seismic Pri	164	2950
Seismic RFE	164	2950
Thermal RFE	292	7020

The above moments are applied at the end of the safe end. The weld of concern is the safe end to nozzle weld which is 9.75 inches +/- 1/16 inch from the load application point.

Nozzle Design Pressure: 1250 psi
Nozzle Faulted Pressure: 1375 psi

Nozzle Loads for Recirculation Outlet Nozzle from Calculation 8.14.107 which includes power uprate and snubber optimization of the recirculation piping.

Condition	Force - lbs	Moment - inch kips
Primary	5552	167.408
Secondary	34431	1805.391
Primary (Faulted)	25481	1066.453

$$\sigma_p(r) := \frac{a^2 \cdot Pd}{b^2 - a^2}\left(1 + \frac{b^2}{r^2}\right)$$

$\sigma_p(r) = 6.536 \cdot 10^3$ psi.

Thus the tangential pressure stress varies from 7800 psi to 6530 psi. This stress is tensile around the circumference of the shell. Based on the orientation of the flaw the tangential stress would not be a tensile stress for a flaw in the tangential direction.

Reset the radius to vary from ID to OD and recalculate the radial pressure stress.

$r := 10.84, 11.2 .. 12.75$ inch

$a = 10.844$

$b = 12.75$

$$\sigma_{pr}(r) := \frac{a^2 \cdot Pd}{b^2 - a^2}\left(1 - \frac{b^2}{r^2}\right)$$

$\sigma_{pr}(r)$ psi	r inches
$-1.253 \cdot 10^3$	10.84
-967.181	11.2
-707.494	11.56
-470.979	11.92
-254.958	12.28
-57.13	12.64

Calculate nozzle bending stresses at the safe end to nozzle weld by applying the moment plus the force times the offset to give a maximum bending moment

Deadweight Loads:

$Mdwt := 167.5 + 5.552 \cdot Z$ in - kips $c := 12.75$

$Mdwt = 221.632$

$$\sigma_{dwt} := \frac{Mdwt \cdot c}{I_{mom}} \qquad \sigma_{dwt} = 0.286 \quad ksi$$

Upset Loads including Thermal

The GE load combination for RPV nozzles takes the maximum of eight different combinations which include thermal, obe, obe displacements, turbine stop valve closure, srv, and srv inertia.

$$M_{obe} := 1806 + 34.5 \cdot Z$$

$$M_{obe} = 2.142 \cdot 10^3 \qquad in - kips$$

$$\sigma_{obe} := \frac{M_{obe} \cdot c}{I_{mom}} \qquad \sigma_{obe} = 2.76 \quad ksi$$

Faulted Loads:

The GE faulted loads combination does not include thermal bending on the nozzle. Since the upset load combination includes thermal, it is conservatively added to the faulted loading without removal of the dynamic upset loads.

$$M_{sse} := 1067 + 25.5 \cdot Z + M_{obe}$$

$$M_{sse} = 3.458 \cdot 10^3 \qquad in - kip$$

$$\sigma_{sse} := \frac{M_{sse} \cdot c}{I_{mom}} \qquad \sigma_{sse} = 4.455 \quad ksi$$

Determine the discontinuity stresses due to the attachment of the stainless steel safe end to the carbon steel vessel nozzle. The vessel nozzle has a 3/8 in inconel butter on the surface and then is jointed to the safe end with an inconel weld. Thus there are three different materials to be evaluated for thermal growth.

Nozzle Forging - SA-508 CL 2 (3/4NI-1/2Mo-CR-V)
Coeffiecient of Thermal Expansion - Group A Materials at 550 F
7.34X10^-6in/in/F
Modulus of Elasticity - 27.0X10^6 psi

Safe End - SA-336 F8 - (18CR - 8Ni) Group G
Coefficient of Thermal Expansion - Group 9.45X10^-6 in/in/F
Modulus of Elasticity - 25.55X10^6 psi.

Inconel Weld Metal: SB-167 N06690 (58 Ni - 29Cr - 9Fe)
Coeffiecient of Thermal Expansion - 8.13X10^-6in/in/F
Modulus of Elasticity - 28.2X10^6psi

Check nozzle to inconel thermal discontinuity.

$$E_{ab} := \frac{27.0 \cdot 10^6 + 28.2 \cdot 10^6}{2} \qquad E_{ab} = 2.76 \cdot 10^7 \quad \text{psi}$$

$$\alpha_a := 7.34 \cdot 10^{-6} \qquad \alpha_b := 8.13 \cdot 10^{-6}$$

$$T_a := 550 - 70 \qquad T_b := 550 - 70$$

$$\sigma_{tdis} := E_{ab} \cdot \left| \alpha_a \cdot T_a - \alpha_b \cdot T_b \right|$$

$$\sigma_{tdis} = 1.047 \cdot 10^4 \quad \text{psi} \quad \text{Nozzle to safe end}$$

Check the inconel weld to safe end discontinuity.

$$E_{ab} := \frac{25.5 \cdot 10^6 + 28.2 \cdot 10^6}{2} \qquad E_{ab} = 2.685 \cdot 10^7$$

$$\alpha_a := 9.45 \cdot 10^{-6} \qquad \alpha_b := 8.13 \cdot 10^{-6}$$

$T_a := 550 - 70$ $T_b := 550 - 70$

$\sigma_{tdis} := E_{ab} \cdot |\alpha_a \cdot T_a - \alpha_b \cdot T_b|$

$\sigma_{tdis} = 1.701 \cdot 10^4$ Safe end to inconel weld.

Thus the maximum discontinuity stress is between the stainless steel safe end and the inconel weld metal.

The original vessel stress report provided calculation of the stress concentration factors at the locations of tapered transitions in the nozzle. There was no stress concentration listed for the joint that we are evaluating. Since the weld joint between the safe end and the nozzle is a flush weld between two equivalent diameter cylinders, we can use the stress indices from a flush weld in table NB-3683.2-1.The table lists C3 as 1.0 and K3 as 1.1. Thus for determining peak stress at the material discontinuity, the C3 and K3 indices are applied.

$\sigma_{dis} := 1.0 \cdot 1.1 \cdot \sigma_{tdis} \cdot \frac{1}{1000}$ $\sigma_{dis} = 18.713$ ksi

Summary of Safe end to nozzle stresses:

Design Pressure Stress = 7.790 ksi

Deadweight Bending Stress $\sigma_{dwt} = 0.286$ ksi

Upset Primary plus Sec. Bending Stress $\sigma_{obe} = 2.76$ ksi

Faulted Bending Stress, includes thermal, deadweight, obe and sse.:

$\sigma_{sse} = 4.455$ ksi

Thermal Discontinuity Stress at the Carbon To Stainless Steel Intersection:

$$\sigma_{dis} = 18.713 \quad \text{ksi}$$

Stresses classified as bending stresses above are based on the outer fiber stress to maximize the magnitude. Bending stress on the inner wall is obtained by factoring the stress by 10.84/12.75. Stresses though the wall thickness are linear between the minimum on the inner wall to a maximum at the outer wall.

Weld Residual Stress Calculation for through wall thickness based on NuReg 0313 Rev 2 methodology. (4)

Definition of terms:

S = polynomial coefficients
ε = percent of through wall thickness x/t
R = ratio of residual stress to room temperature yield of 30 ksi for stainless steel. (9)
x = Point measured through wall from ID to OD.
t = Thickness of 2.00"
σ_i = The room temperature yield strength of stainless steel 30 ksi.
σ = The calculated residual stress at location x through wall $\sigma_i * R = \sigma$.

$$S := \begin{bmatrix} 1.0 \\ -6.910 \\ 8.687 \\ -.480 \\ -2.027 \end{bmatrix} \quad i := 0...4 \quad j := 0...10 \quad \varepsilon := \begin{bmatrix} 0.0 \\ 0.1 \\ 0.2 \\ 0.3 \\ 0.4 \\ 0.5 \\ 0.6 \\ 0.7 \\ 0.8 \\ 0.9 \\ 1.0 \end{bmatrix}$$

$$R_j := \sum_i s_i \cdot \varepsilon_j^i$$

$R = \sigma / \sigma_i$ at the % thickness, ref ε above and σ_i =30 ksi.

$$R = \begin{bmatrix} 1.0 \\ 0.395 \\ -0.042 \\ -0.321 \\ -0.457 \\ -0.47 \\ -0.385 \\ -0.232 \\ -0.044 \\ 0.138 \\ 0.27 \end{bmatrix}$$

RES := $R * 30$ ksi RES is the weld residual stress

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: R-R13-031

PROJECT: WNP2
1GW80 - RFO13

PROCEDURE: UT-WNP2-209V0 REV: 1 FRR: WNP298-02
N/A
N/A

UT-WNP2-207V0 REV: 0 FRR: N/A
N/A
N/A

QCI 3-3 REV: FRR: N/A
N/A
N/A

SYSTEM: RECIRCULATION

WELD NO.: 24RRC(2)A-1

CONFIGURATION: NOZZLE TO SAFE END

EXAMINER: OLIN CRIBBE LEVEL: II

EXAMINER: CHUCK BARRETT LEVEL: II

EXAMINER: N/A LEVEL:

☐ MT ■ PT ■ UT ☐ VT

WELD TYPE: ■ CIRCUMFERENTIAL ☐ LONGITUDINAL ☐ OTHER N/A

DATA SHEET NO.(S): DAR13-093 THRU DAR13-098

CAL SHEET NO.(S): CAR13-074 THRU CAR13-078

During the automated ultrasonic examination of the above referenced weld, one (1) reportable ID connected planar indication was recorded with the "SMART 2000" examination system utilizing a 45° shear wave, and 35°, 45°, and 60° refracted longitudinal (RL) wave search units.

This indication has the following parameters:

Ind. No.	Ind. Start	Ind. Stop	OD Length	ID Length	*Thru Wall Dimension	*Remaining Ligament	Flaw Location (Side of Weld)	Indication Orientation
1	28.5"	32.7"	4.20"	3.52"	0.29"	1.71"	DNST (Safe End)	Circumferential

*Remaining ligament and thru-wall dimension information is documented utilizing the measured wall thickness (2.00") from the safe-end side of the configuration.

Indication length and thru wall dimension was determined utilizing the 45° shear wave search unit. A component ID/OD ratio of 0.839 was utilized for determination of ID length. This ratio is based upon a measured component circumference of 78.0" and a measured material thickness of 2.00".

Indication Characterization:

This indication provides substantial ultrasonic response from both the 45° shear wave and 45° refracted longitudinal wave (RL) search units. The signal characteristics observed are not indicative of typical IGSCC indications, however the axial position of the indication is distinctly within the heat affected zone (HAZ) of the safe end component. Observable sound scattering prior to impingement at the inside diameter surface provides ultrasonic responses similar to a weld repair region.

■ EXAM COMPLETE ☐ PARTIALLY EXAMINED (EXPLAIN IN COMMENTS) ☐ EXAM COMPLETE IN COMBINATION WITH DATA SHEETS BELOW

ADDITIONAL DATA SHEETS: N/A

COMPARED TO: ☐ PSI ■ ISI REPORT NO.(S): R-R9-017 ■ NO CHANGE

EXAMINATION RESULTS: ☐ ACCEPTABLE ■ UNACCEPTABLE

NO. OF RECORDABLE INDICATIONS: 4(UT)

NO. OF REPORTABLE INDICATIONS: 1

CODE COVERAGE OBTAINED: 100 %

SUMMARY BY	III	5-14-98	UTILITY REVIEW	5/14/98	DATE
GE REVIEWED BY	III	5-14-98	ANII REVIEW	5/14/98	DATE
	LEVEL	DATE			

FORM UT-09 REV. 9

GE Nuclear Energy	EXAMINATION SUMMARY CONTINUATION SHEET	REPORT NO.: R-R13-031
PROJECT: WNP2 1GW80 - RFO13	SYSTEM: RECIRCULATION WELD NO.: 24RRC(2) A-1 CONFIGURATION: NOZZLE TO SAFE-END	

The 60° RL search unit provided limited ultrasonic response during the automated examination. This can be partially attributed to the OD surface conditioning (machining) within the area of the required setback distance for this examination angle. Manual 60° RL re-looks in this area provided an increased but intermittent degree of detectability, and insufficient depth sizing information.

Supplemental manual examinations were also performed in the indication area utilizing 45° shear wave and 70° RL (WSY 70) search units. The 45° shear wave search unit did not identify any flaw faceting or axially oriented components from the indication, and provided a rapid fall off in signal amplitude when skewed away from perpendicular. The WSY 70 search unit did not provide meaningful information due to search unit contact inefficiencies.

The indication is observable in re-evaluation of RFO9 automated inspection data utilizing an enhanced data analysis software (Tomoview). The indication shows no noticeable signs of growth in either the length or thru wall dimensions. See supplemental report R-R13-031-S for additional information.

The 45° degree shear wave also recorded non-relevant indications from both sides of the weld, as well as root geometry and reflectors from the inconel weld/butter material that have been further characterized below from the downstream side of the weld.

The 35° RL search unit recorded non-relevant indications from both the upstream and downstream sides of the weld as well as reflectors from the inconel weld/butter material that have been further characterized below from the downstream side of the weld.

The 45° RL recorded non-relevant indications from both the upstream and downstream sides of the weld, along with the previously mentioned planar flaw indication from the downstream side of the weld.

The 60° RL also recorded non-relevant indications from both sides of the weld, as well as reflectors from the inconel weld and buttering material that have been further characterized below from the downstream side of the weld.

The upstream examination was limited to a "W" dimension of 1.80" from weld centerline due to the nozzle configuration.

A liquid penetrant examination was performed prior to the ultrasonic examination utilizing procedure QCI 3-3 Revision 5. This examination resulted in (3) three recordable indications. For further information, reference WNP-2 Liquid Penetrant Examination Report Number 2RRP-012.

Inconel butter indications:

Ultrasonic reflectors were recorded from the area associated with the inconel weld/butter material. These indications do not display signal characteristics indicative of IGSCC and have been interpreted as non-relevant metallurgical (acoustical interface) or fabrication process (welding discontinuity) indications. This resolution is based upon review of component radiographs and system fabrication and modification records. For additional information refer to the ultrasonic data and indication plot sheets of this report.

