CAROLINA POWER & LIGHT COMPANY

ROBINSON NUCLEAR POWER PLANT

UNIT 2

EDDY CURRENT EXAMINATION REPORT

APRIL 1992

DOCUMENT NO. IR-ISI-136

ASEA BROWN BOVERI
COMBUSTION ENGINEERING, INC.
NUCLEAR POWER BUSINESSES
OUTAGE SERVICES

PREPARED BY: Alice P. Putnam — 6-9-92 DATE

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APPROVED BY: Roy N Brown — MANAGER NDE SERVICES — 6-9-92 DATE

ABSTRACT

This document summarizes the examination program, results, and presents information concerning examination procedures, personnel and equipment used for inspection at the H.B. Robinson Unit 2 1992 outage.

The eddy current examination outage included eddy current inspections utilizing the Zetec bobbin probes for defect examination. One MRPC examination was performed in the cold side 5th support area to further evaluate a suspect indication. A 20% full-length bobbin probe examination was performed in steam generator's 1, 2 and 3, except for row 1 tubes which were examined from 6C to HTE. One tube was plugged in steam generator "A", (Row 1 Column 29). This tube was obstructed to a .580" probe at the 6th hot leg support. Details are contained in the text of this document.

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TO: Carolina Power & Light Co.

CERTIFICATE OF PERFORMANCE

Carolina Power & Light Co.
H.B. Robinson Plant, Unit 2
Steam Generator Eddy Current Examination

Combustion Engineering, Inc., hereby certifies that the Robinson Unit 2 steam generator eddy current examinations performed during April 1992 were in compliance with CP&L Purchase Order XM 10370000/WA# XS 10370002. Documentation attesting to this conformance is contained within the data of this QC Records Package.

Q. A. Engineer

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VOLUME II

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1	Data package transmittal and CP&L receipt acknowledgement.
2	All Data on all Tubes sorted in Row - Column order.
3	All Tubes selected by CP&L as Previous Indication tubes with supportive data from 1990, 1988 and 1977 outages.
4	Final DDA-4 Report Printouts and Lissajous Printouts for all Data sorted by reel number.
5	Eddy Current Calibration Sheets.

STEAM GENERATOR #B EXAMINATION DATA

Tab	
1	Data package transmittal and CP&L receipt acknowledgement.
2	All Data on all Tubes sorted in Row - Column order.
3	All Tubes selected by CP&L as Previous Indication tubes with supportive data from 1990, 1988 and 1977 outages.
4	Final DDA-4 Report Printouts and Lissajous Printouts for all Data sorted by reel number.
5	Eddy Current Calibration Sheets.

Document No: IR-ISI-136

STEAM GENERATOR #C EXAMINATION DATA

Tab	
1	Data package transmittal and CP&L receipt acknowledgement.
2	All Data on all Tubes sorted in Row - Column order.
3	All Tubes selected by CP&L as Previous Indication tubes with supportive data from 1990, 1988 and 1977 outages.
4	Final DDA-4 Report Printouts and Lissajous Printouts for all Data sorted by reel number.
5	Eddy Current Calibration Sheets.

INTRODUCTION

Combustion Engineering, Inc. conducted an in-service eddy current examination of the steam generator (S/G) tubing at Carolina Power & Light (CP&L) Robinson Unit 2 Nuclear Power Plant in April 1992. The purpose of the examination was to assess the condition of the S/G's, identify tubes requiring repair and to provide the necessary information needed to fulfill Technical Specification requirements.

The examination program included multi-frequency bobbin coil and motorized rotating pancake coil (MRPC) testing for indications of degradation, dents, and deposits.

The examinations were conducted in accordance with Combustion Engineering Procedure No. ROB-410-004 Rev. 4 in compliance with the USNRC Regulatory Guide 1.83 "Inservice Inspection of PWR Steam Generator Tubes", Revision 1, dated July, 1975 and the ASME Boiler and Pressure Vessel Code, Section XI "Rules for Inservice Inspection of Nuclear Power Plant Components", 1986 Edition, with no Addenda, and the Robinson Unit 2 Technical Specifications.

The eddy current data analysis variables were established in accordance with the Procedure No. ROB-410-005 Rev. 3 "Eddy Current Data Analysis Procedure, Evaluation of Westinghouse Steam Generator Tubing", and the attached Guideline, H.B. Robinson Eddy Current Analysis Supplement. The data was independently analyzed by two groups of certified Level IIA (minimum) data analysts. Discrepancies between the two sets of evaluation results were reviewed by a Lead Level III eddy current examiner.

WORK SCOPE

The examination program was conducted to meet all the necessary requirements of the Plant Technical Specifications. A 20% examination was performed utilizing bobbin probe testing.

Component: SG #A

Steam Generator Inspection Summary

Exams:	Extent:	<20%	20-39%	>= 40%	Probe:
1	5H HTE	0	0	0	A680SFRM
26	6C HTE	0	0	0	A680SFRM
2	6H HTE	0	0	0	A700SFRM
16	CTEHTE	0	0	0	A680SFRM
59	CTEHTE	0	1	0	A700SFRM
594	CTEHTE	0	1	0	A720MULC
TOTALS:		LT20	GE 20-40	GE 40	
698	EXAMINATIONS PERFORMED				
661	Tubes Examined				
Number of Indications:		0	2	0	

Component: SG #B

Steam Generator Inspection Summary

Exams:	Extent:	<20%	20-39%	>= 40%	Probe:
16	6C HTE	0	0	0	A680SFRM
12	6C HTE	0	0	0	A700SFRM
32	CTEHTE	0	0	0	A680SFRM
63	CTEHTE	0	0	0	A700SFRM
581	CTEHTE	4	1	0	A720MULC
TOTALS:		LT20	GE 20-40	GE 40	
704	EXAMINATIONS PERFORMED				
659	Tubes Examined				
Number of Indications:		4	1	0	

Component: SG #C

Steam Generator Inspection Summary

Exams:	Extent:	<20%	20-39%	>= 40%	Probe:
13	6C HTE	0	0	0	A680SFRM
13	6C HTE	0	0	0	A700SFRM
29	CTEHTE	0	0	0	A680SFRM
84	CTEHTE	0	0	0	A700SFRM
559	CTEHTE	18	2	0	A720MULC
TOTALS:		LT20	GE 20-40	GE 40	
698	EXAMINATIONS PERFORMED				
667	Tubes Examined				
Number of Indications:		18	2	0	

Summary

Full length bobbin coil eddy current examinations were conducted as summarized in the previous section of this report. The scan plan was provided by ABB/CE and approved by CP&L, and depicted a 20% random sample of tubes throughout the 3 steam generators, including tubes referenced as "previous indication" tubes. The "previous indication" tube examination results were compared against the 1990, 1988, 1987, and baseline outage (where possible) for indication of degradation progression.

None of the flaw-type signals reported during this inspection indicated any growth of previous indications, attributing further conclusions that the previous indications are indicative of manufacturing blemishes. Dent indications also indicated no growth, as these indications are also indicative of manufacturing anomalies.

A complete summary of the "previous indication" tubes as submitted by CP&L is found in the data section of this report (Tabs labeled "3" in Vol. II). The results from the previous three outages (1987, 1988, 1990) are shown for these tubes along with 1992 tube data. *You will note that many of the shallow depth (<20%) flaws have been updated to Manufacturing Buff Mark (MBM). Many of the other "previous indications" show no indications at all, and therefore are listed as such.*

Several flaws were reported in the <20% range and ≥20 to 39% range in S/G's A, B & C. A summary of the 1992 outage % Through-wall flaws is as follows:

COMPONENT: SG #A
ALL % THROUGH-WALL INDICATIONS

Row/Col	Reel	Volts	CH Desc.	Ind.	%TWD	Location	Indication	Probe Tested	Extent
3 38	AH12	0.9	1		25	1H	+20.7	A700SFRM	CTEHTE
40 49	AH07	0.5	1		32	5C	+26.4	A720MULC	CTEHTE

COMPONENT: SG #B
ALL % THROUGH-WALL INDICATIONS

Row/Col	Reel	Volts	CH Desc.	Ind.	%TWD Location	Indication	Probe Tested	Extent
20 87	BH07	0.6	1	15	5C	+34.9	A720MULC	CTEHTE
25 26	BH04	2.8	1	17	3C	+40.6	A720MULC	CTEHTE
25 26	BH04	1.4	1	24	4H	+46.6	A720MULC	CTEHTE
25 26	BH04	4.4	1	6	4C	+17.0	A720MULC	CTEHTE
34 30	BH04	0.9	1	19	HTS	+ 1.9	A720MULC	CTEHTE

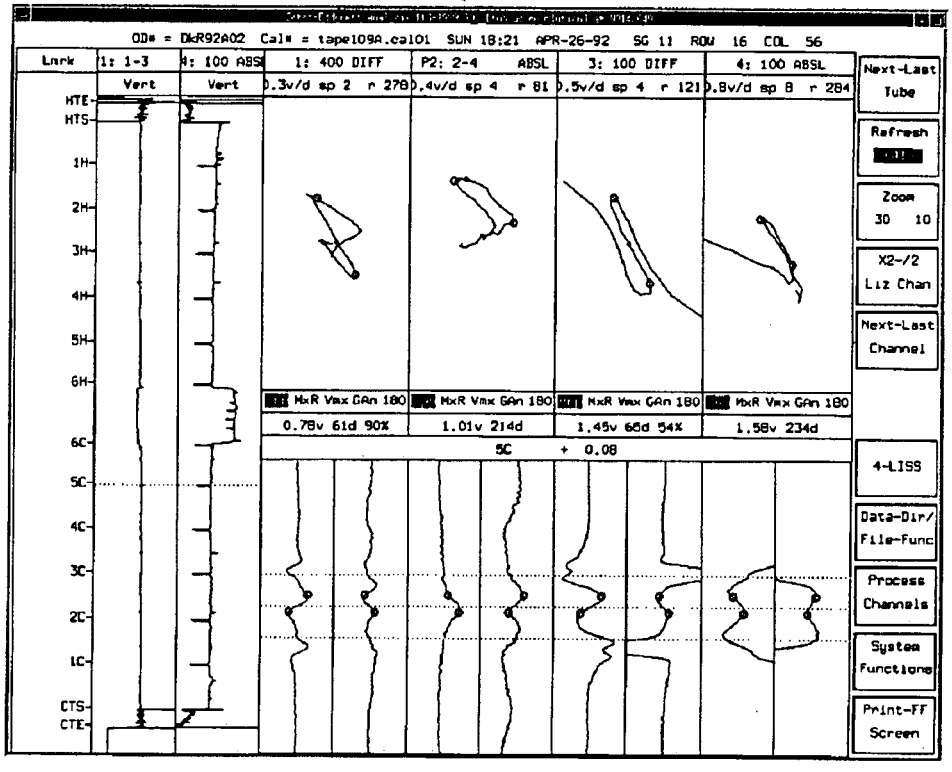
COMPONENT: SG #C
ALL % THROUGH-WALL INDICATIONS

Row/Col	Reel	Volts	CH Desc.	Ind.	%TWD Location	Indication	Probe Tested	Extent
10 10	CH01	0.6	1	14	CTS	+15.2	A720MULC	CTEHTE
10 10	CH01	0.7	1	17	CTS	+16.3	A720MULC	CTEHTE
10 11	CH01	1.1	1	11	CTS	+ 3.3	A720MULC	CTEHTE
10 11	CH01	1.0	1	10	CTS	+ 4.4	A720MULC	CTEHTE
10 54	CH07	0.6	P 1	9	CTS	+ 1.3	A720MULC	CTEHTE
10 54	CH07	0.9	1	10	CTS	+ 2.3	A720MULC	CTEHTE
10 55	CH07	1.3	1	20	3C	+11.0	A720MULC	CTEHTE
10 55	CH07	2.0	1	6	CTS	+ 6.7	A720MULC	CTEHTE
10 55	CH07	2.1	1	10	CTS	+ 5.6	A720MULC	CTEHTE
13 3	CH01	1.1	1	17	CTS	+11.3	A720MULC	CTEHTE
13 3	CH01	1.5	1	16	CTS	+12.3	A720MULC	CTEHTE
13 4	CH01	1.8	1	13	CTS	+10.0	A720MULC	CTEHTE
13 4	CH01	4.8	1	8	CTS	+21.1	A720MULC	CTEHTE
13 4	CH01	4.6	1	9	CTS	+20.0	A720MULC	CTEHTE
13 4	CH01	4.5	1	5	CTS	+17.3	A720MULC	CTEHTE
13 4	CH01	3.6	1	7	CTS	+16.2	A720MULC	CTEHTE
13 4	CH01	0.9	1	19	CTS	+15.5	A720MULC	CTEHTE
13 4	CH01	0.7	1	22	CTS	+14.4	A720MULC	CTEHTE
13 4	CH01	2.6	1	9	CTS	+11.1	A720MULC	CTEHTE
19 6	CH01	1.1	1	12	FBC	+ 1.4	A720MULC	CTEHTE

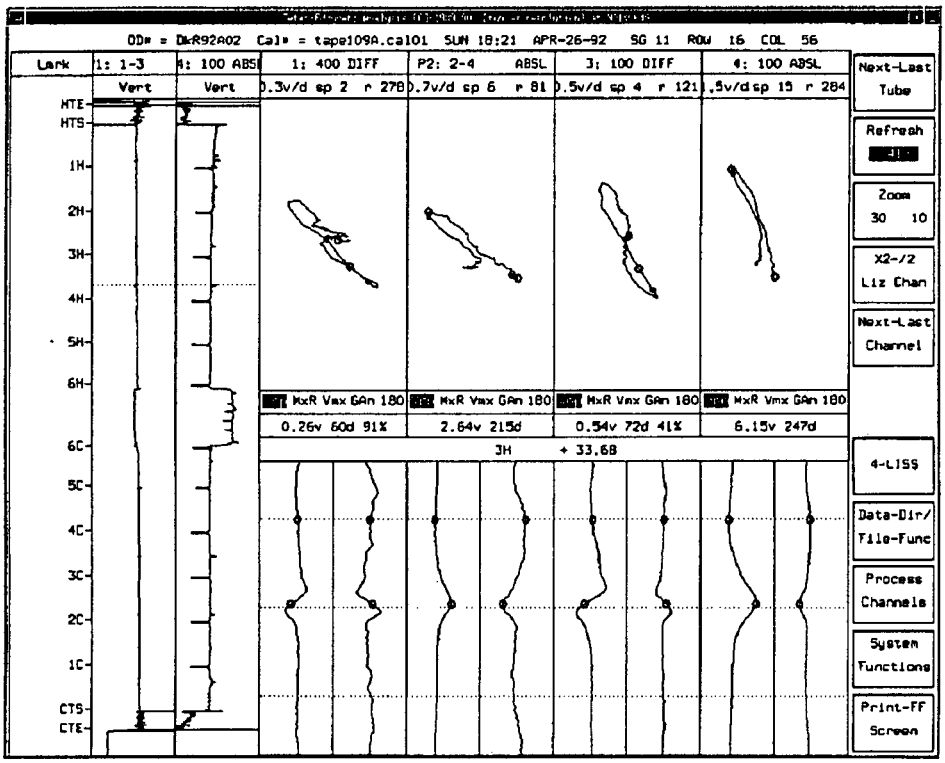
Steam generator "A" Row 1 Column 29 was preventively plugged due to an obstruction at the 6th support on the hot side. Various bobbin probes of decreasing size down to 0.580" dia. were implemented but were unable to pass the obstruction. After looking up the baseline data on this tube, it was shown to indicate an obstruction with a 0.720 probe and was not examined further, but left in service.

Another tube in steam generator "A", Row 16 Column 59 was examined utilizing an MRPC probe to further evaluate a signal at the 5th support on the cold leg side. After MRPC examination it was concluded the indication was a small buff mark that was distorted by the support signal. Graphic displays of this indication follow.

As you can see by this first graphic, there is a flaw-like indication at support 5C. Although it appears here like a true flaw, it is distorted by the support. The absolute mix channel indicates a buff mark rather than a flaw however.

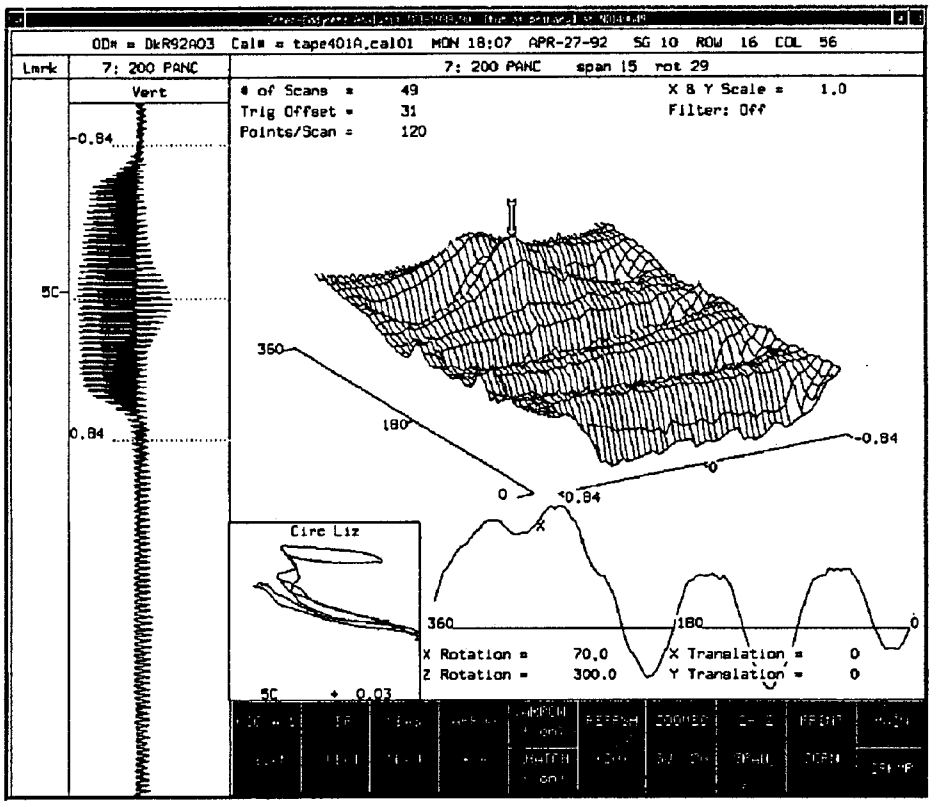


Indication at 5C support



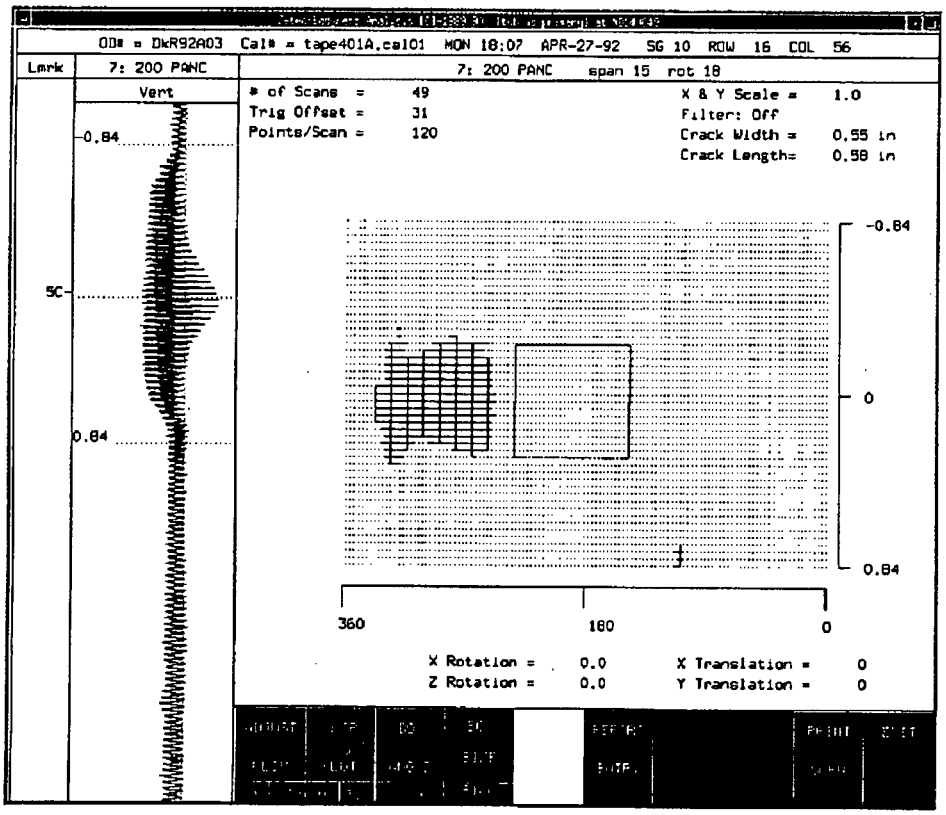
Buff mark indication for same tube (16/56)

By comparing results of the indication at the support to a buff-mark in the free span area, you can see similar characteristics indicating the suspect flaw is a buff-mark, and not a true flaw of measurable depth.



MRPC C-Scan of 5C

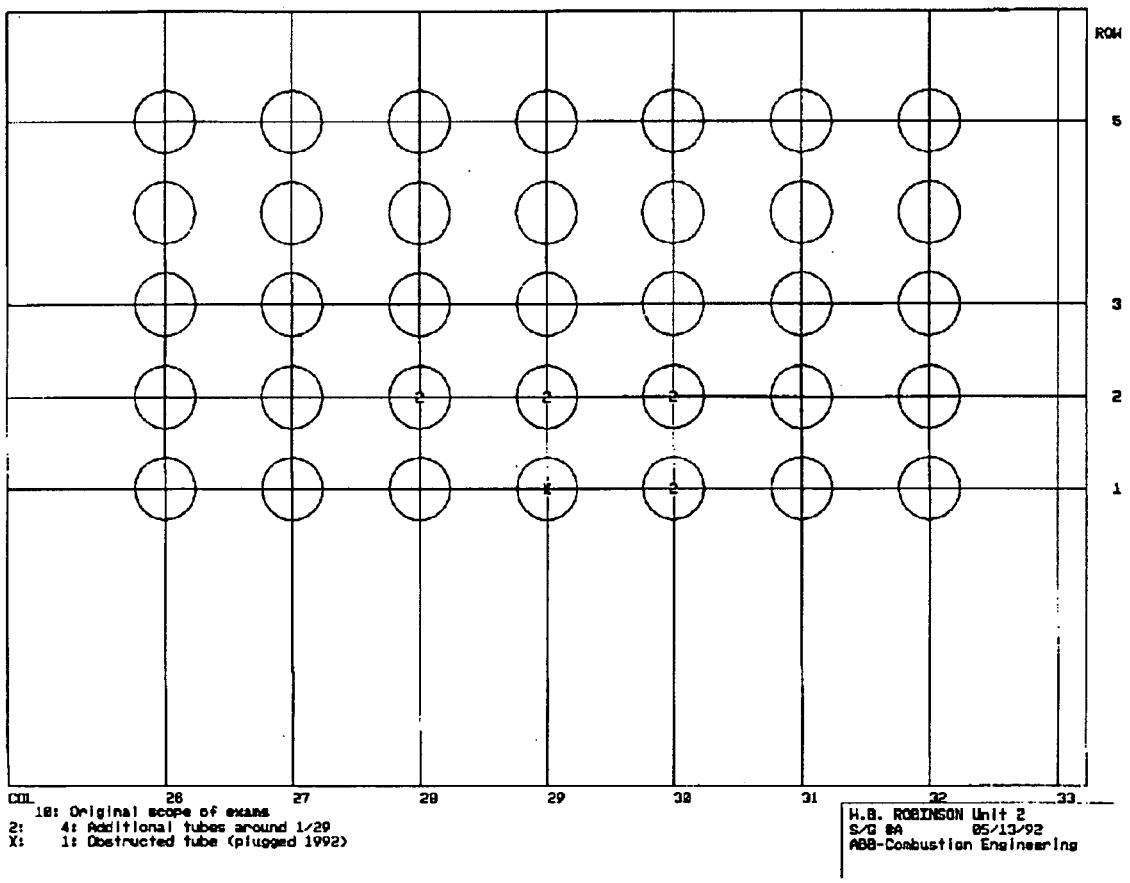
This MRPC graphic shows the small indication at 5C. A 3-coil MRPC probe was utilized, which aids in determining if the indication is linear (crack-like) and its orientation. The technique used showed no indication of crack-like signals and confirms the buff-mark conclusion



Top view of Buff Mark

This view shows a "top" view of the indication. Note the size and shape of the indication, confirming a broad signal indicative of a Buff Mark.

Another aspect of this outage, was a tube which was obstructed at the 6th hot support. As mentioned earlier, this tube was obstructed during the base-line examination, but was left in-service. The following graphic shows surrounding tubes which were added to the inspection scope to investigate any further tube damage which may have occurred near tube row 1 column 29. Tube row 1 column 28 was tested in the original plan. No further damage was indicated in any surrounding tubes.

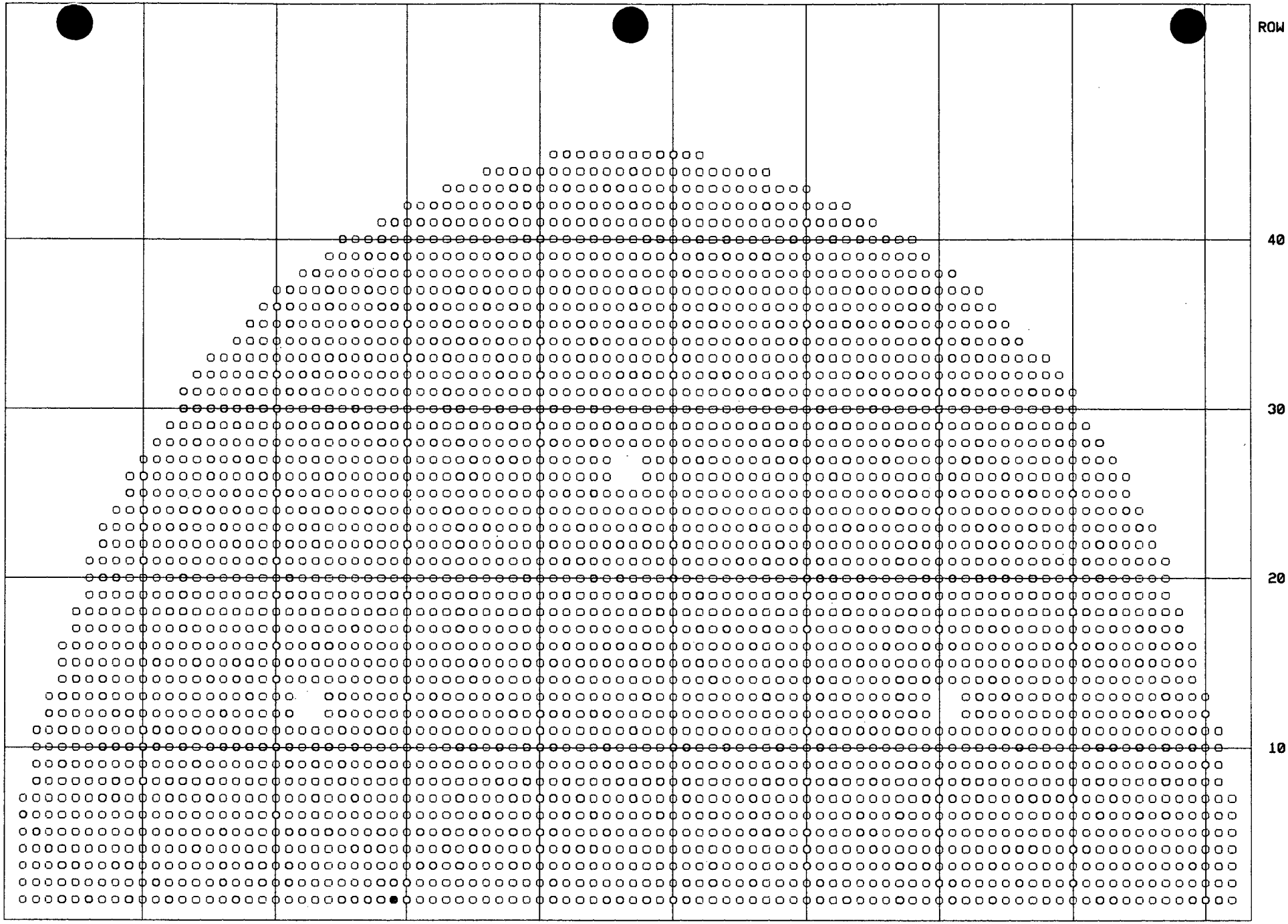


Tube 1/29 and surrounding tubes

Additional information may be found by reviewing the graphic tube-sheet maps found in the following sections. These include:

All tubes examined
Plugged tubes (S/G #A only)
Tubes with % through-wall indications
Tubes with varying degrees of sludge
Tubes with copper indications

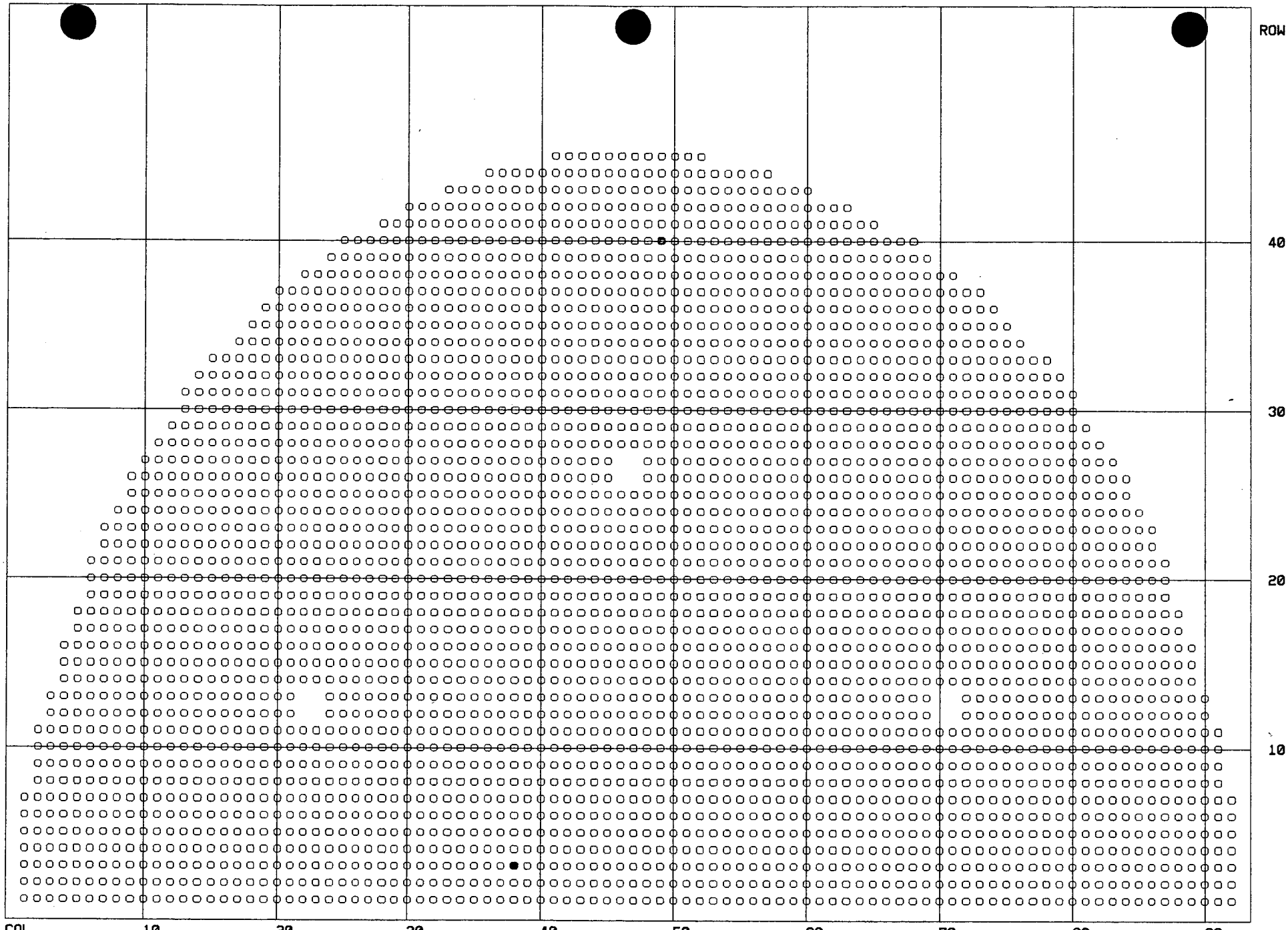
All tubes were analyzed for sludge and copper indications as requested by CP & L. The sludge map shows sludge less than 1", 1" to 2", and over 2". There was no sludge reported greater than 3" thick. Sludge less than ~.5" was not reported, due to inability to accurately measure at this level.



660: Tubes Inspected 1992
1: Obstructed tube (plugged 1992)

H.B. ROBINSON Unit 2
S/G #A 05/08/92
ABB-Combustion Engineering

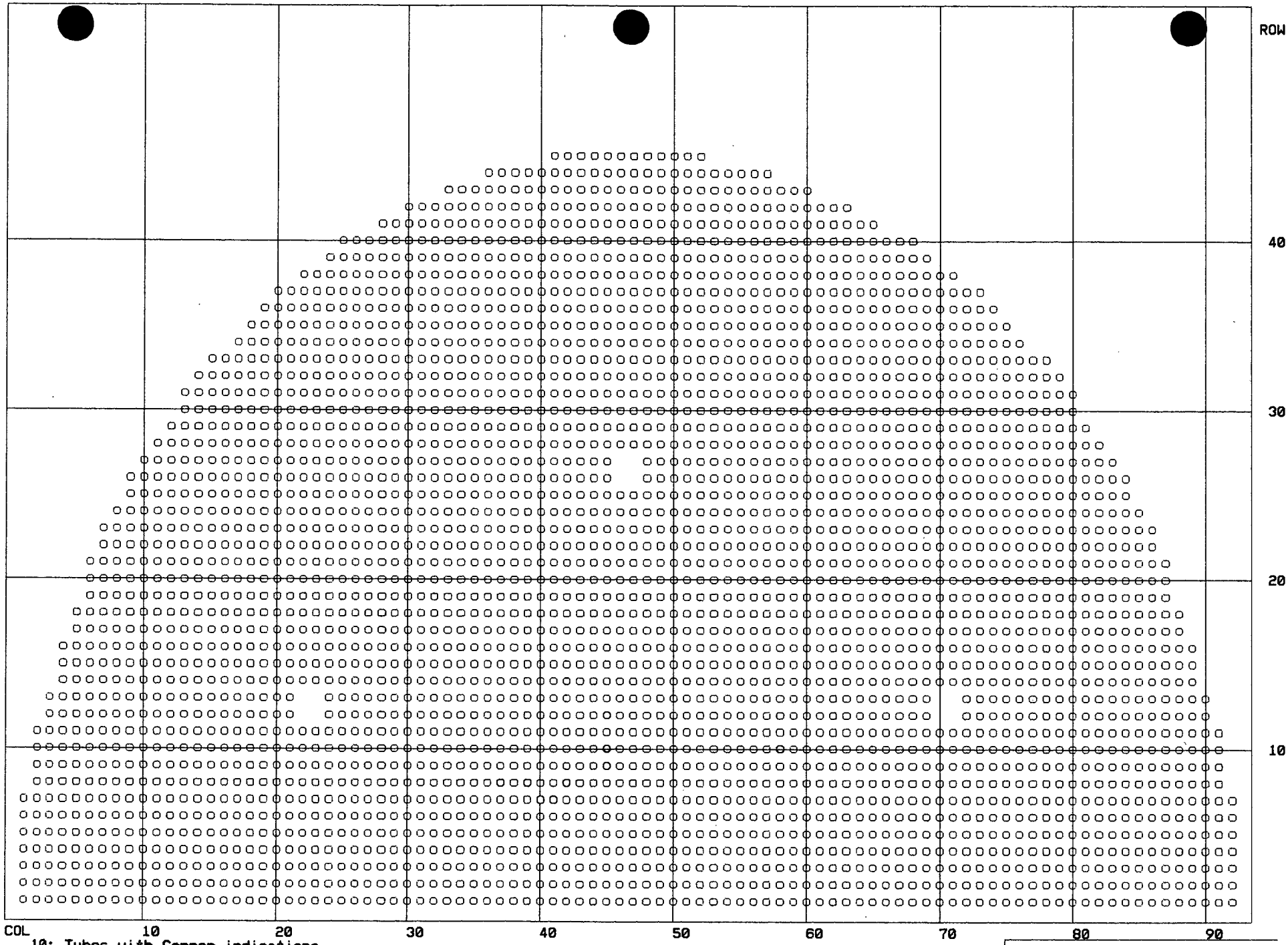
ACRI ISIS Tubes



0: Tubes w/GT 0%/LE 19% Indications
2: Tubes w/GE 20%/LE 39% Indications

H.B. ROBINSON Unit 2
S/G #A 05/09/92
ABB-Combustion Engineering

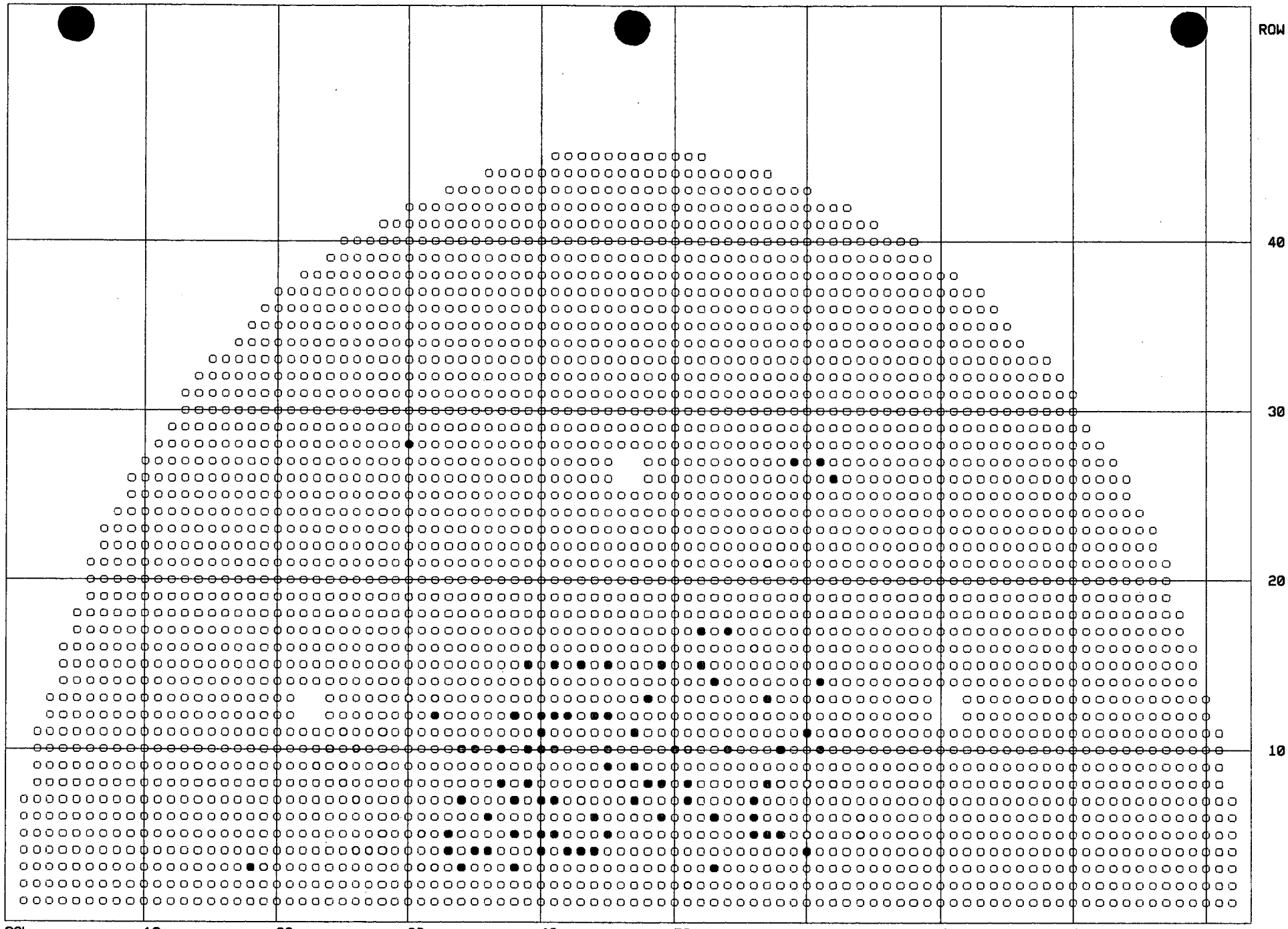
ACRI ISIS Tubes



10: Tubes with Copper indications

H.B. ROBINSON Unit 2
S/G #A 05/08/92
ABB-Combustion Engineering

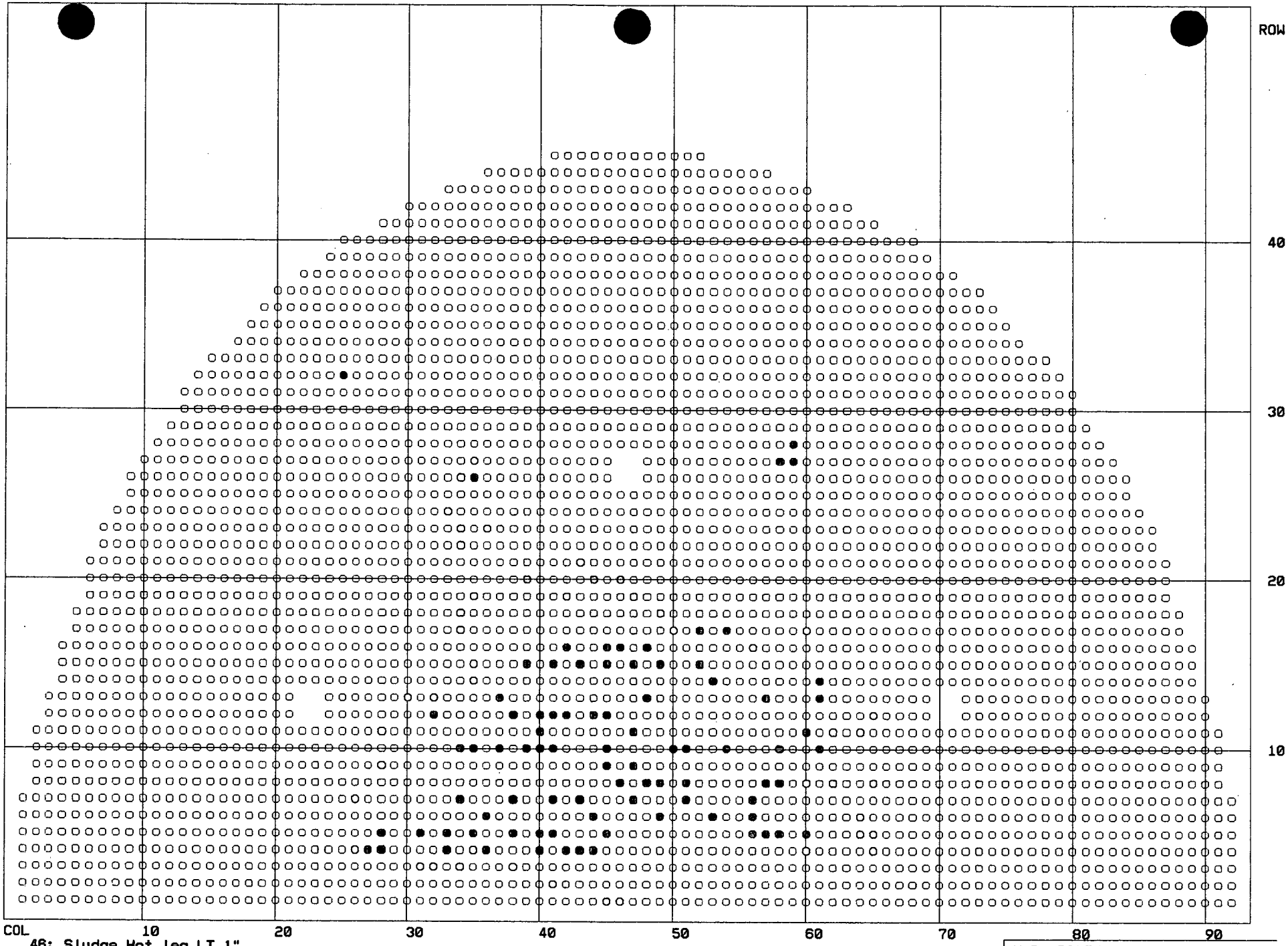
ACRI ISIS Tubes



35: Sludge Cold leg LT 1"
66: Sludge Cold leg GT 1"
11: Sludge Cold leg GT 2"

H.B. ROBINSON Unit 2
S/G #A 05/08/92
ABB-Combustion Engineering

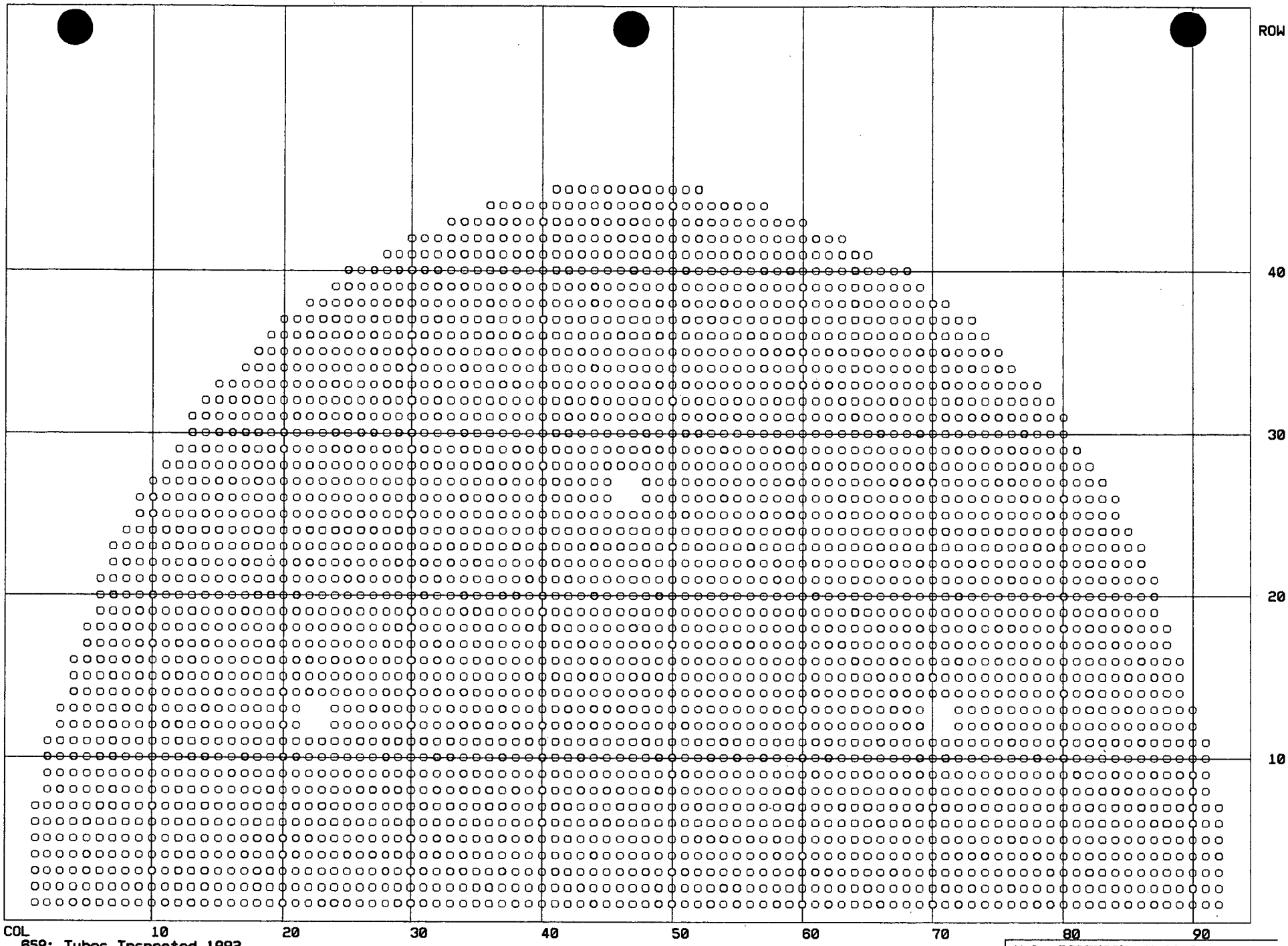
ACRI ISIS Tubes



46: Sludge Hot leg LT 1"
69: Sludge Hot leg GT 1"
17: Sludge Hot leg GT 2"

