N131-1194

Nebraska Public Power District

L ESIGN CALCULATIONS COVER SHEET

Title Evaluation of Core Shroud Inspection Results	Calculation No. NEDC 95-191
	Task Identification No. N/A
System/Structure RPV	Design Change No. N/A
Component Core Shroud	Discipline Civil/Structural
Classification: ■ Essential ☐ Non-Essential	

Calc. Description:

The purpose of this calculation is to evaluate the results of General Electric's (GE) inspection of the CNS Core Shroud horizontal welds to determine if additional evaluation or NDE characterization is needed for the welds. The inspection results will be evaluated using the "Evaluation and Screening Criteria for the Cooper Shroud" developed by GE (see Attachment 2.4). Eight horizontal (circumferential) welds (H1, H2, H3, H4, H5, H6a, H6b, and H7) were inspected during CNS's 1995 refueling outage and are subject to this evaluation.

References: (See Sheet 2 of the Calculation)

1. USAR
2. TECH. SPECS.
3. Consult. Calculation:
4. NED Calculation:
5. Computer Program:

Attachments: (See Sheet 2 of the Calculation)

A.
B.
C.
D.
E.

Rev. No.	Status	Revision Description	Prepared By/Date	Checked or Reviewed By/Date	Design Verification/Date	Approved By/Date
0	2	Original Issue	Perry K. Adelung 11-29-95	ATWOOD A. Browning 11-29-95	ATwood A Browning 11-29-95 / Barcodee Benjamin 12-1-95	12/1/95

Status Code

1. As-Built
2. Information only
3. For Construction
4. Superseded or Deleted

N153-0595

Nebraska Public Power District

DESIGN CALCULATION CROSS REFERENCE INDEX

Sheet 1 of 3

NEDC 95-191 Prepared By: Perry K. Adelung Checked/Reviewed By: ATWOOD A. BROWNING

Date: November 29 1995 Date: 11-29 1995

NEDC Rev. No.	SOURCE DOCUMENTS (Indicate A or D)*	A* OR D*	Rev. No.	AFFECTED DOCUMENTS (Indicate C, A or D)*	A* C* D*	Rev. No.	Tracking System**
0	GENE-523-174-1293	A	2				
0	GENE- "Shroud UT Project IFSCN Oct. & Nov. 1995"	A	N/A				

* C = Change A = Addition D = Deletion

** Use modification document (DC, ESC, etc.) number when a calculation is associated with a modification. Otherwise, the CMDC database is normally specified.

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DESIGN CALCULATIONS SHEET

Calc No. NEDC 95-191 Prepared By: Perry K. Adelung PKA Checked/Reviewed By: Atwood A. Browning AAB

Date: November 29, 1995 Date: November 29, 1995

1.0 REFERENCES

1.1 USAR - Section III-3.4.1.1 and IV-2.5.2
1.2 Technical Specifications - N/A
1.3 Consultant Calculation - N/A
1.4 NED Calculation - N/A
1.5 Computer Program - N/A
1.6 "BWR Core Shroud Inspection and Flaw Evaluation Guidelines", Rev. 1, GENE-523-113-0894

2.0 ATTACHMENTS

2.1 Evaluation of Weld Indications using Screening Criteria for Limit Load Method
2.2 Evaluation of Weld Indications using Screening Criteria for LEFM Method
2.3 General Electric Final Inspection Report
2.4 General Electric document GENE-523-174-1293, Rev. 2, "Evaluation and Screening Criteria for the Cooper Shroud"

3.0 PURPOSE

The purpose of this calculation is to evaluate the results of General Electric's (GE) inspection of the CNS Core Shroud horizontal welds to determine if additional evaluation or NDE characterization is needed for the welds. The inspection results will be evaluated using the "Evaluation and Screening Criteria for the Cooper Shroud" developed by GE (see Attachment 2.4). Eight horizontal (circumferential) welds (H1, H2, H3, H4, H5, H6a, H6b, and H7) were inspected during CNS's 1995 refueling outage and are subject to this evaluation.

4.0 CALCULATION INPUTS

4.1 GE inspection data (see Attachment 2.3)
4.2 Core Shroud thickness (t) = 1.5 inches (see Attachment 2.4)
4.3 Crack growth extension (Δa) = 0.6 inches for an 18 month fuel cycle (see Attachment 2.4). For the calculations in Attachments 2.1 and 2.2, $a = \Delta a$.
4.4 Allowable flaw lengths are specified in Attachment 2.4.

5.0 ASSUMPTIONS

5.1 All uninspected areas of a weld are conservatively assumed to be through-wall cracks for the entire uninspected length of the weld (e.g., for weld H1 the flaw length between 0 - 15.5° = 15.5° x 1.65"/° = 25.58").
5.2 See sheet 7 of Attachment 2.4.

Calc No. NEDC 95-191 Prepared By: Perry K. Adelung PKA Checked/Reviewed By: Atwood A. Browning AAB

Date: November 29, 1995 Date: November 29, 1995

6.0 METHODOLOGY

6.1 General

The General Electric screening criteria document (Attachment 2.4) specifies two methods for determining if additional evaluation or NDE characterization is needed for the Core Shroud welds: 1) Limit Load Analysis and 2) Linear Elastic Fracture Mechanics (LEFM).

6.2 Limit Load Method

Inspection data is evaluated by calculating effective flaw lengths using established "proximity rule" equations and comparing these calculated flaw lengths with allowable flaw lengths. The allowable flaw lengths are for any 90° sector of the applicable weld. The application of the limit load effective length criteria is applied to two adjacent indications/flaws at a time. This methodology is explained in detail in Attachment 2.4.

6.3 LEFM Method

Inspection data is evaluated by calculating equivalent flaw lengths using established "proximity rule" equations and comparing these calculated flaw lengths with the allowable flaw length. The allowable flaw length is compared to the maximum single equivalent flaw length. The allowable flaw length was determined as described on sheet 25 of Attachment 2.4. The equivalent flaw length is described on sheets 18-19 of Attachment 2.4.

7.0 CALCULATIONS

7.1 Limit Load

All eight horizontal welds were evaluated using the Limit Load screening criteria (reference section 5.0 of Attachment 2.4). The evaluation of welds H1, H2, H3, H4, H5, H6a, H6b, and H7 is included as Attachment 2.1.

7.2 LEFM

Three horizontal welds were evaluated using the LEFM screening criteria (reference section 5.0 of Attachment 2.4). The evaluation of welds H4, H5, and H6a is included as Attachment 2.2.

8.0 CONCLUSIONS

All evaluated welds meet the applicable Limit Load and/or LEFM screening criteria. No further evaluation or NDE characterization is necessary for any of the horizontal welds.

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DESIGN CALCULATIONS SHEET

Sheet — of —

Calc No. NEDC 95-191 Prepared By: Perry K. Adelung PKA Checked/Reviewed By: Atwood A. Browning AAB

Date: November 29 1995 Date: November 29 1995

ATTACHMENT 2.1

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H1 (REFERENCE SHEET 7 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication $S_{i,i+1}$ (in.)	2t + 2a (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i,i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i,i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{i+eff} = L_i + S + a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{i+eff} = L_i + 2a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *G	C	334.9	15.5	67	74.53	4.2		68.2			H1.1		
1	C	60.67	61.8	1.87	5.12	4.2		3.07			H1.2		
*B	C	64.9	75.5	17.49	18.79	4.2		18.69			H1.3		
2	C	86.89	87.52	1.04	7.69	4.2		2.24			H1.4		
3	C	92.18	93.31	1.87	13.35	4.2		3.07			H1.5		
*C	C	101.4	115.5	23.27	54.91	4.2		24.47			H1.6		
4	C	148.78	150.29	2.5	24.11	4.2		3.7			H1.7	105	Sat. (No 90 deg. sector exceeds 105")
*D	C	164.9	195.5	50.49	23.99	4.2		51.69			H1.8		
5	C	210.04	211.55	2.5	55.03	4.2		3.7			H1.9		
*E	C	244.9	257.5	20.79	23.81	4.2		21.99			H1.10		
6	C	271.93	273.69	2.91	18.5	4.2		4.11			H1.11		
*F	C	284.9	295.5	17.49	5.2	4.2		18.69			H1.12		
7	C	298.65	299.66	1.67	48.46	4.2		2.87			H1.13		
8	C	329.03	330.92	3.13	6.57	4.2		4.33			H1.14		
				214.02	380.06								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 18.69 - (a = 0.6) + 2.87 + 4.33 + (40 deg x 1.65"/deg) + (a = 0.6) = 91.89" (in sector 284.9 - 14.9 deg.)

2. One degree = 1.65"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H2 (REFERENCE SHEET 20 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	2t + 2a (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *G	C	334.9	15.5	67	81.51	4.2		68.2			H2.1		
*B	C	64.9	75.5	17.49	42.74	4.2		18.69			H2.2	105	Sat.
*C	C	101.4	115.5	23.27	81.51	4.2		24.47			H2.3		(No 90 deg.
*D	C	164.9	195.5	50.49	81.51	4.2		51.69			H2.4		sector
*E	C	244.9	257.5	20.79	45.21	4.2		21.99			H2.5		exceeds
*F	C	284.9	295.5	17.49	65.01	4.2		18.69			H2.6		105")
				196.53	397.49								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 18.69 - (a = 0.6) + (40 deg x 1.65"/deg) + (a = 0.6) = 84.69" (in sector 284.9 - 14.9 deg.)
2. One degree = 1.65"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H3 (REFERENCE SHEET 31 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	2t + 2a (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1\,eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1\,eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A+8+*D	C	333.54	15.6	65.19	75.08	4.2		66.39			H3.1		
1	C	64.04	66.31	3.52	13.55	4.2		4.72			H3.2		
2	C	75.05	79.38	6.71	55.1	4.2		7.91			H3.3		
3	C	114.93	120.01	7.87	14.73	4.2		9.07			H3.4		
4	C	129.51	134.8	8.19	37.12	4.2		9.39			H3.5		
5 + *B	C	158.75	194.2	54.93	47.09	4.2		56.13			H3.6	98	Sat.
6	C	224.58	227.22	4.09	89.4	4.2		5.2[illegible]			H3.7		(No 90 deg.
*C	C	284.9	295.6	16.59	20.58	4.2		17.79			H3.8		sector
7	C	308.88	314.04	7.99	30.23	4.2		9.[illegible]			H3.9		exceeds
													98")
				175.08	382.88								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 17.79 - (a = 0.6) + 9.19 + (41.36 deg x 1.55"/deg) + (a = 0.6) = 91.09" (in sector 284.9 - 14.9 deg.)
2. One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H4 (REFERENCE SHEET 45 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	2t + 2a (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *D	C	339.3	15.5	56.12	238.39	4.2		57.32			H4.1		
*B	C	169.3	195.5	40.61	76.42	4.2		41.81			H4.2	96	Sat. (No 90 deg. sector exceeds 96")
*C	C	244.8	260	23.56	122.91	4.2		24.76			H4.3		
				120.29	437.72								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 41.81 - (a = 0.6) + (14.5 deg x 1.55"/deg) + (a = 0.6) = 64.29" (in sector 169.3 - 259.3 deg.)
2. One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H5 (REFERENCE SHEET 56 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication $S_{i,i+1}$ (in.)	$2t + 2a$ (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i,i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i,i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1\,eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1\,eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *D	C	339.6	15.5	55.65	31	4.2		56.85			H5.1		
1	C	35.5	37.26	2.73	204.66	4.2		3.93			H5.2		
*B	C	169.3	198.5	45.26	71.77	4.2		46.46			H5.3	92	Sat.
*C	C	244.8	265.5	32.09	114.86	4.2		33.29			H5.4		(No 90 deg. sector exceeds 92")
				135.73	422.29								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 46.46 - (a =0.6) + (14.5 deg x 1.55"/deg) + (a = 0.6) = 68.94" (In sector 169.3 - 259.3 deg.)
2. One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H6a (REFERENCE SHEET 69 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	$2t + 2a$ (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *D	C	334.8	15.5	63.09	238.39	4.2		64.29			H6a.1		
*B	C	169.3	203.5	53.01	48.92	4.2		54.21			H6a.2	90	Sat. (No 90 deg. sector exceeds 90")
1	C	235.06	236.44	2.14	12.96	4.2		3.34			H6a.3		
*C	C	244.8	265.5	32.09	107.42	4.2		33.29			H6a.4		
				150.33	407.69								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 54.21 - (a = 0.6) + 3.34 + (14.5 deg x 1.55"/deg) + (a = 0.6) = 80.03" (in sector 169.3 - 259.3 deg.)
2. One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H6b (REFERENCE SHEET 82 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	2t + 2a (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1\,eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1\,eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *D	C	334.6	15.5	63.09	238.39	4.2		64.29			H6b.1		
*B	C	169.3	203.5	53.01	64.02	4.2		54.21			H6b.2	87	Sat.
*C	C	244.8	265.5	32.09	107.42	4.2		33.29			H6b.3		(No 90 deg. sector exceeds 87")
				148.19	409.83								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 54.21 - (a = 0.6) + (14.5 deg x 1.55"/deg) + (a = 0.6) = 76.69" (in sector 169.3 - 259.3 deg.)

2. One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LIMIT LOAD METHOD

WELD DESIGNATION: H7 (REFERENCE SHEET 93 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	2t + 2a (in.)	L_{eff} (C/C) $L_{eff} = L_i + S + L_{i+1} + 2a$ ($S_{i+1} < 2t + 2a$)	L_{eff} (C/C) $L_{eff} = L_i + 2a$ ($S_{i+1} > 2t + 2a$)	L_{eff} (C/A) $L_{eff} = L_i + S + a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S < 2t + a$)	L_{eff} (C/A) $L_{eff} = L_i + 2a$ $L_{i+1eff} = L_{i+1} + 2a$ ($S > 2t + a$)	Adjusted Indication Number	Allowable L_i (in.) (Per any 90 deg. sector)	Results (Sat/Unsat)
*A + *D	C	339.5	15.5	53.65	229.16	4.2		54.85			H7.1		
*B	C	169.3	205.5	53.94	58.56	4.2		55.14			H7.2	80	Sat.
*C	C	244.8	285.5	60.64	80.46	4.2		61.84			H7.3		(No 90 deg. sector exceeds 80")
				168.23	368.18								

* - Indicates an assumed indication in an uninspected area

Evaluation: 1. The maximum effective flaw length for any one 90 degree sector = 55.14 - (a = 0.6) + (14.5 deg x 1.49"/deg) + (a = 0.6) = 76.75" (in sector 169.3 - 259.3 deg.)
2. One degree = 1.49"

Calc No. NEDC 95-191 Prepared By: Perry K. Adelung PKA Checked/Reviewed By: Atwood A. Browning AAB

Date: November 29 1995 Date: November 29 1995

ATTACHMENT 2.2

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LEFM METHOD

WELD DESIGNATION: H4 (REFERENCE SHEET 45 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	4a (in.)	L_{eq} (C/C) $L_{eq} = L_i + L_{i+1} + 4a$ ($S_{i+1} < 0.75 (L_i + L_{i+1} + 4a)$)	$L_{eq} = L_i + 2a$ ($S_{i+1} > 0.75 (L_i + L_{i+1} + 4a)$)	Adjusted Indication Number	Equivalent Single Ind. Allowable L (in.)	Results (Sat/Unsat)
*A + *D	C	339.3	15.5	56.12	238.39	2.4		57.32	H4.1		
*B	C	169.3	195.5	40.61	76.42	2.4		41.81	H4.2	235	Sat. (Max. single $L_{eq} < 235$")
*C	C	244.8	260	23.56	122.91	2.4		24.76	H4.3		
				120.29	437.72						

* - Indicates an assumed indication in an uninspected area

Note: One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LEFM METHOD

WELD DESIGNATION: H5 (REFERENCE SHEET 56 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication S_{i+1} (in.)	4a (in.)	L_{eq} (C/C) $L_{eq} = L_i + L_{i+1} + 4a$ ($S_{i+1} < 0.75 (L_i + L_{i+1} + 4a)$)	$L_{eq} = L_i + 2a$ ($S_{i+1} > 0.75 (L_i + L_{i+1} + 4a)$)	Adjusted Indication Number	Equivalent Single Ind. Allowable L (in.)	Results (Sat/Unsat)
*A + *D	C	339.6	15.5	55.65	31	2.4	60.78		H5.1		
1	C	35.5	37.26	2.73	204.66	2.4		3.93	H5.2		
*B	C	169.3	198.5	45.26	71.77	2.4		46.46	H5.3	168	Sat.
*C	C	244.8	265.5	32.09	114.86	2.4		33.29	H5.4		(Max. single L_{eq} < 168")
				135.73	422.29						

* - Indicates an assumed indication in an uninspected area

Note: One degree = 1.55"

CNS CORE SHROUD - EVALUATION OF WELD INDICATIONS USING SCREENING CRITERIA FOR LEFM METHOD

WELD DESIGNATION: H6a (REFERENCE SHEET 69 OF ATTACHMENT 2.3)

Indication Number	Indication Type (C or A)	Start Location (Azimuth)	End Location (Azimuth)	Indication Length L_i (in.)	Distance to Next Indication $S_{i,i+1}$ (in.)	4a (in.)	L_{eq} (C/C) $L_{eq} = L_i + L_{i+1} + 4a$ ($S_{i,i+1} < 0.75 (L_i + L_{i+1} + 4a)$)	$L_{eq} = L_i + 2a$ ($S_{i,i+1} > 0.75 (L_i + L_{i+1} + 4a)$)	Adjusted Indication Number	Equivalent Single Ind. Allowable L (in.)	Results (Sat/Unsat)
*A + *D	C	334.8	15.5	63.09	238.39	2.4		64.29	H6a.1		
*B	C	169.3	203.5	53.01	48.92	2.4		54.21	H6a.2	145	Sat. (Max. single $L_{eq} < 145"$)
1	C	235.06	236.44	2.14	12.96	2.4	36.63		H6a.3		
*C	C	244.8	265.5	32.09	107.42	2.4		33.29	H6a.4		
				150.33	407.69						

* - Indicates an assumed indication in an uninspected area

Note: One degree = 1.55"

Calc No. NEDC 95-191 Prepared By: — Checked/Reviewed By: —

1/0 Date: - 19— Date: — 19—

ATTACHMENT 2.3

Attachment 2.3
Sheet ii of ii

GE Nuclear Energy

NEDC 95-191

General Electric Company
3211 West 22nd St., Suite 201, Oak Brook, IL 60521
312 573-3825

PKA 12-5-95

GENE-THB95-01
December 4, 1995

cc:
Cooper Nuclear Station
C.R. Moeller
M. J. Spencer

Mr. Terry Ackerman
Programs Engineer
Nebraska Public Power District
Cooper Nuclear Station
P. O. Box 98
Brownville, Nebraska 68321

SUBJECT: GE NUCLEAR ENERGY REPORT, NEBRASKA PUBLIC POWER DISTRICT, COOPER NUCLEAR STATION, RFO16, SHROUD UT PROJECT, 1F5CN, OCTOBER & NOVEMBER 1995

Dear Mr. Ackerman:

GENE has reviewed the content of the subject report. This review was conducted by Robert Joffe and Ralph Edwards of our Inspection Services office. Based on the review, it has been determined that the information contained within the report should not have been marked "Proprietary."

Very truly yours,

Thomas H Black

Thomas H. Black
GE Site Services Manager
402/825-5665

GE Nuclear Energy

Nebraska Public Power District

Cooper Nuclear Station

RFO16

Shroud UT Project 1F5CN

October & November 1995

Prepared by: Stephen W. Stanford
Steve Stanford, Shroud Project Level III

Approved by: R. S.
Ricky Seals, GENE ISI Project Manager

Approved by: K. B. Thomas for
Terry Ackerman, CNS Site Engineering

Proprietary Information Notice

Table of Contents

Not included in this Calculation

PKA
11-15-95

GE Nuclear Energy

Preface

Introduction

During October and November of 1995, GE Nuclear Energy Inspection Services performed Shroud support weld UT examinations at Nebraska Public Power District's Cooper Nuclear Station site. The original scope of examinations scheduled were all of the areas accessible for scanning with the GE Shroud OD Tracker Scanner on shroud support horizontal welds H1, H2, H3, H4, H5, H6A, H6B and H7. After examination of each weld, Nebraska Public Power District was notified of any indications within 24 hours of final sizing and categorization, depending on relevancy. In the events of actual cracking, ultrasonic length and depth sizing were provided. Visual indications and examinations are documented under a separate IVVI Report for the In-vessel Visual Inspections.

All accessible areas of the eight welds referenced above were inspected ultrasonically with the GE OD Tracker System. Actual circumferential scan areas obtained varied depending on accessibility due to various obstructions that were encountered. These areas of inaccessibility are documented on the Smart 2000 examination data sheets provided within this report. Descriptions of circumferential coverage and limitations are also described in the Examination Summary Sheet provided with each weld examination package.

Examination results are documented by weld number, in stand alone sections, within this Shroud UT report. Each section covers the weld number referenced (e.g. H1, H2, etc.) and provides a summary of examination, ultrasonic data examination sheets indicating type of indications recorded, examination profiles illustrating ultrasonic coverage, documentation supporting any relevant findings, such as cracking, is well documented in the form of graphs, illustrations or charts displaying lengths and depths, and tables containing all critical information. The overall results of the scope of examinations can be found under the Examination Data section of this report and in table form, shown at the end of this preface section.

Procedure

The shroud was examined per " Procedure for Automated Ultrasonic Examination of Shroud Assembly Welds", UT-CNS-503V4, Revision 0. Work was performed per Nebraska Public Power District's work authorizations and in accordance with the GENE QA Manual QAM-003. Shroud inspectibility was pre-determined from the Nebraska Public Power District Shroud OD Inspectibility Study Report and is not referenced within this document. By utilizing this procedure a pre-inspection of the projected scan areas were documented in order to ensure that proper clearances were available for the shroud UT inspection tooling.

Equipment

The equipment utilized for the Shroud UT Examinations was the Smart 2000 Data Acquisition System, the GE Shroud OD Tracker Scanner, the GE Motion Controller and Tri-modal search units containing a combination of 45° Shear Wave, 60° Refracted Longitudinal, and OD Creeping Wave search units. Installation and use of this equipment is described in detail in the Procedures section of this Report. Related equipment requiring certifications can be found in the Certifications section of this report.

Limitations

Due to varying obstacles near the shroud outside diameter, and in close proximity to the welds that were examined, interferences in scanning were encountered. The Guide Rods, Core Spray Downcomers and Jet Pump Sensing Lines all posed scanning limitations at various locations of the welds. In addition to these limitations, the combination of welds with unfavorable geometric configurations did further contribute to loss of examination coverage. Every attempt was made to obtain the most extensive examination coverage possible.

Data Recording

All scan data has been digitized and recorded by the Smart 2000 Data Acquisition System onto 1 Gigabyte optical discs. The original data discs are to be provided to Nebraska Public Power District and are included as part of the Shroud Ultrasonic Examination Report, October / November 1995 - 1F5CN.

The flaw indications recorded were sized in circumferential length and thru-wall depth. A measurement of flaw maximum extension from the initiating surface, whether ID or OD, is supplied in actual crack height and length, as recorded. A maximum flaw depth reading, along with it's corresponding circumferential position, was taken for each indication. Indications are referenced by Indication Number, for future reference. Start and stop positions of each indication are also supplied by their respective indication reference number for future comparison.

Summary

The following table summarizes the inspections performed and overall findings of the examinations. Detailed information of the examinations can be found in the Examination Data section of this report.

Weld	Scan %	Indications	Comments
H1	66.9	See Data	IGSCC or IASCC Cracking Recorded
H2	66.9	N/A	No Evidence of IGSCC or IASCC Cracking was recorded
H3	79.9	See Data	IGSCC or IASCC Cracking Recorded
H4	78.5	N/A	No Evidence of IGSCC or IASCC Cracking was recorded
H5	76.1	See Data	IGSCC or IASCC Cracking Recorded
H6A	73.4	See Data	IGSCC or IASCC Cracking Recorded
H6B	73.4	N/A	No Evidence of IGSCC or IASCC Cracking was recorded
H7	68.6	N/A	No Evidence of IGSCC or IASCC Cracking was recorded

All Scanning was performed with an index increment of 50% of the smallest active transducer element width (50% Overlap Method).

For flaw length and though-wall sizing information of relevant cracking, as well as other types of indications recorded such as weld defects and geometric indications, reference the "Examination Data" section of this report containing each of the weld's examination results.

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-01

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 **REV:** 0 **FRR:** N/A N/A N/A

SYSTEM: SHROUD ASSEMBLY WELDS

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

WELD NO.: H1

CONFIGURATION: SHROUD FLANGE TO PLATE

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

EXAMINER: T. ROCKWOOD **LEVEL:** III

☐ MT ☐ PT ■ UT ☐ VT

EXAMINER: C. MCKEAN **LEVEL:** II

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

EXAMINER: N/A **LEVEL:** N/A

DATA SHEET NO.(S): SD-23 THRU SD-29

CAL SHEET NO.(S): SC-31 THRU SC-33

During the examination of the referenced weld, eight (8) indications associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The parameters for these indications are on the following page.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications along with the indications referenced.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications along with the indications refererenced.

The OD creeping wave recorded non-relevant indications and inside surface geometry along with the indications referenced.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.65 inches per degree.

This examination was performed only from the plate side due to the shroud lug interferences which obstruct scanning on the shroud support flange side. This examination was also performed simultaneously with the H2 weld.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs and instrumentation lines.

The examination area that was interrogated by all angles was 240.90° (66.9%). 119.10° (33.1%) was not examined due to the above referenced obstructions.

Stephen W. Stanford	III	11-11-95	R. [illegible]	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
W. Schlicht	III	11-11-95	T. B. Thomas	11/14/95	PAGE: 1 OF: 13
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-09 REV. 4

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H1 Indication Data

Total Scan Length (Deg.)	240.90	Total Flaw Length (Deg.)	10.57
Total Scan Length (In.)	398.37	Total Flaw Length (In.)	17.48
Percentage of Weld Length Examined	66.9	Thickness (In.)	1.50
Percentage of Examined Weld Length Flawed	4.4	Circumference (In.)	595.33
Percentage of Total Weld Length Flawed	2.9	Inches per Degree	1.65

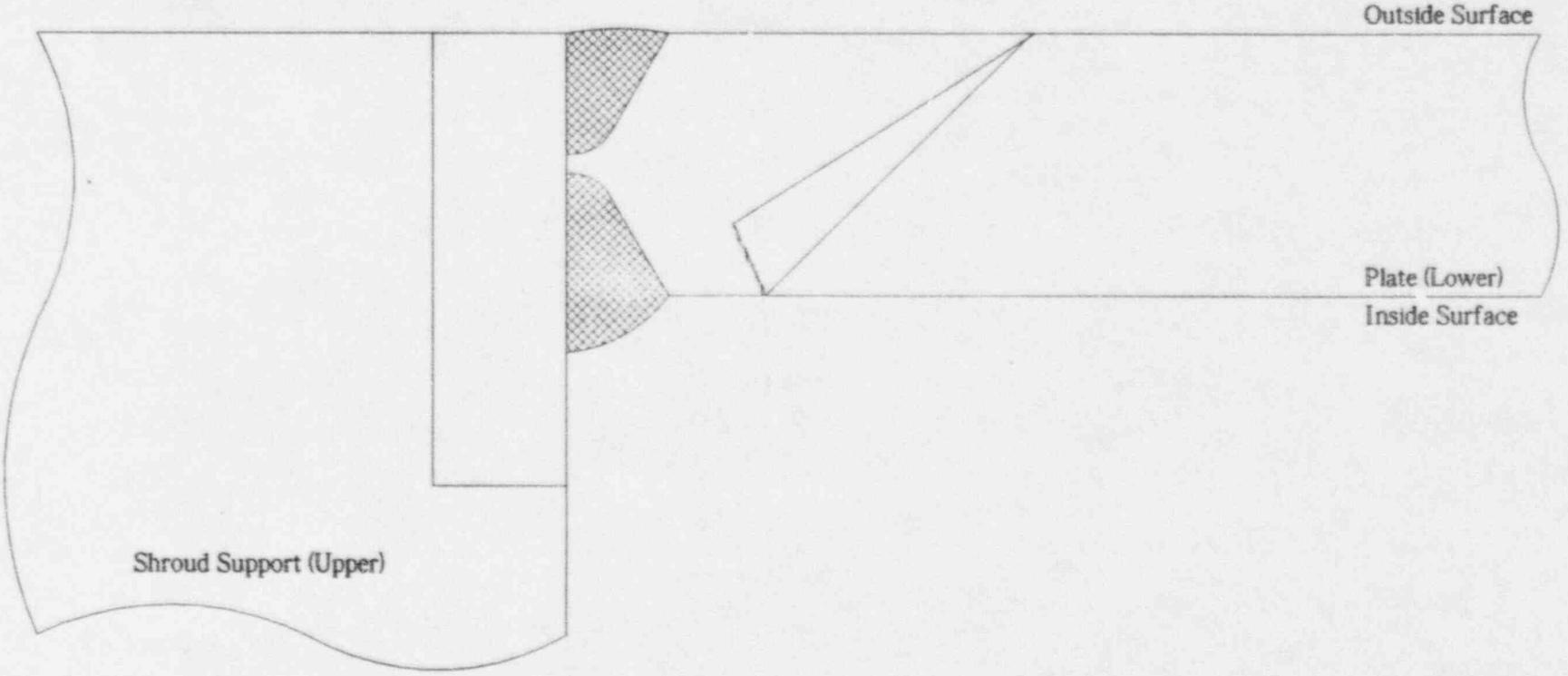
Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer
1	60.67	61.80	1.13	1.87	0.27	61.30	18.0	ID/Near	45° Shear	60° Long.
2	86.89	87.52	0.63	1.04	0.10	87.39	6.7	ID/Near	45° Shear	60° Long.
3	92.18	93.31	1.13	1.87	0.15	92.69	10.0	ID/Near	45° Shear	60° Long.
4	148.78	150.29	1.51	2.50	0.37	149.54	24.7	ID/Near	45° Shear	60° Long.
5	210.04	211.55	1.51	2.50	0.27	210.67	18.0	ID/Near	45° Shear	60° Long.
6	271.93	273.69	1.76	2.91	0.41	272.81	27.3	ID/Near	45° Shear	60° Long.
7	298.65	299.66	1.01	1.67	0.11	299.03	7.3	ID/Near	45° Shear	60° Long.
*8	329.03	330.92	1.89	3.13	0.49	329.66	32.7	ID/Near	45° Shear	60° Long.

*The deepest through-wall indication sized.

Areas Not Examined by All 3 Transducers
0° to 15.5°, 64.9° to 75.5°, 101.4° to 115.5°, 164.9° to 195.5°,
244.9° to 257.5°, 284.9° to 295.5° & 334.9° to 0° (Total of 119.1° Not Examined)

Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

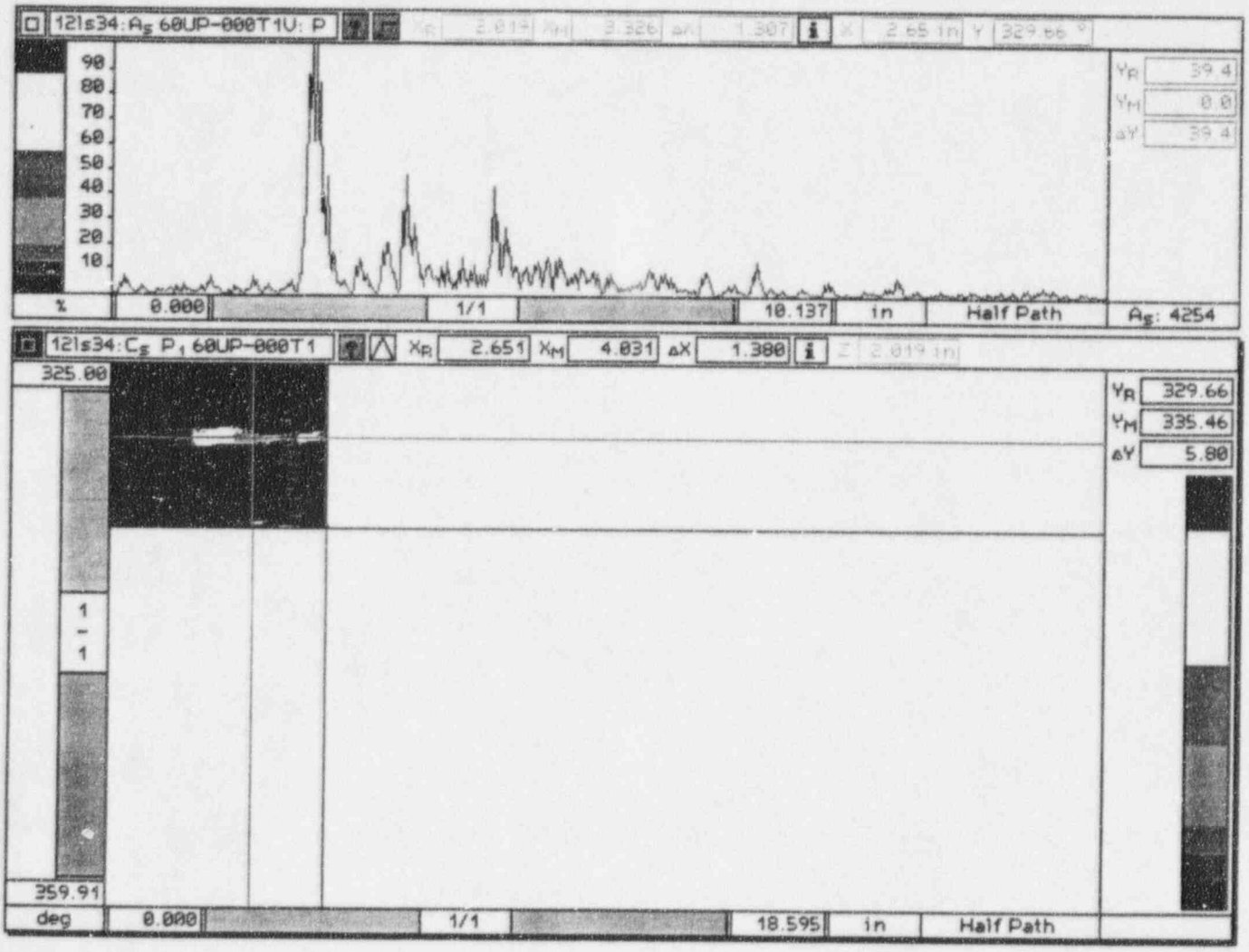
H1 - Typical Flaw Indication @ 329.66 Deg. .49 In. Max. Depth



NEDC 95-19 ATTACH 2.3
SHEET 8 OF 101

GE Nuclear Energy

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



Indication # 8 on the ID below the weld.