SUMMARY BY	III	5-14-98	UTILITY REVIEW	5/14/98	
GE REVIEWED BY	III	5-14-98	ANII REVIEW	5/14/98	PAGE: 2 OF: 22
	LEVEL	DATE		DATE	

FORM UT-10 REV. 4

GE Nuclear Energy

WALL THICKNESS PROFILE SHEET

SITE: WNP UNIT: 2

PROJECT: 1GW80-BEQ13

REPORT NO.: B-B13-031

SYSTEM: RECIRCULATION

COMPONENT ID NO.: 24RRC(2)A-1

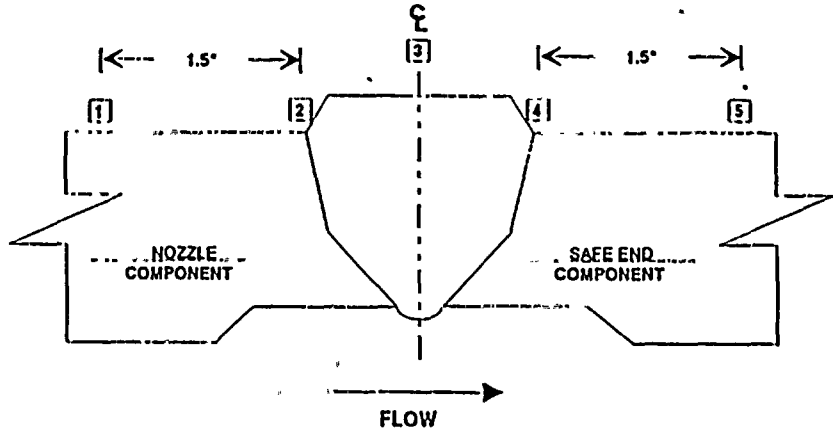
POSITION	0°	90°	180°	270°
1	2.01"	1.92"	N/A	N/A
2	1.86"	1.92"	N/A	N/A
3	1.92"	1.92"	N/A	N/A
4	1.92"	2.00"	N/A	N/A
5	1.95"	2.00"	N/A	N/A

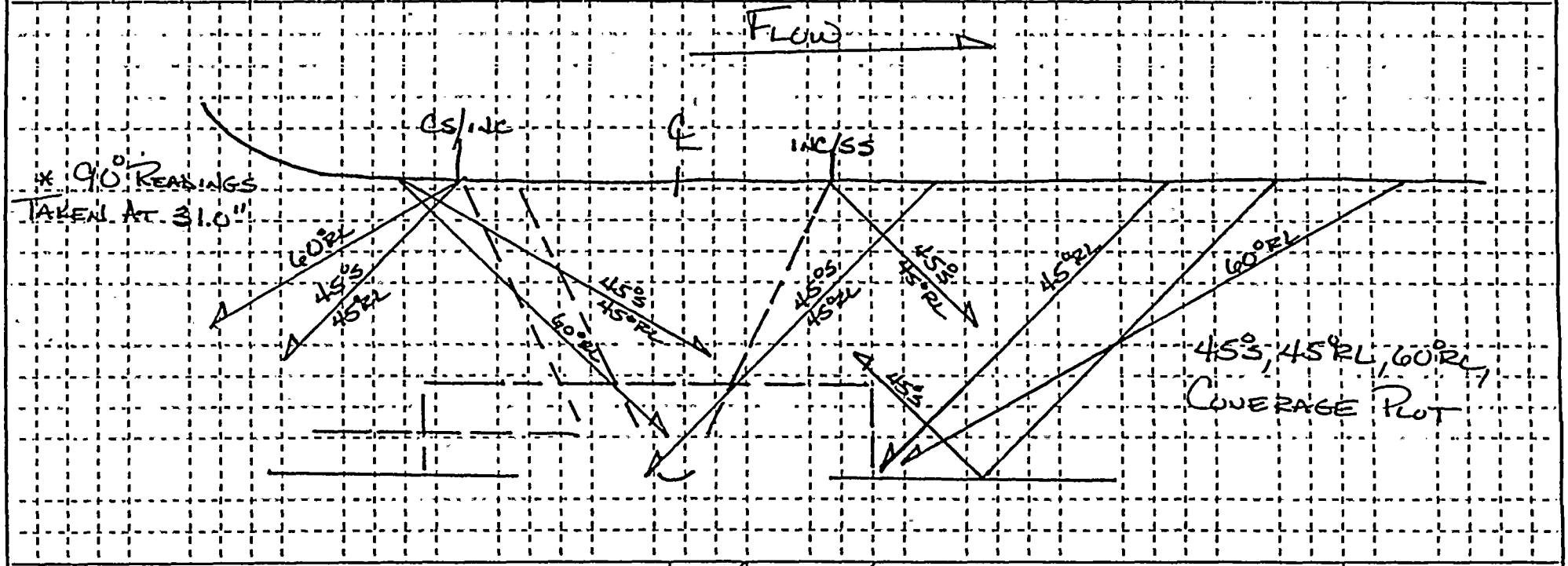
CROWN HEIGHT: FLUSH

CROWN WIDTH: 2.00"

NOM DIAMETER: 24.00"

WELD LENGTH: 78.00"





DRAWN BY — LEVEL III — DATE 5/10/98

GE REVIEWED BY — LEVEL III — DATE 5/10/98

FORM UT 01 REV 9

GE Nuclear Energy

INDICATION PLOT SHEET

SITE: WNP UNIT: 2

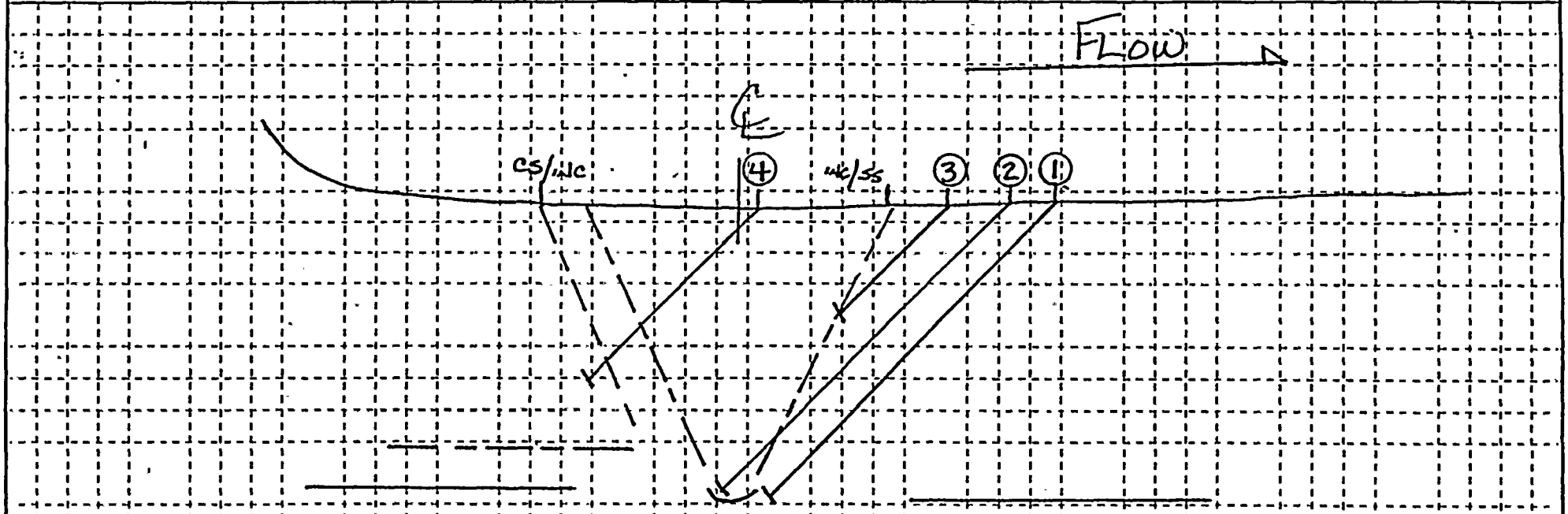
PROJECT: 1GW80-REQ13

REPORT NO.: R-R13-031

SYSTEM: RECIRCULATION

COMPONENT ID NO.: 24RRC(2)A-1

CONFIGURATION: NOZZLE FLOW SAFE END



① PLANAR FLAW INDICATION 45°S (REPORTABLE)

② ROOT GEOMETRY 45°S

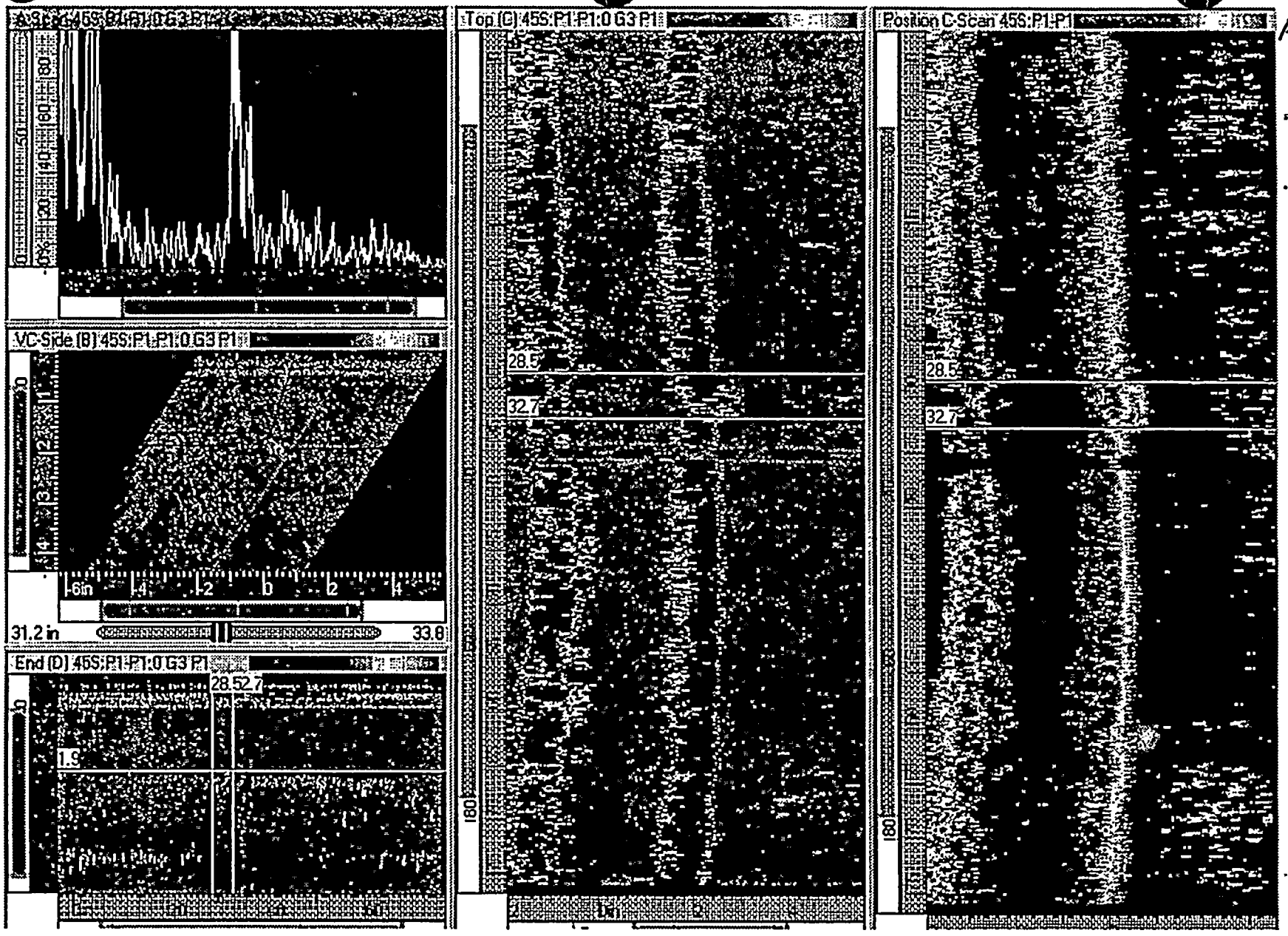
③ INCONEL WELD INDICATION 45°S

④ INCONEL BUTTER INDICATION 45°S

DRAWN BY	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE
	III	5/10/98		III	5/10/98

FORM UT 02 REV 13

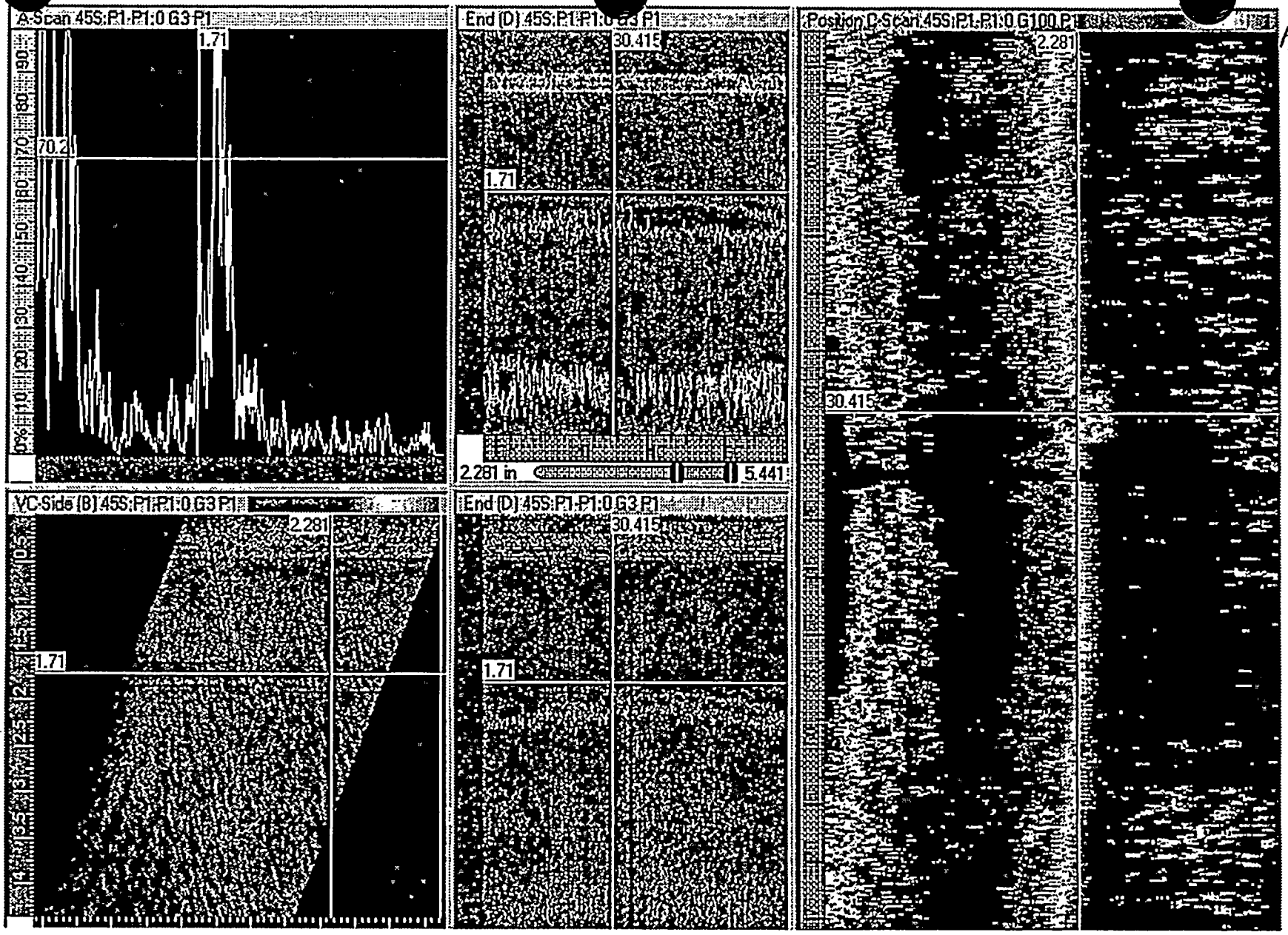
R-R13-031



Comments
WNP2 RFO13 Weld 24RRC(2)A-1 N1A Nozzle to Safe End Weld Planar Flaw/Weld Repair Indication