H.B. ROBINSON Unit 2
S/G #A 05/08/92
ABB-Combustion Engineering

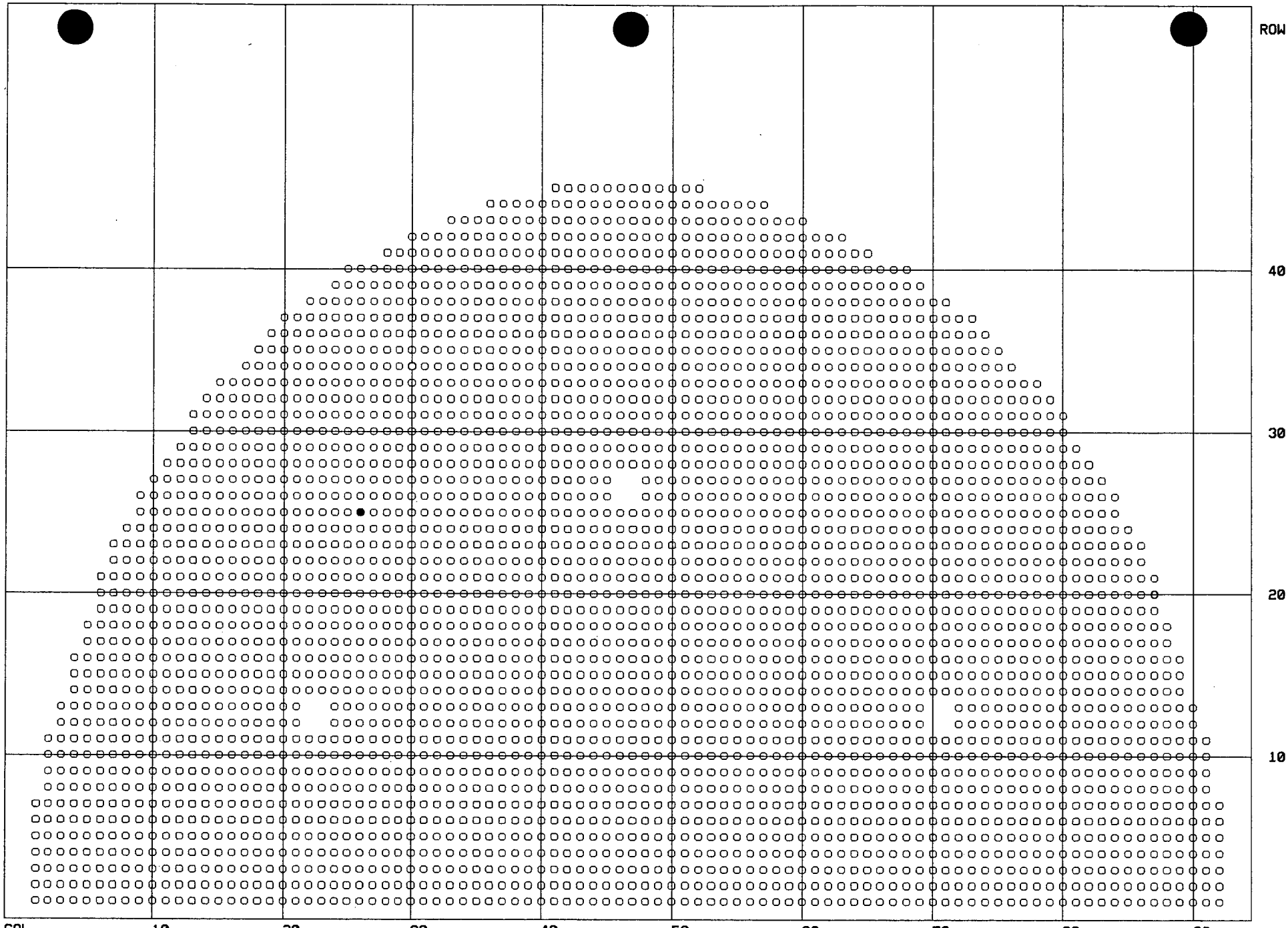
ACRI ISIS Tubes



859: Tubes Inspected 1992

H.B. ROBINSON Unit 2
S/G #B 05/08/92
ABB-Combustion Engineering

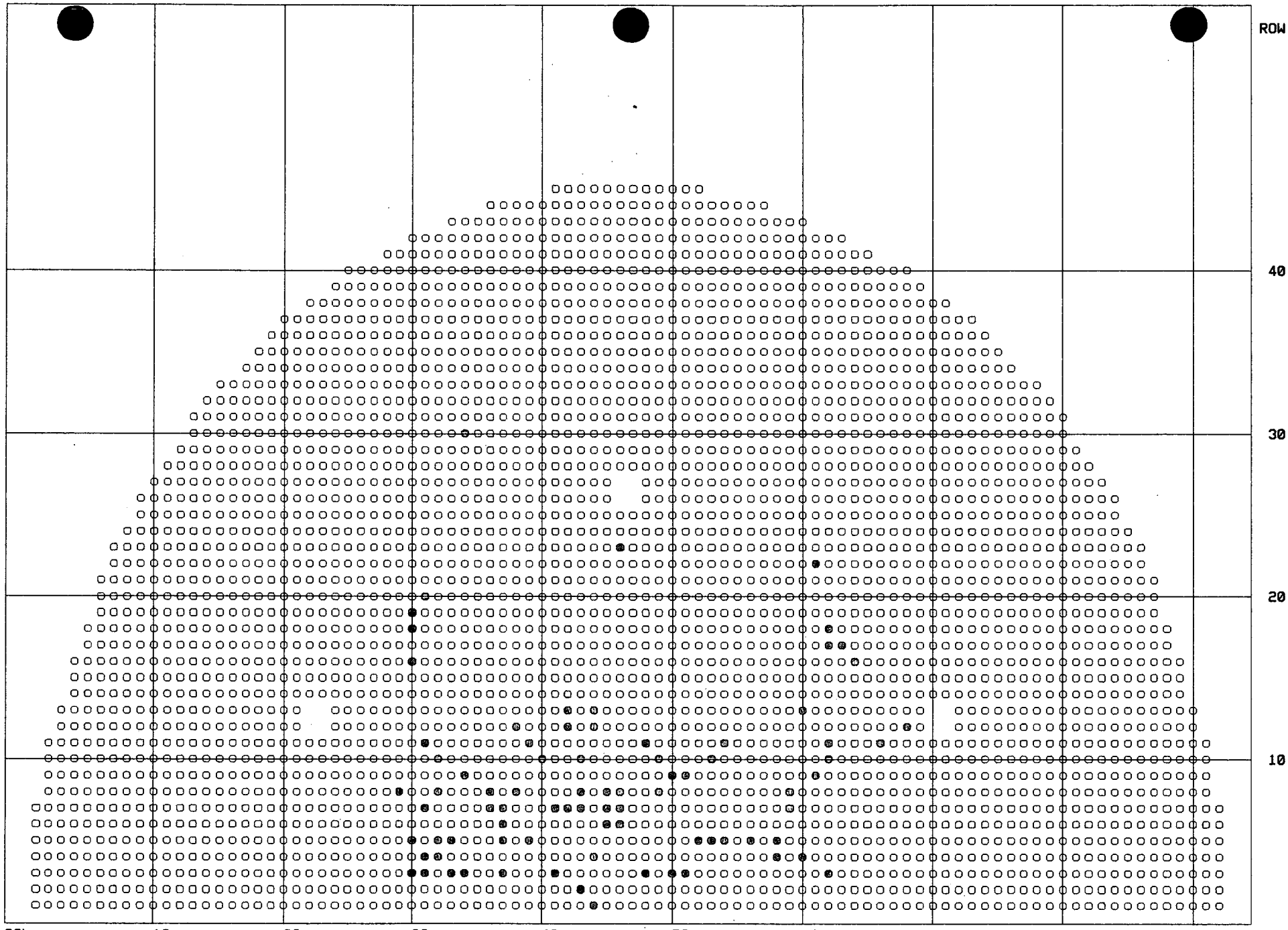
ACRI ISIS Tubes



2: Tubes w/GT 0%/LE 19% Indications
1: Tubes w/GE 20%/LE 39% Indications

H.B. ROBINSON Unit 2
S/G #B 05/09/92
ABB-Combustion Engineering

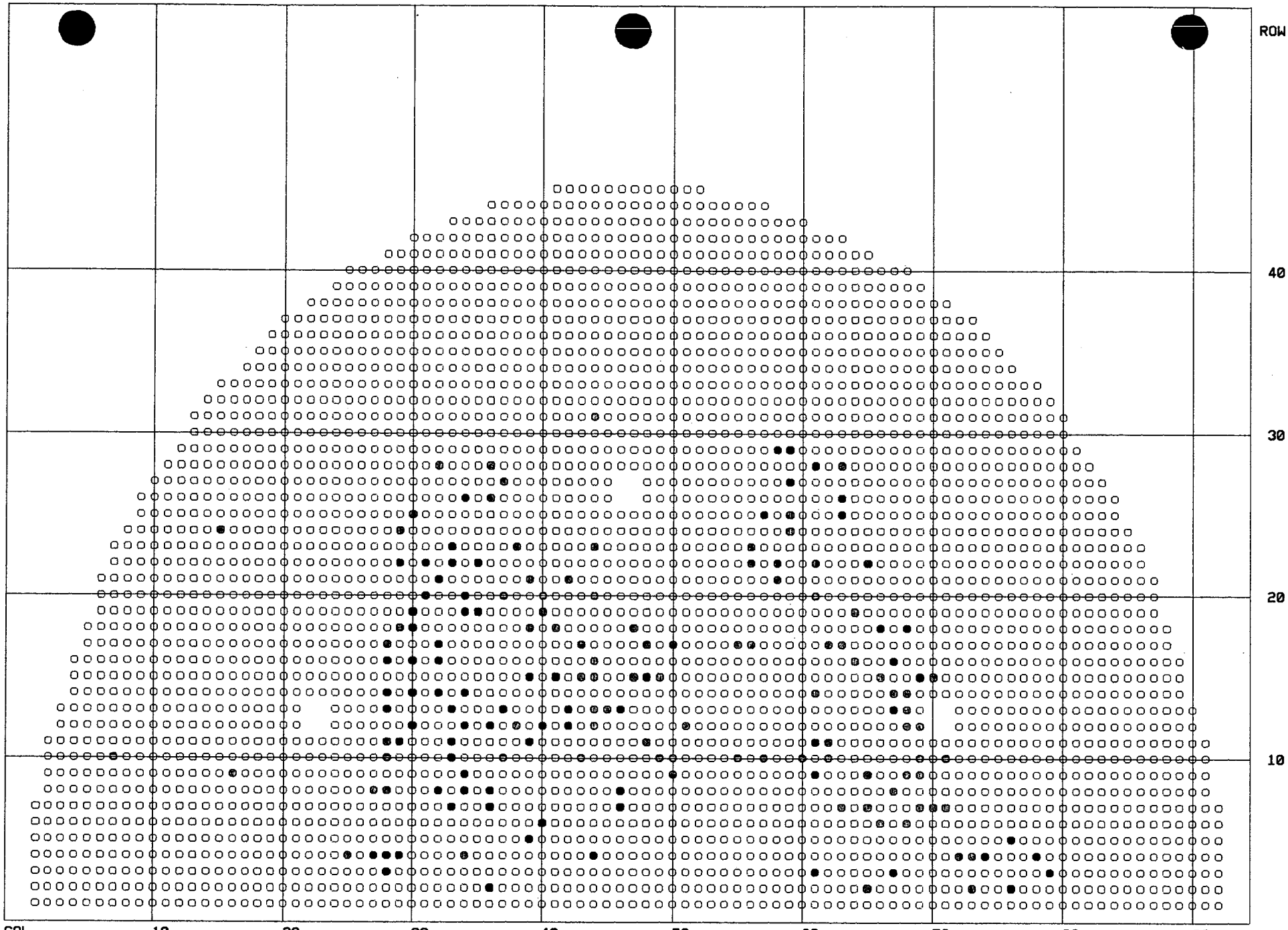
ACRI ISIS Tubes



82: Tubes with Copper Indications

H.B. ROBINSON Unit 2
S/G #B 05/08/92
ABB-Combustion Engineering

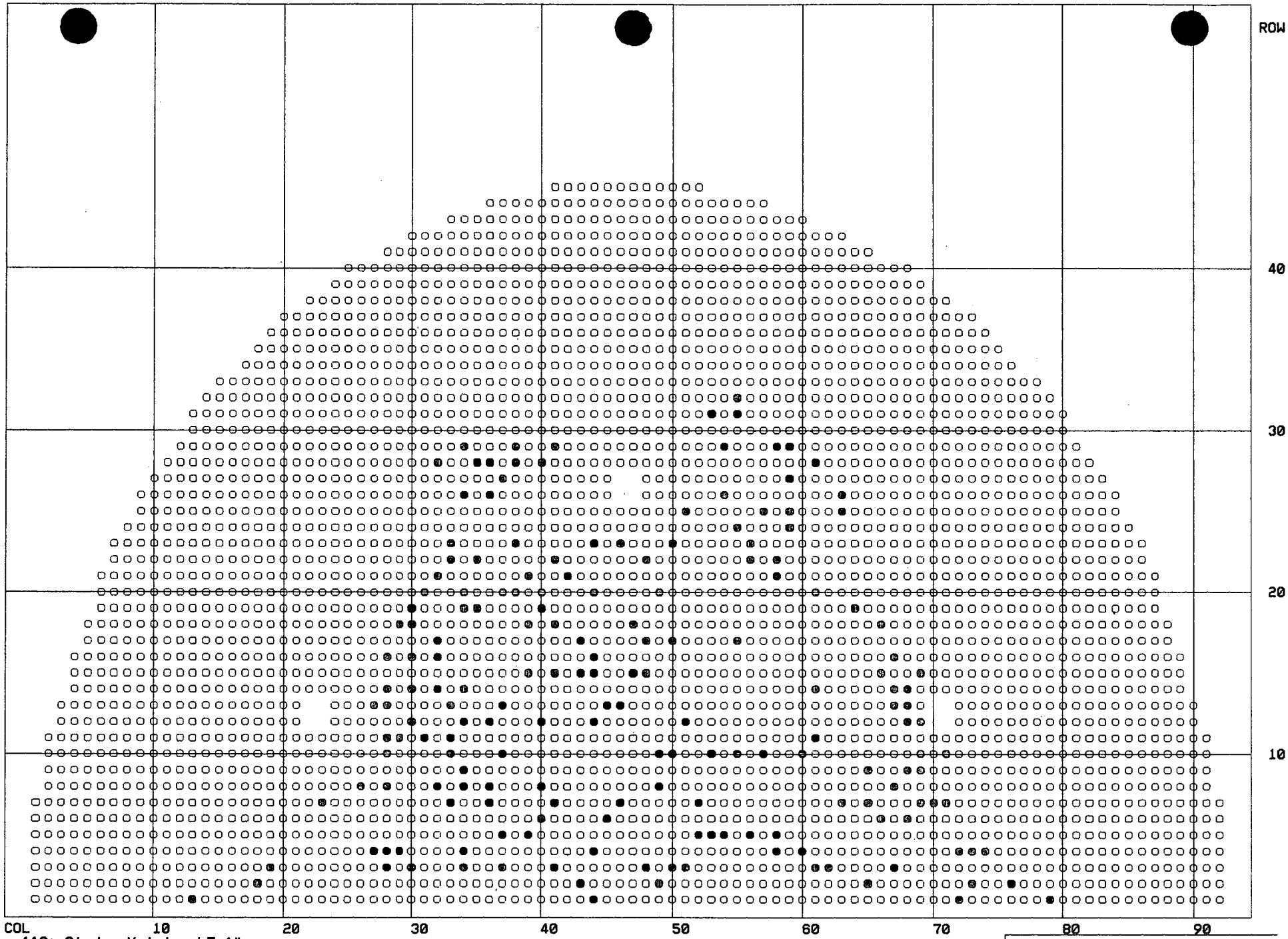
ACRI ISIS Tubes



86: Sludge Cold leg LT 1"
65: Sludge Cold leg GT 1"
18: Sludge Cold leg GT 2"

H.B. ROBINSON Unit 2
S/G #B 05/08/92
ABB-Combustion Engineering

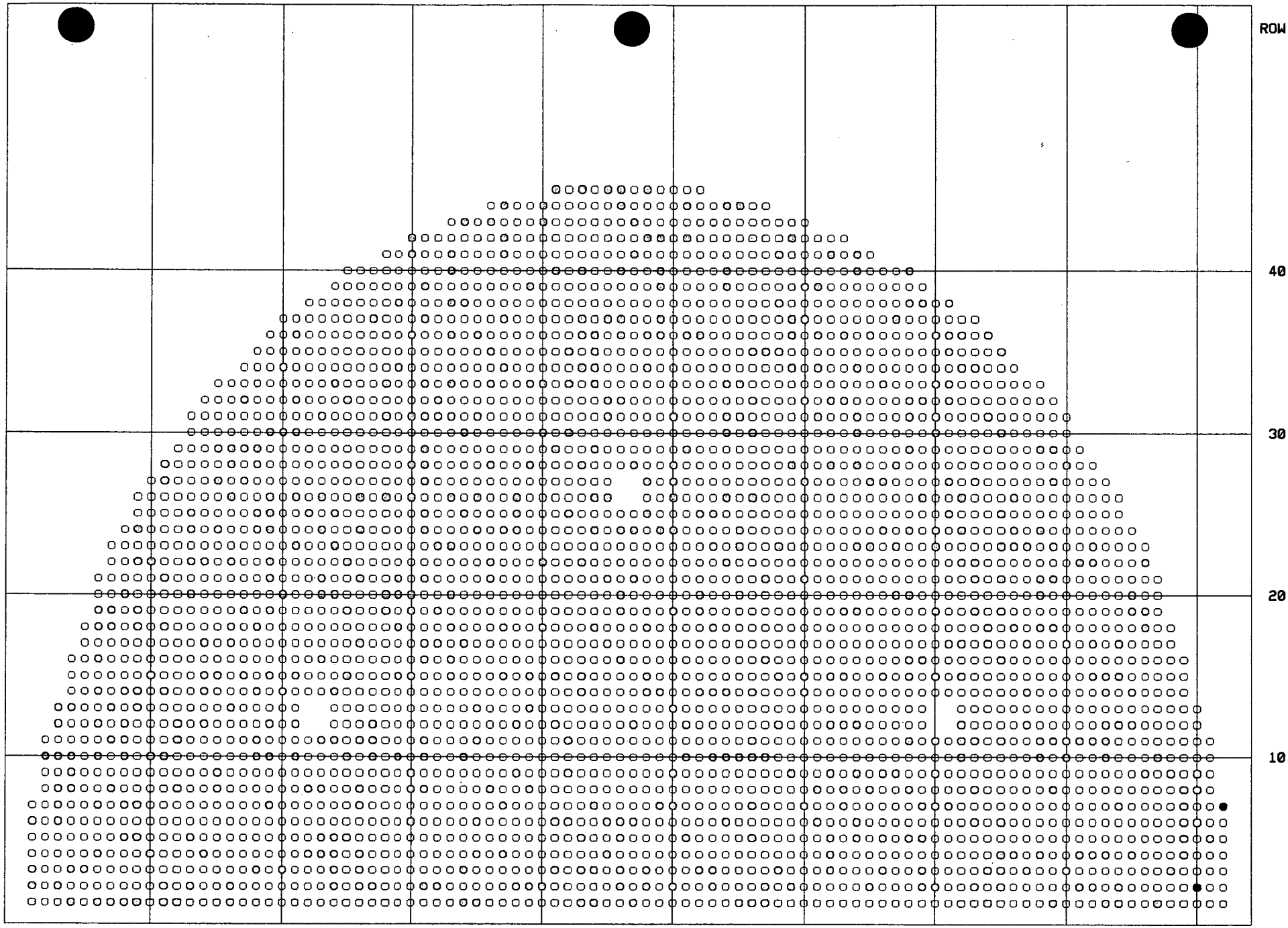
ACRI ISIS Tubes



110: Sludge Hot leg LT 1"
51: Sludge Hot leg GT 1"
24: Sludge Hot leg GT 2"

H.B. ROBINSON Unit 2
S/G #B 05/08/92
ABB-Combustion Engineering

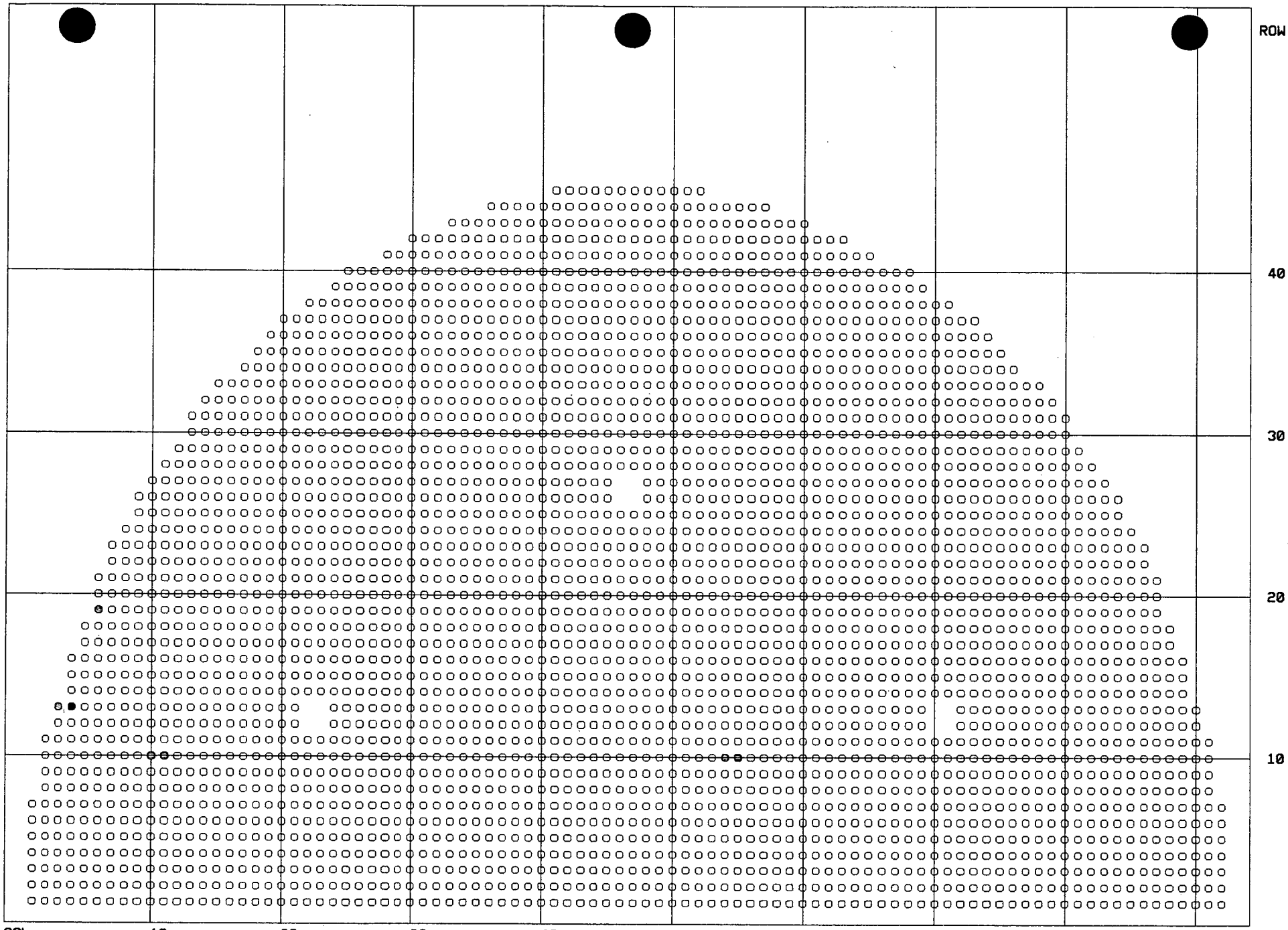
ACRI ISIS Tubes



667: Tubes Inspected 1992
2: Previously plugged tubes ('88 & '90)

H.B. ROBINSON Unit 2
S/G #C 05/08/92
ABB-Combustion Engineering

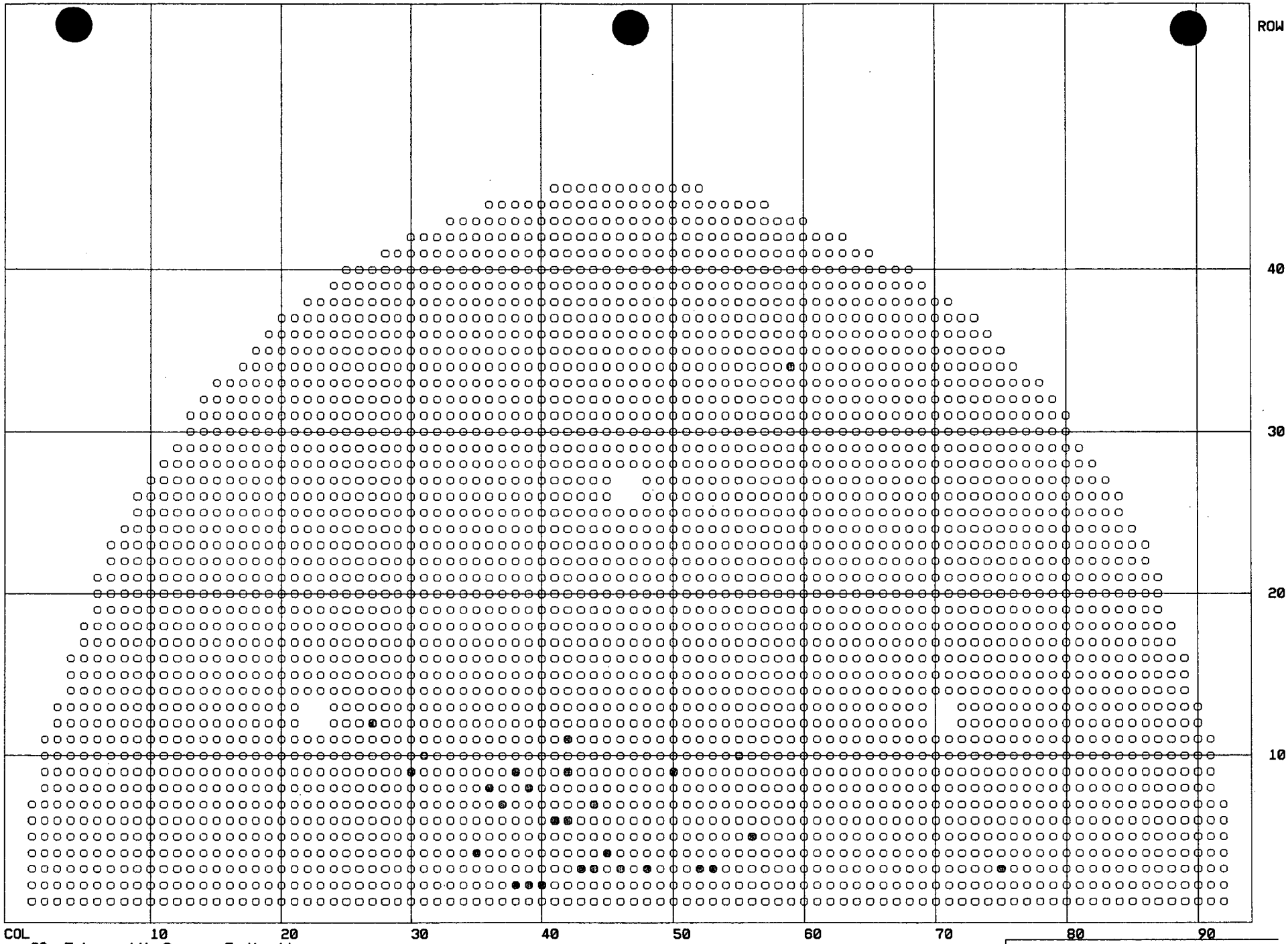
ACRI ISIS Tubes



5: Tubes w/GT 0%/LE 19% Indications
2: Tubes w/GE 20%/LE 39% Indications

H.B. ROBINSON Unit 2
S/G #C 05/09/92
ABB-Combustion Engineering

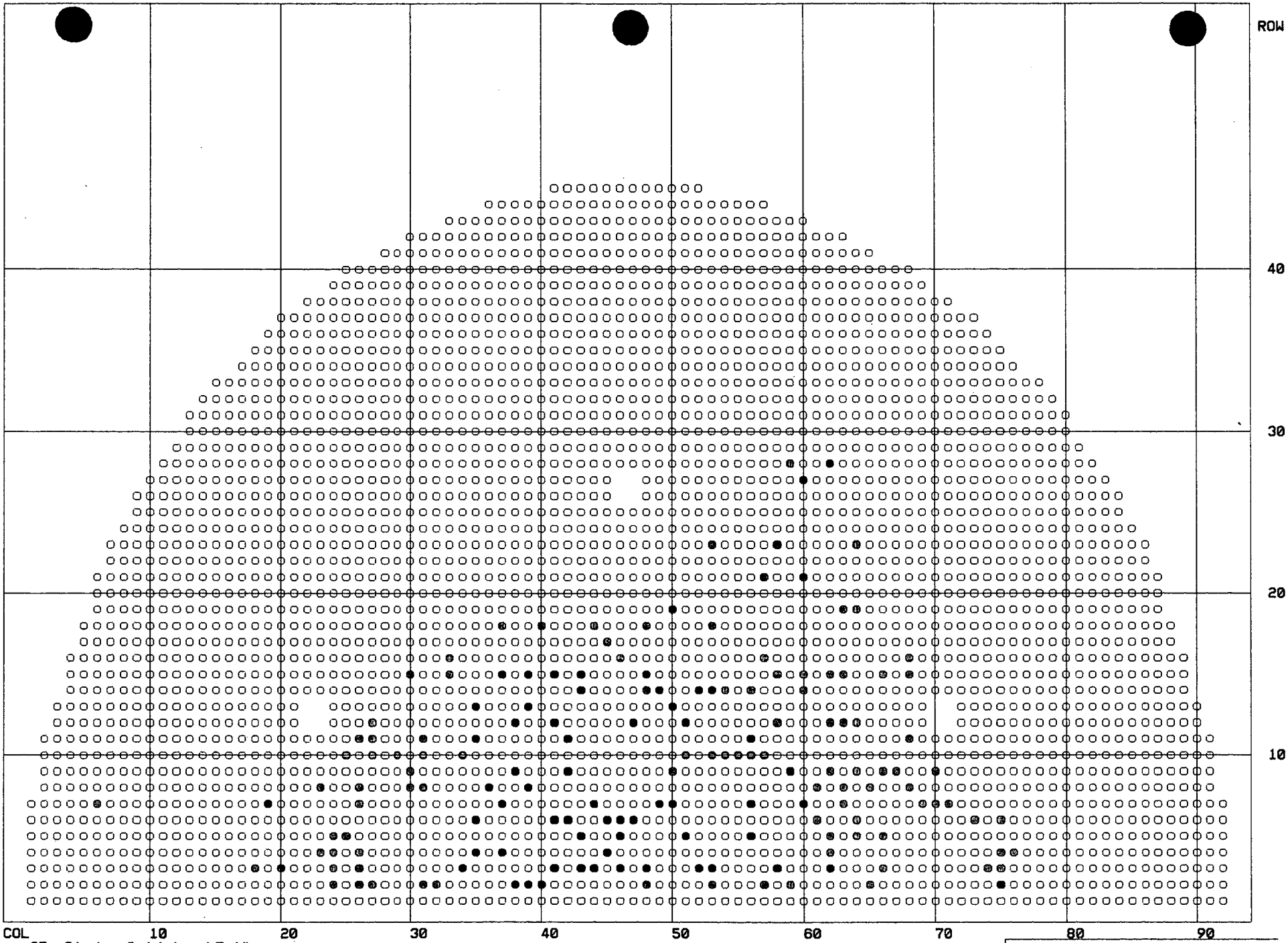
ACRI ISIS Tubes



28: Tubes with Copper Indications

H.B. ROBINSON Unit 2
S/G #C 05/08/92
ABB-Combustion Engineering

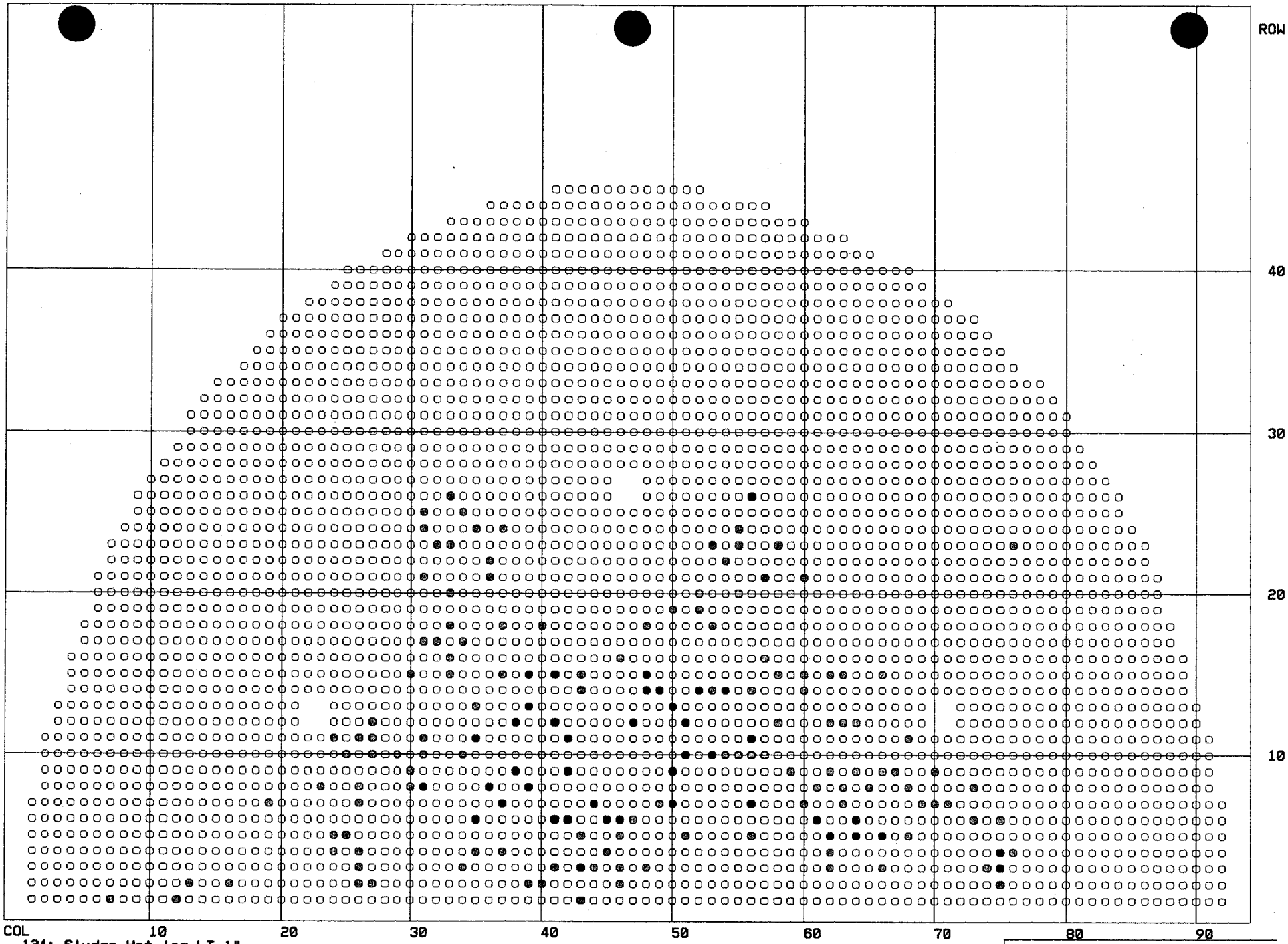
ACRI ISIS Tubes



97: Sludge Cold leg LT 1"
57: Sludge Cold leg GT 1"
10: Sludge Cold leg GT 2"

H.B. ROBINSON Unit 2
S/G #C 05/08/92
ABB-Combustion Engineering

ACRI ISIS Tubes



124: Sludge Hot leg LT 1"
36: Sludge Hot leg GT 1"
10: Sludge Hot leg GT 2"

H.B. ROBINSON Unit 2
S/G #C 05/08/92
ABB-Combustion Engineering

ACRI ISIS Tubes

MULTI-FREQUENCY EDDY CURRENT INSPECTION

SET UP INSTRUCTIONS

MIZ-18

SITE	UNIT	COMPONENT	SIDE	DATE
H. B. ROBINSON	# 2	S/G # 4 B,C	HOT or COLD	4/24/92

PROBE TYPE	CALIBRATION STANDARD (CIRCLE OR DESCRIBE OTHER)
BOBBIN PROBE A680SFRM, A700SFRM, A720MULC	(ASME) OTHER Z-8554, Z-8555, Z-8556
PROCEDURE ROB-410-004-R4	TEST PURPOSE BOBBIN 20% EXAM

MIZ-18 (MIZ-18A) CONFIGURATION

NUMBER:
NAME--: N/A

SAMPLES PER SEC: 400 FOR 12"/SEC
800 FOR 22"/SEC

FREQUENCY SEQUENCE		PROBE CHANNEL SELECT							
#	FREQUENCY	COIL 1	COIL 2	COIL 3	COIL 4	COIL 5	COIL 6	COIL 7	COIL 8
1	400 kHz	X				X			
2	100 kHz	X				X			
3	600 kHz	X				X			
4	10 kHz	X				X			

SPECIAL NOTES TO OPERATOR / ANALYST

Rows 1-5 use 12"/sec @ 400 samples/sec

Rows 6-↑ use 22"/sec @ 800 samples/sec

[A720-MULC]

SEE APPENDIX A FOR SETUP INSTRUCTIONS.

PREPARED BY: Thomas W. Rivers LEVEL III DATE 4-24-92

APPROVED BY: [signature] LEVEL III DATE 4-24-92

COMBUSTION ENGINEERING

MULTI-FREQUENCY EDDY CURRENT INSPECTION

SET UP INSTRUCTIONS

MIZ-18

SITE	UNIT	COMPONENT	SIDE	DATE
H. B. ROBINSON	# 2	S/G # A, B, C	HOT or COLD	4/24/92

PROBE TYPE BOBBIN PROBE A630SFRM, A700SFRM, A720MULC

CALIBRATION STANDARD (CIRCLE OR DESCRIBE OTHER)
(ASME) OTHER 2-8554, ~~2-8555~~ 2-8556

PROCEDURE
ROB-410-004-R4

TEST PURPOSE
BOBBIN 20% EXAM

MIZ-18 (MIZ-18A) CONFIGURATION

NUMBER:
NAME--: N/A

SAMPLES PER SEC: 400 FOR 12"/SEC
800 FOR 22"/SEC

FREQUENCY SEQUENCE		PROBE CHANNEL SELECT							
#	FREQUENCY	COIL 1	COIL 2	COIL 3	COIL 4	COIL 5	COIL 6	COIL 7	COIL 8
1	400 kHz	X				X			
2	100 kHz	X				X			
3	600 kHz	X				X			
4	10 kHz	X				X			

SPECIAL NOTES TO OPERATOR / ANALYST

Rows 1-5 use 12"/sec @ 400 samples/sec

Rows 6-↑ use 22"/sec @ 800 samples/sec

[A720-MULC]

SEE APPENDIX A FOR SETUP INSTRUCTIONS.

PREPARED BY: Thomas W. Bipes LEVEL III DATE 4-24-92

APPROVED BY: [signature] LEVEL III DATE 4-24-92

COMBUSTION ENGINEERING

MULTI-FREQUENCY EDDY CURRENT INSPECTION

SET UP INSTRUCTIONS

MIZ-18

SITE	UNIT	COMPONENT	SIDE	DATE
H. B. ROBINSON	# 2	S/G # A, B, C	HOT or COLD	4/24/92

PROBE TYPE	CALIBRATION STANDARD (CIRCLE OR DESCRIBE OTHER)
BOBBIN PROBE A630 SFRM, A700SFRM, A720 MULC	(ASME) OTHER 2-8554, 2-8555, 2-8556
PROCEDURE ROB-410-004-R4	TEST PURPOSE BOBBIN 20% EXAM

MIZ-18 (MIZ-18A) CONFIGURATION

NUMBER: N/A
NAME- -:

SAMPLES PER SEC: 400 FOR 12"/SEC
800 FOR 22"/SEC

FREQUENCY SEQUENCE		PROBE CHANNEL SELECT							
#	FREQUENCY	COIL 1	COIL 2	COIL 3	COIL 4	COIL 5	COIL 6	COIL 7	COIL 8
1	400 kHz	X				X			
2	100 kHz	X				X			
3	600 kHz	X				X			
4	10 kHz	X				X			

SPECIAL NOTES TO OPERATOR / ANALYST

ROWS 1-5 USE 12"/SEC @ 400 SAMPLES/SEC

ROWS 6-↑ USE 22"/SEC @ 800 SAMPLES/SEC

[A720-MULC]

SEE APPENDIX A FOR SETUP INSTRUCTIONS.

PREPARED BY: Thomas W. Briggs LEVEL III DATE 4-24-92

APPROVED BY: [signature] LEVEL III DATE 4-24-92

COMBUSTION ENGINEERING

C P & L
H. B. ROBINSON
COMPONENT: S/G #A
OUTAGE: 9204

Date: 05/17/92
Page: 1

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
1 4	RAND	1 6	RAND	1 9	RAND	1 12	RAND	1 17	RAND
1 25	RAND	1 26	RAND	1 27	RAND	1 28	RAND	1 29	RAND
1 30	BIND	1 41	RAND	1 45	RAND	1 46	PREV	1 48	RAND
1 50	RAND	1 51	RAND	1 61	RAND	1 63	RAND	1 67	RAND
1 71	RAND	1 74	RAND	1 82	RAND	1 83	RAND	1 89	RAND
1 90	RAND	1 91	RAND	2 11	RAND	2 16	RAND	2 19	RAND
2 21	PREV	2 28	BIND	2 29	BIND	2 30	BIND	2 41	RAND
2 51	RAND	2 53	RAND	2 56	RAND	2 61	RAND	2 70	RAND
2 71	RAND	2 76	RAND	2 80	RAND	3 4	RAND	3 5	RAND
3 8	PREV	3 9	RAND	3 16	RAND	3 18	RAND	3 19	RAND
3 21	1987	3 31	RAND	3 32	RAND	3 34	RAND	3 38	RAND
3 53	RAND	3 60	RAND	3 67	RAND	3 69	RAND	3 74	RAND
3 89	RAND	4 3	RAND	4 14	RAND	4 26	RAND	4 27	RAND
4 28	RAND	4 33	RAND	4 35	RAND	4 36	RAND	4 40	RAND
4 42	RAND	4 43	RAND	4 44	RAND	4 60	RAND	4 65	RAND
4 75	RAND	4 76	RAND	4 77	RAND	4 80	RAND	4 81	RAND
5 2	RAND	5 16	RAND	5 21	RAND	5 22	RAND	5 24	RAND
5 28	RAND	5 31	RAND	5 33	RAND	5 35	RAND	5 38	RAND
5 40	RAND	5 41	PREV	5 45	RAND	5 56	RAND	5 57	RAND
5 58	RAND	5 60	PREV	5 64	RAND	5 65	RAND	5 70	RAND
6 1	RAND	6 20	PREV	6 36	PREV	6 42	RAND	6 44	PREV
6 49	RAND	6 53	PREV	6 56	RAND	6 64	RAND	6 67	RAND
6 82	RAND	6 85	RAND	6 87	RAND	7 7	RAND	7 8	RAND
7 12	RAND	7 15	RAND	7 23	RAND	7 26	RAND	7 34	RAND
7 38	RAND	7 40	RAND	7 41	RAND	7 43	PREV	7 47	RAND
7 51	RAND	7 56	PREV	7 69	RAND	7 70	RAND	7 71	RAND
7 73	RAND	7 76	RAND	7 77	PREV	7 78	PREV	7 79	RAND
7 80	RAND	7 83	RAND	8 2	RAND	8 8	RAND	8 10	RAND
8 12	RAND	8 13	RAND	8 15	RAND	8 25	RAND	8 37	RAND
8 39	RAND	8 42	RAND	8 46	RAND	8 48	RAND	8 49	RAND
8 51	RAND	8 57	RAND	8 58	RAND	8 60	RAND	8 62	PREV
8 65	RAND	8 70	RAND	8 72	RAND	8 73	RAND	8 82	PREV
8 87	RAND	9 4	RAND	9 14	RAND	9 21	RAND	9 23	RAND
9 25	RAND	9 28	RAND	9 45	PREV	9 47	RAND	9 68	RAND
9 86	RAND	9 90	RAND	10 7	RAND	10 8	RAND	10 9	RAND
10 10	RAND	10 11	RAND	10 13	RAND	10 15	PREV	10 16	PREV
10 17	1987	10 18	PREV	10 19	RAND	10 20	RAND	10 21	1987
10 23	RAND	10 24	RAND	10 26	RAND	10 34	RAND	10 35	RAND
10 37	RAND	10 39	RAND	10 40	RAND	10 41	RAND	10 45	RAND
10 50	RAND	10 51	RAND	10 54	RAND	10 58	RAND	10 61	RAND
10 76	RAND	10 82	RAND	10 83	RAND	10 85	RAND	10 87	RAND
10 89	RAND	11 2	PREV	11 4	RAND	11 7	RAND	11 10	RAND
11 11	PREV	11 12	PREV	11 14	RAND	11 17	PREV	11 25	RAND
11 28	RAND	11 40	RAND	11 47	RAND	11 60	RAND	11 62	RAND
11 64	RAND	11 65	RAND	11 67	RAND	11 75	RAND	11 89	RAND
12 3	RAND	12 8	RAND	12 9	RAND	12 16	PREV	12 21	RAND
12 25	PREV	12 32	RAND	12 38	RAND	12 40	RAND	12 41	PREV
12 42	RAND	12 44	RAND	12 45	RAND	12 65	RAND	12 66	RAND

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
12 68	RAND	12 73	RAND	12 85	RAND	12 87	RAND	12 90	RAND
13 4	RAND	13 7	RAND	13 18	RAND	13 24	PREV	13 25	PREV
13 30	RAND	13 32	RAND	13 37	PREV	13 48	RAND	13 57	PREV
13 61	RAND	13 67	RAND	13 73	RAND	13 75	RAND	13 87	RAND
14 5	RAND	14 7	RAND	14 15	RAND	14 17	PREV	14 20	RAND
14 35	RAND	14 53	RAND	14 61	RAND	14 67	RAND	14 69	RAND
14 74	RAND	15 11	RAND	15 14	RAND	15 17	PREV	15 18	PREV
15 21	RAND	15 35	RAND	15 39	RAND	15 41	RAND	15 43	RAND
15 45	RAND	15 47	PREV	15 49	RAND	15 52	RAND	15 64	RAND
15 76	RAND	15 81	RAND	15 83	RAND	15 85	RAND	15 86	RAND
15 88	RAND	16 20	RAND	16 23	RAND	16 24	RAND	16 42	RAND
16 45	RAND	16 46	RAND	16 48	RAND	16 56	RAND	16 66	RAND
16 69	PREV	16 71	RAND	16 79	RAND	16 80	RAND	16 82	RAND
16 86	RAND	16 88	RAND	17 13	RAND	17 26	RAND	17 34	RAND
17 50	RAND	17 52	RAND	17 54	RAND	17 57	RAND	17 60	RAND
17 64	RAND	17 67	RAND	17 70	RAND	17 74	RAND	17 83	RAND
17 85	RAND	17 86	RAND	17 88	RAND	18 12	RAND	18 13	RAND
18 28	RAND	18 34	RAND	18 49	PREV	18 63	RAND	18 68	RAND
18 80	RAND	18 81	RAND	18 83	RAND	19 13	RAND	19 20	RAND
19 21	RAND	19 22	RAND	19 29	RAND	19 30	RAND	19 35	RAND
19 42	RAND	19 47	RAND	19 52	RAND	19 60	RAND	19 64	RAND
19 69	RAND	19 77	RAND	20 7	RAND	20 8	RAND	20 13	RAND
20 21	RAND	20 39	RAND	20 44	RAND	20 46	RAND	20 50	PREV
20 60	RAND	20 61	RAND	20 62	RAND	20 64	RAND	20 69	RAND
20 71	RAND	20 73	RAND	20 74	RAND	20 75	RAND	20 77	RAND
20 80	RAND	20 82	RAND	21 10	RAND	21 20	RAND	21 42	RAND
21 43	RAND	21 55	RAND	21 57	RAND	21 59	RAND	21 61	PREV
21 67	RAND	21 81	PREV	22 7	RAND	22 17	RAND	22 21	RAND
22 23	PREV	22 27	RAND	22 30	RAND	22 34	RAND	22 41	RAND
22 45	PREV	22 46	RAND	22 48	RAND	22 50	RAND	22 51	RAND
22 58	RAND	22 68	RAND	22 69	RAND	22 74	RAND	22 76	RAND
22 82	RAND	22 83	RAND	23 10	RAND	23 12	RAND	23 13	RAND
23 16	RAND	23 22	RAND	23 34	RAND	23 36	RAND	23 43	RAND
23 48	RAND	23 56	RAND	23 63	RAND	23 64	RAND	23 73	RAND
23 74	RAND	23 77	PREV	23 85	RAND	24 10	RAND	24 13	RAND
24 14	RAND	24 15	RAND	24 17	RAND	24 22	RAND	24 24	RAND
24 27	RAND	24 33	RAND	24 67	RAND	24 70	RAND	24 84	RAND
25 9	RAND	25 17	RAND	25 20	RAND	25 21	RAND	25 23	RAND
25 42	RAND	25 44	RAND	25 66	RAND	25 68	RAND	25 71	RAND
25 73	RAND	25 76	RAND	25 77	RAND	25 80	RAND	26 10	RAND
26 15	RAND	26 19	RAND	26 24	PREV	26 34	RAND	26 35	RAND
26 62	RAND	26 71	RAND	26 75	RAND	27 15	RAND	27 17	RAND
27 18	RAND	27 35	PREV	27 37	RAND	27 38	RAND	27 52	RAND
27 58	RAND	27 59	RAND	27 61	PREV	27 63	RAND	27 66	RAND
27 72	RAND	27 73	RAND	28 14	RAND	28 28	RAND	28 30	RAND
28 32	RAND	28 34	RAND	28 40	RAND	28 41	RAND	28 44	RAND
28 57	RAND	28 59	RAND	28 67	RAND	28 73	RAND	28 79	RAND
28 81	PREV	28 82	RAND	29 15	RAND	29 17	RAND	29 22	RAND

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
29 24	RAND	29 25	1987	29 26	RAND	29 27	RAND	29 29	RAND
29 32	RAND	29 35	RAND	29 38	RAND	29 40	RAND	29 45	RAND
29 46	RAND	29 56	RAND	29 58	RAND	29 62	RAND	29 63	RAND
29 70	RAND	29 76	RAND	30 13	RAND	30 14	RAND	30 15	RAND
30 16	RAND	30 17	RAND	30 18	RAND	30 19	RAND	30 20	RAND
30 23	RAND	30 24	RAND	30 26	RAND	30 33	RAND	30 34	RAND
30 37	RAND	30 41	RAND	30 44	RAND	30 61	RAND	30 65	RAND
30 70	RAND	31 13	PREV	31 18	RAND	31 21	1987	31 22	RAND
31 33	RAND	31 45	RAND	31 55	RAND	31 57	RAND	31 65	RAND
31 66	RAND	31 68	RAND	31 69	RAND	31 70	RAND	31 71	RAND
31 72	PREV	31 74	RAND	31 77	RAND	31 79	RAND	32 20	RAND
32 22	PREV	32 23	RAND	32 25	RAND	32 37	RAND	32 40	RAND
32 46	RAND	32 47	RAND	32 48	RAND	32 50	RAND	32 53	RAND
32 54	RAND	32 64	RAND	33 24	RAND	33 25	PREV	33 27	RAND
33 30	RAND	33 31	RAND	33 33	RAND	33 37	RAND	33 43	RAND
33 50	RAND	33 51	RAND	33 61	RAND	33 71	PREV	33 73	PREV
34 32	PREV	34 34	RAND	34 35	RAND	34 37	RAND	34 40	RAND
34 44	PREV	34 55	RAND	34 59	RAND	34 69	PREV	34 70	PREV
34 72	RAND	34 75	RAND	34 76	PREV	35 18	RAND	35 21	RAND
35 26	RAND	35 30	RAND	35 33	RAND	35 35	RAND	35 39	RAND
35 43	PREV	35 46	RAND	35 51	RAND	35 53	RAND	35 58	RAND
35 60	RAND	35 61	RAND	35 63	RAND	35 64	RAND	35 66	RAND
35 67	RAND	35 74	RAND	36 20	RAND	36 21	RAND	36 24	RAND
36 28	RAND	36 29	RAND	36 31	RAND	36 32	RAND	36 36	RAND
36 38	RAND	36 47	RAND	36 53	RAND	36 68	RAND	36 69	RAND
37 21	PREV	37 24	RAND	37 27	RAND	37 34	RAND	37 36	RAND
37 42	RAND	37 47	RAND	37 55	RAND	37 64	PREV	37 68	RAND
37 69	RAND	38 23	PREV	38 51	RAND	38 71	RAND	39 27	RAND
39 29	RAND	39 37	RAND	39 50	RAND	39 52	PREV	39 54	RAND
39 56	RAND	39 57	RAND	40 25	PREV	40 28	RAND	40 39	RAND
40 40	RAND	40 48	RAND	40 49	RAND	40 52	RAND	40 54	RAND
40 59	RAND	40 62	RAND	40 64	RAND	40 66	RAND	41 29	RAND
41 31	RAND	41 33	RAND	41 38	RAND	41 60	RAND	41 61	RAND
41 63	RAND	41 64	RAND	42 32	RAND	42 39	RAND	42 47	RAND
42 57	RAND	43 38	RAND	43 39	RAND	43 42	RAND	43 45	RAND
43 46	RAND	44 38	RAND	44 47	RAND	45 42	RAND	45 49	RAND
45 50	RAND								