SITE: COOPER UNIT: 1 PROJECT NO.: 1F5CN REPORT NO.: SR-01

WELD NO.: H-1 SEARCH UNIT: 60° RL INDICATION NO.: 8 PAGE: 4 OF: 13

FORM UT-13 REV. 1

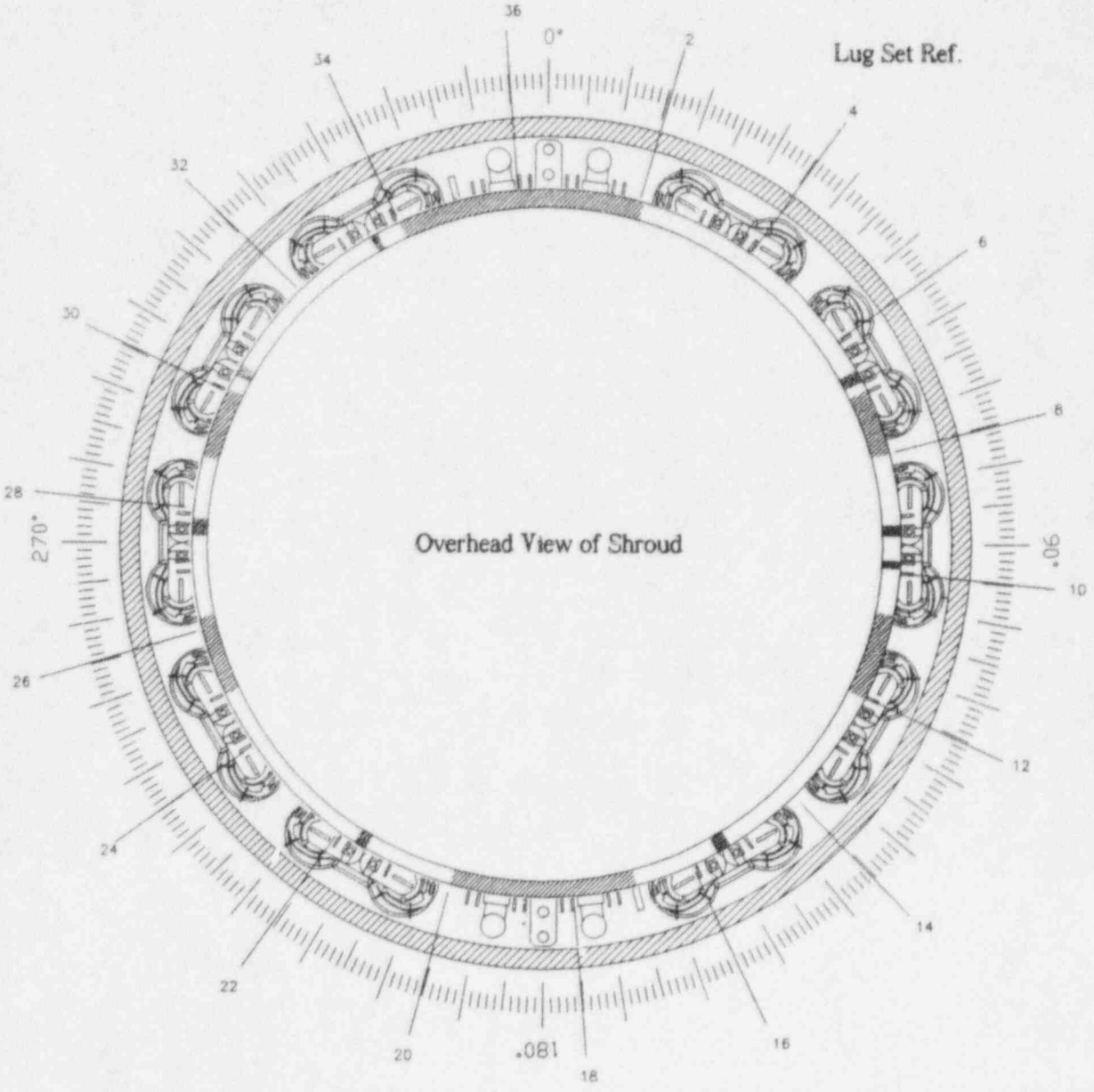
GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

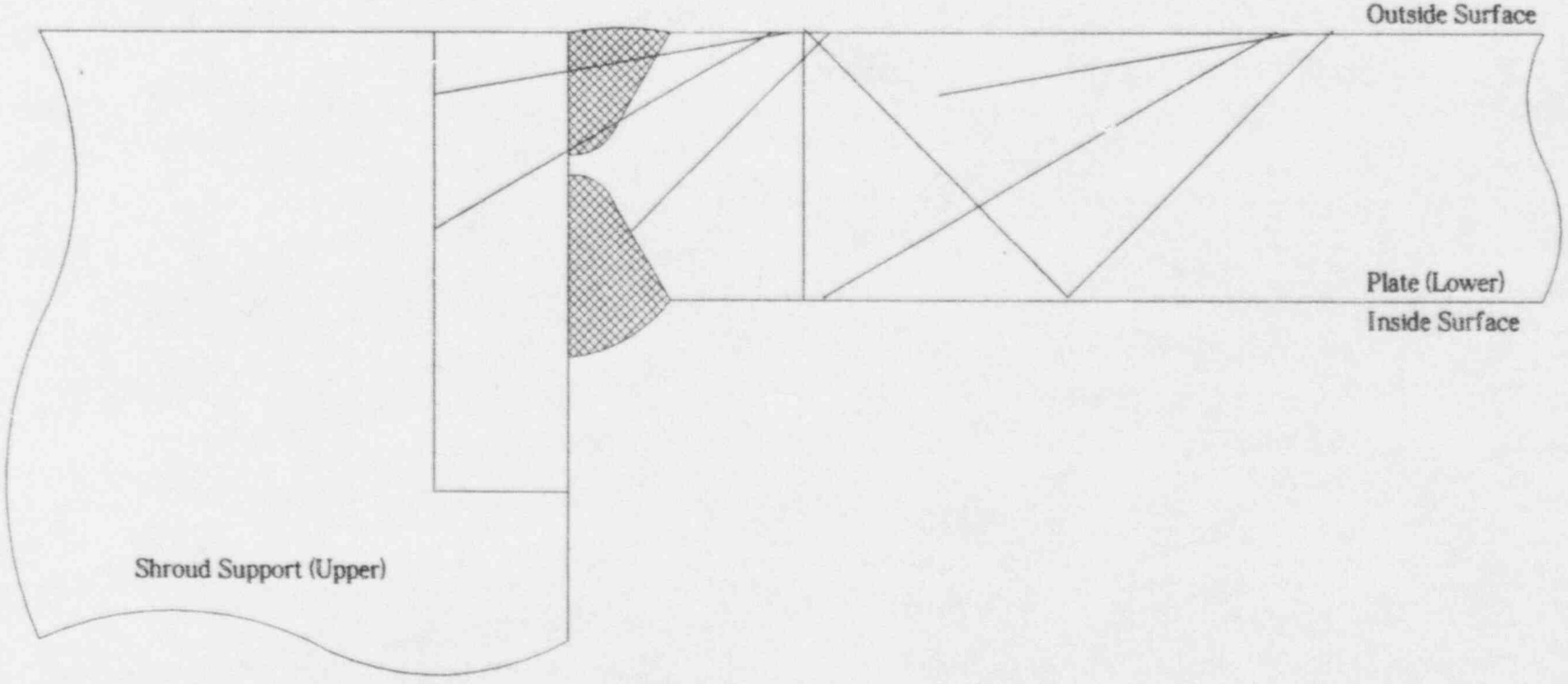
Shroud Weld H1

Areas Not Examined

Indication Areas



H1 - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-01
DATA SHEET NO.: SD-23
CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder: cw (marked)	06:26 Time	N/A 45°	15.5 45°	0 Start°	12LS3	45° LKDN			
Lug Set # 3	11/2 Date	N/A 60°	15.0 60°	10.5 Stop°	D-03 / A	45° LKUP	43	C, E, F	
Lug Side: ccw (marked)	nlw Examiner's Initials	N/A ODCR	14.4 ODCR			60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown.
Cylinder: cw (marked)	06:52 Time	N/A 45°	25.5 45°	0 Start°	12LS4	45° LKDN			
Lug Set # 4	11/2 Date	N/A 60°	25.0 60°	10.5 Stop°	D-03 / A	45° LKUP	43	C, E, F	
Lug Side: ccw (marked)	nlw Examiner's Initials	N/A ODCR	24.4 ODCR			60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown.
Cylinder: cw (marked)	07:07 Time	N/A 45°	35.5 45°	0 Start°	12LS5	45° LKDN			
Lug Set # 5	11/2 Date	N/A 60°	35.0 60°	10.5 Stop°	D-03 / A	45° LKUP	43	C, E, F	
Lug Side: ccw (marked)	[initials] Examiner's Initials	N/A ODCR	34.4 ODCR			60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder: cw (marked)	07:21 Time	N/A 45°	45.5 45°	0 Start°	12LS6	45° LKDN			
Lug Set # 6	11/2 Date	N/A 60°	45.0 60°	10.5 Stop°	D-03 / A	45° LKUP	43	C, E, F	
Lug Side: ccw (marked)	[initials] Examiner's Initials	N/A ODCR	44.4 ODCR			60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

[signature] EXAMINER	II LEVEL	11-2-95 DATE	[signature] III GE INDEPENDENT REVIEW	11-9-95 DATE
[signature] GE REVIEWED BY	III LEVEL	11-9-95 DATE	[signature] UTILITY REVIEW	11/14/95 DATE

FORM UT32_R1

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-01
DATA SHEET NO.: SD-24
CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW ☐ CCW Lug Set # 7 Lug Side ☐ CW ■ CCW	07:36 Time 11/2 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	55.5 45° 55.0 60° 54.4 ODCR	0 Start° 10.5 Stop°	12LS7 D-03 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 51	B, C, E, F B, C, E B, C, J	Indication # 1 J = Shear Component to ID crown and Indication # 1.
Cylinder ■ CW ☐ CCW Lug Set # 9 Lug Side ☐ CW ■ CCW	08:05 Time 11/2 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	75.5 45° 75.0 60° 74.4 ODCR	0 Start° 10.5 Stop°	12LS9 D-03 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 51	C, E, F C, E C, J	J = Shear Component to ID crown.
Cylinder ■ CW ☐ CCW Lug Set # 10 Lug Side ☐ CW ■ CCW	08:20 Time 11/2 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	85.5 45° 85.0 60° 84.4 ODCR	0 Start° 10.5 Stop°	12LS10 D-03 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 51	B, C, E, F B, C, E B, C, J	Indications # 2 & # 3 J = Shear Component to ID crown and Indication # 2 & # 3.
Cylinder ■ CW ☐ CCW Lug Set # 11 Lug Side ☐ CW ■ CCW	08:36 Time 11/2 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	95.5 45° 95.0 60° 94.4 ODCR	0 Start° 7.0 Stop°	12LS11 D-03 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 51	C, E, F C, E C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	DATE 11-7-95	GE INDEPENDENT REVIEW	LEVEL III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/9/95

FORM UT32.R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-01
DATA SHEET NO.: SD-25
CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Weld Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	08:57 Time	N/A 45°	115.5 45°	0 Start°	12LS13	45° LKDN			
Lug Set # 13	11/2 Date	N/A 60°	115.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	MB Examiner's Initials	N/A ODCR	114.4 ODCR	10.5 Stop°	D-03 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	09:15 Time	N/A 45°	125.5 45°	0 Start°	12LS14	45° LKDN			
Lug Set # 14	11/2 Date	N/A 60°	125.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	MB Examiner's Initials	N/A ODCR	124.4 ODCR	10.5 Stop°	D-03 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	09:30 Time	N/A 45°	135.5 45°	0 Start°	12LS15	45° LKDN			
Lug Set # 15	11/2 Date	N/A 60°	135.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	MB Examiner's Initials	N/A ODCR	134.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	09:45 Time	N/A 45°	145.5 45°	0 Start°	12LS16	45° LKDN			
Lug Set # 16	11/2 Date	N/A 60°	145.0 60°			45° LKUP	43	B, C, E, F	Indication # 4
Lug Side □ cw ■ ccw	MB Examiner's Initials	N/A ODCR	144.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	51	B, C, J	Indication # 4.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	DATE 11/2/95	GE INDEPENDENT REVIEW	III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/14/95

FORM UT32 R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-01
DATA SHEET NO.: SD-26
CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	09:58 Time	N/A 45°	155.5 45°	0 Start°	12LS17	45° LKDN			
Lug Set # 17	11/2 Date	N/A 60°	155.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	MB Examiner's Initials	N/A ODCR	154.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	10:32 Time	N/A 45°	195.5 45°	0 Start°	12LS21	45° LKDN			
Lug Set # 21	11/2 Date	N/A 60°	195.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	MB Examiner's Initials	N/A ODCR	194.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	10:48 Time	N/A 45°	205.5 45°	0 Start°	12LS22	45° LKDN			
Lug Set # 22	11/2 Date	N/A 60°	205.0 60°			45° LKUP	43	B, C, E, F	Indication # 5
Lug Side ○ CW ● CCW	MB Examiner's Initials	N/A ODCR	204.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	51	B, C, J	Indication # 5.
Cylinder ● CW ○ CCW	11:10 Time	N/A 45°	215.5 45°	0 Start°	12LS23	45° LKDN			
Lug Set # 23	11/2 Date	N/A 60°	215.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	MB Examiner's Initials	N/A ODCR	214.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	DATE 11/2/95	GE INDEPENDENT REVIEW	III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/11/95

FORM I.T32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER | PROCEDURE NO.: UT-CNS-503V4 | REPORT NO.: SR-01

UNIT: 1 | REVISION / FRR NO.: 0 | DATA SHEET NO.: SD-27

PROJECT NO.: 1F5CN | CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 | Exam Surface: OD | Stroke: 4.0" | Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" | Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	11:21 Time	N/A 45°	225.5 45°	0 Start°	12LS24	45° LKDN			
Lug Set # 24	11/2 Date	N/A 60°	225.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	Examiner's Initials	N/A ODCR	224.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw	11:43 Time	N/A 45°	235.5 45°	0 Start°	12LS25	45° LKDN			
Lug Set # 25	11/2 Date	N/A 60°	235.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	Examiner's Initials	N/A ODCR	234.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw	13:08 Time	N/A 45°	257.5 45°	2.0 Start°	12LS27	45° LKDN			
Lug Set # 27	11/2 Date	N/A 60°	257.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	Examiner's Initials	N/A ODCR	256.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw	13:23 Time	N/A 45°	265.5 45°	0 Start°	12LS28	45° LKDN			
Lug Set # 28	11/2 Date	N/A 60°	265.0 60°			45° LKUP	43	B, C, E, F	Indication # 6
Lug Side ○ cw ● ccw	Examiner's Initials	N/A ODCR	264.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	51	B, C, J	Indication # 6.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	11/6/95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	LEVEL III	11-9-95 DATE	UTILITY REVIEW	11/9/95 DATE	PAGE: 11 OF: 13

FORM UT33_R1

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-01
DATA SHEET NO.: SD-28
CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	13:35 Time	N/A 45°	275.5 45°	0 Start°	12LS29	45° LKDN			
Lug Set # 29	11/2 Date	N/A 60°	275.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	TSR Examiner's Initials	N/A ODCR	274.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	17:10 Time	N/A 45°	295.5 45°	0 Start°	12LS31	45° LKDN			
Lug Set # 31	11/2 Date	N/A 60°	295.0 60°			45° LKUP	43	B, C, E, F	Indication # 7
Lug Side ○ CW ● CCW	TSR Examiner's Initials	N/A ODCR	294.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	51	B, C, J	Indication # 7.
Cylinder ● CW ○ CCW	17:26 Time	N/A 45°	305.5 45°	0 Start°	12LS32	45° LKDN			
Lug Set # 32	11/2 Date	N/A 60°	305.0 60°			45° LKUP	43	C, E, F	Vertical seam @ end of scan.
Lug Side ○ CW ● CCW	TSR Examiner's Initials	N/A ODCR	304.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	17:41 Time	N/A 45°	315.5 45°	0 Start°	12LS33	45° LKDN			
Lug Set # 33	11/2 Date	N/A 60°	315.0 60°			45° LKUP	43	C, E, F	Vertical seam @ start of scan.
Lug Side ○ CW ● CCW	TSR Examiner's Initials	N/A ODCR	314.4 ODCR	10.5 Stop°	D-03 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	51	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL III	11-7-95 DATE	GE INDEPENDENT REVIEW		11-9-95 DATE
GE REVIEWED BY	LEVEL III	11-9-95 DATE	UTILITY REVIEW		11/14/95 DATE

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-01
DATA SHEET NO.: SD-29
CALIBRATION SHEET NO.: SC-31 THRU 33

Weld ID: H1 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	17:55 Time	N/A 45°	325.5 45°	0 Start°	12LS34	45° LKDN			
						45° LKUP	43	B, C, E, F	Indication # 8
Lug Set # 34	11/2 Date	N/A 60°	325.0 60°			60° LKDN			
				10.5 Stop°	D-03 / B	60° LKUP	46	B, C, E	
Lug Side □ CW ■ CCW	[initials] Examiner's Initials	N/A ODCR	324.4 ODCR			ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	51	B, C, J	Indication # 8.
Cylinder □ CW □ CCW	Time	45°	45°	Start°		45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°			60° LKDN			
				Stop°		60° LKUP			
Lug Side □ CW □ CCW	Examiner's Initials	ODCR	ODCR			ODCR LKDN			
						ODCR LKUP			
Cylinder □ CW □ CCW	Time	45°	45°	Start°		45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°			60° LKDN			
				Stop°		60° LKUP			
Lug Side □ CW □ CCW	Examiner's Initials	ODCR	ODCR			ODCR LKDN			
						ODCR LKUP			
Cylinder □ CW □ CCW	Time	45°	45°	Start°		45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°			60° LKDN			
				Stop°		60° LKUP			
Lug Side □ CW □ CCW	Examiner's Initials	ODCR	ODCR			ODCR LKDN			
						ODCR LKUP			

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

[signature]	III	11-7-95	[signature] III	11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE
[signature]	III	11-9-95	[signature]	11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE

PAGE: 13 OF: 13

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-02

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 REV: 0 FRR: N/A N/A N/A

SYSTEM: SHROUD ASSEMBLY WELDS

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

WELD NO.: H2

CONFIGURATION: PLATE TO TOP GUIDE RING

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

EXAMINER: T. ROCKWOOD LEVEL: III

EXAMINER: C. MCKEAN LEVEL: II

☐ MT ☐ PT ■ UT ☐ VT

EXAMINER: N/A LEVEL: N/A

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

DATA SHEET NO.(S): SD-30 THRU SD-36

CAL SHEET NO.(S): SC-34 THRU SC-36

During the examination of the referenced weld, no indications associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications.

The OD creeping wave recorded non-relevant indications and inside surface geometry.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.65 inches per degree.

This examination was performed only from the plate side due to the narrow width of the top guide support ring. This examination was also performed simultaneously with H1 weld.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs and instrumentaion lines.

The examination area that was interrogated by all angles was 240.90° (66.9%). 119.10° (33.1%) was not examined due to the above referenced obstructions.

Stephen W. Shepherd	III	11-11-95	R. L.	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
K Gehlbach	III	11.11.95	K B. Thomas	11/14/95	PAGE: 1 OF: 11
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-09 REV. 8

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H2 Indication Data

Total Scan Length (Deg.)	240.90	Total Flaw Length (Deg.)	0.00
Total Scan Length (in.)	398.37	Total Flaw Length (in.)	0.00
Percentage of Weld Length Examined	66.9	Thickness (in.)	1.50
Percentage of Examined Weld Length Flawed	0.0	Circumference (in.)	595.33
Percentage of Total Weld Length Flawed	0.0	Inches per Degree	1.65

Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer

No Relevant Indications Recorded

Areas Not Examined by All 3 Transducers
0° to 15.5°, 64.9° to 75.5°, 101.4° to 115.5°, 164.9° to 195.5°,
244.9° to 257.5°, 284.9° to 295.5° & 334.9° to 0° (Total of 119.1° Not Examined)

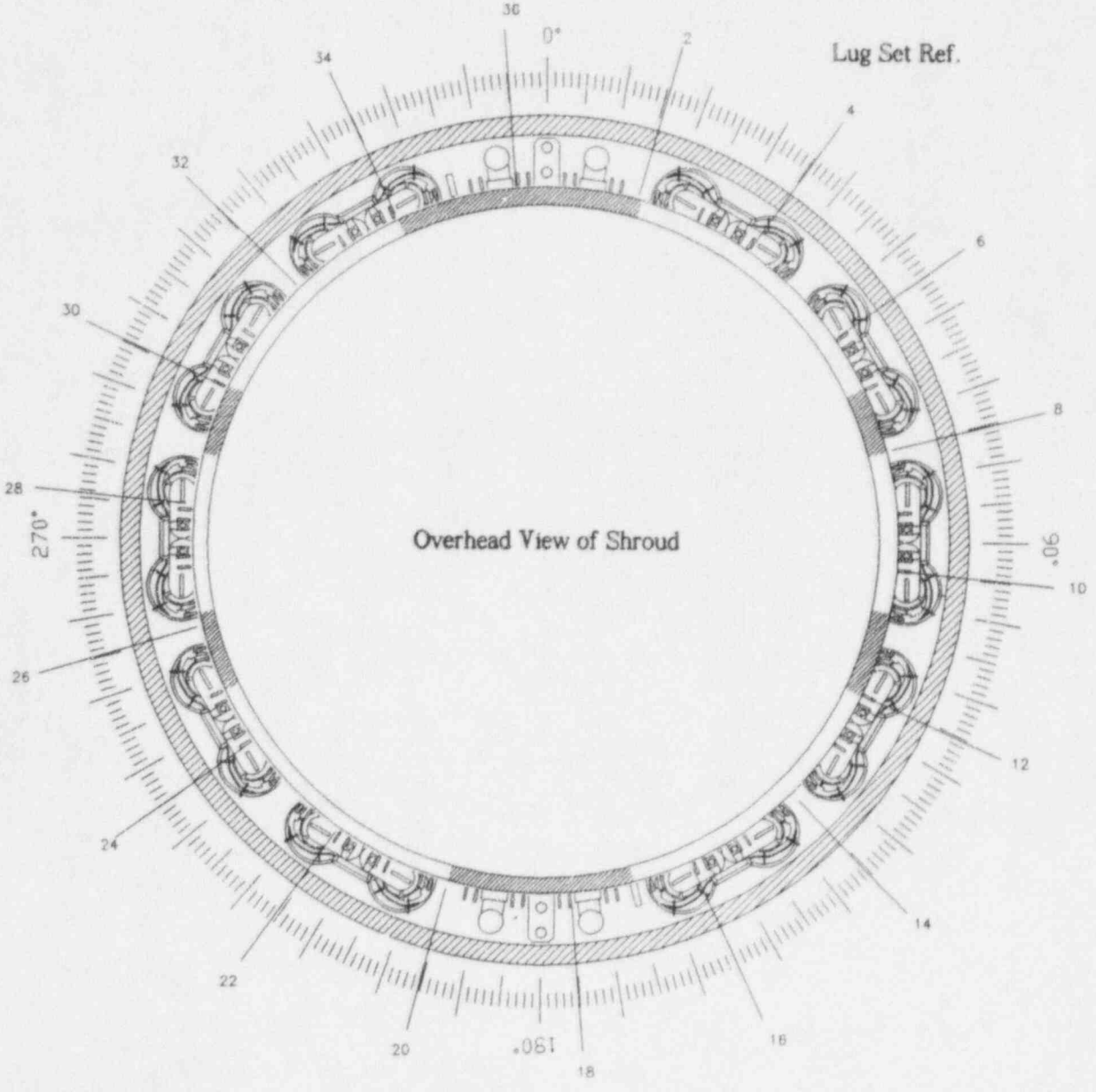
Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

GE Nuclear Energy

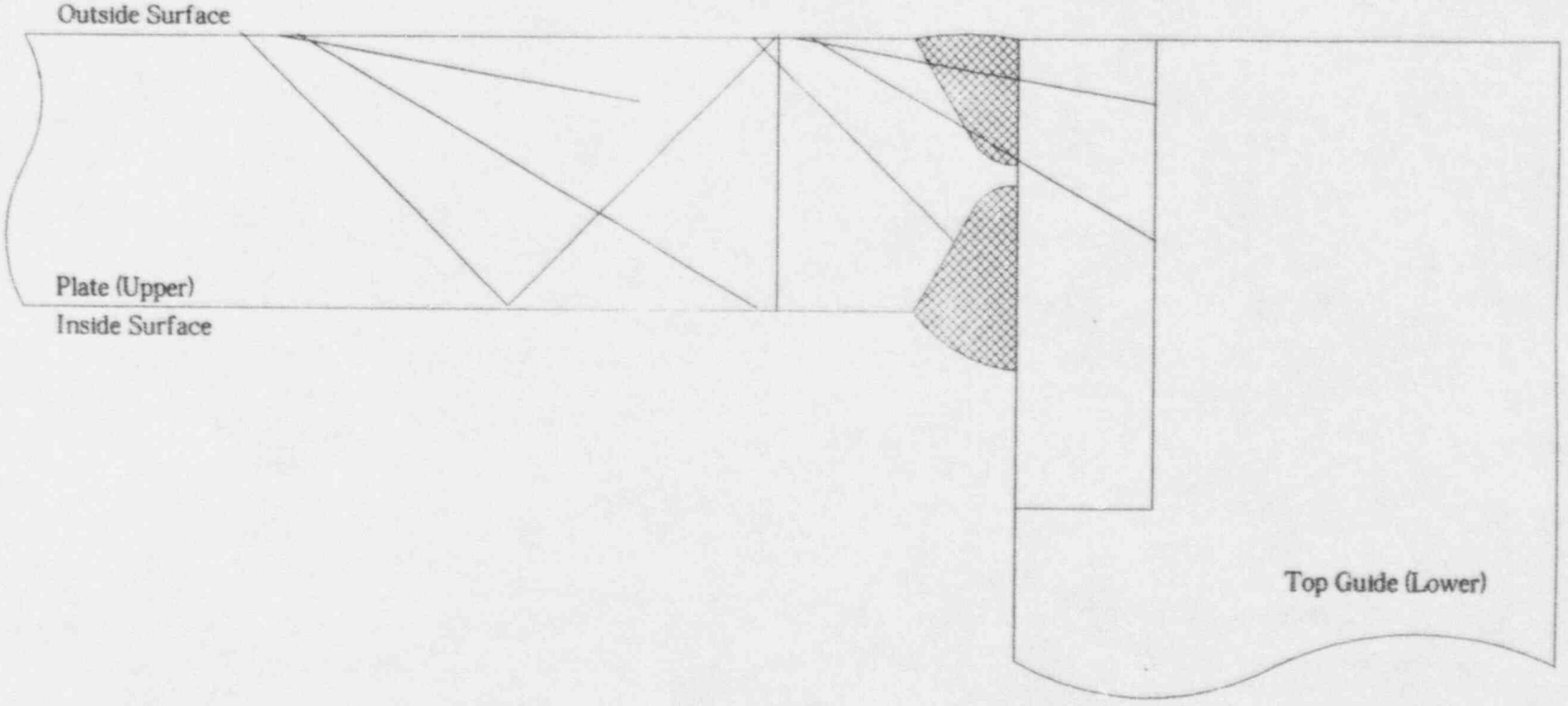
Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H2

Areas Not Examined



H2 - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-02
DATA SHEET NO.: SD-30
CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	06:26 Time	14.4 45°	N/A 45°	0 Start°	12LS3	45° LKDN	46	C, E, F	
Lug Set # 3	11/2 Date	15.0 60°	N/A 60°			45° LKUP			
Lug Side ○ cw ● ccw	Examiner's Initials	15.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	06:52 Time	24.4 45°	N/A 45°	0 Start°	12LS4	45° LKDN	46	C, E, F	
Lug Set # 4	11/2 Date	25.0 60°	N/A 60°			45° LKUP			
Lug Side ○ cw ● ccw	Examiner's Initials	25.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKDN	46	C, E, G	
						60° LKUP			
						ODCR LKDN	51	C, J, G	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	07:07 Time	34.4 45°	N/A 45°	0 Start°	12LS5	45° LKDN	46	C, E, F	
Lug Set # 5	11/2 Date	35.0 60°	N/A 60°			45° LKUP			
Lug Side ○ cw ● ccw	Examiner's Initials	35.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ● cw ○ ccw	07:21 Time	44.4 45°	N/A 45°	0 Start°	12LS6	45° LKDN	46	C, E, F	
Lug Set # 6	11/2 Date	45.0 60°	N/A 60°			45° LKUP			
Lug Side ○ cw ● ccw	Examiner's Initials	45.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	DATE 11-2-95	GE INDEPENDENT REVIEW	LEVEL III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/9/95

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-02
DATA SHEET NO.: SD-31
CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	07:36 Time	54.4 45°	N/A 45°			45° LKDN	46	C, E, F, G	
Lug Set # 7	11/2 Date	55.0 60°	N/A 60°	0 Start°	12LS7	45° LKUP 60° LKDN	46	C, E, G	
Lug Side □ CW ■ CCW	BR Examiner's Initials	55.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKUP ODCR LKDN ODCR LKUP	51	C, J, G	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	08:05 Time	74.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 9	11/2 Date	75.0 60°	N/A 60°	0 Start°	12LS9	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MS Examiner's Initials	75.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKUP ODCR LKDN ODCR LKUP	51	C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	08:20 Time	84.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 10	11/2 Date	85.0 60°	N/A 60°	0 Start°	12LS10	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MS Examiner's Initials	85.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKUP ODCR LKDN ODCR LKUP	51	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	08:36 Time	94.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 11	11/2 Date	95.0 60°	N/A 60°	0 Start°	12LS11	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MS Examiner's Initials	95.5 ODCR	N/A ODCR	7.0 Stop°	D-03 / A	60° LKUP ODCR LKDN ODCR LKUP	51	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	III	11-9-95 DATE
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW		11/14/95 DATE

FORM UT33_R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-02
DATA SHEET NO.: SD-32
CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	08:57 Time	114.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 13	11/2 Date	115.0 60°	N/A 60°	0 Start°	12LS13	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MB Examiner's Initials	115.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ CW □ CCW	09:15 Time	124.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 14	11/2 Date	125.0 60°	N/A 60°	0 Start°	12LS14	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MB Examiner's Initials	125.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / A	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ CW □ CCW	09:30 Time	134.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 15	11/2 Date	135.0 60°	N/A 60°	0 Start°	12LS15	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MB Examiner's Initials	135.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ CW □ CCW	09:45 Time	144.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 16	11/2 Date	145.0 60°	N/A 60°	0 Start°	12LS16	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	MB Examiner's Initials	145.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			

CALIBRATION dB:

45° LKDN 17 60° LKUP
45° LKUP ODCR LKDN 37
60° LKDN 35 ODCR LKUP

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE
	II	11/2/95	III	11-9-95
GE REVIEWED BY	**LEVEL**	**DATE**	**UTILITY REVIEW**	**DATE**
	III	11-9-95		11/4/95

FORM UT32.R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-02
DATA SHEET NO.: SD-33
CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	09:58 Time	154.4 45°	N/A 45°	0 Start°	12LS17	45° LKDN	46	C, E, F	
Lug Set # 17	11/2 Date	156.0 60°	N/A 60°			45° LKUP			
Lug Side □ CW ■ CCW	MB Examiner's Initials	155.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ CW □ CCW	10:32 Time	194.4 45°	N/A 45°	0 Start°	12LS21	45° LKDN	46	C, E, F	
Lug Set # 21	11/2 Date	195.0 60°	N/A 60°			45° LKUP			
Lug Side □ CW ■ CCW	MB Examiner's Initials	195.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ■ CW □ CCW	10:48 Time	204.4 45°	N/A 45°	0 Start°	12LS22	45° LKDN	46	C, E, F	
Lug Set # 22	11/2 Date	205.0 60°	N/A 60°			45° LKUP			
Lug Side □ CW ■ CCW	MB Examiner's Initials	205.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ CW □ CCW	11:10 Time	214.4 45°	N/A 45°	0 Start°	12LS23	45° LKDN	46	C, E, F	
Lug Set # 23	11/2 Date	215.0 60°	N/A 60°			45° LKUP			
Lug Side □ CW ■ CCW	MB Examiner's Initials	215.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	DATE 11/2/95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/14/95	PAGE: 3 OF: 11

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-02
DATA SHEET NO.: SD-34
CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	11:21 Time	224.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 24	11/2 Date	225.0 60°	N/A 60°	0 Start°	12LS24	45° LKUP 60° LKDN	46	C, E	
Lug Side □ cw ■ ccw	MG Examiner's Initials	225.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ cw □ ccw	11:43 Time	234.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 25	11/2 Date	235.0 60°	N/A 60°	0 Start°	12LS25	45° LKUP 60° LKDN	46	C, E, G	
Lug Side □ cw ■ ccw	MG Examiner's Initials	235.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ■ cw □ ccw	13:08 Time	256.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 27	11/2 Date	257.0 60°	N/A 60°	2.0 Start°	12LS27	45° LKUP 60° LKDN	46	C, E	
Lug Side □ cw ■ ccw	TSR Examiner's Initials	257.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ cw □ ccw	13:23 Time	264.4 45°	N/A 45°			45° LKDN	46	C, E, F	
Lug Set # 28	11/2 Date	265.0 60°	N/A 60°	0 Start°	12LS28	45° LKUP 60° LKDN	46	C, E	
Lug Side □ cw ■ ccw	TSR Examiner's Initials	265.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKUP ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			

CALIBRATION dB:

45° LKDN 17 60° LKUP
45° LKUP ODCR LKDN 37
60° LKDN 35 ODCR LKUP

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	LEVEL II	DATE 11/2/95	GE INDEPENDENT REVIEW	LEVEL III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/14/95

FORM UT32_NS

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRN NO.: 0

REPORT NO.: SR-02
DATA SHEET NO.: SD-35
CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2 Exam Surface: OD Stroke: 4.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6" Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	13:35 Time	274.4 45°	N/A 45°	0 Start°	12LS29	45° LKDN	46	C, E, F	
Lug Set # 29	11/2 Date	275.0 60°	N/A 60°			45° LKUP			
Lug Side □ cw ■ ccw	TSR Examiner's Initials	275.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ cw □ ccw	17:10 Time	294.4 45°	N/A 45°	0 Start°	12LS31	45° LKDN	46	C, E, F	
Lug Set # 31	11/2 Date	295.0 60°	N/A 60°			45° LKUP			
Lug Side □ cw ■ ccw	TSR Examiner's Initials	295.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ■ cw □ ccw	17:26 Time	304.4 45°	N/A 45°	0 Start°	12LS32	45° LKDN	46	C, E, F	Vertical seam @ end of scan.
Lug Set # 32	11/2 Date	305.0 60°	N/A 60°			45° LKUP			
Lug Side □ cw ■ ccw	TSR Examiner's Initials	305.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder ■ cw □ ccw	17:41 Time	314.4 45°	N/A 45°	0 Start°	12LS33	45° LKDN	46	C, E, F	Vertical seam @ start of scan.
Lug Set # 33	11/2 Date	315.0 60°	N/A 60°			45° LKUP			
Lug Side □ cw ■ ccw	TSR Examiner's Initials	315.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	60° LKDN	46	C, E	
						60° LKUP			
						ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

EXAMINER	III	11-7-95	GE INDEPENDENT REVIEW		11-9-95
	LEVEL	DATE			DATE
GE REVIEWED BY	III	11-9-95	UTILITY REVIEW	11/14/95	11/14/95
	LEVEL	DATE			DATE

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER	PROCEDURE NO.: UT-CNS-503V4	REPORT NO.: SR-02
UNIT: 1	REVISION / FRR NO.: 0	DATA SHEET NO.: SD-36
PROJECT NO.: 1F5CN		CALIBRATION SHEET NO.: SC-34 THRU 36

Weld ID: H2   Exam Surface: OD   Stroke: 4.0"   Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 26.6"   Wo Location: * LKDN @ WELD TOE ON H2

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder: [x] cw [ ] ccw	17:55 Time	324.4 45°	N/A 45°			45° LKDN	46	C, E, F	
						45° LKUP			
Lug Set # 34	11/2 Date	325.0 60°	N/A 60°	0 Start°	12LS34	60° LKDN	46	C, E	
						60° LKUP			
Lug Side: [ ] cw [x] ccw	[initials] Examiner's Initials	325.5 ODCR	N/A ODCR	10.5 Stop°	D-03 / B	ODCR LKDN	51	C, J	J = Shear Component to ID crown
						ODCR LKUP			
Cylinder: [ ] cw [ ] ccw	Time	45°	45°			45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°	Start°		60° LKDN			
						60° LKUP			
Lug Side: [ ] cw [ ] ccw	Examiner's Initials	ODCR	ODCR	Stop°		ODCR LKDN			
						ODCR LKUP			
Cylinder: [ ] cw [ ] ccw	Time	45°	45°			45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°	Start°		60° LKDN			
						60° LKUP			
Lug Side: [ ] cw [ ] ccw	Examiner's Initials	ODCR	ODCR	Stop°		ODCR LKDN			
						ODCR LKUP			
Cylinder: [ ] cw [ ] ccw	Time	45°	45°			45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°	Start°		60° LKDN			
						60° LKUP			
Lug Side: [ ] cw [ ] ccw	Examiner's Initials	ODCR	ODCR	Stop°		ODCR LKDN			
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H1 & H2 were scanned simultaneously

[signature]	III	11-7-95	[signature] III	11-9-95	
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
[signature]	III	11-9-95	[signature]	11/14/95	PAGE: 11 OF: 11
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-03

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 **REV:** 0 **FRR:** N/A
N/A
N/A

SYSTEM: SHROUD ASSEMBLY WELDS

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

WELD NO.: H3

CONFIGURATION: TOP GUIDE TO PLATE

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

EXAMINER: T. ROCKWOOD **LEVEL:** III

☐ MT ☐ PT ■ UT ☐ VT

EXAMINER: C. MCKEAN **LEVEL:** II

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

EXAMINER: N/A **LEVEL:** N/A

DATA SHEET NO.(S): SD-01 THRU SD-08

CAL SHEET NO.(S): SC-01 THRU SC-06

During the examination of the referenced weld,eight (8) indications associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The parameters for these indications are on the following page.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications along with the indications referenced.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications along with the indications referenced.