INDICATION # 1

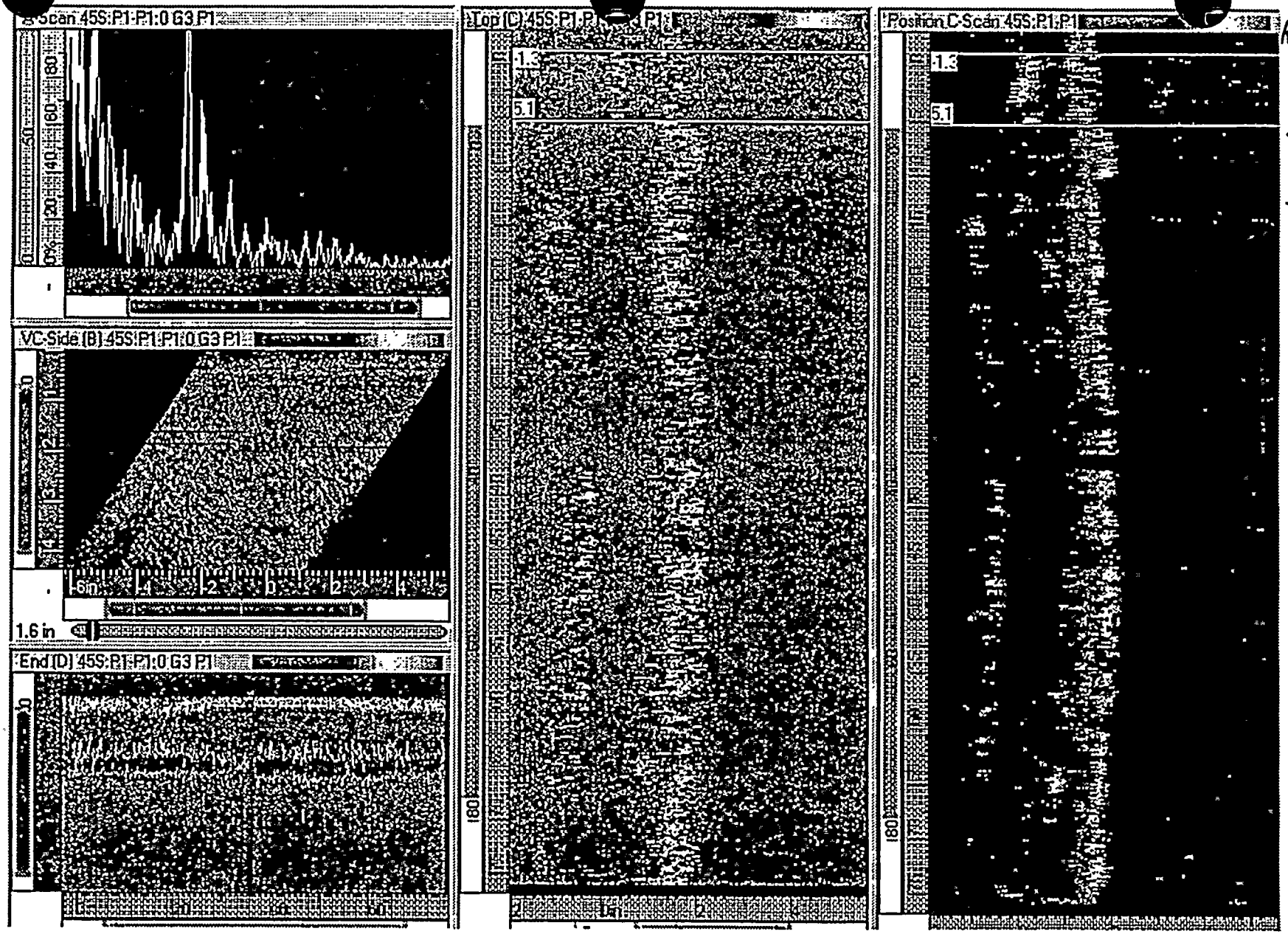
R-R13 031



Comments
WNP2 RFO13 Weld 24RRC(2)A-1 45 degree shear wave thru wall sizing (AATT) 1.71" remaining ligament

INDICATION #1

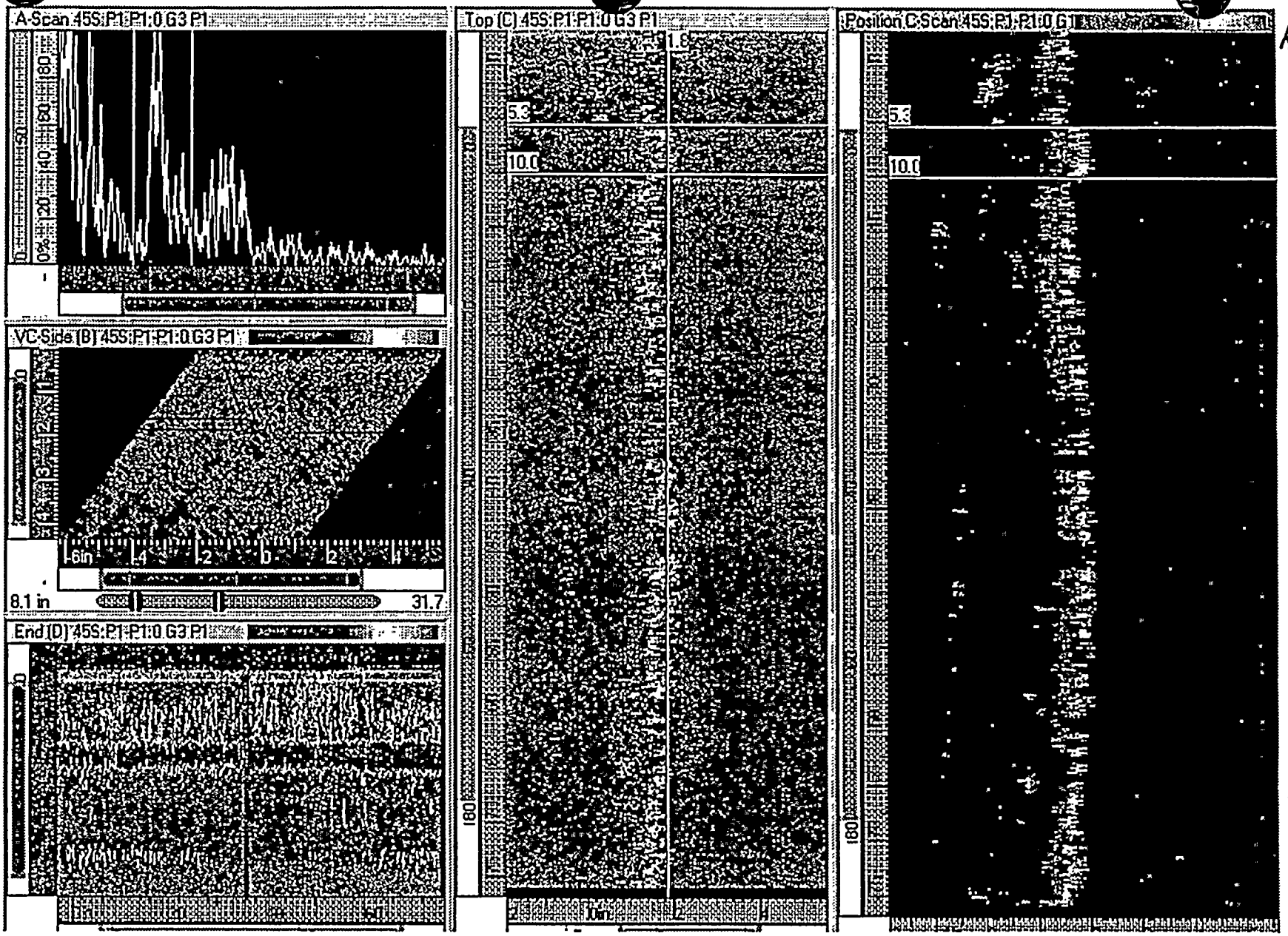
R-R13-031



Comments
WNP2 RFO13 Weld 24RRC(2)A-1 N1A Nozzle to Safe End Weld Inconel Butter Indication

INDICATION #4

R-R13-031

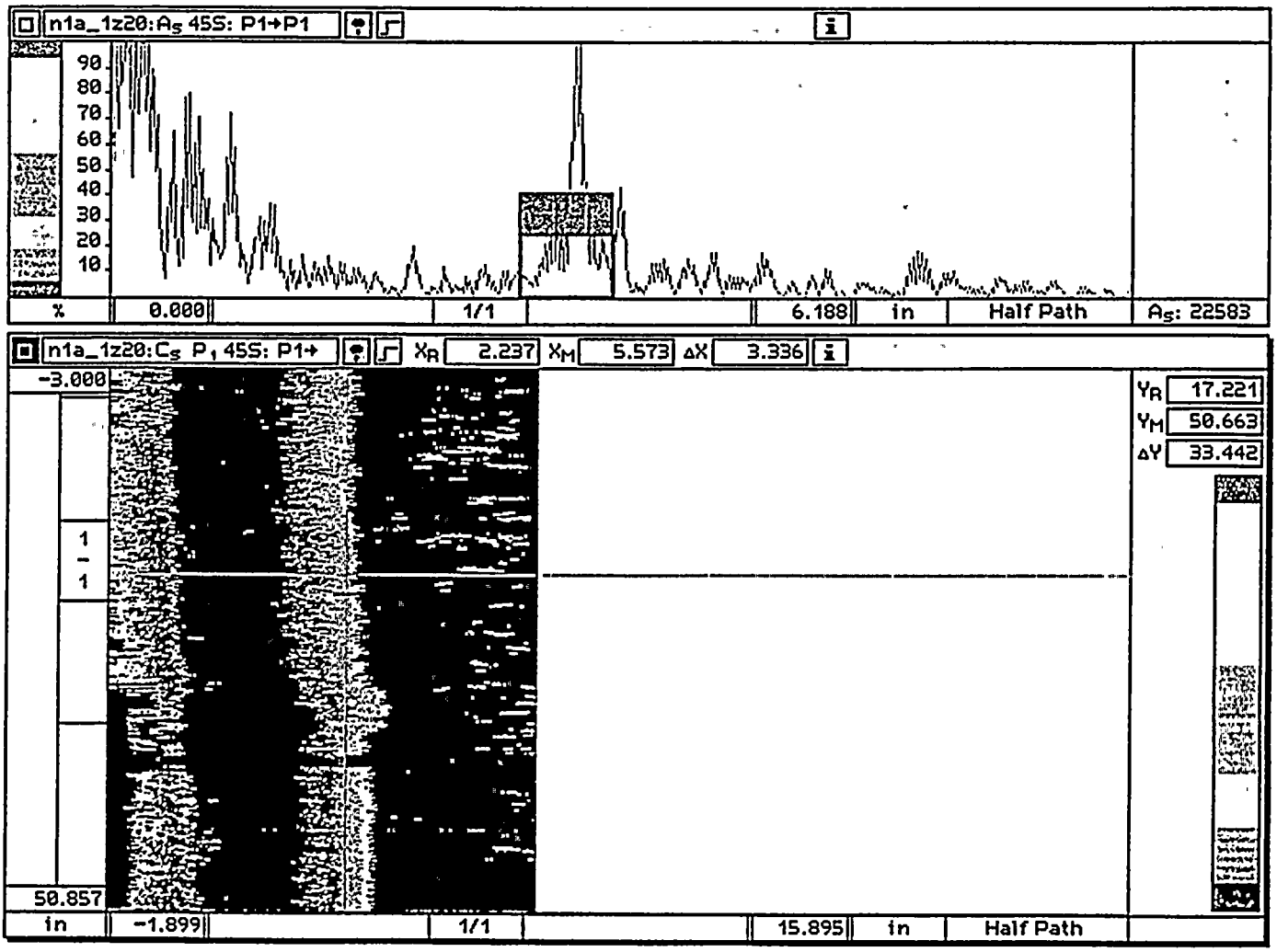


Comments
WNP2 RFO13 Weld 24RRC(2)A-1 N1A Nozzle to Safe End Weld Inconel Weld Indications

INDICATION #: 3

GE Nuclear Energy

ULTRASONIC SCAN DATA PRINT SHEET (AUTOMATED WITH *Smart 2000*)