PREV tubes: 63
XTRA tubes: 0
BIND tubes: 4
All Remain: 594 TOTAL Tubes: 661

C P & L
H. B. ROBINSON
COMPONENT: SG #B
OUTAGE: 9204

Date: 05/17/92
Page: 1

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
1 4	RAND	1 5	RAND	1 11	RAND	1 13	RAND	1 20	RAND
1 23	RAND	1 24	RAND	1 25	RAND	1 29	PREV	1 30	RAND
1 31	RAND	1 44	RAND	1 49	RAND	1 50	RAND	1 53	RAND
1 55	RAND	1 58	RAND	1 60	RAND	1 62	RAND	1 66	RAND
1 70	PREV	1 72	RAND	1 78	RAND	1 79	RAND	1 85	RAND
1 87	RAND	2 1	RAND	2 9	RAND	2 14	RAND	2 18	RAND
2 36	RAND	2 43	RAND	2 49	RAND	2 54	RAND	2 55	RAND
2 65	RAND	2 71	RAND	2 73	RAND	2 76	PREV	2 90	RAND
3 1	RAND	3 5	RAND	3 10	RAND	3 12	RAND	3 14	RAND
3 18	RAND	3 19	PREV	3 28	RAND	3 30	RAND	3 31	RAND
3 33	RAND	3 34	RAND	3 37	RAND	3 41	RAND	3 48	RAND
3 50	PREV	3 51	RAND	3 61	RAND	3 62	RAND	3 67	RAND
3 79	RAND	3 82	RAND	4 5	RAND	4 17	RAND	4 20	RAND
4 21	RAND	4 25	RAND	4 27	RAND	4 28	RAND	4 29	RAND
4 31	RAND	4 32	RAND	4 34	RAND	4 44	PREV	4 58	RAND
4 60	RAND	4 72	RAND	4 73	RAND	4 74	RAND	4 78	RAND
4 92	RAND	5 18	RAND	5 19	RAND	5 20	RAND	5 21	RAND
5 22	RAND	5 30	RAND	5 32	RAND	5 33	RAND	5 37	RAND
5 39	RAND	5 52	RAND	5 53	RAND	5 54	RAND	5 56	RAND
5 58	RAND	5 76	PREV	6 5	RAND	6 40	RAND	6 45	RAND
6 66	RAND	6 68	RAND	6 87	RAND	6 88	RAND	6 90	RAND
7 6	RAND	7 7	RAND	7 10	RAND	7 14	RAND	7 21	RAND
7 23	RAND	7 31	RAND	7 33	RAND	7 36	RAND	7 37	RAND
7 41	PREV	7 42	RAND	7 46	PREV	7 52	RAND	7 59	RAND
7 63	RAND	7 65	RAND	7 69	RAND	7 70	RAND	7 71	RAND
7 82	RAND	7 86	RAND	7 89	RAND	7 90	RAND	8 3	RAND
8 7	RAND	8 19	RAND	8 26	RAND	8 27	RAND	8 28	RAND
8 29	RAND	8 32	RAND	8 34	RAND	8 36	RAND	8 38	RAND
8 40	RAND	8 43	RAND	8 45	PREV	8 46	RAND	8 49	RAND
8 59	RAND	8 67	RAND	8 75	RAND	8 83	RAND	8 84	RAND
8 85	RAND	8 90	RAND	9 16	RAND	9 34	RAND	9 50	RAND
9 51	RAND	9 61	RAND	9 65	RAND	9 68	RAND	9 69	RAND
9 81	RAND	9 84	RAND	9 87	RAND	9 89	RAND	9 90	RAND
10 2	RAND	10 4	PREV	10 6	RAND	10 7	RAND	10 13	RAND
10 14	RAND	10 17	1988	10 20	1988	10 21	RAND	10 28	RAND
10 32	RAND	10 33	RAND	10 37	RAND	10 40	RAND	10 43	RAND
10 49	RAND	10 50	RAND	10 53	RAND	10 55	RAND	10 57	RAND
10 60	RAND	10 62	RAND	10 69	RAND	10 71	RAND	10 78	RAND
10 80	RAND	11 7	RAND	11 12	RAND	11 26	PREV	11 28	RAND
11 29	RAND	11 31	RAND	11 33	RAND	11 39	RAND	11 48	PREV
11 54	RAND	11 61	RAND	11 62	RAND	11 66	RAND	11 76	RAND
11 80	RAND	11 82	RAND	11 83	RAND	11 84	RAND	11 86	RAND
12 7	PREV	12 11	RAND	12 12	RAND	12 14	RAND	12 20	RAND
12 30	PREV	12 34	PREV	12 36	RAND	12 38	RAND	12 40	PREV
12 42	RAND	12 44	RAND	12 51	RAND	12 68	RAND	12 69	RAND
12 75	RAND	13 8	RAND	13 14	PREV	13 27	PREV	13 28	RAND
13 33	RAND	13 37	PREV	13 42	PREV	13 44	RAND	13 45	PREV
13 46	RAND	13 60	RAND	13 67	RAND	13 68	RAND	13 82	RAND

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
13 85	RAND	14 4	RAND	14 15	RAND	14 20	RAND	14 22	PREV
14 28	RAND	14 30	PREV	14 32	RAND	14 34	RAND	14 61	RAND
14 67	RAND	14 68	RAND	14 80	RAND	14 82	RAND	15 7	RAND
15 9	RAND	15 11	RAND	15 12	RAND	15 15	RAND	15 21	RAND
15 39	PREV	15 41	RAND	15 43	RAND	15 44	RAND	15 47	RAND
15 48	RAND	15 49	RAND	15 66	RAND	15 69	RAND	15 70	RAND
15 85	RAND	15 87	RAND	16 5	PREV	16 6	PREV	16 8	RAND
16 9	RAND	16 13	PREV	16 19	RAND	16 21	RAND	16 22	RAND
16 24	RAND	16 26	RAND	16 28	RAND	16 30	RAND	16 32	RAND
16 44	RAND	16 64	PREV	16 67	RAND	16 72	RAND	16 86	RAND
17 5	RAND	17 9	RAND	17 10	RAND	17 12	RAND	17 14	RAND
17 19	RAND	17 28	RAND	17 32	RAND	17 43	PREV	17 48	RAND
17 50	RAND	17 55	RAND	17 56	RAND	17 62	RAND	17 63	RAND
17 84	RAND	18 8	RAND	18 29	RAND	18 30	RAND	18 39	RAND
18 41	RAND	18 47	RAND	18 62	RAND	18 66	RAND	18 68	RAND
18 69	RAND	18 73	RAND	18 75	RAND	18 76	RAND	18 80	RAND
18 82	RAND	18 85	RAND	19 9	RAND	19 13	1988	19 17	1988
19 21	1988	19 30	RAND	19 34	RAND	19 35	PREV	19 40	PREV
19 64	RAND	19 83	RAND	20 7	RAND	20 10	RAND	20 18	1988
20 19	RAND	20 21	RAND	20 31	RAND	20 34	RAND	20 37	RAND
20 38	RAND	20 40	1987	20 44	RAND	20 49	RAND	20 61	RAND
20 72	RAND	20 80	RAND	20 87	PREV	21 25	1988	21 26	RAND
21 32	RAND	21 39	RAND	21 42	RAND	21 58	RAND	21 76	RAND
22 8	RAND	22 13	RAND	22 17	1988	22 21	RAND	22 22	PREV
22 29	RAND	22 31	RAND	22 33	RAND	22 35	RAND	22 41	RAND
22 48	RAND	22 56	RAND	22 58	RAND	22 61	PREV	22 65	RAND
22 67	RAND	22 69	RAND	22 73	RAND	22 82	RAND	22 84	RAND
22 86	RAND	23 12	RAND	23 18	RAND	23 33	RAND	23 38	RAND
23 44	RAND	23 46	RAND	23 50	PREV	23 56	RAND	23 66	RAND
23 68	RAND	23 78	RAND	23 79	RAND	24 11	RAND	24 12	RAND
24 14	1988	24 15	1988	24 18	RAND	24 22	RAND	24 24	RAND
24 25	1988	24 26	PREV	24 27	RAND	24 29	RAND	24 55	RAND
24 59	RAND	24 71	RAND	24 75	RAND	24 83	RAND	25 9	RAND
25 10	RAND	25 14	PREV	25 26	PREV	25 30	RAND	25 51	RAND
25 57	RAND	25 59	RAND	25 63	RAND	25 67	RAND	25 79	RAND
26 10	RAND	26 15	RAND	26 34	RAND	26 36	RAND	26 54	PREV
26 63	RAND	26 77	RAND	26 80	RAND	27 15	RAND	27 16	RAND
27 18	RAND	27 37	RAND	27 41	PREV	27 48	RAND	27 59	RAND
27 67	RAND	27 68	RAND	27 69	RAND	27 70	RAND	27 75	RAND
27 76	RAND	27 83	PREV	28 18	RAND	28 32	RAND	28 35	RAND
28 36	RAND	28 38	RAND	28 40	RAND	28 45	RAND	28 46	RAND
28 61	RAND	28 63	RAND	28 69	RAND	28 77	RAND	29 14	RAND
29 17	RAND	29 19	RAND	29 20	RAND	29 24	1988	29 25	RAND
29 26	RAND	29 28	RAND	29 30	RAND	29 31	RAND	29 34	RAND
29 38	PREV	29 39	PREV	29 41	PREV	29 48	RAND	29 49	RAND
29 54	RAND	29 58	PREV	29 59	RAND	29 72	RAND	29 74	RAND
29 76	RAND	29 77	RAND	29 81	RAND	30 13	RAND	30 15	1987
30 16	RAND	30 17	RAND	30 18	RAND	30 20	1988	30 24	RAND

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
30 26	RAND	30 27	RAND	30 29	RAND	30 30	RAND	30 34	RAND
30 41	RAND	30 42	RAND	30 48	RAND	30 51	RAND	30 52	RAND
30 66	RAND	30 69	RAND	30 77	RAND	31 14	PREV	31 21	PREV
31 23	RAND	31 25	1988	31 26	RAND	31 32	PREV	31 42	PREV
31 44	RAND	31 53	RAND	31 55	RAND	31 64	RAND	31 71	RAND
31 73	RAND	31 74	RAND	31 75	RAND	31 76	RAND	31 78	RAND
32 15	PREV	32 16	1988	32 17	1988	32 18	RAND	32 28	RAND
32 30	RAND	32 32	RAND	32 42	RAND	32 44	RAND	32 50	RAND
32 55	RAND	32 58	RAND	32 63	RAND	32 67	RAND	32 72	RAND
33 24	1988	33 28	RAND	33 29	PREV	33 32	RAND	33 34	RAND
33 37	RAND	33 38	RAND	33 49	PREV	33 51	RAND	33 60	RAND
33 62	RAND	33 71	RAND	34 29	RAND	34 30	RAND	34 34	RAND
34 44	RAND	34 57	RAND	34 60	RAND	34 73	RAND	34 75	RAND
35 18	1988	35 27	RAND	35 29	RAND	35 30	RAND	35 31	RAND
35 33	RAND	35 36	RAND	35 38	RAND	35 43	RAND	35 57	RAND
35 58	RAND	35 59	RAND	35 60	RAND	35 62	RAND	35 63	RAND
35 65	PREV	35 69	RAND	35 71	RAND	35 74	RAND	36 22	RAND
36 25	RAND	36 27	RAND	36 30	RAND	36 31	RAND	36 36	RAND
36 38	RAND	36 46	PREV	36 49	RAND	36 56	RAND	36 70	RAND
37 23	RAND	37 24	RAND	37 27	RAND	37 29	RAND	37 32	RAND
37 36	RAND	37 40	RAND	37 51	RAND	37 53	RAND	38 25	PREV
38 29	PREV	38 36	RAND	38 44	PREV	38 49	PREV	38 51	RAND
38 54	PREV	38 60	RAND	38 64	RAND	38 70	RAND	39 25	PREV
39 32	PREV	39 33	RAND	39 34	PREV	39 38	RAND	39 44	RAND
39 56	RAND	39 60	RAND	40 25	PREV	40 27	RAND	40 29	RAND
40 30	PREV	40 31	PREV	40 32	RAND	40 37	PREV	40 41	RAND
40 42	RAND	40 47	RAND	40 51	RAND	40 57	RAND	40 59	RAND
40 64	RAND	40 68	PREV	41 33	PREV	41 34	PREV	41 36	PREV
41 38	RAND	41 39	RAND	41 43	PREV	41 45	RAND	41 48	RAND
41 55	RAND	41 63	RAND	41 64	RAND	42 33	PREV	42 37	PREV
42 41	RAND	42 46	PREV	42 52	PREV	42 61	RAND	43 33	PREV
43 34	PREV	43 36	PREV	43 37	RAND	43 38	PREV	43 40	PREV
43 41	RAND	43 44	PREV	43 46	RAND	43 47	RAND	43 52	PREV
44 36	PREV	44 38	RAND	44 45	PREV	44 48	PREV	44 50	PREV
44 54	RAND	44 55	PREV	45 41	PREV	45 43	PREV	45 45	PREV
45 46	PREV	45 47	PREV	45 48	PREV	45 52	PREV		

PREV tubes: 95
XTRA tubes: 0
BIND tubes: 0
All Remain: 564 TOTAL Tubes: 659

C P & L
H. B. ROBINSON
COMPONENT: SG #C
OUTAGE: 9204

Date: 05/17/92
Page: 1

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
1 4	RAND	1 6	RAND	1 7	RAND	1 8	RAND	1 9	RAND
1 11	RAND	1 12	RAND	1 16	RAND	1 34	RAND	1 35	RAND
1 43	RAND	1 44	RAND	1 47	RAND	1 55	RAND	1 56	RAND
1 57	RAND	1 74	RAND	1 79	PREV	1 83	RAND	1 84	RAND
1 87	RAND	2 1	RAND	2 3	RAND	2 11	RAND	2 13	RAND
2 16	RAND	2 24	RAND	2 26	RAND	2 27	RAND	2 31	RAND
2 32	RAND	2 38	RAND	2 39	RAND	2 40	RAND	2 46	RAND
2 48	RAND	2 50	RAND	2 53	RAND	2 57	RAND	2 59	RAND
2 65	RAND	2 69	RAND	2 70	RAND	2 73	RAND	2 75	RAND
2 81	RAND	2 82	RAND	2 84	PREV	3 1	RAND	3 4	PREV
3 5	PREV	3 18	RAND	3 20	RAND	3 24	RAND	3 26	RAND
3 34	RAND	3 41	RAND	3 43	PREV	3 44	RAND	3 46	RAND
3 48	RAND	3 52	RAND	3 53	RAND	3 58	RAND	3 62	RAND
3 66	RAND	3 69	RAND	3 74	RAND	3 75	RAND	3 77	RAND
3 80	RAND	3 88	RAND	4 6	PREV	4 10	RAND	4 14	RAND
4 22	RAND	4 23	RAND	4 24	RAND	4 26	RAND	4 35	RAND
4 37	RAND	4 45	RAND	4 62	RAND	4 75	RAND	4 76	RAND
4 78	PREV	4 81	RAND	4 82	RAND	4 83	RAND	4 85	RAND
4 89	RAND	5 8	RAND	5 9	RAND	5 13	PREV	5 23	RAND
5 24	RAND	5 25	RAND	5 43	RAND	5 46	RAND	5 51	RAND
5 56	RAND	5 62	RAND	5 64	RAND	5 66	PREV	5 68	RAND
5 69	RAND	5 89	RAND	5 91	RAND	6 1	RAND	6 3	PREV
6 30	PREV	6 35	PREV	6 41	RAND	6 42	RAND	6 45	RAND
6 46	RAND	6 47	RAND	6 54	RAND	6 61	PREV	6 64	RAND
6 73	RAND	6 75	PREV	6 89	RAND	6 90	RAND	7 3	PREV
7 6	RAND	7 8	RAND	7 9	RAND	7 19	RAND	7 26	RAND
7 37	RAND	7 44	RAND	7 49	RAND	7 50	PREV	7 56	RAND
7 60	PREV	7 63	RAND	7 69	PREV	7 70	RAND	7 71	RAND
7 84	RAND	7 89	RAND	8 3	RAND	8 4	RAND	8 7	RAND
8 12	RAND	8 15	RAND	8 22	RAND	8 23	RAND	8 26	RAND
8 30	PREV	8 31	RAND	8 36	RAND	8 39	RAND	8 61	PREV
8 63	RAND	8 65	RAND	8 68	PREV	8 73	PREV	8 79	RAND
8 89	RAND	8 90	RAND	9 4	RAND	9 15	RAND	9 30	RAND
9 38	RAND	9 42	RAND	9 50	PREV	9 59	RAND	9 62	RAND
9 64	PREV	9 66	RAND	9 67	RAND	9 70	RAND	9 86	RAND
9 88	RAND	9 90	RAND	10 2	RAND	10 3	RAND	10 4	RAND
10 6	RAND	10 8	RAND	10 10	RAND	10 11	RAND	10 18	RAND
10 19	RAND	10 21	RAND	10 25	PREV	10 27	RAND	10 29	RAND
10 31	RAND	10 34	RAND	10 51	RAND	10 53	RAND	10 54	RAND
10 55	PREV	10 56	RAND	10 57	RAND	10 72	RAND	10 78	RAND
10 80	RAND	10 83	RAND	10 87	RAND	11 7	RAND	11 8	RAND
11 12	RAND	11 18	RAND	11 23	PREV	11 24	PREV	11 26	RAND
11 27	RAND	11 31	RAND	11 35	RAND	11 42	PREV	11 56	RAND
11 68	RAND	11 70	RAND	11 72	RAND	11 73	RAND	11 75	RAND
11 78	RAND	11 79	RAND	11 80	RAND	11 81	RAND	11 82	RAND
11 83	RAND	12 3	RAND	12 6	RAND	12 8	RAND	12 12	RAND
12 14	RAND	12 19	PREV	12 21	RAND	12 27	RAND	12 38	RAND
12 41	RAND	12 47	RAND	12 51	RAND	12 58	RAND	12 62	RAND

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
12 63	RAND	12 64	RAND	12 72	RAND	12 77	RAND	12 83	RAND
12 84	RAND	12 85	RAND	13 3	PREV	13 4	RAND	13 7	RAND
13 9	RAND	13 16	RAND	13 35	RAND	13 39	RAND	13 50	RAND
14 6	RAND	14 8	RAND	14 9	RAND	14 11	RAND	14 14	RAND
14 18	RAND	14 20	RAND	14 24	RAND	14 43	PREV	14 48	RAND
14 49	RAND	14 52	RAND	14 53	RAND	14 54	RAND	14 56	RAND
14 60	RAND	14 77	RAND	14 83	RAND	14 85	RAND	15 10	RAND
15 14	RAND	15 15	RAND	15 17	RAND	15 19	RAND	15 21	RAND
15 25	RAND	15 29	RAND	15 30	RAND	15 33	RAND	15 37	RAND
15 39	XTRA	15 41	RAND	15 43	PREV	15 48	RAND	15 58	RAND
15 60	RAND	15 62	RAND	15 63	PREV	15 66	RAND	15 68	RAND
15 70	RAND	15 72	RAND	15 82	RAND	15 83	RAND	15 84	RAND
16 6	RAND	16 23	RAND	16 31	XTRA	16 33	RAND	16 46	RAND
16 57	PREV	16 68	RAND	16 69	RAND	16 75	RAND	17 14	RAND
17 16	RAND	17 26	RAND	17 31	RAND	17 32	RAND	17 34	PREV
17 45	PREV	17 71	RAND	17 72	PREV	17 74	RAND	17 77	RAND
17 80	RAND	17 82	RAND	17 84	RAND	18 6	RAND	18 7	RAND
18 9	RAND	18 11	RAND	18 16	RAND	18 18	RAND	18 29	RAND
18 33	RAND	18 37	RAND	18 40	RAND	18 44	RAND	18 48	RAND
18 53	RAND	18 74	RAND	18 76	RAND	18 78	RAND	18 79	RAND
18 86	RAND	19 6	RAND	19 7	RAND	19 9	RAND	19 17	RAND
19 19	RAND	19 25	RAND	19 28	RAND	19 30	RAND	19 32	RAND
19 46	RAND	19 50	RAND	19 52	RAND	19 63	RAND	19 64	RAND
19 70	RAND	19 73	RAND	19 75	RAND	19 85	RAND	19 86	RAND
20 8	RAND	20 13	RAND	20 20	RAND	20 23	RAND	20 24	RAND
20 28	RAND	20 29	RAND	20 30	RAND	20 33	RAND	20 46	RAND
20 52	RAND	20 55	PREV	20 67	RAND	20 68	RAND	20 78	RAND
20 85	RAND	21 11	PREV	21 19	RAND	21 23	RAND	21 26	RAND
21 29	RAND	21 31	RAND	21 36	RAND	21 45	RAND	21 47	RAND
21 57	RAND	21 60	RAND	21 73	RAND	21 75	RAND	21 78	RAND
21 79	RAND	22 9	RAND	22 10	RAND	22 13	RAND	22 14	RAND
22 16	RAND	22 19	RAND	22 25	RAND	22 36	RAND	22 40	RAND
22 43	RAND	22 54	RAND	22 72	RAND	22 73	RAND	22 81	RAND
22 82	RAND	22 86	RAND	23 21	RAND	23 24	RAND	23 32	PREV
23 33	RAND	23 53	RAND	23 55	RAND	23 58	RAND	23 64	RAND
23 65	RAND	23 67	RAND	23 70	RAND	23 75	RAND	23 76	RAND
23 77	RAND	23 79	RAND	23 82	RAND	24 9	RAND	24 13	RAND
24 15	RAND	24 18	RAND	24 19	RAND	24 23	RAND	24 26	RAND
24 31	RAND	24 35	RAND	24 37	RAND	24 38	RAND	24 44	RAND
24 46	RAND	24 47	RAND	24 49	RAND	24 50	RAND	24 55	RAND
24 66	RAND	24 68	RAND	24 70	PREV	24 72	RAND	24 76	RAND
24 78	RAND	25 13	RAND	25 18	RAND	25 19	RAND	25 22	RAND
25 24	XTRA	25 31	RAND	25 34	RAND	25 38	RAND	25 42	RAND
25 48	RAND	25 52	RAND	25 53	RAND	25 71	RAND	25 75	RAND
26 16	RAND	26 19	RAND	26 21	RAND	26 23	RAND	26 26	RAND
26 28	RAND	26 30	RAND	26 33	PREV	26 35	RAND	26 38	RAND
26 44	RAND	26 45	RAND	26 50	RAND	26 54	RAND	26 56	RAND
26 69	RAND	26 72	RAND	26 76	RAND	27 11	RAND	27 15	PREV

LIST OF ALL SCHEDULED EXAMS

Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP	Row/Col	GRP
27 17	RAND	27 31	RAND	27 48	RAND	27 50	RAND	27 60	RAND
27 65	RAND	27 66	RAND	27 71	RAND	27 73	RAND	27 79	RAND
28 11	RAND	28 16	RAND	28 18	RAND	28 30	RAND	28 31	RAND
28 36	RAND	28 39	RAND	28 43	PREV	28 47	RAND	28 50	RAND
28 59	RAND	28 62	RAND	28 64	RAND	28 67	PREV	28 80	RAND
29 15	RAND	29 16	RAND	29 17	RAND	29 18	RAND	29 31	RAND
29 41	RAND	29 44	RAND	29 51	RAND	29 68	RAND	29 78	RAND
29 79	RAND	30 19	RAND	30 20	RAND	30 21	RAND	30 34	RAND
30 40	PREV	30 42	RAND	30 54	RAND	30 56	RAND	30 64	RAND
30 70	RAND	30 75	RAND	31 23	RAND	31 28	RAND	31 30	RAND
31 31	RAND	31 32	RAND	31 33	RAND	31 35	RAND	31 45	RAND
31 50	RAND	31 54	RAND	31 55	RAND	31 61	PREV	31 64	RAND
31 68	RAND	31 70	RAND	31 74	RAND	32 17	RAND	32 21	RAND
32 25	PREV	32 32	RAND	32 45	RAND	32 46	RAND	32 56	RAND
32 60	RAND	32 62	RAND	32 63	RAND	32 68	RAND	32 69	RAND
32 71	RAND	33 24	RAND	33 28	RAND	33 31	RAND	33 33	RAND
33 36	RAND	33 39	RAND	33 40	RAND	33 42	RAND	33 44	RAND
33 54	RAND	33 55	RAND	33 66	RAND	33 70	RAND	33 71	RAND
34 20	RAND	34 29	RAND	34 37	PREV	34 43	RAND	34 44	RAND
34 48	RAND	34 59	PREV	34 61	RAND	34 64	RAND	34 72	RAND
34 73	RAND	35 36	RAND	35 42	RAND	35 44	RAND	35 56	RAND
35 57	RAND	35 58	RAND	35 71	RAND	35 75	PREV	36 21	RAND
36 30	RAND	36 33	RAND	36 35	RAND	36 43	RAND	36 44	RAND
36 46	RAND	36 48	RAND	36 49	RAND	36 51	RAND	36 52	RAND
36 59	RAND	36 61	RAND	36 63	RAND	36 65	RAND	36 70	RAND
36 71	PREV	36 72	RAND	36 74	PREV	37 27	RAND	37 31	1987
37 37	RAND	37 43	RAND	37 45	RAND	37 46	RAND	37 49	RAND
37 59	RAND	37 60	RAND	37 67	RAND	38 29	RAND	38 33	RAND
38 34	RAND	38 58	RAND	38 68	PREV	38 69	RAND	38 71	PREV
39 31	RAND	39 39	RAND	39 49	RAND	39 54	RAND	39 60	RAND
39 61	RAND	40 33	RAND	40 41	RAND	40 43	RAND	40 46	RAND
40 49	RAND	40 54	RAND	40 64	RAND	40 68	PREV	41 30	RAND
41 33	RAND	41 37	RAND	41 47	RAND	41 58	RAND	41 62	RAND
41 64	RAND	42 30	PREV	42 37	RAND	42 48	RAND	42 49	RAND
42 51	RAND	42 59	RAND	43 34	RAND	43 36	RAND	43 40	RAND
43 47	RAND	44 37	PREV	44 40	RAND	44 46	RAND	44 51	RAND
44 54	PREV	44 55	PREV	45 41	PREV	45 43	RAND	45 45	PREV
45 46	RAND	45 48	PREV						

PREV tubes: 64
XTRA tubes: 3
BIND tubes: 0
All Remain: 600 TOTAL Tubes: 667

CAROLINA POWER AND LIGHT COMPANY
H.B. ROBINSON SEG PLANT

SPECIAL PROCEDURE

SP-1110

EDDY CURRENT EXAMINATION OF NONFERROMAGNETIC STEAM GENERATOR TUBING USING MIZ-18 EQUIPMENT

REVISION 0

CONTROLLED
RECIPIENT
ID 386

Effective Date 4-18-92

Expiration Date 10-17-92

RECOMMENDED BY: Byron A. Howard — Supervisor - Technical Support — 4-2-92 — Date

APPROVED BY: M Ball — Manager - Technical Support — 4/15/92 — Date

LIST OF EFFECTIVE PAGES

EFFECTIVE PAGES	REVISION
Cover Sheet	0
LEP	0
3 through 31	0

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1.0 PREREQUISITES

Ensure individuals are on an appropriate RWP if work is to be performed inside the Radiation Control Area.

This procedure has been reviewed per PLP-037 and it has been determined NOT to be applicable.

N/A — Unit / Section Manager

9/17/92 — Date

2.0 PRECAUTIONS

Use the principles of ALARA in planning and performing work and operations in the Radiation Control Area.

3.0 ATTACHMENT

3.1 Eddy Current Examination of Nonferromagnetic Steam Generator Tubing Using MIZ-18 Equipment.

4.0 DISPOSITION OF RECORDS

A copy of this procedure and the completed attachments shall be sent to the records vault for storage.

ATTACHMENT 3.1

EDDY CURRENT EXAMINATION OF NONFERROMAGNETIC STEAM GENERATOR TUBING USING MIZ-18 EQUIPMENT

H.B. ROBINSON

UNIT 2

PROCEDURE NO.

ROB-410-004

REVISION 4

ABB COMBUSTION ENGINEERING NUCLEAR SERVICES

APPROVED BY: Thomas A. Bipes DATE: 3-31-92
E.T. LEVEL III

APPROVED BY: Thomas D. Tad DATE: 3/31/92
QUALITY OPERATIONS

APPROVED BY: Ann B. Brown DATE: 3-31-92
COGNIZANT SUPERVISOR

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1.0 OBJECTIVE:

Eddy current examinations of steam generator tubing is performed to assess the reactor coolant pressure boundary integrity. The results of this examination are permanently recorded and used for comparison with the results of past and/or subsequent steam generator tubing inspection. The eddy current equipment operator is responsible for proper equipment interconnection, setup and collection of eddy current data. The shift supervisor will provide additional technical support during all these activities.

2.0 SCOPE:

This procedure, when used in accordance with the eddy current system setup and calibration parameters established in the specific appendices, meets the intent of the requirements of the USNRC Regulatory Guide I.83 "Inservice Inspection of PWR Steam Generator Tubes", Revision 1, dated July, 1975 and the ASME Boiler and Pressure Vessel Code, Section XI "Rules for Inservice Inspection of Nuclear Power Plant Components", 1986 Edition, with no Addenda.

3.0 REFERENCES:

3.1 ABB/Combustion Engineering Nuclear Power Nuclear Quality Assurance Manual.

3.2 ABB/Combustion Engineering Nuclear Power Businesses Quality Assurance Procedures Manual.

3.3 ZETEC DDA-4 System Operating Guideline

3.4 MIZ-18 Data Acquisition System Operating Guide

3.5 STD-410-076; Control of S/G Eddy Current Examination Data Using the Personal Computer (PC) Data Base System.

3.6 ASME Code Case N-401-1; Use of Digital Equipment.

3.7 ROB-410-005; Eddy Current Data Analysis Procedure for the Evaluation of Westinghouse Steam Generator Tubing.

3.8 ASME Code interpretation XI-1-83-18: 1980 SNT-TC-1A vs. 1975 SNT-TC-1A Certification.

3.9 HP-UX/Zetec Eddynet System Operating Guide (latest revision).

4.0 PERSONNEL REQUIREMENTS:

Each person performing examinations governed by this procedure shall be certified in accordance with SNT-TC-1A 1980 Edition or equivalent. Combustion Engineering personnel shall be certified in accordance with Combustion Engineering written Procedure QAP 2.4. contained in Reference 3.2. If examiners are supplied by the purchaser, the purchaser will be responsible for their certification. In the instance when C-E utilizes a subcontractor, C-E will be responsible for certification either by examination to the requirements of QAP 2.4 or by auditing and accepting the subcontractor(s) written practice.

4.1 A level I may perform specific calibrations and specific tests according to written instructions (procedure) and to record the results. He shall receive the necessary guidance or supervision from a certified ET Level II or III individual.

4.2 The initial equipment setup at the start of the test program shall be verified by a certified ET Level II or III individual.

4.3 The evaluation of the results of the eddy current examination must be conducted by a Data Analyst qualified to at least ET Level II with specific training for the evaluation of data from nonferromagnetic steam generator tubing.

5.0 PRECAUTIONS AND PREREQUISITES:

5.1 It is expected that very high levels of radiation may be encountered inside and adjacent to the primary head of the steam generators. Utmost care shall be taken in the setup and performance of the examination to minimize personnel exposure to ionizing radiation and radioactive contamination.

5.2 Personnel engaged in the eddy current examination program shall be indoctrinated in the radiation protection rules, guidelines, protective clothing and equipment requirements in effect at the plant site as required.

5.3 The eddy current test equipment will be set up in an area designated by the operator and approved by the site personnel in accordance with the appropriate figures and test setup instructions.

NOTE: If the Remote Data Acquisition and Analysis Trailer (RDAAT) is utilized, data acquisition equipment, video equipment and communication equipment may be located in this trailer.

5.4 The steam generator shall be open on the primary side dried and ventilated in such a manner as to provide proper temperature and humidity for personnel safety and comfort and to prevent heat and moisture damage to equipment (approximately 90 deg. F or less).

5.5 The secondary side of the steam generator shall be cooled down to the extent that the temperature of the tubes and tube sheet are 120 deg. F or less.

5.6 Provisions must be made for personnel and equipment entry into and exit from the steam generator (i.e., ladders, scaffolds or staging, platforms, lighting inside and outside the steam generator, breathing air supply, 120 VAC electricity, etc.).

5.7 Health Physics coverage shall be maintained at the steam generator during any personnel entry into the steam generator as required.

5.8 The Eddy Current Examination Sheets will list all the tubes that are to be inspected (Figure 1). The ET Operator will check each tube on the examination sheet after it is inspected. Data control is maintained in accordance with Reference 3.5 or as applicable.

5.9 NOTE: ALL EXAMINATION/INSPECTION FORMS, RECORDS, AND EXAMINATION SHEETS SHALL BE DATED AND SIGNED WHERE REQUIRED. "NA" SHALL BE WRITTEN OR TYPED IN ALL BLANKS THAT ARE NOT APPLICABLE TO THE DOCUMENT. BLACK INK IS REQUIRED AND THE USE OF "WHITE OUT" OR CORRECTION FLUID IS FORBIDDEN. CHANGES WILL BE SINGLE LINED THROUGH, INITIALED, AND DATED. UNUSED PORTIONS OF ANY FORMS SHALL BE LINED THROUGH WITH A SINGLE LINE INDICATING NO FURTHER ACTION.

5.10 A communication system will be setup and operating between the eddy current test instrument Operator and the steam generator platform.

5.11 The primary piping nozzle openings shall have been sealed prior to entry into the steam generator for eddy current testing equipment installation to eliminate the possibility of hardware inadvertently falling into the nozzle.

6.0 CALIBRATION STANDARDS:

6.1 The calibration standard will be fabricated from a length of tubing, of the same alloy, nominal outside diameter, and nominal wall thickness as that in the steam generator. It may also contain secondary side features such as carbon steel or stainless steel as support rings, copper rings, and other features as needed to provide signals for subsequent multi-parameter frequency mixing by the data analyst.

6.2 Documentation shall include an as-built drawing of the calibration standard, a mill test report, serial number and manufacture's heat treat number for tube material used in the calibration standard.

6.3 The ASME calibration standard will typically contain the following artificial discontinuities as a minimum but other designs may be used as required for specific applications. See Figure 2 for typical standard. Use as-built drawing of actual standard for specific details.

6.3.1 A single hole drilled 100% through wall 0.067 in. dia.

6.3.2 Flat-bottomed drill hole 5/64 in. dia. x 80% through from the outer tube wall surface.

6.3.3 Flat-bottomed drill hole 7/64 in. dia. x 60% through from the outer tube wall surface.

6.3.4 Flat-bottomed drill hole 3/16 in. dia. x 40% through from the outer tube wall surface.

6.3.5 Four flat-bottomed drill hole 3/16 in. dia., spaced 90 deg. apart around the tube circumference, 20% through from the outer tube wall surface.

6.3.6 1/16 in. wide 360 deg. circumferential groove. 20% through from the inner tube wall surface.

6.3.7 1/8 in. wide 360 degrees circumferential groove 10% through from the outer tube wall surface.

6.4 The profile calibration standard (when used) will contain sufficient tube expansions and/or reductions in diameter to provide a set of known values for profile evaluations. See Figure 3 for typical standard. Use as-built drawing of the actual standard for specific details.

6.5 Other special calibration standards (when used) will contain a variety of notches, holes and grooves for calibration of special setups such as rotating probes. See Figure 4 for typical special calibration standard. Use as-built drawing of the actual standard for specific details.

7.0 EQUIPMENT:

All eddy current test equipment provided by Combustion Engineering shall be certified to be equivalent to or exceed the applicable requirements of the ASME Code, Section XI, Appendix IV, Paragraph IV-3100, with Code Case N-401-1 addressing the use of digital examination equipment. Documentation of calibration will be provided prior to the start of the inspection. A typical equipment list is provided below.

7.1 Computer System with Data Acquisition Software and a supply of storage media.

7.2 Data Cartridge Recorder and a supply of properly formatted storage media cartridges.

7.3 Remote Data Acquisition Unit (RDAU) as required.

7.4 Eddy Current test/reference probes. See appropriate appendix for probe size and type.

7.5 Remote controlled manipulator, eg. SM-10/SM-20.

7.6 Steam Generator Templates (optional).

7.7 Mechanical probe pusher and flexible probe guide material (optional).

7.8 A calibration and reference standard (hand held or in-line).

7.9 Eddy Current Examination Sheets.

7.10 Closed circuit television system (optional).

7.11 Communication system (optional).

8.0 EQUIPMENT SETUP:

8.1 Satisfy applicable requirements specified in Section 5. (Precautions and Prerequisites).

8.2 Set up communications between steam generator platform and data station as required.

8.3 Install templates into the steam generator primary head as required.

8.4 Install the remote manipulator into the steam generator primary head as required.

8.5 Attach guide tube with flexible guide material between remote manipulator and the probe driver.

8.6 Interconnect the acquisition system as shown in Figure 5 and 6 described as follows:

8.6.1 Connect the General Purpose Input Output (GPIO) interface card on the (address 12) to the Data Cartridge Recorder with an appropriate cable. (When duplicating tapes, connect a second GPIO Interface Card at address 11 for the duplicate)

8.6.2 Connect the acquisition computer system (ACS) to the ACS/RDAU interface (HPIB or equiv.) with an appropriate cable.

8.6.3 Connect the ACS/RDAU Interface to the RDAU remote Unit with the desired lengths (500' to 1000' typical) of cable(s). The appropriate (IEEE-488 type) connector of the RDAU should be used. Interconnect the probe controller to the RDAU if the automated (Zetec 4d) probe pusher is used.

8.6.4 An appropriate probe splitter/adaptor connected to the PROBE connector on the RDAU is used to adapt the test probe to the RDAU.

8.7 Should absolute data be desired, the probe splitter/adaptor must have at least two probes; one probe attached to the connector labeled "probe" and one probe attached to the connector labeled "ref". The reference probe shall be placed in a reference standard. Ten foot extension cables or longer may be used as required. Typically the following splitter/adaptor will be utilized with the following probe types:

8.7.1 4 pin splitter/adaptor - bobbin probes.

8.7.2 10 pin splitter/adaptors - 8 x 1 probes, rotating probes, segmented bobbin probes, profilometry probes, etc. Other appropriate adaptors as required by probe design.

9.0 EQUIPMENT OPERATION AND CALIBRATION:

The following will describe the typical equipment calibration sequence with the specific calibration technique requirements described in Appendix A through D. The appropriate Appendix will be selected based on the particular type of inspection. The operator will be provided written instruction by the shift supervisor with the issue of a completed "Set Up Instruction" Form. See Figure 7.

9.1 Load data acquisition software into the right disk drive and a blank diskette into left disk drive.

9.2 Turn power on. Turn display intensity to desired readability.

9.3 The system will prompt the user into the set clock and date mode. Place the data cartridge into the data cartridge recorder with power activated; the cartridge will self-load.

9.4 Set all appropriate time and date settings. Use 24 hour mode if available.

9.5 Initialize (format) the blank diskette. (If not previously initialized).

9.6 Insure the disk backup (drive 1) is enabled through user selectable menu options.

9.7 Change the acquisition setup parameters to the appropriate settings for the identification of system variables. e.g; S/G designator, Row and Col designators, printer enable, printer type, etc.

9.8 Configure system frequencies and operating modes (absolute or differential) as required by the appendices for the examination to be performed as directed by the shift supervisor. Be sure to set the configuration for MIZ-18 or MIZ-18A as required, and the appropriate samples per second.

9.9 Pull the probe through the calibration standard and adjust spans and rotations for all channels as described in the appendix utilized.

NOTE: In utilizing the Zetec 4d probe pusher (or equivalent), the appropriate soft key menu options should be selected. Be sure to check the setup menu options to insure proper pull speeds, rotation speeds, etc.

9.10 Complete the summary with the following plant specific information supplied by the shift supervisor and by documenting the equipment being utilized.

Owner	Calibration Standard S/N(S)
Plant and Unit Number	Procedure/Revision Number
Date	ET Operator Name/cert. level
Component ID & Side	Company Affiliation
Data Cartridge Number	Tubing Size
Probe ID, Size and Length	RDAU S/N
Length of cables (as required)	

NOTE: When completing the line item "plant", identify by initials only. The Plant field should include an abbreviated owner/plant designation and WXYY (W representing the S/G designation (A, B, C), X representing the Hot (H) or Cold (C) side, the YY representing the tape number.) EXAMPLE: CPL/ROB AH22.

When completing the line "ET Operator Name" use the operator's last name followed by the operator's initials. EXAMPLE: "Jones JR." For consistency, it is desired that no punctuation be used.

9.11 Record data from the calibration standard onto the data cartridge at the speed required for the examination as defined in the applicable appendix.

9.12 Complete the eddy current calibration sheet and cartridge label recording the appropriate information and calibration time (See Figure 8 & 9).

10.0 PROBE SPEED AND VERIFICATION:

10.1 Insert the probe into the tube to known position.

10.2 Retract the probe at test speed with acquisition system on, but not recording to tape.

10.3 Use the applicable steam generator drawing dimensions for the distance between tube

support structures.

10.4 Determine the travel time for the probe between two desired tube support structures using the strip chart display on the acquisition system (marked at 1 second intervals) or appropriate software procedure may be used (see operations manual).

10.5 Probe speed shall not exceed 26 in./sec. Probe speed should be adjusted to approximately 22 in./sec. or as required by the appendix utilized.

11.0 CALIBRATION VERIFICATION: (Span and Rotation Settings)

A calibration check must be recorded at the following intervals:

11.1 Within 4 hours of the previous calibration check.

11.2 At the beginning and end of each data cartridge recording tape.

11.3 Whenever test components are changed, loss of power, malfunction is suspected or the operator deems it necessary.

11.4 The shift supervisor or a designee shall initial the appropriate section of the eddy current calibration sheet verifying compliance of calibration.

11.5 If a calibration discrepancy should occur the shift supervisor or an eddy current Level II or III shall identify the discrepant condition on the eddy current calibration sheet. A discrepant condition occurs when items in 11.1 through 11.3 cannot be met, or when phase and amplitude tolerance levels are exceeded as defined in the referenced ASME code (section 2.0). The ECT Level III shall initial indicating acceptance of the disposition.

11.6 In the event that calibrations cannot be performed because of building evacuations, equipment malfunctions, etc., a calibration shall be made upon reentry or repair/replacement and will suffice as the fourth hour calibration.

NOTE: If discrepancies are found with the calibration as defined above, re-calibration will be required. The re-calibration information shall be forwarded to the data analyst(s). The data analyst shall determine which tubes, if any shall be reinspected.

12.0 EXAMINATION:

12.1 Position the manipulator at the location of the first tube.

12.2 Press ACS (Acquisition Computer System) "ON" soft key.

12.3 Properly identify tube location on the acquisition system.

12.4 Insert the probe into the tube to the desired elevation as defined by the Eddy Current Examination Sheets.

12.5 Press the "Run" soft-key and withdraw the probe while recording the entire length of tube to be inspected on tape during withdrawal. Take special care not to start the probe retraction or stop the data recorder too quickly which may result in an incomplete examination. Press "Pause" to stop data cartridge recorder. "Run" and "Pause" will simultaneously start or stop the recorder and probe drive when using the automated

(Zetec 4d) probe driver. See the appropriate operator manual for details of operation.

12.6 Insure the tubes to be tested are indicated as completed on the Eddy Current Examination Sheet. If a tube or portion of is not inspectable, note any apparent cause on the Eddy Current Examination Sheet. The message area should be used to note any conditions which may arise, such as incomplete or obstructed tubes, tubes which are unreachable, operator changes, probe changes, etc.

12.7 Position the probe at the next tube to be examined.

12.8 Repeat paragraph 12.3 through 12.7 for each tube to be examined.

13.0 OPERATING PRACTICES:

13.1 The acquisition system has a message capability that is provided for written information about the testing. Notations such as operator changes, probe changes and other description of testing should be included. (see 12.6)

13.2 During the examinations, cycling through the channels during data collection is recommended to ensure proper operation of all coils. This should be done in the review mode occasionally to ensure the quality of the data being recorded. Extreme care must be exercised when utilizing the review mode. Improper use of the review mode could cause a loss of tube entries on tape.

13.3 Care should be taken to ensure similar probes are used as reference probes to avoid an impedance mismatch.

13.4 The data cartridges shall be labeled appropriately utilizing the data cartridge label (Figure 9). These shall be attached to the data cartridge container and cartridge respectively.

13.5 The S/G identification system will be a two digit number with the first digit indicating the S/G and the second digit indicating the inlet or outlet side of the generator eq. "S/G 31" = S/G #3 on the inlet side eq. "S/G 20" = S/G #2 on the outlet side, etc.

13.6 The Row and Column (line) numbers shall be set to "Row 999 Col 999" for all calibration checks.

13.7 Typically whenever a calibration is required, 3 calibration pulls are recorded. Certain tests such as MRPC may not require 3 calibration pulls due to factors considering radiation dose to platform worker, etc.

14.0 MANIPULATOR POSITION VERIFICATION:

14.1 Position verification shall be done upon the installation of the remote fixture and (before relocation) of the fixture in the generator. Verification for tube locations shall be recorded on the examination sheets similar to figure 1. The position of the fixture shall be verified by sending the fixture to a known location in the generator. Once the operator has visually verified the correct tube location with the fixture camera or with the tube-sheet camera and the computer read-out, a message shall be made on the Examination Sheet (see Figure 1). Operator verification need only be made at required verifications (see 14.2).

14.2 Position verification is required:

a. Prior to eddy current work in the generator.
b. Before and after relocation of the fixture.
c. Upon concluding eddy current work in the generator.

14.3 Position verification is recommended:

a. At the beginning or end of an eddy current examination sheet.
b. When "breaking the arm" to the opposite side of the plenum.
c. When returning to the tube-sheet after lowering the arm to the manway.
d. Whenever the operator has doubt of the tube location.

NOTE: Position verifications are entered on the examination sheet(s). Care should be taken to insure operator knowledge of verification points when there is an operator change, shift change, or other similar situation.

14.4 In the instance where the location has been incorrectly identified and a position verification cannot be made from the last tube tested, all tubes tested from the last valid position verification must be reexamined.

15.0 RECORDING CRITERIA:

15.1 All data from the examination shall be recorded on the data cartridge or other media. The media will contain at a minimum the information defined in paragraph 9.10.

16.0 EVALUATION:

16.1 The data analysis shall be conducted in accordance with Reference 3.8 Procedure ROB-410-005, titled "Eddy Current Data Analysis Procedure for the Evaluation of Westinghouse Steam Generator Tubing", or ROB Steam Generator Evaluation Guidelines.

17.0 REPORTING CRITERIA:

The report of the inspection results supplied to the customer will contain the following at a minimum.

17.1 All detectable tube wall degradations.

17.2 All detectable tube dents known to obstruct probe passage.

17.3 Any additional conditions that the data analyst deems necessary.

APPENDIX A
TEST PARAMETERS FOR STANDARD
BOBBIN PROBE FOR DEFECTS, DENTS, SLUDGE, ETC.

I. Tubing

A. O.D. - 0.875"
B. Wall - 0.050" Nominal
C. Material - Inconel 600

II. Calibration Standard

See Figure 2 for Typical ASME Calibration Standard to be utilized for calibration of phase and span settings. Use as-built drawings of actual standards for specific details.

III. Test Frequencies

Frequency 1 - 400 KHz Diff. and Abs. Toggle Coils 1 and 5
Frequency 2 - 100 KHz Diff. and Abs. Toggle Coils 1 and 5
Frequency 3 - 600 KHz Diff. and Abs. Toggle Coils 1 and 5
Frequency 4 - 10 KHz Diff. and Abs. Toggle Coils 1 and 5
Other test frequencies may be used to augment the examination as required by the data analyst. Changes to the test frequencies will be accomplished through use of the Set-up Instruction Form (Figure 7) with concurrence by the customer representative.

IV. Samples/Sec.

Speeds greater than 12"/sec. should typically use a sample rate of 800 samples/sec. vs. 400 samples/sec.

V. Signal Phase

All differential channels shall be phased so the response from the 100% through-wall flaw is at 40 degrees, goes down first, and is approximately 50% of full screen height as practical.

All absolute channels shall be phased so the response from the 20% I.D. groove lies horizontal to the left and is approximately 3 screen divisions.

VI. Probes - Manufactured by Combustion Engineering, Zetec, or equivalent. Diameters are listed below. Probes may have varying prefixes and suffixes describing body shape and centering features.

A. Straight Tubing - .740", .720", .700" or as required
B. U-Bend tubing - .740", .720", .700" or as required
C. Low Row U-Bend - .650", .680", .700" or as required.
D. Specialty Testing - As required by the data analyst.
*The above listed probes may also be used with a Ring Magnet.

VII. Probe Speed

The mechanical probe pusher test scan speed shall not exceed 26 in./sec. for bobbin coil testing. Desired nominal test speed shall be documented on the set up instruction. (Figure 7) Special testing may be required at the rate specified by the Shift Supervisor. Speeds greater than 12"/sec. should typically use a sample rate of 800 samples/sec. vs. 400 samples/sec.

APPENDIX B
TEST PARAMETERS FOR BEADED JOINT FLEX (BJF)
PROBE FOR DEFECTS, DENTS, SLUDGE, HEAT TREAT, ETC.

I. Tubing

A. O.D. - 0.875"
B. Wall - 0.050" Nominal
C. Material - Inconel 600

II. Calibration Standard

See Figure 2 for Typical ASME Calibration Standard to be utilized for calibration of phase and span settings. Use as-built drawings of actual standard for specific detail.

III. Test Frequencies

Frequency 1 - 400 KHz Diff. and Abs. Toggle Coils 1 and 5
Frequency 2 - 100 KHz Diff. and Abs. Toggle Coils 1 and 5
Frequency 3 - 600 KHz Diff. and Abs. Toggle Coils 1 and 5
Frequency 4 - 10 KHz Diff. and Abs. Toggle Coils 1 and 5
Other test frequencies may be used to optimize the examination as required by the data analyst.

IV. Samples/Sec.

Speeds greater than 12"/sec. should typically use a sample rate of 800 samples/sec. vs. 400 samples/sec.

V. Signal Phase

All differential channels shall be phased so the response from the 100% through-wall flaw is at 40 deg., goes down first, and is approximately 50% of full screen height as practical.

All absolute channels shall be phased so the response from the 20% I.D. groove lies horizontal to the left and is approximately 3 screen divisions as practical.

VI. Probes

Manufactured by Combustion Engineering, Zetec or equiv. Diameters are listed below. Probes may have varying prefixes and suffixes describing body shape and centering features.

BJF Probes - .720", .700", and .680" or as required.

VII. Probe Speed

The mechanical probe pusher test scan speed shall not exceed 26 in./sec. for beaded joint flex bobbin coil testing. Desired nominal test speed shall be documented on the set up instruction. (Figure 7) Special testing may be required at the rate specified by the Shift Supervisor.

APPENDIX C
TEST PARAMETERS FOR ROTATING PROBE COIL TEST

This examination employs a surface riding pancake coil which is rotated as it traverses the tube axis producing a helical scan. Axial location is tracked by means of a positional encoder with positive feedback to the acquisition system. Flaw depths can be evaluated using a phase delay or amplitude curve and the indication topography presented in C-Scan Graphics.

I. Tubing

A. O.D. - 0.875"
B. Wall - 0.050" Nominal
C. Material - Inconel 600

II. Calibration Standard

See Figure 4 for a Typical MRPC Calibration Standard to be utilized for calibration of phase and span settings. Use as-built drawings of actual standards for specific details. Other specialized calibration standards may be used in lieu of the typical ASME calibration standard.

III. Test Frequencies

	Single Coil	3-Coil(See Figure 10)
Frequency 1 - 800 KHz, Toggle Coil 1		Coil 1, 3, 5
Frequency 2 - 400 KHz, Toggle Coil 1		Coil 1, 3, 5
Frequency 3 - 200 KHz, Toggle Coil 1, 3, 5		Coil 1, 3, 5
Frequency 4 - 100 KHZ, Toggle Coil 1, 4		Coil 1, 4, 5, 7

NOTE: The following is the designation of each coil:
Coil 1 is the internal reference pancake coil.
Coil 3 is the axial encoder [if used] or axial coil (3-coil).
Coil 4 is the event marker (rotation pulse).
Coil 5 is the "down" indicator coil. (If applicable) or circumferential coil (3-coil).
Coil 7 is the bobbin coil locator.

Probes which do not balance (e.g. coil 7) do not need to be changed. These signals do not affect the test coils.

IV. Samples/Sec.

Sample rate of 400 samples/sec. is typical for MRPC. Higher samples are permitted if indicated by lead analyst.

V. Signal Phase

All test frequencies of coil 1 (3 and 5 also for 3-coil) shall be phased so the response from the probe lift-off or noise is horizontal and the signal responses are positive. The 100% through wall hole from the standard should be approximately 4 screen divisions as practical.