The OD creeping wave recorded non-relevant indications and inside surface geometry along with the indications referenced.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.55 inches per degree.

This examination was performed from the plate side only due to the configuration of the top guide support ring.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, and shroud lifting lugs.

The examination area that was interrogated by all angles was 287.55° (79.9%). 72.45° (20.1%) was not examined due to the above referenced obstructions.

Stephen W. Rockwood	III	11-11-95	R. D.	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
H. Schlicht	III	11.11.95	K. B. Thomas	11/14/95	PAGE: 1 OF: 14
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-09 REV. 6

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H3 Indication Data

Total Scan Length (Deg.)	287.55	Total Flaw Length (Deg.)	42.73
Total Scan Length (in.)	445.41	Total Flaw Length (in.)	66.19
Percentage of Weld Length Examined	79.9	Thickness (in.)	1.50
Percentage of Examined Weld Length Flawed	14.9	Circumference (in.)	557.63
Percentage of Total Weld Length Flawed	11.9	Inches per Degree	1.55

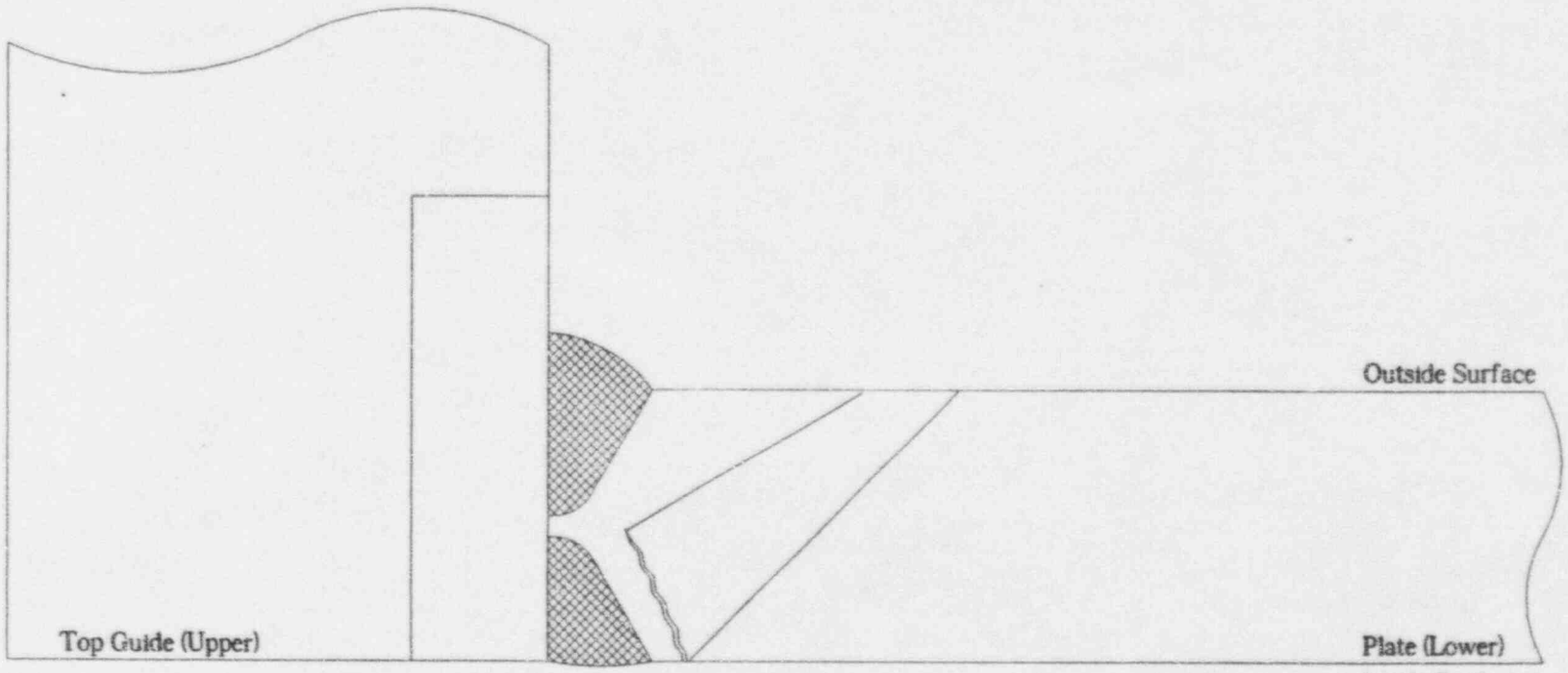
Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer
1	64.04	66.31	2.27	3.52	0.41	65.59	27.3	ID/Near	45° Shear	60° Long.
*2	75.05	79.38	4.33	6.71	0.73	77.02	48.7	ID/Near	45° Shear	60° Long.
3	114.93	120.01	5.08	7.87	0.62	117.77	41.3	ID/Near	45° Shear	60° Long.
4	129.51	134.80	5.29	8.19	0.60	131.55	40.0	ID/Near	45° Shear	60° Long.
**5	158.75	170.47	11.72	18.15	0.69	167.10	46.0	ID/Near	45° Shear	60° Long.
6	224.58	227.22	2.64	4.09	0.39	226.12	26.0	ID/Near	45° Shear	60° Long.
7	308.88	314.04	5.16	7.99	0.58	311.05	38.7	ID/Near	45° Shear	60° Long.
**8	333.54	339.78	6.24	9.67	0.54	334.91	36.0	ID/Near	45° Shear	60° Long.

** Length sizing of indications #5 & #8 are restricted by the limitation of the core spray downcomer.
* Deepest flawed area found.

Areas Not Examined by All 3 Transducers
0° to 15.60°, 169.40° to 194.20°, 284.90° to 295.60° & 338.65° to 0° (Total of 72.45° Not Examined)

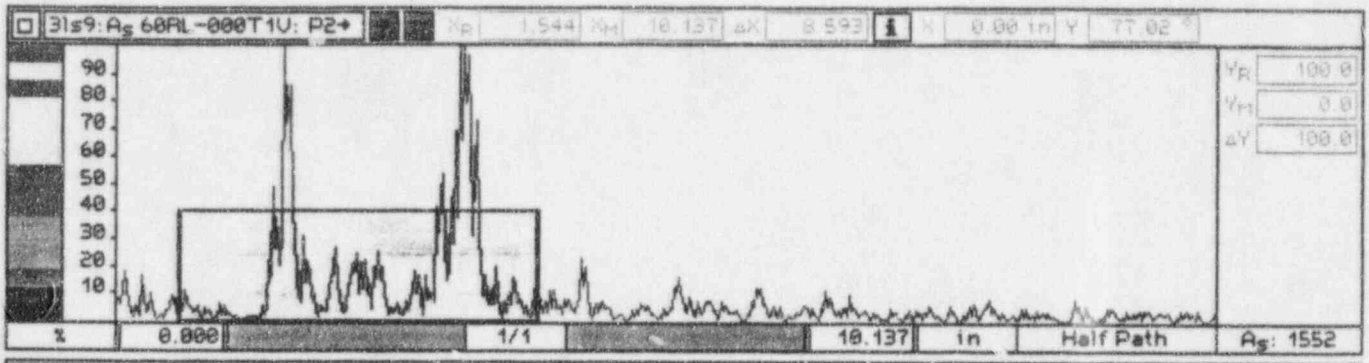
Limitations: Core Spray Downcomers, Guide Pins, and Lifting Lugs

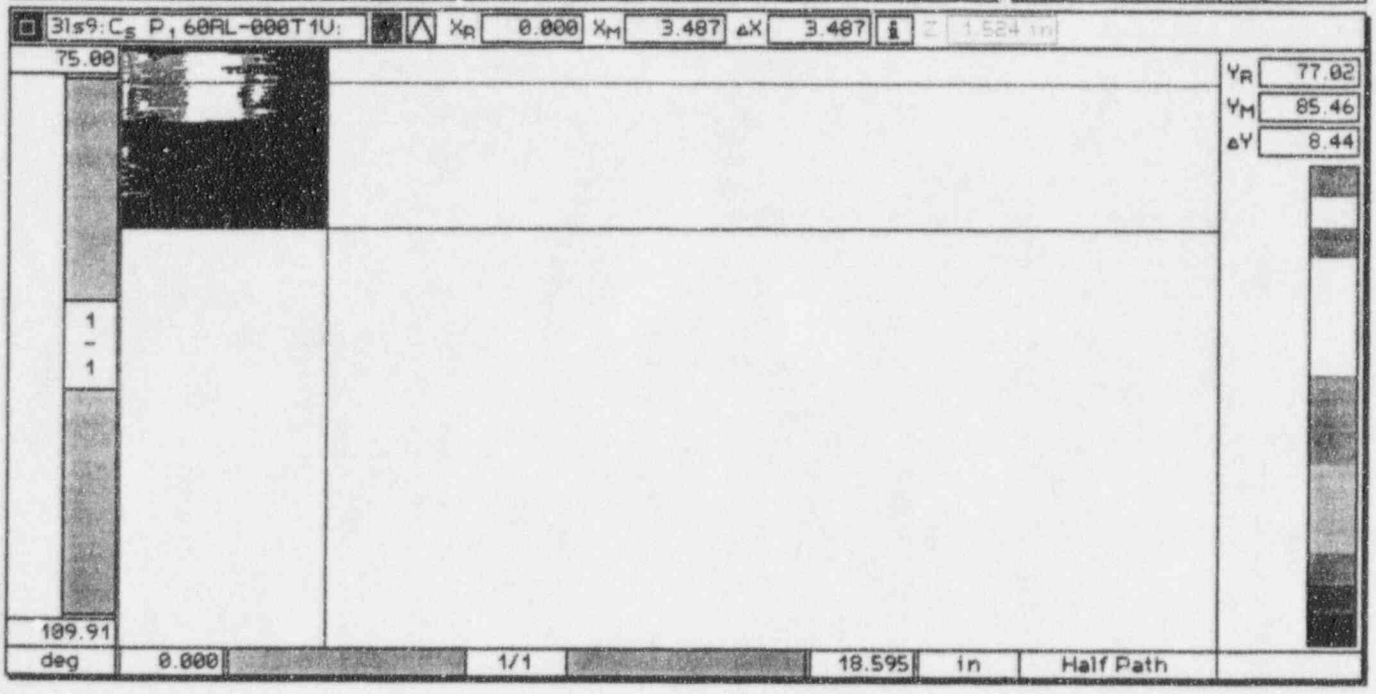
H3 - Typical Flaw Indication @ 77.02 Deg. .73 In. Max Depth



GE Nuclear Energy

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





Indication # 2 on the ID below the weld.

SITE: COOPER UNIT: 1 PROJECT NO.: 1F5CN REPORT NO.: SR-03

WELD NO.: H-3 SEARCH UNIT: 60° RL INDICATION NO.: 2 PAGE: 4 OF: 14

FORM UT-13 REV. 1

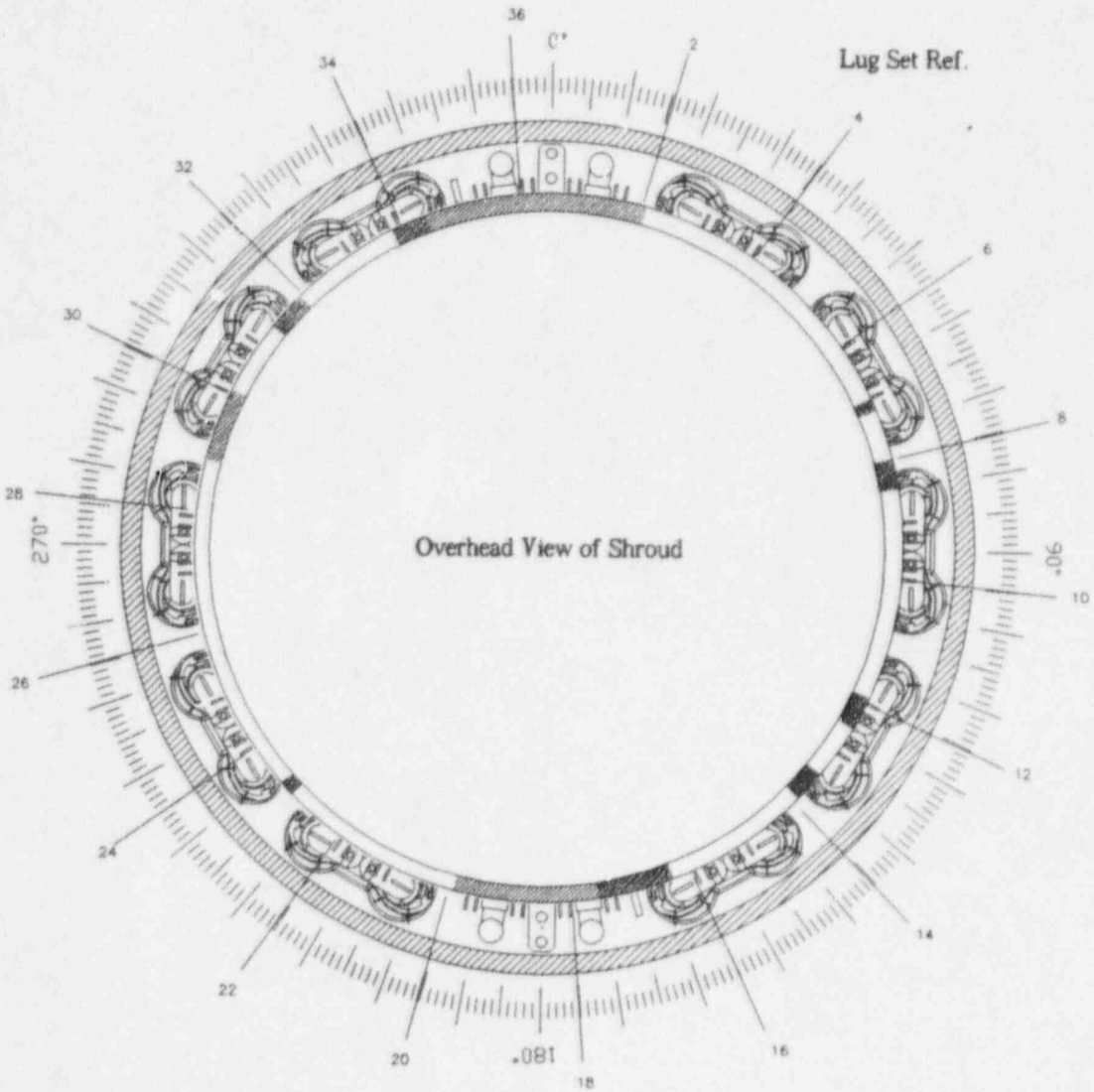
GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

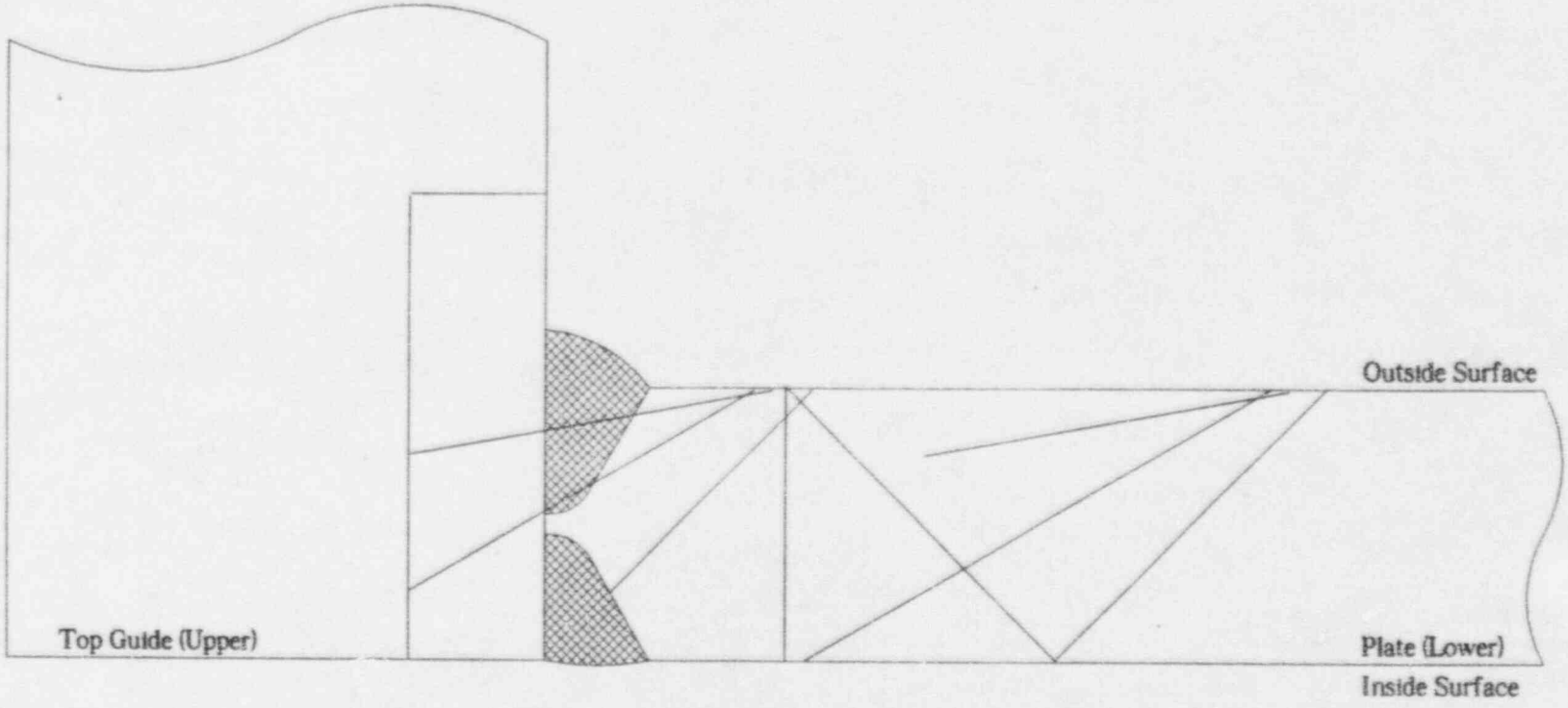
Shroud Weld H3

Areas Not Examined

Indication Areas



H3 - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-01
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw Lug Set # 3 Lug Side □ cw ■ ccw	05:40 Time 10/29 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	15.6 45° 15.0 60° 14.4 ODCR	0 Start° 10.5 Stop°	3LS3 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 4 Lug Side □ cw ■ ccw	05:50 Time 10/29 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	25.6 45° 25.0 60° 24.4 ODCR	0 Start° 10.5 Stop°	3LS4 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	E, F C, E C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 5 Lug Side □ cw ■ ccw	06:00 Time 10/29 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	35.6 45° 35.0 60° 34.4 ODCR	0 Start° 10.5 Stop°	3LS5 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 6 Lug Side □ cw ■ ccw	06:10 Time 10/29 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	45.6 45° 45.0 60° 44.4 ODCR	0 Start° 10.5 Stop°	3LS6 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	C, E, F C, E C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

MW Webster	II	10-29-95	Stephen D. Stanford III		11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Stan E. Bolton	III	11-9-95	11/14/95 T.B. Thomas		11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT 3D 95

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-02
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	06:20 Time	N/A 45°	55.6 45°	0 Start°	3LS7	45° LKDN			
						45° LKUP	45	B, C, E, F	Indication # 1
Lug Set # 7	10/29 Date	N/A 60°	55.0 60°			60° LKDN			
						60° LKUP	49	B, C, E	
Lug Side □ cw ■ ccw	nfw Examiner's Initials	N/A ODCR	54.4 ODCR	14.25 Stop°	D-02 / A	ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	55	B, C, J	Indication # 1.
Cylinder ■ cw □ ccw	07:20 Time	N/A 45°	65.6 45°	0 Start°	3LS8	45° LKDN			
						45° LKUP	45	B, C, E,.F	Indication # 2
Lug Set # 8	10/29 Date	N/A 60°	65.0 60°			60° LKDN			
						60° LKUP	49	B, C, E	
Lug Side □ cw ■ ccw	nfw Examiner's Initials	N/A ODCR	64.4 ODCR	10.5 Stop°	D-02 / A	ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	55	B, C, J	Indication # 2.
Cylinder ■ cw □ ccw	07:40 Time	N/A 45°	75.6 45°	0 Start°	3LS9	45° LKDN			
						45° LKUP	45	B, C, E, F	Indication # 2 continued
Lug Set # 9	10/29 Date	N/A 60°	75.0 60°			60° LKDN			
						60° LKUP	49	B, C, E	
Lug Side □ cw ■ ccw	nfw Examiner's Initials	N/A ODCR	74.4 ODCR	10.5 Stop°	D-02 / A	ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	55	B, C, J	Indication # 2.
Cylinder ■ cw □ ccw	06:50 Time	N/A 45°	85.6 45°	0 Start°	3LS10	45° LKDN			
						45° LKUP	45	C, E, F	
Lug Set # 10	10/29 Date	N/A 60°	85.0 60°			60° LKDN			
						60° LKUP	49	C, E	
Lug Side □ cw ■ ccw	BR Examiner's Initials	N/A ODCR	84.4 ODCR	10.5 Stop°	D-02 / A	ODCR LKDN			
						ODCR LKUP	55	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

nfWebster	II	10-29-95	Stephen W. Stanford III	11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE
George E. DeBree	III	11-9-95	K.B. Thomas	11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE

FORM UT32 R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-03
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW Lug Set # 11 Lug Side ○ CW ● CCW	07:05 Time 10/29 Date TJB Examiner's Initials	N/A 45° N/A 60° N/A ODCR	95.6 45° 95.0 60° 94.4 ODCR	0 Start° 10.5 Stop°	3LS11 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW Lug Set # 12 Lug Side ○ CW ● CCW	07:38 Time 10/29 Date TJB Examiner's Initials	N/A 45° N/A 60° N/A ODCR	105.6 45° 105.0 60° 104.4 ODCR	0 Start° 10.5 Stop°	3LS12 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	B, C, E, F B, C, E B, C, J	Indication # 3 J = Shear Component to ID crown and Indication # 3.
Cylinder ● CW ○ CCW Lug Set # 13 Lug Side ○ CW ● CCW	07:48 Time 10/29 Date TJB Examiner's Initials	N/A 45° N/A 60° N/A ODCR	115.6 45° 115.0 60° 114.4 ODCR	0 Start° 10.5 Stop°	3LS13 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	B, C, E, F B, C, E B, C, J	Indication # 3 continued J = Shear Component to ID crown and Indication # 3.
Cylinder ● CW ○ CCW Lug Set # 14 Lug Side ○ CW ● CCW	07:59 Time 10/29 Date TJB Examiner's Initials	N/A 45° N/A 60° N/A ODCR	125.6 45° 125.0 60° 124.4 ODCR	0 Start° 10.5 Stop°	3LS14 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	45 49 55	B, C, E, F B, C, E B, C, J	Indication # 4 J = Shear Component to ID crown and Indication # 4.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	DATE 10/29/95	GE INDEPENDENT REVIEW		DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/14/95

FORM UT32.R5

GE Nuclear Energy

.OUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-04
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side.	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	08:09 Time	N/A 45°	135.6 45°	0 Start°	3LS15	45° LKDN			
Lug Set # 15	10/29 Date	N/A 60°	135.0 60°			45° LKUP	45	C, E, F	
Lug Side ○ CW ● CCW	HB Examiner's Initials	N/A ODCR	134.4 ODCR	10.5 Stop°	D-02 / A	60° LKDN			
						60° LKUP	49	C, E	
						ODCR LKDN			
						ODCR LKUP	55	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	08:19 Time	N/A 45°	145.6 45°	0 Start°	3LS16	45° LKDN			
Lug Set # 16	10/29 Date	N/A 60°	145.0 60°			45° LKUP	45	C, E, F	
Lug Side ○ CW ● CCW	HB Examiner's Initials	N/A ODCR	144.4 ODCR	10.5 Stop°	D-02 / A	60° LKDN			
						60° LKUP	49	C, E	
						ODCR LKDN			
						ODCR LKUP	55	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	08:29 Time	N/A 45°	155.6 45°	0 Start°	3LS17	45° LKDN			
Lug Set # 17	10/29 Date	N/A 60°	155.0 60°			45° LKUP	45	B, C, E, F	Indication # 5 (see remarks)
Lug Side ○ CW ● CCW	HB Examiner's Initials	N/A ODCR	154.4 ODCR	15.0 Stop°	D-02 / A	60° LKDN			
						60° LKUP	49	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	55	B, C, J	Indication # 5.
Cylinder ● CW ○ CCW	01:40 Time	N/A 45°	194.2 45°	0 Start°	3LS21	45° LKDN			
Lug Set # 21	10/26 Date	N/A 60°	193.6 60°			45° LKUP	43	B, C, E, F	
Lug Side ○ CW ● CCW	MW Examiner's Initials	N/A ODCR	193.0 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	48	B, C, E	
						ODCR LKDN			
						ODCR LKUP	50.5	B, C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14**	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS:

* Length sizing Indication # 5 restricted by core spray downcomer limitation.
** Lug Set 21 had a reference gain of 18dB

Charles Hall	II	10/29/95	Stephen W. Stanyon	III	11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Roger E. Ruff for	III	11-9-95	Lab 11/9/95 K.B. Thomas		11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT32 R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-05
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	02:06 Time	N/A 45°	204.2 45°	0 Start°	3LS22	45° LKDN			
Lug Set # 22	10/26 Date	N/A 60°	203.6 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	MW Examiner's Initials	N/A ODCR	203.0 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	48	C, E	
						ODCR LKDN			
						ODCR LKUP	50.5	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	02:38 Time	N/A 45°	214.2 45°	0 Start°	3LS23	45° LKDN			
Lug Set # 23	10/26 Date	N/A 60°	213.6 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	MW Examiner's Initials	N/A ODCR	213.0 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	48	C, E	
						ODCR LKDN			
						ODCR LKUP	50.5	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	02:56 Time	N/A 45°	224.2 45°	0 Start°	3LS24	45° LKDN			
Lug Set # 24	10/26 Date	N/A 60°	223.6 60°			45° LKUP	43	B, C, E, F	Indication # 6
Lug Side □ cw ■ ccw	MW Examiner's Initials	N/A ODCR	223.0 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	48	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	50.5	B, C, J	Indication # 6.
Cylinder ■ cw □ ccw	04:26 Time	N/A 45°	234.2 45°	0 Start°	3LS25A	45° LKDN			
Lug Set # 25	10/26 Date	N/A 60°	233.6 60°			45° LKUP	43	B, C, E, F	
Lug Side □ cw ■ ccw	MW Examiner's Initials	N/A ODCR	233.0 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	48	B, C, E	
						ODCR LKDN			
						ODCR LKUP	50.5	B, C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	18	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

MW Nichols	II	10-26-95	Stephen W. Stanford III		11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Wayne E. Hoffman	III	11-9-95	[illegible] 11-9-95		11/9/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT12.R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-06
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	04:39 Time	N/A 45°	234.2 45°	0 Start°	3LS25C	45° LKDN			
Lug Set # 25	10/26 Date	N/A 60°	233.6 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	233.0 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	48	C, E	
						ODCR LKDN			
						ODCR LKUP	50.5	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	23:30 Time	N/A 45°	245.6 45°	0 Start°	3LS26	45° LKDN			
Lug Set # 26	10/28 Date	N/A 60°	245.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	244.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	23:50 Time	N/A 45°	255.6 45°	0 Start°	3LS27	45° LKDN			
Lug Set # 27	10/28 Date	N/A 60°	255.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	254.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	00:01 Time	N/A 45°	265.6 45°	0 Start°	3LS28	45° LKDN			
Lug Set # 28	10/29 Date	N/A 60°	265.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	264.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14**	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: ** Lug Set 26 had a reference gain setting of 18 dB

EXAMINER	LEVEL II	DATE 10-26-95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/9/95	PAGE: 12 OF: 14

FORM UT32.R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-07
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW ☐ CCW	00:20 Time	N/A 45°	275.6 45°	0 Start°	3LS29	45° LKDN			
Lug Set # 29	10/29 Date	N/A 60°	275.0 60°			45° LKUP	43	C, E, F	
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	274.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW ☐ CCW	01:20 Time	N/A 45°	295.6 45°	0 Start°	3LS31	45° LKDN			
Lug Set # 31	10/29 Date	N/A 60°	295.0 60°			45° LKUP	43	C, E, F	ODCR data says 295.4 should be 294.4 for start of data.
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	294.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW ☐ CCW	01:33 Time	N/A 45°	305.6 45°	0 Start°	3LS32	45° LKDN			
Lug Set # 32	10/29 Date	N/A 60°	305.0 60°			45° LKUP	43	B, C, E, F	Indication # 7
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	304.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	50	B, C, J	Indication # 7.
Cylinder ■ CW ☐ CCW	01:50 Time	N/A 45°	315.6 45°	0 Start°	3LS33	45° LKDN			
Lug Set # 33	10/29 Date	N/A 60°	315.0 60°			45° LKUP	43	C, E, F	
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	314.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	II	10-29-95 DATE	GE INDEPENDENT REVIEW	III	11-9-95 DATE
GE REVIEWED BY	III	11-9-95 DATE	UTILITY REVIEW		11/9/95 DATE

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-03
DATA SHEET NO.: SD-08
CALIBRATION SHEET NO.: SC-01 THRU 06

Weld ID: H3 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.0"

Search Unit Separation (Front To Front): N/A Wo Location: LKUP @ TOE & .2" DOWN FROM TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	02:00 Time	N/A 45°	325.6 45°	0 Start°	3LS34	45° LKDN			
Lug Set # 34	10/29 Date	N/A 60°	325.0 60°			45° LKUP	43	B, C, E, F	Indication # 8.
Lug Side ○ cw ● ccw	Examiner's Initials	N/A ODCR	324.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN			
						60° LKUP	46	B, C, E	
						ODCR LKDN			J = Shear Component to ID crown and
						ODCR LKUP	50	B, C, J	Indication # 8.
Cylinder ● cw ○ ccw	02:16 Time	N/A 45°	332.6 45°	7.0 Start°	3LS34A	45° LKDN			
Lug Set # 34	10/29 Date	N/A 60°	332.0 60°			45° LKUP	43	C, E, F	Indication # 8 continued
Lug Side ○ cw ● ccw	Examiner's Initials	N/A ODCR	331.4 ODCR	14.25 Stop°	D-01 / A	60° LKDN			Offsets in data incorrect - Actual
						60° LKUP	46	C, E	positions are as entered on this sheet.
						ODCR LKDN			J = Shear Component to ID crow and
						ODCR LKUP	50	C, J	Indication # 8.
Cylinder ○ cw ○ ccw	Time	45°	45°	Start°		45° LKDN			
Lug Set # N/A	Date	60°	60°			45° LKUP			
Lug Side ○ cw ○ ccw	Examiner's Initials	ODCR	ODCR	Stop°		60° LKDN			
						60° LKUP			
						ODCR LKDN			
						ODCR LKUP			
Cylinder ○ cw ○ ccw	Time	45°	45°	Start°		45° LKDN			
Lug Set # N/A	Date	60°	60°			45° LKUP			
Lug Side ○ cw ○ ccw	Examiner's Initials	ODCR	ODCR	Stop°		60° LKDN			
						60° LKUP			
						ODCR LKDN			
						ODCR LKUP			

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	DATE 10-29-95	GE INDEPENDENT REVIEW		DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/14/95

PAGE: 14 OF: 14

FORM UT32.R5

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-04

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

SYSTEM: SHROUD ASSEMBLY WELDS

WELD NO.: H4

CONFIGURATION: PLATE TO PLATE

EXAMINER: T. ROCKWOOD LEVEL: III

EXAMINER: C. MCKEAN LEVEL: II

EXAMINER: N/A LEVEL: N/A

PROCEDURE: UT-CNS-503V4 REV: 0 FRR: N/A
N/A
N/A

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

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

☐ MT ☐ PT ■ UT ☐ VT

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

DATA SHEET NO.(S): SD-09 THRU SD-15

CAL SHEET NO.(S): SC-07 THRU SC-12

During the examination of the referenced weld, no indications associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The 45° shear wave recorded inside and outside surface weld crown geometry, weld discontinuities and non-relevant indications.