45° Shear Root Geometry

SITE: WNP UNIT: 2 PROJECT NO.: 1GW80 REPORT NO.: R-R13-031

WELD NO.: 24RRC(2)A-1 SEARCH UNIT: 45° SHEAR INDICATION NO.: 2 PAGE: 9 OF: 22

FORM UT-13 REV. 1

GE Nuclear Energy

INDICATION PLOT SHEET

SITE: WNP UNIT: 2

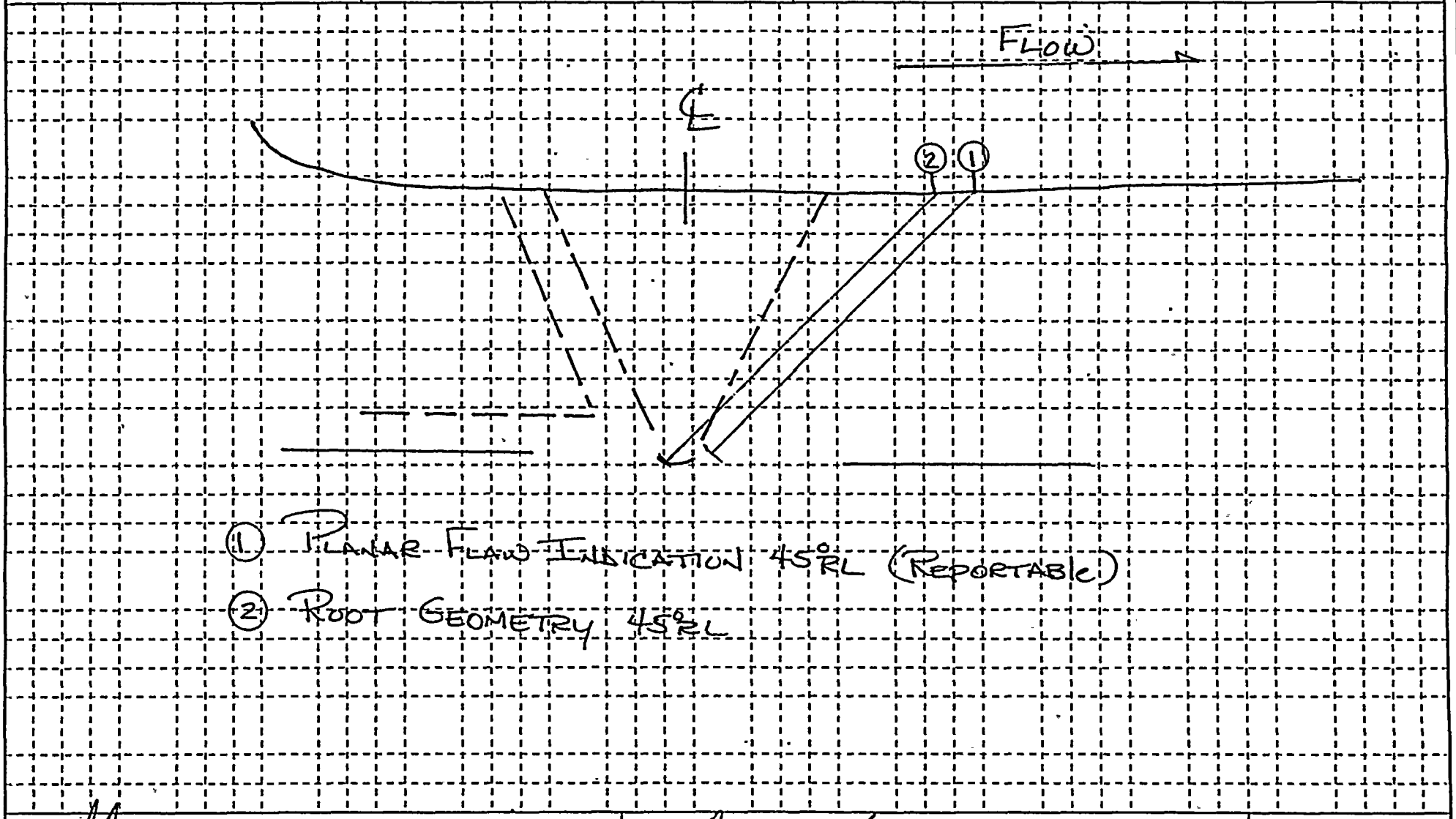
PROJECT: 1GW80 - REO13

REPORT NO.: R-R13-031

SYSTEM: RECIRCULATION

COMPONENT ID NO.: 24RRC(2)A-1

CONFIGURATION: NOZZLE FLOW SAFE END

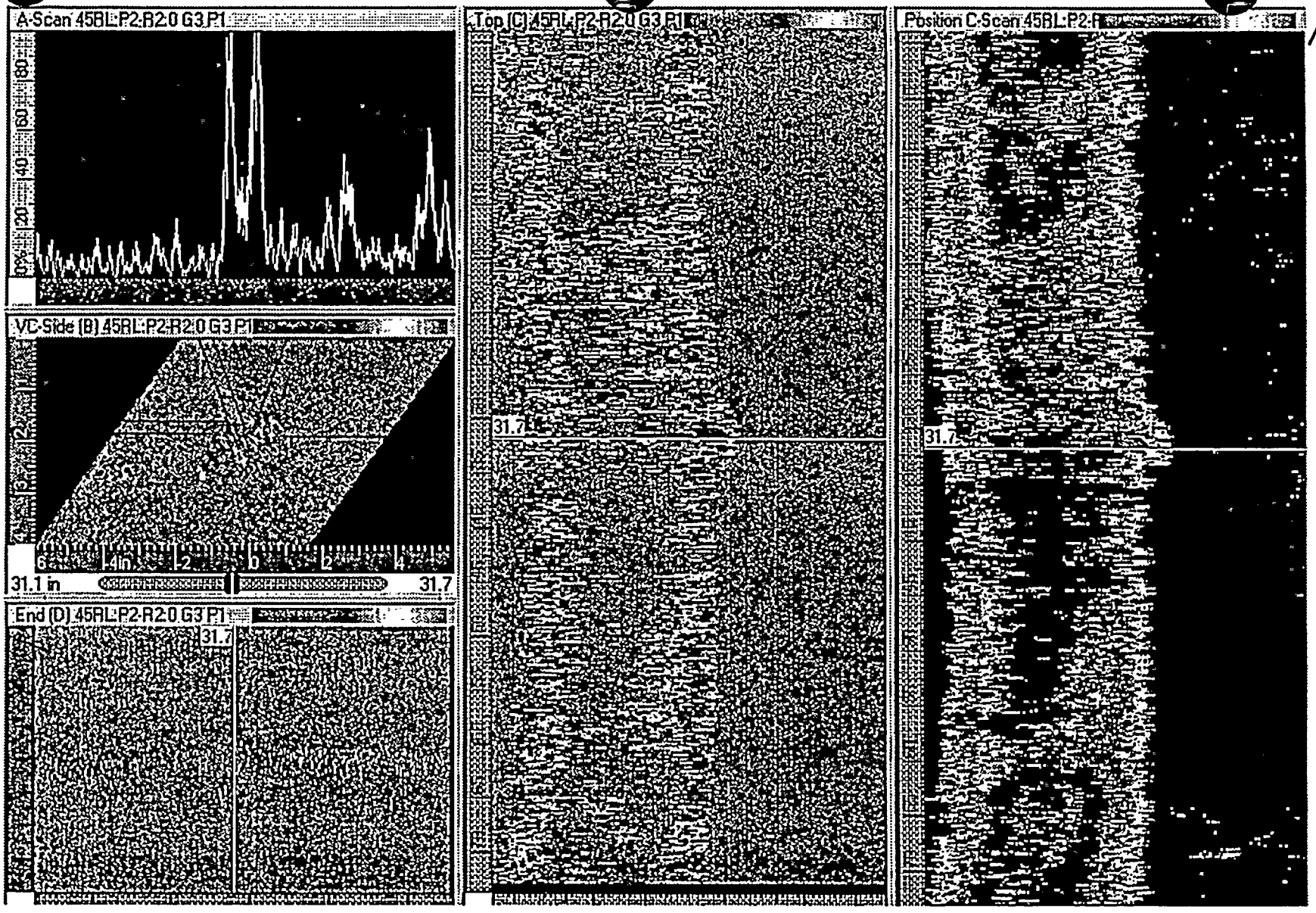


DRAWN BY — LEVEL III — DATE 5/10/98

GE REVIEWED BY — LEVEL III — DATE 5/10/98

FORM UT-02 REV. 12

R-R13-031

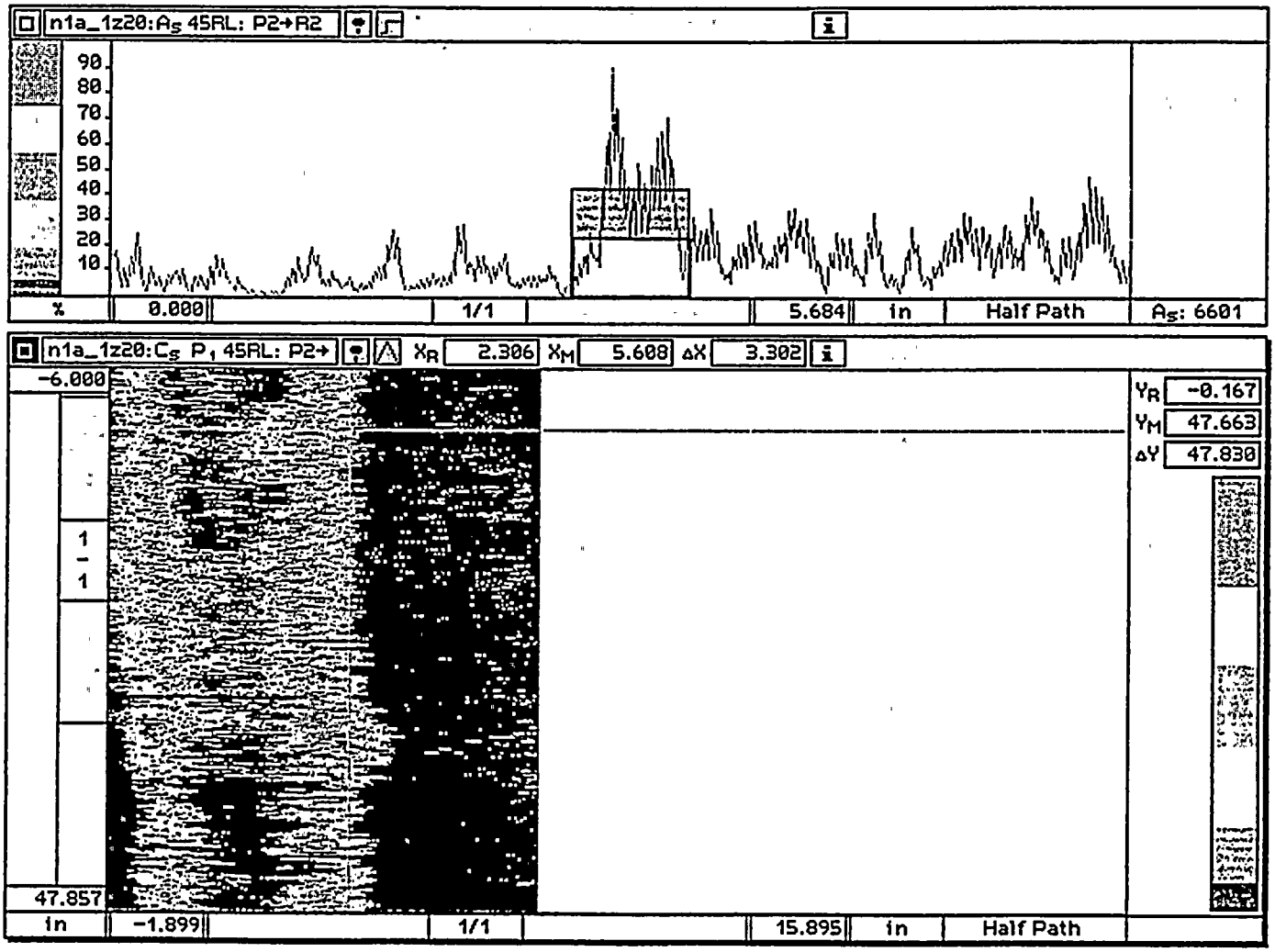


Comments
WNP2 RFO13 Weld 24RRC(2)A-1 N1A Nozzle to Safe End Weld Planar Flaw/Weld Repair Indication

INDICATION #1

GE Nuclear Energy

ULTRASONIC SCAN DATA PRINT SHEET (AUTOMATED WITH *Smart 2000*)



45°RL Root Geometry

SITE: WNP UNIT: 2 PROJECT NO.: 1GW80 REPORT NO.: R-R13-031

WELD NO.: 24RRC(2)A-1 SEARCH UNIT: 45° L INDICATION NO.: 2 PAGE: 12 OF: 22

GE Nuclear Energy

INDICATION PLOT SHEET

SITE: WNP UNIT: 2

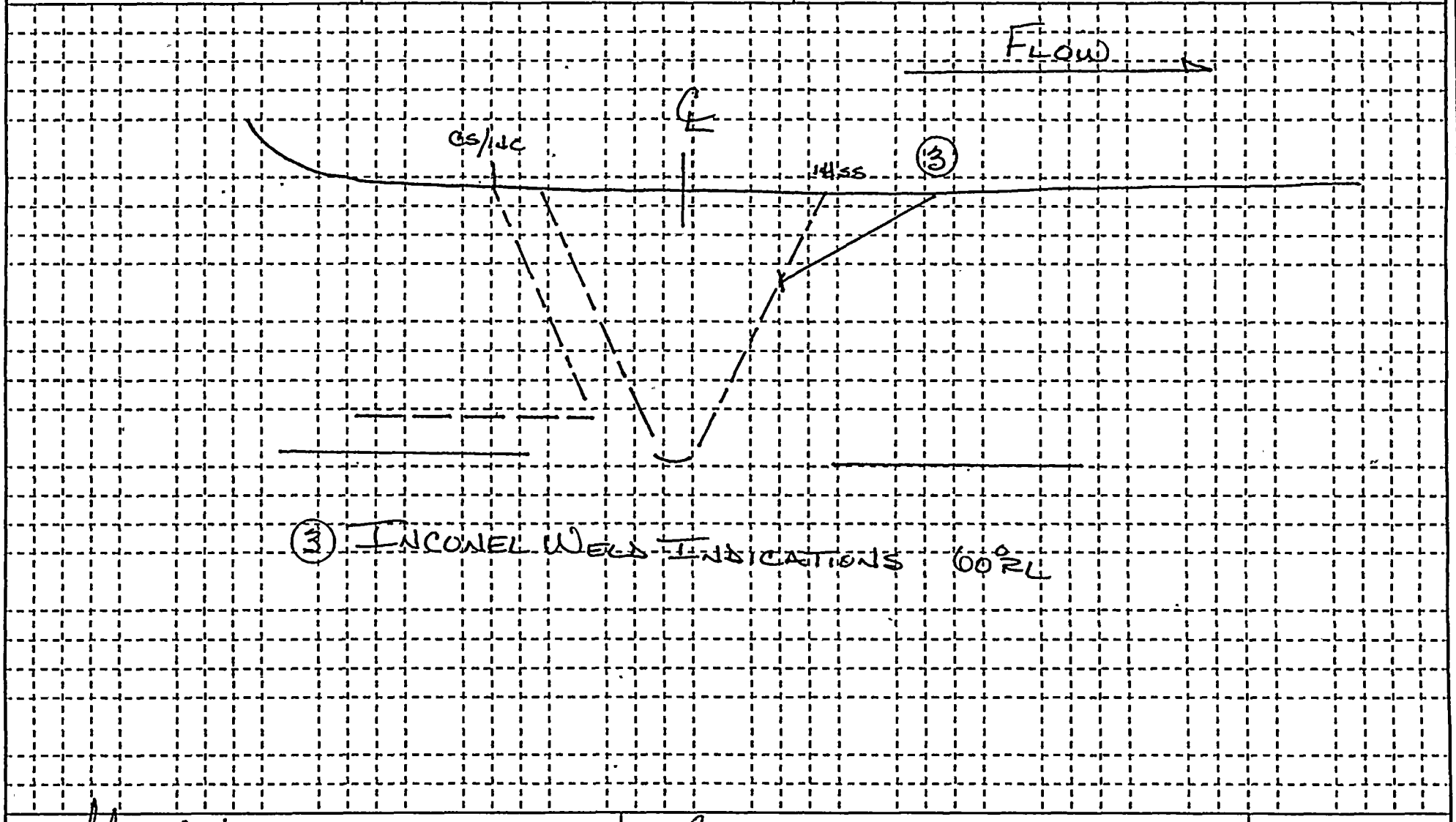
PROJECT: 1GW80 - REO13

REPORT NO.: R-R13-031

SYSTEM: RECIRCULATION

COMPONENT ID NO.: 24RRC(2)A-1

CONFIGURATION: NOZZLE FLOW SAFE END

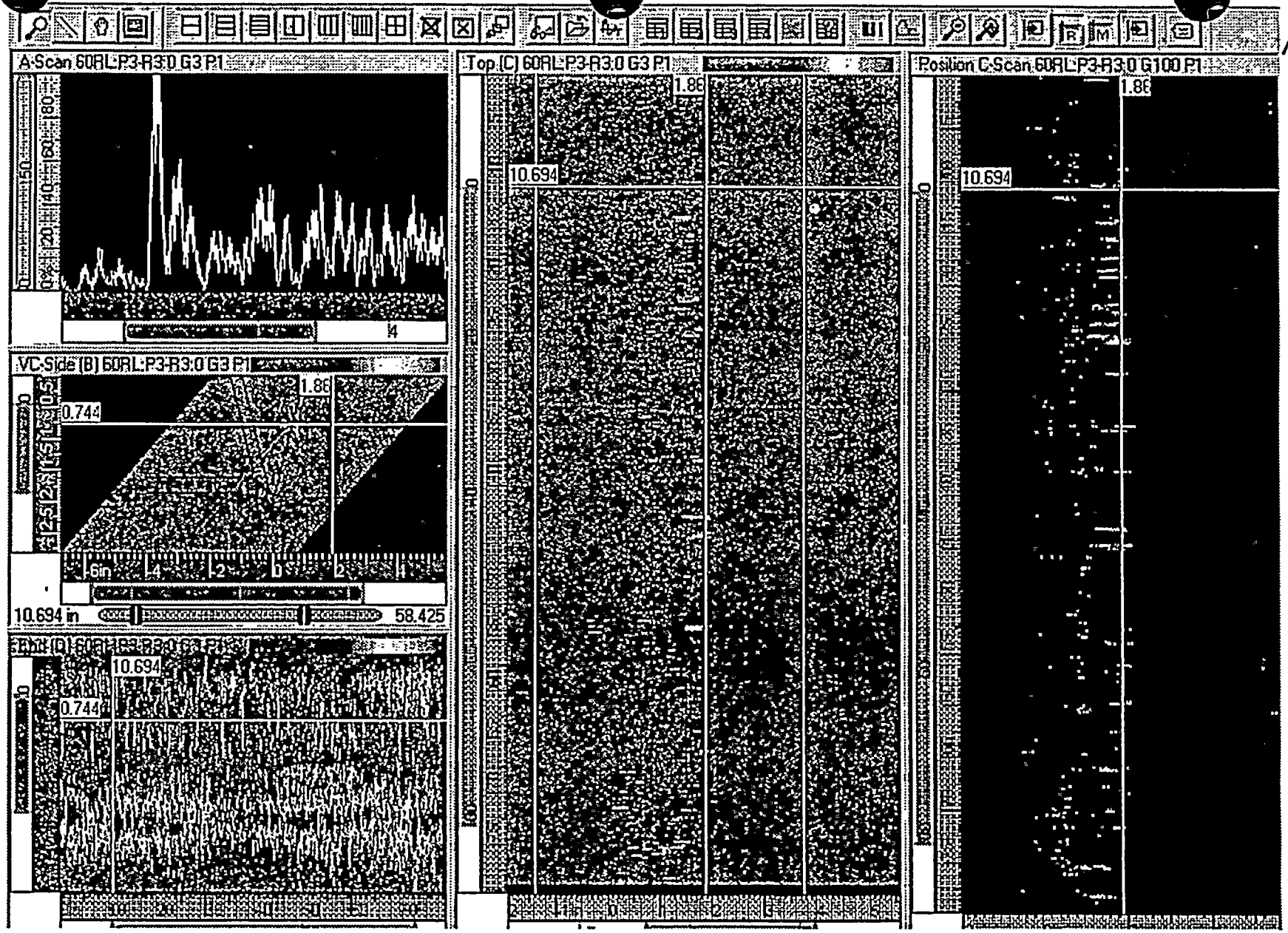


DRAWN BY — LEVEL III — DATE 5/10/98

GE REVIEWED BY — LEVEL III — DATE 5/10/98

FORM UT-02 REV. 12

R-R13-03



Comments
WNP2 RFO13 Weld 24RRC(2)A-1 N1A Nozzle to Safe End Weld Inconel Weld Indications