Single coil rotation pulse (coil 4) should be adjusted to position the signal vertically as practical with span at 75% of one-half screen height.

APPENDIX C Cont'd

Three (3) coil rotation pulse (coil 4) has additional pulses. Adjust the phase of the large pulse in a vertical direction, with the smaller pulses horizontal. This should position the large pulse to ~ 45° on the screen. Span should be set to approximately 75% of one-half screen.

VI. Probes

Manufactured by Combustion Engineering, Zetec or equiv. Rotating probe pancake coil of the appropriate diameter to maintain consistent contact.

*The above listed probe may also be used with a saturation magnet.

VII. Probe Speed

The mechanical probe pusher test scan speed shall not exceed 0.1 in./sec. The rotating probe test speed will be 200 revolutions /min. as verified by the probe speed indicator of the software, found by depressing the "display speeds" soft key. Specialty tests may be performed at the rates specified by the Shift Supervisor.

NOTE: Recommended insertion speed should be <6"/sec. Special care must be exercised when inserting the probe into the flexible probe guide and calibration standard. The probe head may need to be rotated while inserting to the desired position.

APPENDIX D
TEST PARAMETERS FOR
PROFILOMETRY PROBE TEST

I. Tubing

A. O.D. - 0.875"
B. Wall - 0.050" Nominal
C. Material - Inconel 600

II. Calibration Standard

See Figure 3 for Typical Profilometry Standard. Use As-Built drawings of actual standard for specific details.

III. Test Frequencies

Frequency 1 - 400 KHz Abs. Toggle Coils 1, 3, 5, 7
Frequency 2 - 400 KHz Abs. Toggle Coils 2, 4, 6, 8
Frequency 3 - 10 KHz Abs. Toggle Coils 1, 3, 5, 7

Adjust samples per second to 120 in Configure mode. Other test frequencies may be used to optimize the examination as required by the data analyst.

IV. Signal Phase

Absolute frequencies 1, 2 and 3 shall be phased so the response from the step goes vertically up and approximately 3 divisions. During calibration, the probe should be nulled in the nominal section of the tube, held for 3 - 5 seconds, retracted to the reduced section, held for 3 - 5 seconds and retracted again. This process should be repeated at least six times.

V. Probes

Manufactured by Combustion Engineering, Zetec or equivalent. A special designed 8 coil pancake probe or equiv.

VI. Probe Speed

The mechanical probe pusher test scan speed shall not exceed 14 in./sec. for profilometry coil testing, 6 in./sec. is desired. Specialty tests may be retracted at the rate specified by the Shift Supervisor.

TYPICAL EDDY CURRENT EXAMINATION SHEET

COMBUSTION ENGINEERING EDDY CURRENT EXAMINATION SHEET PAGE: 2

OWNER: H L & P PLANT/UNIT: STP Unit 1 SG #A
PROBE: A620SFRH EXTENT TESTED: CTE-HTE
PROCEDURE: STP-410-004 R0 LEG: HOT
FREQUENCY: 400/200/100/10 KHz TEST DATE: 5-10-99
ECT DESCRIPTION: Bobbin Probe for Defect Examination

ISIS-ID	ROW	COL	DATA SET	TESTED	REEL #	COMMENTS
5061	3	26	SAMPLE2	✓	1H01	PV
5062	3	27	SAMPLE2	✓		
5063	3	28	SAMPLE2	✓		
5064	3	29	SAMPLE2	✓		
5065	3	30	SAMPLE2	✓		
5066	3	31	SAMPLE2	✓		
5067	3	32	SAMPLE2	✓		
5068	3	33	SAMPLE2	✓		
5069	3	34	SAMPLE2	✓		
5070	3	35	SAMPLE2	✓		[illegible]
5071	3	36	SAMPLE2	✓		
5072	3	37	SAMPLE2	✓		
5073	3	38	SAMPLE2	✓		
5074	3	39	SAMPLE2	✓		
5075	3	40	SAMPLE2	✓		
5076	3	41	SAMPLE2	✓		
5077	3	42	SAMPLE2	✓		
5078	3	43	SAMPLE2	✓		
5079	3	44	SAMPLE2	✓		
5080	3	45	SAMPLE2	✓		
5081	3	46	SAMPLE2	✓		
5082	3	47	SAMPLE2	✓		
5083	3	48	SAMPLE2	✓		
5084	3	49	SAMPLE2	✓		
5085	3	50	SAMPLE2	✓		

Running Total of Exams: 50 This page: 25

Figure 1

TYPICAL ASME CALIBRATION STANDARD

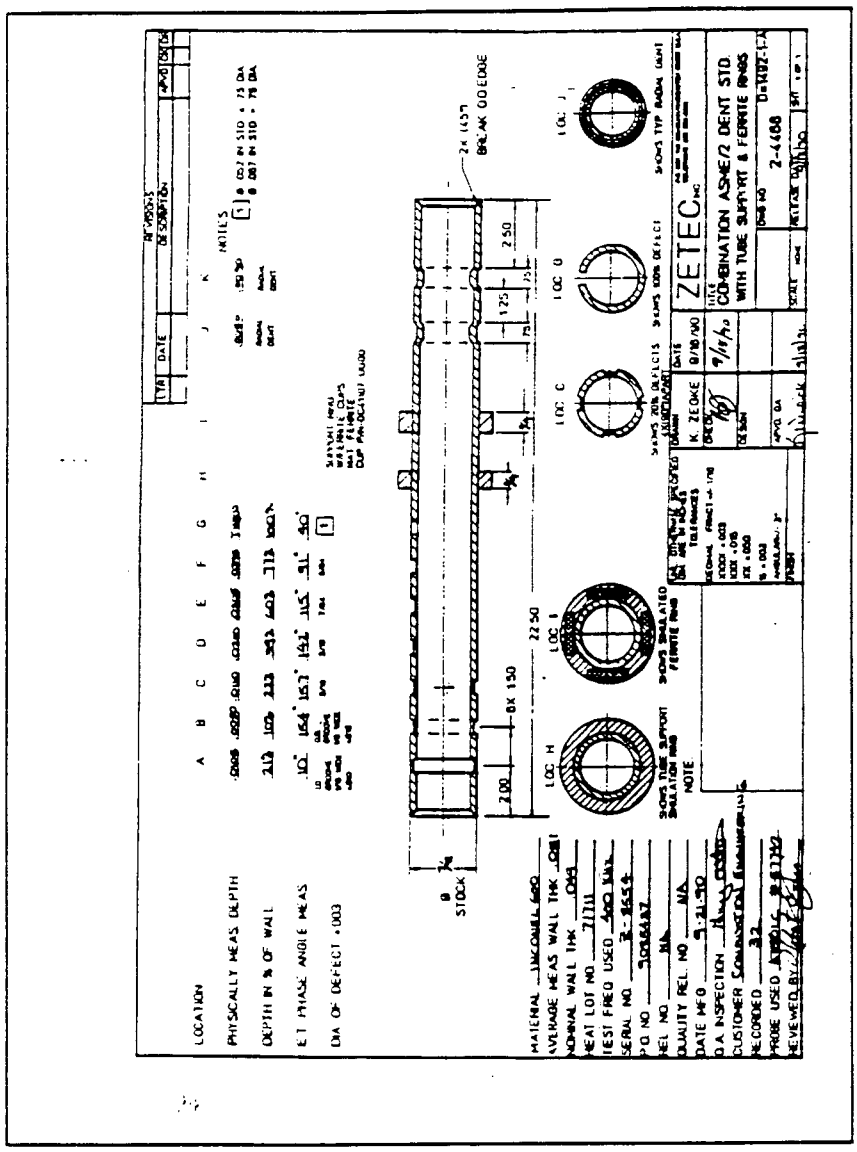

Figure 2

TYPICAL PROFILOMETRY CALIBRATION STANDARD

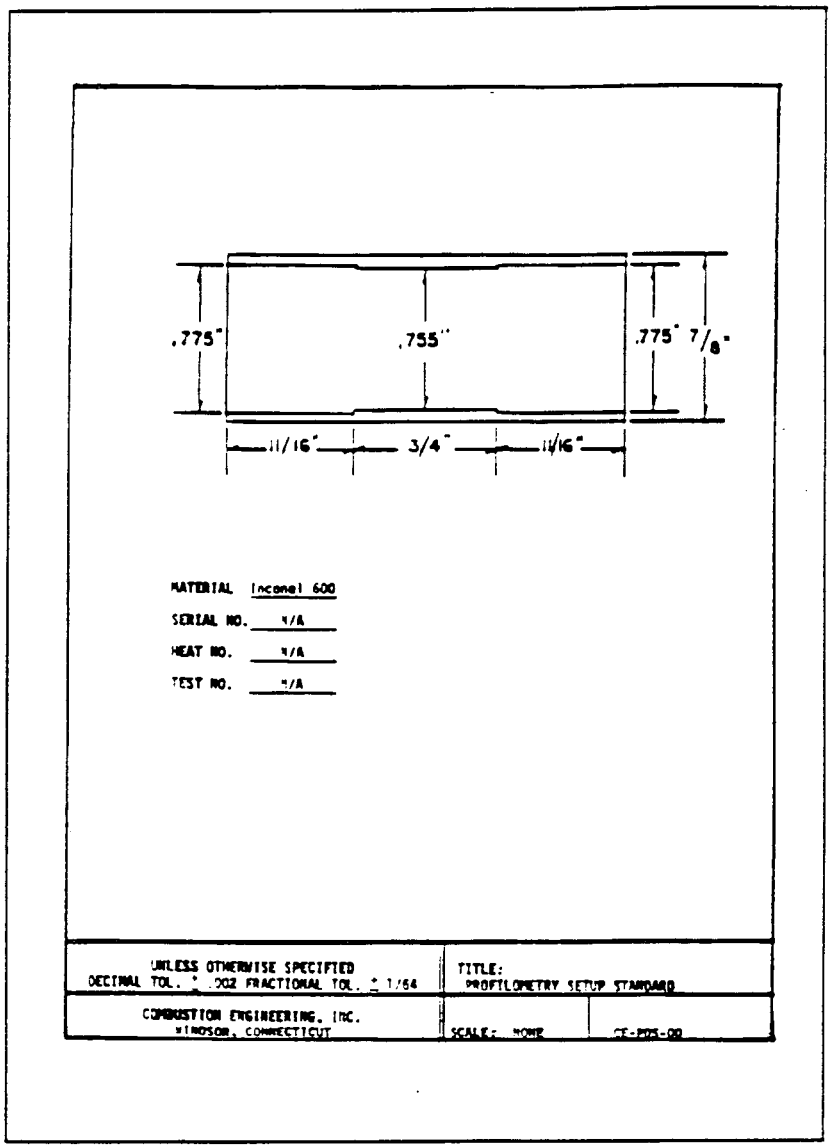

Figure 3

MRPC GUIDE TUBE STANDARD

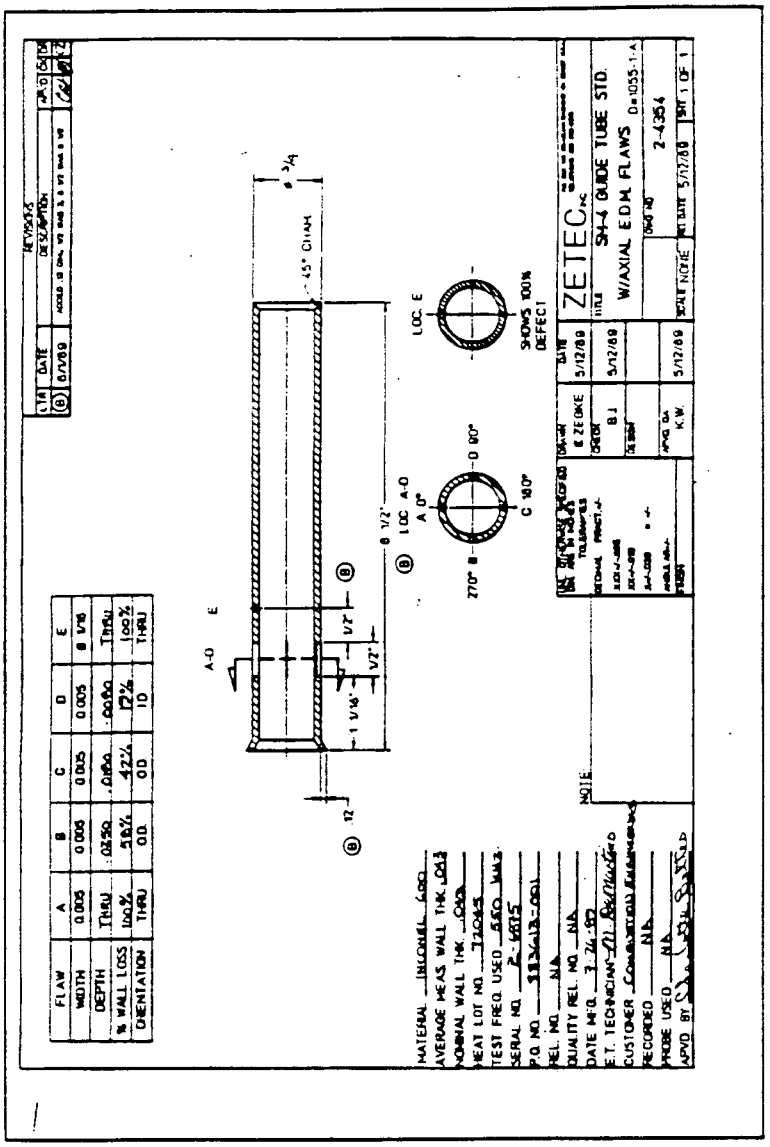

Figure 4

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TYPICAL RDAU INTERCONNECTION SCHEMATIC

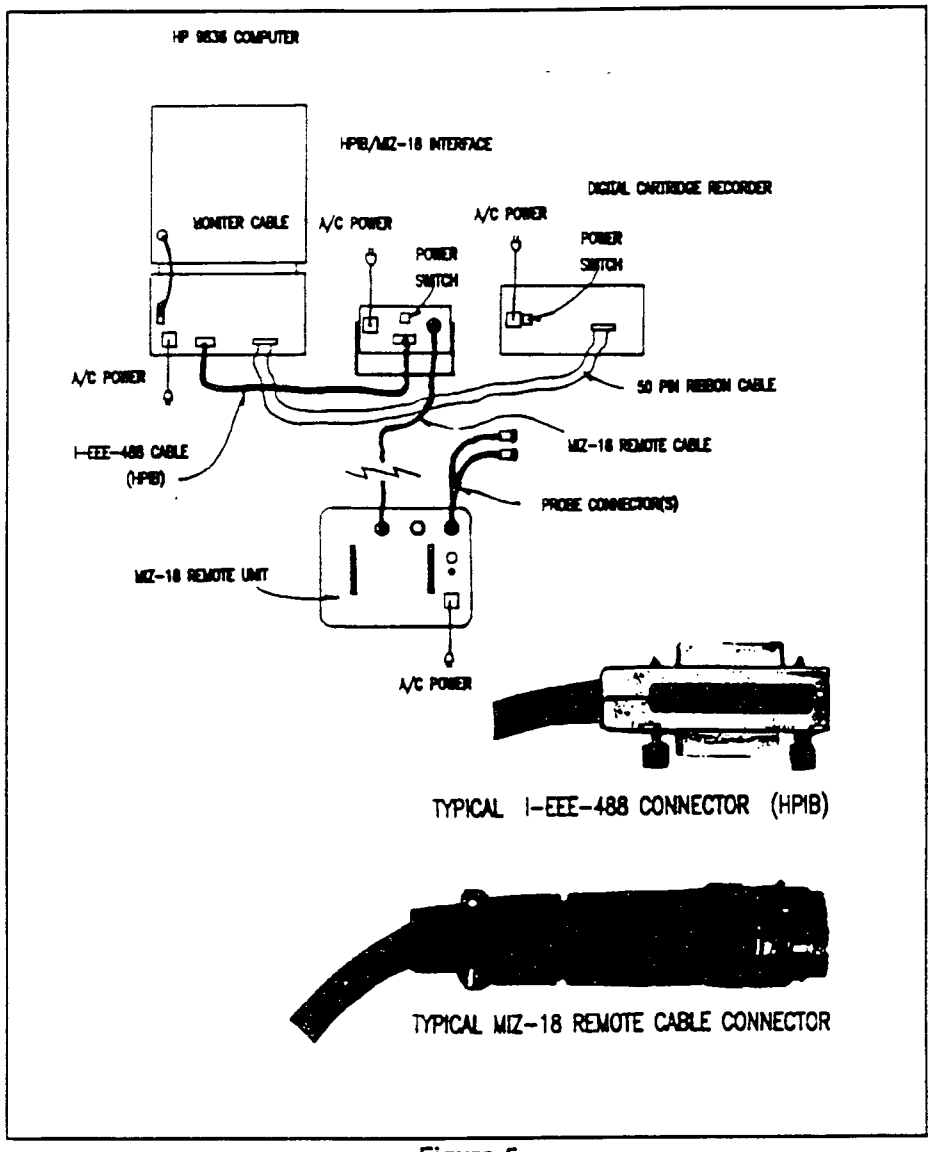

Figure 5

TYPICAL SET-UP INSTRUCTION FORM

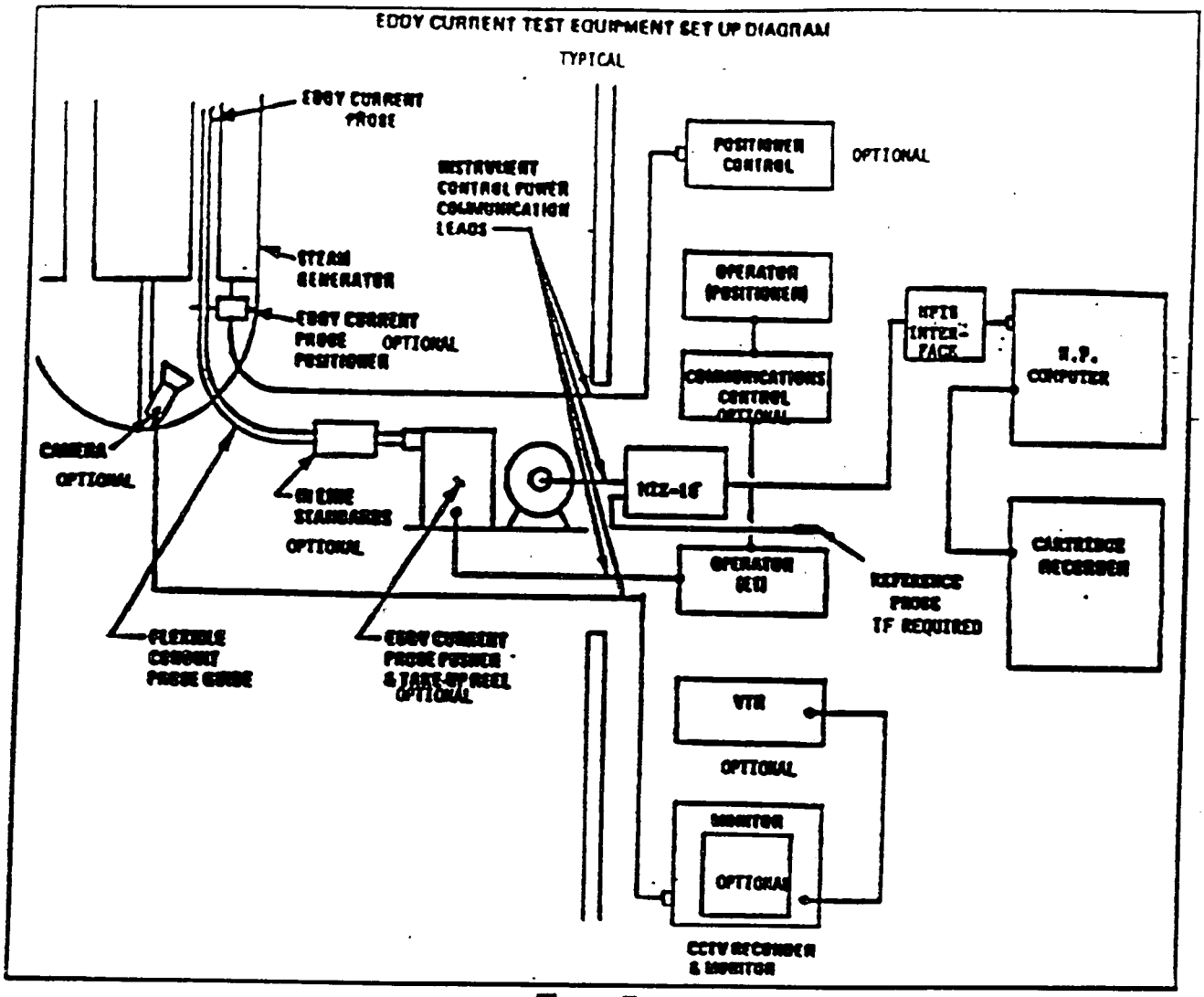

Figure 7

TYPICAL SET-UP INSTRUCTION FORM

MULTI-FREQUENCY EDDY CURRENT INSPECTION

SET UP INSTRUCTIONS

MIZ-18

SITE	UNIT #	COMPONENT S/G #	SIDE HOT COLD	DATE / /
PROBE TYPE		CALIBRATION STANDARD (CIRCLE OR DESCRIBE OTHER) ASME OTHER		
PROCEDURE		TEST PURPOSE		

MIZ-18 MIZ-18A CONFIGURATION

NUMBER:
NAME--:

SAMPLES PER SEC:

FREQUENCY SEQUENCE		PROBE CHANNEL SELECT							
#	FREQUENCY	COIL 1	COIL 2	COIL 3	COIL 4	COIL 5	COIL 6	COIL 7	COIL 8
1	kHz								
2	kHz								
3	kHz								
4	kHz								

SPECIAL NOTES TO OPERATOR / ANALYST

SEE APPENDIX _____ FOR SETUP INSTRUCTIONS.

PREPARED BY: _____ LEVEL _____ DATE _____

APPROVED BY: _____ LEVEL _____ DATE _____

Figure 7

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TYPICAL EDDY CURRENT CALIBRATION SHEET

COMBUSTION ENGINEERING
EDDY CURRENT CALIBRATION SHEET

PAGE 1 of 7

OWNER	SITE/UNIT	COMPONENT	LEG (Side)
		S/G # 3	HOT / COLD

PROCEDURE/Rev	DEFECT STANDARD	MAP STANDARD	MIZ-18 S/N
SONP-410-004 REV. 5	ASME- Z 1184	EPI Z 6128	009

DATE	TIME	REEL	ROW/COL	COMMENT(S)	EXAMINER/LEVEL	*INIT
2/18/89	12:59	3H01	7-1	NEW TAPE CAL	[illegible] II	
2/18/89	15:45	3H01	9-12	End Of Tape Cal	[illegible] II	
2/18/89	16:00	3H02	10-12	Beginning Of Tape Cal	[illegible] II	
2/18/89	17:19	3H02	23-14	END OF TAPE CAL [illegible]	[illegible] II	
2/18/89	17:48	3H03	23-15	Beginning Of Tape Cal	[illegible] II	
2-18-89	21:17	3H03	7-23	4 ME Cal / End of Tape	WE Dennis / I	
2-18-89	22:04	3H04	7/24	Beginning of Tape Cal	WE Dennis / I	
2-19-89	01:50	3H04	11/33	4 ME Cal	WE Dennis / I	
2-19-89	02:15	3H04	10/34	End of probe Cal	WE Dennis / I	
2-19-89	02:52	3H04	10/35	NEW Probe Cal	[illegible] II	
2-19-89	04:18	3H04	11/35	End of Temperal	[illegible] II	
2-19-89	05:07	3H05	10/35	NEW Temperal	[illegible] II	
2/20/89	08:50	3H05	10/51	4 ME Cal Check	[illegible] II	
2/20/89	10:49	3H05	23/83	610 Probe Cal. Change Ind bat	[illegible] II	

* Supervisor Initials in this section indicate compliance with the procedure. If no initials are present, a description of the discrepancy is as follows:

DISCREPANCY DEFINITION	DISPOSITION	**APPROVED

Reviewed by [illegible] Level III

**ET Level III

Figure 8

TYPICAL DATA CARTRIDGE LABEL

[ ] ORIGINAL [ ] DUPLICATE	COMBUSTION ENGINEERING EDDY CURRENT CARTRIDGE LABEL			REEL #
OWNER	SITE/UNIT	COMPONENT	LEG	DATE
PROBE TYPE/SIZE	PROCEDURE	DEFECT STANDARD		DENT STD.
TEST PURPOSE:				

FREQUENCY SEQUENCE		PROBE CHANNEL SELECT							
#	FREQUENCY	COIL 1	COIL 2	COIL 3	COIL 4	COIL 5	COIL 6	COIL 7	COIL 8
1	kHz								
2	kHz								
3	kHz								
4	kHz								

Figure 9

MRPC PROBE

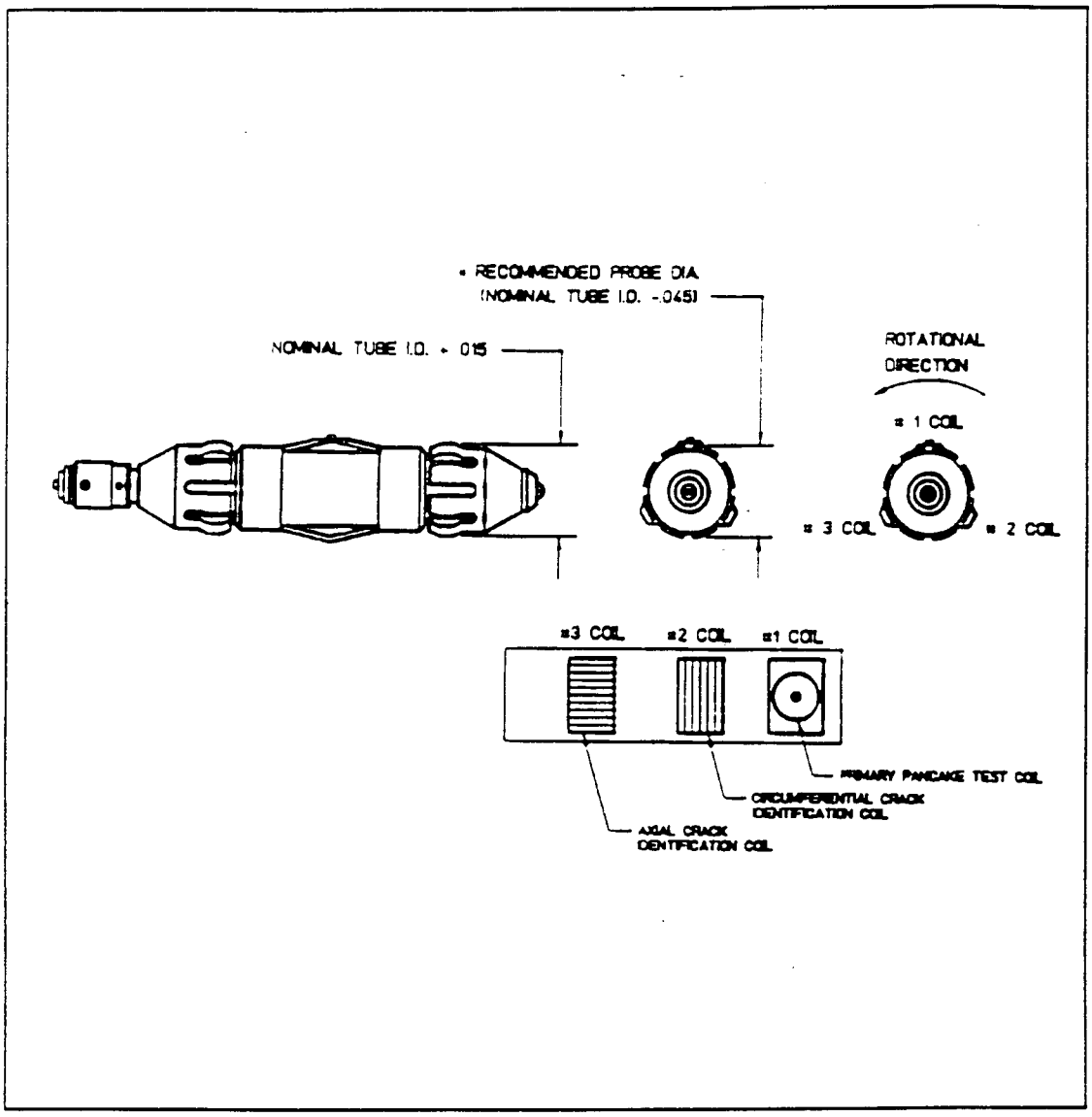

Figure 10

CAROLINA POWER AND LIGHT COMPANY
H.B. ROBINSON SEG PLANT

SPECIAL PROCEDURE

SP-1111

EDDY CURRENT DATA ANALYSIS PROCEDURE EVALUATION OF WESTINGHOUSE STEAM GENERATOR TUBING

REVISION 0

Effective Date 4-18-92

Expiration Date 10-17-92

RECOMMENDED BY: _____ 4-6-92
Supervisor - Technical Support — Date

APPROVED BY: _____ 4/13/92
Manager - Technical Support — Date

LIST OF EFFECTIVE PAGES

EFFECTIVE PAGES	REVISION
Cover Sheet	0
LEP	0
3 through 50	0

TABLE OF CONTENTS

1.0 PREREQUISITES

Ensure individuals are on an appropriate RWP if work is to be performed inside the Radiation Control Area.

This procedure has been reviewed per PLP-037 and it has been determined **NOT** to be applicable.

N/A
Unit / Section Manager

9/17/92
Date

2.0 PRECAUTIONS

Use the principles of ALARA in planning and performing work and operations in the Radiation Control Area.

3.0 ATTACHMENT

3.1 Eddy Current Data Analysis Procedure Evaluation of Westinghouse Steam Generator Tubing.

3.2 H.B. Robinson Eddy Current Analysis Supplement

4.0 DISPOSITION OF RECORDS

A copy of this procedure and the completed attachments shall be sent to the records vault for storage.

TABLE OF CONTENTS

1.0 OBJECTIVE

This procedure will establish a set of guidelines to be utilized by the eddy current Data Analyst with the intent of providing a consistent method for reporting the eddy current results. THIS PROCEDURE IS NOT INTENDED TO BE UTILIZED BY AN INDIVIDUAL WHO HAS NOT HAD PROPER TRAINING IN THE EVALUATION OF EDDY CURRENT DATA. This procedure may be superseded in its entirety or in part by client specific analysis guidelines.

2.0 REFERENCES

2.1 ABB/Combustion Engineering Nuclear Power Quality Assurance Manual.

2.2 ABB/Combustion Engineering Nuclear Power Businesses, Nuclear Quality Assurance Manual.

2.3 Zetec DDA-4 System Operating Guideline.

2.4 STD-410-076 Procedure for the control of Eddy Current examination data for the personal computer (PC) Data Base System.

2.5 ASME Code interpretation X1-83-18: 1980 SNT-TC-1A vs. 1975 SNT-TC-1A Certification.

2.6 HP-UX/Zetec Eddynet System Operating Guide (latest revision).

2.7 ASME Code Case N-401-1, use of digital equipment.

3.0 PERSONNEL REQUIREMENTS

3.1 The evaluation of the results of the eddy current examination must be conducted by a Data Analyst qualified to at least ET Level II with specific training for the evaluation of data from nonferrogmagnetic steam generator tubing.

3.2 Each person performing Data Analysis governed by this procedure shall be certified in accordance with SNT-TC-1A 1980 Edition or equivalent. Combustion Engineering personnel shall be certified in accordance with Combustion Engineering written Procedure QAP 2.4 contained in Reference 2.1.

If data analysts are supplied for primary or secondary data review by the purchaser, the purchaser will be responsible for their certification. In the instance when C-E utilized a subcontractor for primary or secondary data review, C-E will be responsible for certification either by examination to the requirements of QAP 2.4 or by auditing and accepting the subcontractor(s) written practice.

3.3 The Analyst shall be responsible for evaluating the data and reporting the results of the examination.

3.4 The independent data analyst (if used) shall be responsible for evaluating the data provided by the data controller.

4.0 EQUIPMENT

The equipment required to analyze the eddy current examination data includes but is not limited to the following: (Interconnect as appropriate). If LAN System is used, configuration may differ.

4.1 HP 200/300/400 Series Computer or equivalent.

4.2 Zetec Analysis software or equivalent.

4.3 Ample supply of floppy disks, data cartridges or applicable media.

4.4 Data Cartridge Recorder HCD-75Z, ADIC or equivalent media.

4.5 Appropriate printer or equivalent device (optional).

4.6 Eventide Expressway Intelligent Buffer Model WPB-109 or equivalent (optional).

4.7 Appropriate interconnect cables, power cords and peripherals.

5.0 AREA OF INTEREST

The evaluation of data shall include all information recorded on storage media per the requirements of the Data Acquisition operating procedure in use or as specified by the client.

6.0 EVALUATION OF DATA

6.1 The data evaluation shall be conducted by viewing the lissajous pattern and the appropriate strip chart presentations on the computer screen for the entire recorded length of each tube. Any abnormal signals will be investigated for determination of location and percent through wall dimension (% TWD) as practical.

6.2 The screening frequencies utilized for the data analysis shall be the optimum defect detection frequencies for the size and wall thickness of the tubing being inspected. These frequencies will be determined by the lead data analyst and documented on Attachment A, Client Specific Data Analysis Requirements. No Field Change Notice (FCN) is required for additions or deletions to Attachment A. Signatures by the ET Level III and the client representative will represent concurrence of the specific requirements.

NOTE: As work progresses, Attachment A's shall be completed as required. The revision number shall be changed in the appropriate section of the Attachment A form.

6.3 If the Analyst determines that a condition exists that precludes accurate data analysis, the analyst will submit a list of tubes that have been affected by this condition and those tubes may be retested if required.

6.4 Interpretation of test results shall be conducted by certified eddy current data analysts. Test results are interpreted using calibration curves generated from information obtained by passing a test probe through a calibration standard manufactured from a piece of material of the same alloy, nominal outside diameter and nominal wall thickness as the tubing in the steam generator containing known, machined, or natural discontinuities ranging from 100% through wall to 20% through wall from the O.D. or as required. Typical calibration standard shown in Figure 2.

6.5 The data shall be analyzed using any or all the recorded information necessary to determine the nature and severity of all detectable indications, as required.

6.6 All indications analyzed will be categorized using the recommended DDA-4 Notation. These codes are inclusive, but shall not be limited to the listing located in Figure 3.

6.7 When the signal of interest is interfered with by a support structure, sludge, dent, noise, or other unwanted responses, a multi-frequency mix may be used to aid in evaluation of the signal. These indications will be evaluated using the appropriate sizing frequency and mixes as needed.

6.8 When the signal of interest is interfered with by a support structure, noise, or other indications, one or more of the following techniques may be utilized to improve the accuracy of classification and sizing.

6.8.1 Other frequencies
6.8.2 Mixes
6.8.3 Special techniques

6.8.3.1 Rotating Eddy Current Probes
6.8.3.2 Magnetic Bias Probes
6.8.3.3 8 x 1 Probes
6.8.3.4 Ultrasonic Inspection
6.8.3.5 D Coils or Segment Bobbin Coil Probes
6.8.3.6 Other

7.0 SIGNAL FORMATION

The initial direction of the signal formation supplies important information about the indication type to the data analyst. Signal formation may be determined by strip chart recordings or by CRT display. Signal phase must be set to a known standard prior to initiation of the data analysis.

7.1 Relevant indications in the differential mode shall be phased such that known flaws in the calibration standard form (negative) initially. Relevant absolute signals shall be phased such that flaws in the calibration standard form upward (positive) initially.

7.2 Non-relevant indications in the differential mode will normally form upward (positive) initially. Non-relevant indications in the absolute mode will normally form downward (negative) initially.

7.3 The data analyst shall be cognizant of the fact that a real flaw (relevant indication) will have appropriate phase and voltage correlation at various frequencies.

8.0 PHASE ANGLE MEASUREMENTS

8.1 All phase angle measurements will be compared to the relevant calibration curve to determine percent through wall, utilizing a 3 point fit curve. This curve shall be constructed utilizing the as-built dimension of the calibration standard and actual phase angle or amplitude data obtained from passing the test probe through the calibration standard. (See Figure 4 for a typical curve). The 4.1 curve supplied with the DDA-4 Data Analysis Software will only be utilized if specified in the Customer Specific Data Analysis Requirements.

8.2 Phase angle of an indication must be determined by the proper selection of angle points.

8.3 Indications that return to calibration point (null point) and have a definite straight line transition between peaks shall be called from straight line peaks. Figure 5.

8.4 Any indication that deviates from the calibration point (null point) shall be called from amplitude peak to peak points. Figure 5.

9.0 SIZING MEASUREMENTS

9.1 The "set-volts" sizing capability of the DDA-4 should be set to 8.00 volts peak-to-peak on the calibration standard support plate signal at 400 KHz. This voltage should then be saved and stored to all other channels.

9.2 The lower the frequency, the more the signal penetration, but the smaller the phase separation. Therefore, the lower frequencies are mainly used for detection not sizing. Low frequencies may be used for sludge, loose parts detection, etc.

10.0 AXIAL POSITION LOCATION

All indications representing tube wall degradation shall be recorded with reference to a known structure, i.e., tube support plates, tubesheets, anti-vibration bars.

10.1 Determine from as-built drawing, (preferred) design drawings or client supplied information the actual distance between support members.

10.2 Calibrate the DDA-4 axial position indicator as described in the System Operating Guideline.

10.3 TSP (tube support plate) reference locations shall be conducted using the center of the support as the zero (0) reference point.

10.4 Figures 6 and 8 are examples of typical plant layout, S/G sectional views and tube sheet maps. The client will supply the as-built drawings required for the data analyst.

11.0 DDA-4 FORMAT INFORMATION

All information pertaining to DDA-4 final report format will be typically described below.

11.1 The analysis report identification will be typically entered as directed by data management. Parameters should be discussed and mutually agreed prior to examination.

11.2 The DDA-4 final report headings shall be typically entered as directed by data management. Special note should be taken for line one as this is used for specific information in the data base system.

11.3 Data base software parameters require the generator designator to be the first digit in the "SG" column of the DDA-4 report. The second digit should represent the leg from which the tube is inspected. A "1" is used for the 'hot' side and a "0" for the 'cold' side. Be sure to change the "SG" code if client specific requirements for data acquisition are different.

11.4 All notation information of tubes shall be entered in the % column of the final report. Any tube requiring retesting shall contain the letter "R" as the first letter of the three letter code entered in the % TWD column of the DDA-4 Report as shown in Figure 3.

11.5 Data analyst shall enter in the extent tested column of DDA-4 final report format, the area of the tube actually tested to the nearest support member actually recorded on the tape. The order of the extent tested column is determined by the direction and extent of the data recording during the data acquisition. The first S/G member noted by the data analyst will identify first on the extent tested column. The last S/G member noted by the data analyst will be identified second in the extent tested column (typically CTE or HTE, cold tube end, hot tube end, etc.)

EXAMPLE: A tube being tested from the cold leg to the hot leg tube end shall be entered as CTEHTE.

11.6 When the DDA-4 final report is completed, the data analyst(s) will sign the report. (See Figure 9).

11.7 The analyst should verify the supplement type and revision number of the analysis supplement in the summary section of the DDA-4 report as required by supplementary guidelines.

12.0 RE-EXAMINATIONS

All tubes that require re-examination as a direct result of the evaluation of the data shall be identified by the data analyst. The data analyst is responsible for supplying the row/column number and an explanation for why the re-examination is requested.

13.0 CONFIRMATION OF PLUGGABLE INDICATION

Confirmation of tubes identified for removal from service are usually conducted after completion of the entire eddy current examination or as requested by the client. The intent of this confirmation examination is to verify the indication exists and the data is repeatable in the tube identified to be removed from service. Pluggable limits will be set by plant technical specifications.

13.1 A typical procedure for accomplishing the confirmation is to supply the data acquisition personnel with oscillographs of the pluggable indications for visual verification. The data generated is normally recorded on magnetic tape but is only required at the direct request of client. If the data is recorded and the indication is verified as being correct, the data analyst shall enter the DDA-4 code of "PID" into the data base.

13.2 In the event that the "positive identification" examination does not confirm the tube location, resolution is required. Upon completion of the resolution process, the correct tube number shall be noted and all previous data shall be corrected accordingly.

14.0 DATA CONTROL

The lead data management operator shall be responsible for data control of the magnetic tape, oscillographs, printouts, disks, etc. These items shall be turned over to the client upon completion of the examination. Data control shall be in compliance with procedure STD-410-076, titled "CONTROL OF S/G EDDY CURRENT EXAMINATION DATA USING THE PERSONAL COMPUTER (PC) DATA BASE SYSTEM".

15.0 RECORDING CRITERIA

All indications evaluated to be one of the items identified in Figure 3 recommended DDA-4 notations shall be recorded by the appropriate method. Client specific recording requirements shall augment Figure 3.

16.0 REPORTING CRITERIA

All reportable indications shall be reported to the client on a regular basis. The final report of the inspections results supplied to the client will contain the following at a minimum. Client reporting requirement shall augment this procedure.

16.1 Tube wall degradations of 20% through wall or greater shall be reported.

16.2 All detectable tube dents known to obstruct probe passage shall be reported.

16.3 Any additional condition(s) or abnormalities that the data analyst deems necessary to report shall be reported.

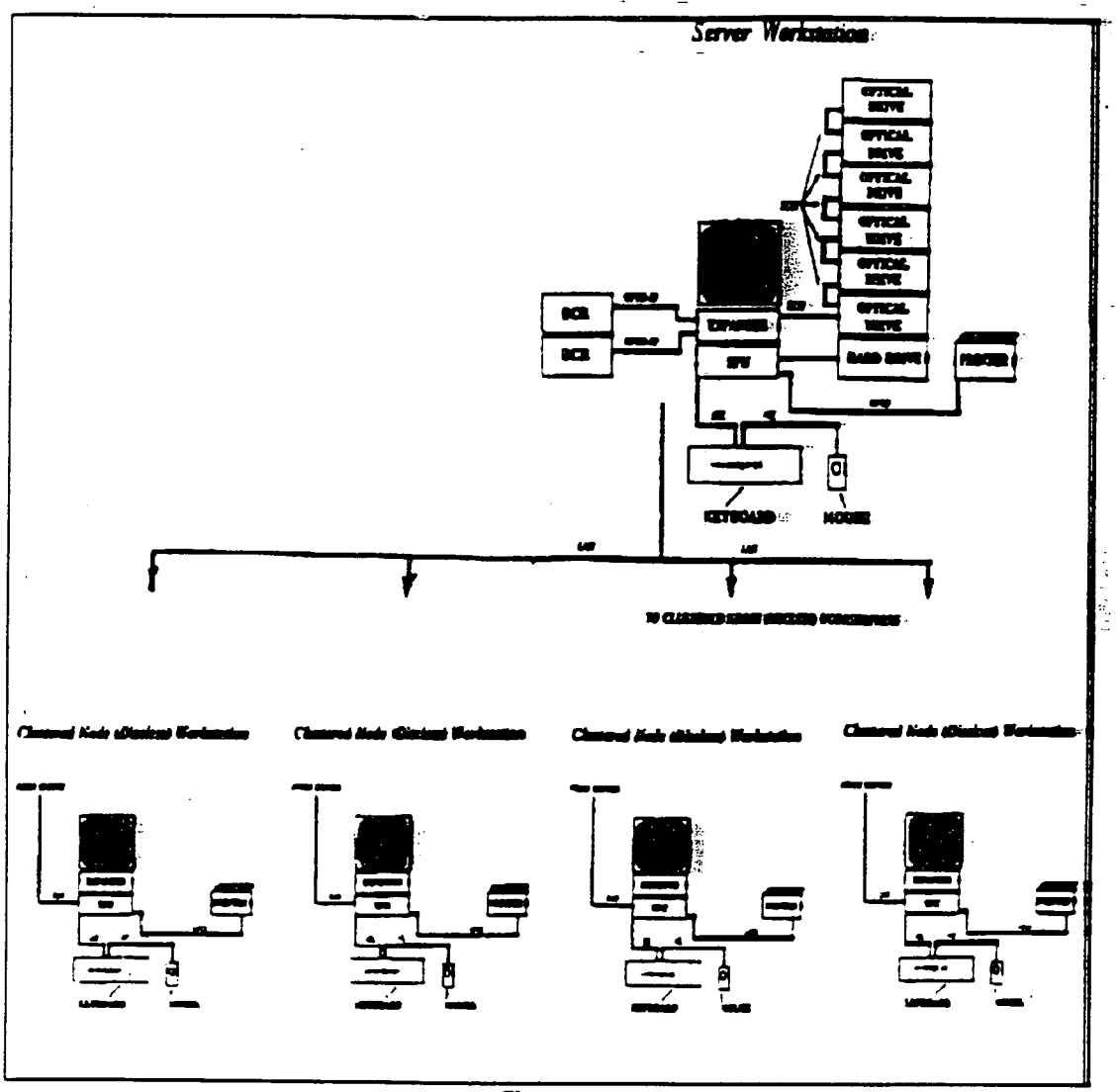
Server Workstation
OPTICAL DRIVE
OPTICAL DRIVE
OPTICAL DRIVE
OPTICAL DRIVE
OPTICAL DRIVE
OPTICAL DRIVE
SCSI
SCSI
ETHERNET
SCSI
RAID DRIVE
PRINTER
KEYBOARD
MOUSE
LAN
LAN
TO CLASSIFIED LOCAL AREA NETWORK

Figure 1

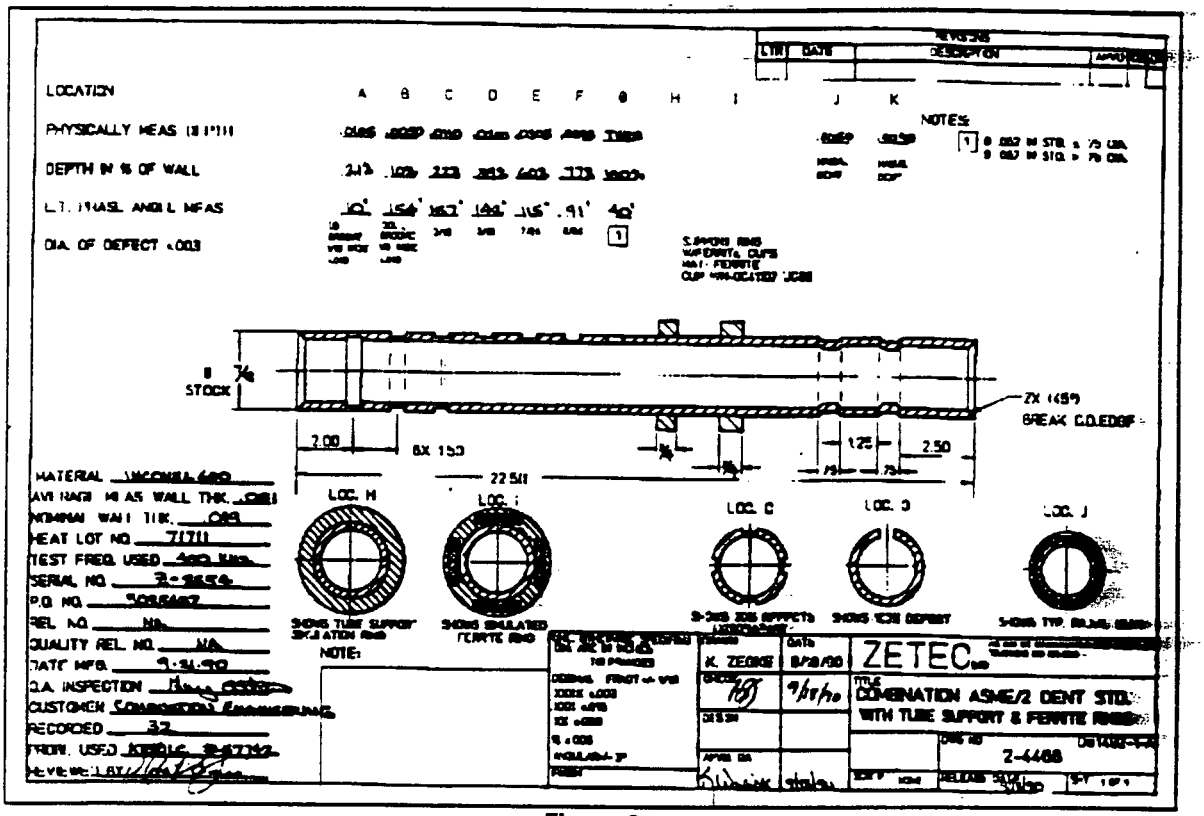

Figure 2

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NOTATION	DESCRIPTION
ADI	ABSOLUTE DRIFT INDICATION
ADR	ABSOLUTE DRIFT
APT	ABSOLUTE POSITIVE TRACE
BLANK	NO INDICATION (NDD)
BLG	BULGE
CUD	COPPER DEPOSIT
DEP	DEPOSIT (NON-COPPER)
DNT	DENT
DRI	DISTORTED ROLL INDICATION
DRT	DISTORTED ROLL TRANSITION
DSI	DISTORTED SUPPORT PLATE INDICATION
DSS	DISTORTED SUPPORT SIGNAL (NO INDICATION)
DTS	DISTORTED TUBESHEET SIGNAL
DTI	DISTORTED TUBESHEET INDICATION
EXP	EXPANSION
HTM	HEAT TREATMENT MARGINAL
HTT	HEAT TREATMENT
IDC	INSIDE DIAMETER CHATTER
IDV	INSIDE DIAMETER VARIATION
INF	INDICATION NOT FOUND
LAR	LEAD ANALYST REVIEW
LPI	LOOSE PART(S) WITH INDICATION
NHT	NO HEAT TREATMENT
NQI	NON QUANTIFIABLE INDICATION
NSY	NOISY TUBE
NTE	NO TUBESHEET EXPANSION
OBS	OBSTRUCTED TUBE
OVR	OVER ROLL ABOVE TOP OF TUBE SHEET (TTS)
OXP	OVER EXPANSION
PHT	POP-UP HEAT TREATMENT
PID	POSITIVE IDENTIFICATION
PLG	PLUG
PLP	POSSIBLE LOOSE PART(S)
PTE	PARTIAL TUBESHEET EXPANSION
PVN	PERMEABILITY VARIATION
RBD	RETEST BAD DATA
RFX	RETEST FIXTURE
RNC	RETEST TUBE NUMBER CHECK
RND	RETEST NO DATA
RPI	RETEST FOR POSITIVE INDICATION
RTI	RETEST TUBE INCOMPLETE
RTP	RETEST TEMPLATE PLUG
SHT	STRAIGHT LEG HEAT TREATMENT
SKR	SKIP ROLLED
SLG	SLUDGE
SLV	SLEEVE
TMR	TOP MAIN ROLL
1PT	ROW 1 PROBE POSITIVE TRACE IN ROW 1 TUBE
2PT	ROW 1 PROBE POSITIVE TRACE IN ROW 2 TUBE
1ST	ROW 1 PROBE SUSPECTED TRACE IN ROW 1 TUBE
2ST	ROW 1 PROBE SUSPECTED TRACE IN ROW 2 TUBE
IDI	INSIDE DIAMETER INDICATION
ODI	OUTSIDE DIAMETER INDICATION
RES	RESTRICTED TUBE (WITH CURRENT PROBE SIZE)
SAI	SINGLE AXIAL INDICATION
MAI	MULTIPLE AXIAL INDICATION
MBM	MANUFACTURING BUFF MARK
REC	RETEST FOR ENCODE CHECK