The 60° RL recorded inside surface weld crown geometry, weld discontinuities and non-relevant indications.

The OD creeping wave recorded non-relevant indications, weld discontinuities and inside surface geometry.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.55 inches per degree.

This examination was performed from both sides of the weld.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs and instrumentation lines.

The examination area that was interrogated by all angles was 282.40° (78.5%). 77.6° (21.5%) was not examined due to the above referenced obstructions.

Stephen D. Rayter	III	11-11-95	R. L.	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
K Schlitt	III	11-11-95	K.B. Thomas	11/14/95	PAGE: 1 OF: 11
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-09 REV. 6

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H4 Indication Data

Total Scan Length (Deg.)	282.40	Total Flaw Length (Deg.)	0.00
Total Scan Length (In.)	437.72	Total Flaw Length (In.)	0.00
Percentage of Weld Length Examined	78.5	Thickness (In.)	1.50
Percentage of Examined Weld Length Flawed	0.0	Circumference (In.)	557.63
Percentage of Total Weld Length Flawed	0.0	Inches per Degree	1.55

Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer

No Relevant Indications Recorded

Areas Not Examined by All 3 Transducers
0° to 15.5°, 169.3° to 195.5°, 244.8° to 260.0°, & 339.3° to 0° (Total of 77.6 Not Examined)

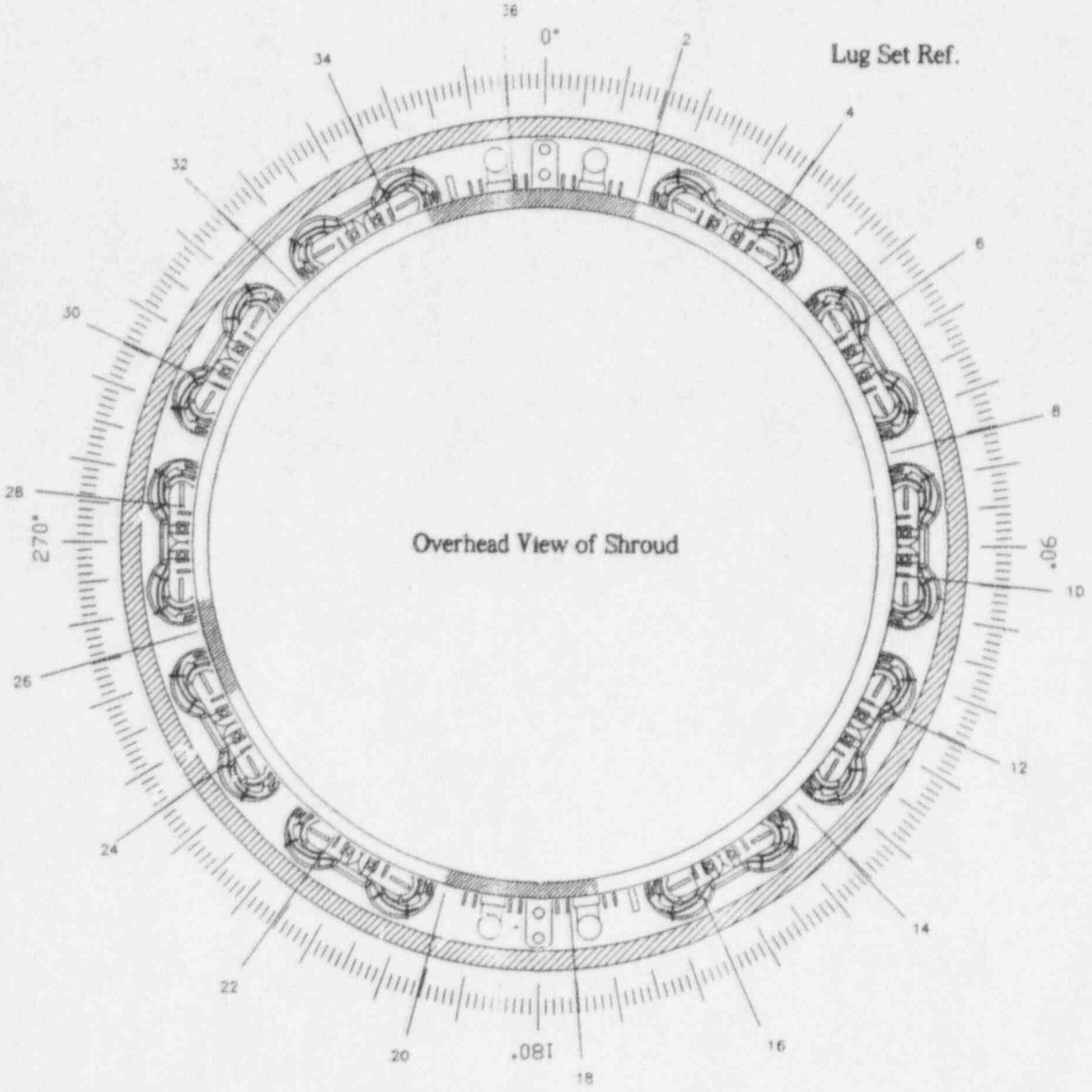
Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

GE Nuclear Energy

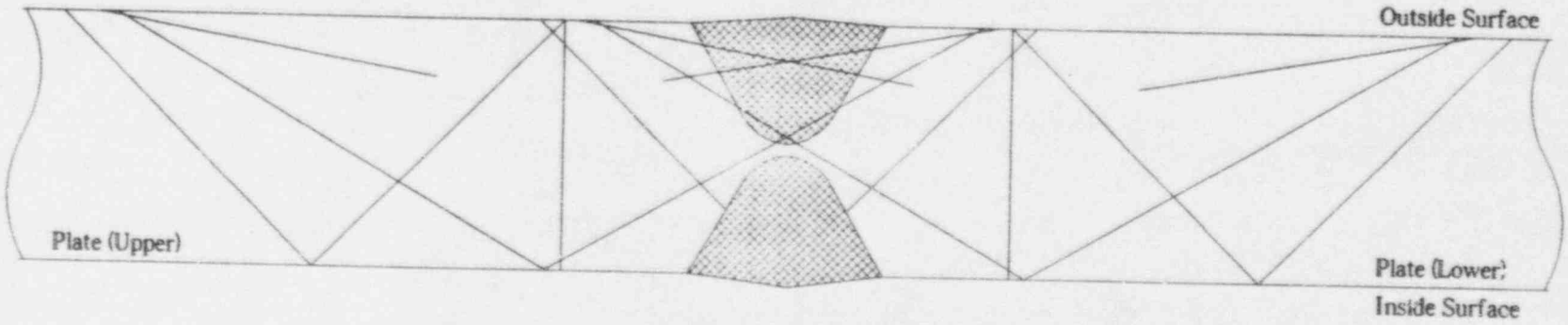
Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H4

Areas Not Examined



H4 - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-09
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	23:27 Time	14.3 45°	15.6 45°	0 Start°	4LS3	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 3	10/29 Date	14.9 60°	15.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	15.5 ODCR	14.4 ODCR	10.5 Stop°	D-03 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	23:57 Time	24.3 45°	25.6 45°	0 Start°	4LS4	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 4	10/29 Date	24.9 60°	25.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	25.5 ODCR	24.4 ODCR	10.5 Stop°	D-03 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	01:14 Time	34.3 45°	35.6 45°	0 Start°	4LS5	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 5	10/30 Date	34.9 60°	35.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	35.5 ODCR	34.4 ODCR	10.5 Stop°	D-03 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	01:39 Time	44.3 45°	45.6 45°	0 Start°	4LS6	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 6	10/30 Date	44.9 60°	45.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	45.5 ODCR	44.4 ODCR	10.5 Stop°	D-03 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	10/30/95 DATE	GE INDEPENDENT REVIEW	III	11-8-95 DATE
GE REVIEWED BY	LEVEL III	11-9-95 DATE	UTILITY REVIEW		11/4/95 DATE

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FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-10
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	01:59 Time	54.3 45°	55.6 45°	0 Start°	4LS7	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 7	10/30 Date	54.9 60°	55.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	55.5 ODCR	54.4 ODCR	10.5 Stop°	D-03 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	03:30 Time	64.3 45°	65.6 45°	0 Start°	4LS8	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 8	10/30 Date	64.9 60°	65.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	65.5 ODCR	64.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	03:48 Time	74.3 45°	75.6 45°	0 Start°	4LS9	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 9	10/30 Date	74.9 60°	75.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	75.5 ODCR	74.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	04:00 Time	84.3 45°	85.6 45°	0 Start°	4LS10	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 10	10/30 Date	84.9 60°	85.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	85.5 ODCR	84.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	10/30/95 DATE	GE INDEPENDENT REVIEW	III	11-9-95 DATE
GE REVIEWED BY	LEVEL III	11-9-95 DATE	UTILITY REVIEW		11/14/95 DATE

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-11
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	04:17 Time	94.3 45°	95.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 11	10/30 Date	94.9 60°	95.0 60°	0 Start°	4LS11	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	95.5 ODCR	94.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	06:15 Time	104.3 45°	105.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 12	10/30 Date	104.9 60°	105.0 60°	0 Start°	4LS12	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	105.5 ODCR	104.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	06:25 Time	114.3 45°	115.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 13	10/30 Date	114.9 60°	115.0 60°	0 Start°	4LS13	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	115.5 ODCR	114.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	06:50 Time	124.3 45°	125.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 14	10/30 Date	124.9 60°	125.0 60°	0 Start°	4LS14	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ CW ● CCW	Examiner's Initials	125.5 ODCR	124.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	DATE 10-30-95	GE INDEPENDENT REVIEW		DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/9/95

FORM UT3J 95

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-12
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	07:05 Time	134.3 45°	135.6 45°	0 Start°	4LS15	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 15	10/30 Date	-.9 60°	135.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E, G	
Lug Side □ CW ■ CCW	Examiner's Initials	135.5 ODCR	134.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	07:24 Time	144.3 45°	145.6 45°	0 Start°	4LS16	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 16	10/30 Date	144.9 60°	145.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	145.5 ODCR	144.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	07:38 Time	154.3 45°	155.6 45°	0 Start°	4LS17R	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 17	10/30 Date	154.9 60°	155.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	155.5 ODCR	154.4 ODCR	15.0 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	08:50 Time	194.3 45°	195.6 45°	0 Start°	4LS21	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 21	10/30 Date	194.9 60°	195.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	195.5 ODCR	194.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL III	DATE 11-7-95	GE INDEPENDENT REVIEW	III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/14/95

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-13
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	09:07 Time	204.3 45°	205.6 45°	0 Start°	4LS22	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F, G	
Lug Set # 22	10/30 Date	204.9 60°	205.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
Lug Side ○ cw ● ccw	Examiner's Initials	205.5 ODCR	204.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	09:24 Time	214.3 45°	215.6 45°	0 Start°	4LS23	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 23	10/30 Date	214.9 60°	215.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	215.5 ODCR	214.4 ODCR	10.5 Stop°	D-04 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	09:53 Time	224.3 45°	225.6 45°	0 Start°	4LS24	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 24	10/30 Date	224.9 60°	225.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	225.5 ODCR	224.4 ODCR	10.5 Stop°	D-04 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw	10:05 Time	234.3 45°	235.6 45°	0 Start°	4LS25	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 25	10/30 Date	234.9 60°	235.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	235.5 ODCR	234.4 ODCR	10.5 Stop°	D-04 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL III	DATE 11-2-95	GE INDEPENDENT REVIEW	LEVEL III	DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW		DATE 11/14/95

FORM UT32_R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-14
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW Lug Set # 27 Lug Side □ CW ■ CCW	11:06 Time 10/30 Date Examiner's Initials	258.8 45° 259.4 60° 260.0 ODCR	260.1 45° 259.5 60° 258.9 ODCR	4.5 Start° 10.5 Stop°	4LS27 D-04 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E C, E, C, J C, J	Exam limited due to instrumentation lines. J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 28 Lug Side □ CW ■ CCW	11:38 Time 10/30 Date Examiner's Initials	264.3 45° 264.9 60° 265.5 ODCR	265.6 45° 265.0 60° 264.4 ODCR	0 Start° 10.5 Stop°	4LS28 D-04 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E, G C, E C, J C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 29 Lug Side □ CW ■ CCW	11:52 Time 10/30 Date Examiner's Initials	274.3 45° 274.9 60° 275.5 ODCR	275.6 45° 275.0 60° 274.4 ODCR	0 Start° 10.5 Stop°	4LS29 D-04 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E C, E C, J C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW Lug Set # 30 Lug Side □ CW ■ CCW	12:53 Time 10/30 Date Examiner's Initials	284.3 45° 284.9 60° 285.5 ODCR	285.6 45° 285.0 60° 284.4 ODCR	0 Start° 10.5 Stop°	4LS30 D-04 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F, G C, E C, E C, J C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	III	11-7-95	GE INDEPENDENT REVIEW		11-9-95
	LEVEL	DATE			DATE
GE REVIEWED BY	III	11-9-95	UTILITY REVIEW	11/9/95	11/9/95
	LEVEL	DATE			DATE

FORM UT32 R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-04
DATA SHEET NO.: SD-15
CALIBRATION SHEET NO.: SC-07 THRU 12

Weld ID: H4 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	13:05 Time	294.3 45°	295.6 45°	0 Start°	4LS31	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 31	10/30 Date	294.9 60°	295.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
Lug Side ○ cw ● ccw	Examiner's Initials	295.5 ODCR	294.4 ODCR	10.5 Stop°	D-04 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	13:17 Time	304.3 45°	305.6 45°	0 Start°	4LS32	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 32	10/30 Date	304.9 60°	305.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	305.5 ODCR	304.4 ODCR	10.5 Stop°	D-04 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	13:28 Time	314.3 45°	315.6 45°	0 Start°	4LS33	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 33	10/30 Date	314.9 60°	315.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	315.5 ODCR	314.4 ODCR	10.5 Stop°	D-04 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw	13:44 Time	324.3 45°	325.6 45°	0 Start°	4LS34	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F, G	
Lug Set # 34	10/30 Date	324.9 60°	325.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	325.5 ODCR	324.4 ODCR	15.0 Stop°	D-04 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL III	DATE 11-7-95	GE INDEPENDENT REVIEW		DATE 11-9-95
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	Jan 11 1995	DATE 11/14/95

PAGE: 11 OF: 11

FORM UT32 R3

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-05

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 REV: 0 FRR: N/A
N/A
N/A

SYSTEM: SHROUD ASSEMBLY WELDS

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

WELD NO.: H5

CONFIGURATION: PLATE TO PLATE

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

EXAMINER: T. ROCKWOOD LEVEL: III

EXAMINER: C. MCKEAN LEVEL: II

EXAMINER: N/A LEVEL: N/A

☐ MT ☐ PT ■ UT ☐ VT

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

DATA SHEET NO.(S): SD-16 THRU SD-22

CAL SHEET NO.(S): SC-13 THRU SC-18

During the examination of the referenced weld, one (1) indication associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The parameters for this indication are on the following page.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications along with the refererenced indication.

The OD creeping wave recorded non-relevant indications and inside surface geometry along with the referenced indication.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.55 inches per degree.

This examination was performed from both sides of the weld.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs and instrumentaion lins.

The examination area that was interrogated by all angles was 273.90° (76.1%). 86.10° (23.9%) was not examined due to the above referenced obstructions.

Stephen W. Shepard	III	11-11-95	R. J. [illegible]	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
K. Schlitt	III	11-11-95	K. B. Thomas	11/14/95	PAGE: 1 OF: 13
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-05 REV. 6

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H5 Indication Data

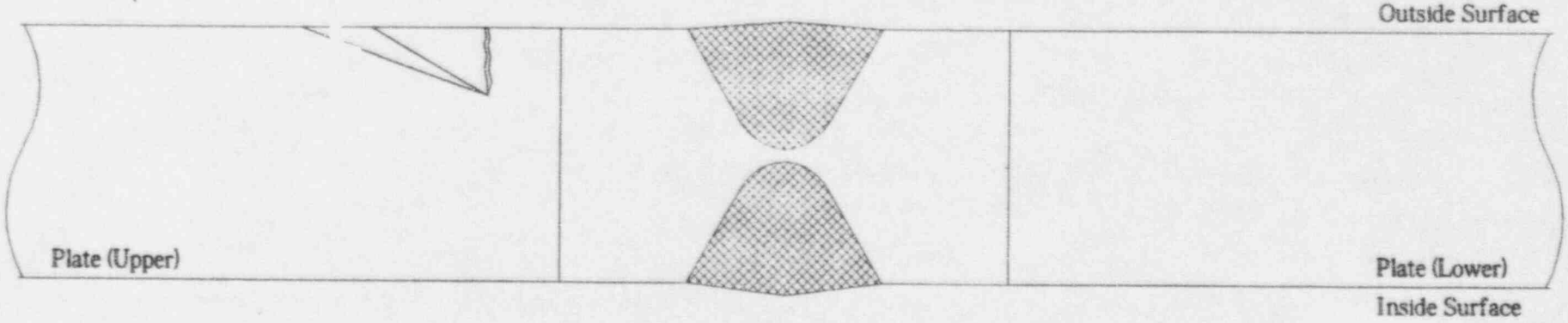
Total Scan Length (Deg.)	273.90	Total Flaw Length (Deg.)	1.76
Total Scan Length (In.)	424.55	Total Flaw Length (In.)	2.73
Percentage of Weld Length Examined	76.1	Thickness (In.)	1.50
Percentage of Examined Weld Length Flawed	0.6	Circumference (In.)	557.63
Percentage of Total Weld Length Flawed	0.5	Inches per Degree	1.55

Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer
1	35.50	37.26	1.76	2.73	0.45	36.01	30.0	OD/Near	ODCr	60° Long.

Areas Not Examined by All 3 Transducers
0° to 15.50°, 169.3° to 198.5°, 244.8° to 265.5° & 339.3° to 0° (Total of 86.1° Not Examined)

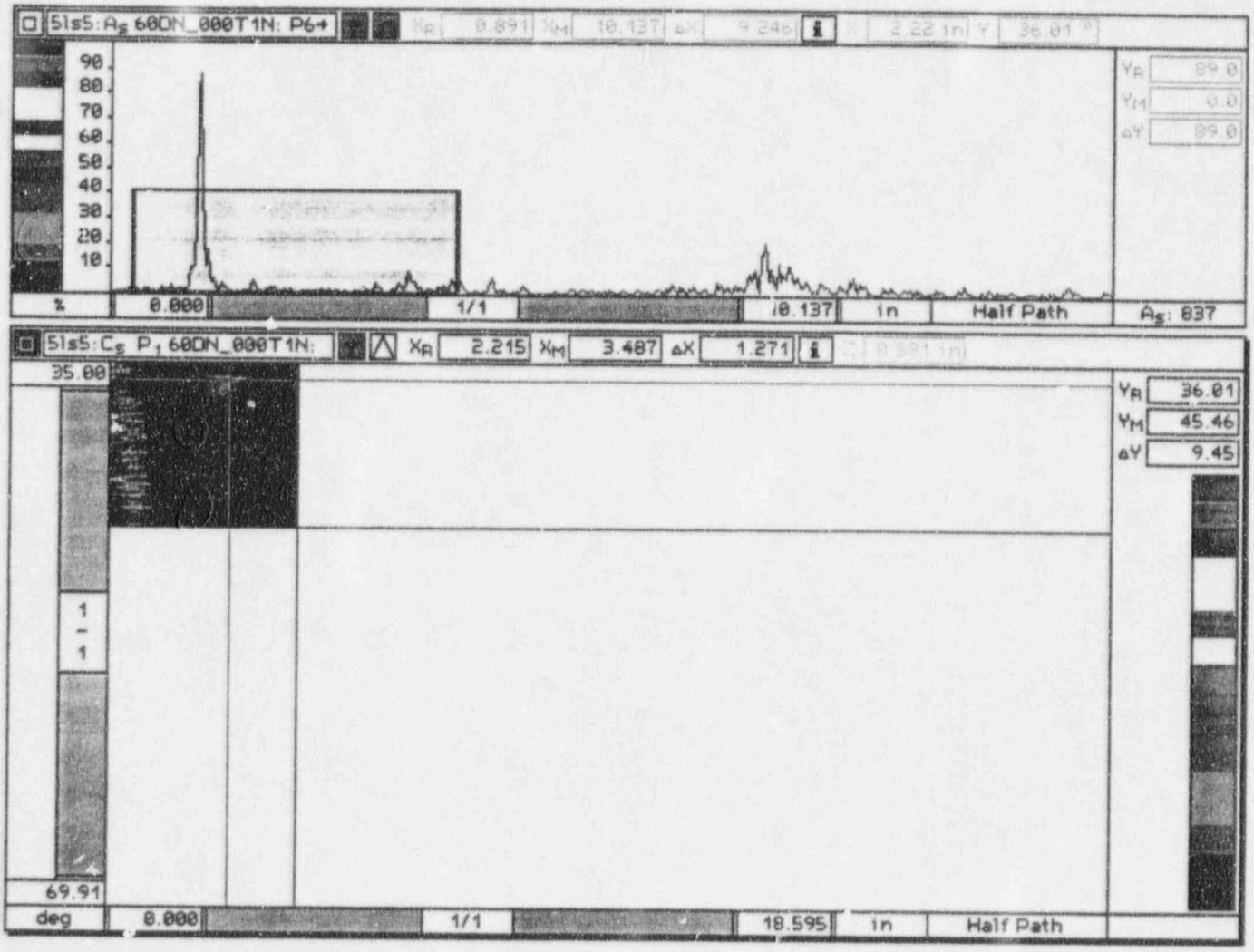
Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

H5 - Typical Flaw Indication @ 36.01 Deg. .45 In. Max Depth



GE Nuclear Energy

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



Indication # 1 on the OD above the weld.

SITE: COOPER UNIT: 1 PROJECT NO.: 1F5CN REPORT NO.: SR-05

WELD NO.: H-5 SEARCH UNIT: 60° RL INDICATION NO.: 1 PAGE: 4 OF: 13

FORM UT-13 REV. 1

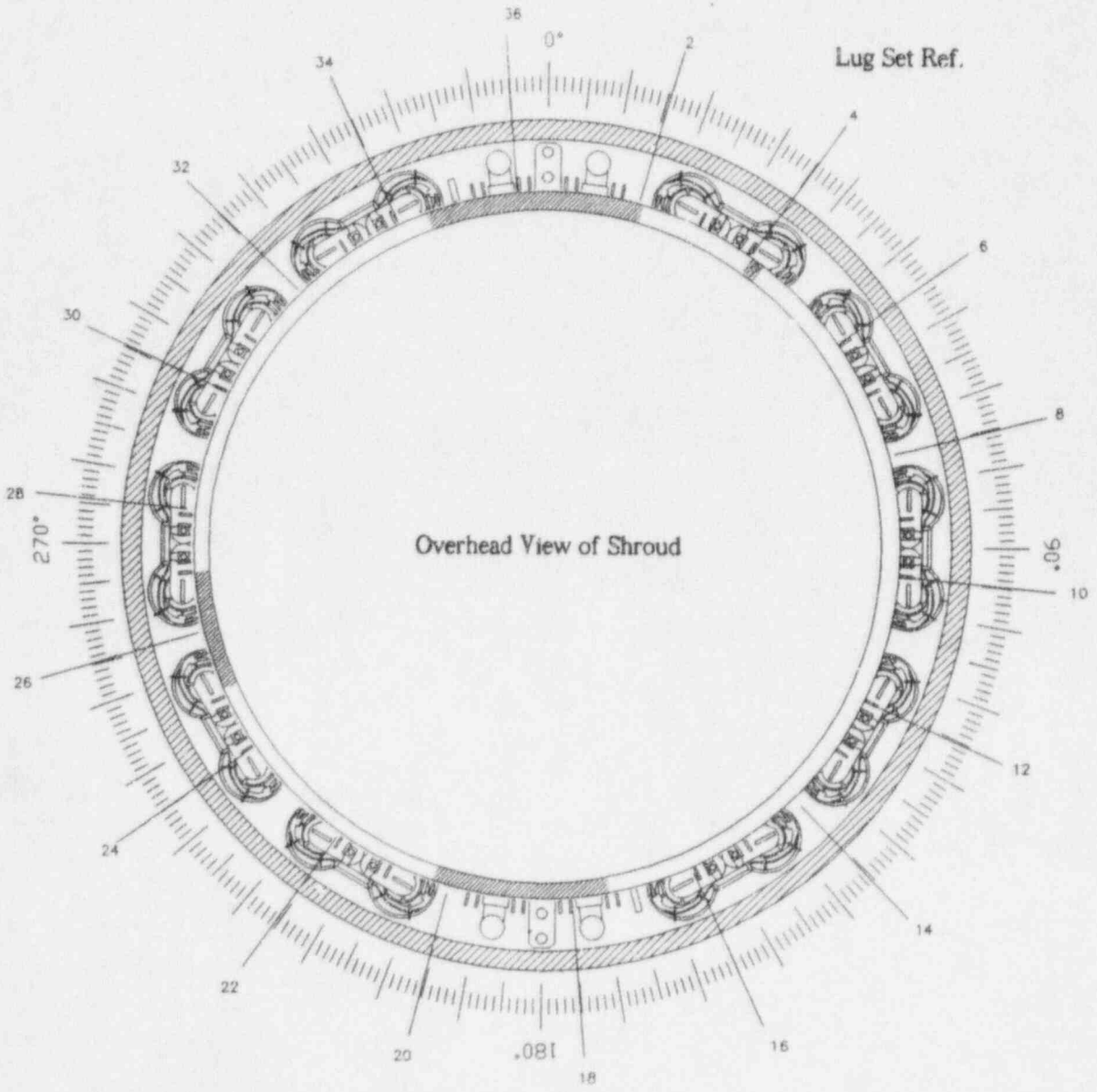
GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

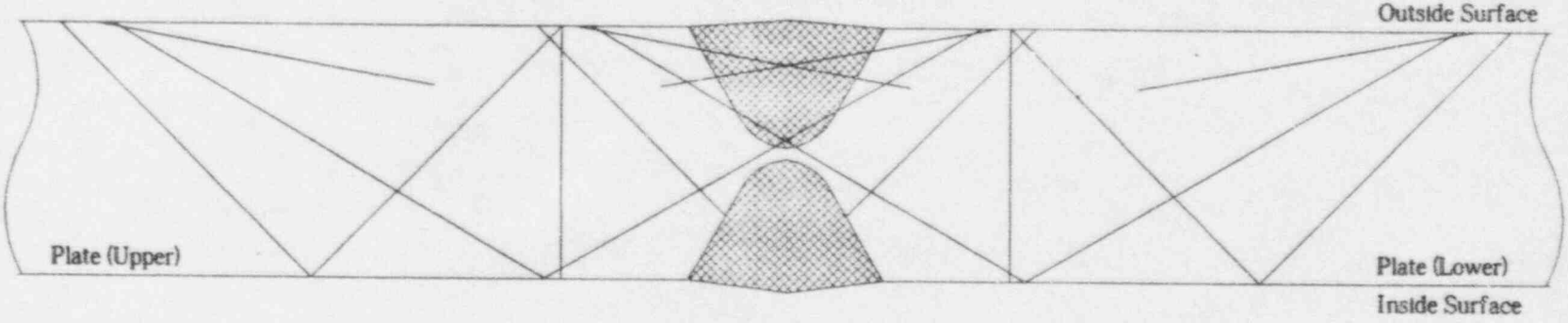
Shroud Weld H5

Areas Not Examined

Indication Areas



H5 - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-16
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	20:47 Time	14.3 45°	15.6 45°	0 Start°	5LS3	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 3	10/30 Date	14.9 60°	15.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
Lug Side ○ cw ● ccw	MW Examiner's Initials	15.5 ODCR	14.4 ODCR	10.5 Stop°	D-01 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	21:13 Time	24.3 45°	25.6 45°	0 Start°	5LS4	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 4	10/30 Date	24.9 60°	25.. 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	MW Examiner's Initials	25.5 ODCR	24.4 ODCR	10.5 Stop°	D-01 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	21:25 Time	34.3 45°	35.6 45°	0 Start°	5LS5	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 5	10/30 Date	34.9 60°	35.0 60°			60° LKDN	46	B, C, E	Indication # 1
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	MW Examiner's Initials	35.5 ODCR	34.4 ODCR	10.5 Stop°	D-01 / A	ODCR LKDN	50	B, C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw	21:50 Time	44.3 45°	45.6 45°	0 Start°	5LS6	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 6	10/30 Date	44.9 60°	45.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ○ cw ● ccw	MW Examiner's Initials	45.5 ODCR	44.4 ODCR	10.5 Stop°	D-01 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

MW White	II	10-30-95	Stephen W Stafford	III	11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Gary E Hafer	III	11-9-95	Jack 11 9 95 K B Thomas		11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT51 R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CINS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-17
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Index Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	22:07 Time	54.3 45°	55.6 45°	0 Start°	5LS7	45° LKDN	43	C, E, F	
Lug Set # 7	10/30 Date	54.9 60°	55.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	MW Examiner's Initials	55.5 ODCR	54.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	00:50 Time	64.3 45°	65.6 45°	0 Start°	5LS8	45° LKDN	43	C, E, F	
Lug Set # 8	10/31 Date	64.9 60°	65.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	Con Examiner's Initials	65.5 ODCR	64.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	01:14 Time	74.3 45°	75.6 45°	0 Start°	5LS9	45° LKDN	43	C, E, F	
Lug Set # 9	10/31 Date	74.9 60°	75.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	Con Examiner's Initials	75.5 ODCR	74.4 ODCR	10.5 Stop°	D-01 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	01:35 Time	84.3 45°	85.6 45°	0 Start°	5LS10	45° LKDN	43	C, E, F	
Lug Set # 10	10/31 Date	84.9 60°	85.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ cw ● ccw	Con Examiner's Initials	85.5 ODCR	84.4 ODCR	10.5 Stop°	D-01 / B	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

MW Shutts EXAMINER	II LEVEL	10-30-95 DATE	Gary E Hackbarth GE INDEPENDENT REVIEW	11-9-95 DATE	
Stephen W Stanford GE REVIEWED BY	III LEVEL	11-9-95 DATE	for 11-9-95 K.B. Thomas UTILITY REVIEW	11/9/95 DATE	PAGE: 8 OF: 13

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-18
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Weld Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	01:54 Time	94.3 45°	95.6 45°	0 Start°	5LS11	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 11	10/31 Date	94.9 60°	95.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
Lug Side □ cw ■ ccw	mjw Examiner's Initials	95.5 ODCR	94.4 ODCR	10.5 Stop°	D-01 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	03:25 Time	104.3 45°	105.6 45°	0 Start°	5LS12	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 12	10/31 Date	104.9 60°	105.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ cw ■ ccw	mjw Examiner's Initials	105.5 ODCR	104.4 ODCR	10.5 Stop°	D-01 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	03:40 Time	114.3 45°	115.6 45°	0 Start°	5LS13	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 13	10/31 Date	114.9 60°	115.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ cw ■ ccw	mjw Examiner's Initials	115.5 ODCR	114.4 ODCR	10.5 Stop°	D-01 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	03:58 Time	124.3 45°	125.6 45°	0 Start°	5LS14	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 14	10/31 Date	124.9 60°	125.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ cw ■ ccw	mjw Examiner's Initials	125.5 ODCR	124.4 ODCR	10.5 Stop°	D-01 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

mjw Webster	II	10-31-95	Lance E Dexter		11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Stephen W. Stanford	III	11-9-95	1nb11495 K.B. Thomas		11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT3J_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-19
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw Lug Set # 15 Lug Side □ cw ■ ccw	04:10 Time 10/31 Date MW Examiner's Initials	134.3 45° 134.9 60° 135.5 ODCR	135.6 45° 135.0 60° 134.4 ODCR	0 Start° 10.5 Stop°	5LS15 D-01 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E C, E, C, J C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 16 Lug Side □ cw ■ ccw	04:28 Time 10/31 Date MW Examiner's Initials	144.3 45° 144.9 60° 145.5 ODCR	145.6 45° 145.0 60° 144.4 ODCR	0 Start° 10.5 Stop°	5LS16 D-01 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E C, E C, J C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 17 Lug Side □ cw ■ ccw	04:40 Time 10/31 Date MW Examiner's Initials	154.3 45° 154.9 60° 155.5 ODCR	155.6 45° 155.0 60° 154.4 ODCR	0 Start° 15.0 Stop°	5LS17 D-01 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E C, E C, J C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 21 Lug Side □ cw ■ ccw	17:45 Time 10/31 Date Examiner's Initials	197.3 45° 197.9 60° 198.5 ODCR	198.6 45° 198.0 60° 197.4 ODCR	3.0 Start° 10.5 Stop°	5LS21 D-02 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 43 46 46 50 50	C, E, F C, E, F C, E C, E C, J C, J	Exam limited due to vibration lines J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

MW Webster	II	10-31-95	Greg E Hafner		11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Stephen D. Stanford	III	11-9-95	11/9/95 K.B. Thomas		11/9/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-20
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	18:08 Time	204.3 45°	205.6 45°	0 Start°	5LS22	45° LKDN	43	C, E, F	
Lug Set # 22	10/31 Date	204.9 60°	205.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	205.5 ODCR	204.4 ODCR	10.5 Stop°	D-02 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	18:20 Time	214.3 45°	215.6 45°	0 Start°	5LS23	45° LKDN	43	C, E, F	
Lug Set # 23	10/31 Date	214.9 60°	215.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	215.5 ODCR	214.4 ODCR	10.5 Stop°	D-02 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	18:35 Time	224.3 45°	225.6 45°	0 Start°	5LS24	45° LKDN	43	C, E, F	
Lug Set # 24	10/31 Date	224.9 60°	225.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	225.5 ODCR	224.4 ODCR	10.5 Stop°	D-02 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	18:44 Time	234.3 45°	235.6 45°	0 Start°	5LS25	45° LKDN	43	C, E, F	
Lug Set # 25	10/31 Date	234.9 60°	235.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	235.5 ODCR	234.4 ODCR	10.5 Stop°	D-02 / A	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
						ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/9/95 DATE	PAGE: 11 OF: 13

FORM UT32_R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-21
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	23:50 Time	264.3 45°	265.6 45°	0 Start°	5LS28	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 28	10/31 Date	264.9 60°	265.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
Lug Side □ CW ■ CCW	Examiner's Initials	265.5 ODCR	264.4 ODCR	10.5 Stop°	D-02 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	00:07 Time	274.3 45°	275.6 45°	0 Start°	5LS29	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 29	11/01 Date	274.9 60°	275.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	275.5 ODCR	274.4 ODCR	10.5 Stop°	D-02 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	20:40 Time	284.3 45°	285.6 45°	0 Start°	5LS30	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 30	10/31 Date	284.9 60°	285.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	285.5 ODCR	284.4 ODCR	10.5 Stop°	D-02 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	21:02 Time	294.3 45°	295.6 45°	0 Start°	5LS31	45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 31	10/31 Date	294.9 60°	295.0 60°			60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	295.5 ODCR	294.4 ODCR	10.5 Stop°	D-02 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	DATE 10-31-95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/14/95	PAGE: 12 OF: 13

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-05
DATA SHEET NO.: SD-22
CALIBRATION SHEET NO.: SC-13 THRU 18

Weld ID: H5 Exam Surface: OD Stroke: 3.5" Crown Width: ~1.5"

Search Unit Separation (Front To Front): 4.5" Wo Location: LKDN @ WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ☐ CCW	21:20 Time	304.3 45°	305.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 32	10/31 Date	304.9 60°	305.0 60°	0 Start°	5LS32	60° LKDN	46	C, E	
						60° LKUP	46	C, E,	
Lug Side ☐ CW ● CCW	MW Examiner's Initials	305.5 ODCR	304.4 ODCR	10.5 Stop°	D-02 / A	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ☐ CCW	21:35 Time	314.3 45°	315.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 33	10/31 Date	314.9 60°	315.0 60°	0 Start°	5LS33	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ☐ CW ● CCW	MW Examiner's Initials	315.5 ODCR	314.4 ODCR	10.5 Stop°	D-02 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ☐ CCW	21:50 Time	324.3 45°	325.6 45°			45° LKDN	43	C, E, F	
						45° LKUP	43	C, E, F	
Lug Set # 34	10/31 Date	324.9 60°	325.0 60°	0 Start°	5LS34	60° LKDN	46	C, E	
						60° LKUP	46	C, E	
Lug Side ☐ CW ● CCW	MW Examiner's Initials	325.5 ODCR	324.4 ODCR	15.0 Stop°	D-02 / B	ODCR LKDN	50	C, J	
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ☐ CW ☐ CCW	Time	45°	45°			45° LKDN			
						45° LKUP			
Lug Set # N/A	Date	60°	60°	Start°		60° LKDN			
						60° LKUP			
Lug Side ☐ CW ☐ CCW	Examiner's Initials	ODCR	ODCR	Stop°		ODCR LKDN			
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	17	60° LKUP	37
45° LKUP	14	ODCR LKDN	37
60° LKDN	35	ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS:

EXAMINER	LEVEL II	10-31-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	LEVEL III	11-9-95 DATE	UTILITY REVIEW	11/14/95 DATE	PAGE: 13 OF: 13

FORM UT32_R5

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-06A

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 **REV:** 0 **FRR:** N/A N/A N/A

SYSTEM: SHROUD ASSEMBLY WELDS

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

WELD NO.: H6A

CONFIGURATION: PLATE TO CORE PLATE RING

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

EXAMINER: T. ROCKWOOD **LEVEL:** III

EXAMINER: C. MCKEAN **LEVEL:** II

EXAMINER: N/A **LEVEL:** N/A

☐ MT ☐ PT ■ UT ☐ VT

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

DATA SHEET NO.(S): SD-37 THRU SD-43

CAL SHEET NO.(S): SC-19 THRU SC-24

During the examination of the referenced weld, one (1) indication associated with IGSCC/IASCC was recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The parameters for this indication are on the following page.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications along with the referenced indication.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications along with the referenced indication.