INDICATION #3

GE Nuclear Energy

ULTRASONIC EXAMINATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031
UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-093
PROJECT NO.: 1GW80 - RF013 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-074

SYSTEM: RECIRCULATION | EXAM SURFACE TEMP: 82 °F | COUPLANT: ULTRAGEL II | EXAM START: 20:27
WELD ID: 24RRC(2)A-1 | THERMOMETER S/N: 177460 | BATCH NO.: 97425 | EXAM END: 06:45
SEARCH UNIT: 45° / SHR | EXAMINATION SURFACE: OD | COMPONENT: NOZZLE FLOW SAFE END

SCAN: Z10 | SCAN DIRECTION: LKDN | GAIN(dB): 44.0

DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z10 N/A

EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ■ OTHER: BEAM REDIRECT

COMMENTS: N/A

SCAN: Z20 | SCAN DIRECTION: LKUP | GAIN(dB): 42.0

DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z20 N/A

EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ■ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ■ NON-GEOMETRIC INDICATIONS
- ■ OTHER: BEAM REDIRECT SEE COMMENTS

COMMENTS: INCONEL \ WELD BUTTER INDICATION

SCAN: Z11 | SCAN DIRECTION: LKDN | GAIN(dB): 44.0

DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z11 N/A

EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ■ OTHER: BEAM REDIRECT

COMMENTS: Supplemental scan to complete coverage of Scan Z10

SCAN: Z12 | SCAN DIRECTION: LKDN | GAIN(dB): 44.0

DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z12 N/A

EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ■ OTHER: BEAM REDIRECT

COMMENTS: Supplemental scan performed to enhance primary examination coverage of Scan Z10.

SCAN: Z30 | SCAN DIRECTION: LKCW | GAIN(dB): 40.0

DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z30 N/A

EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: Z40 | SCAN DIRECTION: LKCC | GAIN(dB): 45.0

DISK/SIDE: D-04/A | FILENAME(S): N1A_1Z40 N/A

EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

REMARKS: N/A

EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE
	II	5/6/98		III	5/10/98

FORM UT-07 REV. 10

GE Nuclear Energy

ULTRASONIC EXAMINATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031
UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-094
PROJECT NO.: 1GW80 - REO13 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-074

SYSTEM: RECIRCULATION | EXAM SURFACE TEMP: 82 °F | COUPLANT: ULTRAGEL II | EXAM START: 20:27
WELD ID: 24RRC(2)A-1 | THERMOMETER S/N: 177460 | BATCH NO.: 97425 | EXAM END: 06:45
SEARCH UNIT: 45° / SHR | EXAMINATION SURFACE: OD | COMPONENT: NOZZLE FLOW SAFE END

SCAN: Z21 | SCAN DIRECTION: LKUP | GAIN(dB): 42.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z21, N/A
EXAMINATION RESULTS:
- [ ] NO RECORDED INDICATIONS
- [x] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [x] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [x] NON-GEOMETRIC INDICATIONS
- [x] OTHER: BEAM REDIRECT, SEE COMMENTS

COMMENTS: INCONEL \ WELD BUTTER INDICATION

SCAN: Z13 | SCAN DIRECTION: LKUP | GAIN(dB): 44.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z13, N/A
EXAMINATION RESULTS:
- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [x] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [x] OTHER: BEAM REDIRECT

COMMENTS: Supplemental scan to complete coverage of Scan Z10.

SCAN: Z31 | SCAN DIRECTION: LKCW | GAIN(dB): 44.0
DISK/SIDE: D-04/A | FILENAME(S): N1A_1Z31, N/A
EXAMINATION RESULTS:
- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [x] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS: Supplemental scan performed to enhance primary examination coverage of Scan Z30.

SCAN: Z32 | SCAN DIRECTION: LKCW | GAIN(dB): 44.0
DISK/SIDE: D-04/A | FILENAME(S): N1A_1Z32, N/A
EXAMINATION RESULTS:
- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [x] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS: Supplemental scan to complete coverage of Scan Z31.

SCAN: N/A | SCAN DIRECTION: N/A | GAIN(dB): N/A
DISK/SIDE: N/A | FILENAME(S): N/A
EXAMINATION RESULTS:
- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [ ] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS: N/A

SCAN: N/A | SCAN DIRECTION: N/A | GAIN(dB): N/A
DISK/SIDE: N/A | FILENAME(S): N/A
EXAMINATION RESULTS:
- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [ ] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS: N/A

REMARKS: N/A

EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE
[signature]	II	5/6/98	[signature]	III	5/10/98

GE Nuclear Energy

ULTRASONIC EXAMINATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP	PROCEDURE NO.: UT-WNP2-209V0	REPORT NO.: R-R13-031
UNIT: 2	REVISION NO.: 1	DATA SHEET NO.: DAR13-095
PROJECT NO.: 1GW80 - RFO13	FRR NO.: WNP298-02	CALIBRATION SHEET NO.: CAR13-075

SYSTEM: RECIRCULATION EXAM SURFACE TEMP: 82 °F COUPLANT: ULTRAGEL II EXAM START: 02:25

WELD ID: 24RRC(2)A-1 THERMOMETER S/N: 177460 BATCH NO.: 97425 EXAM END: 06:45

SEARCH UNIT: 35° / RL EXAMINATION SURFACE: OD COMPONENT: NOZZLE FLOW SAFE END

SCAN: Z30 SCAN DIRECTION: LKCW GAIN(dB): 54.0

DISK/SIDE: D-04/B FILENAME(S): N1A_1Z30, N/A

EXAMINATION RESULTS:

- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [x] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [x] OTHER: SEE COMMENTS

COMMENTS:
INCONEL \ WELD BUTTER INDICATION.

SCAN: Z40 SCAN DIRECTION: LKCC GAIN(dB): 54.0

DISK/SIDE: D-04/A FILENAME(S): N1A_1Z40, N/A

EXAMINATION RESULTS:

- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [x] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [x] OTHER: SEE COMMENTS

COMMENTS:
INCONEL \ WELD BUTTER INDICATION.

SCAN: N/A SCAN DIRECTION: N/A GAIN(dB): N/A

DISK/SIDE: N/A FILENAME(S): N/A

EXAMINATION RESULTS:

- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [ ] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS:
N/A

SCAN: N/A SCAN DIRECTION: N/A GAIN(dB): N/A

DISK/SIDE: N/A FILENAME(S): N/A

EXAMINATION RESULTS:

- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [ ] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS:
N/A

SCAN: N/A SCAN DIRECTION: N/A GAIN(dB): N/A

DISK/SIDE: N/A FILENAME(S): N/A

EXAMINATION RESULTS:

- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [ ] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS:
N/A

SCAN: N/A SCAN DIRECTION: N/A GAIN(dB): N/A

DISK/SIDE: N/A FILENAME(S): N/A

EXAMINATION RESULTS:

- [ ] NO RECORDED INDICATIONS
- [ ] ROOT GEOMETRY
- [ ] COUNTERBORE GEOMETRY
- [ ] NON-RELEVANT INDICATIONS
- [ ] ACOUSTIC INTERFACE
- [ ] INSIDE SURFACE GEOMETRY
- [ ] NON-GEOMETRIC INDICATIONS
- [ ] OTHER: N/A

COMMENTS:
N/A

REMARKS: N/A

[signature]	II	5/6/98	[signature]	III	5/10/98	PAGE: 17 OF: 22
EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE	

GE Nuclear Energy

ULTRASONIC EXAMINATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031
UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-096
PROJECT NO.: 1GW80 - RFO13 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-076, 077

SYSTEM: RECIRCULATION | EXAM SURFACE TEMP: 82 °F | COUPLANT: ULTRAGEL II | EXAM START: 20:27
WELD ID: 24RRC(2)A-1 | THERMOMETER S/N: 177460 | BATCH NO.: 97425 | EXAM END: 06:45
SEARCH UNIT: 45° / RL | EXAMINATION SURFACE: OD | COMPONENT: NOZZLE FLOW SAFE END

SCAN: Z10 | SCAN DIRECTION: LKDN | GAIN(dB): 52.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z10, N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: Z20 | SCAN DIRECTION: LKUP | GAIN(dB): 54.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z20, N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ■ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ■ NON-GEOMETRIC INDICATIONS
- ■ OTHER: SHEAR COMPONENT

COMMENTS: N/A

SCAN: Z11 | SCAN DIRECTION: LKDN | GAIN(dB): 52.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z11, N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: Supplemental scan to complete coverage of Scan Z10.

SCAN: Z12 | SCAN DIRECTION: LKDN | GAIN(dB): 52.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z12, N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: Supplemental scan performed to enhance primary examination coverage of Scan Z10.

SCAN: Z30 | SCAN DIRECTION: LKCW | GAIN(dB): 54.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z30, N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: Z40 | SCAN DIRECTION: LKCC | GAIN(dB): 54.0
DISK/SIDE: D-04/A | FILENAME(S): N1A_1Z40, N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

REMARKS: N/A

EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE
[signature]	II	5/6/98	[signature]	III	5/10/98

GE Nuclear Energy

ULTRASONIC EXAMINATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031
UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-097
PROJECT NO.: 1GW80 - RFO13 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-076

SYSTEM: RECIRCULATION | EXAM SURFACE TEMP: 82 °F | COUPLANT: ULTRAGEL II | EXAM START: 20:27
WELD ID: 24RRC(2)A-1 | THERMOMETER S/N: 177460 | BATCH NO.: 97425 | EXAM END: 06:45
SEARCH UNIT: 45° / RL | EXAMINATION SURFACE: OD | COMPONENT: NOZZLE FLOW SAFE END

SCAN: Z13 | SCAN DIRECTION: LKDN | GAIN(dB): 52.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z13 N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: Supplemental scan to complete coverage of Scan Z10.

SCAN: N/A | SCAN DIRECTION: N/A | GAIN(dB): N/A
DISK/SIDE: N/A | FILENAME(S): N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ☐ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: N/A | SCAN DIRECTION: N/A | GAIN(dB): N/A
DISK/SIDE: N/A | FILENAME(S): N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ☐ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: N/A | SCAN DIRECTION: N/A | GAIN(dB): N/A
DISK/SIDE: N/A | FILENAME(S): N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ☐ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: N/A | SCAN DIRECTION: N/A | GAIN(dB): N/A
DISK/SIDE: N/A | FILENAME(S): N/A
EXAMINATION RESULTS:
- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ☐ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

REMARKS: N/A

EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE
[signature]	II	5/6/98	[signature]	III	5/10/98

GE Nuclear Energy

ULTRASONIC EXAMINATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031
UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-098
PROJECT NO.: 1GW80 - RFO13 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-078

SYSTEM: RECIRCULATION | EXAM SURFACE TEMP: 82 °F | COUPLANT: ULTRAGEL II | EXAM START: 20:27
WELD ID: 24RRC(2)A-1 | THERMOMETER S/N: 177460 | BATCH NO.: 97425 | EXAM END: 02:10
SEARCH UNIT: 60° / RL | EXAMINATION SURFACE: OD | COMPONENT: NOZZLE FLOW SAFE END

SCAN: Z10 | SCAN DIRECTION: LKDN | GAIN(dB): 56.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z10
EXAMINATION RESULTS: N/A

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: Z20 | SCAN DIRECTION: LKUP | GAIN(dB): 56.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z20
EXAMINATION RESULTS: N/A

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ■ OTHER: SHEAR COMPONENT SEE COMMENTS

COMMENTS: INCONEL \ WELD BUTTER INDICATION

SCAN: Z11 | SCAN DIRECTION: LKDN | GAIN(dB): 56.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z11
EXAMINATION RESULTS: N/A

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: Supplemental scan to complete coverage of Scan Z10.

SCAN: Z12 | SCAN DIRECTION: LKDN | GAIN(dB): 56.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z12
EXAMINATION RESULTS: N/A

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: Supplemental scan performed to enhance primary examination coverage of Scan Z10.

SCAN: Z13 | SCAN DIRECTION: LKDN | GAIN(dB): 56.0
DISK/SIDE: D-04/B | FILENAME(S): N1A_1Z13
EXAMINATION RESULTS: N/A

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ☐ NON-GEOMETRIC INDICATIONS
- ☐ OTHER: N/A

COMMENTS: N/A

SCAN: Z21 | SCAN DIRECTION: LKUP | GAIN(dB): 56
DISK/SIDE: D-04 \ B | FILENAME(S): N1A_1Z21
EXAMINATION RESULTS:

- ☐ NO RECORDED INDICATIONS
- ☐ ROOT GEOMETRY
- ☐ COUNTERBORE GEOMETRY
- ■ NON-RELEVANT INDICATIONS
- ☐ ACOUSTIC INTERFACE
- ☐ INSIDE SURFACE GEOMETRY
- ■ NON-GEOMETRIC INDICATIONS
- ■ OTHER: SEE COMMENTS

COMMENTS: INCONEL \ WELD BUTTER INDICATIONS.