FIGURE 3
LIST OF APPROVED DDA-4 NOTATIONS

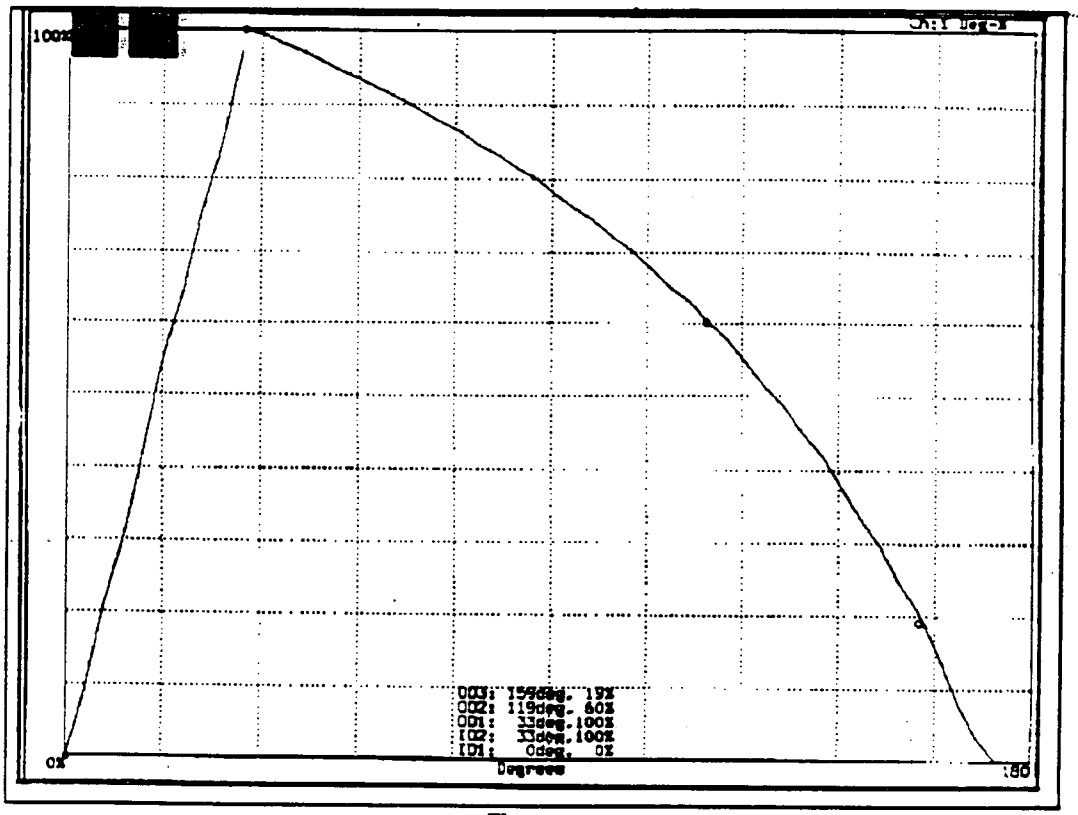
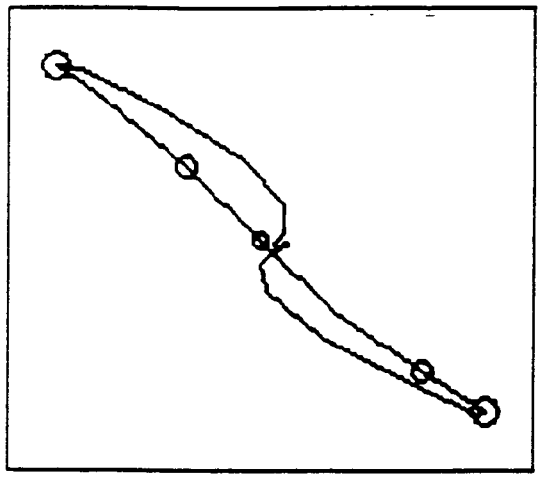


Figure 4



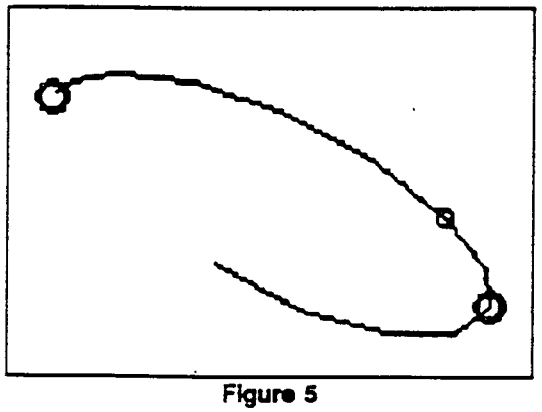


Figure 5

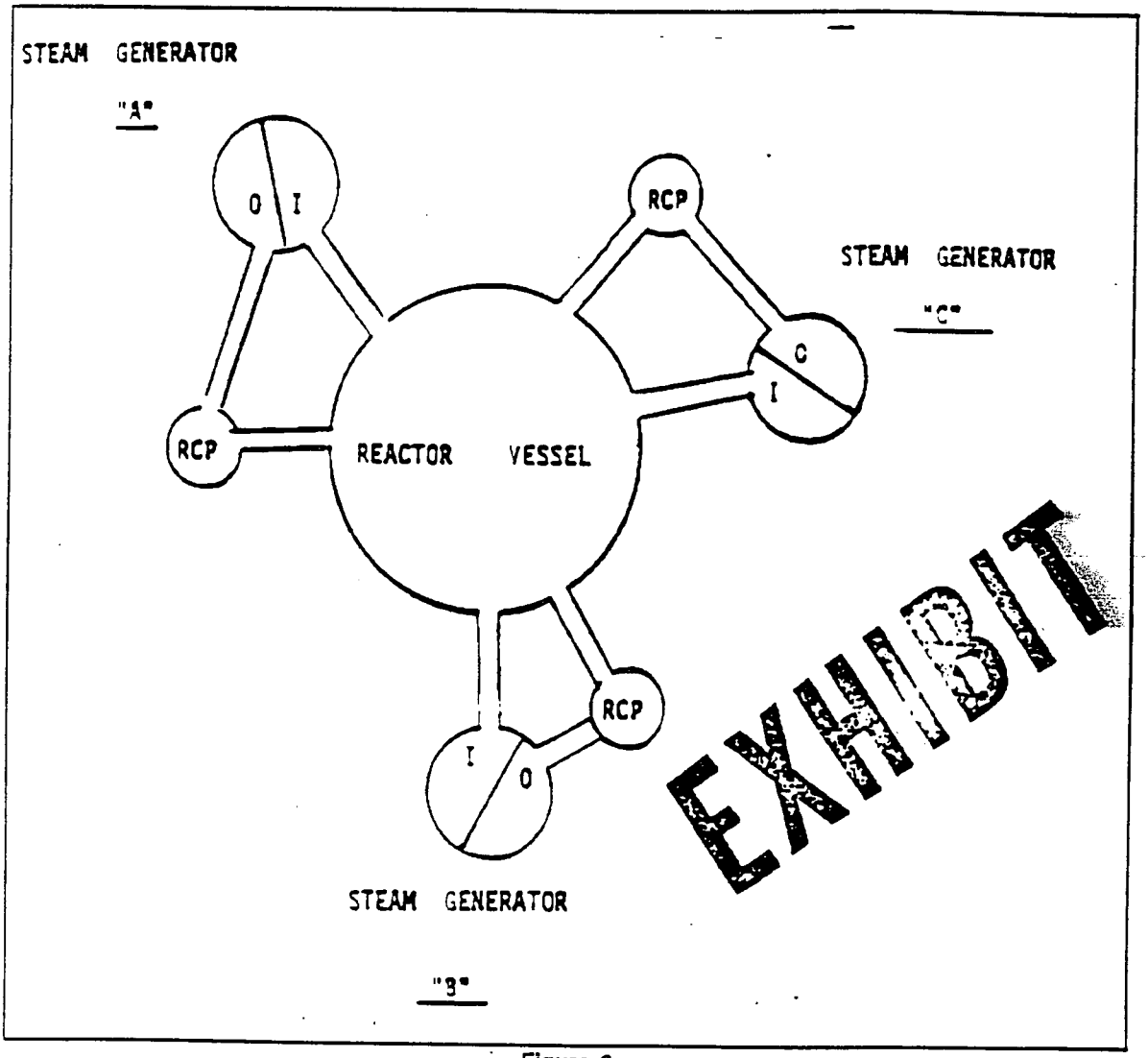

STEAM GENERATOR
"A"
O
I
RCP
STEAM GENERATOR
"C"
C
I
RCP
REACTOR VESSEL
RCP
I
O
STEAM GENERATOR
"B"
EXHIBIT

Figure 6

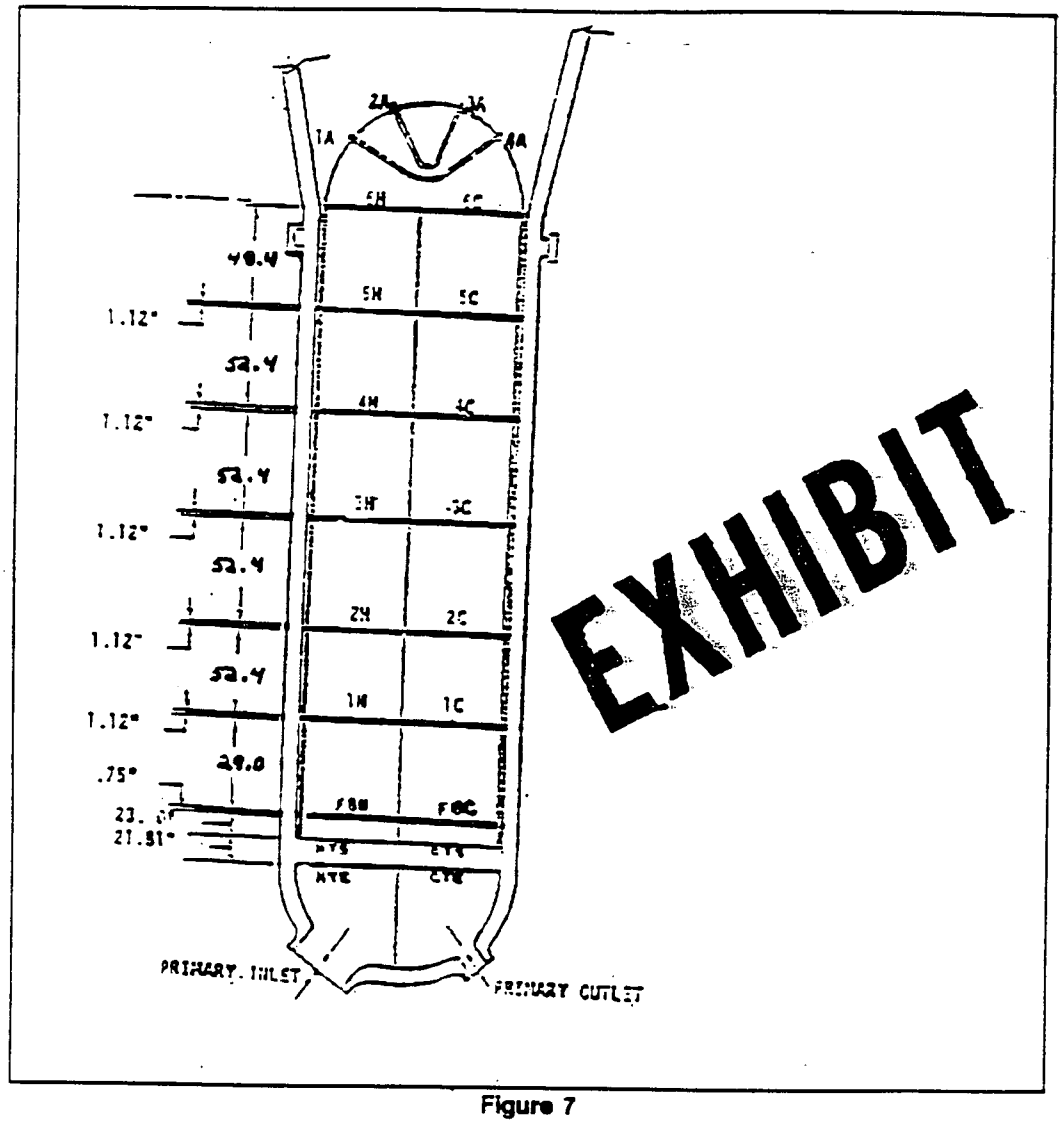

1A
2A
3A
4A
5H
5C
4H
4C
3H
3C
2H
2C
1H
1C
FBH
FBC
NYS
EYS
NYE
EYE
40.4
52.4
52.4
52.4
52.4
29.0
1.12"
1.12"
1.12"
1.12"
1.12"
.75"
23.
21.81"
PRIMARY INLET
PRIMARY OUTLET
EXHIBIT

Figure 7

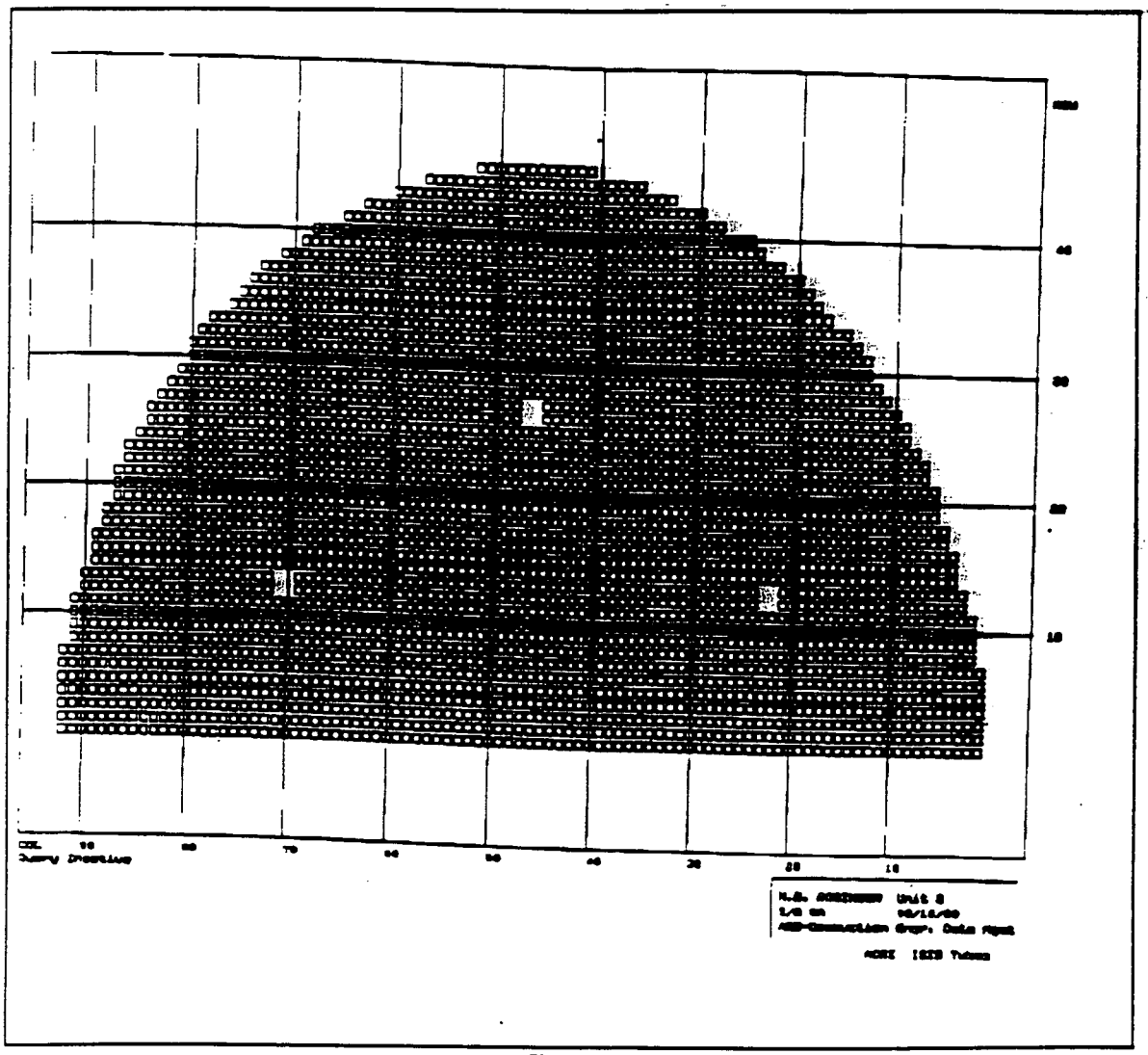


Figure 8

```
Sep 18 12:40 1991  /rod3/resolution/tape001A.ca101/gat5028.res Page 1


File=resolution/tape001A.ca101  User=gat5028  Data=9/18/91 12:40
Disc Label = OkDB_AO5
    TERMINO GA     AC01          AS10MULC        DB_AO5     09/17/91
 20  62   1                                                 UTELTE
 20  63   1                                                 UTELTE
 20  64   1                                                 UTELTE
 20  65   1                                                 UTELTE
 20  66   1                                                 UTELTE
 20  67   1                                                 UTELTE
 20  68   1                                                 UTELTE
 20  69   1                                                 UTELTE
 20  70   1                                                 UTELTE
 20  71   1                                                 UTELTE
 20  72   1                                                 UTELTE
 20  73   1                                                 UTELTE
 20  74   1                                                 UTELTE
 20  75   1                                                 UTELTE
 20  78   1                                                 UTELTE
 20  79   1                                                 UTELTE
 20  80   1                                                 UTELTE
 20  81   1                                                 UTELTE
 20  82   1                                                 UTELTE
 20  83   1  0.35  77  35  17 015      +  0.00              UTELTE
 20  84   1                                                 UTELTE
 20  85   1                                                 UTELTE
 20  86   1  0.36  78 S/N  17 013      +  0.18              UTELTE
 20  87   1                                                 UTELTE
 20  88   1                                                 UTELTE
 20  89   1                                                 UTELTE
 20  90   1                                                 UTELTE
 20  91   1                                                 UTELTE
 20  92   1                                                 UTELTE
 20  93   1                                                 UTELTE
 20  94   1                                                 UTELTE
 20  95   1                                                 UTELTE
 20  96   1                                                 UTELTE
 20  97   1                                                 UTELTE
 20  98   1                                                 UTELTE
 20  99   1                                                 UTELTE
 20 100   1                                                 UTELTE
 20 101   1                                                 UTELTE
 20 102   1                                                 UTELTE
 20 103   1                                                 UTELTE
 20 104   1 11.30 170 CNG   3 UTSF     + 16.89              UTELTE
 20 105   1                                                 UTELTE
 20 106   1                                                 UTELTE
 20 107   1                                                 UTELTE
 20 108   1                                                 UTELTE
 20 109   1  1.53 120 MEM   3 006      + 31.37              UTELTE
 20 110   1                                                 UTELTE
 20 111   1  2.96 123 MEM   3 008      +  1.74              UTELTE
 20 111   1  0.90  78 S/N  17 008      -  0.24              UTELTE
 20 112   1  1.16 115 MEM   3 015      + 13.61              UTELTE
                          END TAPE
```

Figure 9

ABB-COMBUSTION ENGINEERING EDDY CURRENT EXAMINATION SHEET PAGE: 1

OWNER:
PLANT/UNIT: SG #1

PROCEDURE: 410-004 R2
PROBE: FREQUENCY: 400/600/100/10 KHz

ECT DESCRIPTION: BOBBIN EXAM FOR DEFECT DETECTION
DATASET: ABOBBIN ZONE: 2 LEG: HOT EXTENT:

ROW	COL	TESTED	DATE	REEL	COMMENTS
1	96				C6
3	96				C6
2	97				C6
1	98				C6
3	98				C6
2	99				C6
1	100				C6
3	100				C6
2	101				C6
1	102				C6
3	102				C6
2	103				C6
1	104				C6
3	104				C6
2	105				C6
1	106				C6
3	106				C6
2	107				C6
1	108				C6
3	108				C6
2	109				C6
1	110				C6
3	110				C6
2	111				C6
1	112				C6
3	112				C6
2	113				C6
1	114				C6
3	114				C6
2	115				C6

Total Exams this Dataset: 30 This page: 30

Figure 10

C-E ET LEVEL III DATE CUSTOMER REPRESENTATIVE CONCURRENCE DATE

Attachment A
Data Sheet Documenting
Customer Specific Data Analysis Requirements

ATTACHMENT 3.2

H. B. Robinson
Eddy Current Analysis Supplement

The following information is provided to the Data Analyst and Data Management personnel to insure the consistent analysis and reporting of eddy current data results during the 1992 refueling outage. It should be noted that this supplement is a guideline, and should not override judgement of the experienced data analyst.

I. GENERAL INFORMATION

A. Frequencies

400 KHz (Bobbin probes)
100 KHz
600 KHz
10 KHz
800 KHz (MRPC probes)
400 KHz
200 KHz
100 KHz

B. S/G INFO

Location Names	Distance
HTE/CTE	21.8"
HTS/CTS	3.4"
FBH/FBC	29.0"
1H / 1C	52.4"
2H / 2C	52.4"
3H / 3C	52.4"
4H / 4C	52.4"
5H / 5C	48.4"
6H / 6C	

C. Calibration Standards

	Flaw	Dent	
Z-8554	100-77-60-39-22	.0050	.0090
Z-8555	100-77-59-39-21	.0035	.0075
Z-8556	100-77-59-39-21	.0040	.0075

Common Notations

(see ROB-410-005 R2 for complete list)

ADR - Absolute Drift Signal
DNT - Dent Indication (2.0V)
DRI - Distorted Roll Indication (P/S only)
IDC - Inside Diameter Chatter
INF - Indication Not Found
LAR - Lead Analyst Review (P/S only)
MBM - Manufacturing Buff Mark
NSY - Noisy Tube
PID - Positive Identification (used for pluggable confirmation)
PLP - Possible Loose Part

RBD - Retest Bad Data
RFX - Retest Due to Fixture
REC - Retest for Encode Check
RND - Retest NO DATA
RPI - Restest for Possible Indication (requires location and extent)
RTI - Restest Incomplete (requires an extent)

II. SET-UP PARAMETERS

Three (3) Point Fit Curves:
400 KHz Diff M-R (100% 40 degrees ± 5)
600 KHz Diff M-R (100% @ ~ 20 degrees)
100 KHz Diff M-R (Noise [dent] horizontal)
400/100 Diff P-P (Noise [dent] horizontal)
400/100 Abs P-P (Noise [dent] horizontal)

Set volts to * 5.0 V P-P on ASME support ring - save to all channels

*Unless otherwise noted use 5.0 volts

III. DATA SCREENING

Bobbin Data

Left Strip Chart	-	400/100 diff. Mix vertical
Right Strip Chart	-	100 abs. vertical
Lissajous	-	400 diff.

IV. RECORDING RESULTS

A. Final Report Header

See attached example sheet

B. Flaw Reporting

Flaws - *Confirm on another channel Dump 4-liss Graphics. (M1-1-3-4)

MBM - Manufacturing Buff Mark
Nominal ≥ 5.0 V on 100 KHz Absolute (P-P)
NO GRAPHICS must be flaw like on 400 Diff.

DNT - Dent - ≥ 2.0 V on 400/100 mix

PVN - ≥ 5.0 V on 400 KHz diff.

ADR - ≥ 5.0 V on 100 KHz Absolute (P-P)
measure location and voltage at greatest transition.

NOTE: If AVB wear is apparent, measure with Abs. Mix curve, and instruct Lead Analyst to notify acquisition to install AVB standard for retests.

If indications are present which are affected by copper deposits, call from the 400/100 diff. Mix unless otherwise instructed.

Use special mixes to confirm flaws at TTS or other areas as necessary, but for confirmation only - no calls on special mixes, unless otherwise instructed.

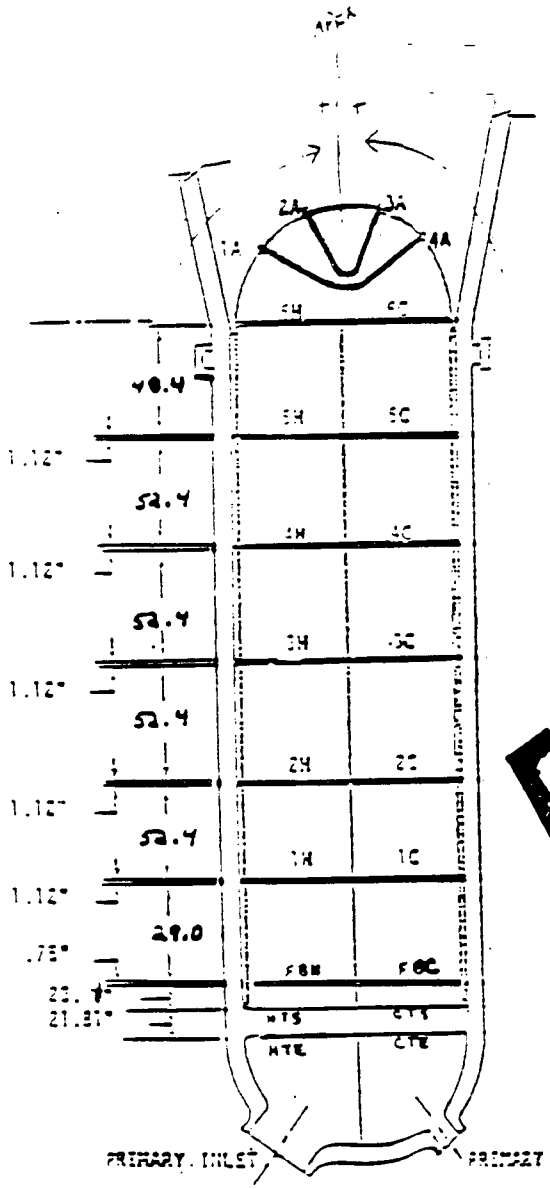
D. Graphics Printout

First graphic

Reporting Channel (400 KHz diff)

Second graphic

Multiple Liss/Strip Charts as applicable

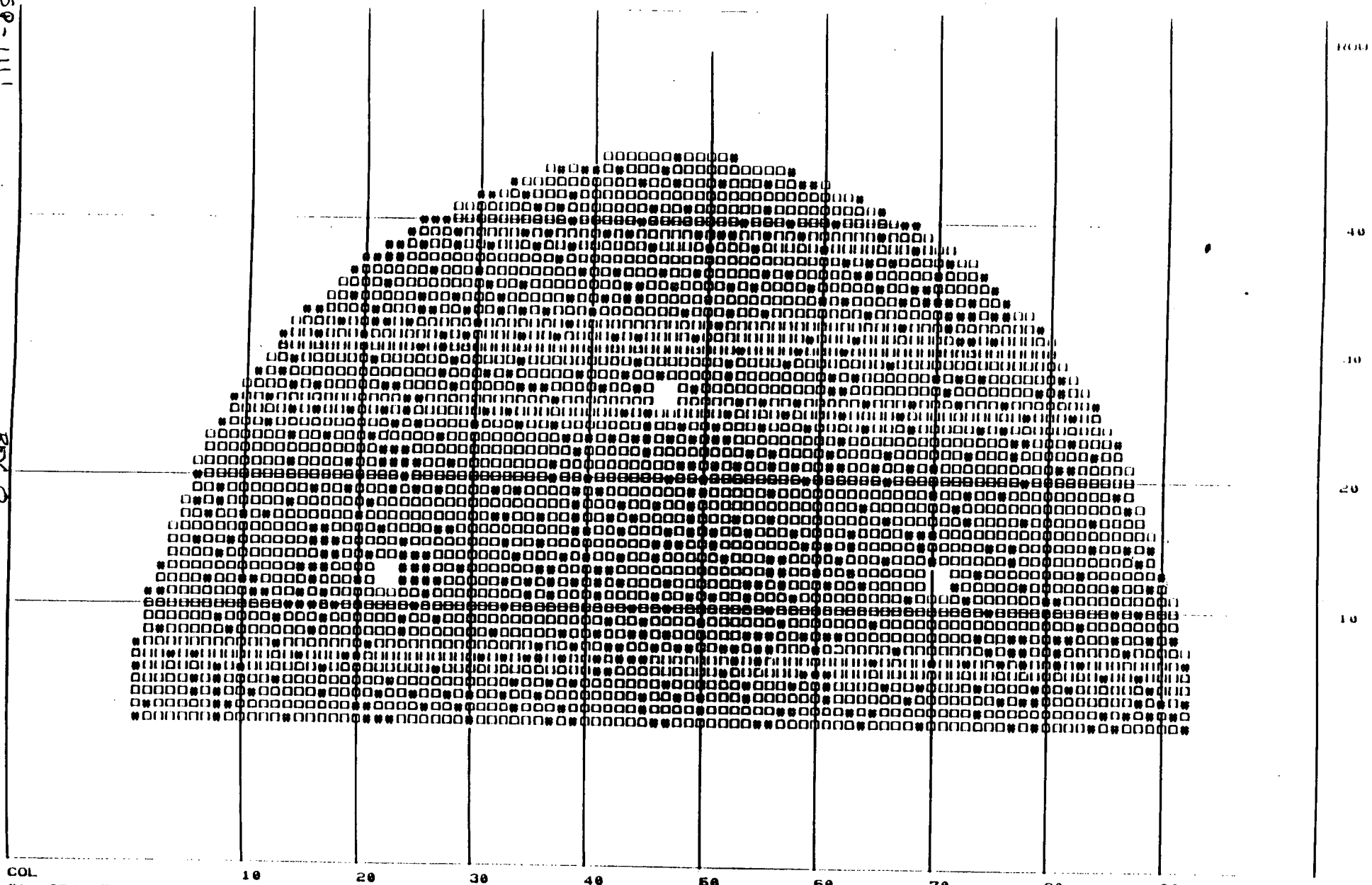


FLOW LOCATION REPORTING

EXHIBIT

SG-1111

REV 0



#: 654: Tubes To Be Examined

H.B. ROBINSON Unit 2
S/G #A 10/15/90
ABB-Combustion Engineering

ACRI ISIS Tubes

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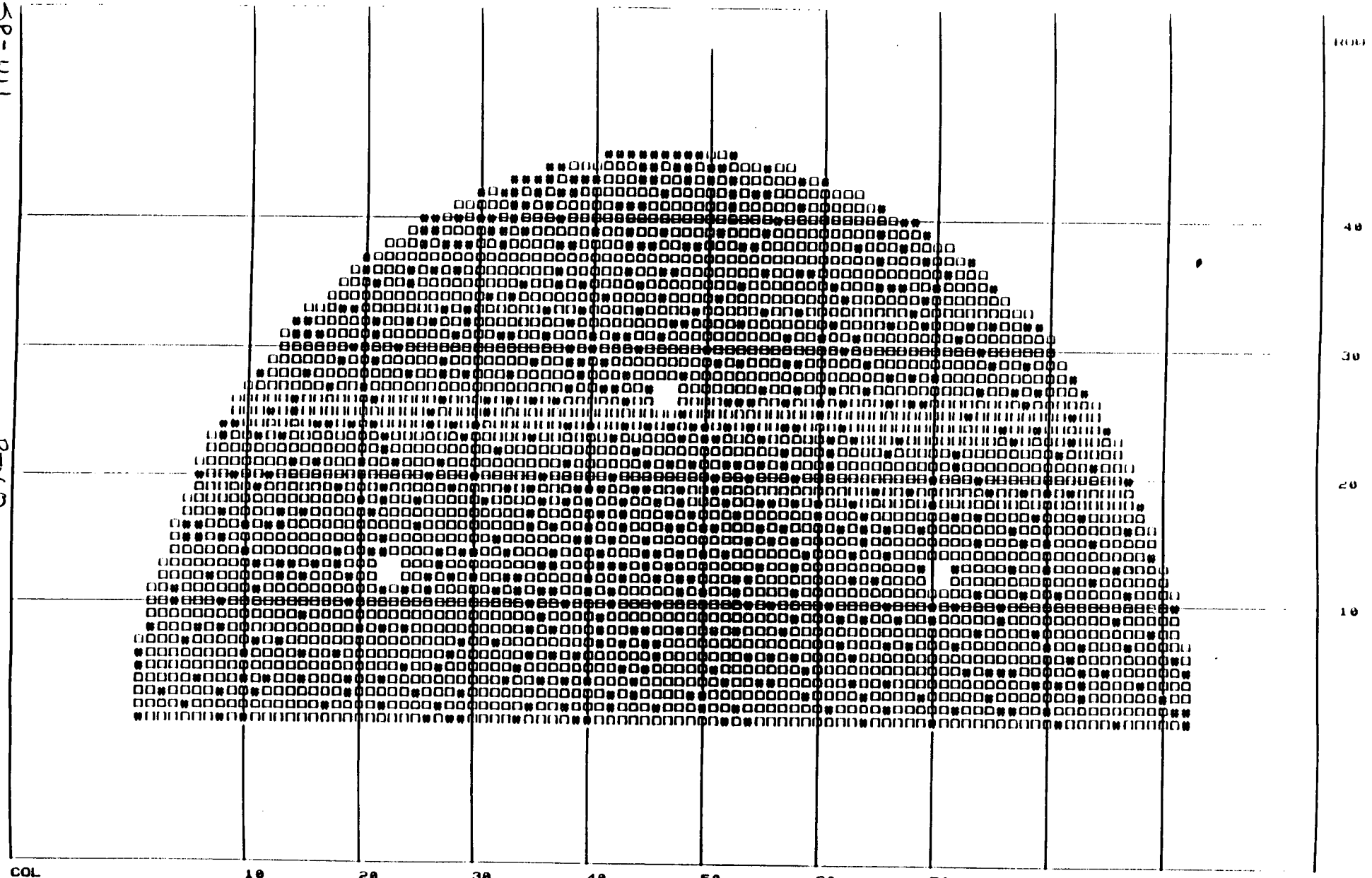

#: 660: Tubes To Be Examined

H.B. ROBINSON Unit 2
S/G #B 10/16/90
ABB-Combustion Engineering

ACRI ISIS Tubes

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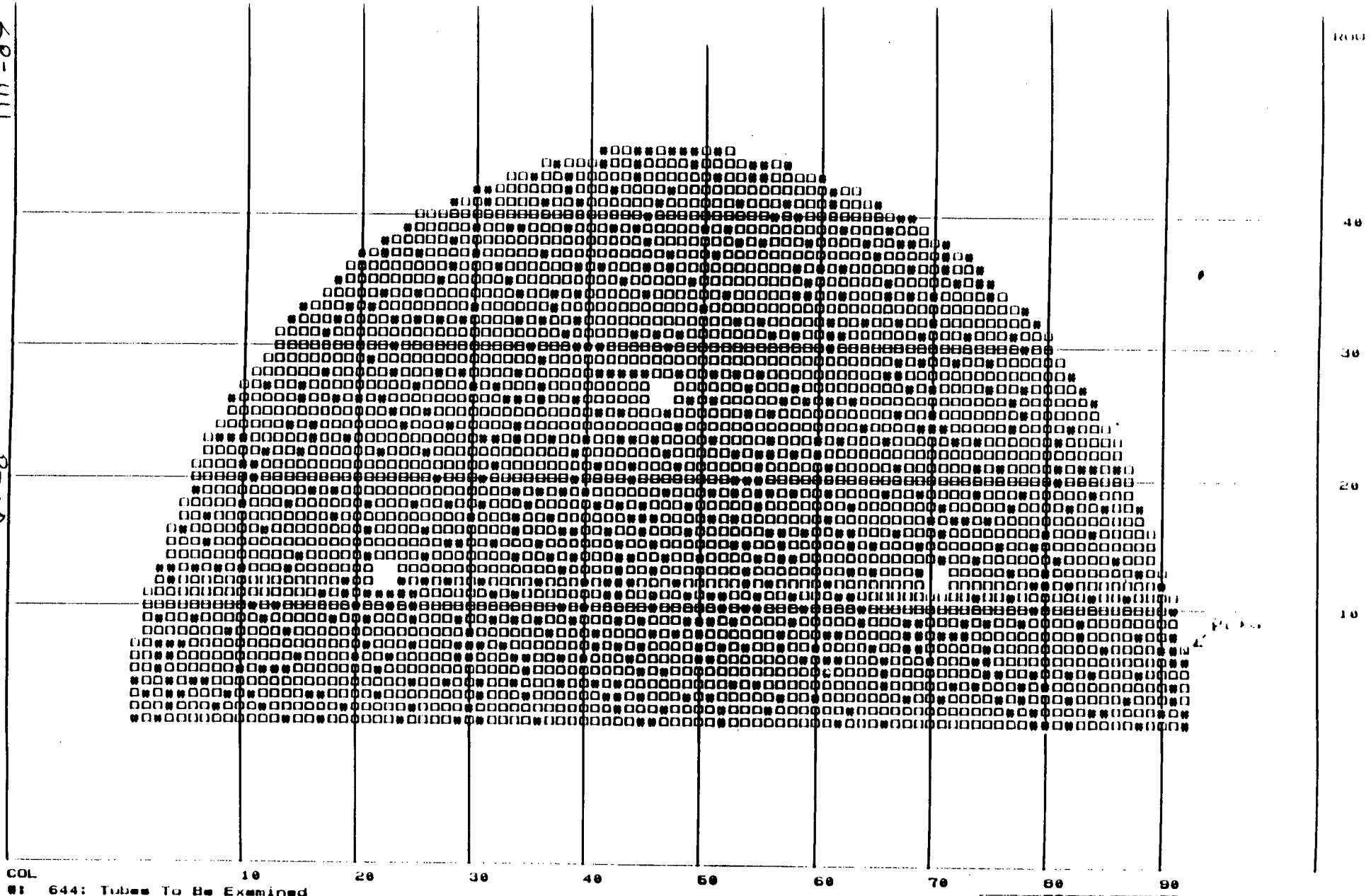

#: 644: Tubes To Be Examined

H.B. ROBINSON Unit 2
S/G #C 10/15/98
ABB-Combustion Engineering

ACRI ISIS Tubes

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Disc Label = DkDB_A05

	TERNING	GA	AC01			A510MULC		DB_A05	09/17/91
20	62	1							UTELTE
20	63	1							UTELTE
20	64	1							UTELTE
20	65	1							UTELTE
20	66	1							UTELTE
20	67	1							UTELTE
20	68	1							UTELTE
20	69	1							UTELTE
20	70	1							UTELTE
20	71	1							UTELTE
20	72	1							UTELTE
20	73	1							UTELTE
20	74	1							UTELTE
20	75	1							UTELTE
20	78	1							UTELTE
20	79	1							UTELTE
20	80	1							UTELTE
20	81	1							UTELTE
20	82	1							UTELTE
20	83	1	0.35	77	35	17 015	+ 0.00		UTELTE
20	84	1							UTELTE
20	85	1							UTELTE
20	86	1	0.36	78	S/N	17 013	+ 0.18		UTELTE
20	87	1							UTELTE
20	88	1							UTELTE
20	89	1							UTELTE
20	90	1							UTELTE
20	91	1							UTELTE
20	92	1							UTELTE
20	93	1							UTELTE
20	94	1							UTELTE
20	95	1							UTELTE
20	96	1							UTELTE
20	97	1							UTELTE
20	98	1							UTELTE
20	99	1							UTELTE
20	100	1							UTELTE
20	101	1							UTELTE
20	102	1							UTELTE
20	103	1							UTELTE
20	104	1	11.30	170	DNG	3 UTSF	+ 16.89		UTELTE
20	105	1							UTELTE
20	106	1							UTELTE
20	107	1							UTELTE
20	108	1							UTELTE
20	109	1	1.53	120	MBM	3 006	+ 31.37		UTELTE
20	110	1							UTELTE
20	111	1	2.96	123	MBM	3 008	+ 1.74		UTELTE
20	111	1	0.90	78	S/N	17 008	- 0.24		UTELTE
20	112	1	1.16	115	MBM	3 015	+ 13.61		UTELTE
						END TAPE			

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Rev O

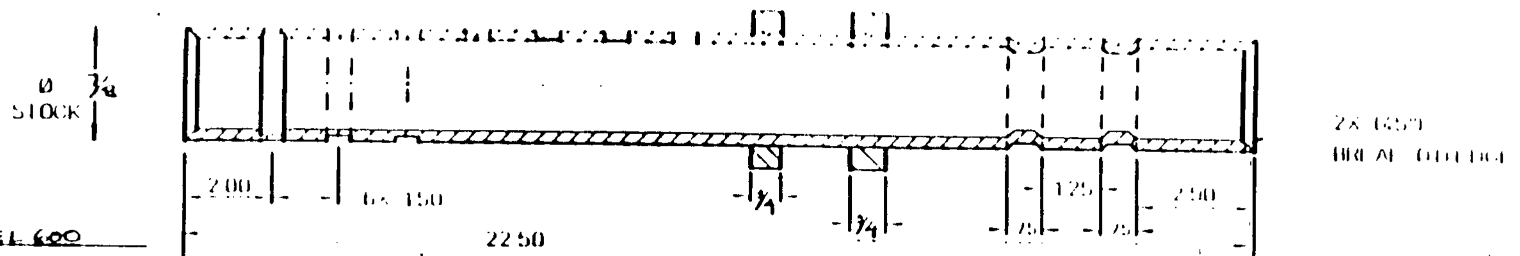
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR

LOCATION	A	B	C	D	E	F	G	H	I	J	K
PHYSICALLY MEAS DEPTH	.0105	.0050	.010	.0200	.0305	.0395	THRU			.0050 RADIAL DENT	.0090 RADIAL DENT
DEPTH IN % OF WALL	21%	10%	22%	39%	60%	77%	100%				
EC PHASE ANGLE MEAS	10°	154°	157°	142°	115°	91°	40°				
DIA OF DEFECT ±.003	ID GROOVE 1/16 WIDE ±.010	OD GROOVE 1/8 WIDE ±.010	3/16	3/16	7/64	5/64	[1]				

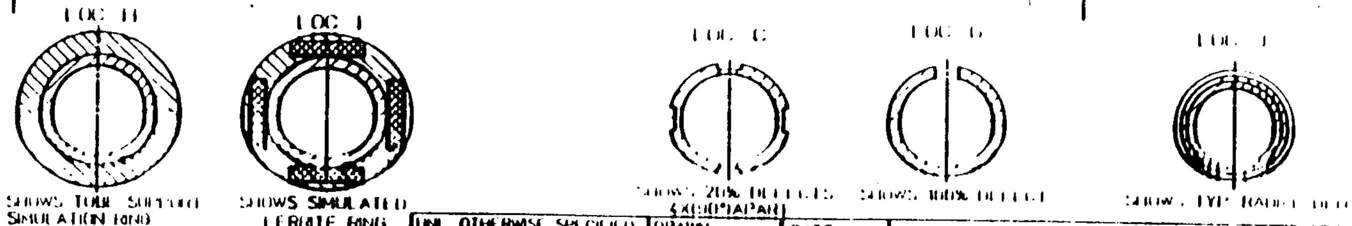
NOTES

[1] Ø .052 REL STD - .75 DIA
Ø .089 REL STD - .75 DIA

SUPPORT RING W/FERRITE CUPS MAT FERRITE CUST P/N 0E4107 0600



MATERIAL INCONEL 600
AVERAGE MEAS WALL THK .051
NOMINAL WALL THK .049
HEAT LOT NO 7171
TEST FREQ USED 400 KHZ
...
REF NO NA
QUALITY REF NO NA
DATE REC 9-21-90
QA INSPECTION
CUSTOMER COMBUSTION ENGINEERING
RECORDED 32
PROBE USED 750LC #67742
REVIEWED BY



NOTE

UNL OTHERWISE SPECIFIED DIM ARE IN INCHES TOLERANCES	DRAWN	DATE	ZETEC INC
DECIMAL FRACT ±1/16	K ZEGEL	9/18/90	TITLE COMBINATION ASME/2 DENT STD WITH TUBE SUPPORT & FERRITE RINGS
XXXX ±.003	CHECK	9/18/90	
XXX ±.015	DESIGN		DWG NO 2-4468
XX ±.050			
% ±.003			
ANGULAR ±/- 3°	APVD QA		
FINISH			SCALE NONE / RELEASE DATE 9/18/90 / SHT 1 of 1

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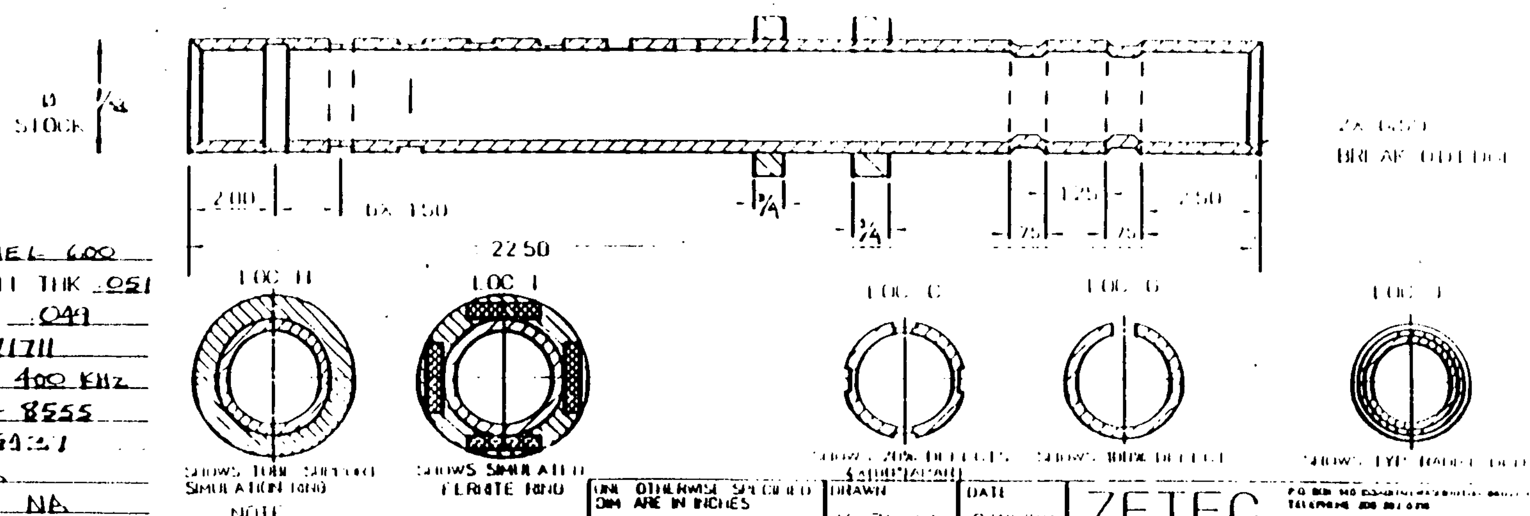
REVISIONS				
LTR	DATE	DESCRIPTION	APVD	CK

LOCATION	A	B	C	D	E	F	G	H	I	J	K
PHYSICALLY MEAS. DEPTH	.0115	.0050	.0105	.0200	.0300	.0395	THRU			.0525 RADIAL DENT	.0375 RADIAL DENT
DEPTH IN % OF WALL	23%	10%	21%	39%	59%	71%	100%				
E.C. PHASE ANGLE MEAS.	11°	152°	158°	142°	116°	91°	40°				
DIA. OF DEFECT ±.003	ID GROOVE 1/16 WIDE ±.010	OD GROOVE 1/8 WIDE ±.010	3/16	3/16	7/64	5/64	[1]	SUPPORT RING W/FERRITE CUPS MAT. FERRITE CUP P/N OC43107 0600			

NOTES:
[1] Ø .052 IN STD < .75 DIA
Ø .067 IN STD > .75 DIA



MATERIAL: INCONEL 600
AVERAGE MEAS. WALL THK: .051
NOMINAL WALL THK: .049
HEAT LOT NO: 71711
TEST FREQ USED: 400 KHz
SERIAL NO: Z-8555
P.O. NO: 10851421
REF. NO: NA
QUALITY REF. NO: NA
DATE MFG: 1-21-90
QA INSPECTION: [illegible]
CUSTOMER: COMBUSTION ENGINEERING
RECORDED: 32
PROBE USED: A350LS #57742
REVIEWED BY: [illegible]

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES TOLERANCES	DRAWN	DATE	ZETEC INC.
DECIMAL FRACT ±1/16	K. ZEGEL	9/18/90	TITLE: COMBINATION ASME/2 DENT STD WITH TUBE SUPPORT & FERRITE RINGS
.XXXX ±.001	CHECK	[illegible]	DWG NO: 2-4468
.XXX ±.005	DESIGN		001492 1 A
.XX ±.050	APVD QA		SCALE: NONE
% ±.003	[illegible]	[illegible]	RELEASE DATE: [illegible]
ANGULAR ±3°			SHEET 1 OF 1
FINISH			

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REVISIONS				
LTR	DATE	DESCRIPTION	APVD	

LOCATION	A	B	C	D	E	F	G	H	I	J	K
PHYSICALLY MEAS DEPTH	.045	.045	.090	.090	.090	.045	THRU			.0040	.0015
DEPTH AS % OF WALL	19%	9%	20%	19%	51%	17%	100%			RADIAL DENT	RADIAL DENT
E.T. PHASE ANGLE MEAS	9°	152°	152°	134°	106°	83°	40°				
DIA OF DEFECT +.000	TO DRILL 1/16 WALL +.010	DO DRILL 1/8 WALL +.010	3/16	3/16	7/64	5/64	[1]				

NOTES:
1. Ø .052 IN STD ± .75 DIA
   Ø .067 IN STD ± .75 DIA

SUPPORT RING
W/FERRITE CUPS
MAT FERRITE
CUP P/N 0C-5307-0000

Ø 7/8 STOCK

2X (45°) BREAK EDGE DIA

.200 — 6X 1.50 — 22.50 — 1.25 — 2.50

LOC H — SHOWS TUBE SUPPORT SIMULATION RING

LOC I — SHOWS SIMULATED FERRITE RING

LOC C — SHOWS 20% DEFECTS EXTRAPOLATED

LOC G — SHOWS 100% DEFECT

LOC J — SHOWS TYP RADIAL DENT

NOTE

MATERIAL INCONEL 600
AVERAGE MEAS WALL THK .051
NOMINAL WALL THK .049
HEAT LOT NO 71311
TEST FREQ USED 400 KHz
SERIAL NO 2-8556
P.O. NO 9085437
REF NO NA
QUALITY REF NO NA
DATE MFD 9-21-90
QA INSPECTION [illegible] OSL
SUBCONTRACTED Combustion Engineering
RECORDED 32
PROBE USED ATSOLC 2" 57712
REVIEWED BY [illegible]

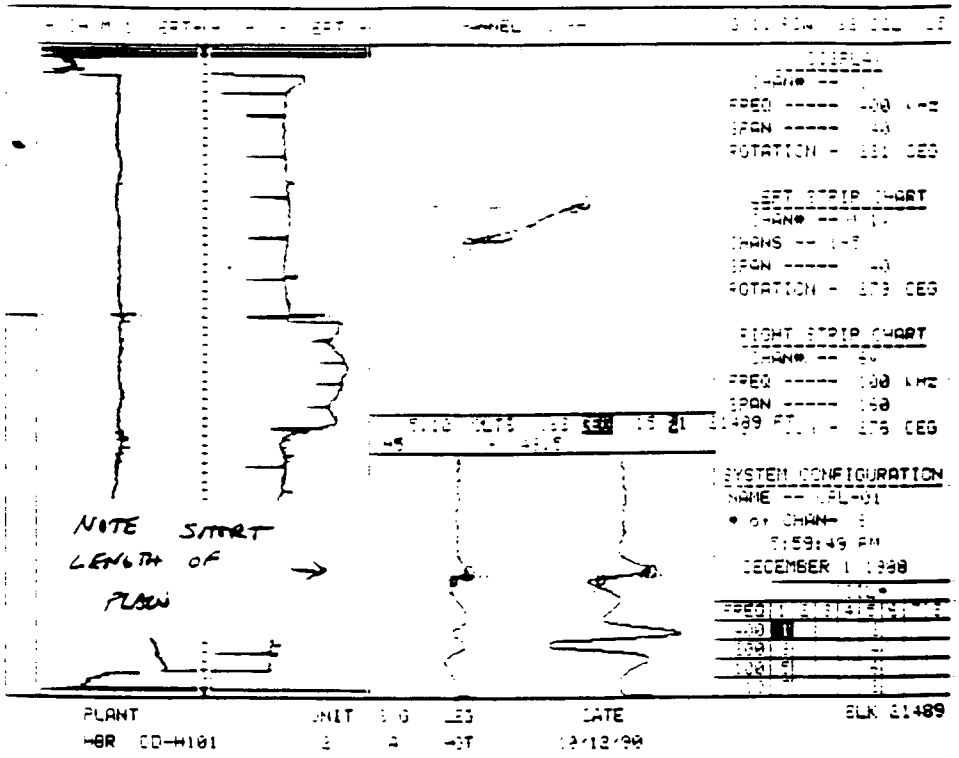
UNL OTHERWISE SPECIFIED DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT +/- 1/16
XXXX ±.003
XXX ±.015
XX ±.010
% ±.003
ANGULAR +/- 3°
FINISH