The OD creeping wave recorded non-relevant indications and inside surface geometry along with the referenced indication.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.55 inches per degree.

This weld was examined from the plate side only, however additional scanning was performed across the weld and and on the core plate ring side, directed away from the weld, and resulting in no relevant indications found. This was achieved because the examination was performed simutaneously with the H6B weld.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs and instrumentation lines

The examination area that was interrogated by all angles was 264.40° (73.4%). 95.60° (26.6%) was not examined due to the above referenced obstructions.

Stephen D. Stanford	III	11-11-95	R. L. [illegible]		11/13/95
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
H. Schlueter	III	11-11-95	K. B. Thomas		11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT-09 REV. 6

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H6A Indication Data

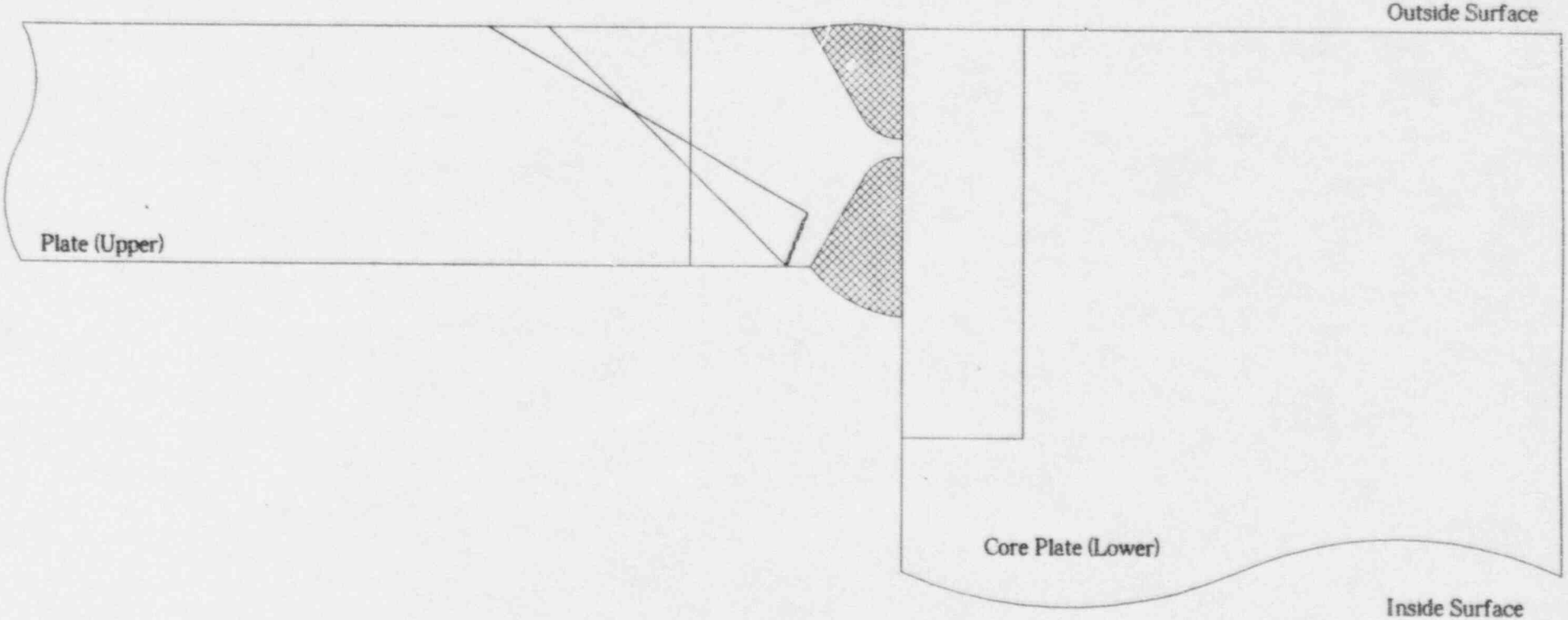
Total Scan Length (Deg.)	264.40	Total Flaw Length (Deg.)	1.38
Total Scan Length (In.)	409.55	Total Flaw Length (In.)	2.14
Percentage of Weld Length Examined	73.4	Thickness (In.)	1.50
Percentage of Examined Weld Length Flawed	0.5	Circumference (In.)	557.63
Percentage of Total Weld Length Flawed	0.4	Inches per Degree	1.55

Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer
1	235.06	236.44	1.38	2.14	0.33	235.50	22.0	OD/Near	ODCr	60° Long.

Areas Not Examined by All 3 Transducers
0° to 16.5°, 169.3° to 203.5°, 244.8° to 265.5° & 334.8° to 0° (Total of 95.6° Not Examined)

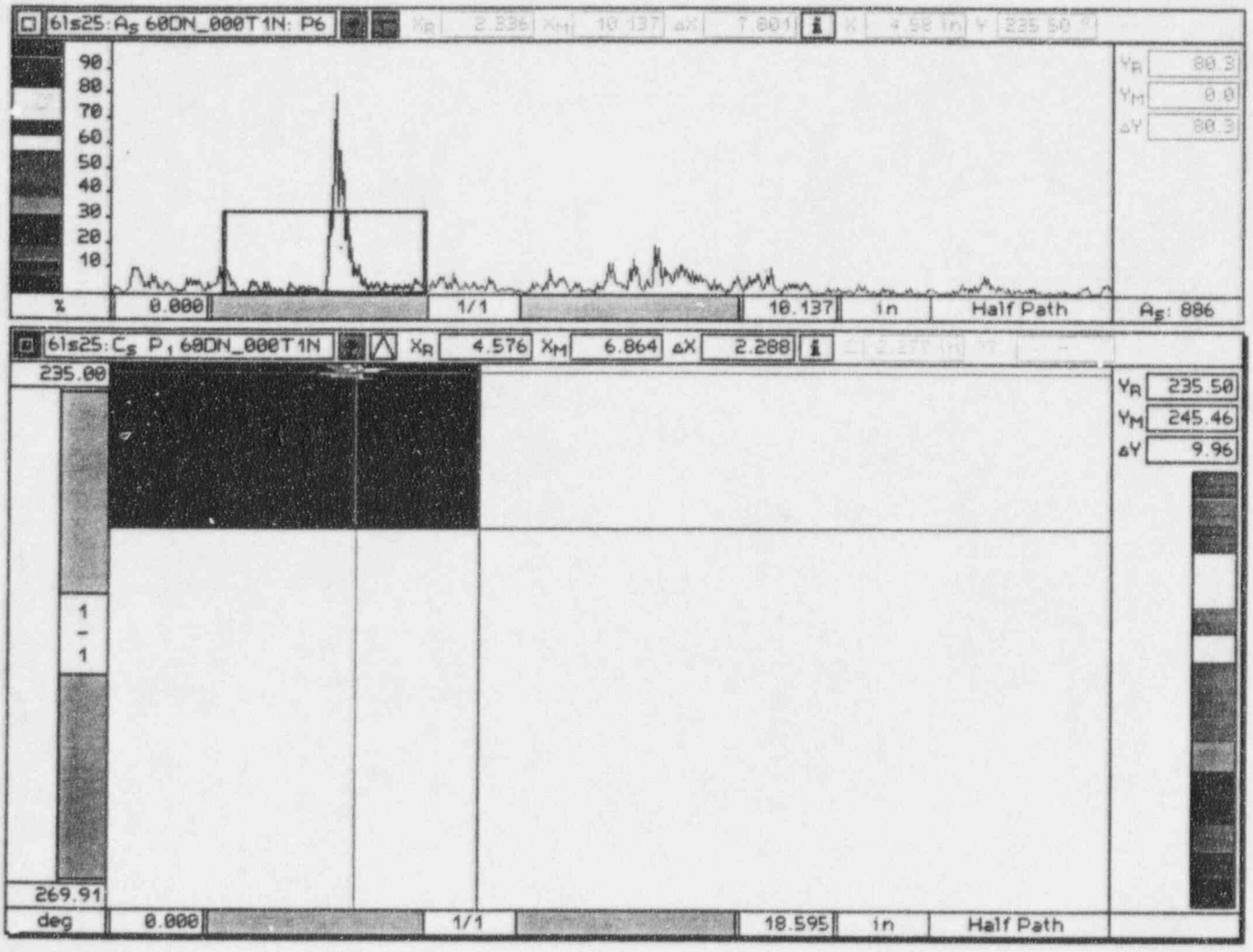
Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

H6A - Typical Flaw Indication @ 235.5 Deg. .33 In. Max. Depth



Nuclear Energy

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



Indication # 1 on the ID above the weld.

SITE: COOPER UNIT: 1 PROJECT NO.: 1F5CN REPORT NO.: SR-06A

WELD NO.: H-6A SEARCH UNIT: 60° RL INDICATION NO.: 1 PAGE: 4 OF: 13

FORM UT-13 REV. 1

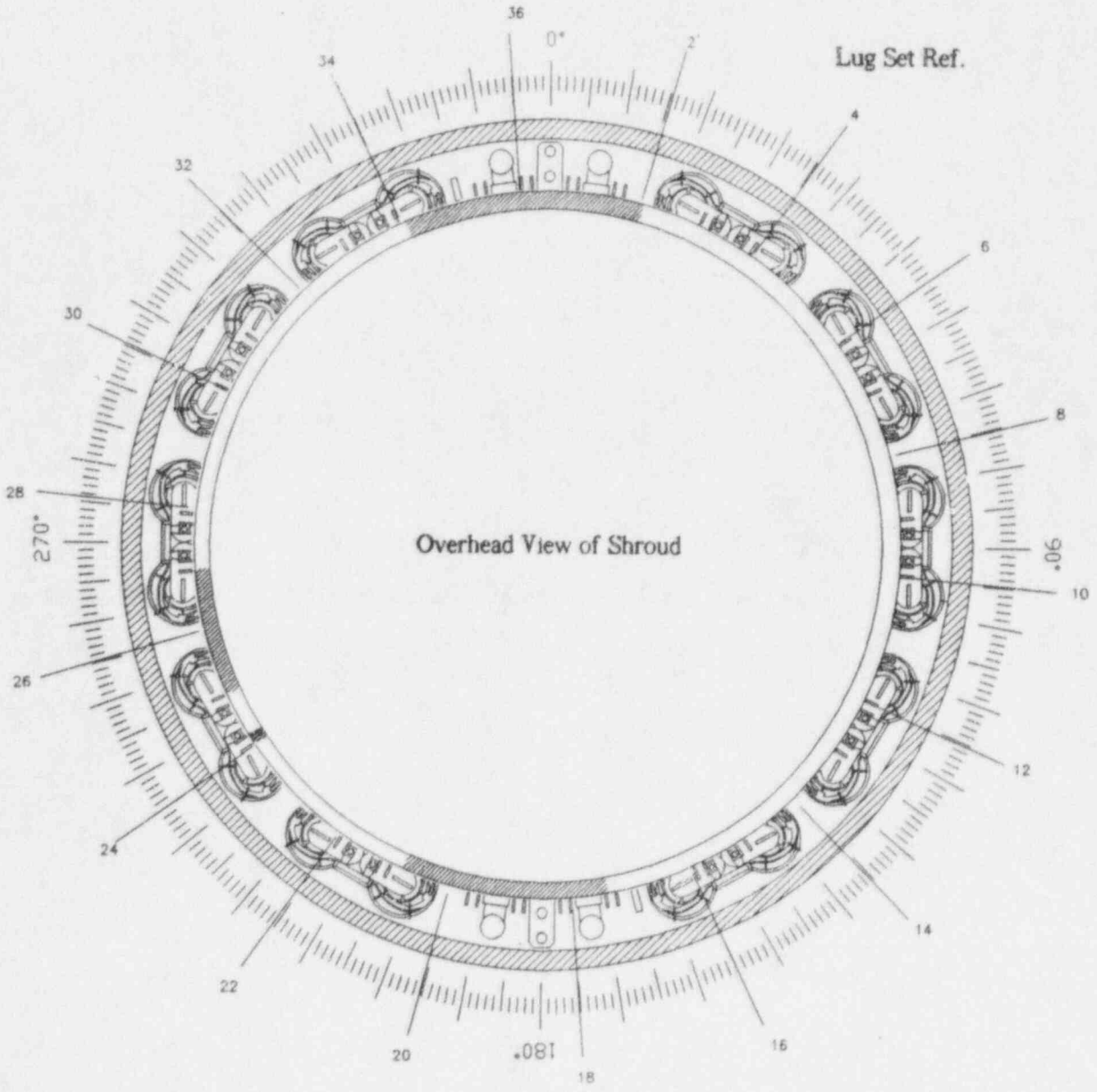
GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

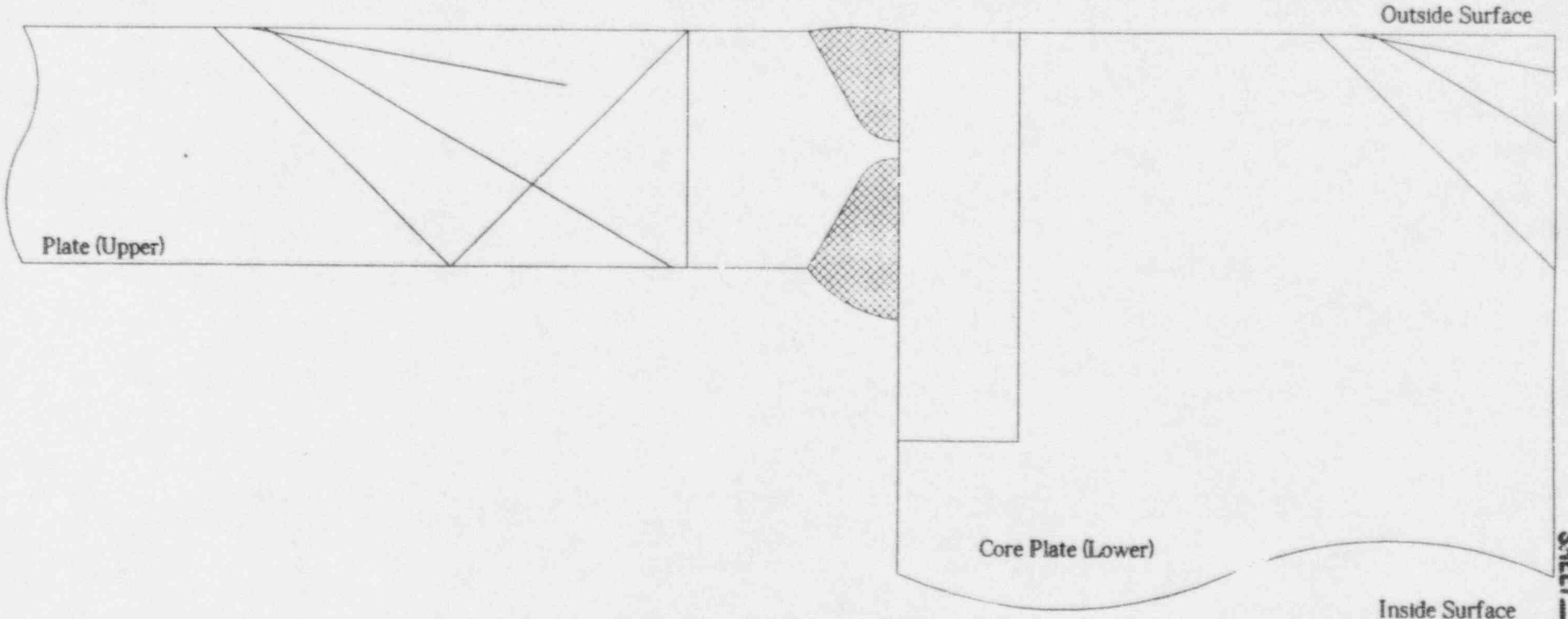
Shroud Weld H6A

Areas Not Examined

Indication Areas



H6A - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-37
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW ☐ CCW Lug Set # 3 Lug Side ☐ CW ■ CCW	07:40 Time 11/1 Date MB Examiner's Initials	14.3 45° 15.0 60° 15.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS3 D-01 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown
Cylinder ■ CW ☐ CCW Lug Set # 4 Lug Side ☐ CW ■ CCW	08:14 Time 11/1 Date MB Examiner's Initials	24.3 45° 25.0 60° 25.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS4 D-01 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ CW ☐ CCW Lug Set # 5 Lug Side ☐ CW ■ CCW	08:36 Time 11/1 Date TSR Examiner's Initials	34.3 45° 35.0 60° 35.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS5 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ CW ☐ CCW Lug Set # 6 Lug Side ☐ CW ■ CCW	09:22 Time 11/1 Date TSR Examiner's Initials	44.3 45° 45.0 60° 45.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS6 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN 17 60° LKUP ____
45° LKUP ____ ODCR LKDN 37
60° LKDN 35 ODCR LKUP ____

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	II	11/1/95	GE INDEPENDENT REVIEW	11-9-95	
GE REVIEWED BY	III	11-9-95	UTILITY REVIEW	11/14/95	
	LEVEL	DATE		DATE	

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-38
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): *6.375" Weld Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	09:42 Time	54.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 7	11/1 Date	55.0 60°	N/A 60°	0 Start°	6LS7	45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	55.5 ODCR	N/A ODCR	10.5 Stop°	D-05 / A	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	14:25 Time	64.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 8	11/1 Date	65.0 60°	N/A 60°	0 Start°	6LS8	45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	65.5 ODCR	N/A ODCR	10.5 Stop°	D-05 / B	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	14:47 Time	74.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 9	11/1 Date	75.0 60°	N/A 60°	0 Start°	6LS9	45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	75.5 ODCR	N/A ODCR	10.5 Stop°	D-05 / B	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	23:30 Time	84.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 10	11/2 Date	85.0 60°	N/A 60°	0 Start°	6LS10	45° LKUP 60° LKDN	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	85.5 ODCR	N/A ODCR	10.5 Stop°	D-05 / B	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			

CALIBRATION dB:

45° LKDN 17 | 60° LKUP ____
45° LKUP ____ | ODCR LKDN 37
60° LKDN 35 | ODCR LKUP ____

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	LEVEL III	DATE 11-7-95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/9/95	PAGE: 8 OF: 13

FORM UT32.R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-39
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): *6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw Lug Set # 11 Lug Side □ cw ■ ccw	00:04 Time 11/3 Date Examiner's Initials	94.3 45° 95.0 60° 95.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS11 D-05 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 12 Lug Side □ cw ■ ccw	10:38 Time 11/1 Date Examiner's Initials	104.3 45° 105.0 60° 105.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS12 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 13 Lug Side □ cw ■ ccw	11:05 Time 11/1 Date Examiner's Initials	114.3 45° 115.0 60° 115.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS13 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 14 Lug Side □ cw ■ ccw	11:25 Time 11/1 Date Examiner's Initials	124.3 45° 125.0 60° 125.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS14 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	II LEVEL	11-3-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/9/95 DATE	PAGE: 9 OF: 13

FORM UT3D_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503\4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-40
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): *6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	11:48 Time	134.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 15	11/1 Date	135.0 60°	N/A 60°	0 Start°	6LS15	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	135.5 ODCR	N/A ODCR	10.5 Stop°	D-05 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	12:11 Time	144.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 16	11/1 Date	145.0 60°	N/A 60°	0 Start°	6LS16	45° LKUP 60° LKDN	46	C, D, E	
Lug Side □ CW ■ CCW	Examiner's Initials	145.5 ODCR	N/A ODCR	10.5 Stop°	D-05 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	12:34 Time	154.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 17	11/1 Date	155.0 60°	N/A 60°	0 Start°	6LS17	45° LKUP 60° LKDN	46	C, D, E	
Lug Side □ CW ■ CCW	Examiner's Initials	155.5 ODCR	N/A ODCR	15.0 Stop°	D-05 / B	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	02:22 Time	202.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 21	11/3 Date	203.0 60°	N/A 60°	8.0 Start°	6LS21	45° LKUP 60° LKDN	46	C, E	
Lug Side □ CW ■ CCW	Examiner's Initials	203.5 ODCR	N/A ODCR	10.5 Stop°	D-02 / B	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN 17 | 60° LKUP ____
45° LKUP ____ | ODCR LKDN 37
60° LKDN 35 | ODCR LKUP ____

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	LEVEL III	DATE 11-7-95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/14/95	PAGE: 10 OF: 13

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-41
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): *6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW Lug Set # 22 Lug Side ○ CW ● CCW	02:43 Time 11/3 Date CM Examiner's Initials	204.3 45° 205.0 60° 205.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS22 D-02 / B	45° LKDN 45° LKUP 60° LKDN 46 60° LKUP ODCR LKDN 50 ODCR LKUP	43	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW Lug Set # 23 Lug Side ○ CW ● CCW	03:09 Time 11/3 Date CM Examiner's Initials	214.3 45° 215.0 60° 215.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS23 D-02 / B	45° LKDN 45° LKUP 60° LKDN 46 60° LKUP ODCR LKDN 50 ODCR LKUP	43	C, E, F C, E C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW Lug Set # 24 Lug Side ○ CW ● CCW	03:47 Time 11/3 Date CM Examiner's Initials	224.3 45° 225.0 60° 225.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS24 D-02 / B	45° LKDN 45° LKUP 60° LKDN 46 60° LKUP ODCR LKDN 50 ODCR LKUP	43	C, E, F C, E C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW Lug Set # 25 Lug Side ○ CW ● CCW	04:11 Time 11/3 Date CM Examiner's Initials	234.3 45° 235.0 60° 235.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS25 D-02 / B	45° LKDN 45° LKUP 60° LKDN 46 60° LKUP ODCR LKDN 50 ODCR LKUP	43	B, C, E, F B, C, E B, C, J	Indication # 1 J = Shear Component to ID crown and Indication # 1.

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

Chris H McKee	II	11/3/95	Gary E Dyer	11-9-95	
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
Stephen Shepard	III	11-9-95	11/9/95 K.B. Thomas	11/14/95	PAGE: 11 OF: 13
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-42
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	09:09 Time	264.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 28	11/3 Date	265.0 60°	N/A 60°	0 Start°	6LS28	45° LKUP 60° LKDN	46	C, E	
Lug Side □ cw ■ ccw	Examiner's Initials	265.5 ODCR	N/A ODCR	10.5 Stop°	D-06 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	09:3/ Time	274.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 29	11/3 Date	275.0 60°	N/A 60°	0 Start°	6LS29	45° LKUP 60° LKDN	46	C, E	
Lug Side □ cw ■ ccw	Examiner's Initials	275.5 ODCR	N/A ODCR	10.5 Stop°	D-06 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	06:09 Time	284.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 30	11/3 Date	285.0 60°	N/A 60°	0 Start°	6LS30	45° LKUP 60° LKDN	46	C, E	
Lug Side □ cw ■ ccw	Examiner's Initials	285.5 ODCR	N/A ODCR	10.5 Stop°	D-02 / B	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	07:02 Time	294.3 45°	N/A 45°			45° LKDN	43	C, E, F	
Lug Set # 31	11/3 Date	295.0 60°	N/A 60°	0 Start°	6LS31	45° LKUP 60° LKDN	46	C, E, G	
Lug Side □ cw ■ ccw	Examiner's Initials	295.5 ODCR	N/A ODCR	10.5 Stop°	D-02 / B	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/14/95 DATE	PAGE: 12 OF: 13

FORM UT32_R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06A
DATA SHEET NO.: SD-43
CALIBRATION SHEET NO.: SC-19 THRU 24

Weld ID: H6A Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw Lug Set # 32 Lug Side □ cw ■ ccw	07:28 Time 11/3 Date Examiner's Initials	304.3 45° 305.0 60° 305.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS32 D-06 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 33 Lug Side □ cw ■ ccw	07:49 Time 11/3 Date Examiner's Initials	314.3 45° 315.0 60° 315.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS33 D-06 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 34 Lug Side □ cw ■ ccw	08:10 Time 11/3 Date Examiner's Initials	324.3 45° 325.0 60° 325.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	6LS34 D-06 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E C, J	J = Shear Component to ID crown.
Cylinder □ cw □ ccw Lug Set # N/A Lug Side □ cw □ ccw	Time Date Examiner's Initials	45° 60° ODCR	45° 60° ODCR	Start° Stop°		45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP			

CALIBRATION dB:

45° LKDN	17	60° LKUP	
45° LKUP		ODCR LKDN	37
60° LKDN	35	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/9/95 DATE	PAGE: 13 OF: 13

FORM UT32 R5

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-06B

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 REV: 0 FRR: N/A
N/A
N/A

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

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

SYSTEM: SHROUD ASSEMBLY WELDS

WELD NO.: H6B

CONFIGURATION: CORE PLATE RING TO PLATE

EXAMINER: T. ROCKWOOD LEVEL: III

EXAMINER: C. MCKEAN LEVEL: II

EXAMINER: N/A LEVEL: N/A

☐ MT ☐ PT ■ UT ☐ VT

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

DATA SHEET NO.(S): SD-44 THRU SD-50

CAL SHEET NO.(S): SC-25 THRU SC-30

During the examination of the referenced weld, no indications associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The parameters for these indications are on the following page.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications.

The OD creeping wave recorded non-relevant indications and inside surface geometry.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.55 inches per degree.

This weld was examined from the plate side only, however additional scanning was performed across the weld and and on the core plate ring side,directed away from the weld, and resulting in no relevant indications found. Also the looking down transducer from the H6A examination achieved a limited scan with the transducer directed toward the weld, also resulting in no relevant indications found. This was acheived because the examination was performed simutaneously with the H6A weld.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs and instrumentation lines.

The examination area that was interrogated by all angles was 264.40° (73.4%). 95.60° (26.6%) was not examined due to the above referenced obstructions.