REMARKS: N/A

EXAMINER	LEVEL	DATE	REVIEWED BY	LEVEL	DATE
[signature]	II	5/6/98	[signature]	III	5/10/98

FORM UT-07 REV 10

GE Nuclear Energy

ULTRASONIC SCAN PARAMETER SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031

UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-093 THRU DAR13-098

PROJECT NO.: 1GW80 - REO13 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-074 THRU CAR13-078

SYSTEM: RECIRCULATION WELD ID: 24RRC(2)A-1 MOTOR STEPS: CIR: 452.60 / in TRA: 633.02 / in

WELD REFERENCE, (GE-ADM-1005): Lo: TOP DEAD CENTER Wo: WELD CENTERLINE

SEARCH UNIT(S): 45°/SHR, 45°/RL, 60°/RL

EXAMINATION SETUP

COMPONENT DIA: 24.0" WELD LENGTH: 78.0" TRACK DIA: 28.0" ARM LENGTH: 18.0" TRACK LOCATION: 10.75" DNST FROM CSWNC INTERFACE

SCAN PARAMETERS

	SCAN: Z10	SCAN: Z11	SCAN: Z12	SCAN: Z13	SCAN: N/A	SCAN: N/A
SCAN DIRECTION:	LKDN	LKDN	LKDN	LKDN	N/A	N/A
SKEW:	0°	0°	0°	0°	N/A	N/A
	SCANNING "X"	INDEXING "Y"	SCANNING "X"	INDEXING "Y"	SCANNING "X"	INDEXING "Y"	SCANNING "X"	INDEXING "Y"	SCANNING "X"	INDEXING "Y"	SCANNING "X"	INDEXING "Y"
START:	-1.50"	0"	-1.50"	26.00"	-1.50"	30.50"	-1.50"	70.00"	N/A	N/A	N/A	N/A
SIZE:	3.40"	38.00"	3.40"	53.00"	3.40"	2.50"	3.40"	9.00"	N/A	N/A	N/A	N/A
SCANNER ZERO POSITIONS:												
OFFSET:	*	*	*	*	*	*	*	*	N/A	N/A	N/A	N/A
CIR:	TOP DEAD CENTER		TOP DEAD CENTER		TOP DEAD CENTER		TOP DEAD CENTER		N/A		N/A	
RESOLUTION:	0.0347"	0.1944"	0.0347"	0.1944"	0.0347"	0.1944"	0.0347"	0.1944"	N/A	N/A	N/A	N/A
TRA:	WELD CENTERLINE		WELD CENTERLINE		WELD CENTERLINE		WELD CENTERLINE		N/A		N/A	
MOTOR DIR.:	NORMAL	INVERSE	NORMAL	INVERSE	NORMAL	INVERSE	NORMAL	INVERSE	N/A	N/A	N/A	N/A
ROT:	LOOKING DOWNSTREAM		LOOKING DOWNSTREAM		LOOKING DOWNSTREAM		LOOKING DOWNSTREAM		N/A		N/A	

REMARKS:

* Offsets for the 45°/SHR are -3.0 inches. Offsets for the 45°/RL are 0.0 inches. Offsets for the 60°/RL are -6.00 inches.

The upstream exam was limited to a "W" dimension of 1.80" from weld centerline due to the nozzle configuration.

EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE
	II	5/6/98		III	5/10/98

FORM UT-08 REV 10

GE Nuclear Energy

ULTRASONIC SCAN PARAMETER SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP | PROCEDURE NO.: UT-WNP2-209V0 | REPORT NO.: R-R13-031

UNIT: 2 | REVISION NO.: 1 | DATA SHEET NO.: DAR13-093 THRU DAR13-098

PROJECT NO.: 1GW80 - REQ13 | FRR NO.: WNP298-02 | CALIBRATION SHEET NO.: CAR13-074 THRU CAR13-078

SYSTEM: RECIRCULATION WELD ID: 24RRC(2)A-1 MOTOR STEPS: CIR: 452.60 / in TRA: 633.02 / in

WELD REFERENCE, (GE-ADM-1005): Lo: TOP DEAD CENTER Wo: WELD CENTERLINE

SEARCH UNIT(S): 45°/SHR, 45°/RL, 35°/RL, 60°/RL

EXAMINATION SETUP

COMPONENT DIA: 24.0" WELD LENGTH: 78.0" TRACK DIA: 28.0" ARM LENGTH: 18.0" TRACK LOCATION: 10.8" DNST FROM CS/INC INTERFACE

SCAN PARAMETERS

SCAN: Z20	SCAN DIRECTION: LKUP	SKEW: +180°	SCAN: Z21	SCAN DIRECTION: LKUP	SKEW: +180°
	SCANNING "X":	INDEXING "Y":		SCANNING "X":	INDEXING "Y":
START:	-01.90	0"	START:	-1.40"	30.00"
SIZE:	7.50"	79.00"	SIZE:	7.00"	11.00"
OFFSET:	*	*	OFFSET:	*	*
RESOLUTION:	0.0347"	0.1948"	RESOLUTION:	0.0347"	0.1948"
MOTOR DIR.:	INVERSE	INVERSE	MOTOR DIR.:	INVERSE	INVERSE
SCANNER ZERO POSITIONS:	CIR: TOP DEAD CENTER		SCANNER ZERO POSITIONS:	CIR: TOP DEAD CENTER	
	TRA: WELD CENTERLINE			TRA: WELD CENTERLINE	
	ROT: LOOKING DOWNSTREAM			ROT: LOOKING DOWNSTREAM	

SCAN: Z30	SCAN DIRECTION: LKCW	SKEW: +90°	SCAN: Z31	SCAN DIRECTION: LKCW	SKEW: +90°
	SCANNING "X":	INDEXING "Y":		SCANNING "X":	INDEXING "Y":
START:	0"	-1.80"	START:	0"	-1.80"
SIZE:	79.00"	3.60"	SIZE:	79.00"	3.60"
OFFSET:	*	0"	OFFSET:	*	0"
RESOLUTION:	0.0353"	0.0955"	RESOLUTION:	0.0353"	0.0955"
MOTOR DIR.:	INVERSE	INVERSE	MOTOR DIR.:	INVERSE	INVERSE
SCANNER ZERO POSITIONS:	CIR: TOP DEAD CENTER		SCANNER ZERO POSITIONS:	CIR: TOP DEAD CENTER	
	TRA: WELD CENTERLINE			TRA: WELD CENTERLINE	
	ROT: LOOKING DOWNSTREAM			ROT: LOOKING DOWNSTREAM	

SCAN: Z32	SCAN DIRECTION: LKCW	SKEW: +90°	SCAN: Z40	SCAN DIRECTION: LKCC	SKEW: -90°
	SCANNING "X":	INDEXING "Y":		SCANNING "X":	INDEXING "Y":
START:	0"	1.20"	START:	0"	-1.80"
SIZE:	79.00"	0.60"	SIZE:	79.00"	3.60"
OFFSET:	*	*	OFFSET:	*	*
RESOLUTION:	0.0353"	0.0995"	RESOLUTION:	0.0353"	0.0995"
MOTOR DIR.:	INVERSE	INVERSE	MOTOR DIR.:	INVERSE	INVERSE
SCANNER ZERO POSITIONS:	CIR: TOP DEAD CENTER		SCANNER ZERO POSITIONS:	CIR: TOP DEAD CENTER	
	TRA: WELD CENTERLINE			TRA: WELD CENTERLINE	
	ROT: LOOKING DOWNSTREAM			ROT: LOOKING DOWNSTREAM	

REMARKS: * Offsets for the 45°/SHR are -3.0 inches. Offsets for the 45°/RL are 0.0 inches. Offsets for the 60°/RL and 35°\RL are -6.00" The upstream exam was limited to a "W" dimension of 1.80" from weld centerline due to the nozzle configuration.

EXAMINER	LEVEL	DATE	GE REVIEWED BY	LEVEL	DATE	PAGE: 22 OF: 22
	II	5/6/98		III	5/10/98	

FORM UT-08 REV 10

GE Nuclear Energy

ULTRASONIC CALIBRATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP UNIT: 2

CALIBRATION SHEET NO.: CAR13-074

PROJECT NO.: 1GW80 - RFO13

LINEARITY SHEET NO.: L-005

PROCEDURE NO.: UT-WNP2-209V0 REVISION: 1 FRR: WNP298-02

Instrument: TECRAD / TOMOSCAN (Manufacturer / Model) TTS10091109 (System Serial No.)

Search Unit: RTD (Manufacturer) 98-154 (Serial No.) (24 x 17)mm (Size) 1.50 MHz (Freq.) 45° / SHR (Angle/Mode) 50" (Incident to wedge front)

Cable: RG-174 (Type) 250, 25, 3 (Length) 2 (No. of Connectors)

Calibration Standard: UT-101 (Serial No.) SS / CS (Material) 1.875" (Nominal Thickness) 1.873" (Measured Thickness) 85 °F (Temp.)

Thermometer: 177460 (Serial No.)

Couplant: ULTRAGEL II (Type) 094041 (Batch No.) Measured Angle: 45.9°

CALIBRATION

ORIENTATION:	CIRC (WM/SS)	AXIAL (SS/WM)
TYPE:	ID NOTCH	ID NOTCH
DEPTH:	1.873" / 1.873"	1.873" / 1.873"
AMPLITUDE:	70% / 80%	80% / 60%
SWEEP:	2.550" / 2.695"	2.804" / 2.816"
GAIN: (dB)	17.0 / 10.0	13.0 / 36.0

☐ TIME ☐ DEPTH ■ METAL PATH

3/8 SDH: 2.079 MP 35 dB at 80%
5/8 SDH: 3.517 MP 35 dB at 60%

FIELD SIMULATOR: ROMPAS S/N: CAL-RHOM-011

REFLECTOR:	1.0" RADIUS	2.0" RADIUS
MAX AMPLITUDE:	60%	80%
SWEEP:	1.003"	2.006"
GAIN: (dB)	0	0

CALIBRATION VERIFICATION

	TIME	DATE	OPER.	COMP.	REPORT NO
INITIAL	20:05	05/05/98		24RRC(2)A-1	R-R13-031
VERIFIED					
VERIFIED					
VERIFIED					
VERIFIED					
FINAL	06:58	05/06/98		24RRC(2)A-1	R-R13-031

BASIC SETTINGS

1. DELAY: 0.6617 in
2. TIMEBASE: 6.1883 in
3. FREQUENCY: (MHz) 5.00
4. RATE: /S 20.0
5. UNITS: ☐ DISTANCE ■ HALF PATH ☐ TIME
6. VELOCITY: 120866 in/s
7. SAMPLES: 512

PULSER / RECEIVER

1. MODE: ■ PULSE ECHO ☐ THRU-TRANSMISSION
2. PULSER: P1 TO RECEIVER: P1
3. VOLTAGE: (v) 400
4. WIDTH: (Ns) 335
5. FILTER: ☐ NONE ☐ 0.5 - 2 MHz ■ 1 - 5 MHz ☐ 2 - 10 MHz ☐ 5 - 15 MHz
6. RECTIFICATION: ☐ NONE ☐ UNIPOLAR + ☐ UNIPOLAR - ■ BIPOLAR
7. SMOOTHING: ☐ NONE ☐ FAST ■ MEDIUM ☐ SLOW

EXAMINER II LEVEL 5/6/98 DATE

GE REVIEWED BY III LEVEL 5/10/98 DATE

FORM UT-08 REV. 12

GE Nuclear Energy

ULTRASONIC CALIBRATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP UNIT: 2 CALIBRATION SHEET NO.: CAR13-075

PROJECT NO.: 1GW80 - RFO13 LINEARITY SHEET NO.: I-006

PROCEDURE NO.: UT-WNP2-209V0 REVISION: 1 FRR: WNP298-02

Instrument: TECRAD / TOMOSCAN (Manufacturer / Model) TTS10091109 (System Serial No.)

Search Unit: RTD (Manufacturer) 98-241 (Serial No.) 2(10 x 18)mm (Size) 2.00 MHz (Freq.) 35° / RL (Angle/Mode) .50" (Incident to wedge front)

Cable: 2(RG-174) (Type) 2(250, 25, 3) (Length) 4 (No. of Connectors)

Calibration Standard: UT-101 (Serial No.) SS / CS (Material) 1.875" (Nominal Thickness) 1.873" (Measured Thickness) 85 °F (Temp.)

Thermometer: 177460 (Serial No.)

Couplant: ULTRAGEL II (Type) 094041 (Batch No.) Circ Scan Only

CALIBRATION

ORIENTATION:	AXIAL (WM)	AXIAL (SS)
TYPE:	ID NOTCH	ID NOTCH
DEPTH:	1.873"	1.873"
AMPLITUDE:	80%	80%
SWEEP:	2.565"	2.520"
GAIN: (dB)	44.0	38.0

☐ TIME ☐ DEPTH ■ METAL PATH

FIELD SIMULATOR: ROMPAS S/N: CAL-RHOM-011

REFLECTOR:	1.0" RADIUS	2.0" RADIUS
MAX AMPLITUDE:	30%	80%
SWEEP:	0.999"	1.954"
GAIN: (dB)	13.0	13.0

CALIBRATION VERIFICATION

	TIME	DATE	OPER.	COMP.	REPORT NO
INITIAL	02:20	05/06/98		24RRC(2)A-1	R-R13-031
VERIFIED					
VERIFIED					
VERIFIED					
VERIFIED					
FINAL	06:57	05/06/98		24RRC(2)A-1	R-R13-031

BASIC SETTINGS

1. DELAY: 0.9326 in
2. TIMEBASE: 5.6844 in
3. FREQUENCY: (MHz) 10.0
4. RATE: /S 20.0
5. UNITS: ☐ DISTANCE ■ HALF PATH ☐ TIME
6. VELOCITY: 222047 in/s
7. SAMPLES: 512

PULSER / RECEIVER

1. MODE: ☐ PULSE ECHO ■ THRU-TRANSMISSION
2. PULSER: P2 TO RECEIVER: R2
3. VOLTAGE: (v) 400
4. WIDTH: (Ns) 252
5. FILTER: ☐ NONE ☐ 0.5 - 2 MHz ■ 1 - 5 MHz ☐ 2 - 10 MHz ☐ 5 - 15 MHz
6. RECTIFICATION: ☐ NONE ☐ UNIPOLAR + ☐ UNIPOLAR - ■ BIPOLAR
7. SMOOTHING: ☐ NONE ☐ FAST ■ MEDIUM ☐ SLOW

EXAMINER II LEVEL 5/6/98 DATE

GE REVIEWED BY III LEVEL 5/10/98 DATE

FORM UT-06 REV. 12

GE Nuclear Energy

ULTRASONIC CALIBRATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP UNIT: 2 CALIBRATION SHEET NO.: CAR13-076

PROJECT NO.: 1GW80 - RFO13 LINEARITY SHEET NO.: L-006

PROCEDURE NO.: UT-WNP2-209V0 REVISION: 1 FRR: WNP298-02

Instrument: TECRAD / TOMOSCAN (Manufacturer / Model) TTS10091109 (System Serial No.)

Search Unit: RTD (Manufacturer) 98-163 (Serial No.) 2(10 x 18)mm (Size) 2.00 MHz (Freq.) 45° / RL (Angle/Mode) .50" (Incident to wedge front)

Cable: 2(RG-174) (Type) 2(250, 25, 3) (Length) 4 (No. of Connectors)

Calibration Standard: UT-101 (Serial No.) SS / CS (Material) 1.875" (Nominal Thickness) 1.873" (Measured Thickness) 85 °F (Temp.)

Thermometer: 177460 (Serial No.)