DRAWN K ZEIGLER DATE 9/18/90
CHECK [illegible] 9/18/90
DESIGN
APVD QA [illegible]

ZETEC INC
P.O. BOX NO [illegible]
TELEPHONE [illegible]

TITLE
COMBINATION ASME/2 DENT STD
WITH TUBE SUPPORT & FERRITE RINGS

DWG NO 2-4488 REV [illegible]
SCALE NONE RELEASE DATE 9/18/90 SHEET 1 OF 1



EXAMPLE OF SMALL FLAW < 20% (NEAR SURFACE)

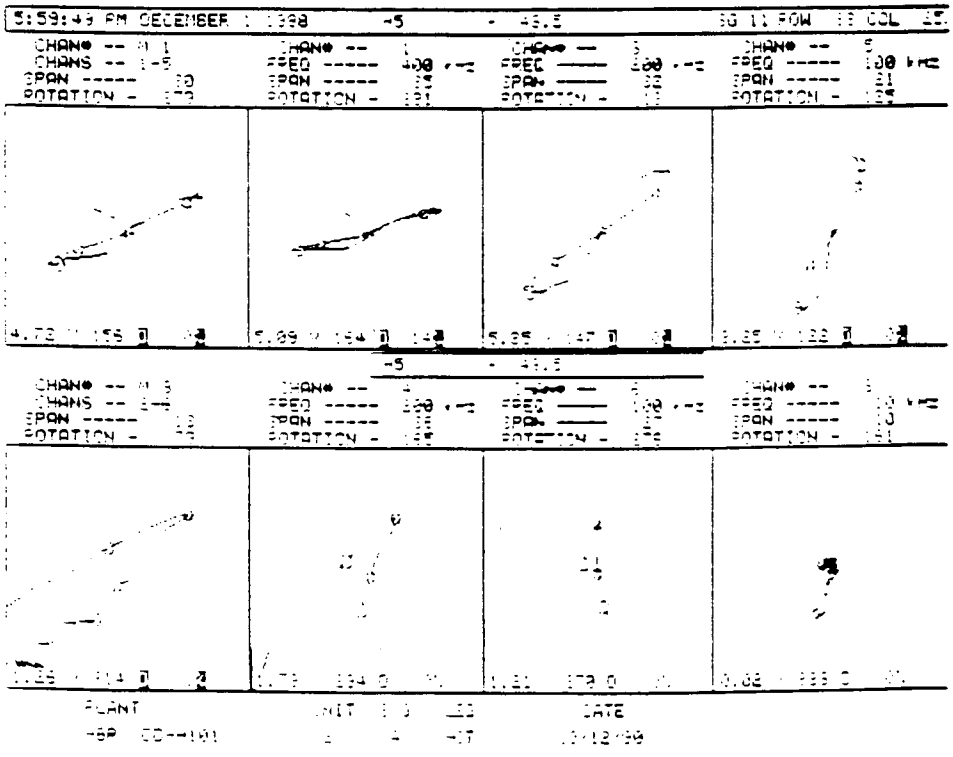
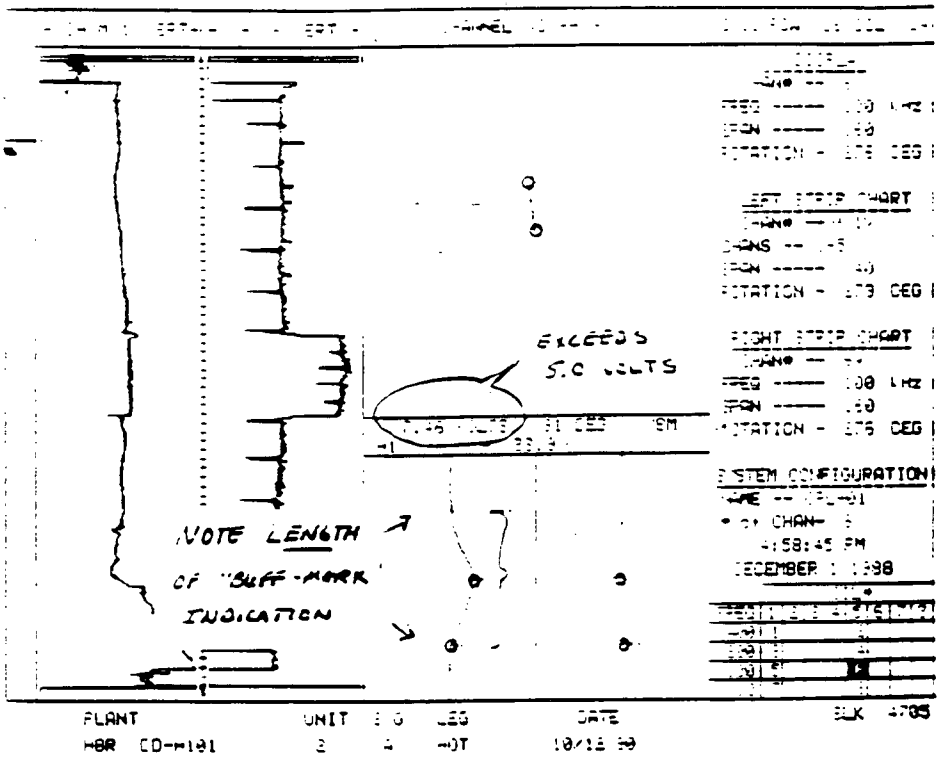


FIGURE 1
REV 0



EXAMPLE OF MBM (MANUFACTURING BUFF MARK

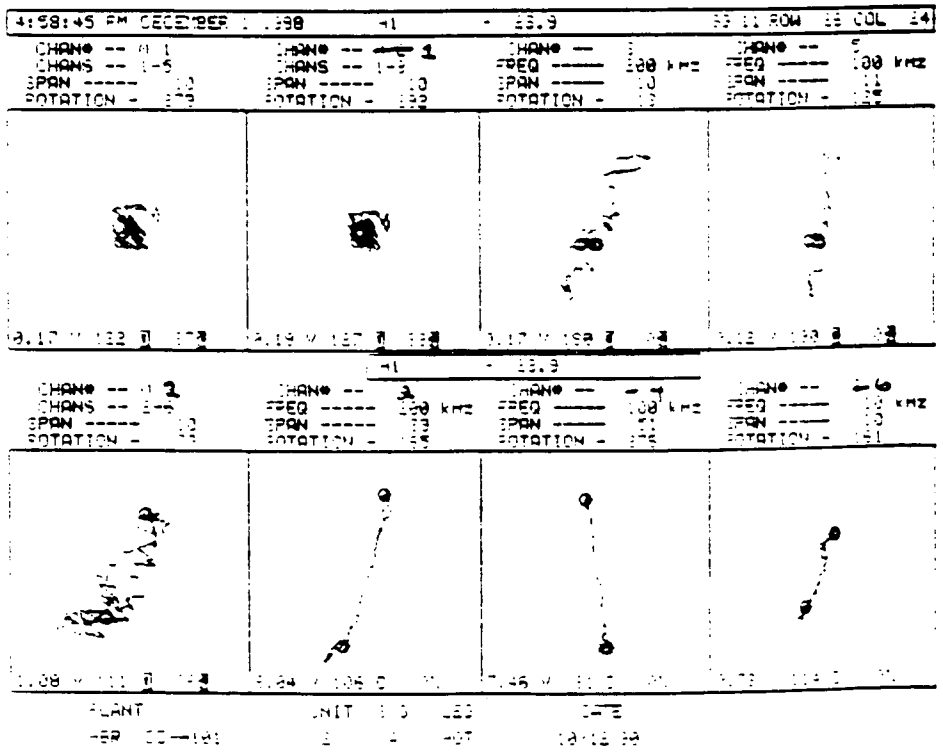
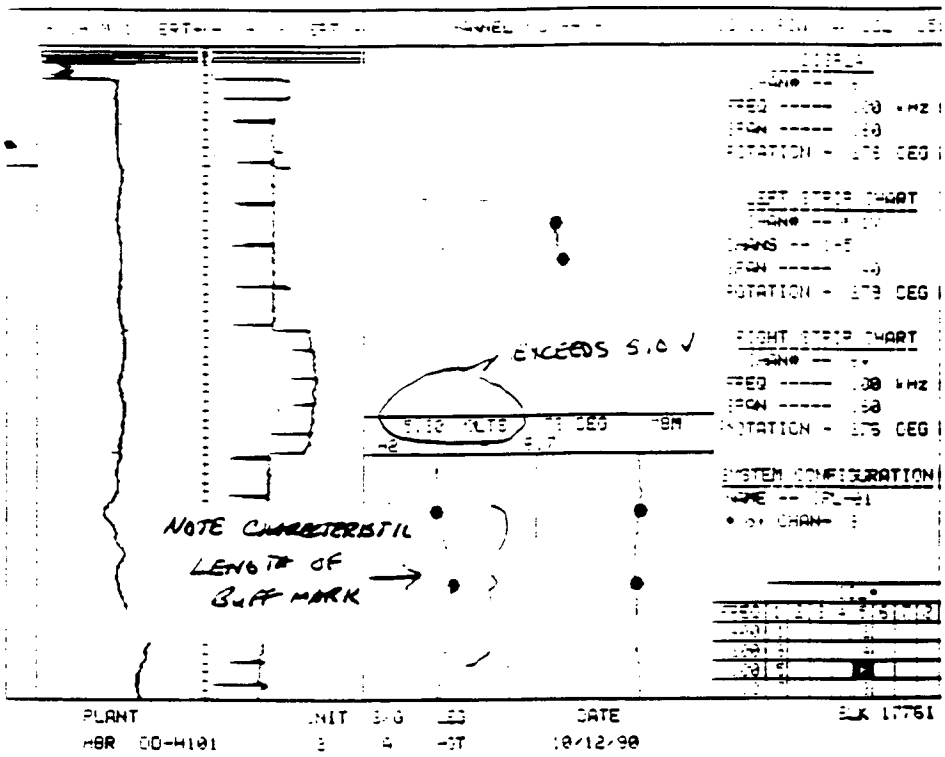
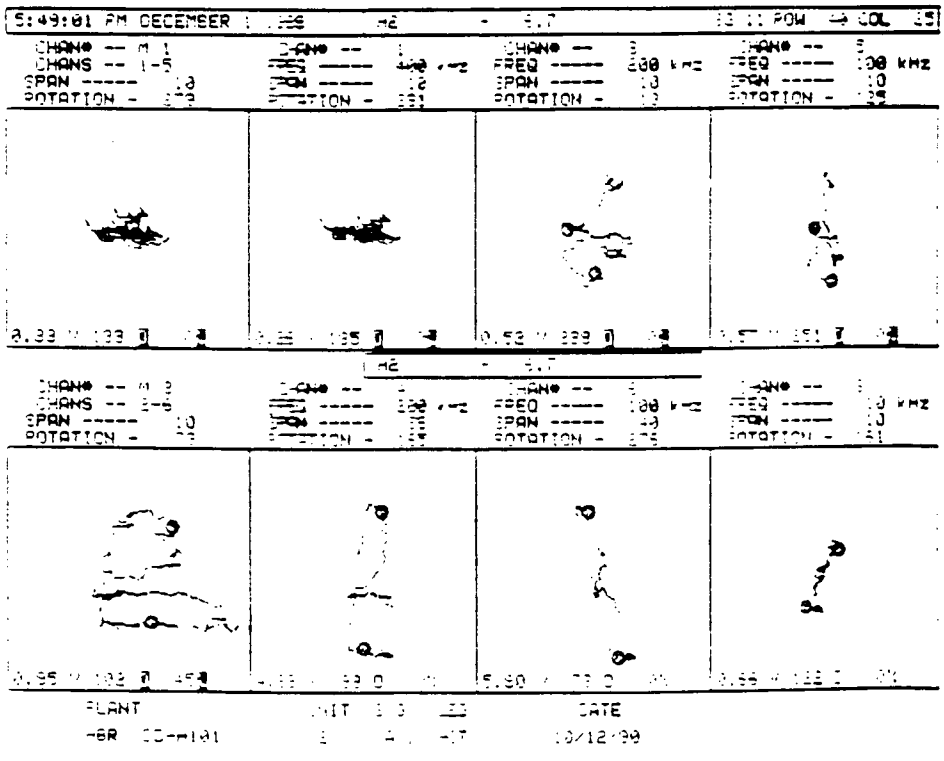
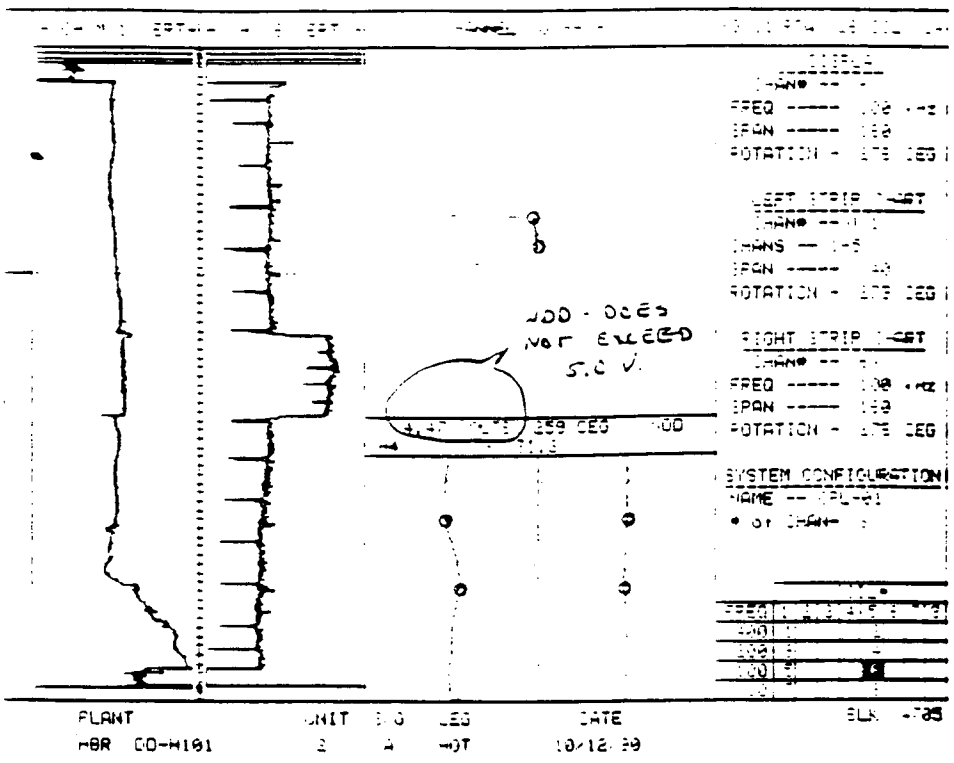


FIGURE 2


EXCEEDS 5.0 ✓
NOTE CHARACTERISTIC LENGTH OF BUFF MARK
PLANT
MBR 00-M101
DATE
10/12/90

MBM EXAMPLE


5:49:01 PM DECEMBER
PLANT
MBR 00-M101
DATE
10/12/90



EXAMPLE OF NDD (BUFF MARK BELOW RECORDING LEVEL)

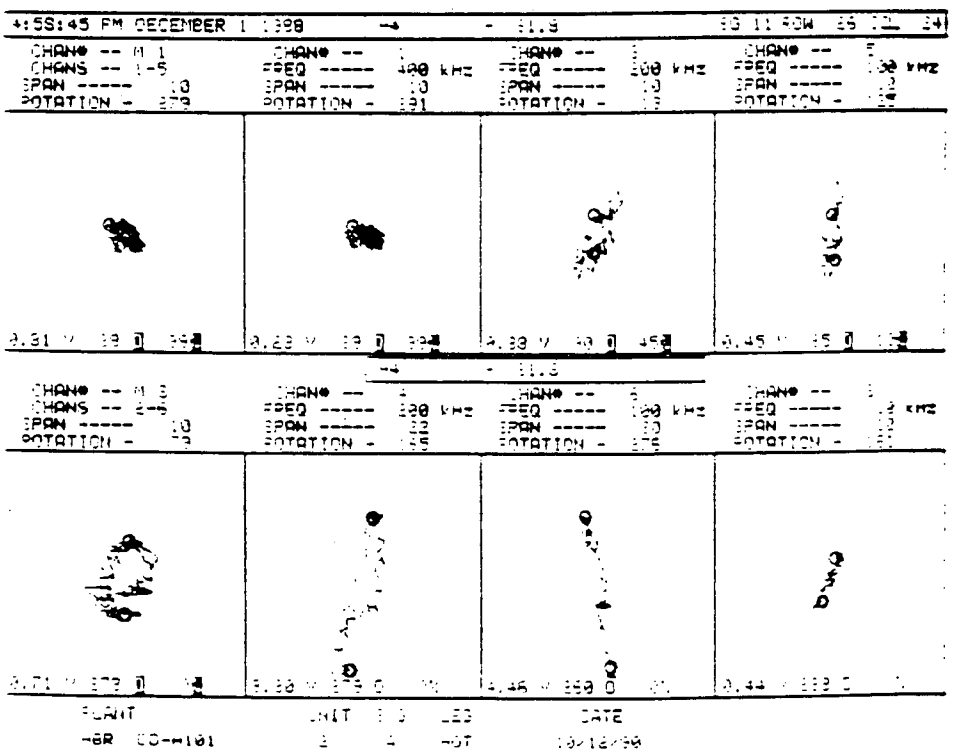
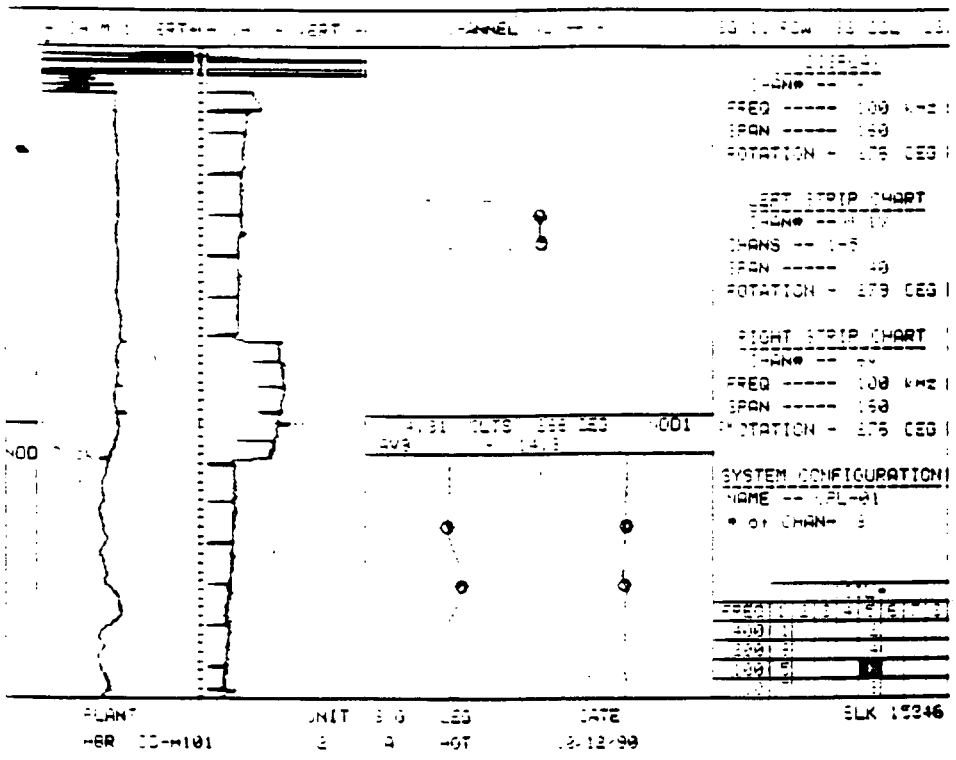
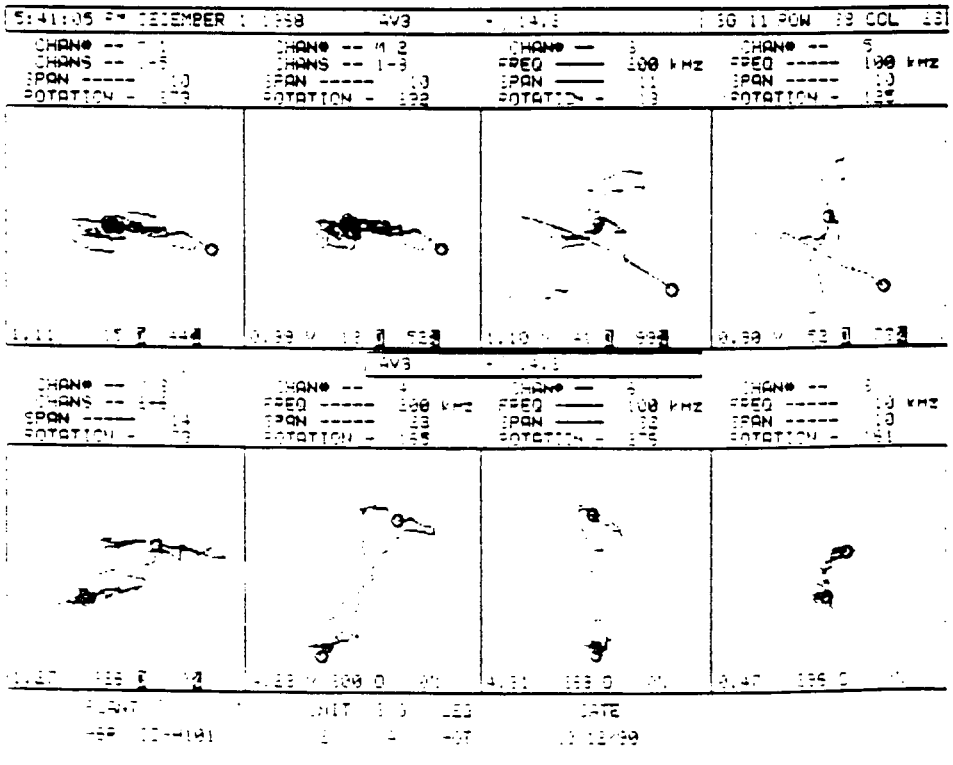
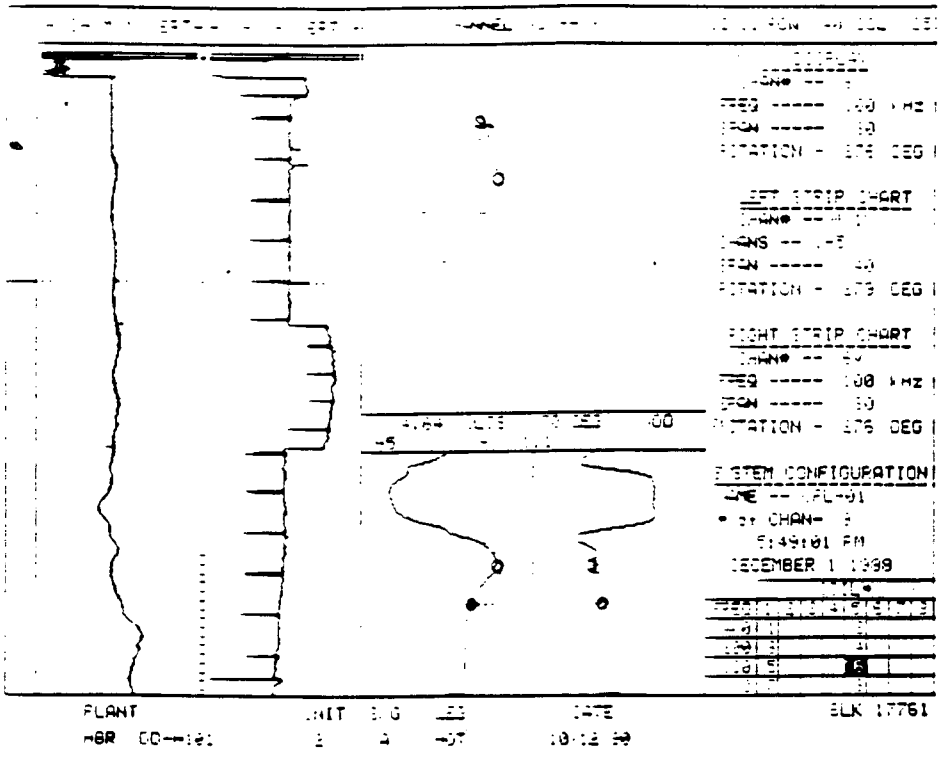


FIGURE 4
REV 0



EXAMPLE OF NOD (SHOW SHIFT MARK)





EXAMPLE OF NDD (SMALL BUFF MARK @ SUPPORT EDGE)

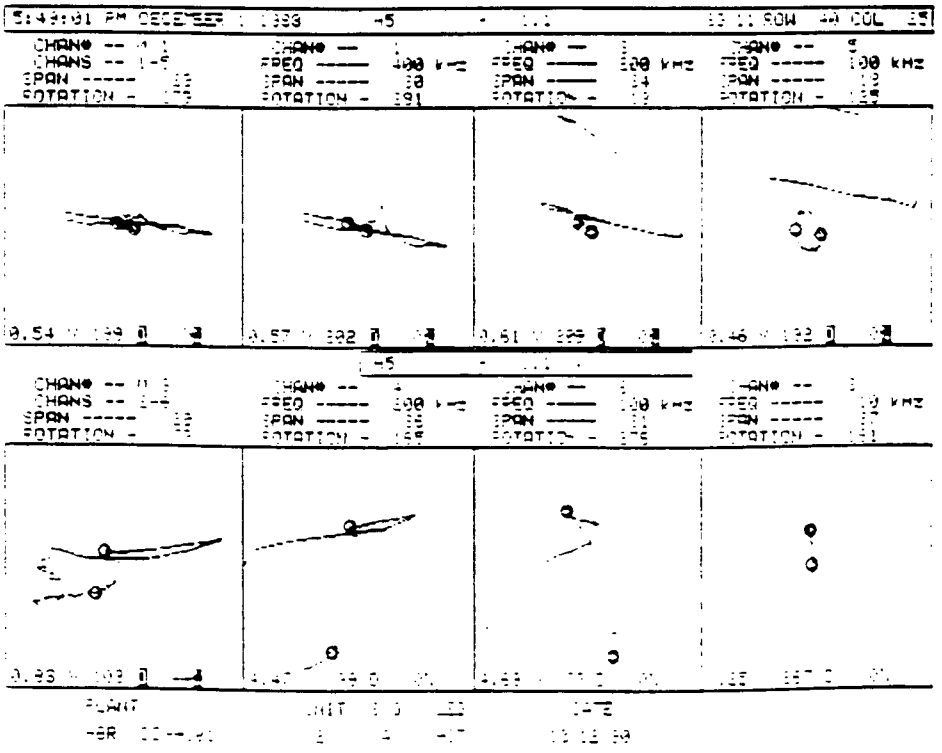
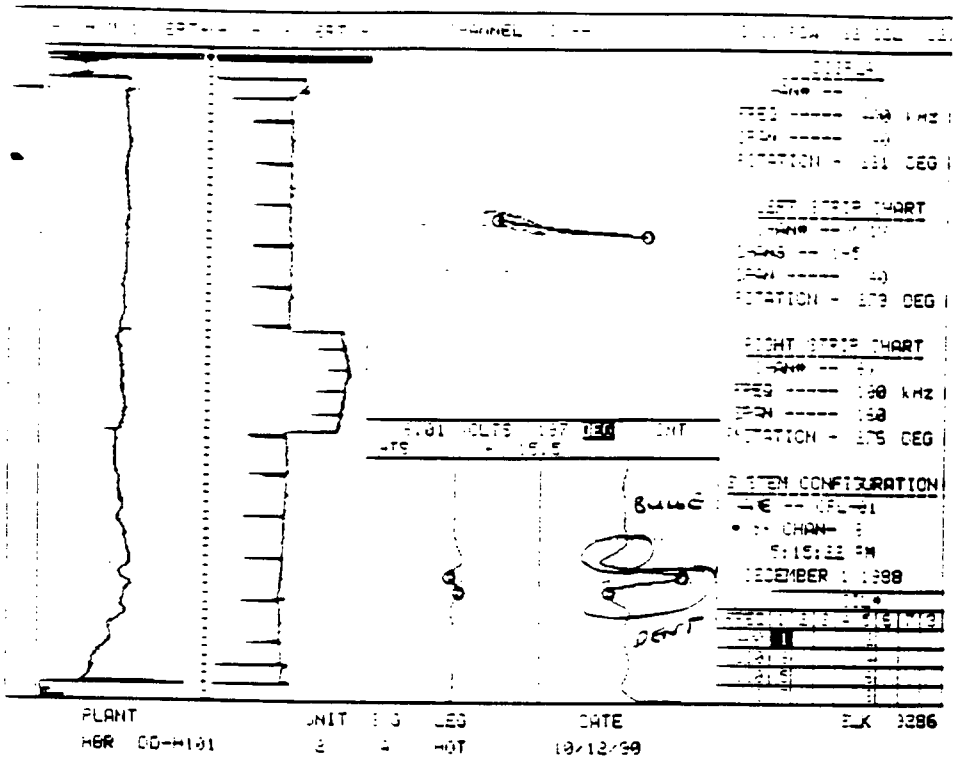


Figure 6
REV 0



EXAMPLE OF DENT WITH SMALL BULGE

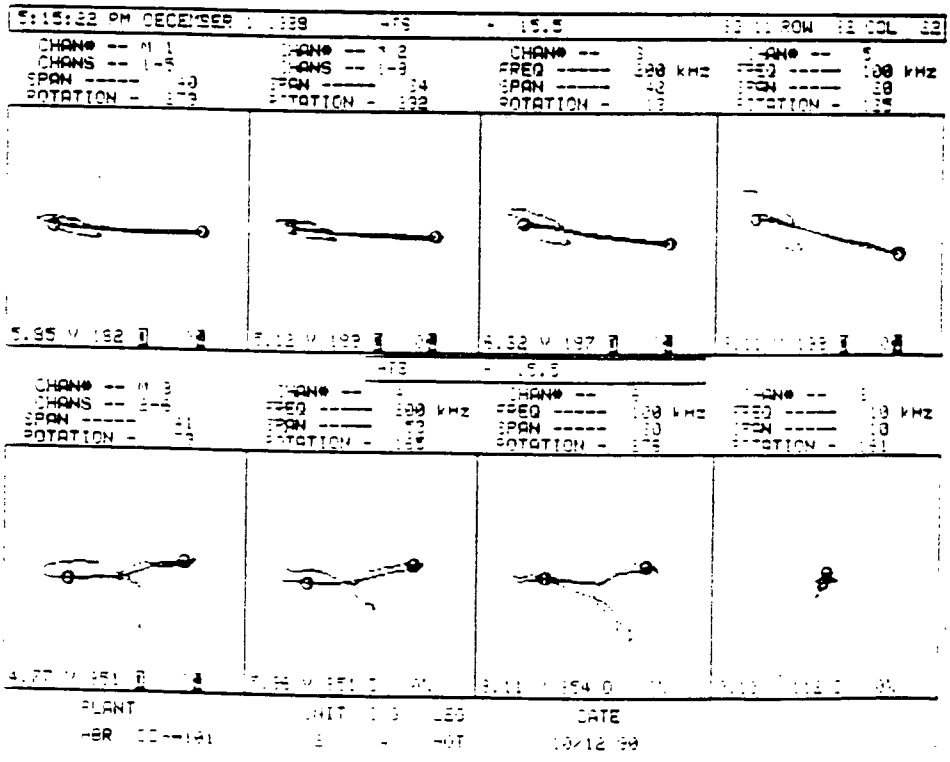
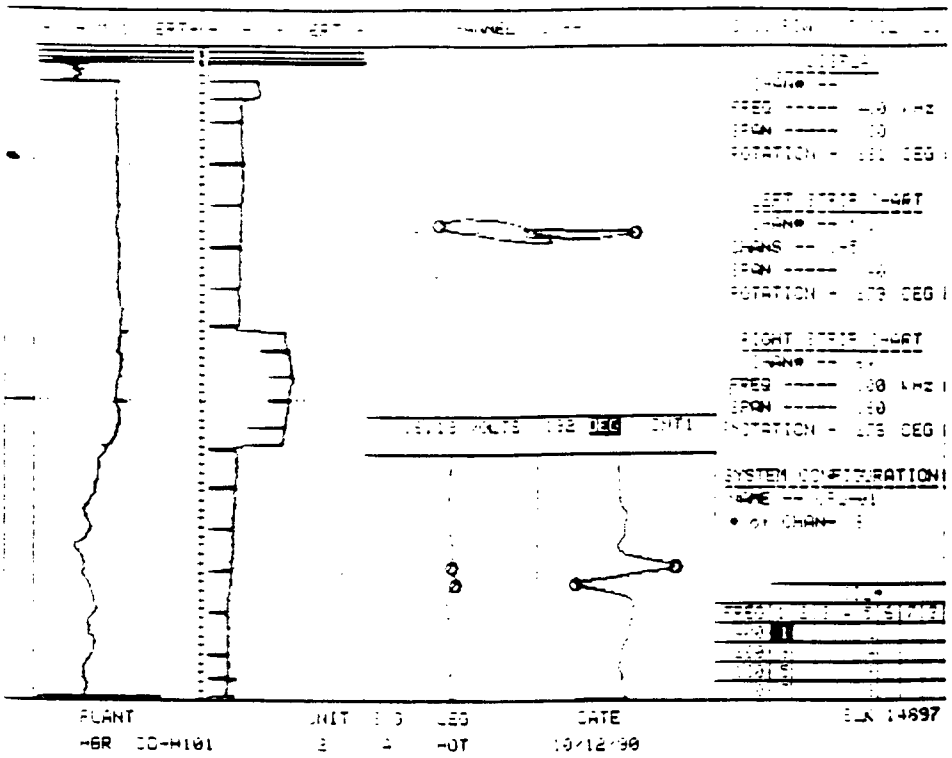
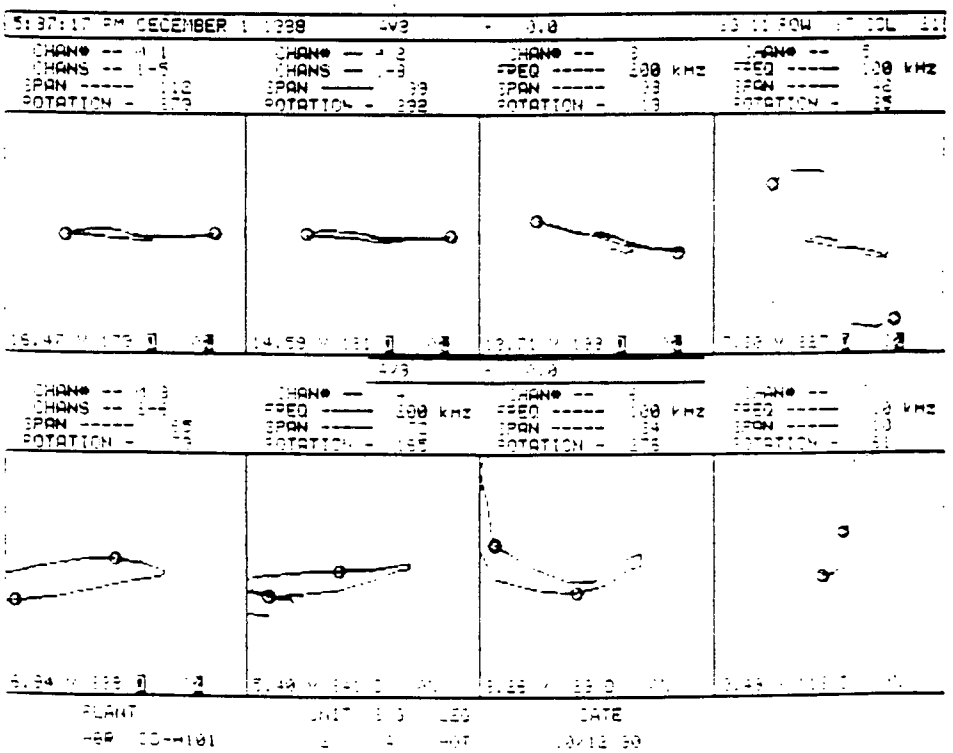


FIGURE 7

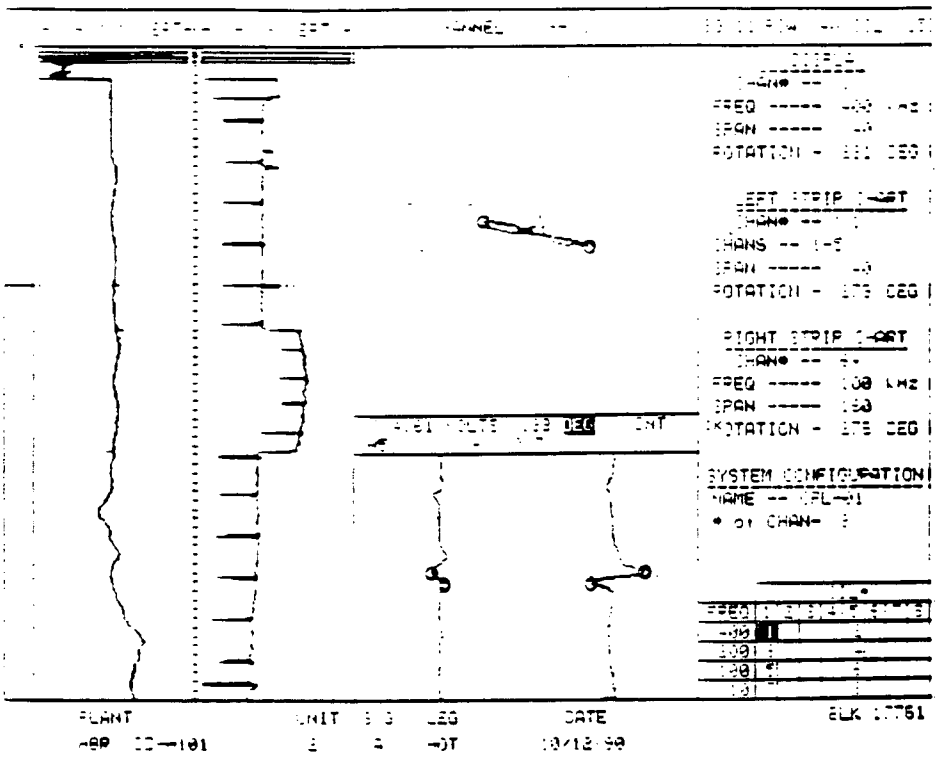


EXAMPLE OF OGT @ AUB



NOTE LOSES @ 100 KHZ

FIGURE 9



EXAMPLE OF SMALL DENT NEAR SUPPORT

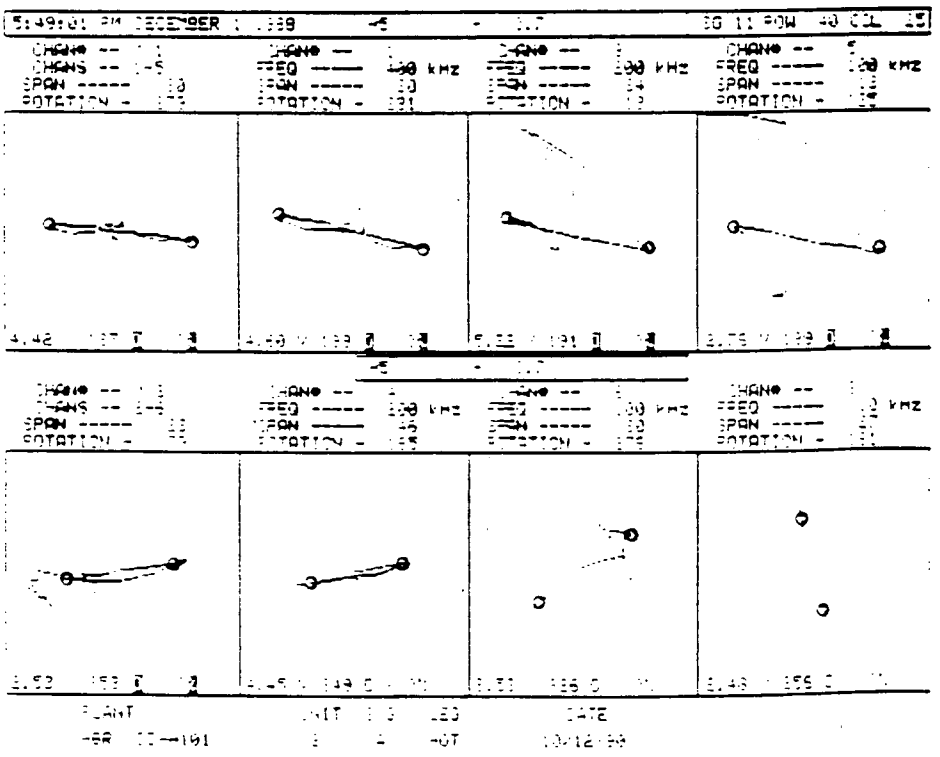


FIGURE 2

MRPC ANALYSIS

The following information is provided to the Data Analyst and Data Management personnel to insure the consistent analysis and reporting of eddy current data results during the 1992 refueling outage. It should be noted that this supplement is a guideline, and should not override judgement of the experienced data analyst.

I. GENERAL INFORMATION

A. See Original Supplement

B. See Original Supplement

C. Calibration Standards

	Flaw	Dent
Z-8644	**100-56od-42od-20id edm slots & 100% drill hole**	
Z-8645	**100-63od-43od-20id edm slots & 100% drill hole**	
Z-8658	**100-57od-38od-21id edm slots & 100% drill hole**	

Common Notations

(see ROB-410-005 and original supplement for complete list)

IDI Inside Diameter Indication

ODI Outside Diameter Indication

II. SETUP PARAMETERS

NO 3 Point Fit curves required

Set Volts to *5.0 V P-P on MRPC drill hole @ 400 KHz - save to all channels

*unless otherwise noted use 5.0 volts

MIXES - Setup 400/100 mix as applicable

III. DATA SCREENING

MRPC Data

Left Strip Chart	-	400 abs. vertical
Right Strip Chart	-	200 abs. vertical
Lissajous	-	400 abs.

IV. RECORDING RESULTS

A. Final Report Header

See original supplement

B. Flaw Reporting

Flaws - *Confirm on another channel as flaw-like
*Record as IDI or ODI
*Dump Graphics

Size - *Establish sizing box from Cal standard 60% od EDM notch
*Dump size criteria to report following flaw information.

** NOTE **

The lead analyst may establish a 3-point fit curve to determine a possible depth-of-flaw using the 100-60-40 od slots in the MRPC standard.

Use special mixes to confirm flaws at TTS or other areas as necessary, but for confirmation only - no calls on special mixes, unless otherwise instructed.

C. **Graphics Printout**

SETUP:

Set Left Strip Chart to 200 KHz Abs.
Set Right Strip Chart to 400 KHz Abs.
Set Lissajous to 400 KHz Abs.
Set chart Length to display area of interest.

Set Scale using MRPC standard (as-built dwg.)
Set C-Scan Window to +/- 1.2"
Set Pull/Rot value to 7/8 and dial to ~ 775
Set Perspective to Z-300 - X-80
Set Plot Channel to 200 KHz Abs.
Set Size of C-Scan display to fill window 90%

Set Box size according to EDM notch length using 60% OD groove. (0.5" long)
Set size to 5.0 V P-P using 400 KHz and drill hole.

Check settings using calibration standard

FLAW REPORTING:

First graphic

Reporting Channel (400 KHz abs. lissajous)

Second graphic

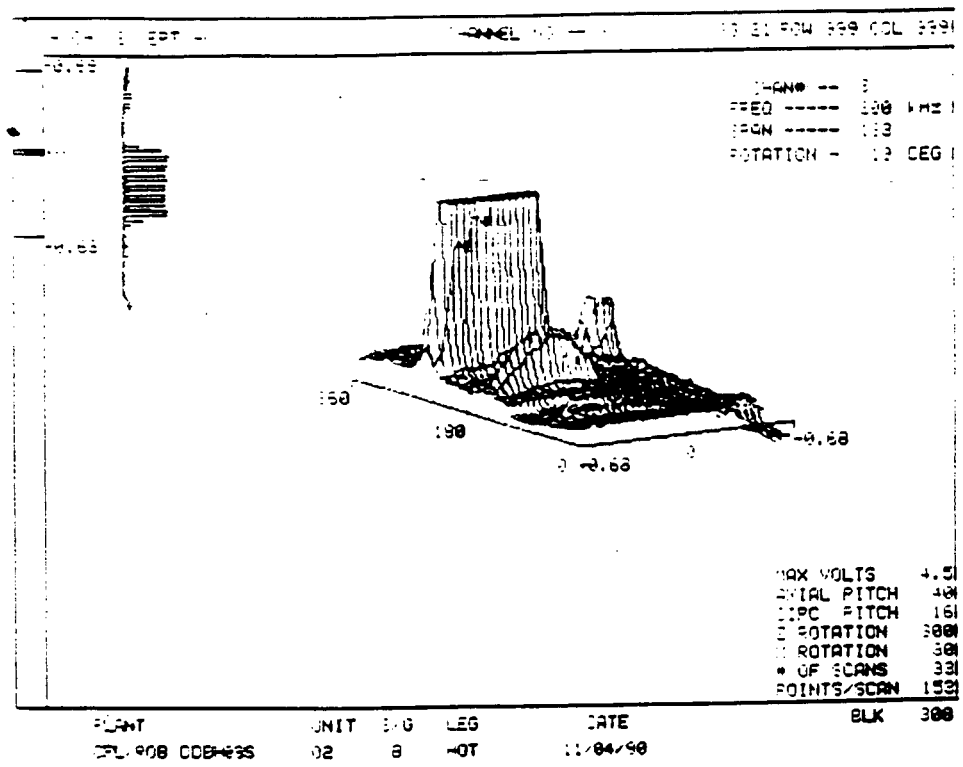
C-Scan Isometric - Z Rotation 300
- X Rotation 80

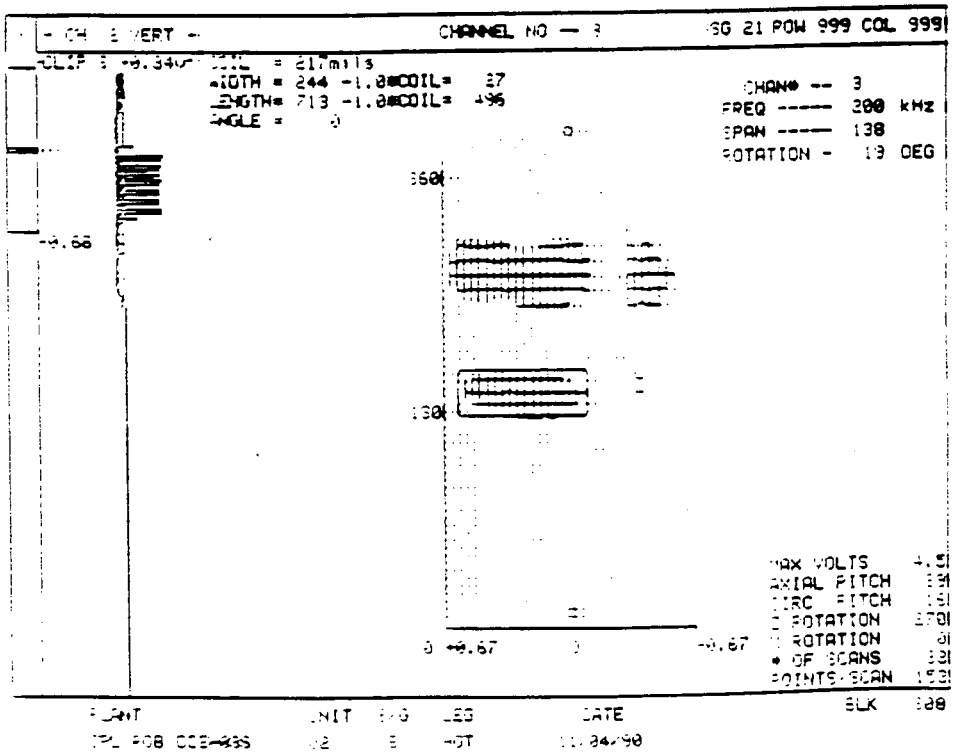
Third graphic

Clip Plot - Show measuring Box and Size

Fourth graphic

Single Iso Scan - Show flaw profile


CHAN# -- 3
FREQ ----- 300 kHz
SPAN ----- 138
ROTATION - 19 DEG
360
180
0
-0.68
MAX VOLTS 4.5
AXIAL PITCH 40
CIRC PITCH 16
ROTATION 300
ROTATION 60
OF SCANS 33
POINTS/SCAN 153
BLK 300
PLANT
UNIT
LEG
DATE
POB CCB-635
02
B
HOT
11/04/90


CHANNEL NO — 3
SG 21 POW 999 COL 999
= 21.mils
WIDTH = 244 -1.8*COIL= 87
LENGTH= 713 -1.8*COIL= 496
ANGLE = 0
CHAN# -- 3
FREQ ----- 300 kHz
SPAN ----- 138
ROTATION - 19 DEG
360
180
0
-0.67
MAX VOLTS 4.5
AXIAL PITCH 39
CIRC PITCH 16
ROTATION 270
ROTATION 0
OF SCANS 33
POINTS/SCAN 153
BLK 300
PLANT
UNIT
LEG
DATE
POB CCB-635
02
B
HOT
11/04/90

ATTACHMENT 6.1
Page 1 of 3

DOCUMENT CHANGE FORM

DCF # 92-P-0787
New Rev
Temp. # T-4408
Temp Change Expires 5-15-92

Section I

Doc Kind PROCEDURE # SP-1111 Affected Rev 0

Alternate ID N/A Markup Attached? ✓ yes ___ no

Document Title EDDY CURRENT DATA ANALYSIS PROCEDURE
EVALUATION OF WESTINGHOUSE STEAM GENERATOR TUBING

Rev Basis Incorporate clarification of steps in SP-1111 to agree with the H.B. Robinson Eddy Current Analysis Supplement (4/23/92 revision).

Due Date/Prerequisite for

Initiator Bruce A. Johnson Group Tech. Support Date 4/24/92

Section II

Pages Revised 27, 28

Doc Type Code N/A Applic System/File #s 15508, 3005

Description of Change Change Attachment 3-2 to SP-1111 to agree with the current H.B. Robinson Eddy Current Analysis Supplement (4/23/92 revision).

Reason/Justification H. B. Robinson Eddy Current Analysis Supplement was recently revised (4/23/92) for clarification and to allow the analyst to discern dent signals from noise.

(Attach Additional Paper If Required)

DOCUMENT CHANGE FORM

Section II (cont.)

Affected Documents

Kind	Number	Title
None		

Comments _____

Document Released For Review

Preparer Lee Ann Johnson Group Tech. Support Date 4/24/92

Recommender _____ Title _____ Date _____

Recommended Effective Date _____

Training required before becoming effective? ___ yes ✓ no

description _____

DOCUMENT CHANGE FORM

Section III

Type of Review	Req'd (See ATTACH 6.3)	Not Req'd	Assigned Reviewer	Reviewer's Signa/Date (per ATTACHMENT 6.4)
1. Design Verification			See Design Verification Package	
2. Technical				
3. Nuclear Safety			See Safety Review Package	
4. 10CFR50 App. R				
5a. Environmental Qual.				
5b. R.G. 1.97				
6. PNSC				
7. NAD				Review done, Ref.
				Review may follow approval
8. NRC			Permission to proceed, Ref.	
			(per Reg. Comp., signa/date	
9. In-Service Inspec.				
10. System/Compon. Engrg				
11a. Operations				
11b. Human Factors				
12. Simulator				
13. Maint-Elec/I&C				
14. Maint-Mech/Insul				
15. Installation				
16. E&RC				
17. ALARA				
18. Security				
19. Fire Protection				
20. Quality Ver. Section				
21. Checker				
22. Project Coordinator				
23. Other _____				
24. Other _____				
25. Other _____				

Temporary Change Approval: A temporary change has a maximum duration of 21 days.