Stephen D. Sturgeon	III	11-11-95	R. L. [illegible]	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
[illegible]	III	11.11.95	L. A. Thomas	11/14/95	PAGE: 1 OF: 11
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-09 REV. 6

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H6B Indication Data

Total Scan Length (Deg.)	264.40	Total Flaw Length (Deg.)	0.00
Total Scan Length (In.)	409.55	Total Flaw Length (In.)	0.00
Percentage of Weld Length Examined	73.4	Thickness (In.)	1.50
Percentage of Examined Weld Length Flawed	0.0	Circumference (In.)	557.63
Percentage of Total Weld Length Flawed	0.0	Inches per Degree	1.55

Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer

No Relevant Indications Recorded

Areas Not Examined by All 3 Transducers
0° to 15.5°, 169.3° to 203.5°, 244.8° to 265.5° & 334.8° to 0° (Total of 95.6° Not Examined)

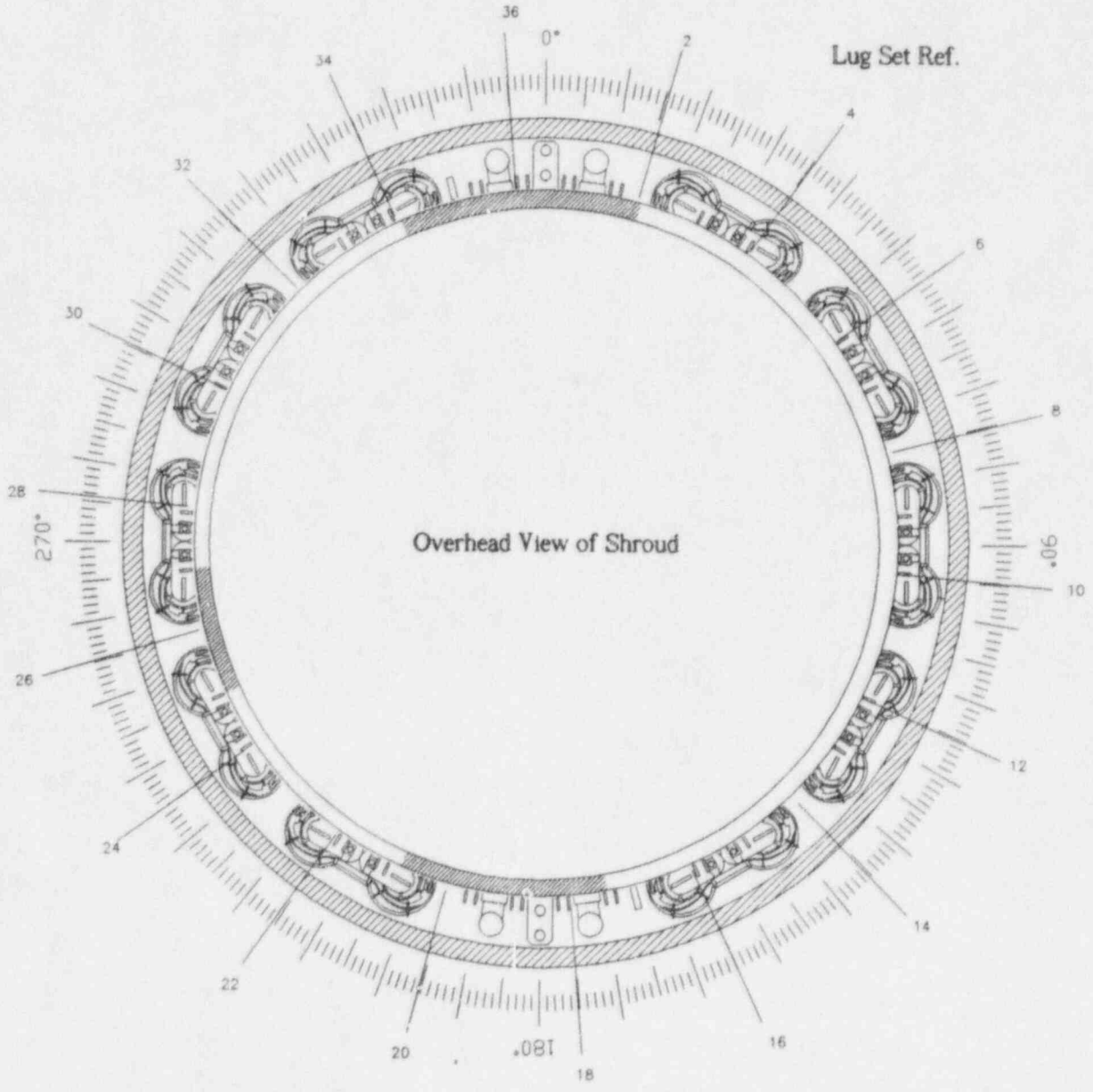
Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

GE Nuclear Energy

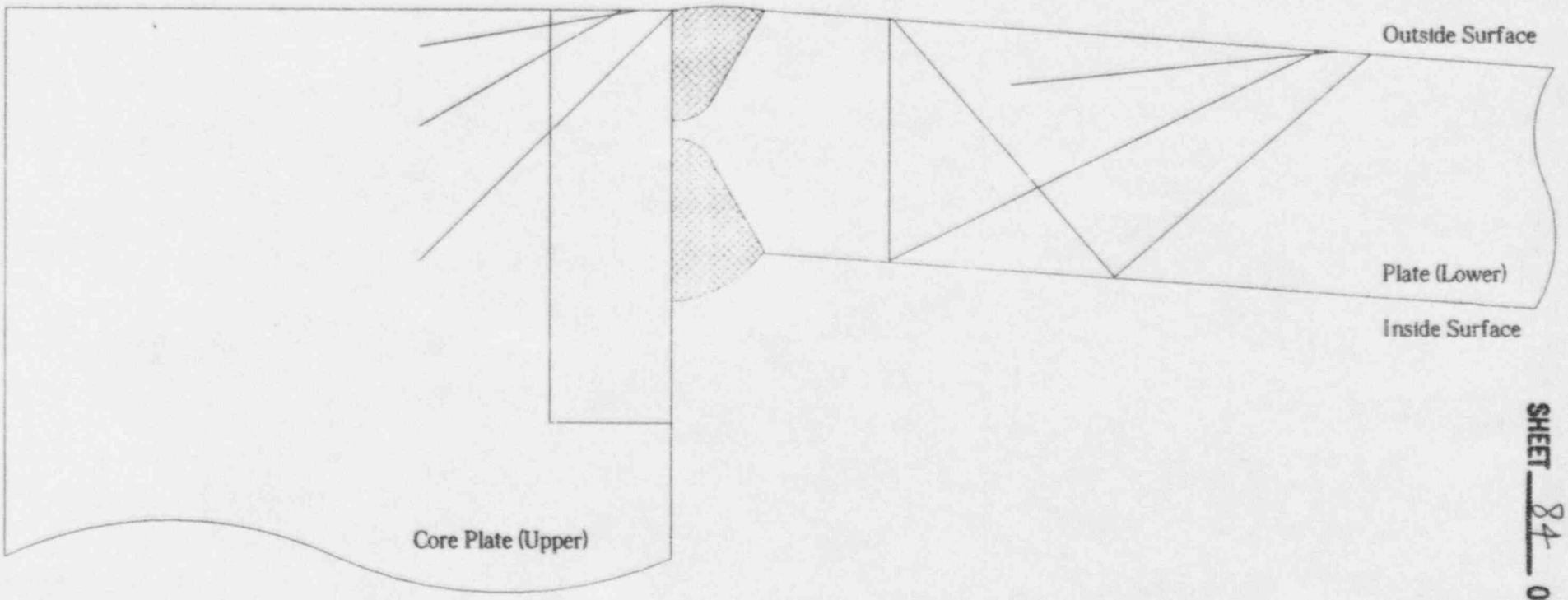
Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H6B

Areas Not Examined



H6B - Actual Examination Coverage - 45S, 60L, & ODCr



NEDC 95-19 ATTACH 2.3
SHEET 84 OF 101

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-44
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW ☐ CCW	07:40 Time	N/A 45°	15.6 45°	0 Start°	6LS3	45° LKDN			
Lug Set # 3	11/1 Date	N/A 60°	15.0 60°			45° LKUP	43	C, E, F, G	
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	14.4 ODCR	10.5 Stop°	D-01 / B	60° LKDN			
						60° LKUP	46	C, D, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW ☐ CCW	08:14 Time	N/A 45°	25.6 45°	0 Start°	6LS4	45° LKDN			
Lug Set # 4	11/1 Date	N/A 60°	25.0 60°			45° LKUP	43	C, E, F	
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	24.4 ODCR	10.5 Stop°	D-01 / B	60° LKDN			
						60° LKUP	46	C, D, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW ☐ CCW	08:36 Time	N/A 45°	35.6 45°	0 Start°	6LS5	45° LKDN			
Lug Set # 5	11/1 Date	N/A 60°	35.0 60°			45° LKUP	43	C, E, F	
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	34.4 ODCR	10.5 Stop°	D-05 / A	60° LKDN			
						60° LKUP	46	C, D, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW ☐ CCW	09:22 Time	N/A 45°	45.6 45°	0 Start°	6LS6	45° LKDN			
Lug Set # 6	11/1 Date	N/A 60°	45.0 60°			45° LKUP	43	C, E, F	
Lug Side ☐ CW ■ CCW	Examiner's Initials	N/A ODCR	44.4 ODCR	10.5 Stop°	D-05 / A	60° LKDN			
						60° LKUP	46	C, D, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	LEVEL II	DATE 11/1/95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/14/95	PAGE: 5 OF: 11

FORM UT32 R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-45
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW Lug Set # 7 Lug Side □ CW ■ CCW	09:42 Time 11/1 Date TSR Examiner's Initials	N/A 45° N/A 60° N/A ODCR	55.6 45° 55.0 60° 54.4 ODCR	0 Start° 10.5 Stop°	6LS7 D-05 / A	45° LKDN 45° LKUP 43 60° LKDN 60° LKUP 46 ODCR LKDN ODCR LKUP 50		C, E, F C, D, E C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW Lug Set # 8 Lug Side □ CW ■ CCW	14:25 Time 11/1 Date TSR Examiner's Initials	N/A 45° N/A 60° N/A ODCR	65.6 45° 65.0 60° 64.4 ODCR	0 Start° 10.5 Stop°	6LS8 D-05 / B	45° LKDN 45° LKUP 43 60° LKDN 60° LKUP 46 ODCR LKDN ODCR LKUP 50		C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 9 Lug Side □ CW ■ CCW	14:47 Time 11/1 Date TSR Examiner's Initials	N/A 45° N/A 60° N/A ODCR	75.6 45° 75.0 60° 74.4 ODCR	0 Start° 10.5 Stop°	6LS9 D-05 / B	45° LKDN 45° LKUP 43 60° LKDN 60° LKUP 46 ODCR LKDN ODCR LKUP 50		C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 10 Lug Side □ CW ■ CCW	23:30 Time 11/2 Date MH Examiner's Initials	N/A 45° N/A 60° N/A ODCR	85.6 45° 85.0 60° 84.4 ODCR	0 Start° 10.5 Stop°	6LS10 D-05 / B	45° LKDN 45° LKUP 43 60° LKDN 60° LKUP 46 ODCR LKDN ODCR LKUP 50		C, E, F C, E C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/9/95 DATE	PAGE: 6 OF: 11

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-46
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Weld Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw Lug Set # 11 Lug Side ○ cw ● ccw	00:04 Time 11/3 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	95.6 45° 95.0 60° 94.4 ODCR	0 Start° 10.5 Stop°	6LS11 D-05 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ● cw ○ ccw Lug Set # 12 Lug Side ○ cw ● ccw	10:38 Time 11/1 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	105.6 45° 105.0 60° 104.4 ODCR	0 Start° 10.5 Stop°	6LS12 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw Lug Set # 13 Lug Side ○ cw ● ccw	11:05 Time 11/1 Date MW Examiner's Initials	N/A 45° N/A 60° N/A ODCR	115.6 45° 115.0 60° 114.4 ODCR	0 Start° 10.5 Stop°	6LS13 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw Lug Set # 14 Lug Side ○ cw ● ccw	11:25 Time 11/1 Date ESR Examiner's Initials	N/A 45° N/A 60° N/A ODCR	125.6 45° 125.0 60° 124.4 ODCR	0 Start° 10.5 Stop°	6LS14 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

MW Examiner	II Level	11-3-95 Date	George E. Dutton GE Independent Review	11-9-95 Date	
Stephen W. Shepherd GE Reviewed By	III Level	11-9-95 Date	2W611-9-95 K.B. Thomas Utility Review	11/14/95 Date	PAGE: 7 OF: 11

FORM UT32.R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-47
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw Lug Set # 15 Lug Side □ cw ■ ccw	11:48 Time 11/1 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	135.6 45° 135.0 60° 134.4 ODCR	0 Start° 10.5 Stop°	6LS15 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw Lug Set # 16 Lug Side □ cw ■ ccw	12:11 Time 11/1 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	145.6 45° 145.0 60° 144.4 ODCR	0 Start° 10.5 Stop°	6LS16 D-05 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 17 Lug Side □ cw ■ ccw	12:34 Time 11/1 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	155.6 45° 155.0 60° 154.4 ODCR	0 Start° 15.0 Stop°	6LS17 D-05 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, D, E C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw Lug Set # 21 Lug Side □ cw ■ ccw	02:22 Time 11/3 Date Examiner's Initials	N/A 45° N/A 60° N/A ODCR	203.6 45° 203.0 60° 202.4 ODCR	8.0 Start° 10.5 Stop°	6LS21 D-02 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, E, F C, E, G C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	LEVEL III	DATE 11-7-95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/14/95	PAGE: 8 OF: 11

FORM UT32_R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-48
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): *6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ cw □ ccw	02:43 Time	N/A 45°	205.6 45°	0 Start°	6LS22	45° LKDN			
Lug Set # 22	11/3 Date	N/A 60°	205.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	N/A ODCR	204.4 ODCR	10.5 Stop°	D-02 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ cw □ ccw	03:09 Time	N/A 45°	215.6 45°	0 Start°	6LS23	45° LKDN			
Lug Set # 23	11/3 Date	N/A 60°	215.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	N/A ODCR	214.4 ODCR	10.5 Stop°	D-02 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	03:47 Time	N/A 45°	225.6 45°	0 Start°	6LS24	45° LKDN			
Lug Set # 24	11/3 Date	N/A 60°	225.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	N/A ODCR	224.4 ODCR	10.5 Stop°	D-02 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ cw □ ccw	04:11 Time	N/A 45°	235.6 45°	0 Start°	6LS25	45° LKDN			
Lug Set # 25	11/3 Date	N/A 60°	235.0 60°			45° LKUP	43	C, E, F	
Lug Side □ cw ■ ccw	Examiner's Initials	N/A ODCR	234.4 ODCR	10.5 Stop°	D-02 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

Chris H McKee	II	11/3/95	George E Dickerson		11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Stephen D. Stanford	III	11-9-95	11-9-95 K B Thomas		11/4/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-49
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): *6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW	09:09 Time	N/A 45°	265.6 45°	0 Start°	6LS28	45° LKDN			
Lug Set # 28	11/3 Date	N/A 60°	265.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	264.4 ODCR	10.5 Stop°	D-06 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ● CW ○ CCW	09:30 Time	N/A 45°	275.6 45°	0 Start°	6LS29	45° LKDN			
Lug Set # 29	11/3 Date	N/A 60°	275.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	274.4 ODCR	10.5 Stop°	D-06 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	06:09 Time	N/A 45°	285.6 45°	0 Start°	6LS30	45° LKDN			
Lug Set # 30	11/3 Date	N/A 60°	285.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	284.4 ODCR	10.5 Stop°	D-02 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW	07:02 Time	N/A 45°	295.6 45°	0 Start°	6LS31	45° LKDN			
Lug Set # 31	11/3 Date	N/A 60°	295.0 60°			45° LKUP	43	C, E, F	
Lug Side ○ CW ● CCW	Examiner's Initials	N/A ODCR	294.4 ODCR	10.5 Stop°	D-02 / B	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/14/95 DATE	PAGE: 10 OF: 11

FORM UT32.R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-06B
DATA SHEET NO.: SD-50
CALIBRATION SHEET NO.: SC-25 THRU 30

Weld ID: H6B Exam Surface: OD Stroke: 7.0" Crown Width: ~1.5"

Search Unit Separation (Front To Front): * 6.375" Wo Location: * LKDN 2.5" BELOW H6A WELD TOE

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW	07:28 Time	N/A 45°	305.6 45°	0 Start°	6LS32	45° LKDN			
Lug Set # 32	11/3 Date	N/A 60°	305.0 60°			45° LKUP	43	C, E, F, G	
Lug Side □ CW ■ CCW	Examiner's Initials	N/A ODCR	304.4 ODCR	10.5 Stop°	D-06 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown
Cylinder ■ CW □ CCW	07:49 Time	N/A 45°	315.6 45°	0 Start°	6LS33	45° LKDN			
Lug Set # 33	11/3 Date	N/A 60°	315.0 60°			45° LKUP	43	C, E, F	
Lug Side □ CW ■ CCW	Examiner's Initials	N/A ODCR	314.4 ODCR	10.5 Stop°	D-06 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW	08:10 Time	N/A 45°	325.6 45°	0 Start°	6LS34	45° LKDN			
Lug Set # 34	11/3 Date	N/A 60°	325.0 60°			45° LKUP	43	C, E, F	
Lug Side □ CW ■ CCW	Examiner's Initials	N/A ODCR	324.4 ODCR	10.5 Stop°	D-06 / A	60° LKDN			
						60° LKUP	46	C, E	
						ODCR LKDN			
						ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder □ CW □ CCW	Time	45°	45°	Start°		45° LKDN			
Lug Set # N/A	Date	60°	60°			45° LKUP			
Lug Side □ CW □ CCW	Examiner's Initials	ODCR	ODCR	Stop°		60° LKDN			
						60° LKUP			
						ODCR LKDN			
						ODCR LKUP			

CALIBRATION dB:

45° LKDN		60° LKUP	37
45° LKUP	14	ODCR LKDN	
60° LKDN		ODCR LKUP	38

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * H6A & H6B were scanned simultaneously

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11.9.95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	11/9/95 UTILITY REVIEW	11/14/95 DATE	PAGE: 11 OF: 11

FORM UT32_R5

GE Nuclear Energy

EXAMINATION SUMMARY SHEET

REPORT NO.: SR-07

PROJECT: COOPER RFO16
SHROUD UT PROJECT 1F5CN

PROCEDURE: UT-CNS-503V4 **REV:** 0 **FRR:** N/A
N/A
N/A

SYSTEM: SHROUD ASSEMBLY WELDS

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

WELD NO.: H7

CONFIGURATION: PLATE TO PLATE

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

EXAMINER: T. ROCKWOOD **LEVEL:** III

EXAMINER: C. MCKEAN **LEVEL:** II

☐ MT ☐ PT ■ UT ☐ VT

EXAMINER: N/A **LEVEL:** N/A

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

DATA SHEET NO.(S): SD-51 THRU SD-56

CAL SHEET NO.(S): SC-37 THRU SC-39

During the examination of the referenced weld, no indications associated with IGSCC/IASCC were recorded by the Smart 2000 system utilizing a TRI-MODAL search unit containing a 45° shear wave, OD creeping wave and 60° refracted longitudinal (RL) wave.

The 45° shear wave recorded inside and outside surface weld crown geometry and non-relevant indications.

The 60° RL recorded inside surface weld crown geometry and non-relevant indications.

The OD creeping wave recorded non-relevant indications and inside surface geometry.

Circumferential (L) dimensions were recorded in angular units. The conversion factor for linear units is 1.49 inches per degree.

This examination was performed from the plate side only due to the weld configuration of the lower plate support and the backing ring configuration.

This exam was limited to the areas scanned due to obstructions from the guide pins, core spray downcomers, shroud lifting lugs, instrumentation lines.

The examination area that was interrogated by all angles was 246.90° (68.6%). 113.10° (31.4%) was not examined due to the above referenced obstructions.

Stephen W. Stanford	III	11-11-95	R. [illegible]	11/13/95	
SUMMARY BY	LEVEL	DATE	GE INDEPENDENT REVIEW	DATE	
[illegible]	III	11-11-95	K.B. Thomas	10/14/95	PAGE: 1 OF: 10
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW	DATE	

FORM UT-00 REV. 8

GE Nuclear Energy

Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H7 Indication Data

Total Scan Length (Deg.)	246.90	Total Flaw Length (Deg.)	0.00
Total Scan Length (In.)	368.44	Total Flaw Length (In.)	0.00
Percentage of Weld Length Examined	68.6	Thickness (In.)	1.50
Percentage of Examined Weld Length Flawed	0.0	Circumference (In.)	537.21
Percentage of Total Weld Length Flawed	0.0	Inches per Degree	1.49

Indication Number	Start Azimuth	End Azimuth	Length Degrees	Length Inches	Max. Depth Inches	Max. Depth Pos. (Deg.)	% of Thruwall	Initiating Surface	Length Transducer	Depth Transducer

No Relevant Indications Recorded

Areas Not Examined by All 3 Transducers
0° to 15.5°, 169.3° to 205.5°, 244.8° to 285.5° & 339.5° to 0° (Total of 113.10° Not Examined)

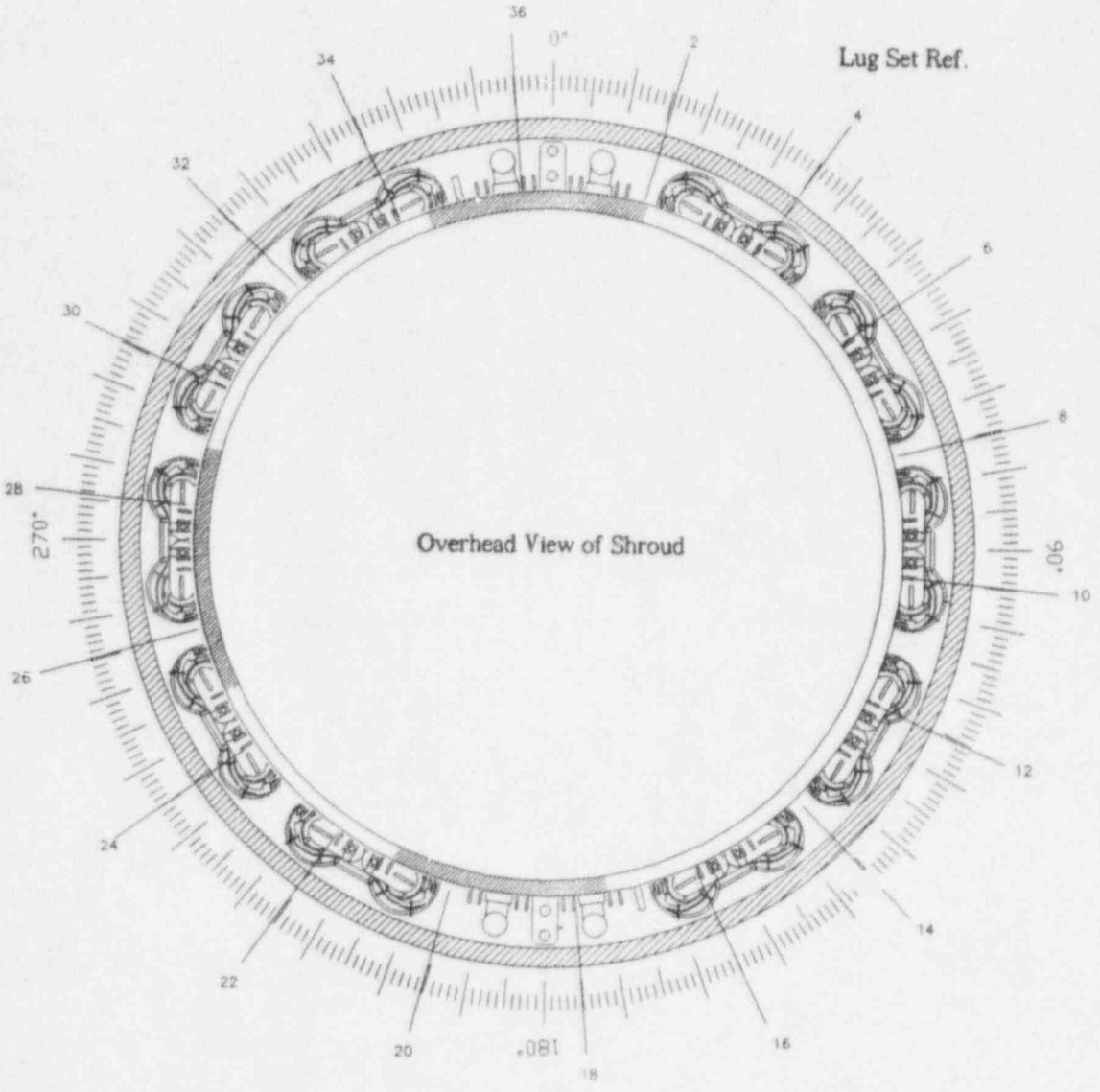
Limitations: Guide Pins, Core Spray Downcomers, Instrumentation Lines and Lifting Lugs

GE Nuclear Energy

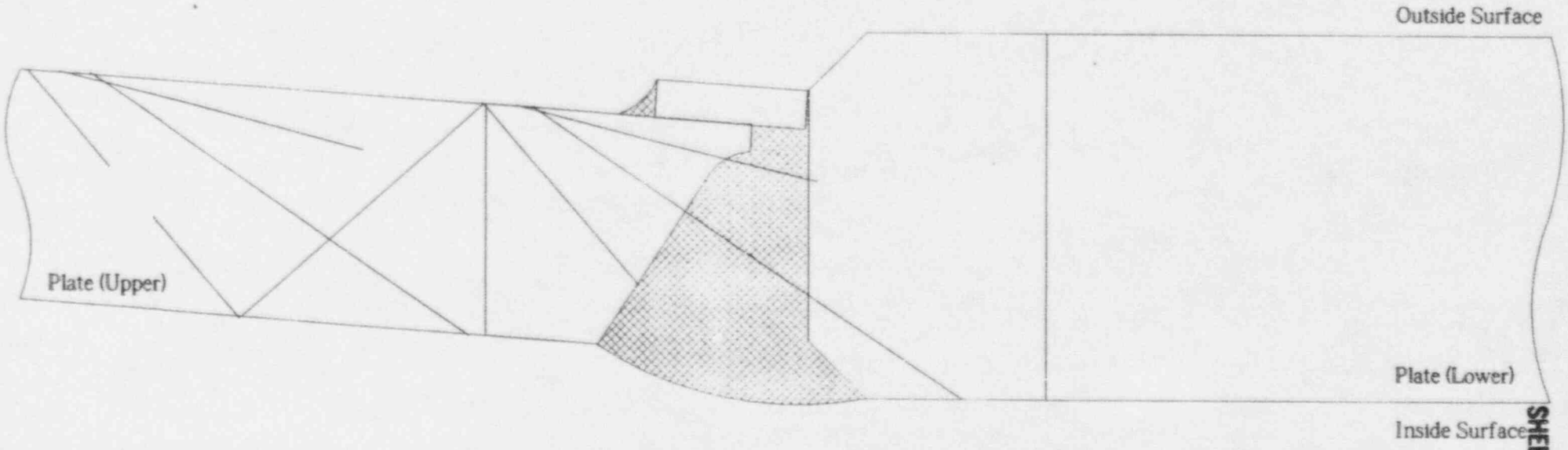
Nebraska Public Power District
Cooper Nuclear Station RFO16 Shroud UT Project 1F5CN October/November 1995

Shroud Weld H7

Areas Not Examined



H7 - Actual Examination Coverage - 45S, 60L, & ODCr



GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-07
DATA SHEET NO.: SD-51
CALIBRATION SHEET NO.: SC-37 THRU 39

Weld ID: H7 Exam Surface: OD Stroke: 3.5" Crown Width: * ~1.25"

Search Unit Separation (Front To Front): N/A Wo Location: LKDN @ BACKING RING

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	16:39 Time	14.3 45°	N/A 45°	0 Start°	7LS3	45° LKDN	43	C, E, F	
Lug Set # 3	11/3 Date	15.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	15.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	17:01 Time	24.3 45°	N/A 45°	0 Start°	7LS4	45° LKDN	43	C, D, E, F	
Lug Set # 4	11/3 Date	25.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	25.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	17:11 Time	34.3 45°	N/A 45°	0 Start°	7LS5	45° LKDN	43	C, D, E, F	
Lug Set # 5	11/3 Date	35.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	34.4 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	17:48 Time	44.3 45°	N/A 45°	0 Start°	7LS6R	45° LKDN	43	C, D, E, F	
Lug Set # 6	11/3 Date	45.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ○ ccw	Examiner's Initials	45.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, J	J = Shear Component to ID crown.
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	19	60° LKUP	
45° LKUP		ODCR LKDN	38
60° LKDN	37	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * Measurement of the backing ring.

EXAMINER	II	11-7-95	GE INDEPENDENT REVIEW	11-9-95	
	LEVEL	DATE		DATE	
GE REVIEWED BY	III	11-9-95	UTILITY REVIEW	11/14/95	
	LEVEL	DATE		DATE	

FORM UT32.R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-07
DATA SHEET NO.: SD-52
CALIBRATION SHEET NO.: SC-37 THRU 39

Weld ID: H7 Exam Surface: OD Stroke: 4.0" Crown Width: * ~1.25"

Search Unit Separation (Front To Front): N/A Wo Location: LKDN @ BACKING RING

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	18:00 Time	54.3 45°	N/A 45°	0 Start°	7LS7	45° LKDN	43	C, D, E, F	
Lug Set # 7	11/3 Date	55.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	55.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, D, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	04:08 Time	64.3 45°	N/A 45°	0 Start°	7LS8	45° LKDN	43	C, D, E, F	
Lug Set # 8	11/4 Date	65.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	65.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, D, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	04:42 Time	74.3 45°	N/A 45°	0 Start°	7LS9	45° LKDN	43	C, D, E, F	
Lug Set # 9	11/4 Date	75.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	75.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, D, J	J = Shear Component to ID crown.
						ODCR LKUP			
Cylinder ● cw ○ ccw	05:10 Time	84.3 45°	N/A 45°	0 Start°	7LS10	45° LKDN	43	C, D, E, F	
Lug Set # 10	11/4 Date	85.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ○ ccw	Examiner's Initials	85.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN	50	C, D, J	J = Shear Component to ID crown.
						ODCR LKUP			

CALIBRATION dB:

45° LKDN	19	60° LKUP	
45° LKUP		ODCR LKDN	38
60° LKDN	37	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * Measurement of the backing ring.

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	UTILITY REVIEW	11/14/95 DATE	PAGE: 6 OF: 10

FORM UT32.R5

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-07
DATA SHEET NO.: SD-53
CALIBRATION SHEET NO.: SC-37 THRU 39

Weld ID: H7 Exam Surface: OD Stroke: 4.0" Crown Width: * ~1.25"

Search Unit Separation (Front To Front): N/A Wo Location: LKDN @ BACKING RING

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● cw ○ ccw	05:42 Time	94.3 45°	N/A 45°	0 Start°	7LS11	45° LKDN	43	C, E, F	
Lug Set # 11	11/4 Date	95.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, E	
Lug Side ○ cw ● ccw	Examiner's Initials	95.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	23:23 Time	104.3 45°	N/A 45°	0 Start°	7LS12	45° LKDN	43	C, D, E, F	
Lug Set # 12	11/3 Date	105.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	105.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, D, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	23:45 Time	114.3 45°	N/A 45°	0 Start°	7LS13	45° LKDN	43	C, D, E, F	
Lug Set # 13	11/3 Date	115.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ● ccw	Examiner's Initials	115.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, D, J	J = Shear Component to ID crown.
Cylinder ● cw ○ ccw	10:48 Time	124.3 45°	N/A 45°	0 Start°	7LS14R	45° LKDN	43	C, D, E, F	
Lug Set # 14	11/4 Date	125.0 60°	N/A 60°			45° LKUP 60° LKDN	46	C, D, E	
Lug Side ○ cw ○ ccw	Examiner's Initials	125.5 ODCR	N/A ODCR	10.5 Stop°	D-07 / A	60° LKUP ODCR LKDN ODCR LKUP	50	C, D, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN	19	60° LKUP	
45° LKUP		ODCR LKDN	38
60° LKDN	37	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * Measurement of the backing ring.

Christopher McKenna	II	11-3-95	George E. Astleford		11-9-95
EXAMINER	LEVEL	DATE	GE INDEPENDENT REVIEW		DATE
Stephen D. Bayford	III	11-9-95	11/11/95 K. B. Thomas		11/14/95
GE REVIEWED BY	LEVEL	DATE	UTILITY REVIEW		DATE

FORM UT32_R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-07
DATA SHEET NO.: SD-54
CALIBRATION SHEET NO.: SC-37 THRU 39

Weld ID: H7 Exam Surface: OD Stroke: 3.5" Crown Width: * ~1.25"

Search Unit Separation (Front To Front): N/A Wo Location: LKDN @ BACKING RING

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ● CW ○ CCW Lug Set # 15 Lug Side ○ CW ● CCW	10:58 Time 11/4 Date TSR Examiner's Initials	134.3 45° 135.0 60° 135.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS15R D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW Lug Set # 16 Lug Side ○ CW ● CCW	11:06 Time 11/4 Date TSR Examiner's Initials	144.3 45° 145.0 60° 145.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS16R D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW Lug Set # 17 Lug Side ○ CW ● CCW	11:17 Time 11/4 Date TSR Examiner's Initials	154.3 45° 155.0 60° 155.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 15.0 Stop°	7LS17R D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW Lug Set # 22 Lug Side ○ CW ● CCW	12:49 Time 11/4 Date TSR Examiner's Initials	204.3 45° 205.0 60° 205.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS22 D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN 19 60° LKUP
45° LKUP ODCR LKDN 38
60° LKDN 37 ODCR LKUP

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * Measurement of the backing ring.

EXAMINER	III LEVEL	11-7-95 DATE	GE INDEPENDENT REVIEW	11-9-95 DATE	
GE REVIEWED BY	III LEVEL	11-9-95 DATE	11/9/1995 UTILITY REVIEW	11/9/95 DATE	PAGE: 8 OF: 10

FORM UT3) R0

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER | PROCEDURE NO.: UT-CNS-503V4 | REPORT NO.: SR-07

UNIT: 1 | REVISION / FRR NO.: 0 | DATA SHEET NO.: SD-55

PROJECT NO.: 1F5CN | CALIBRATION SHEET NO.: SC-37 THRU 39

Weld ID: H7 | Exam Surface: OD | Stroke: 3.5" | Crown Width: * ~1.25"

Search Unit Separation (Front To Front): N/A | Wo Location: LKDN @ BACKING RING

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
Cylinder ■ CW □ CCW Lug Set # 23 Lug Side □ CW ■ CCW	13:00 Time 11/4 Date Examiner's Initials	214.3 45° 215.0 60° 215.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS23 D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 24 Lug Side □ CW ■ CCW	13:15 Time 11/4 Date Examiner's Initials	224.3 45° 225.0 60° 225.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS24 D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 25 Lug Side □ CW ■ CCW	13:20 Time 11/4 Date Examiner's Initials	234.3 45° 235.0 60° 235.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS25 D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ■ CW □ CCW Lug Set # 30 Lug Side □ CW ■ CCW	15:43 Time 11/4 Date Examiner's Initials	284.3 45° 285.0 60° 285.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS30 D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.

CALIBRATION dB:

45° LKDN	19	60° LKUP	
45° LKUP		ODCR LKDN	38
60° LKDN	37	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS
B - NON-GEOMETRIC INDICATIONS
C - NON-RELEVANT INDICATIONS
D - ACOUSTIC INTERFACE
E - INSIDE SURFACE GEOMETRY
F - OUTSIDE SURFACE GEOMETRY
G - WELD DISCONTINUITY
H - WELD CROWN GEOMETRY
J - OTHER (SEE COMMENTS)

REMARKS: * Measurement of the backing ring.

EXAMINER	II	11-7-95	GE INDEPENDENT REVIEW	11-9-95	
	LEVEL	DATE		DATE	
GE REVIEWED BY	III	11-9-95	UTILITY REVIEW	11/14/95	
	LEVEL	DATE		DATE	

FORM UT 32 R3

GE Nuclear Energy

SHROUD ULTRASONIC EXAMINATION DATA SHEET (AUTOMATED with Smart 2000 OD TRACKER)

SITE: COOPER
UNIT: 1
PROJECT NO.: 1F5CN

PROCEDURE NO.: UT-CNS-503V4
REVISION / FRR NO.: 0

REPORT NO.: SR-07
DATA SHEET NO.: SD-56
CALIBRATION SHEET NO.: SC-37 THRU 39

Weld ID: H7 Exam Surface: OD Stroke: 3.5" Crown Width: * ~1.25"

Search Unit Separation (Front To Front): N/A Wo Location: LKDN @ BACKING RING

Lug / Cell No.	Scan Data:	LKDN Search Unit Start:	LKUP Search Unit Start:	Indexer Start° / Stop°	File Name and Disk / Side:	Search Unit	Scan dB	Results: (See Legend)	Comments:
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Cylinder ● CW ○ CCW Lug Set # 32 Lug Side ○ CW ● CCW	16:06 Time 11/4 Date ZSR Examiner's Initials	304.3 45° 305.0 60° 305.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS32 D-07 / A	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
Cylinder ● CW ○ CCW Lug Set # 33 Lug Side ○ CW ● CCW	16:14 Time 11/4 Date ZSR Examiner's Initials	314.3 45° 315.0 60° 315.5 ODCR	N/A 45° N/A 60° N/A ODCR	0 Start° 10.5 Stop°	7LS33 D-07 / B	45° LKDN 45° LKUP 60° LKDN 60° LKUP ODCR LKDN ODCR LKUP	43 46 50	C, D, E, F C, D, E C, D, J	J = Shear Component to ID crown.
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CALIBRATION dB:

45° LKDN	19	60° LKUP	
45° LKUP		ODCR LKDN	38
60° LKDN	37	ODCR LKUP	

EXAMINATION RESULTS LEGEND:

A - NO RECORDABLE INDICATIONS	D - ACOUSTIC INTERFACE	G - WELD DISCONTINUITY
B - NON-GEOMETRIC INDICATIONS	E - INSIDE SURFACE GEOMETRY	H - WELD CROWN GEOMETRY
C - NON-RELEVANT INDICATIONS	F - OUTSIDE SURFACE GEOMETRY	J - OTHER (SEE COMMENTS)

REMARKS: * Measurement of the backing ring.