Couplant: ULTRAGEL II (Type) 094041 (Batch No.) Measured Angle: 44.3°

CALIBRATION

ORIENTATION:	CIRC (WM)	CIRC (SS)
TYPE:	ID NOTCH	ID NOTCH
DEPTH:	1.873"	1.873"
AMPLITUDE:	80%	80%
SWEEP:	2.554"	2.620"
GAIN: (dB)	35.0	38.0

☐ TIME ☐ DEPTH ■ METAL PATH

FIELD SIMULATOR: ROMPAS S/N: CAL-RHOM-011

REFLECTOR:	1.0" RADIUS	2.0" RADIUS
MAX AMPLITUDE:	40%	80%
SWEEP:	1.010"	1.965"
GAIN: (dB)	10.0	10.0

CALIBRATION VERIFICATION

	TIME	DATE	OPER.	COMP.	REPORT NO
INITIAL	20:07	05/05/98		24RRC(2)A-1	R-R13-031
VERIFIED					
VERIFIED					
VERIFIED					
VERIFIED					
FINAL	06:59	05/06/98		24RRC(2)A-1	R-R13-031

BASIC SETTINGS

1. DELAY: 1.0492 in
2. TIMEBASE: 5.6844 in
3. FREQUENCY: (MHz) 10.0
4. RATE: /S 20.0
5. UNITS: ☐ DISTANCE ■ HALF PATH ☐ TIME
6. VELOCITY: 222047 in/s
7. SAMPLES: 512

PULSER / RECEIVER

1. MODE: ☐ PULSE ECHO ■ THRU-TRANSMISSION
2. PULSER: P2 TO RECEIVER: R2
3. VOLTAGE: (v) 400
4. WIDTH: (Ns) 252
5. FILTER: ☐ NONE ☐ 0.5 - 2 MHz ■ 1 - 5 MHz ☐ 2 - 10 MHz ☐ 5 - 15 MHz
6. RECTIFICATION: ☐ NONE ☐ UNIPOLAR + ☐ UNIPOLAR - ■ BIPOLAR
7. SMOOTHING: ☐ NONE ☐ FAST ■ MEDIUM ☐ SLOW

EXAMINER II LEVEL 5/6/98 DATE

GE REVIEWED BY III LEVEL 5/10/98 DATE

FORM UT-08 REV 12

GE Nuclear Energy

ULTRASONIC CALIBRATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP UNIT: 2 CALIBRATION SHEET NO.: CAR13-077

PROJECT NO.: 1GW80 - RFO13 LINEARITY SHEET NO.: L-007

PROCEDURE NO.: UT-WNP2-209V0 REVISION: 1 FRR: WNP298-02

Instrument: TECRAD / TOMOSCAN (Manufacturer / Model) TTS10091109 (System Serial No.)

Search Unit: RTD (Manufacturer) 98-165 (Serial No.) 2(10 x 18)mm (Size) 2.00 MHz (Freq.) 45° / RL (Angle/Mode) .50" (Incident to wedge front)

Cable: 2(RG-174) (Type) 2(250, 25, 3) (Length) 4 (No. of Connectors)

Calibration Standard: UT-101 (Serial No.) SS / CS (Material) 1.875" (Nominal Thickness) 1.873" (Measured Thickness) 85 °F (Temp.)

Thermometer: 177460 (Serial No.)

Couplant: ULTRAGEL II (Type) 094041 (Batch No.) Measured Angle: 44.3°

CALIBRATION

ORIENTATION:	CIRC (WM)	CIRC (SS)
TYPE:	ID NOTCH	ID NOTCH
DEPTH:	1.873"	1.873"
AMPLITUDE:	80%	80%
SWEEP:	2.554"	2.620"
GAIN: (dB)	35.0	38.0

☐ TIME ☐ DEPTH ■ METAL PATH

FIELD SIMULATOR: ROMPAS S/N: CAL-RHOM-011

REFLECTOR:	1.0" RADIUS	2.0" RADIUS
MAX AMPLITUDE:	40%	80%
SWEEP:	1.010"	1.965"
GAIN: (dB)	10.0	10.0

CALIBRATION VERIFICATION

	TIME	DATE	OPER.	COMP.	REPORT NO
INITIAL	02:22	05/06/98		24RRC(2)A-1	R-R13-031
VERIFIED					
VERIFIED					
VERIFIED					
VERIFIED					
FINAL	06:59	05/06/98		24RRC(2)A-1	R-R13-031

BASIC SETTINGS

1. DELAY: 1.0492 in
2. TIMEBASE: 5.6844 in
3. FREQUENCY: (MHz) 10.0
4. RATE: /S 20.0
5. UNITS: ☐ DISTANCE ■ HALF PATH ☐ TIME
6. VELOCITY: .222047 in/s
7. SAMPLES: 512

PULSER / RECEIVER

1. MODE: ☐ PULSE ECHO ■ THRU-TRANSMISSION
2. PULSER: P3 TO RECEIVER: R3
3. VOLTAGE: (v) 400
4. WIDTH: (Ns) 252
5. FILTER: ☐ NONE ☐ 0.5 - 2 MHz ■ 1 - 5 MHz ☐ 2 - 10 MHz ☐ 5 - 15 MHz
6. RECTIFICATION: ☐ NONE ☐ UNIPOLAR + ☐ UNIPOLAR - ■ BIPOLAR
7. SMOOTHING: ☐ NONE ☐ FAST ■ MEDIUM ☐ SLOW

EXAMINER II LEVEL 5/6/98 DATE

GE REVIEWED BY III LEVEL 5/10/98 DATE

PAGE: 1 OF: 1

FORM UT-06 REV. 12

GE Nuclear Energy

ULTRASONIC CALIBRATION DATA SHEET
(AUTOMATED WITH *Smart 2000*)

SITE: WNP UNIT: 2 CALIBRATION SHEET NO.: CAR13-078

PROJECT NO.: 1GW80 - RFO13 LINEARITY SHEET NO.: L-007

PROCEDURE NO.: UT-WNP2-209V0 REVISION: 1 FRR: WNP298-02

Instrument: TECRAD / TOMOSCAN (Manufacturer / Model) TTS10091109 (System Serial No.)

Search Unit: RTD (Manufacturer) 98-175 (Serial No.) 2(10 x 18)mm (Size) 2.00 MHz (Freq.) 60° / RL (Angle/Mode) .50" (Incident to wedge front)

Cable: 2(RG-174) (Type) 2(250, 25, 3) (Length) 4 (No. of Connectors)

Calibration Standard: UT-101 (Serial No.) SS / CS (Material) 1.875" (Nominal Thickness) 1.873" (Measured Thickness) 85 °F (Temp.)

Thermometer: 177460 (Serial No.)

Couplant: ULTRAGEL II (Type) 094041 (Batch No.) Measured Angle: 57.8°

CALIBRATION

ORIENTATION:	CIRC (WM)	CIRC (SS)
TYPE:	ID NOTCH	ID NOTCH
DEPTH:	1.873"	1.686"
AMPLITUDE:	80%	80%
SWEEP:	3.486"	3.164"
GAIN: (dB)	44.0	46.0

☐ TIME ☐ DEPTH ■ METAL PATH

FIELD SIMULATOR: ROMPAS S/N: CAL-RHOM-011

REFLECTOR:	1.0" RADIUS	2.0" RADIUS
MAX AMPLITUDE:	40%	80%
SWEEP:	1.055"	2.054"
GAIN: (dB)	15.0	15.0

CALIBRATION VERIFICATION

	TIME	DATE	OPER.	COMP.	REPORT NO
INITIAL	20:09	05/05/98		24RRC(2)A-1	R-R13-031
VERIFIED					
VERIFIED					
VERIFIED					
VERIFIED					
FINAL	06:51	05/06/98		24RRC(2)A-1	R-R13-031

BASIC SETTINGS

1. DELAY: 1.0936 in
2. TIMEBASE: 5.6844 in
3. FREQUENCY: (MHz) 10.0
4. RATE: /S 20.0
5. UNITS: ☐ DISTANCE ■ HALF PATH ☐ TIME
6. VELOCITY: 222047 in/s
7. SAMPLES: 512

PULSER / RECEIVER

1. MODE: ☐ PULSE ECHO ■ THRU-TRANSMISSION
2. PULSER: P3 TO RECEIVER: R3
3. VOLTAGE: (v) 400
4. WIDTH: (Ns) 252
5. FILTER: ☐ NONE ☐ 0.5 - 2 MHz ■ 1 - 5 MHz ☐ 2 - 10 MHz ☐ 5 - 15 MHz
6. RECTIFICATION: ☐ NONE ☐ UNIPOLAR + ☐ UNIPOLAR - ■ BIPOLAR
7. SMOOTHING: ☐ NONE ☐ FAST ■ MEDIUM ☐ SLOW

EXAMINER — LEVEL II — DATE 5/6/98

GE REVIEWED BY — LEVEL III — DATE 5/10/98

FORM UT-08 REV. 12

GE Nuclear Energy

SMART 2000 Indication Evaluation Data Sheet

Project : WNP2 RFO13
Weld ID : 24RRC(2)A-1

Exam report no. R-R13-031
Ind. Data Sheet : EIDS-01
Indication : 1

Flaw Thruwall Dimension = 0.29
Flaw Length "l" = 3.52
Surface Separation "S" = 0.00

"T" nominal = 1.88
"T" measured = 2.00

ASME Section XI, 1989 Edition, No Addenda
TABLE IWB-3514-2

a/l	Surface %	Subsurface %	Surface %	Subsurface %
0.00	10.6	10.6Y	~	~
0.05	10.7	10.7Y	10.89	#VALUE!
0.10	11.0	11.0Y	~	~
0.15	11.1	11.1Y	~	~
0.20	11.4	11.4Y	~	~
0.25	11.5	11.5Y	~	~
0.30	11.7	11.7	~	~
0.35	11.9	11.9	~	~
0.40	12.1	12.1	~	~
0.45	12.2	12.2	~	~
0.50	12.5	12.5	~	~
			Allowed	Allowed
			10.89	#VALUE!

a = 0.290
a/l value = 0.082
Y = 0.000

Flaw is Surface

Allowed a/t = 10.89%
a/t = 14.50%

Flaw is unacceptable by Table IWB-3514-2

Comments Flaw length is ID length

Analyst: [signature] Level: III Date: 5-14-98

Reviewed By: [signature] Level: III Date: 5-14-98

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: R-R13-031-S

PROJECT: WNP2
1GW80 - RFO13

PROCEDURE: N/A REV: N/A FRR: N/A
N/A
N/A

SYSTEM: RECIRCULATION

N/A REV: N/A FRR: N/A
N/A
N/A

WELD NO.: 24RRC(2)A-1

N/A REV: N/A FRR: N/A
N/A
N/A

CONFIGURATION: NOZZLE TO SAFE END

EXAMINER: N/A LEVEL:

EXAMINER: N/A LEVEL:

EXAMINER: N/A LEVEL:

☐ MT ☐ PT ■ UT ☐ VT

WELD TYPE: ■ CIRCUMFERENTIAL ☐ LONGITUDINAL ☐ OTHER N/A

DATA SHEET NO.(S): N/A

CAL SHEET NO.(S): N/A

The purpose of this report is to provide supplemental information in support of flaw growth monitoring for the above referenced weld.

Discussion:

During RFO13, an inside surface connected planar flaw was detected utilizing the "Smart 2000" ultrasonic examination system. This indication is documented in GE Nuclear Energy examination report R-R13-031.

This indication can be identified in the RFO9 "Smart 2000" ultrasonic examination data utilizing an enhanced data analysis software (Tomoview) . The addition of system "soft gain" (+ 9 Db) was required in order to enhance the ultrasonic images.

This report documents the indication length and thru wall dimension comparisons between the RFO9 and RFO13 examinations. It is important to note the key differences between the RFO9 and RFO13 examinations for future comparison.

Examination Search Units - The examination search units utilized during RFO13 were recently purchased and provide up-to-date advances in ultrasonic technology (specifically, crystal shape, beam focus, and impedance matching).

Data Analysis Software - The data analysis software utilized during RFO13 (Tomoview) is a state-of-the-art data analysis program. This PC based analysis tool provides enhanced volumetric image capabilities in either global or single plane projections. Geometric templates can be applied to give additional identification of sound interaction.

☐ EXAM COMPLETE ☐ PARTIALLY EXAMINED (EXPLAIN IN COMMENTS) ☐ EXAM COMPLETE IN COMBINATION WITH DATA SHEETS BELOW

ADDITIONAL DATA SHEETS: N/A

COMPARED TO: ☐ PSI ☐ ISI REPORT NO.(S): N/A ☐ NO CHANGE

EXAMINATION RESULTS: ☐ ACCEPTABLE ☐ UNACCEPTABLE

NO. OF RECORDABLE INDICATIONS: N/A

NO. OF REPORTABLE INDICATIONS: N/A

CODE COVERAGE OBTAINED: N/A %

SUMMARY BY	III	5-14-98	UTILITY REVIEW		5/14/98
	LEVEL	DATE			DATE
GE REVIEWED BY	III	5-14-98	ANII REVIEW		5/14/98
	LEVEL	DATE			DATE

FORM UT-09 REV. 9

GE Nuclear Energy	EXAMINATION SUMMARY CONTINUATION SHEET	REPORT NO.: R-R13-031-S

PROJECT: WNP2
1GW80 - RFO13

SYSTEM: RECIRCULATION
WELD NO.: 24RRC(2) A-1
CONFIGURATION: NOZZLE TO SAFE-END

Statistical Information:

RFO9

Ind. No.	Ind. Start	Ind. Stop	OD Length	ID Length	*Thru Wall Dimension	*Remaining Ligament	Flaw Location (Side of Weld)	Indication Orientation
1	28.5"	32.7"	4.20"	3.52"	0.26"	1.74"	DNST (Safe End)	Circumferential

RFO13

Ind. No.	Ind. Start	Ind. Stop	OD Length	ID Length	*Thru Wall Dimension	*Remaining Ligament	Flaw Location (Side of Weld)	Indication Orientation
1	28.5"	32.7"	4.20"	3.52"	0.29"	1.71"	DNST (Safe End)	Circumferential

* Remaining ligament and thru wall dimension information is documented utilizing the measured wall thickness (2.00") from the safe end side of the configuration.

Indication length and thru wall dimension was determined utilizing the 45° shear wave search unit. A component ID/OD ratio of 0.839 was utilized for determination of ID length. This ratio is based upon a measured component circumference of 78.0" and a measured material thickness of 2.00".