Signature	Management Title	Date
[signature]	Project Engineer	4/24/92
[signature]	Ops Procedure Coord SRO SRO	4-24-92

Final Approval _____ _____ PNSC followup review recommended [ ]
Signature Date

Void/Cancel _____ _____
Signature Date

Reason: _____

_____

_____

Section IV

Appropriate actions have been taken regarding these temporary changes to allow this Revision to become effective. _____ (list)

_____
Recommender Signa/Date

REVISION 2 | 10CFR50.59 PROGRAM MANUAL | Page 59
ATTACHMENT A
CP&L SAFETY REVIEW PACKAGE Page 1 of ____

SAFETY REVIEW COVER SHEET

DOCUMENT NO. SP-1111 REV. NO. 0

DESCRIPTION OF TITLE: EDDY CURRENT DATA ANALYSIS PROCEDURE EVALUATION OF WESTINGHOUSE STEAM GENERATOR TUBING

1. Assigned Responsibilities:

   Safety Analysis Preparer: Bruce A. Johnson
   Lead 1st Safety Reviewer: _____
   2nd Safety Reviewer: _____

2. Safety Analysis Preparer: Complete PART I, SAFETY ANALYSIS

Safety Analysis Preparer _____ 4/24/92
SIGNATURE DATE

3. Lead 1st Safety Reviewer: Complete Part II, Item Classification.

4. Lead 1st Safety Reviewer: Part III may be completed. If either question 1 or 2 is "yes," then Part IV is not required.

5. Lead 1st Safety Reviewer: Determine which DISCIPLINES are required for review of this item (including own) and mark the appropriate block(s) below.

DISCIPLINES Required:	(Print Name)	Signature/Date (Step 7)
[] Nuclear Plant Operations		
[] Nuclear Engineering		
[] Mechanical		
[] Electrical		
[] Instrumentation & Control		
[] Structural		
[] Metallurgy		
[] Chemistry/Radiochemistry		
[] Health Physics		
[] Administrative Controls		

6. A QUALIFIED SAFETY REVIEWER will be assigned for each DISCIPLINE marked in step 5 and his/her name printed in the space provided. Each person listed shall perform a SAFETY REVIEW and provide input into the Safety Review Package.

7. The Lead 1st Safety Reviewer will assure that a Part III or Part IV is completed (see step 4 above) and a Part VI if required (see 5.b of Part II). Each person listed in step 5 shall sign and date next to his/her name in step 5, indicating completion of a SAFETY REVIEW.

8. 2nd Safety Reviewer: Perform a SAFETY REVIEW in accordance with Section 8.0.

2nd Safety Reviewer _____ Date _____
DISCIPLINE: _____

9. PNSC review required? If "yes" attach Part V and mark reason below:

	Yes	No
	[]	[]

   [] Potential UNREVIEWED SAFETY QUESTION
   [] Question 9 of Part IV answered "Yes"
   [] Other (specify): _____

PART I: SAFETY ANALYSIS
(See instructions in Section 8.4.1)
(Attach additional sheets as necessary)

DOCUMENT NO. SP-1111 REV. NO. 0

DESCRIPTION OF CHANGE: Temporary change to incorporate clarification steps into SP-1111 to agree with the current H. B. Robinson Eddy Current Analysis Supplement (4/23/92 revision). 4/29/92

ANALYSIS: See attached.

REFERENCES:

UFSAR 5.4-2, 39.6
SP-1111 Rev. 0
H. B. Robinson Eddy Current Analysis Supplement (4/23/92 revision)

"Dents" occur in free-span tube lengths; are the result of isolated, singular events (such as handling, installation or other mechanical contact); and will remain constant with time. "Denting" is the result of corrosive constriction of the tube at the support plate and may change as a result of operating characteristics. The current threshold reporting level for "dents" and "denting" is 2.00 volts (which corresponds to a radial dent of 0.000071"). Such a threshold level does not allow the analyst the ability to discern reliably between dent signals and noise (i.e., a very small noise signal will appear very similar to a very small dent). A threshold level of 10.00 volts for "dents" in free-span tube lengths will now be used. This corresponds to a dent of 0.00035", which is very conservative. A threshold level of 2.00 volts will still be used for "dents" and "denting" at tube support plates (or any other support structure) since "denting" may change as a result of operating characteristics and development of such denting may be detected early. The testing will still be fully adequate, conservative, and comply with the current (4/23/92 revision) H. B. Robinson Eddy Current Analysis Supplement. Additionally, the H.B.

is a guideline, not to override the judgement of the experienced data analyst. Also, see attached pages 5-11 ~~thru 6~~ of this Safety review package for additional information / justification. Based on these observations, this item does not result in an unreviewed safety question.

April 22, 1992

Memorandum

To: Bob Cooper
Steam Generator System Engineer
H.B. Robinson Unit 2

Subject: Proposed revision of dent reporting criteria - RFO 14

Dear Bob:

The purpose of this letter is to document the issues and logic used for resolution of the proposed revision to dent sizing/reporting criteria requested by ABB/CE. (see attached)

Briefly, ABB/CE proposed that the reporting threshold for dents be raised from 2 volts to 10 volts, in order to discriminate very small noise signals from very small dent signals.

A telephone conference was held between CP&L personnel Paul Bauer and David Meleg and EPRI's Steve Brown in order to determine the [standard] practice(s) used within the industry. Steve recalled a value of approximately 5 volts or greater being used as the dent reporting threshold. This value was contingent on a calibration set-up using the ASME 4 x 20% o.d. holes set at 5 volts. The advantage of using the 4 x 20% holes would feasibly be to provide a more uniform and comparible reference standard throughout the industry. In addition, Steve conceded that alternate calibration references are being used within the industry. Those are namely, the 100% calibration hole and the (simulated) tube support plate. (The 100% hole is used infrequently because of geometric asymmetry considerations.)

Normal calibration set-up procedures currently in use by ABB/CE will set the simulated tube support plate signal at 5 volts. Additionally, Robinson Plant steam generators have quadrifoil tube support plates manufactured from type 405 stainless steel. Many other steam generators use carbon steel.

The primary issue regarding a change of calibration reference source would ask to what degree would previous outage data correspond to RFO-14 data?

A comparison of calibration set-ups using the 20% holes and the tube support plate was performed. Using the current procedure, and establishing a 5 volt reference to the tube support plate, the ASME 20% holes displayed a value of 5.25 volts. The 4 mil dent displayed 113 volts. Alternatively, setting the 20% holes at 5 volts displayed a tube support value of 4.75 volts. The 4 mil dent displayed 106 volts.

The above exercise shows that present levels of sensitivity are comparable (or nearly identical) to those reported by EPRI to be "industry standard." This also provides us with the confidence to compare "apples with apples"; that is, to compare the cited "industry practice" of 5 volts dent reporting threshold with that proposed by ABB/CE.

During our conversations with EPRI and ABB/CE we asked if it is industry practice to assign a geometric threshold for reporting of dents (calculated or otherwise reviewed by engineering). That is, report of dents in excess of x mils because an engineering review has shown values in excess of this to be operationally significant. The answer from both sources was no. Usually the final voltage assigned to a dent was a result of the initial calibration settings; ie. setting 5 volts at the tube support plate initially, will produce a 4 mil dent of 113 volts by default.

The final issue to consider should be to what degree do we report and/or continue to monitor tube dents? First we should differentiate between dents and denting. Dents occur in free-span tube length (between support plates) as a result of handling, installation or other mechanical contact. Usually these are the result of isolated, singular events and will remain constant with time. Denting on the other hand, is a result of corrosive constriction of the tube at the tube support plate. This condition may change as a result of operating characteristics.

We suggest the resolution to this matter be a compromise between the present and proposed reporting criteria. In free-span tube lengths, the reporting criteria for dents may be raised from 2 volts to 10 volts (greater than 0.35 mil). Whenever dents and/or denting occurs at a tube support plate (or any support structure) the reporting criteria shall remain at the current 2 volt level.

This compromise was discussed with Steve Brown. He agreed with this proposed solution.

Respectfully,

4/22/92

David Meleg
N.D.E. Level III E.T.

c: S. Wheeler
R. Brown

ABB

R04

April 20. 1992

To: Phil Smith

Carolina Power & Light Co.
H.B. Robinson Steam Electric Plant
Hwy 151 & FC 23
Hartsville. SC 92550

Subject: Proposed revision to Analysis Supplement - Dent Sizing Criteria

Dear Mr. Smith:

During preparation for RFO 14 I had been reviewing 1990 examination data to prepare the analysis guideline and practice data. In reviewing the Dent data. I realized the threshold level was established quite conservative. Currently, the practice for sizing indications, including flaws. buff-marks and dents; is to set the voltage at 5.00 volts using the 400 KHz differential channel and the simulated support signal from the corresponding ASME calibration standard (see figure 1). In using this set-up. the 0.004" (4 mil) radial dent measures approximately 113 volts. (see figure 2)

By using the current criteria, a very small noise signal (figure 3) will appear very similar to a very small dent signal (figure 4). Extrapolating the approximate size from a 2 volt dent (the current recording threshold), we are recording any dent-like signal which is ≥ 0.000071".

I propose the threshold level be raised to 10.00 volts for recording dent-like signals. This will still give a very conservative recording level for dents (≥ 0.00035" radial dent) and allow the analyst the ability to reliably discern dent signals from noise.

Please review this proposal and respond as soon as possible. An updated Analysis Supplement will be issued when this process is complete

Thank you.

Thomas U. Bipes
ABB Combustion Engineering

Page 8 of 4

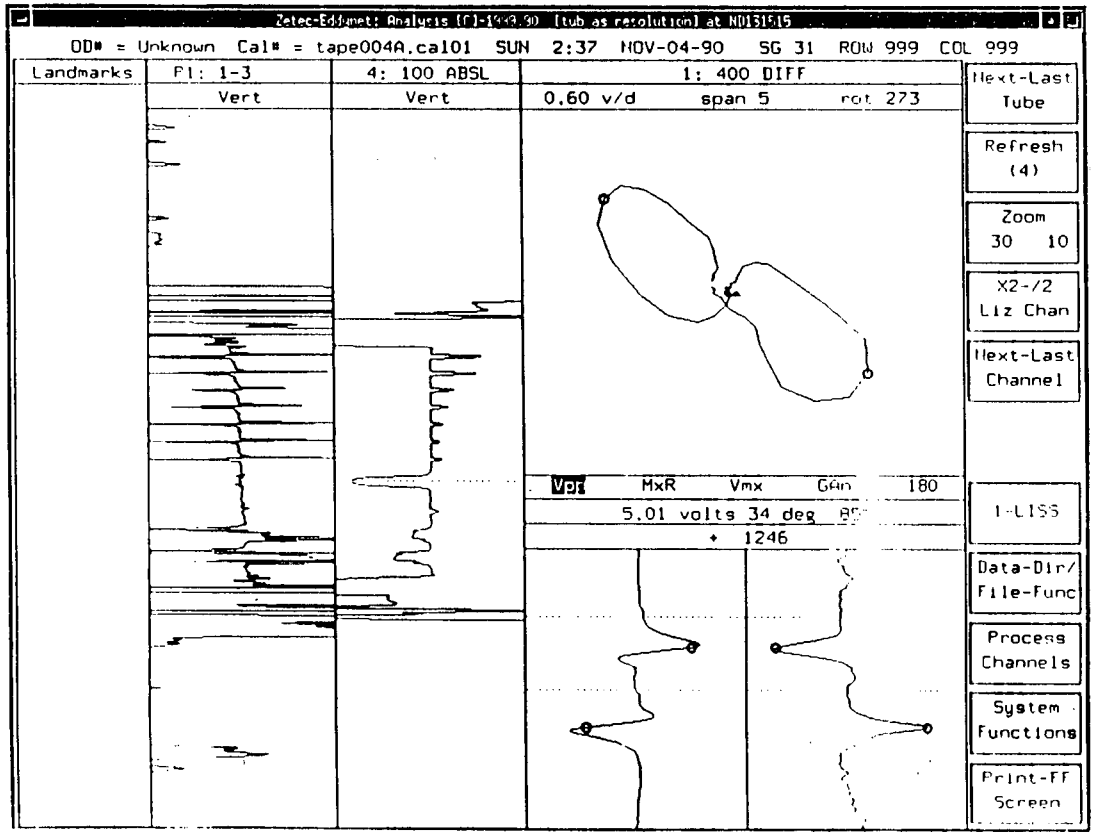


FIGURE 1

ALL SIZING CRITERIA SET FROM 5V PP @ SUPPORT

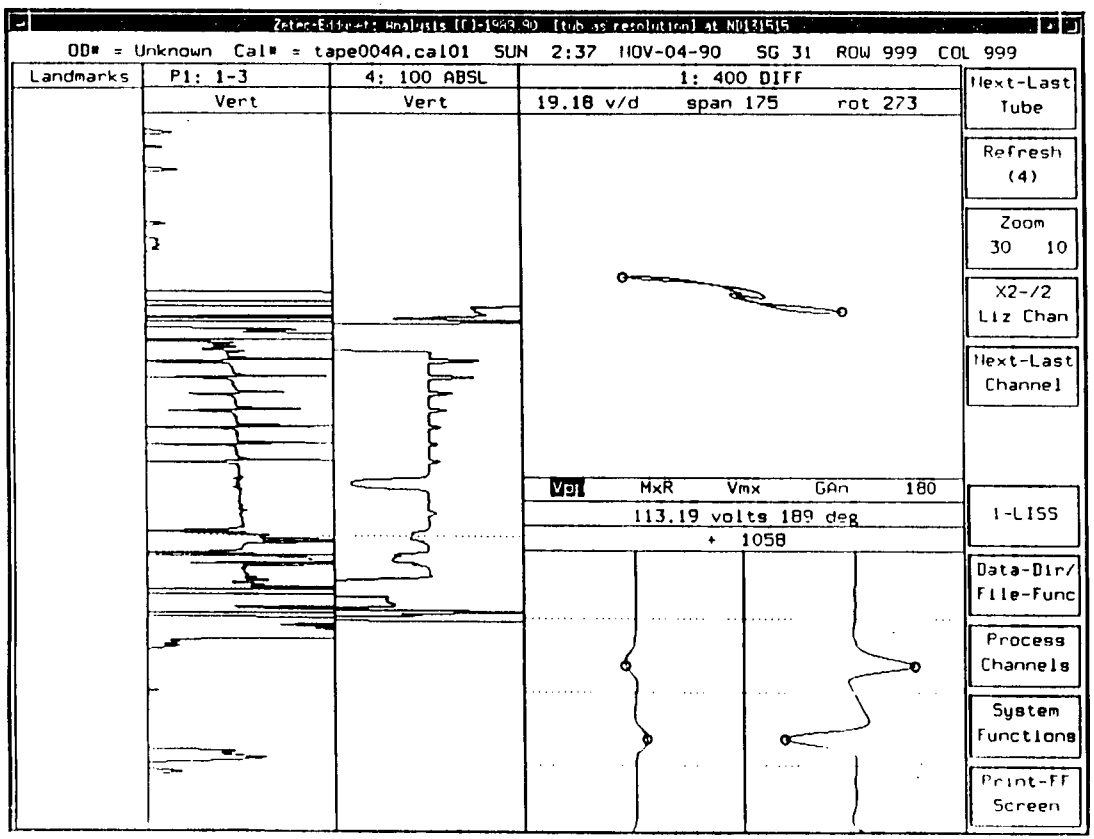
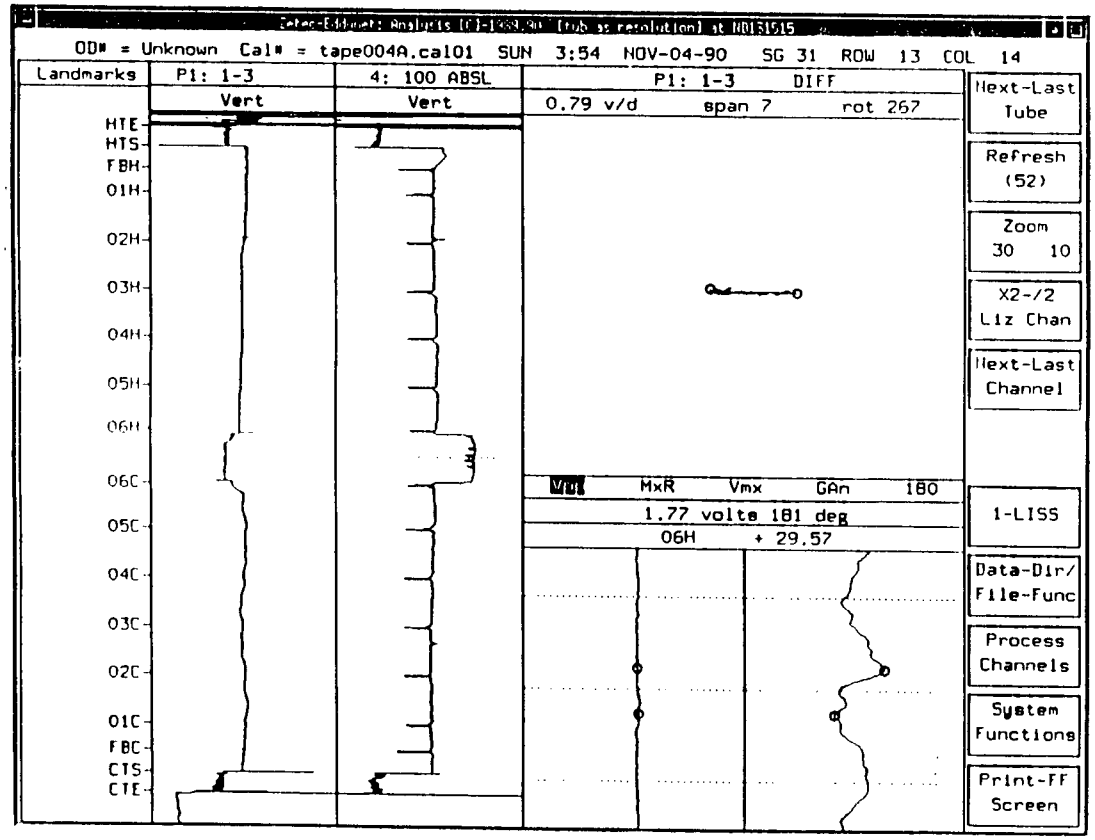
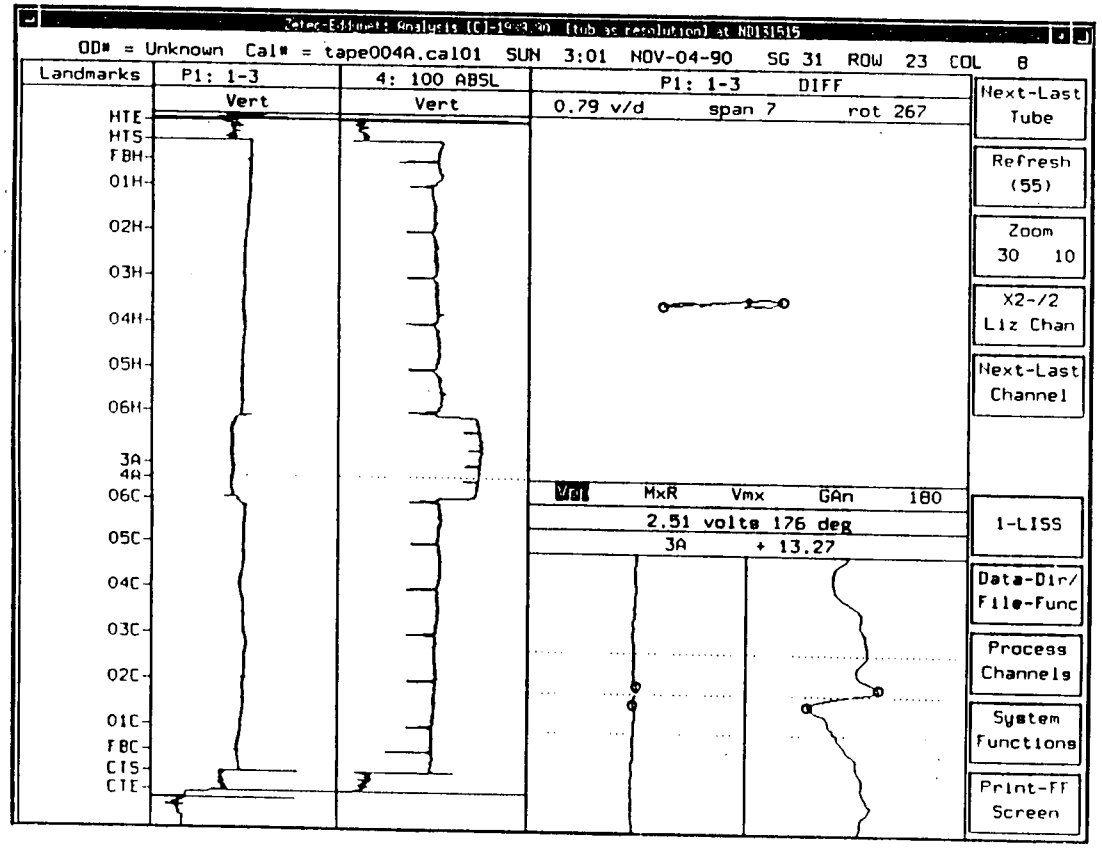


FIGURE 2

4 MILL (.004") RADIAL DENT READS ≈ 113 VOLTS



NOISE IN U-BEND (NO DENT)



SMALL DENT IN U-BEND

FIGURE 4

PART II: ITEM CLASSIFICATION

DOCUMENT NO. SP-1111 REV. NO. 0

		Yes	No
1.	Does this item represent:		
	a. A change to the facility as described in the SAFETY ANALYSIS REPORT?	[]	[]
	b. A change to the procedures as described in the SAFETY ANALYSIS REPORT?	[]	[]
	c. A test or experiment not described in the SAFETY ANALYSIS REPORT?	[]	[]
2.	Does this item involve a change to the individual plant Operating License or to its Technical Specifications?	[]	[]
3.	Does this item require a revision to the FSAR?	[]	[]
4.	Does this item involve a change to the Offsite Dose Calculation Manual?	[]	[]
5.	Does this item constitute a change to the Process Control Program?	[]	[]
6.	Does this item involve a major change to a Radwaste Treatment System?	[]	[]
7.	Does this item involve a change to the Technical Specification Equipment List?	[]	[]
8.	Does this item impact the NPDES Permit (all 3 sites) or constitute an "unreviewed environmental question" (SHNPP Environmental Plan, Section 3.1) or a "significant environmental impact" (BSEP)?	[]	[]
9.	Does this item involve a change to a previously accepted:		
	a. Quality Assurance Program	[]	[]
	b. Security Plan (including Training, Qualification, and Contingency Plans)?	[]	[]
	c. Emergency Plan?	[]	[]
	d. Independent Spent Fuel Storage Installation license? (If "yes," refer to Section 8.4.2, "Question 9," for special considerations. Complete Part VI in accordance with Section 8.4.6)	[]	[]

SEE SECTION 8.4.2 FOR INSTRUCTIONS FOR EACH "YES" ANSWER.

REFERENCES. List FSAR and Technical Specification references used to answer questions 1-9 above. Identify specific reference sections used for any "Yes" answer.

PART III: UNREVIEWED SAFETY QUESTION DETERMINATION SCREEN

DOCUMENT NO. SP-1111 REV. NO. 0

		Yes	No
1.	Is this change fully addressed by another completed UNREVIEWED SAFETY QUESTION determination? (See Sections 7.2.1, 7.2.2.5, and 7.9.1.1)	[]	[]

REFERENCE DOCUMENT: _____ REV. ____

		Yes	No
2.	For procedures, is the change a non-intent change which only (check all that apply): (See Section 7.2.2.3)	[]	[]

[] Corrects typographical errors which do not alter the meaning or intent of the procedure; or,

[] Adds or revises steps for clarification (provided they are consistent with the original purpose or applicability of the procedure); or,

[] Changes the title of an organizational position; or,

[] Changes names, addresses, or telephone numbers of persons; or,

[] Changes the designation of an item of equipment where the equipment is the same as the original equipment or is an authorized replacement; or,

[] Changes a specified tool or instrument to an equivalent substitute; or,

[] Changes the format of a procedure without altering the meaning, intent, or content; or

[] Deletes a part or all of a procedure, the deleted portions of which are wholly covered by approved plant procedures?

If the answer to either Question 1 or Question 2 in PART III is "Yes," then PART IV need not be completed.

PART IV: UNREVIEWED SAFETY QUESTION DETERMINATION

DOCUMENT NO. SP-1111 REV. NO. 0

Using the SAFETY ANALYSIS developed for the change, test or experiment, as well as other required references (LICENSING BASIS DOCUMENTATION, Design Drawings, Design Basis Documents, codes, etc.), the preparer of the Unreviewed Safety Question Determination must directly answer each of the following seven questions and make a determination of whether an UNREVIEWED SAFETY QUESTION exists.

A WRITTEN BASIS IS REQUIRED FOR EACH ANSWER

		Yes	No
1.	May the proposed activity increase the probability of occurrence of an accident evaluated previously in the SAFETY ANALYSIS REPORT?	[]	[]
2.	May the proposed activity increase the consequences of an accident evaluated previously in the SAFETY ANALYSIS REPORT?	[]	[]
3.	May the proposed activity increase the probability of occurrence of a malfunction of equipment important to safety evaluated previously in the SAFETY ANALYSIS REPORT?	[]	[]
4.	May the proposed activity increase the consequence of a malfunction of equipment important to safety evaluated previously in the SAFETY ANALYSIS REPORT?	[]	[]
5.	May the proposed activity create the possibility of an accident of a different type than any evaluated previously in the SAFETY ANALYSIS REPORT?	[]	[]

		Yes	No
6.	May the proposed activity create the possibility of a malfunction of equipment important to safety of a different type than any evaluated previously in the SAFETY ANALYSIS REPORT?	[]	[]
7.	Does the proposed activity reduce the margin of safety as defined in the basis of any Technical Specification?	[]	[]
8.	Based on the answers to questions 1 - 7, does this item result in an UNREVIEWED SAFETY QUESTION? If the answer to any of the questions 1-7 is "Yes", then the item is considered to constitute an UNREVIEWED SAFETY QUESTION.	[]	[]
9.	Is PNSC review required for any of the following reasons?	[]	[]

If, in answering question 1 or 3 "No," it was determined that the probability increase was small relative to the uncertainties; or, in answering question 2 or 4 "No," it was determined that the doses increased, but the dose was still less than the NRC ACCEPTANCE LIMIT; or, in answering question 7 "No," a parameter would be closer to the NRC ACCEPTANCE LIMIT, but the end result was still within the NRC ACCEPTANCE LIMIT; then PNSC review is required.

REFERENCES:

This Unreviewed Safety Question Determination is for the following DISCIPLINE(s):
(Additional Part IV forms may be included as appropriate.)

[] Nuclear Plant Operations
[] Nuclear Engineering
[] Mechanical
[] Electrical
[] Instrumentation & Control
[] Structural
[] Metallurgy
[] Chemistry/Radiochemistry
[] Health Physics
[] Administrative Controls

REVISION 2

10CFR50.59 PROGRAM MANUAL
ATTACHMENT A
CP&L SAFETY REVIEW PACKAGE

PART V: PNSC REVIEW

DOCUMENT NO. SP-1111 REV. NO. 0

Determination/Evaluation:

Action Taken:

Basis:

PNSC Chairman: Date:

III. DATA SCREENING

Bobbin Data

Left Strip Chart	-	400/100 diff. Mix vertical
Right Strip Chart	-	100 abs. vertical
Lissajous	-	400 diff.

IV. RECORDING RESULTS

A. Final Report Header

See attached example sheet

B. Flaw Reporting

Flaws - *Confirm on another channel Dump 4-liss Graphics. (M1-1-3-4)

MBM - Manufacturing Buff Mark
Nominal ≥ 5.0 V on 100 KHz Absolute (P-P)
NO GRAPHICS must be flaw like on 400 Diff.

DNT - Dent - ≥ 2.0 V on 400/100 mix @ supports -- ≥ 10.0V free-span.

PVN - ≥ 5.0 V on 400 KHz diff.

ADR - ≥ 5.0 V on 100 KHz Absolute (P-P)
measure location and voltage at greatest transition.

NOTE: If AVB wear is apparent, measure with Abs. Mix curve, and instruct Lead Analyst to notify acquisition to install AVB standard for retests.

If indications are present which are affected by copper deposits, call from the 400/100 diff. Mix unless otherwise instructed.

Use special mixes to confirm flaws at TTS or other areas as necessary, but for confirmation only - no calls on special mixes, unless otherwise instructed.

C. Calibration Standards

	Flaw	Dent		
Z-8554	100-77-60-39-22	.0050	.0090	S/G A
Z-8555	100-77-59-39-21	.0035	.0075	S/G B
Z-8556	100-77-59-39-21	.0040	.0075	S/G C

Common Notations

(see ROB-410-005 R2 for complete list)

ADR - Absolute Drift Signal
DNT - Dent Indication (2.0V)
DRI - Distorted Roll Indication (P/S only)
IDC - Inside Diameter Chatter
INF - Indication Not Found
LAR - Lead Analyst Review (P/S only)
MBM - Manufacturing Buff Mark
NSY - Noisy Tube
PID - Positive Identification (used for pluggable confirmation)
PLP - Possible Loose Part

RBD - Retest Bad Data
RFX - Retest Due to Fixture
REC - Retest for Encode Check
RND - Retest NO DATA
RPI - Restest for Possible Indication (requires location and extent)
RTI - Restest Incomplete (requires an extent)
INR - Indication Not Recordable

II. SET-UP PARAMETERS

Three (3) Point Fit Curves:
400 KHz Diff M-R (100% 40 degrees ± 5)
600 KHz Diff M-R (100% @ ~ 20 degrees)
100 KHz Diff M-R (Noise [dent] horizontal)
400/100 Diff P-P (Noise [dent] horizontal)
400/100 Abs P-P (Noise [dent] horizontal)

Set volts to * 5.0 V P-P on ASME support ring - save to all channels

*Unless otherwise noted use 5.0 volts

CAROLINA POWER AND LIGHT COMPANY
H.B. ROBINSON SEG PLANT

SPECIAL PROCEDURE

SP-1112

CONTROL OF EDDY CURRENT EXAMINATION DATA USING THE PERSONAL COMPUTER (PC) DATA BASE SYSTEM

REVISION 0

CONTROLLED
RECIPIENT
ID 386

Effective Date 4-18-92

Expiration Date 10-17-92

RECOMMENDED BY: Bruce A. Howard — Supervisor - Technical Support — 4-2-92 Date

APPROVED BY: M T Page — Manager - Technical Support — 4/15/92 Date

LIST OF EFFECTIVE PAGES

EFFECTIVE PAGES	REVISION
Cover Sheet	0
LEP	0
3 through 14	0

TABLE OF CONTENTS

1.0 PREREQUISITES

Ensure individuals are on an appropriate RWP if work is to be performed inside the Radiation Control Area.

This procedure has been reviewed per PLP-037 and it has been determined **NOT** to be applicable.

N/A
Unit / Section Manager

9/17/97
Date

2.0 PRECAUTIONS

Use the principles of ALARA in planning and performing work and operations in the Radiation Control Area.

3.0 ATTACHMENT

3.1 Control of Eddy Current Examination Data Using the Personal Computer (PC) Data Base System

4.0 DISPOSITION OF RECORDS

A copy of this procedure and the completed attachments shall be sent to the records vault for storage.

ATTACHMENT 3.1

CONTROL OF EDDY CURRENT EXAMINATION DATA USING THE PERSONAL COMPUTER (PC) DATA BASE SYSTEM

PROCEDURE NO.

STD-410-076

REVISION 0

ABB COMBUSTION ENGINEERING NUCLEAR SERVICES

APPROVED BY: Gary Fenning DATE: 2-18-92
Level III

APPROVED BY: R. T. Johnson DATE: 2-18-92
Quality Operations

APPROVED BY: Roy N Brown DATE: 2-18-92
Cognizant Supervisor

TABLE OF CONTENTS

1.0 OBJECTIVE

Control of Eddy Current Examination Data is the tracking, control, uploading, resolving and reporting of eddy current data which has been acquired during an eddy current examination. The eddy current data is tracked from arrival at the data management area until the final reports are presented to the client. To avoid data management discrepancies, specific forms, sign-offs, and procedures will be used to ensure the efficient routing of the data cartridge tapes (DCR's), DDA-4 reports, and data management reports.

2.0 REFERENCES

2.1 Combustion Engineering Nuclear Power, Nuclear Quality Assurance Manual.

2.2 ISIS HX & SG Tube Data Management System Manual.

2.3 Applicable Analysis Guideline (if required).

2.4 Applicable Procedure for Eddy Current Inspection of Steam Generators.

3.0 PERSONNEL REQUIREMENTS

Each person performing Data Management duties governed by this procedure shall be trained in the use and operation of the CE-ISIS data management system, and the specific requirements of this procedure.

3.1 The Data Controller shall be responsible for all editing performed on DDA-4 data files/disks or within the CE-ISIS data management system once the data has been transferred from the Analyst. The Data Controller may assign specific editing actions to an Analyst.

3.2 Data Management shall be responsible for tracking all eddy current data from the time it is delivered to the data management/analysis center until final reports of analysis results are submitted to the customer.

3.3 The ECT Level III Lead Analyst shall be responsible for the disposition of analysis discrepancies.

4.0 PRECAUTIONS AND PREREQUISITES

4.1 The eddy current data management equipment will be set up in an area designated by the site personnel and approved by the vendor.

4.2 Eddy current data management checkoff sheets will be used to document tracking of the eddy current data throughout the data management process.

4.3 Checkoff sheets may vary in form to meet specific requirements or modifications.

5.0 OPERATIONAL STEPS

The following will describe the data management sequence to be followed to properly track the eddy current data and load the completed DDA-4 data files/disks to the data management system.

5.1 **(Acquisition)** Deliver the eddy current data package to the data management center. The eddy current data package shall consist of:

DCR tape (or as required)
Operator examination sheets (or as required)

5.2 **(Data Controller)** Review the DCR tape labels to assure they are properly completed. Correct any discrepancies noted.

5.3 **(Data Controller)** Verify that the labels on the container and the tapes contain the same information.

5.4 **(Data Controller)** Log in the tapes on form DM-5 (Figure 1).

5.5 **(System Administrator)** Copy the DCR tape to an optical disk on the Eddynet system and record on form DM-5 (Figure 1).

5.6 **(Data Analysts)** Record on form DM-5 when files are being analyzed.

NOTE: THE FOLLOWING STEPS APPLY TO PRIMARY, SECONDARY, OR FINAL DATA DDA-4.

5.7 **(Data Analysts)** If floppy disks are used, write protect the DDA-4 data disk when analysis is complete and return the DDA-4 hard copy reports and DDA-4 data disks to the data management center. Otherwise, return the DDA-4 hard copy reports to the data management center. Record return of package on form DM-5.

5.8 **(Data Controller)** Review the DDA-4 hard copy report for correct format and information.

5.9 If the information is in error, the DDA-4 data file/disk will be corrected by the Data Controller or an Analyst.

5.10 **(Data Controller)** When all information is verified, load the DDA-4 data file/disk into the appropriate CE-ISIS database. Record upload of data on form DM-2 (Figure 2).

5.10.1 If an error file (data syntax) is generated, the DDA-4 data file/disk will be edited and the CE-ISIS database will be manually edited with the error report filed for reference. If other errors are encountered which require tracking, the Data Edit Log DM-3 (Figure 3) will be used.

5.11 File the DDA-4 hard copy reports, and any lissajous printouts in the appropriate data book(s). If floppy disks are used, attach a colored identification tab to the upper left corner of the DDA-4 disk label after all corrections have been completed and the CE-ISIS database updated.

5.12 Generate a primary/secondary comparison report when primary and secondary analysis data has been loaded for a given reel (Figure 4). **Data Controller will verify that both primary and secondary analyses have been loaded to the database prior to generating the comparison report.**

5.13 The primary/secondary discrepancies identified in the comparison report shall be resolved in accordance with the following:

Note: Only a Lead Analyst may make resolutions on the final DDA-4 data file/disk.

5.13.1 **(Data Controller)** Provide the Lead Analyst the following for final resolutions:

If floppy disks are used, the Final DDA-4 data disk. The primary DDA-4 data disk will be copied to the final DDA-4 data disk of the reel in question with the 'FINAL' disk label attached.
The primary/secondary comparison report.

(Lead Analyst) Final resolutions will be made on the DDA-4 data file/disk information, and the Analyst will print a DDA-4 report.

5.13.2 **(Data Controller)** Verify that all information on the DDA-4 file/disk is correct. The DDA-4 file/data disk will be loaded to the final CE-ISIS data base.

6.0 REPORTING CRITERIA

6.1 Reporting of accumulated eddy current data shall be performed by the Data Controller or a properly trained designee. Daily reports and final reports will be generated in a timely fashion according to customer requests. Report formats may be established before the outage begins, or during the outage to meet customer specific requirements. Generating reports does not affect the data in the database, therefore no editing documentation is required for reports to be generated. Logs of reports and other printouts generated may be used to track reporting of ISIS data.

FIGURE 1

TYPICAL ACQUISITION/ANALYSIS TRACKING LOG

ANALYSIS TRACKING LOG

PLANT/UNIT: ____________ STEAM GENERATOR: ____ LEG: ____ PAGE ___ OF ___

ACQUISITION / DATA MGMT.			SYS. ADMIN.		ANALYSIS						DATA MGMT.
					PRIMARY		SECONDARY		FINAL		
REEL NO.	DATE/ TIME	DATA SET	# OF TUBES/ ZONE(s)	ROD #	OUT	IN	OUT	IN	OUT	IN	FINAL DATA LOADED

DM-5 05/22/91

FIGURE 2

TYPICAL REEL\DDA-4 DATA TRACKING LOG

DATA TRACKING LOG

PLANT/UNIT_____ STEAM GENERATOR_____ LEG_____ PAGE ____ OF ____

DATA DISK/ REEL#	LOADED TO ISIS **PRIMARY** DATE	INIT	LOADED TO ISIS **SECONDARY** DATE	INIT	PRI/SEC COMP. REPORT RUN DATE	INIT	LOADED TO ISIS **FINAL** DATE	INIT	LOADED TO MAINFRAME DATE	INIT	COPY OF DISK TO UTILITY DATE	INIT
									P S F		P S F	
									P S F		P S F	
									P S F		P S F	
									P S F		P S F	
									P S F		P S F	
									P S F		P S F	
									P S F		P S F	

FORM DM-2

FIGURE 3

TYPICAL DATA EDIT LOG

PLANT ______________ UNIT ___

DDA-4 DATA DISK/ISIS DATA EDIT LOG

S/G:	REEL #:	PRIMARY[ ] SECONDARY[ ] FINAL[ ]

ROW _____ LINE_____ REV. # _____ | EDIT: DDA-4[ ] ISIS[ ]
DDA4 EDIT BY: _____ DATE:__/__/__
ISIS EDIT BY: _____ DATE:__/__/__

ROW _____ LINE_____ REV. # _____ | EDIT: DDA-4[ ] ISIS[ ]
DDA4 EDIT BY: _____ DATE:__/__/__
ISIS EDIT BY: _____ DATE:__/__/__

ROW _____ LINE_____ REV. # _____ | EDIT: DDA-4[ ] ISIS[ ]
DDA4 EDIT BY: _____ DATE:__/__/__
ISIS EDIT BY: _____ DATE:__/__/__

DM-3
05/21/91

FIGURE 4

TYPICAL PRIMARY/SECONDARY COMPARISON REPORT

Date : 9/25/89

UNIT 1
OUTAGE : 8909
COMPONENT : SG C
PRIMARY/SECONDARY ANALYSIS COMPARISON

Depth Range :10 Plug. Depth : 40 Volts Limit : 5.0
Envel. +- : 1.0 Reel :CH06 Probe : A720SF/RM

ROW	COL	LEG	DATA SET	VOLTS	DEG	IDN. %	CH#	LOCATION	EXT	EXT	TESTED	ANALYST	PROBE	DATA
9	31	H	CBOBBIN	.0	0	RTR			.0	.0	07C	07H	.0	HALL K I	A720SF/RM	PRIMARY
		H	CBOBBIN	.0	3	RTR			.0	.0	07C		.0	WHEELER	A720SFRM	SECONDA
EXAMINED EXTENTS DO NOT MATCH																
		H	CBOBBIN	2.9	179	INR	H 1	03H	-.2	.0	07C	07H	.0	HALL K I	A720SF/RM	PRIMARY
NO MATCHING DATA REPORTED																
		H	CBOBBIN	.0	0	MDD			.0	.0	07C	07H	.0	WHEELER	A720SFRM	SECONDA
NO MATCHING DATA REPORTED																
18	31	H	CBOBBIN	.3	0		TE	H 2	AV3	.0	.0	07C	07C	.0	HALL K I	A720SF/RM	PRIMARY
NO MATCHING DATA REPORTED																
		H	CBOBBIN	.0	0	MDD			.0	.0	07C	07C	.0	WHEELER	A720SFRM	SECONDA
NO MATCHING DATA REPORTED																
4	32	H	CBOBBIN	6.9	178	DNT	H 1	04H	.0	.0	07C	07C	.0	HALL K I	A720SF/RM	PRIMARY
NO MATCHING DATA REPORTED																
		H	CBOBBIN	.0	0	MDD			.0	.0	07C	07C	.0	WHEELER	A720SFRM	SECONDA
NO MATCHING DATA REPORTED																
9	32	H	CBOBBIN	.0	0	RTR			.0	.0	TEC	07H	.0	HALL K I	A720SF/RM	PRIMARY
		H	CBOBBIN	.0	0	RTR			.0	.0	TEC		.0	WHEELER	A720SFRM	SECONDA
EXAMINED EXTENTS DO NOT MATCH																
		H	CBOBBIN	.0	0	MDD			.0	.0	TEC	07H	.0	WHEELER	A720SFRM	SECONDA
NO MATCHING DATA REPORTED																
9	33	H	CBOBBIN	.0	0	RTR			.0	.0	07C	07H	.0	HALL K I	A720SF/RM	PRIMARY
		H	CBOBBIN	.0	0	RTR			.0	.0	07C		.0	WHEELER	A720SFRM	SECONDA
EXAMINED EXTENTS DO NOT MATCH																
		H	CBOBBIN	6.3	21	DRI	H 3	TEH	2.4	.0	07C	07H	.0	HALL K I	A720SF/RM	PRIMARY
NO MATCHING DATA REPORTED																
		H	CBOBBIN	.0	0	MDD			.0	.0	07C	07H	.0	WHEELER	A720SFRM	SECONDA
NO MATCHING DATA REPORTED																

Total Resolutions : 5 Tube(s)

Lead Analyst Review

Lead Analyst Review

CAROLINA POWER AND LIGHT COMPANY
H.B. ROBINSON SEG PLANT

SPECIAL PROCEDURE

SP-1113

REMOTE INSTALLATION, CALIBRATION AND REMOVAL OF SM-10/20 MANIPULATOR

REVISION 0

CONTROLLED
RECIPIENT
ID 386

Effective Date 4-18-92

Expiration Date 10-17-92

RECOMMENDED BY: _____ 4-2-92
Supervisor - Technical Support — Date

APPROVED BY: _____ 4/15/92
Manager - Technical Support — Date

LIST OF EFFECTIVE PAGES

EFFECTIVE PAGES	REVISION
Cover Sheet	0
LEP	0
3 through 25	0

TABLE OF CONTENTS

1.0 PREREQUISITES

Ensure individuals are on an appropriate RWP if work is to be performed inside the Radiation Control Area.

This procedure has been reviewed per PLP-037 and it has been determined **NOT** to be applicable.

n/a	9/17/92
Unit / Section Manager	Date

2.0 PRECAUTIONS

Use the principles of ALARA in planning and performing work and operations in the Radiation Control Area.

3.0 ATTACHMENT

3.1 Remote Installation, Calibration and Removal of SM-10/20 Manipulator

4.0 DISPOSITION OF RECORDS

A copy of this procedure and the completed attachments shall be sent to the records vault for storage.

ATTACHMENT 3.1

REMOTE INSTALLATION, CALIBRATION AND REMOVAL OF SM-10/20 MANIPULATOR

PROCEDURE NO.

STD-410-075

Revision 1

ABB COMBUSTION ENGINEERING NUCLEAR SERVICES

APPROVED BY: James D. Lee DATE: 2/14/92
Quality Operations

APPROVED BY: Darrell D. Weller DATE: 2/14/92
Cognizant Supervisor

TABLE OF CONTENTS

1.0 OBJECTIVE

1.1 This procedure provides the general instruction for Installation, Calibration and Removal of the SM-10/20 Manipulator. Actions are the same for the SM-10 and the SM-20 except where noted.

2.0 REFERENCE

2.1 ZETEC SM-10/20 Installation and Operating Guide

2.2 ZETEC SM-10/20 Inspection Planning System

2.3 NPB Nuclear Quality Assurance Manual, QAM-100, Third Edition, Revision 3.

3.0 PREREQUISITE

3.1 Steam generator primary manway cover(s) and stud bolts have been removed (as required).

3.2 The steam generator shall be at an acceptable level of dryness.

3.3 Prior to installation, the steam generator channel heads, should be cooled down to a proper temperature to prevent heat damage to equipment (approximately 90 degrees F).

3.4 Provisions must be made for personnel and equipment entry into and exit from the steam generator (i.e., ladders, scaffolds, or staging platform, lighting inside and outside the steam generator, breathing air supply, 120 VAC electricity, etc.).

3.5 An area near the steam generator suitable for the setup and installation of the equipment will be made available and cleared.

3.6 Nozzle covers have been installed over the hot and coldleg nozzles of opened channel heads (as required).

3.7 It is expected that very high levels of radiation will be encountered inside and adjacent to the primary head of the steam generators. Utmost care shall be taken in the set-up and performance of the examination to minimize personnel exposure to ionizing radiation and radioactive contamination.

Personnel engaged in the eddy current examination program shall be indoctrinated in the radiation protection rules, guidelines, protective clothing and equipment requirements in effect at the plant site.

4.0 PROCEDURE: INSTALLATION AND SET-UP

4.1 General Outline

4.1.1 The installation and set-up for the SM-10/20 will involve hooking up fixture cables to the appropriate locations on the SM-10/20 control box; booting the MIZ-18 ACQUISITION and FIXTURE CONTROL software and loading an INSPECTION PLAN; mounting the trunk assembly to the manway; setting an encoder offset; installing the arm assembly; installing the guide tube with conduit attached; and leveling the arm assembly inside the steam generator.

4.2 Computer Interface

4.2.1 It is good practice to remove power from all instruments, with the exception of the controlling computer, when connecting or disconnecting cables.

4.2.2 The SM-10/20 can operate with or without the MIZ-18 eddy current instrument. When operating alone, connect the interface cable, P/N 5-8103, directly to the SM-10/20 computer connector. Several interface cables, up to 1000 feet total length, can connect in series to the HPIB Interface Unit, which is located within 10 feet of the computer. The Interface Unit then uses a standard IEEE 488 cable to connect to the computer.

4.2.3 When operating in conjunction with the MIZ-18,
the two instruments are "daisy-chained" in series. Either unit can be closer to the computer. The 1st unit in series uses the computer connector to connect the computer, and the auxiliary connector of the 2nd unit in series will not be used. Any length cable can separate the two instruments, as long as the 2nd unit in series is not more than 1000 feet from the computer.

4.3 Fixture Interface

4.3.1 The SM-10/20 Controller can be located up to 100 feet from the fixture. It is connected with extension cables, which can be "daisy-chained" as required.

4.3.2 Connect the three connectors of the extension cable assembly, P/N 4-008005, to the encoder, motor, and trunk connectors on the SM-10/20. Connect the opposite end of the cable to the encoder and motor connectors on the fixture harness, and to the trunk connector, located on the manway mount.

4.4 Video

4.4.1 Connect the video monitor with coaxial cable to the monitor connector on the controller. The fixture camera is connected via the motor connector.

4.4.2 Should it be required to use a camera separate
from the one located on the fixture, an auxiliary camera input is available on the controller. When using this input, the fixture camera will need to be disconnected.

4.5 Powering Up

4.5.1 Assure that the 115/230 V selector plug is in the proper orientation.

4.5.2 Plug unit in. There is no power switch.

4.5.3 Turn on HPIB Interface Unit. SM-10/20 is now ready for computer control.

4.6 Initial Check-Out

4.6.1 Place a 200/300 Series Acquisition System disk in disk drive 0 and close the drive door. For the HP 9836, this is the INTERNAL RIGHT DRIVE. For the HP 300 series computers using external drives, the disk drives should be appropriately marked as '0' or '1'.

4.6.2 Apply power to all components of the system.

4.6.3 Insert the SM-10/20 Control Supplement disk in drive 1. Press LOAD ENTRY key. After the disk has loaded, remove the SM-10/20 Control Supplement (the Acquisition System Disk remains in drive 0). Press TEST.

4.6.4 Insert the Inspection Plan Map disk in drive 1. Press FIXTURE, then LOAD PLAN (SHIFTED). The message 'INSPECTION PLAN LOADED' will appear after the plan has been loaded (the Inspection Plan Map disk will remain in drive 1).

4.6.5 Press FIX CNTRL, then manual (shifted). Press
FREE RUN (SHIFTED).

4.6.6 Using the LIFT, ARM and POLE soft-keys, ensure that the motors operate correctly. Verify proper camera focus with the guide tube prior to performing step 4.6.7.

NOTE: Normally this "check-out" sequence is done in an area away from the steam generators, and afterward the fixture is carried up to the platform for installation.

4.6.7 Fold the camera arm up over the pole, until it
reaches its mechanical limit. To facilitate guide tube pick-up at a later time, it is critical to ensure that the arm is folded in such a way that it will be able to rotate towards the divider plate after installation (e.g., if the divider plate is to the left of the manway, the arm should be able to rotate clockwise from the mechanical stop; if the divider plate is to the right of the manway, the arm should be able to rotate counter-clockwise from the mechanical stop).

4.6.8 Turn OFF the HPIB Interface Unit and leave OFF
for 10 Seconds. Turn ON the HPIB Interface Unit. The red LED on the camera will light and the video will be present on the monitor.

4.6.9 NOTE: Turning power off on the HPIB

Interface Unit, or disconnecting the IEEE 488 Interface Cable, will control the SM-10/20 as follows:

A. All motor power supplies will turn off.
B. All internal registers within the Controller will be reset to the motor off condition.

4.6.10 If necessary, the fixture cables can be disconnected at this point, and the fixture can be transported to the steam generator platform for installation.

4.7 Sequence of Installation of SM-10/20 Into Steam Generator

4.7.1 The sequence of installation steps is shown in Figures 1a through 7a for the SM-10 and Figures 1b through 6b for the SM-20.

4.7.2 SM-20: Loosen the two socket bolts. Determine which side of the trunk the divider plate is located on and swing the trunk until it touches the stop pin on the divider plate side. Re-tighten the two socket bolts.

4.7.3 SM-10: Slide the trunk assembly through the manway (flat side down) until the manway mount reaches the manway (see Figure 1a).

SM-20: Slide the trunk through the manway on its side using the stainless steel rail until the manway mount is flush with the manway flange (see Figure 1b).