EXAMINER	LEVEL III	DATE 11-7-95	GE INDEPENDENT REVIEW	DATE 11-9-95	
GE REVIEWED BY	LEVEL III	DATE 11-9-95	UTILITY REVIEW	DATE 11/14/95	PAGE: 10 OF: 10

FORM UT3J R3

Nebraska Public Power District

DESIGN CALCULATIONS SHEET

Sheet — of —

Calc No. NEDC 95-191 Prepared By: — Checked/Reviewed By: —

Rev. 0 Date: — 19— Date: — 19—

ATTACHMENT 2.4

GE Nuclear Energy

TECHNICAL SERVICES BUSINESS
GE Nuclear Energy
175 Curtner Avenue, San Jose, CA 95125

GENE-523-174-1293
Revision 2
DRF 137-0010-6
Class II
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Evaluation and Screening Criteria for the Cooper Shroud

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H.S. Mehta, Principal Engineer
Engineering & Licensing Consulting Services

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1.0 INTRODUCTION

In preparation for the Cooper shroud inspection, Nebraska Public Power District has requested GE to develop screening criteria for indications that may be found at the shroud welds. Recently, indications have been discovered in some BWR shrouds as a result of in-vessel visual inspection (IVVI). When indications are found by IVVI, only the lengths of the indications are known. Given that non-destructive examination (NDE) of every visually detected indication would be difficult and time consuming, a method of screening indications for subsequent evaluation is required. This report presents such a screening criterion.

The guiding parameter used for the selection of the indications for further evaluation is the allowable through-wall flaw size, which already includes safety factors. If all of the visually detected indications are assumed to be through-wall, then the longest flaws, or combination of flaws, would have the limiting margin against the allowable through-wall flaw size. In reality, the indications are likely not through-wall, and therefore the criteria and methods presented in this report are conservative.

The result of this procedure will be the determination of the effective flaw lengths for the limit load criteria and equivalent flaw lengths for the linear elastic fracture mechanics (LEFM) criteria. These flaw lengths will be used to compare against the allowable flaw size and select indications for more detailed evaluation.

The determination of limit load effective flaw length is based on ASME Code, Section XI, Subarticle IWA-3300 (1989 Edition) proximity criteria. These criteria provide the basis for the combination of neighboring indications depending on various geometric dimensions. The proximity rules described here also conservatively assume that there is interaction between two perpendicular flaws. It is assumed that circumferential and axial indications could increase the limit load effective flaw length depending on the unflawed distance between them. This limit load effective circumferential flaw length must be compared against the allowable circumferential flaw length. The limit load effective axial flaw length would be compared against the allowable axial flaw length. Crack growth over a subsequent cycle is included in the limit load effective flaw length determination.

The determination of the LEFM equivalent flaw length is based on the influence of adjacent flaw tips on the stress intensity factor. These criteria provide the basis for the summation of individual flaws. Crack growth over a subsequent cycle is also included in the LEFM equivalent flaw length determination.

Uncertainty in sizing can also be incorporated into the screening criteria. This is done by adding the uncertainty on crack length sizing to the crack growth expected over the next cycle. However, the several significant conservatisms introduced in the methodology are considered to compensate for uncertainty in sizing.

Flaws are considered in the same plane if the perpendicular distance between the planes is 3.0 inches (twice the shroud thickness of 1.5") or less. Any flaws which lie at an angle to the horizontal plane should be separated into a circumferential and axial component. These components can then be used separately in the determination of limit load effective flaw lengths and LEFM equivalent flaw lengths.

The selection of indications for further investigation can be performed by evaluating the resulting limit load effective flaw lengths or LEFM equivalent flaw lengths. **Indications with flaw lengths greater than the allowable flaw sizes would require further characterization by NDE or more detailed analysis.** The procedure described here is conservative, since all of the indications are assumed through-wall and are being compared against the allowable through-wall flaw size.

This report describes the following steps:

- Determination of limit load effective flaw length including proximity criteria for adjacent flaws and LEFM equivalent flaw lengths including crack tip interaction.
- Determination of allowable flaw sizes based on both linear elastic fracture mechanics (LEFM) and limit load criteria.
- Screening criteria.

The report covers the limiting stresses for all the shroud welds (H1 through H7 welds). Therefore, the screening criteria developed here cover all shroud weld indications. A list of conservative assumptions used in this evaluation is summarized in Table 1-1.

Table 1-1: Conservative Assumptions Included In Screening Evaluation

1. Postulated surface indications were assumed to be through-wall for analysis.

2. Future crack growth was included in effective and equivalent flaw lengths used for evaluation.

3. ASME Code primary pressure boundary safety margins were applied even though the shroud is not a primary pressure boundary.

4. ASME Code, Section XI proximity rules were applied for limit load effective flaw lengths, and the influence of adjacent flaw tips on the stress intensity factor was applied for the LEFM equivalent flaw length.

5. A proximity rule to account for perpendicular flaws was applied, although not required by Section XI for limit load.

6. A proximity rule which accounts for flaw tip interaction between adjacent flaws was used for LEFM.

7. Fracture toughness measured for similar materials having a higher fluence was used (fluence comparable to end-of-life prediction).

8. For welds H4, H5, and H6A, both LEFM and limit load analyses were applied, even though LEFM underestimates allowable flaw size, and is not required for austenitic materials.

9. The screening criteria are limited to one-fourth of the allowable circumferential flaw length in any arbitrary 90° sector for limit load criteria.

10. The limiting flaw length computed in each portion of the shroud is applied to all locations in that portion of the shroud.

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2.0 LIMIT LOAD EFFECTIVE FLAW LENGTH

The limit load effective flaw lengths are based on ASME Code, Section XI proximity criteria as presented in Subarticle IWA-3300. The procedure addresses both circumferential and axial flaws. Indications are considered to be in the same plane if the perpendicular distance between the planes is less than 3.0 inches. All flaws are considered to be through-wall. Therefore, indications on the inside and outside surface should be treated as if they are on the same surface. When two indications are close to each other, rules are established to combine them based on proximity. These rules apply only to the limit load evaluation. The crack tip interaction criteria for LEFM are described in Section 3.2.

Flaw length inspection uncertainty can be incorporated in the proximity rules by adding the uncertainty to crack growth, e.g., replace Δa by $(\Delta a + U)$ or $2\Delta a$ by $(2\Delta a + 2U)$.

2.1 Proximity Rules

The flaw combination methodology used here is similar to the ASME Code, Section XI proximity rules concerning neighboring indications. Under the rules, if two surface indications are in the same plane (perpendicular distance between flaw planes < 3.0 inches) and are within two times the depth of the deepest indication, then the two indications must be considered as one indication.

In Figure 2-1, two adjacent flaws L1 and L2 are separated by a ligament S. Crack growth would cause the tips to be closer. Assuming a conservative crack growth rate of 5×10^{-5} in/hr and 8000 hours of hot operation, the crack extension, Δa, at each tip is 0.6 inches for an 18 month fuel cycle (12,000 hours), and 0.8 inches for a 24 month fuel cycle (16,000 hours). Therefore, combining the crack growth and proximity criteria, the flaws are assumed to be close enough to be considered as one continuous flaw if the ligament is less than (2 x Δa + 2 x shroud thickness). For a shroud thickness of 1.5 inches, this bounding ligament is 4.2 inches for an 18 month fuel cycle and 4.6 inches for a 24 month fuel cycle. Thus, if the ligament is less than $2\Delta a + 2t$, the effective length is $(L1 + L2 + S + 2\Delta a)$. Note that the addition of $2\Delta a$ is to include crack growth at the other (non-adjacent) end of each flaw (See Figure 2-2).

If the ligament is greater than $2\Delta a + 2t$, then the limit load effective flaw length is determined by adding the projected tip growth to each end of the flaw. For this example, $L1_{eff} = L1 + 2\Delta a$, and $L2_{eff} = L2 + 2\Delta a$.

A similar approach is used to combine flaws when a circumferential flaw is close to an axial flaw (See Figure 2-3). If the ligament between the flaws is less than $\Delta a + 2t$, then the limit load effective flaw length for the circumferential flaw is $L_{eff} = L1 + S + \Delta a$ (the bounding ligament for these cases). If the ligament is greater than $\Delta a + 2t$, then the flaws are treated separately.

After the circumferential and axial flaws have been combined per the above criteria, a map of the limit load effective flaws in the shroud can be made, and the effective flaw length can be used for subsequent analysis.

To demonstrate the proximity criteria, three examples are shown in Table 2-1 and described below.

Table 2-1: Flaw Combinations Considered in Proximity Criteria

Case	Circumferential Flaw	Axial Flaw
A	Yes	No
B	Yes	Yes
C	No	Yes

2.1.1 Case A: Circumferential Flaw -- No Axial Flaw

This case applies when two circumferential indications are considered. Figure 2-2a shows this condition. If the distance between the two surface flaw tips is less than $2\Delta a + 2t$, the indications must be combined such that the limit load effective length is (See Figure 2-2b):

$$L_{eff} = L1 + S + L2 + 2\Delta a$$

where: L1 = length of first circumferential indication
L2 = length of second circumferential indication
S = distance between two indications
Δa = estimated crack growth per tip for next operating period

If the distance between the two tips is greater than $2\Delta a + 2t$, the limit load effective flaw lengths are (See Figure 2-2c):

$$L1_{eff} = L1 + 2\Delta a$$
$$L2_{eff} = L2 + 2\Delta a$$

2.1.2 Case B: Circumferential Flaw -- Axial Flaw

This case applies when both a circumferential and an axial flaw are being considered. Figure 2-3a demonstrates this condition. For this case, only growth of the circumferential flaw is considered. If the distance between the circumferential indication tip and the axial indication is less than $\Delta a + 2t$, then the effective circumferential flaw length is (See Figure 2-3b):

$$L_{eff} = L1 + S + \Delta a$$

where: L1 = length of circumferential indication
S = distance between the circumferential tip and axial flaw,

and the limit load effective axial length is (Figure 2-3b):

$$L_{eff} = L2 + 2\Delta a$$

where: L2 = length of axial indication

If the distance between the circumferential indication tip and the axial indication is greater than $\Delta a + 2t$, then the flaws are not combined (See Figure 2-3c) and the effective lengths are:

$$L1_{eff} = L1 + 2\Delta a \text{ (for circumferential flaw)}$$

$$L2_{eff} = L2 + 2\Delta a \text{ (for axial flaw)}$$

2.1.3 Case C: No Circumferential Flaw -- Axial Flaw

This case applies when only axial flaws are being considered. The effective length is determined in a manner similar to that used for Case A for circumferential flaws.

2.2 Application of Limit Load Effective Flaw Length Criteria

The application of the limit load effective length criteria is applied to two adjacent indications at a time. Figure 2-4 is a schematic which illustrates the process. For example, using the 0° azimuth as the starting location for a circumferential weld or plane, the general procedure would be as follows:

- Moving in the positive azimuthal direction, the first indication encountered is indication 1.
- The next indication is indication 2.
- Apply proximity rules to the pair of indications (indications 1 and 2). Combine the flaws if necessary ($L1 + L2 + S + 2\Delta a$). If the flaws are combined, the resulting flaw becomes indication 2.
- Continue along positive azimuthal direction until the next indication is encountered. This becomes indication 3.
- Apply proximity rules to indications 2 and 3. If indication 2 is a combined flaw, do not add an additional Δa, since it is included in the limit load effective flaw length previously determined.
- Continue proximity rule evaluation until all indications along the subject weld or plane have been considered.

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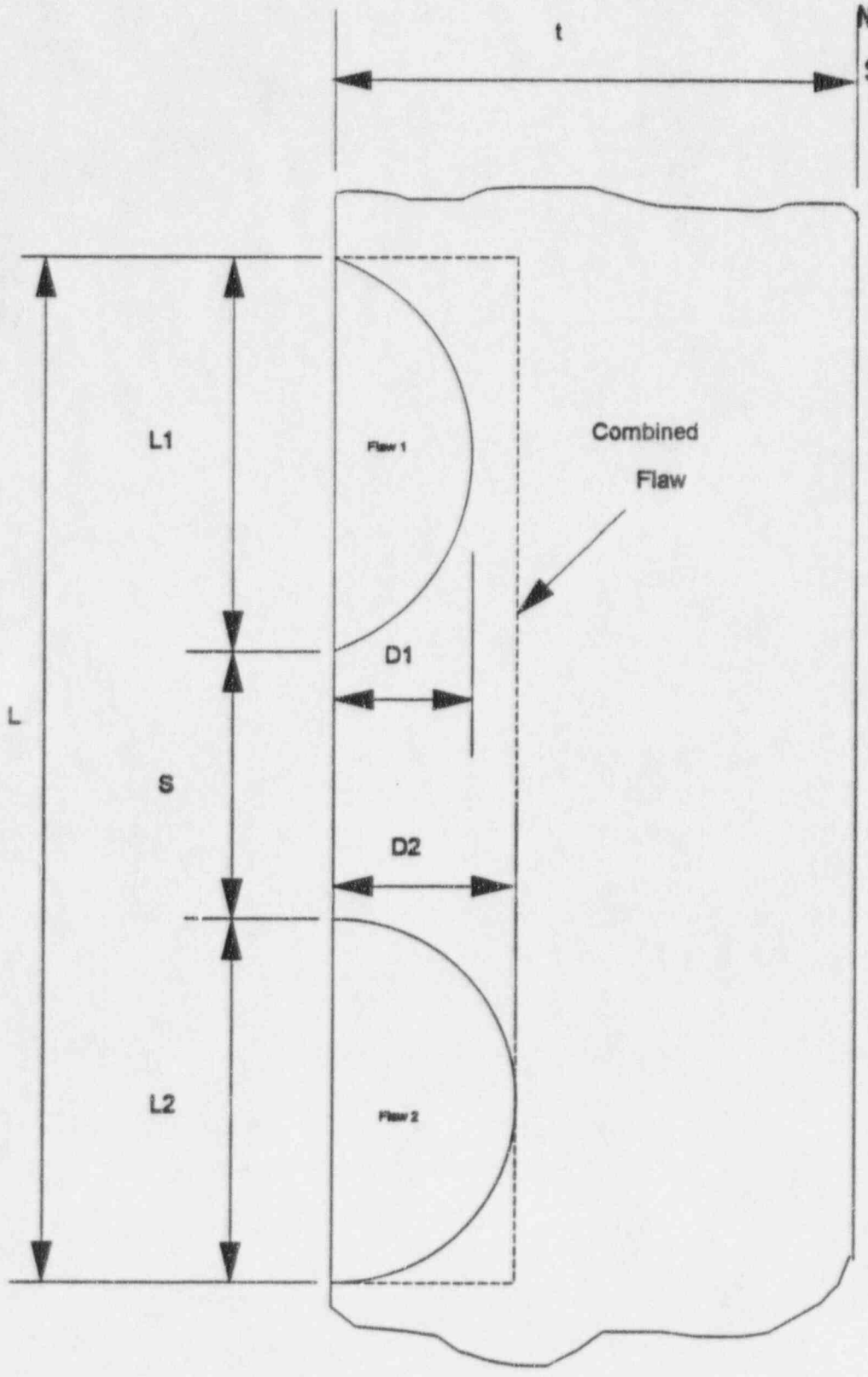

Figure 2-1: ASME Code Proximity Criteria

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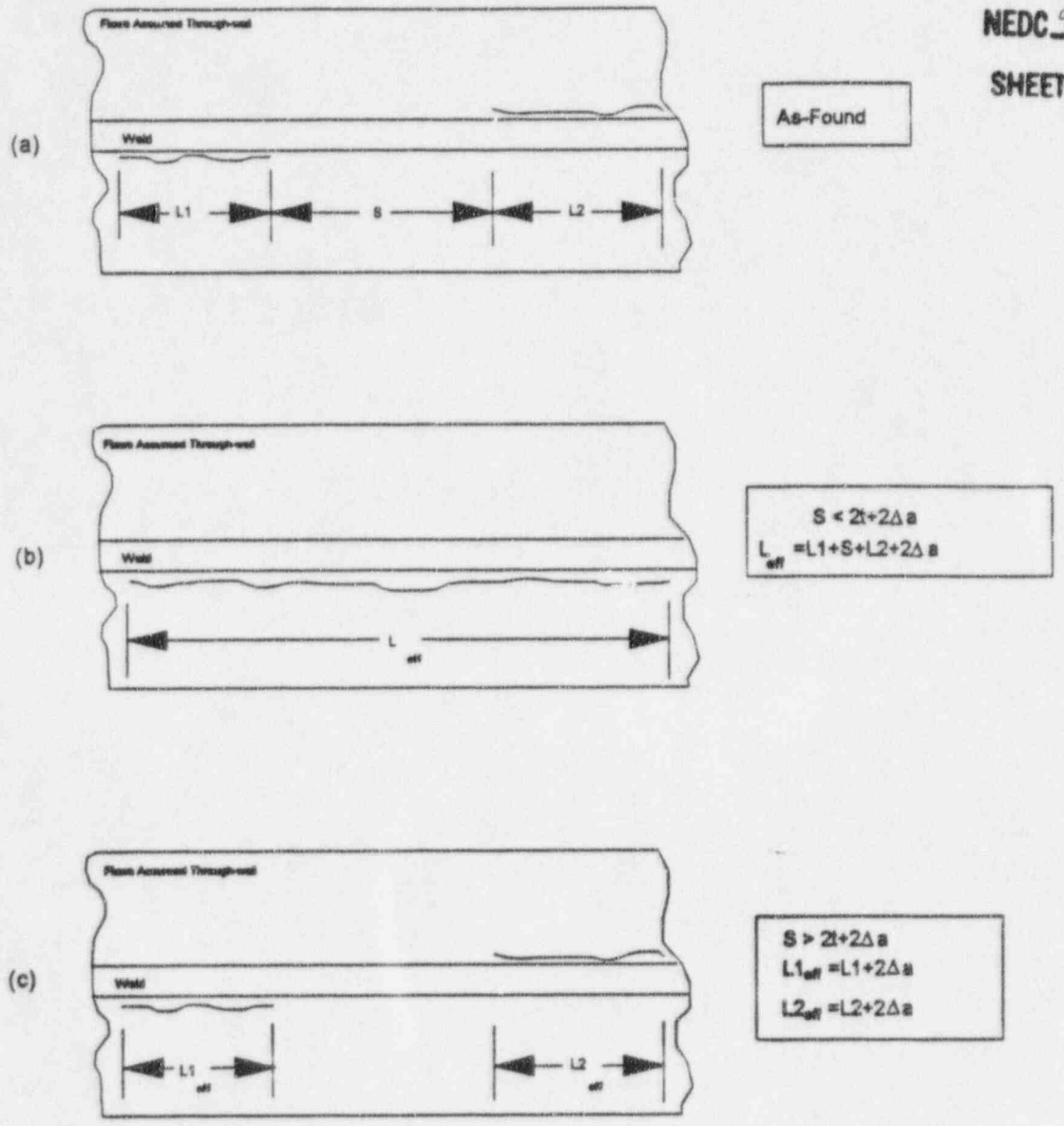

Figure 2-2: Application of Proximity Procedure to Neighboring Circumferential Flaws

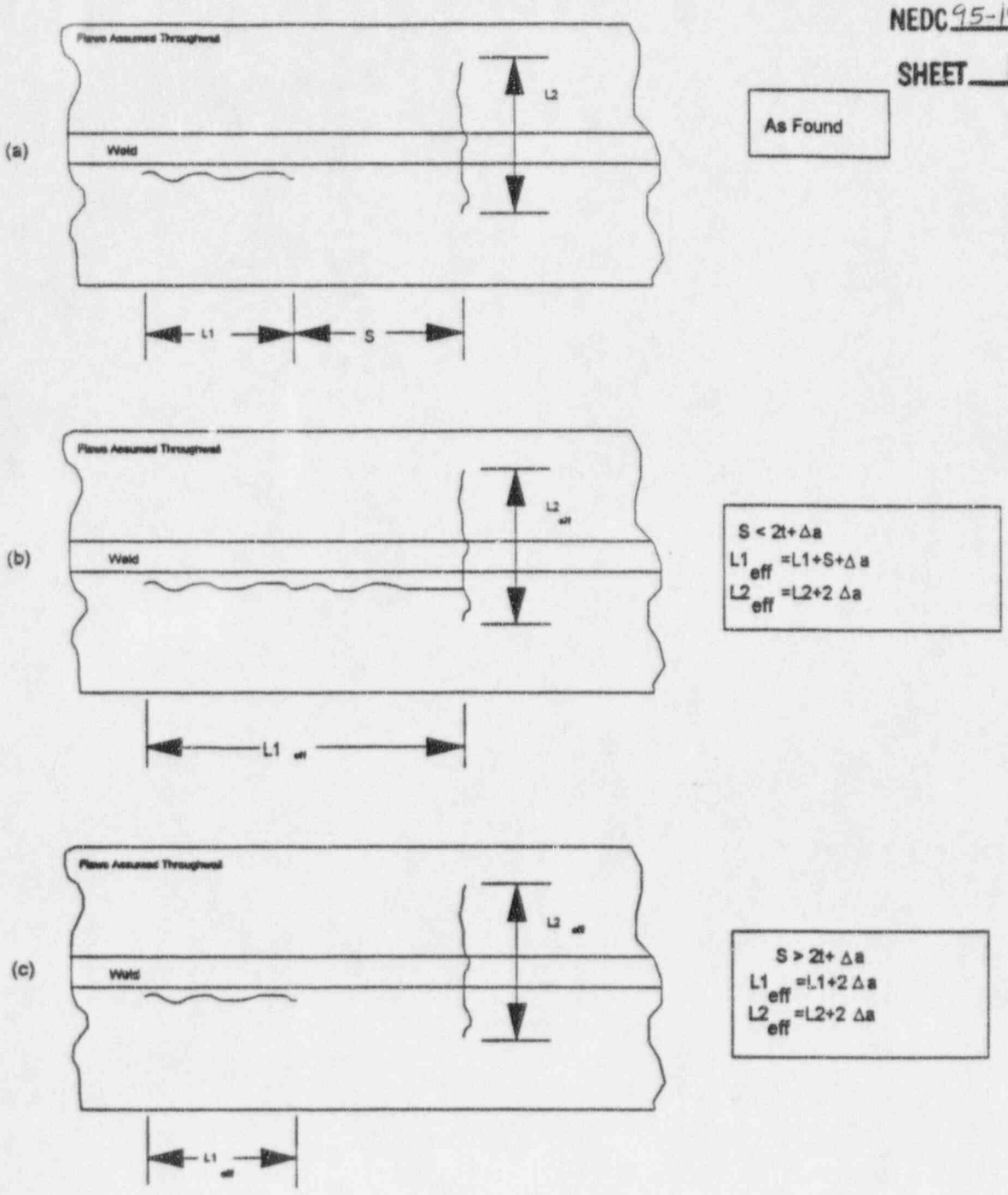

Figure 2-3: Application of Proximity Procedure to Neighboring Axial and Circumferential Flaws

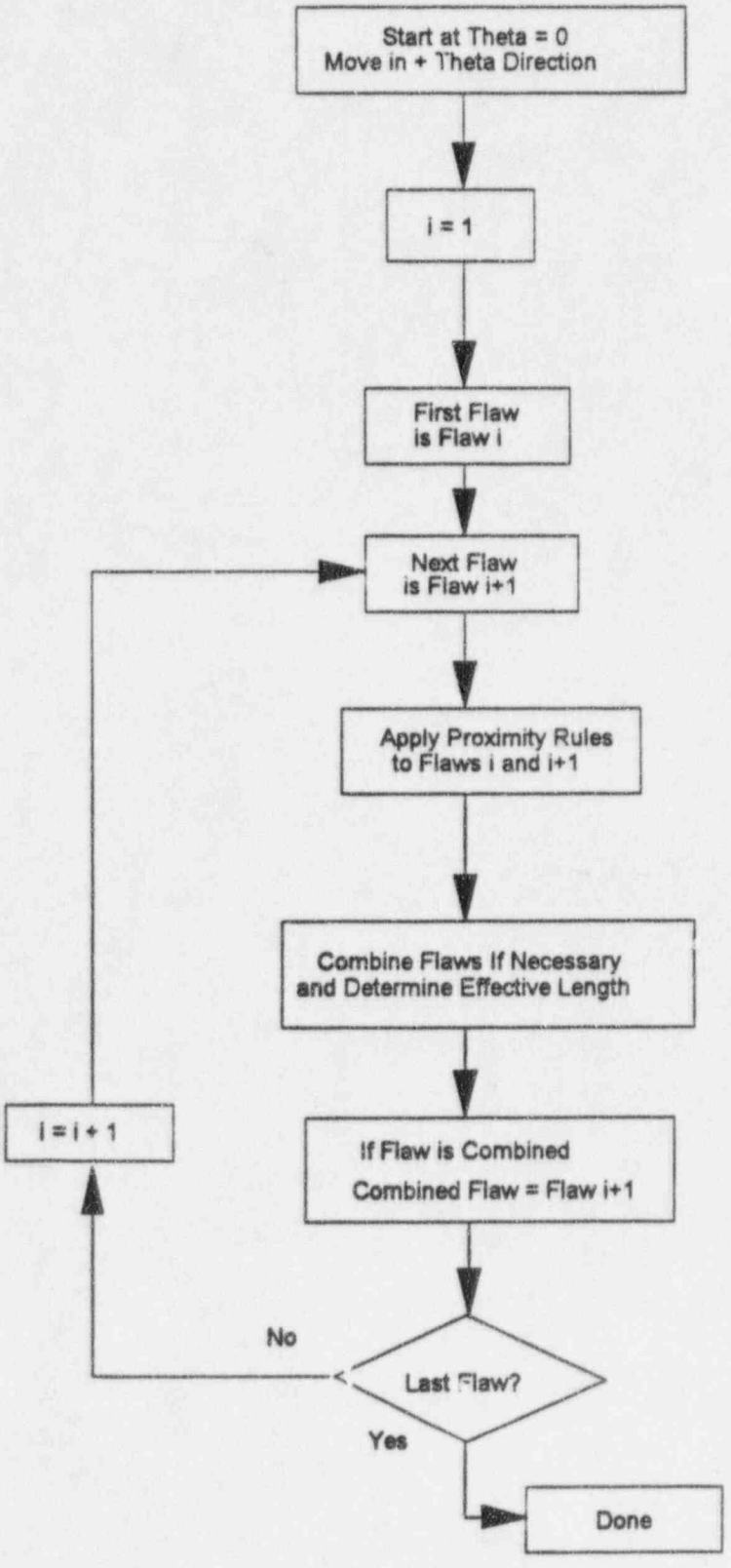

Figure 2-4: Process for Determining Effective Flaw Length

3.0 STRUCTURAL ANALYSIS

The preceding section of this report described the determination of limit load effective flaw lengths from the IVVI results. These limit load effective flaw lengths have to be compared to the allowable flaw lengths to assess the structural integrity of the shroud. This section describes the details and the results of the structural analysis performed to determine the allowable flaw lengths. The structural analysis consists of two steps: (1) the determination of axial and circumferential stress magnitudes in the shroud, and (2) the calculation of the allowable flaw lengths. Both the fracture mechanics and limit load methods are used in the calculation of allowable flaw lengths.

3.1 Applied Loads and Calculated Stresses

The applied loads on the shroud consist of differential pressure and dynamic (seismic). The dynamic loads consist of a horizontal shear force and an overturning bending moment. The shear force acts in a direction which does not influence crack growth significantly, so it is not considered. The bending moment stress at a shroud cross-section varies as a function of its vertical distance from the top of the shroud. Pressure on the crack face is not considered for two reasons: (1) It is overly conservative to consider the stress on a postulated through-wall flaw when the flaw is unlikely to be through-wall, and (2) the pressure stress on the crack face is negligible. Because of the inherent ductility of the material (which will be discussed in Section 3.2 of this report), residual stresses and other secondary stresses do not affect structural margin. Thus, they need not be considered in the analysis.

The magnitudes of the applied loads were obtained from the dynamic stress analysis (Reference 3-1) and system information report (Reference 3-2). The nominal shroud radius and thickness (Reference 3-3) were used to calculate the stresses from the applied loads. Stresses are calculated based on strength of materials formulas. Figure 3-1 shows the weld designation and relative locations in the shroud. Table 3-1 shows the calculated dynamic bending stress magnitudes for both the upset and faulted conditions. The appropriate pressure differences for the normal/upset and faulted conditions are shown in Table 3-2.

Table 3-1: Dynamic Bending Stresses at Shroud Welds

Weld Designation	Moment, (in-kip)		Stress, (ksi)	
	Upset	Faulted	Upset	Faulted
H1	7.60×10^3	1.52×10^4	0.18	0.37
H2	1.01×10^4	2.02×10^4	0.24	0.49
H3	1.04×10^4	2.08×10^4	0.28	0.57
H4	1.49×10^4	2.98×10^4	0.41	0.82
H5	2.95×10^4	5.90×10^4	0.81	1.62
H6A	3.71×10^4	7.42×10^4	1.02	2.03
H6B	3.83×10^4	7.66×10^4	1.05	2.10
H7	5.22×10^4	1.04×10^5	1.54	3.08

Table 3-2: Pressure Differences

Component	Pressure Differences (psi)	
	Normal/Upset Condition	Faulted Condition
Shroud Head and Upper Shroud	11.25	30.3
Core Plate	23.71	26.7
Lower Shroud	31.21	54.0

The structural analysis for the indications uses two methods; linear elastic fracture mechanics (LEFM) and limit load analysis. Both the limit load and the LEFM methods were used in determining the allowable flaw sizes in the shroud. Since the limit load is concerned with the gross failure of the section, the allowable flaw length based on this approach may be used for comparison with the sum of the limit load effective flaw lengths, determined in Section 2.2, of all the flaws at a cross-section. On the other hand, the LEFM approach considers the flaw tip fracture toughness and thus, the allowable flaw length based on this approach may be used for comparison with the LEFM equivalent flaw length, determined in Section 3.2.2, at a cross-section. The fluence levels at welds H1, H2, H6B, and H7 are such that no significant embrittlement effects are expected. Therefore, only the limit load approach was used at these welds. The technical approach for the two methods is described next.

3.2 LEFM Analysis

The shroud material (austenitic stainless steel) is inherently ductile and it can be argued that the structural integrity analysis can be performed entirely on the basis of limit load. In fact, J-R curve measurements (Figure 3-2) made on a core shroud sample taken from an overseas plant having higher fluence ($8x10^{20}$ n/cm^2) than Cooper showed stable crack extension and ductile failure. The ASME Code recognizes this fact in using only limit load techniques in Section XI, Subsubarticle IWB-3640 analysis. Nevertheless, a conservative fracture mechanics evaluation was performed using an equivalent K_{Ic} corresponding to the material J_{Ic}.

3.2.1 Determination of K_{Ic}

The K_{Ic} for the overseas plant shroud was approximately 150ksi$\sqrt{in}$. Use of this equivalence is extremely conservative since:

i) The actual fluence for Cooper is lower than that for the overseas plant from which J-R curves were obtained.

ii) The J-R curves show J_{max} values well above the J_{Ic}, confirming that there is load capability well beyond crack initiation (See Figure 3-2).

Also, for circumferential flaws K_{Ic} is divided by ASME Code safety factors: 2.8 for normal and upset condition stresses, and 1.4 for faulted condition stresses. K_{Ic} is divided by 3.0 and 1.5 respectively for axial flaws. For the analysis presented here, the LEFM analysis is confined to welds H4 to H6A. The fluence corresponding to welds at and below the core plate and above the top guide is an order of magnitude lower and the associated fracture toughness is comparable to that of the unirradiated material. Therefore, for those locations only the limit load analysis is used.

3.2.2 LEFM Equivalent Flaw Length

A consideration that applies only to the fracture mechanics analysis is the question, "When is a flaw independent of an adjacent flaw?" The ASME Code proximity rule described in Section 2 considers how flaws can link up and become a single flaw as a result of proximity. However, even when two flaws are separated by a ligament that exceeds $2\Delta a + 2t$, they may not be considered totally independent of each other. That is, the flaw tip stress intensity factor may be affected by the presence of the adjacent flaw. This can be

accounted for by using the finite width correction factor for a flaw in a finite plate. For a through-wall flaw in an "infinite" plate, the stress intensity factor is:

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$$K = \sigma\sqrt{(\pi a)}$$

For a finite plate, the K value is higher as determined by the finite width correction factor, F (Reference 3-4). In this screening evaluation it is assumed that the plate is "infinite" if the correction factor F is less than 1.1.

As with the limit load proximity criteria, indications are considered to be in the same plane if the perpendicular distance between the planes is less than 3.0 inches. All flaws are considered to be through-wall. Therefore, indications on the inside and outside surface should be treated as if they are on the same surface. When two indications are close to each other, rules are established to combine them based on proximity of adjacent crack tips. These rules are described here and apply only to the LEFM evaluation. The proximity criteria for limit load are described in Section 2.0. Uncertainty in sizing may be incorporated into the LEFM flaw length by adding the uncertainty to each end of the flaw. Thus, Δa in the next paragraph discussion is changed to $(\Delta a + U)$.

As seen in Figure 3-3, if the width of the plate exceeds $2.5(L1 + 2\Delta a)$ (or a/b less than 0.4), then there would be no interaction due to plate end edge effects. If this same condition is applied to two neighboring flaws, then there will be no interaction between the two indications if the tips are at least $0.75(L1 + L2 + 4\Delta a)$ apart. Thus, if the distance between indications is greater than $0.75(L1 + L2 + 4\Delta a)$, then they may be considered as two separate flaws. If however, they are closer, the LEFM equivalent flaw length is the sum of the two individual flaws including crack growth.

3.3 Limit Load Analysis

A through-wall circumferential flaw was assumed in this calculation. Limit load calculations were conducted using the approach outlined in Subsubarticle IWB-3640 and Appendix C of Section XI of the ASME Code. The flow stress was taken as $3S_m$. The S_m value for the shroud material (Type 304 stainless steel) is 16.9 ksi at the approximate normal operating temperature of 550°F.

Safety factors from the ASME Code (for circumferential flaws: 2.8 for normal and upset and 1.4 for emergency and faulted; for axial flaws: 3.0 for normal and upset and 1.5 for emergency and faulted) were used in the analysis.

3.4 Shroud Thickness Considerations

A shroud thickness of 1.5 inches was used in developing the screening criteria. However, there are locations in the shroud with wall thickness greater than 1.5 inches. Therefore, it must be determined if the use of 1.5 inches is applicable to all other shroud locations.