Technical justification for deviation in flaw thru wall dimension:

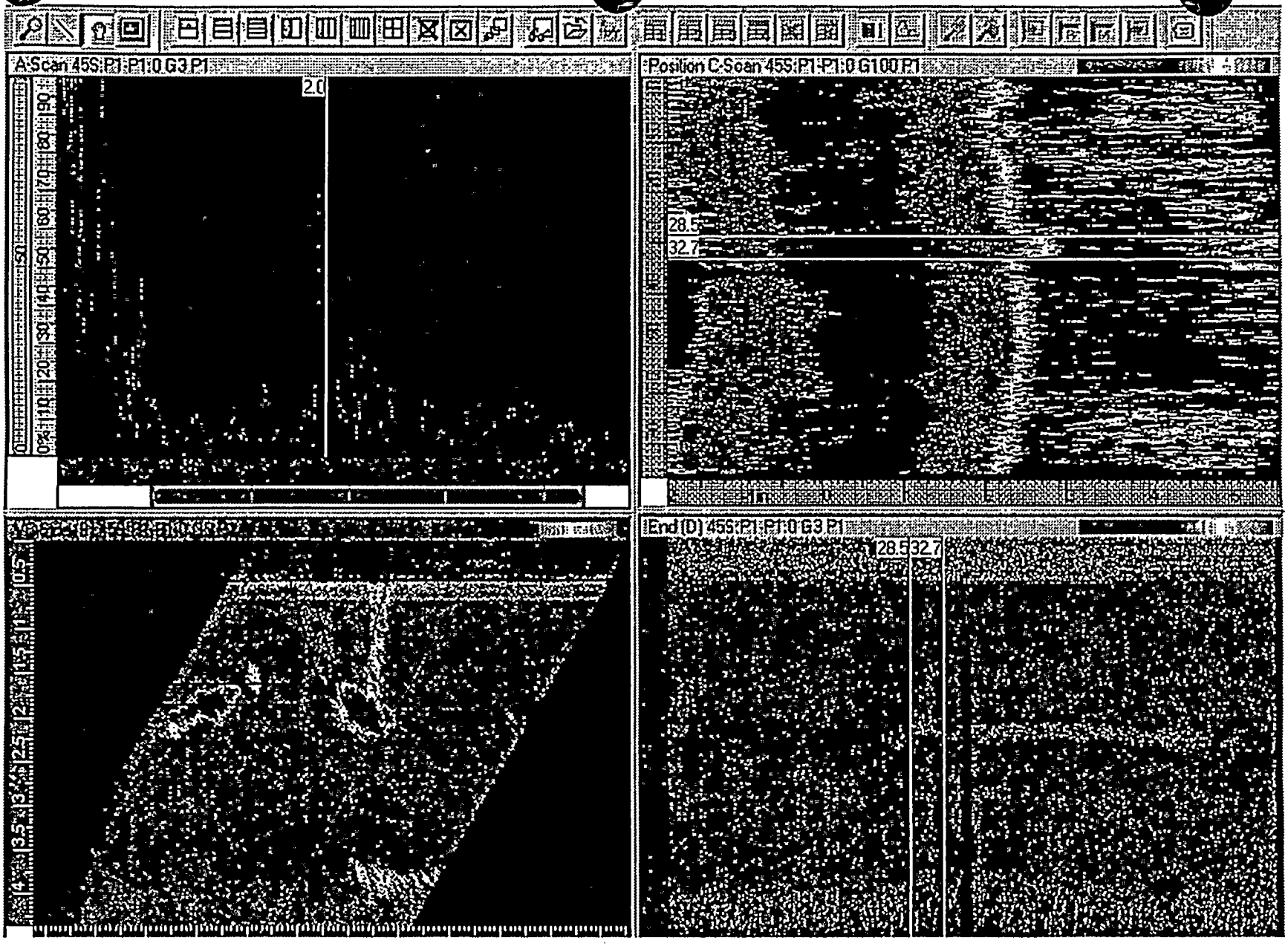
The ultrasonically determined thru wall dimension of an indication is primarily a function of system sensitivity and resolution. These factors, along with precision of display, identify a precise number that is reported as the flaw dimension. In order to produce the exact same (2nd and/or 3rd decimal precision) result from a previous examination, the same equipment, search units and calibration and examination parameters would need to be utilized. As a result of this, it is assumed that an anticipated accuracy margin of approximately ± 0.050" can be expected. In comparison, the demonstrated qualification criteria for sizing uncertainty (RMS) of piping examinations is typically ± 0.125".

Conclusion:

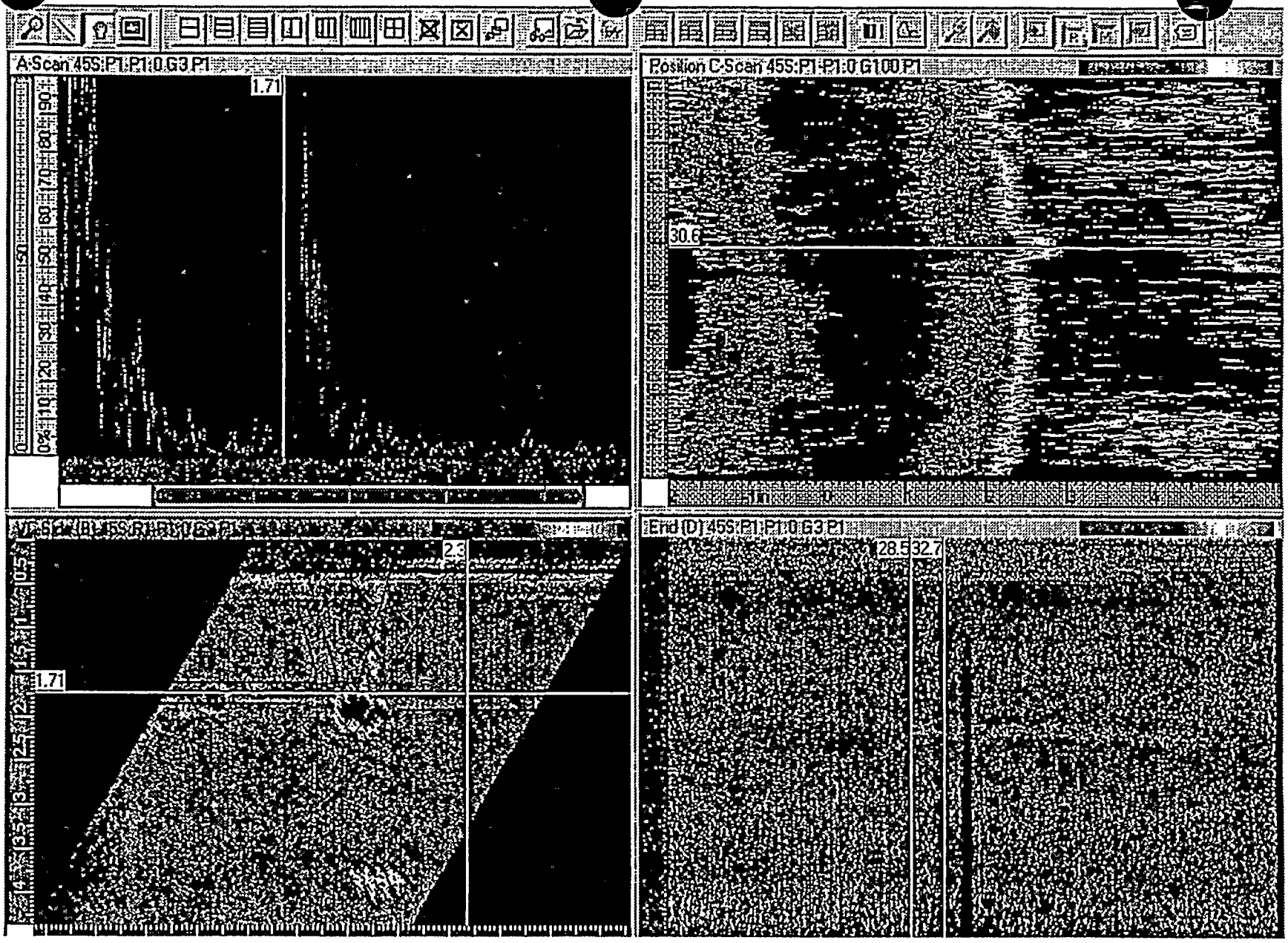
Based upon the information available from the RFO9 and RFO13 examination data, it is concluded that the indication has not exhibited any noticeable signs of indication growth in either the length or thru wall dimensions.

SUMMARY BY	III LEVEL	5-14-98 DATE	UTILITY REVIEW	5/14/98 DATE	
GE REVIEWED BY	III LEVEL	5-14-98 DATE	ANII REVIEW	5/14/98 DATE	PAGE: 2 OF: 6

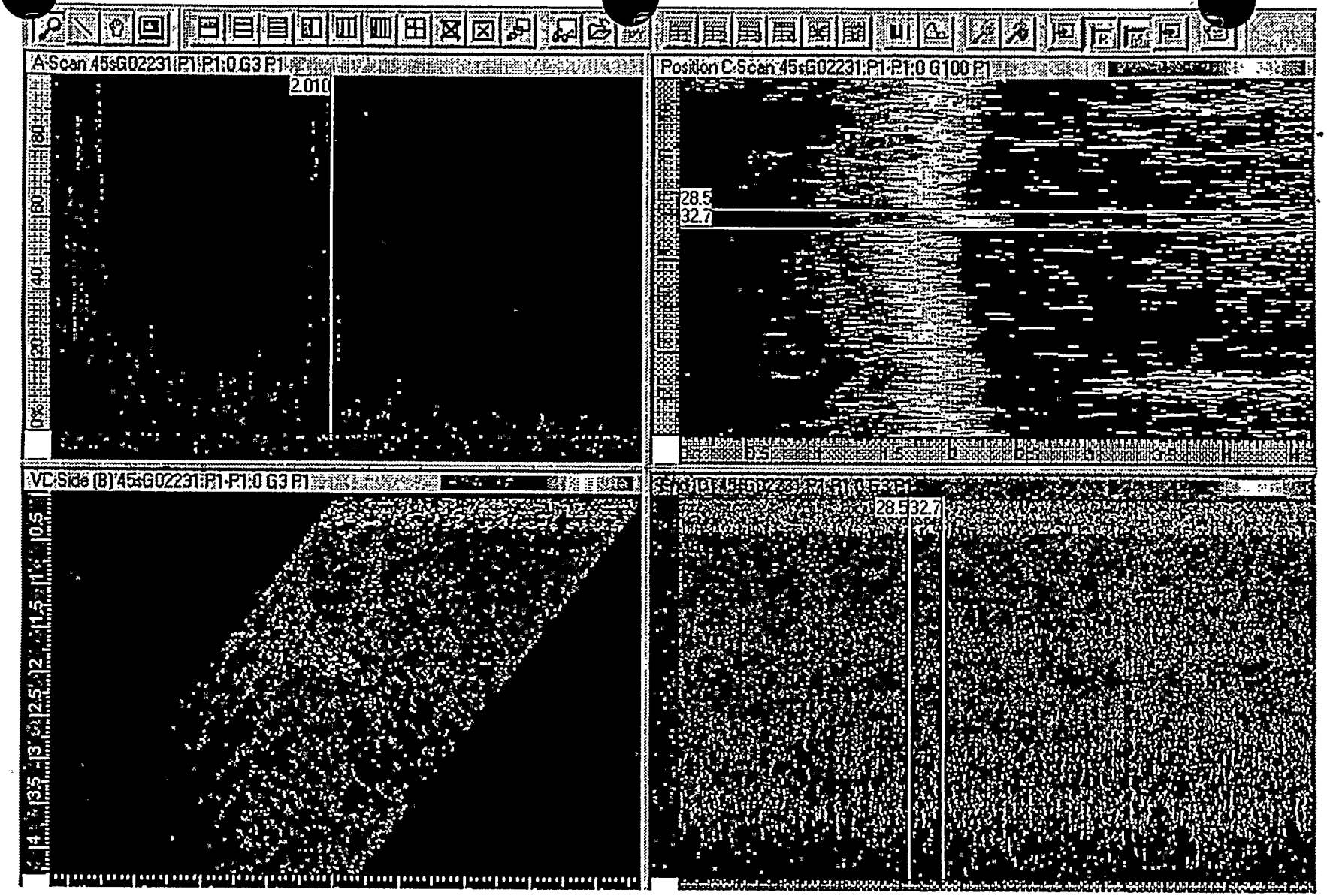
FORM UT-10 REV. 4



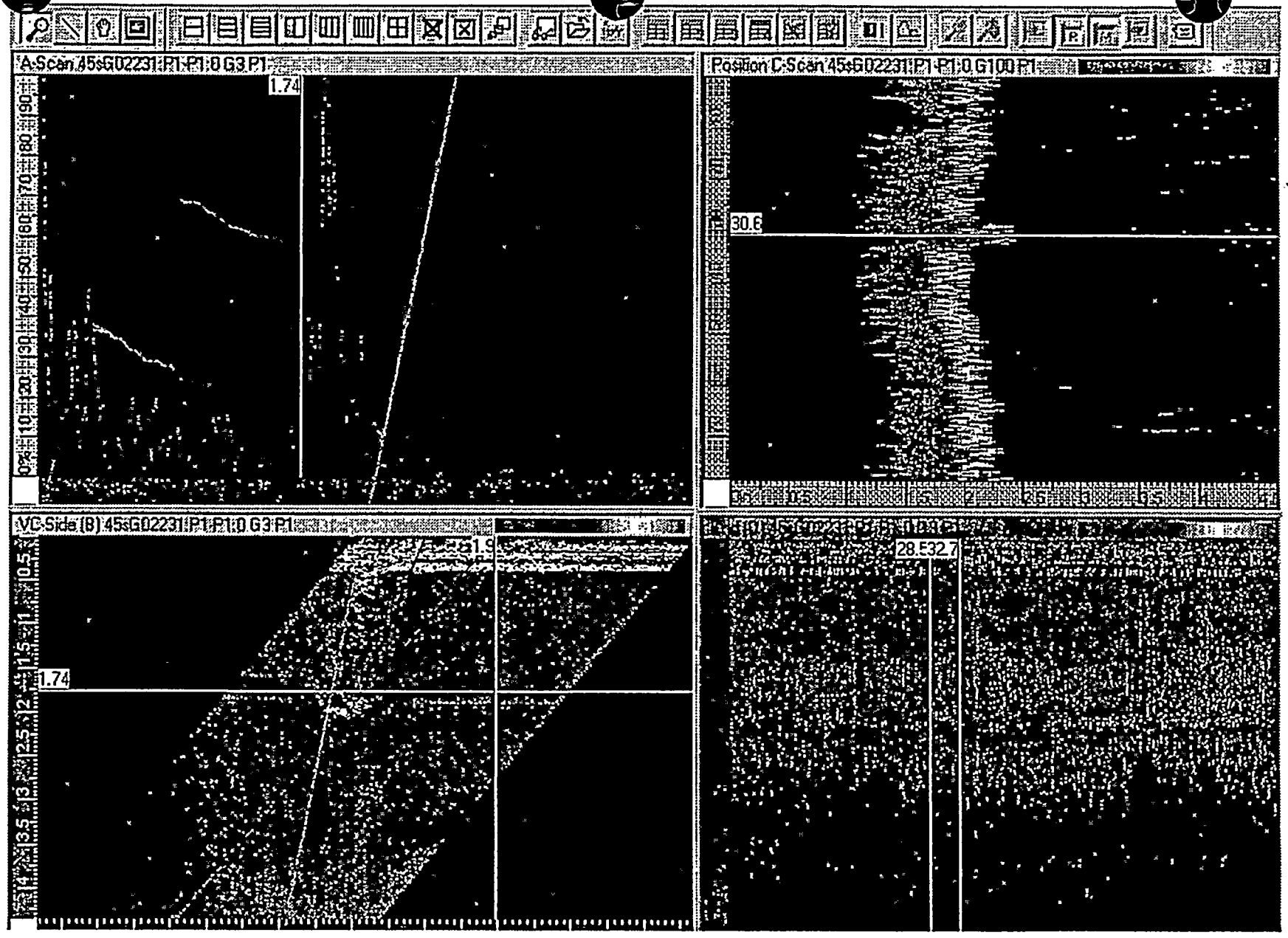
Comments
WNP2 RFO13 Weld 24RRC(2)A-1 Indication Length 28.5" - 32.7" (4.2") Report R-R13-031-S Page 3 of 6



Comments
WNP2 RFO13 Weld 24RRC(2)A-1 Indication thru wall dimension 0.29" (1.71" remaining ligament) Report R-R13-031-S Page 4 of 6



Comments
WNP2 RFO9 Weld 24RRC(2)A-1 Indication Length 28.5" - 32.7" (4.2") Report R-R13-031-S Page 5 of 6



Comments
WNP2 RFO9 Weld 24RRC(2)A-1 Indication thru wall dimension 0.26" (1.74" remaining ligament) Report R-R13-031-S Page 6 of 6