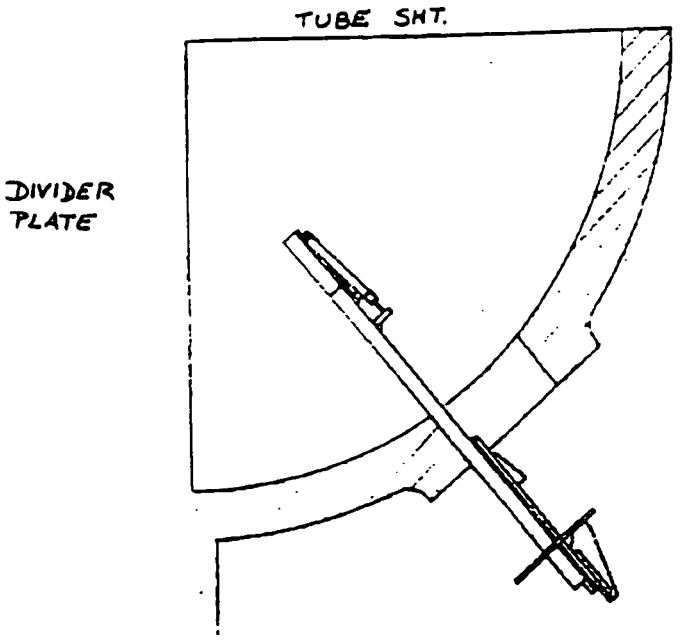


Figure 1a

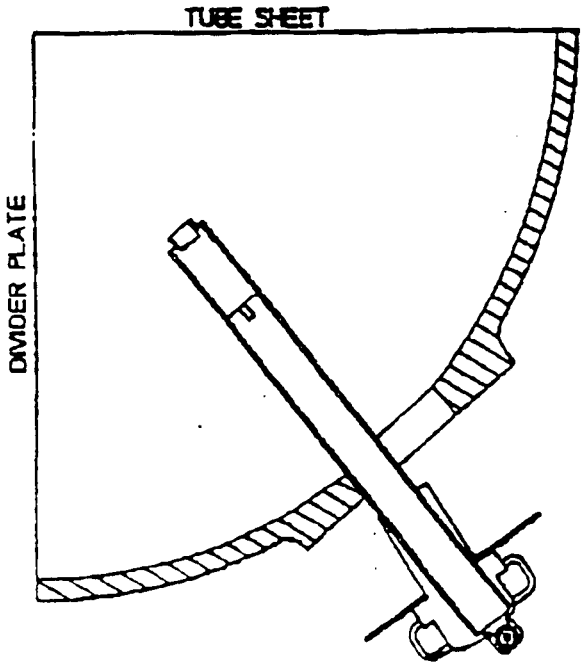


Figure 1b

4.7.4 SM-10: Rotate the trunk 180° (flat side up). See Figure 2a.

SM-20: Rotate the trunk 90°. See Figure 2b.

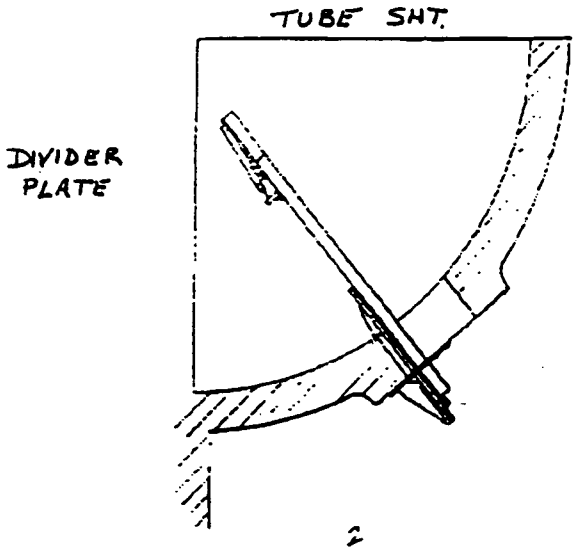


FIGURE 2a

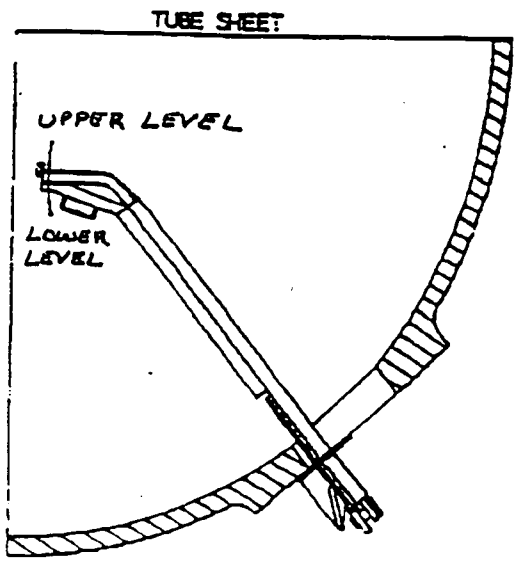
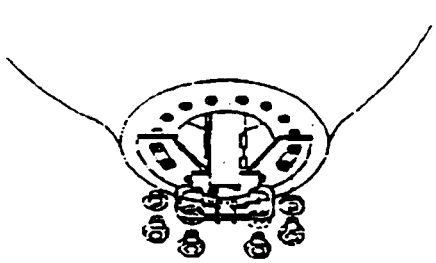
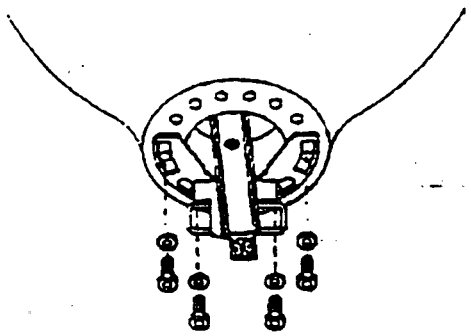


Figure 2b

4.7.5 Install the four manway bolts and washers, and hand-tighten them so that the manway mount remains flush with the manway flange. See Figures 3 and 4.

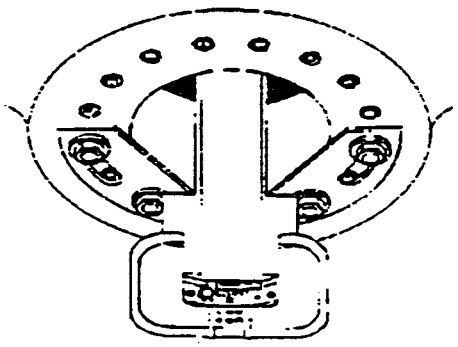


SM-10

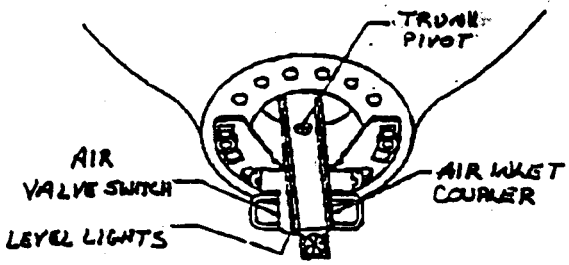


SM-20

Figure 3 a & b



SM-10



SM-20

Figure 4 a & b

4.7.6 Re-connect the trunk extension cable.

4.7.7 SM-10: Rotate the manway mount until the green light on the lower set of three indication lights comes on.

SM-20: Rotate the trunk a few degrees either way until the LOWER green light comes on.

4.7.8 Install the manway clamp approximately over

the pivot point (see Figure 4), ensuring that the top of the clamp assembly securely contacts the curved surface of the manway. Adjust the clamp as necessary so that it fits quite firmly when the lever is pushed all the way up. Verify that the green light and trunk wheels are tight against the bottom of the manway.

4.7.9 Tighten the four manway bolts evenly, starting with the two bottom bolts, using a spanner or large screwdriver. The LOWER green light may flash on and off during this tightening process.

4.7.10 When the tightening is complete, the LOWER green light should be steady. If it is not, loosen the bolts, remove the clamp, and repeat steps 4.7.7, 4.7.8 and 4.7.9. The trunk is not correctly installed until the clamp is in, the bolts are tightened, and the LOWER green light is lit, and the trunk wheels are tight.

NOTE: NEVER fully tighten the manway bolts unless the manway clamp is securely installed. The clamp simulates stress, and provides support for the entire trunk.

4.7.11 SM-10: The track assembly must now be moved far enough from the divider plate to allow the upper track to tilt to its level position. The track position is adjusted after loosening the three set screws located on the track increment scale above the lights. The track should be placed so that it rests against the divider plate, and then backed off enough distance so the upper track can reach a level state. This distance is about six (6) increments. Tighten the three set screws after track position is established. Make sure the green indicator light is still on. If not, then rotate the manway mount until the light comes on. The track position increment reading should be documented for future use.

SM-20: A level adjustment knob is provided at the manway end of the trunk for use in adjusting the level state of the upper platform on the trunk. Turn the knob to its maximum clockwise position. This puts the trunk in its uppermost position, and provides a red-light condition. (The trunk is brought down to a level mode after installing the arm assembly - step 4.7.25.

4.7.12 Attach air line, 80 to 100 psi, to right side of trunk. Verify that the solenoid switch is in the unlocked position (down).

4.7.13 Press FIX CNTRL, and then CAL INSP (SHIFTED).

4.7.14 SM-10: Fold the arm up over the top of the pole and against the mechanical stop. The arm assembly should be folded such that when you reopen the arm from the pole, the arm moves towards the divider plate. Press the SET_OFST soft key in the shifted mode. This will set an offset for the arm encoder. Estimate an offset for the pole encoder so that the picture on the display closely approximates the respective positions of the arm and pole inside the bowl. The offset for the pole encoder will be recalculated at the end of the calibration.

SM-20: If the arm is still rotated against its mechanical stop (see step 4.6.7), press the SET OFST (SHIFTED) key. New variables will be stored to the Inspection Plan Map disk.

NOTE: If the arm is not against its mechanical stop, repeat the procedure(s) in Initial Check-Out until it is. An accurate calibration CANNOT be achieved unless the SET OFST key is pressed while the arm is against its stop.

4.7.15 SM-10: Install the arm assembly on the track rails and insert it through the manway. Slide the arm assembly until it locks into place. See Figure 5a.

SM-20: Remove the manway clamp.

4.7.16 SM-10: Install the manway clamp. Go to step 4.7.18.

SM-20: Check to see that carriage assembly is rotated so that the lock pin will engage at the top of the trunk (see Figure 5b). Then engage the camera arm wheels in the track and carefully slide the arm up the track. Ensure that the cables feed smoothly into the manway.

4.7.17 SM-20: When the camera arm reaches the lower latch, push the camera arm up just until the lower latch takes hold. Reposition yourself and push and lift the arm until the carriage is past the first latch. Let the arm slide back against the latch, coming to rest on the lower latch and raised up 3 to 4 inches on the end closest to manway. This will allow the arm to clear the bowl. Tug on the arm to ensure that the lower latch is supporting the camera arm (see Figure 5b). Push the ball in on the end of the arm using the utility stick.

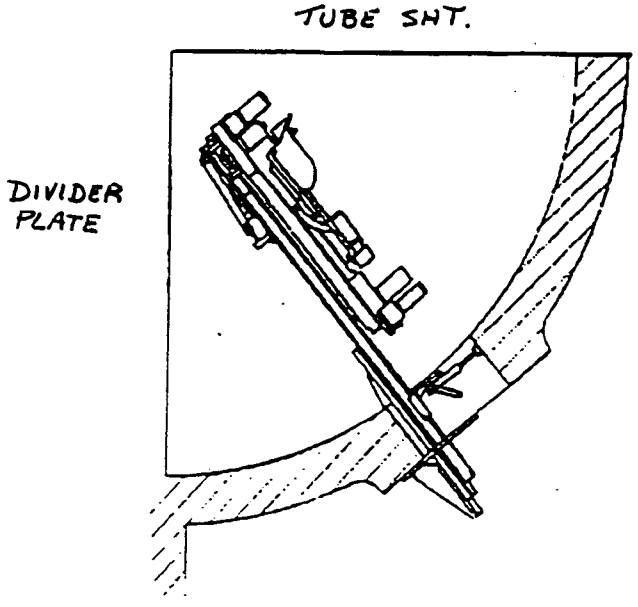


Figure 5a

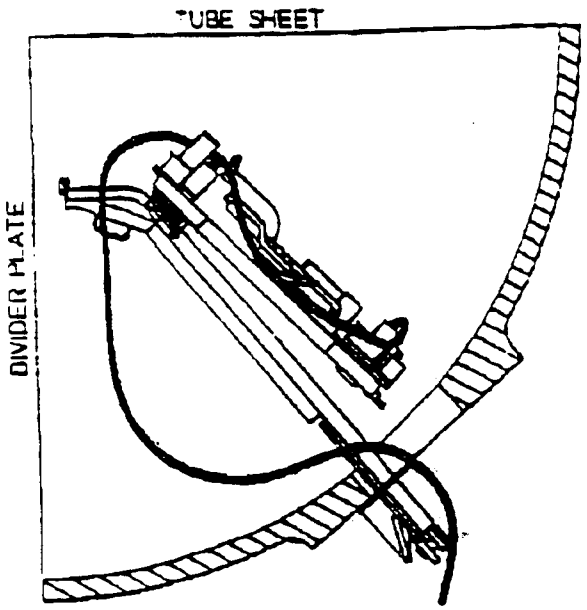


Figure 5b

4.7.18 Press GUIDE.TUB (SHIFTED). The fixture will rotate away from the divider plate.

4.7.19 When the fixture has stopped and the computer prompts you to do so, reach just inside the manway and attach the guide tube and conduit assembly. Insert enough cable and conduit into the steam generator to allow full movement of the fixture.

4.7.20 SM-10: Press the RSME.CAL (SHIFTED). This will tilt the upper track to its level position. The green light on the upper set of three indicating lights will come on when the upper track has reached a level state. The lights may flicker between red and green when it hits a level state. See Figures 6a and 7. Go to 4.7.26.

Caution: If the upper track has been raised manually above the level position, the upper track will raise until the guide tube makes contact with the tube sheet. The track must then be lowered below the level position before leveling may begin.

SM-20: Press GT.ON. The fixture will fold itself back up over the trunk so that it can be moved upward into the top latch.

4.7.21 SM-20: When the fixture stops, attach the utility stick to the ball stud located on the end of the camera arm. Be sure that the utility stick is securely attached.

4.7.22 SM-20: Push the arm up and over the curved ramp until it latches securely in the top latch. The camera arm should be parallel to the tubesheet.

4.7.23 SM-20: Activate the air solenoid to lock the camera arm in position. The switch should be toggled to the "LOCK" position.

4.7.24 SM-20: Remove the utility stick from the camera arm.

4.7.25 SM-20: Install the manway clamp. Pass sufficient cabling and conduit through the manway at this time (Figure 6b). We recommend running the cables and conduit on the side of the manway clamp which is opposite the divider plate. Then rotate the leveling knob counter-clockwise until the upper red light goes out and the upper green light comes on.

4.7.26 Proceed with the calibration process.

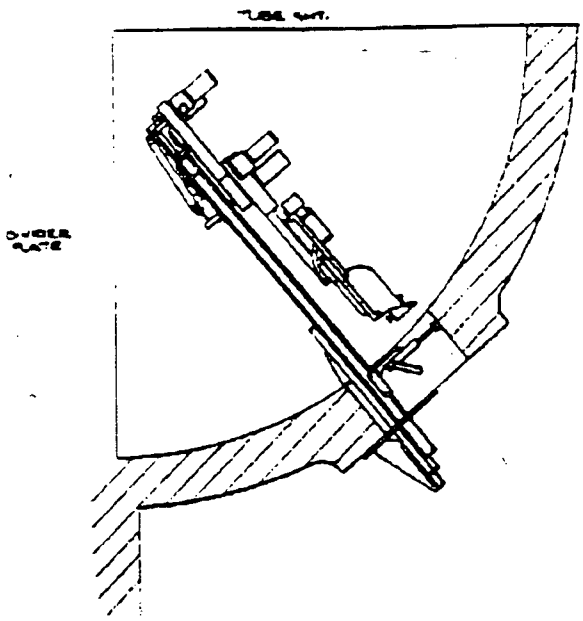


Figure 6a

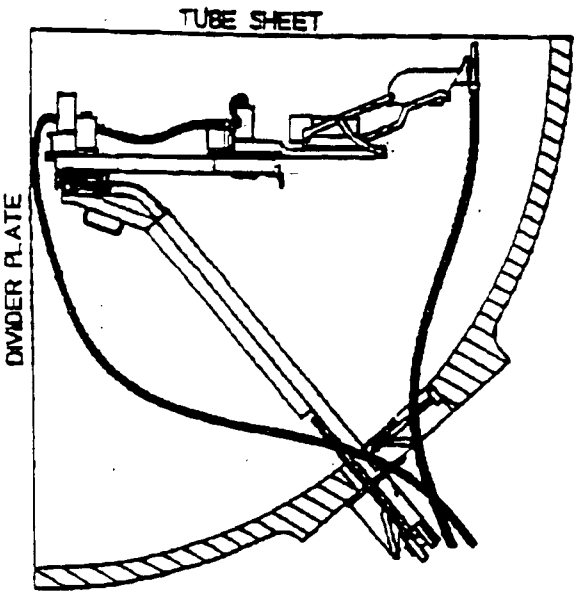


Figure 6b

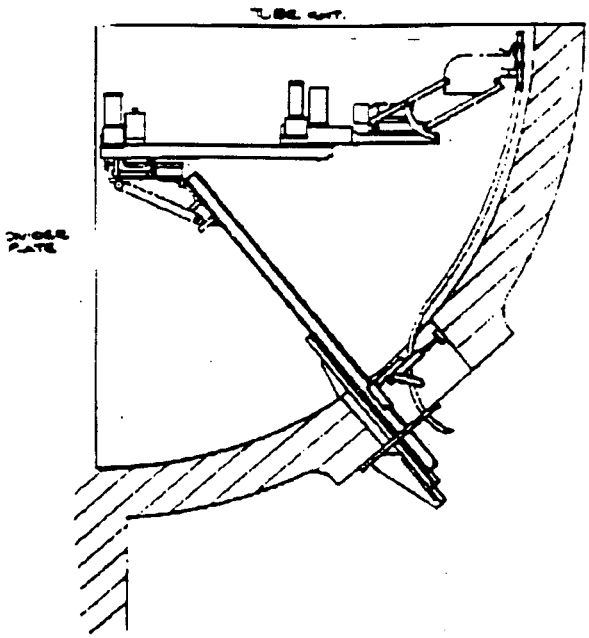


Figure 7

5.0 CALIBRATION

5.1 Using the LIFT_UP key, bring the guide tube closer to the tubesheet.

5.2 Using the ARM and POLE control keys, position the guide tube under the first calibration point as directed on the screen. Press CAL-PT1 (SHIFTED) when guide tube is directly under the tube.

5.3 Position the guide tube under the second calibration point as directed on the screen. Press CAL-PT2 (SHIFTED).

5.4 "Break" the arm by bringing the camera end out of the corner first.

5.5 Continue to the other side of the generator and position the guide tube under the third calibration point as directed on the screen. Press CAL-PT3 (SHIFTED).

5.6 Position the guide tube under the fourth calibration point as directed on the screen. Press CAL-PT4 (SHIFTED).

5.7 The computer computation will begin. Do not touch the

keyboard during this time.

5.8 When the computation is complete, the current fixture position is displayed, and the keys necessary for commencing the inspection are available.

6.0 INSPECTION PLAN EXAMINATIONS

6.1 Store variables to all Insp-Plan disks for that specific steam generator by pressing STORE.VAR (SHIFTED).

6.2 Press the upper left soft key labeled NOFIXTURE (SHIFTED) until TEST-PLAN is displayed.

6.3 Press MIZ-18 ON.

6.3.1 Press START_COL: (SHIFTED) to begin examination by columns.

6.3.2 Press START_ROW: (SHIFTED) to begin examination by rows.

6.3.3 Examine the first tube.

6.3.4 After examining each tube, press NEXT_TUB.

6.3.5 Verify that the guide tube is centered under each tube to be examined. Peripheral tubes, plugs and stays should be used for continuous verification of the manipulator.

6.3.6 To stop an inspection plan press STOP_INSP (SHIFTED).

6.4 If there is more than on Insp-Plan, place the next Insp-Plan disk in the left drive. Return to Insp-Plan mode and load it by pressing LOAD.PLAN (SHIFTED). Repeat steps 6.3.1 through 6.3.6.

7.0 MANUAL OPERATION EXAMINATIONS

7.1 Turn MIZ-18 off. Press FIXTURE soft key.

7.2 Press the upper left soft key (SHIFTED) until MANUAL is displayed and manual tube selection has been initiated.

7.3 Turn the MIZ-18 on and use soft keys ROW +, ROW -, COL +, and COL - to select the next tube to be examined.

7.4 Press LOCATE for automatic location of the tube by the manipulator.

7.5 Press FREE_RUN for manual mode movement using the camera arm and pivot pole keys.

8.0 REMOVAL OF FIXTURE

8.1 Press FOLD UP (SHIFTED). The lift will automatically lower camera head and the arms will move to a pre-determined position.

NOTE: If the arm is not on the correct side of the generator, you will be instructed to break the arm. After doing so, press RESUME (SHIFTED) then press FOLD UP (SHIFTED) again.

8.2 When the fixture has stopped, remove the manway clamp.

SM-10: Remove guide tube. Go to step 8.7.

SM-20: Attach the utility stick to the ball stud on the end of the camera arm. Turn air solenoid switch to the "UNLOCK" position.

8.3 SM-20: Release the upper latch by pulling the release trigger on the left side of the trunk. Lift the release trigger up so that it is locked in the release mode.

8.4 SM-20: Position yourself in such a way that you can use both hands on the utility stick to carefully roll the camera arm down to the lower latch.

8.5 SM-20: Remove the utility stick from the camera arm. Press the LOWERED soft-key, which will cause the fixture to position the guide tube in front of the manway.

8.6 SM-20: When the fixture has stopped, remove the guide tube.

8.7 Press the GT.RMVD key. The fixture will fold up completely.

8.8 Reach inside the manway and grasp the end of the pole (DO NOT HOLD IT ON TOP OF THE MOTOR OR YOU WILL PINCH YOUR HAND ON THE MANWAY WHEN IT COMES DOWN THE TRUNK). With the other hand, pull the lock release ring located on the right side of the trunk. Hold the release until

the carriage is past the latch.

8.9 Slowly lower the camera arm down the trunk, making sure the cable does not hang up on the end of the trunk.

8.10 SM-10: Disconnect the fixture cables.

SM-20: Disengage the wheels from the track and set the camera arm aside. Remove trunk extension cable and air line.

8.11 Remove the manway bolts.

8.12 Rotate the trunk 90° (on edge), and slide it out of the generator.

9.0 EMERGENCY REMOVAL

The SM-10/20 fixture has been designed for removal in the event that a motor or gearbox should fail with the fixture installed.

9.1 Remove the manway clamp.

9.2 Align the camera arm assembly over the trunk.

SM-20: Attach the utility stick to the camera arm and release the upper latch (on the left side of the trunk). Turn the solenoid switch to the "UNLOCKED" position. It may be necessary to swing the arm from side to side to relax the air pistons.

9.3 Roll the camera arm down to the lower latch.

SM-20: Disconnect the utility stick from the camera arm.

9.4 If the lift assembly is up, it will be necessary to place the fixture into the approximate guide tube position. To remove the lift, loosen the draw bolt using a 1/4" nut driver. You may now slide the lift assembly away from the secondary pivot and remove it through the manway. Once the lift assembly has been removed, fold the fixture back up over the trunk.

9.5 Release the lower latch (on the right side of the trunk) and remove the camera arm from the steam generator.

NOTE: The primary and secondary rotation assemblies may be rotated manually in the event of a failure. If sufficient physical pressure is applied to either the primary pivot (which rotates the pole) or secondary pivot (which rotates the arm), the clutches will slip and allow free rotation of the pivot receiving the force.

10.0 COMPUTER LOCK-UP RECOVERY

10.1 Boot computer with MIZ-18 Acquisition software with SM-10/20 Fixture Control.

10.2 Set time and date.

10.3 Check the MIZ-18 for correct configuration.

10.4 Press FIXTURE and LOAD.PLAN (SHIFTED).

10.5 Press NO_FIXTURE (SHIFTED) to get desired mode of operation (usually TEST_PLAN).

10.6 Restore index to RAM from backup disk.

10.7 Go to REVIEW mode and play back the last good entry on the TLIST.

10.8 Return to TEST mode and resume test.

CAROLINA POWER AND LIGHT COMPANY
H.B. ROBINSON SEG PLANT

SPECIAL PROCEDURE

SP-1114

PROCEDURE FOR THE INSTALLATION AND REMOVAL OF TEMPORARY NOZZLE COVERS

REVISION 0

CONTROLLED
RECIPIENT
ID 386

Effective Date 4-18-92

Expiration Date 10-17-92

RECOMMENDED BY: Byron A. Howard — Supervisor - Technical Support — 4-2-92 Date

APPROVED BY: M T Page — Manager - Technical Support — 4/15/92 Date

LIST OF EFFECTIVE PAGES

EFFECTIVE PAGES	REVISION
Cover Sheet	0
LEP	0
3 through 9	0

TABLE OF CONTENTS

1.0 PREREQUISITES

Ensure individuals are on an appropriate RWP if work is to be performed inside the Radiation Control Area.

This procedure has been reviewed per PLP-037 and it has been determined **NOT** to be applicable.

N/A
Unit / Section Manager

9/17/92
Date

2.0 PRECAUTIONS

Use the principles of ALARA in planning and performing work and operations in the Radiation Control Area.

The preferred method of installation is per step 6.5.2 of attachment 3.1. If this cannot be accomplished, step 6.5.3 may be used with the permission of ALARA and Technical Support personnel.

3.0 ATTACHMENT

3.1 Procedure for the installation and Removal of Temporary Nozzle Covers

4.0 DISPOSITION OF RECORDS

A copy of this procedure and the completed attachments shall be sent to the records vault for storage.

ATTACHMENT 3.1

PROCEDURE FOR THE INSTALLATION AND REMOVAL OF TEMPORARY NOZZLE COVERS

H.B. ROBINSON

UNIT TWO

PROCEDURE NO.

ROB-410-008

OUTAGE SERVICES DEPARTMENT
NUCLEAR POWER SYSTEMS
ABB/COMBUSTION ENGINEERING
WINDSOR, CONNECTICUT
CHATTANOOGA, TENNESSEE

PREPARED BY: Leonard A Kistler DATE: 9/12/90

APPROVED BY: Darrell D Weber DATE: 9/11/90
E.T. Level III

APPROVED BY: James J. Jud DATE: 9/12/90
Quality Assurance

APPROVED BY: Roy N Brown DATE: 9-13-90
Nondestructive Program Manager Examination Services

ORIGINAL ISSUE DATE: April 3, 1987 REVISION: 1

DATE: 9-13-90

TABLE OF CONTENTS

1.0 OBJECTIVE

This procedure will establish a set of guidelines to be utilized by the nozzle cover worker with the intent of providing a safe and consistant method for installing and removing nozzle covers in the channel heads of the steam generators.

NOTE: It should be noted that the nozzle cover is the first item into the channel head and the last item removed from the channel head.

2.0 REFERENCES

2.1 Combustion Engineering, Inc. Nuclear Power Businesses Nuclear QA Manual.

2.2 Combustion Engineering, Inc. Quality Procedures (QAP).

2.3 Combustion Engineering, Inc. Power Systems Group, Operating Procedures Manual.

3.0 PERSONNEL REQUIREMENTS

The personnel performing nozzle cover installations will have received documented training and mock-up practice prior to performing installations.

4.0 PRECAUTIONS AND PREREQUISITIES

4.1 It is expected that very high levels of radiation may be encountered inside and adjacent to the primary head of the steam generators. Utmost care shall be taken in the setup to minimize personnel exposure to ionizing radiation and radioactive contamination.

4.2 Personnel engaged in the nozzle cover installation shall be indoctrinated in the radiation protection rules, guidelines, protective clothing and equipment requirements in effect at the plant site as required.

4.3 The steam generator shall be open on the primary side dried and ventilated in such a manner as to provide proper temperature and humidity for personnel safety and comfort to prevent heat and moisture damage to equipment.

4.4 The secondary side of the steam generator shall be cooled down to the extent that the temperature of the tubes and tube sheet are 120 deg. F or less.

4.5 Provisions must be made for personnel and equipment entry into and exit from the steam generator (i.e., ladders, scaffolds or staging, platforms, lighting inside and outside the steam generator, breathing air supply, 120 VAC electricity, etc.).

4.6 Health Physics coverage shall be maintained at the steam generator during any personnel entry into the steam generator as required.

4.7 A communication system may be setup and operating between the control point and the steam generator platform.

5.0 EQUIPMENT

For installation and removal of nozzle covers the following equipment is required.

5.1 Nozzle covers - (1) for each nozzle to be covered.

5.2 Rope (lanyard) to tie off covers - (1) for each cover.

5.3 Safety light for inside generator.

5.4 Installation Pole.

5.5 Pully and tackle (optional).

6.0 INSTALLATION OF NOZZLE COVERS

6.1 Ensure that all equipment is at the work area and is in proper working condition.

6.2 Secure the safety light, then insert into the channel head through the manway opening to ensure proper lighting.

6.3 Secure one end of the lanyard to a safe supporting structure outside the generator. Secure the other end of the lanyard to the handle on the manway cover.

NOTE: Securing the cover in this fasion must be done to insure the cover does not fall deep into the nozzle.

6.4 In the folded position insert the cover into the channel head through the manway opening and unfold it before releasing.

6.5 Depending on accessibility around the manway and radiation level, the worker now has one of three installation options for installing the cover. The installation technique must be evaluated and pre-planned prior to starting the installation process.

6.5.1 Utilize a pole to invert the unfolded cover and push it into place over the nozzle.

6.5.2 Utilize a pully and tackle device clamped to the tubesheet from which the cover will be attached to a rope so as to lift the unfolded cover and lower it into place while guiding it with the long handle pole. After the nozzle cover is installed, remove the pully and tackle and secure the rope outside the generator.

6.5.3 Install the cover manually by entering the channel head through the manway opening. This is a generator entry and must be coordinated with Health Physics personnel.

7.0 CLEANLINESS VERIFICATION

The platform worker shall verify that all tools, equipment and debris is removed from the channel head prior to removing the nozzle cover. If any items are in the channel head, they must be removed prior to the nozzle cover removal.

8.0 NOZZLE COVER REMOVAL

8.1 Ensure the lanyard is still securely tied at both ends.

8.2 Using the rope and/or pole, pull the cover to the manway opening.

8.3 Reach through the manway and fold up the cover.

8.4 Pull the folded cover out of the manway.

8.5 Verify that no foreign object has been left in the channel head.

QAP 2.4 - CERTIFICATION PROGRAM FOR
NONDESTRUCTIVE EXAMINATION PERSONNEL

1.0 PURPOSE

To delineate the technical requirements for qualification and certification of Levels I, II and III nondestructive examination (NDE) personnel.

2.0 REFERENCES

2.1 ASME Code, Sections I, III, V, VIII, XI and ANSI B31.1.

2.2 SNT-TC-1A - 1984, Recommended Practice for Nondestructive Testing Personnel Qualification and Certification.

2.3 Nuclear Field Quality Assurance Manual, System N-9.0.

2.4 Nuclear Spare Parts Quality Assurance Program Description, System 2.0.

2.5 QAP 17.1, Records Retention.

3.0 DEFINITIONS

3.1 Activity or Operation - Any part of a technique including but not limited to, film grading, ultrasonic thickness examination, application of penetrant materials, evaluation of examination results, etc.

3.2 Certification - Written testimony of qualification.

3.3 Certifying Agency - The employer of the personnel being certified.

3.4 Employer - The corporate, private or public entity, which employs personnel for wages, salary, fees, or other considerations.

3.5 Method - The utilization of a physical principle in NDE in
its entirety, i.e., radiography, ultrasonics, liquid penetrant, magnetic particle, eddy current, leak testing, acoustic emission, visual, etc.

3.6 Outside Agency - A company or individual that provides NDE Level III services and whose qualifications to provide these services have been reviewed by the employer that engages the company or individual.

3.7 Qualification - The demonstrated skill, training, knowledge and experience required for personnel to properly perform the duties of a specific job.

3.8 Surveillance - The act of monitoring or observing to verify an item or activity conforms to specified requirements.

3.9 Technique - A specific way of utilizing a particular NDE method, i.e., gamma radiography, contact ultrasonics, solvent removable liquid penetrant examination, etc.

3.10 Training - The program developed to impart the knowledge and skills necessary for qualification.

4.0 LEVELS OF QUALIFICATION

4.1 Trainee - in the process of being qualified and certified to at least NDE Level I, an individual shall be considered a trainee. A trainee shall work with a certified individual and shall not independently conduct any test, interpret or evaluate any results of a test, or write a report of test results.

4.2 Level I - shall be qualified to properly perform specific calibrations, specific tests and specific evaluations for acceptance or rejection according to written instructions, and to record the results. He shall receive the necessary guidance or supervision from a certified Level II or III in the same method. Those individuals performing work governed by ASME Code Section XI shall not independently evaluate or accept the results of a nondestructive examination.

4.3 Level I Limited - shall be qualified to perform only a specific activity or operation within a particular technique (e.g., application of penetrant materials, etc.).

4.4 Level II - shall be qualified to set up and calibrate equipment, and to interpret and evaluate test results with respect to applicable codes, standards and specifications. He shall be able to prepare written instructions and to organize and report nondestructive testing investigations. He shall be familiar with the scope and limitations of the method and shall exercise assigned responsibility for on-the-job training and guidance of trainees and Level I personnel.

4.5 Level II A - (Eddy Current Data Analyst for nonferromagnetic steam generator heat exchanger tubing) - satisfies all the requirements for an Eddy Current Level II and in addition, is capable of interpreting and evaluating data taken from eddy current examinations of nonferromagnetic steam generator heat exchanger tubing.

4.6 Level II Limited - shall be qualified to perform examinations to a specific technique, activity or operation within a method, (e.g., solvent removable penetrant examination, contact ultrasonic examination, gamma radiography, film interpretation or evaluation of results of a technique or method, etc.).

4.7 Level III - shall be capable of and responsible for establishing techniques and procedures, interpreting codes, standards and specifications, and designating the particular test method and technique to be used. The individual shall be capable of evaluating results in terms of existing codes, standards, specifications and shall have sufficient practical background in applicable materials, fabrication or product technology to establish techniques and acceptance criteria where none are otherwise available. The individual shall be responsible for the training and qualification examination of NDE Levels I, II and III candidates. The actual administration and grading of examinations may be delegated in writing, to a duly selected representative of the Level III.

4.8 Certifications to the above levels of qualifications issued to NDE personnel prior to adoption of this written practice and based on an approved C-E written practice shall be considered valid for the remainder of the individual's certification period. Future certifications and recertifications shall be in accordance with this written practice.

5.0 EDUCATION, TRAINING AND EXPERIENCE

5.1 Level I and II personnel shall satisfy the education, training and experience requirements of Table 2.4-1, as modified below.

5.1.1 For a limited certification, work time experience and classroom training may be reduced for the technique, activity or operation being performed as shown in Table 2.4-2.

5.1.2 For Level IIA certification, an additional 24 hours specific training in eddy current data analysis is required to supplement the ET Level II training requirements as defined in Table 2.4-1. No additional experience is required.

5.1.3 Work time experience gained while performing administrative duties shall be considered NDE experience if the duties relate to those covered by certified individuals as defined in Paragraph 4.0.

5.1.4 Limitations for individual's certified in accordance with Paragraph 5.1.1 shall be noted on their certification papers.

5.2 Level III personnel shall satisfy one of the following education and experience criteria:

5.2.1 Graduate of four (4) year accredited engineering or science college or university with a degree in engineering or science plus one (1) year experience in an assignment comparable to that of a Level II in the applicable method.

5.2.2 Completion, with a passing grade, of at least two years of engineering or science study at an accredited university, college, or technical school plus two (2) years experience comparable to that of a Level II in the applicable method.

5.2.3 Four (4) years experience comparable to that of a Level II in the applicable method.

5.3 Organized training shall be completed for all Level I and II individuals seeking certification. For Level III individuals, the training hours shall consist of at least the combined required hours for Levels I and II in the applicable method except when the candidate has been qualified or has held a position certified to that of a Level II, in which case, the requirement for training may be considered met.

5.4 To assure that an individual has assimilated the training material presented, he shall satisfy the examination requirements of Paragraph 6.0, as applicable.

5.5 Records used to substantiate education, training and experience shall be identified and maintained in accordance with Paragraph 9.0.

6.0 EXAMINATIONS

6.1 The following paragraphs describe the examinations for each qualification level. The written examinations shall be administered without access to reference material (closed book) except that necessary data such as graphs, tables, specifications, procedures and codes may be provided.

6.1.1 Qualification examinations for Levels I and II shall consist of a written General Examination, a written Specific Examination and a documented Practical Examination.

(a) The General Examination shall cover the basic test principles relative to the applicable test method or technique. The minimum number of questions shall be as follows:

METHOD	Level I	Level I Limited	Level II	Level II Limited
Radiography	40	20	40	30
Magnetic Particle	30	15	30	20
Ultrasonics	40	20	40	30
Liquid Penetrant	30	15	30	20
Eddy Current	40	20	40	20
Leak Testing	20	10	20	10
Acoustic Emission	40	20	40	20
Visual	20	10	30	20

(b) The Specific Examination shall cover the equipment and operating procedures relative to the applicable test method or technique. It shall also cover specifications, codes and acceptance criteria used in the testing procedures. The minimum number of questions shall be as follows:

METHOD	Level I	Level I Limited	Level II	Level II Limited
Radiography	20	10	20	10
Magnetic Particle	20	10	15	10
Ultrasonics	20	10	20	10
Liquid Penetrant	20	10	15	10
Eddy Current	20	10	20	10
Leak Testing	20	10	20	10
1. Bubble Test	15	10	15	10
2. Absolute Pressure Test (Pressure Change)	15	10	15	10
3. Halogen Diode Leak Test	15	10	15	10
4. Mass Spectrometer Leak Test	20	10	40	20
Acoustic Emission	20	10	20	10
Visual	20	10	15	10

(c) The Practical Examination shall demonstrate to the satisfaction of the examiner that the candidate is familiar with and can operate (except surveillance, see Paragraph 4 below) the necessary test equipment and can interpret and record the resultant information from at least one (1) test specimen. Additional requirements are as follows:

1. At least ten different checkpoints requiring an understanding of the test variables and procedural requirements shall be included in the examination.

2. The description of the specimen(s), the test procedure including checkpoints, and the results of the examination shall be documented.

3. Level I individuals being certified in accordance with ASME Code Section XI are not required to interpret or evaluate results.

4. Surveillance personnel shall have a Practical Examination that shall demonstrate to the satisfaction of the examiner that the candidate is familiar with the necessary equipment (except radiography) and can interpret and record the resultant information from at least one (1) test specimen. The requirements listed in Paragraphs 1, 2 and 3 above shall also apply.

6.1.2 An Eddy Current Level IIA shall satisfy all of the examination requirements for an Eddy Current Level II and, in addition, shall demonstrate proficiency in evaluating data taken from actual eddy current inspections. The evaluation of data shall be done with regard to the applicable acceptance criteria. At least fifty (50) different items of data shall be included in this examination.

6.1.3 Qualification examinations for Level III certification shall consist of written Basic, Method and Specific Examinations.

(a) The Basic Examination is required only once when examinations for more than one method are taken. The examination shall consist of:

1. At least twenty (20) questions relating to understanding the SNT-TC-1A document (reference 2.2).

2. At least fifteen (15) questions relating to applicable materials, fabrication and product technology, and

3. At least fifteen (15) questions which are selected from, or are similar to, Level II questions for other appropriate NDE methods.

(b) The Method Examination shall be administered for each method for which certification is sought and shall consist of:

1. At least thirty (30) questions relating to fundamentals and principles which are selected from, or are similar to, the published ASNT Level III questions for each method, and

2. At least fifteen (15) questions relating to application and establishment of techniques and procedures which are selected from, or similar to, the published ASNT Level III questions for each method, and

3. At least twenty (20) questions relating to capability for interpreting codes, standards and specifications relating to the method.

(c) The Specific Examination shall be administered for each method and shall consist of:

1. At least twenty (20) questions relating to specifications, equipment, techniques and procedures applicable to products and methods utilized by the Combustion Engineering NDE departments and administration of the NDE written practice.

6.1.4 The employer, the responsible Level III or his designee shall be responsible for conducting and grading the examinations.

6.1.5 A composite passing grade (average of all tests) of 80% or greater is required for examinations administered for qualification. In addition, each individual passing grade (General, Specific, etc.) shall be 70% or greater.

6.1.6 If the examinations are administered and graded by an outside agency which issues a pass/fail grade only, a grade value of 80% shall be assigned for each examination administered and successfully passed.

6.1.7 When an outside agency other than ASNT or EPRI is used for qualification services, those services rendered shall be in accordance with this written practice. Combustion Engineering shall retain responsibility for the adequacy of the program of the outside agency.

6.1.8 A valid endorsement on an ASNT NDE Level III certificate for a specific NDE method may be used to fulfill the Basic and Method examination criteria for Level III certification in the applicable NDE method.

6.1.9 Those failing to attain the required grades shall wait at least thirty (30) days or show evidence of having received additional training, as determined by the certifying individual, prior to re-examination.

6.1.10 All levels of NDE personnel shall successfully complete an eye examination to assure natural or corrected near vision acuity in at least one eye capable of reading a minimum of Jaeger Number 1 letters on a standard Jaeger test chart at a distance of not less than 12 inches or a near distance test pattern equivalent to a Snellen fraction of 20/20. In addition, when required by Code, contract, specification or standard, personnel shall have natural or corrected far vision acuity equivalent to a Snellen fraction of 20/30.

NDE personnel shall also pass an Ishihara or equivalent color vision examination to show ability to distinguish and differentiate contrasts between colors used in the method for which qualified. When personnel are unable to pass this examination, they shall satisfactorily show ability to distinguish and differentiate contrast between colors as part of their NDE Practical Examination.

(a) The eye examination shall be given to all NDE personnel on an annual basis.

(b) Eye examinations shall be performed by a Level III, his designate, or medical personnel.

(c) The results of the examination shall be recorded on the Eye Examination Record as shown on Exhibit 2.4-1 or equivalent.

7.0 CERTIFICATION

7.1 A Level III shall certify Level I and II personnel. Certification of Level III personnel shall be by the responsible department head. All certifications shall be documented on a Certification Record as shown on Exhibit 2.4-2.

7.2 The certification period for Levels I and II personnel shall be three (3) years. For Level III personnel, the certification period shall be:

(a) three (3) years for personnel performing work governed by ASME Code Section XI, or

(b) five (5) years for all other Level III Personnel.

7.3 Certification of all levels of NDE personnel shall be based on successful completion of the education, training and experience requirements of Paragraph 5.0 and the required examinations of Paragraph 6.0.

7.3.1 The maximum duration of interrupted service for each NDE method or technique shall be one (1) year. Where evidence of use of the method or technique can not be shown, the individual shall successfully complete the examinations deemed necessary by the responsible Level III or department head prior to reactivating the certification.

7.4 New employees having held valid NDE certifications with their former employer may be certified to their former NDE levels provided that:

7.4.1 The employee provides proof of prior certifications, or

7.4.2 The former employer provides documentation substantiating the training and experience qualification obtained by the employee. The qualifications shall meet the requirements of SNT-TC-1A (reference 2.2) and this written practice.

NOTE: Every attempt shall be made to procure the documentation that substantiates the certification, however

a. When the former employer will not verify training and experience time, an individual's personal history may be acceptable documentation.

b. The employee's former training and experience may be verified by telephone. A record of telephone conversation shall be acceptable documentation of an individual's prior training and/or experience when documentation is otherwise unavailable.

7.4.3 The employee was working in the test method within six months of termination and is certified within six months after termination.

(a) When limits are in excess of those specified above, the employee shall receive additional training, as determined by the certifying individual, prior to certification.

7.4.4 The employee successfully completes the examination requirements, as applicable, of Paragraph 6.0.

7.5 Certification shall be revoked by the responsible Level III or department head by evidence of unsatisfactory performance or termination of employment. Individuals who are separated shall not be considered terminated provided they return to work within one year.

8.0 RECERTIFICATION

8.1 Levels I and II personnel shall be recertified at least every three (3) years by either evidence of continued satisfactory performance or re-examination based on the governing Code and contract requirements.

8.2 Level III personnel shall be recertified at least every:

(a) three (3) years for personnel performing work governed by ASME Code Section XI, or

(b) five (5) years for all other Level III personnel.

8.2.1 Recertification shall be by either continued satisfactory performance or re-examination based on the governing Code and contract requirements. When a Level III is recertified by continued satisfactory performance, the recertification shall be based on documented evidence performing Level III duties such as NDE training, procedure development, certification of Level I's and Level II's, test development, etc.

9.0 RECORDS

9.1 The qualification records of the certified individual shall
be maintained and shall include the following:

(a) Name of the certified individual.

(b) Level of certification and test method.

(c) Educational background and experience of the certified individual.

(d) Statement indicating satisfactory completion of training in accordance with this procedure.

(e) Results of the physical examination prescribed in Paragraph 6.1.10.

(f) Current examination copy(s) or evidence of successful completion of the examinations.

(g) Other suitable evidence of satisfactory qualifications when such qualifications are used in lieu of examinations.

(h) Composite grade(s) or suitable evidence of grades.

(i) Date of certification and/or recertification and the date of assignment to NDE.

(j) Signature of employer's designated representative.

9.2 Records shall be maintained by the responsible group or department and become quality records in accordance with QAP 17.1 when an individual has terminated or transferred from the department.

APPROVED: C S Bloomquist
NDE Level III

MINIMUM TRAINING AND EXPERIENCE

Examination Method	RT		MT		UT		PT		ET		VT		AE		LT							
Level	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I				II			
Technique															BT	PCMT	HOLT	MSLT	BT	PCMT	HOLT	MSLT
	TRAINING (HOURS)																					
Completion with a passing grade of at least 2 years of engineering or science study in a university, college, or technical school	29	35	8	4	24	40	4	4	8	8	2	4	40	35	2	16	8	28	2	12	6	16
High school graduation or equivalent	39	40	12	8	40	40	4	8	12	8	2	4	60	65	2	24	12	40	4	16	8	24
Grammar school graduation, or demonstration proficiency, or additional training	88	80	24	16	40	80	12	16	48	24	4	6	80	85	2	60	24	60	4	80	20	80
	TOTAL WORK TIME EXPERIENCE (MONTHS) PER LEVEL																					
All educational levels as listed above	1	9	1	1	1	9	1	2	1	9	1	2	6	18	*	15	12	4	*	5	4	4	6

NOTE:

1. Training shall be as outlined in Reference 2.2. For level II certification, the experience shall consist of time at Level I, or equivalent. If a person is being qualified directly to Level II with no time at Level I, the required experience shall consist of the sum of the times required for level I and Level II and the hours of training required for Level I and Level II in total shall apply. Credit for experience may be gained simultaneously in two or more methods or techniques. The candidate must spend at least 25% of his work time in each method or technique for which experience is being claimed.

2. VT as identified above refers to VT-1 which includes VT of weldments.

3. Work time experience accumulated in RT, MT, UT, PT, ET or other NDE related methods such as Dimensional, Mechanical, Optical, etc. shall be applied toward not more than 75% of the work time experience required for VT.

4. Training received in the course of qualifying to any NDE Level II, other than VT, will be considered to have met 75% of the training required for VT.

5. One (1) month equals 175 hours.

6. Personnel utilizing methods not covered in Table 2.4-1 above shall be trained and qualified in accordance with SNT-TC-1A and this written practice.

7. BT - Bubble Test
   PCMT - Pressure Change/ Measurement Test
   HOLT - Halogen Diode Leak Test
   MSLT - Mass Spectrometer Leak Test
   = - 2 Hours

TABLE 2.4-1

TRAINING AND EXPERIENCE FOR LIMITED CERTIFICATIONS

TECHNIQUE/ACTIVITY	METHOD	TRAINING (HRS)		EXPERIENCE (HRS)	
		I	II	I	II
Isotope Radiography	RT	N/A	40	N/A	720
Film Evaluation	RT	N/A	20	N/A	520
Data Taking/Equipment Operation	RT	39	N/A	0	N/A
Surveillance	RT	N/A	40	2 surveillance trips	
Coil Technique	MT	2	4	40	260
Yoke Technique	MT	3	4	40	260
Prod Technique	MT	3	4	40	260
Evaluation	MT	N/A	4	N/A	130
Data Taking/Equipment Operation	MT	12	N/A	0	N/A
Surveillance	MT	N/A	10	1 surveillance trip	
Thickness Readings	UT	10	N/A	240	N/A
Contact Testing	UT	N/A	20	N/A	720
Evaluation	UT	N/A	20	N/A	520
Data Taking/Equipment Operation	UT	40	N/A	0	N/A
Surveillance	UT	N/A	40	2 surveillance trips	
Evaluation	PT	N/A	4	N/A	130
Solvent Removable	PT	N/A	4	N/A	130
Data Taking/Equipment Operation	PT	4	N/A	0	N/A
Surveillance	PT	N/A	6	1 surveillance trip	
Weldments	VT	1	2	100	175
VT-1	VT	1	2	100	175
Data Taking/Equipment Operation	VT	2	N/A	0	N/A
Surveillance trips	VT	N/A	6	2 surveillances	
Data Taking/Equipment Operation	ET	12	N/A	0	N/A
Surveillance	ET	N/A	12	1 surveillance trip	
Analysis of Fuel Rods	ET	N/A	20	N/A	250 (Note 7)

1. Work experience in RT, MT, UT, PT, ET or other NDE related methods such as Dimensional, Mechanical, Optical, etc. shall be applied to not more than 75% of the work time experience required for VT.

2. Training received in the course of qualifying to any NDE Level II, other than VT, will be considered to have met 75% of the training required for VT of weldments and/or VT-1.

3. Personnel holding limited certifications in data taking/NDE data analysis equipment operation shall work with a certified (unlimited) individual and shall not independently conduct any test, interpret or evaluate any results of a test, or write a report of test results.

4. The above hours are based on a high school graduate or equivalent. For other education levels, the hours will be adjusted in a ratio based upon the hours shown in Table 2.4-1.

5. It is not intended by this written practice that the sum of the hours listed for each method above is required for unlimited certification. See Table 2.4-1 for unlimited certification requirements.

6. For activities for which limited certification training and experience hours are not included in the table above, the responsible Level III shall establish and document the required training and experience hours prior to initiation of qualification and certification activities.

7. Experience for Fuel Rod ET Analysis must be gained during a minimum of two field assignments. A knowledge of fuel rod manufacturing and/or design is also required.

TABLE 2.4-2

COMBUSTION ENGINEERING

POWER SYSTEMS GROUP
1000 Prospect Hill Road
Windsor Connecticut 06095-0500

EYE EXAMINATION RECORD

NAME: Bruce E. Allbee DATE: 1-18-89

[✓] JAEGER #1 [ ] JAEGER #2 [ ] ORTHORATER

[✓] SNELLEN [ ] OTHER _____
Please fill in method if not listed

EXAMINATION RESULTS:

		Acceptable	Unacceptable
NEAR VISION - Jaeger			
NATURAL:	R # 1 L # 1 B # 1	[✓]	[ ]
CORRECTED:	R # ___ L # ___ B # ___	[ ]	[ ]
FAR VISION - Snellen			
NATURAL:	R 20/40 L 20/40 B 20/40	[ ]	[✓]
CORRECTED:	R 20/20 L 20/15 B 20/20	[✓]	[ ]

COLOR VISION

[✓] ISHIHARA [ ] A.O.H. [✓] [ ]

[ ] OTHER _____
Please fill in color test method if not listed.

CORRECTIVE LENSES OR AIDS ARE REQUIRED WHILE CONDUCTING INSPECTION

NEAR VISION [ ] YES [✓] NO

FAR VISION [✓] YES [ ] NO

ADMINISTERED BY: Virginia Hill

TITLE: R.N.

REVIEWED AND ACCEPTED BY: C F Bloomquist

TITLE: NDE Level III

EXHIBIT

C-E 0013106 (8/84)

EXHIBIT 2.4-1