The screening criteria based on the 1.5 inches thickness is considered applicable to locations of greater thickness, since stresses were determined based on the 1.5 inch thickness. This results in conservative stress values when applied to locations with thickness greater than 1.5 inches, such as the weld between the 1.5 inch shroud cylinder and 3 inch top guide support ring.

3.5 References

3-1. RA No. 145, "Seismic Response of RPV and Internals of Cooper Station," GE Design Analysis Unit, San Jose, CA, Completion date 12/23/69.

3-2. 257HA769 Rev. 3, Reactor Internal Pressure Differences - Data Book - Cooper," GE-NED, San Jose, CA.

3-3. **GE Drawings:**
a. 730E854, Rev. 12, "Shroud Purchased Part," GE-NED, San Jose, CA.
b. 919D690, Rev. 2, "Reactor Vessel Purchased Part," GE-APED, San Jose, CA.

3-4. Hiroshi Tada, Paul C. Paris, and George R. Irwin, "The Stress Analysis of Cracks Handbook - Second Edition," Paris Productions Incorporated, St. Louis, Missouri, 1985.

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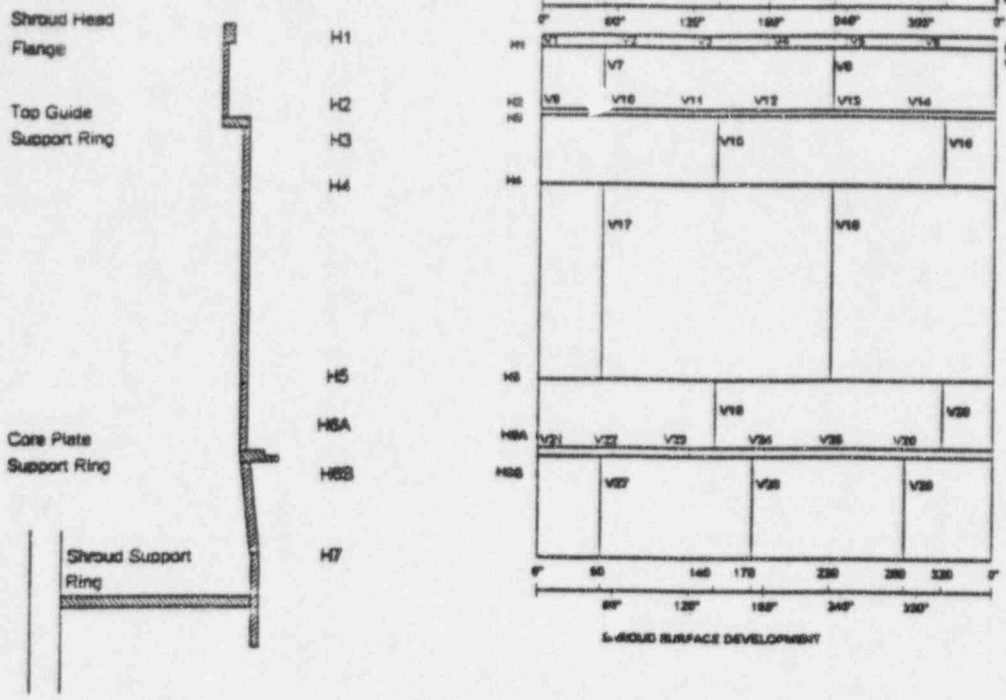

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Figure 3-1: Sketch Showing Typical Welds in the Core Shroud

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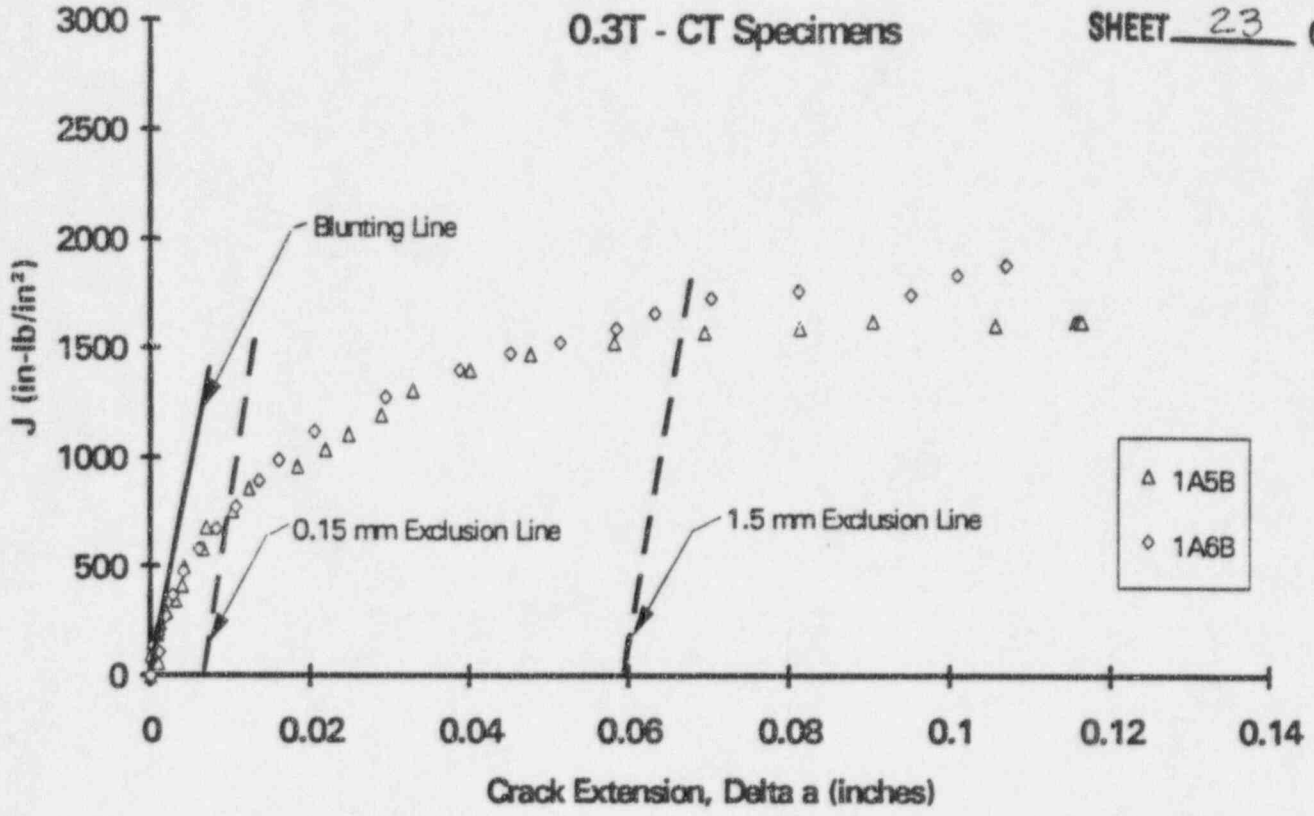

Per ASTM Standard E813

Figure 3-2: Comparison of J-R Curves Developed for Two Irradiated Stainless Steel Specimens

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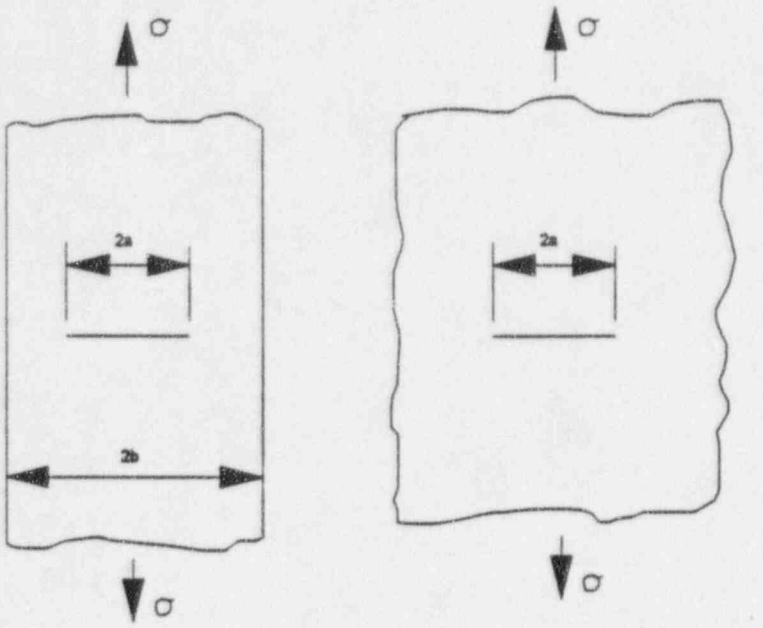
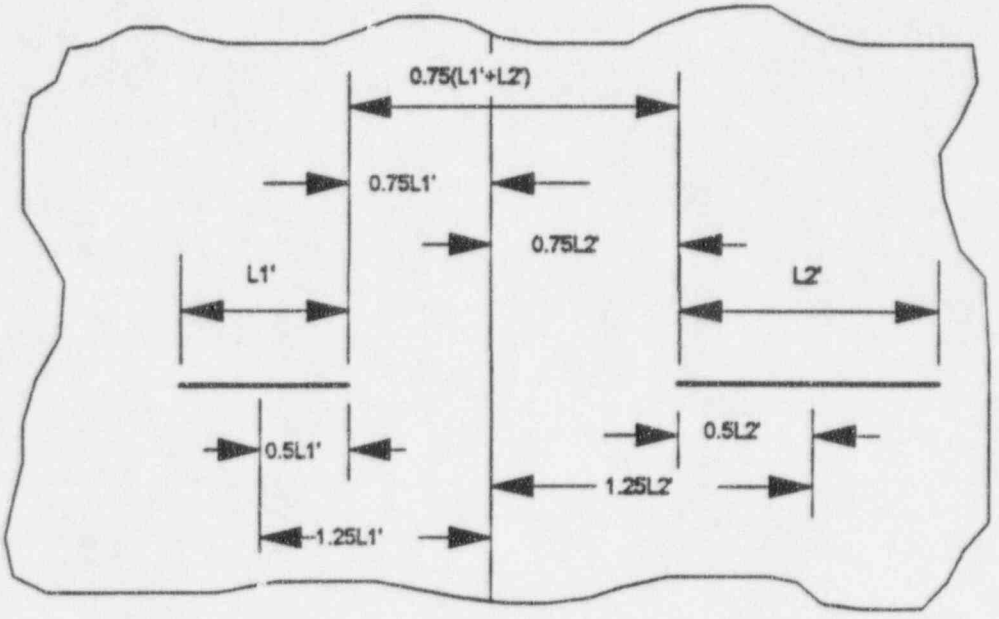


a/b	F (Reference 3-4)
0.0	1.0
0.1	1.006
0.2	1.0246
0.3	1.0577
0.4	1.1094
0.5	1.1867

$K = \sigma\sqrt{\pi a} * F$

$K = \sigma\sqrt{\pi a}$



$L1' = L1 + \Delta 2\ a$
$L2' = L2 + \Delta 2\ a$

L1 and L2 are the lengths of the as-found indications.

Figure 3-3: Schematic Illustrating Flaw Interaction

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4.0 ALLOWABLE THROUGH-WALL FLAWS

Allowable through-wall flaw sizes were determined using both fracture mechanics and limit load techniques for both circumferential and axial flaws. It should be emphasized that the allowable through-wall flaws are based on many conservative assumptions and are intended for use only in the screening criteria. More detailed analysis can be performed to justify larger flaws (both through-wall or part-through when measured flaw depths are available). However, since the intent of the screening criteria is to determine when additional evaluation or NDE characterization is needed, a conservative bounding approach is utilized.

4.1 Allowable Through-Wall Circumferential Flaw Size

Both the LEFM and limit load methods were used to evaluate the allowable through-wall flaws. At welds H4 to H6A, LEFM and limit load analysis methods were used, and the limiting locations for through-wall cracking occurred at the H6A weld. For the limit load analysis, the governing case is the H7 weld location where the pressure and dynamic stresses are high.

4.1.1 LEFM Analysis

The total axial stress at weld H6A is 1.34 ksi for the upset condition and 2.91 ksi for the faulted condition. Using the ASME Code safety factors for fracture analysis (2.8 for normal and upset and 1.4 for faulted), the faulted condition is limiting.

To determine the allowable flaw size based on LEFM methods, the conservatively estimated irradiated material fracture toughness K_{Ic} value of 150 ksi$\sqrt{in}$ was used. Applying the ASME Code safety factors, allowable K_I values of ~ 54 ksi$\sqrt{in}$ (upset) and ~ 107ksi$\sqrt{in}$ (faulted) were obtained. The allowable flaw size was calculated using the following equation:

$$K_I = G_m \sigma \sqrt{(\pi a)}$$

where G_m is a curvature correction factor as defined in (Reference 4-1), σ is the total axial stress, and 'a' is the half flaw length. The bending correction factor G_b, is neglected because of the ductility of the material. The allowable through-wall circumferential flaw length (2a) was determined as ≅ 145 inches for H6A.

4.1.2 Limit Load Analysis

A through-wall circumferential flaw was assumed in this calculation. The limit load calculations were conducted using the approach outlined in Subsubarticle IWB-3640 and Appendix C of Section XI of the ASME Code. The flow stress was taken as $3S_m$. The S_m value for the shroud material is 16.9 ksi at the approximate normal operating temperature of 550°F.

The stresses and allowable flaw length for the limit load analysis are shown in the table below. The allowable flaw length is based on the limiting condition, which was faulted for welds H1-H7, and includes the ASME Code, Section XI safety factors.

Table 4-1: Stresses and Allowable Flaw Lengths at Shroud Welds

	Axial Force Stress (ksi)		Bending Moment Stress (ksi)		Allowable Flaw
Weld	Upset	Faulted	Upset	Faulted	Length (in)
H1-H2	0.35	0.94	0.18	0.37	423
H2	0.35	0.94	0.24	0.49	420
H3	0.33	0.88	0.28	0.57	393
H4	0.33	0.88	0.41	0.82	386
H5	0.33	0.88	0.81	1.62	368
H6A	0.33	0.88	1.02	2.03	360
H6B	0.64	1.23	1.05	2.10	349
H7	0.59	1.16	1.54	3.08	323

4.2 Allowable Axial Flaw Size

4.2.1 LEFM Analysis

The allowable axial flaw size is governed entirely by the pressure hoop stress. As with the circumferential flaw case, the allowable axial flaw size was determined assuming a through-wall flaw. For a through-wall flaw of length 2a in the shroud, the applied stress intensity factor is given by:

$$K = M * \sigma_h * \sqrt{\pi a}$$

where M is the curvature correction factor given by:

$$M = [1 + 1.61a^2/(Rt)]^{0.5} \qquad \text{(from Reference 4-2)}$$

In the above expression, the allowable flaw length 2a can be determined by equating the calculated K to the fracture toughness of 150 ksi$\sqrt{in}$. The hoop stress for the faulted condition is 1.79 ksi; the ASME safety factor of 1.5 is applied and the result is used in the previous equation.

The allowable flaw length was conservatively determined to be 2a = 85 inches above the core plate.

4.2.2 Limit Load

An alternate approach to determining the allowable flaw size is to use limit load techniques. The allowable flaw length is given by the equation:

$$\sigma_h = \sigma_f / (M * SF)$$

where M is a curvature correction factor as defined above, $\sigma_f = 3S_m$ is the flow stress, SF is the safety factor (3.0 for upset conditions, 1.5 for faulted), and σ_h = the hoop stress corresponding to the ΔP of 30.3 psi (faulted) above the core plate and 31.21 psi (upset) below the core plate. The allowable flaw length based on the limit load analysis is 330 inches above the core plate (using the limiting shroud diameter at welds H1 and H2) and 167 inches below the core plate. Since the value above the core plate exceeds the LEFM value, the allowable axial through-wall flaw length is 85 inches between H3 and H6A.

4.3 References

4-1. Rooke, D.P. and Cartwright, D.J., "Compendium of Stress Intensity Factors," The Hillingdon Press (1976).

4-2. Ranganath, S., Mehta, H.S. and Norris, D.M., "Structural Evaluation of Flaws in Power Plant Piping," ASME PVP Volume No. 94 (1984).

5.0 SCREENING CRITERIA

The determination of the allowable through-wall flaws has been described in Section 4. The objective was to use the allowable flaw size as the basis for the screening criteria. Since the screening rules represent the first step in the evaluation, they are by definition conservative. If the criteria are exceeded, the option of doing further detailed evaluation or performing additional NDE remains. The allowable through-wall flaws were:

- Circumferential Flaws
  - H1: 423 inches (limit load)
  - H2: 420 inches (limit load)
  - H3: 393 inches (limit load)
  - H4: 386 inches (limit load), 235 inches (LEFM)
  - H5: 368 inches (limit load), 168 inches (LEFM)
  - H6A: 360 inches (limit load), 145 inches (LEFM)
  - H6B: 349 inches (limit load)
  - H7: 323 inches (limit load)

- Axial Flaws
  - H1-H2: 330 inches (limit load)
  - H3-H6A: 85 inches (LEFM)
  - H6B-H7: 167 inches (limit load)

A conservative approach in developing the screening rule is to include both the LEFM and limit load analysis. For circumferential flaws, LEFM provides the limit on **LEFM equivalent single flaw length** for H4 through H6A, while the limit load analysis provides the limit on **effective cumulative flaw length**. For axial flaws, the allowable flaw length is 330 inches between H1 and H2, 85 inches between H3 and H6A (LEFM), and 167 inches below the core plate (limit load).

For circumferential flaws at welds H4 through H6A, the limits are applied as follows. The fracture mechanics based limit for a single equivalent flaw length at H6A (for example), as determined in Section 3.2.2, is 145 inches. This in itself is not sufficient, since there could be several flaws (each less than 145 inches) in a circumferential plane that cumulatively add up to greater than 360 inches (the allowable circumferential flaw size based on limit

load analysis). Thus, the sum of the effective flaw lengths, as determined in Section 2.2, should be less than 360 inches.

While this fully assures the ASME Code margins, an additional conservative assumption is included in the screening. **This states that the sum of the limit load effective flaw lengths cannot be more than 360/4 = 90 inches in any 90 degree sector of the shroud.** This is a conservative restriction that assures that long continuous flaws are not admissible.

The approach used here for the 90 inch limit for circumferential flaws is to assume a template with a moving window equal to a 90° sector. The sum of the limit load effective flaw lengths that appear in the window should be less than 90 inches. This is shown graphically in Figure 5-1. A similar restriction based on limit loads is not needed for axial flaws, since field experience has shown that they are typically associated only with circumferential welds and are unlikely to be aligned in the same plane.

The allowable flaw length of 90 inches for any 90 degree sector applies to weld H6A. Similarly, limit load allowable flaw lengths divided by four apply to welds H1 through H7.

When considering LEFM based evaluations, the crack interaction criteria described in Section 3.2 must be applied in comparing against the allowable lengths. For example, for adjacent flaws where the spacing, S, is less than $0.75\ (L1 + L2 + 4\Delta a)$, the length $L = L1' + L2'$ is used for comparison with the LEFM based allowable flaw length. The lengths L1' and L2' are as determined in Figure 3-3.

The criteria presented in this report are conservative in that continuous flaws (for limit load) were assumed. Additional analysis assuming the flaws are non-continuous (that is, distributed around the circumference of the shroud) or part-through wall will yield larger cumulative flaw lengths.

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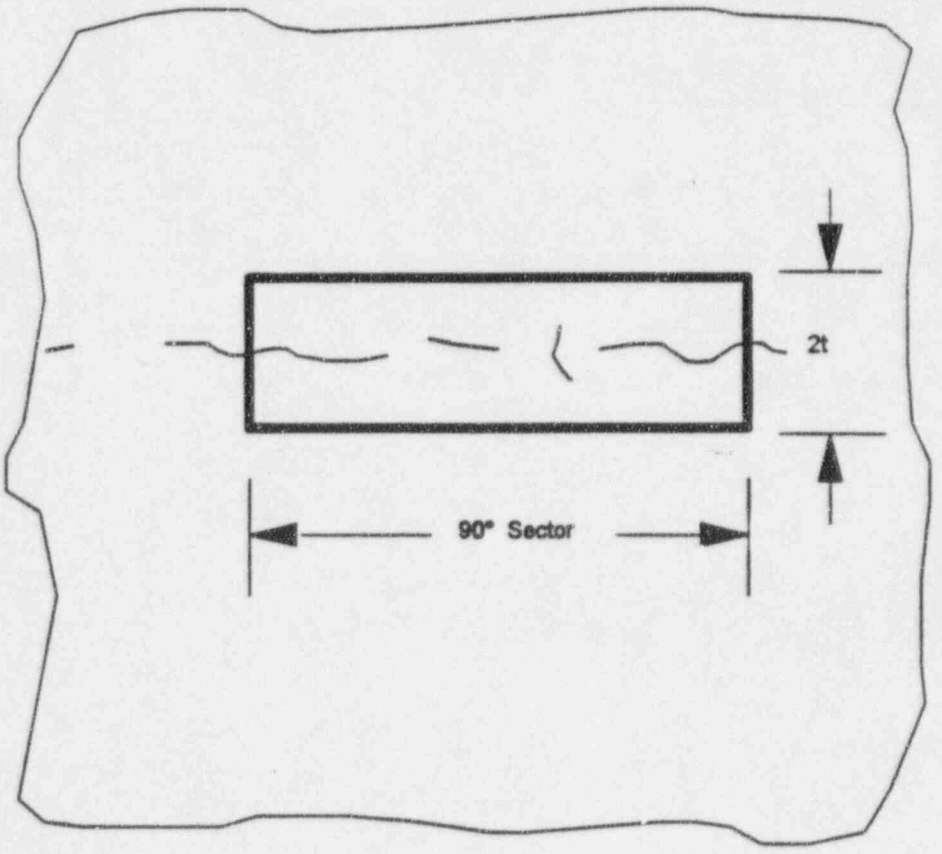

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Figure 5-1: Schematic Illustrating Cumulative Limit Load Effective Flaw Criterion for a 90° Sector

6.0 SUMMARY OF SCREENING CRITERIA

The screening criteria are schematically shown in Figure 6-1. The first step is to map the flaw indications observed by IVVI. Next the proximity rules are applied to the flaw map to develop limit load effective flaw lengths. The results of the limit load effective flaw lengths are also mapped.

For axial flaws, two neighboring flaws must be summed if $S < 0.75(L1 + L2 + 4\Delta a)$. If the longest resulting flaw is less than 85 inches, then the screening limit is met for axial flaws.

For circumferential flaws, all limit load effective flaw lengths (as determined by the methods outlined in Section 2.0) are summed in any 90° sector using a template. The next step is to compare the longest LEFM equivalent flaw to the LEFM based screening criteria for welds H4 to H6A.

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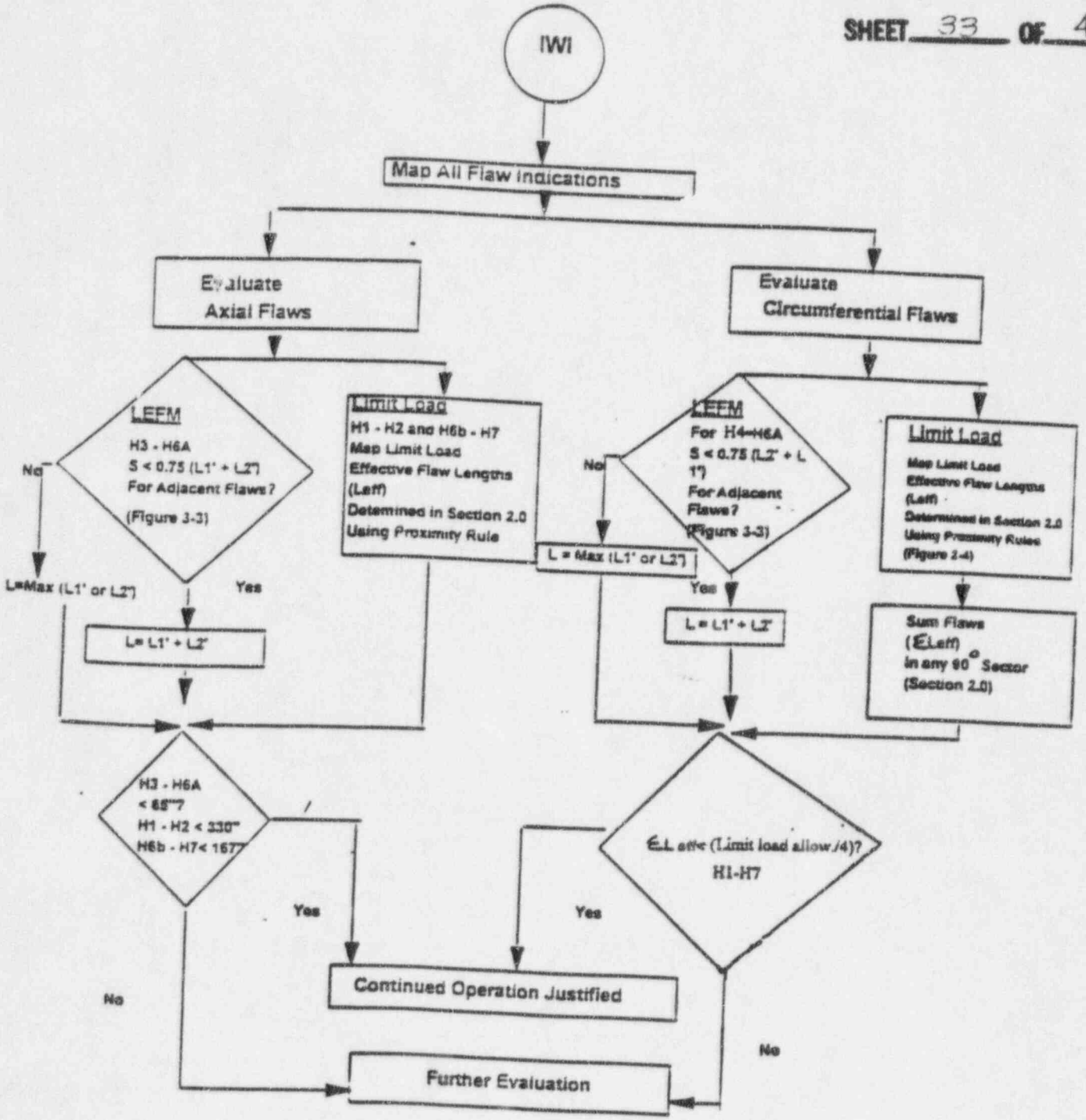

Figure 6-1: Schematic of Screening Criteria

7.0 COOPER FIELD HISTORY

Based on current available information at GE, the Cooper field history was tabulated. Table 7-1 contains the list of known cracking incidences at Cooper. The relatively short list of cracking incidences is likely a reflection of the Cooper water chemistry quality.

Table 7-1. Cooper Field History

COMPONENT	DATE	DESCRIPTION
Instrument Line	1/76	Leak detected in 2-inch 304 S/S instrument line. Leak located 1/2-inch from safe end to pipe weld. 3/4-inch circumferential crack detected. Cause: IGSCC in weld HAZ.
Main Steam Line	10/76	UT indications in 26-inch main steam line carbon steel "D" loop flow restrictor spool. Indications 5/8-inch length, 3/16-inch width, 3/16-inch depth. Cause: Manufacturing defects.
Residual Heat Removal Drain Line	2/77	Failure in 1-inch RHR drain line. Cause: Fatigue.
Feedwater Sample Probe	2/77	Portions of 3/4-inch 316 S/S feedwater sample probe found broken off. Cause: Transgranular SCC associated with chlorides; cyclical vibration may have accelerated failure.
Control Rod Drive Spud	4/78	Failure of Alloy X-750 CRD spud finger. Cause: Mechanical overload.
Steam Jet Air Ejector System Elbow	11/77	Holes detected in 4-inch carbon steel elbow. Cause: Either pitting corrosion or erosion corrosion.
Position Indicator Tube	1975	Leak detected in 3/4-inch 304 S/S indicator tube. Cause: Leaching out of non-metallic inclusions.
Reactor Water Cleanup Flange	9/92	Leak detected in RWCU flange to tee weld. Cause: IGSCC in weld heat affected zone.
CRD Cap Screws	1991	Cracking initiated at the shank to head radius of the CRD cap screws. Cause: IGSCC assisted by crevice and notch conditions in the fillet region at the transition from the shank to the bolt head.
Shroud Head Bolts		Cracking in 21 Alloy 600 shroud head bolts to date. Cause: IGSCC in creviced region.

A.0 Cooper Materials/Chemistry Shroud Evaluation

A.1 Water Chemistry

For the first two cycles of hot operation, Cooper operated with relatively high primary water conductivity. As can be seen in Table 1, the cyclic conductivity mean values averaged 0.27 µS/cm. There was a dramatic conductivity improvement during the third cycle where the conductivity decreased to 0.142 µS/cm. Since the third cycle, conductivity values have improved and were excellent at approximately 0.10 µS/cm during the last three operating cycles. Although Cooper is characterized by some of the best water chemistry in the BWR fleet (noting that Cycle 16 conductivity is somewhat higher), there were several documented early water chemistry transients experienced at Cooper (1):

1. August 29, 1974 -- Cooper reactor water conductivity reached 5 µS/cm and pH decreased to 5.5 during shutdown due to a condensate demineralizer resin intrusion (Cycle 1).

2. December 8, 1974 -- Cooper reactor water conductivity reached 10 µS/cm at power due to a condenser leak (Cycle 1).

3. January 27, 1975 -- Cooper reactor water conductivity reached 11.5 µS/cm and pH decreased to 4.8 at power due to a RWCU resin intrusion (Cycle 1).

4. July 2, 1975 -- Cooper reactor water conductivity reached 12 µS/cm at power due to a condenser tube leak (Cycle 1).

5. February 21, 1976 -- Cooper reactor water conductivity reached 4.3 µS/cm and pH decreased to 4.9 at power due to a suspected resin intrusion. Chloride was also measured at 48 ppb (Cycle 1).

6. May 22, 1976 -- Cooper reactor water conductivity reached 4.9 µS/cm and pH decreased to 4.9 at power due to a suspected resin intrusion. Chloride was also measured at 50 ppb (Cycle 1).

7. February 25, 1977 -- Cooper reactor water conductivity reached 1.1 μS/cm and pH decreased to 5.6 at power due to a suspected resin intrusion. Chloride was also measured at 30 ppb (Cycle 2).

Because of the some higher early life conductivity and intrusion history, it is likely that intergranular stress corrosion cracking (IGSCC) initiation was accelerated in susceptible areas (both uncreviced and creviced) of the primary system, including the shroud. The effect of sulfate/conductivity on crack initiation in uncreviced material is presented in Figure 1. It is clear that an increase in sulfate/conductivity results in an acceleration in crack initiation as measured by the constant extension rate test (CERT). A similar type of initiation acceleration is expected for chloride ions.

The strong correlation between conductivity and IGSCC susceptibility in uncreviced sensitized stainless steels has also been examined in various other laboratory studies (2-4) and it is evident that a significant decrease in crack initiation time is expected with increased concentrations of certain deleterious anionic impurities, in particular sulfates and chlorides. For creviced BWR components the strong correlation of SCC susceptibility with actual BWR plant water chemistry history has been documented (5).

A.2 Shroud Evaluation

The recent cracking of shrouds at several BWRs has placed this stress corrosion concern at the highest levels. When Cooper is compared to 51 other BWRs relative to possible shroud performance, the following rankings and factors are noted:

1. First 5 cycle mean conductivity (0.188 μS/cm) - 41/51 highest. Shrouds in BWRs with lower 5 cycle mean conductivity have cracked.

2. Total mean conductivity (0.152 μS/cm) - 42/51 highest (based on June 1994 data). Shrouds in BWRs with lower total mean conductivity have cracked.

3. On-line years (14.6) - 13/51 highest (based on November 1993 data). Shrouds in BWRs with lower on-line years have cracked.

4. Estimated peak fluence (8.4E20) - 2/51 (based on December 1992 calculations). Shrouds in BWRs with significantly lower estimated peak fluences have cracked.

5. Shrouds fabricated out of Types 304L and 347 stainless steel and Cooper's shroud's material of construction, Type 304 stainless steel, have cracked. It should be noted that all Type 304 stainless steel shrouds inspected to date have revealed cracking.

6. Shrouds built by Rotterdam, Sun Ship, P. F. Avery and Cooper's shroud's manufacturer, Bingham Willamette, have cracked.

Based on the experience of shroud cracking in BWRs with relatively good water chemistry quality and at low fluence locations, independent of manufacturer, material of construction and relative age, future cracking in Cooper's shroud cannot be ruled out.

A.3 References

1. B. H. Dillman et al, "Monitoring of Chemical Contaminants in BWRs," EPRI NP-4134, July 1985.

2. R. B. Davis and M. E. Indig, "The Effect of Aqueous Impurities on the Stress Corrosion Cracking of Austenitic Stainless Steel in High Temperature Water," paper 128 presented at Corrosion 83, Anaheim, CA, NACE, April 1983.

3. L. G. Ljungberg, D. Cubicciotti and M. Trolle, "Effects of Impurities on the IGSCC of Stainless Steel in High Temperature Water," Corrosion, Vol. 44, No. 2, February 1988.

4. W. E. Ruther, W. K. Soppet and T. F. Kassner, "Effect of Temperature and Ionic Impurities at Very Low Concentrations on Stress Corrosion Cracking of Type 304 Stainless Steel," Corrosion, Vol. 44, No. 11, November 1988.

5. K. S. Brown and G. M. Gordon, "Effects of BWR Coolant Chemistry on the Propensity for IGSCC Initiation and Growth in Creviced Reactor Internals Components," paper presented at the Third Int. Symp. of Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors, Traverse City, MI, August 1987, published in proceedings of same, TMS-AIME, Warrendale, PA, 1988.

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Table 1. Cooper Water Chemistry History

Cycle	Mean Value Conductivity µS/cm	Chloride ppb	Sulfate ppb
1	0.204	31.72	
2	0.338	30.65	
3	0.142	31.04	
4	0.119	30.04	
5	0.135	30.07	
6	0.172	30.00	
7	0.210	30.00	
8	0.140	30.00	
9	0.126	30.00	
10	0.170	10.14	
11	0.149	7.41	
12	0.117	1.81	
13	0.093	0.88	1.99
14	0.094	1.70	3.00
15	0.096	1.98	2.60
16	0.123	3.77	4.71

Figure 1: Effect of Sulfate/Conductivity on Crack Initiation in Uncreviced Material