ASEA BROWN BOVERI

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

UNIT 1

STEAM GENERATOR EDDY CURRENT EXAMINATION REPORT

VOLUME I

RFO-7
May 1997

ASEA BROWN BOVERI
COMBUSTION ENGINEERING, INC.
NUCLEAR OPERATIONS

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ABB Combustion Engineering Nuclear Services

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CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

UNIT 1

EDDY CURRENT EXAMINATION REPORT

April 1997

DOCUMENT NO. IR-ISI-164

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

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ABB

Document No: IR-ISI-164

TO: Carolina Power & Light Co.

CERTIFICATE OF CONFORMANCE

Carolina Power & Light Co.
Shearon Harris Plant
Steam Generator Eddy Current Examination
CENO Project No. 2004830

Combustion Engineering, Inc., hereby certifies that the Harris RFO-7 steam generator eddy current examinations performed during April 1997 were in compliance with CP&L Purchase Order XM 10370000 / WA# XS 10370016 dated 11-10-94. Documentation attesting to this conformance is contained within the data of this QC Records Package.

Q. Nato

Q. A. Engineer

ABSTRACT

This document summarizes the examination program, results, and presents information concerning examination procedures, personnel and equipment used for inspection at the Shearon Harris RFO-7 1997 outage.

The examination outage included eddy current inspections of approximately 29% of the tubes in each steam generator utilizing bobbin probes for defect examination. The bobbin probe inspection included all of the outlet (cold leg) pre-heater roll expanded tubes and all of the periphery tubes. All previous indications of possible tube degradation were also examined. Rotating coil (MRPC[1]) examinations utilizing the Zetec Plus Point® were performed on 100% of the inlet (hot) side top-of-tube-sheet expansion transitions and all previous indications including Manufacturing Buff Marks. MRPC inspections were also performed on a 20% sample of the pre-heater expansions in steam generator "A", and on suspect bobbin coil indications (diagnostics). There were several repairable indications with detail contained in the text of this document.

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[1] MRPC originally designated Motorized Rotating Pancake Coil but is also used generically to suggest various types of rotating coil configurations including the Plus Point coil and oriented coils.

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INTRODUCTION

Combustion Engineering, Inc. conducted an in-service eddy current examination of the steam generator (S/G) tubing at Carolina Power & Light (CP&L) Shearon Harris Nuclear Power Plant in April 1997. 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 coil (MRPC) testing for indications of degradation, manufacturing buff marks, dents, and deposits.

The examinations were conducted in accordance with Combustion Engineering Procedure No. HNP-100-004 Rev. 1 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", 1983 Edition, with Summer 1983 Addenda, and the Shearon Harris Technical Specifications.

The eddy current data analysis variables were established in accordance with the Procedure No. HNP-100-005 Rev. 1 "Eddy Current Data Analysis Guideline, Evaluation of Westinghouse Steam Generator Tubing". The data was independently analyzed by two groups of certified Level IIA (minimum) QDA qualified data analysts. Discrepancies between the two sets of evaluation results were reviewed by Lead Level III eddy current examiners representing both Primary and Secondary analysis groups. Data Acquisition and Primary data analysis was performed by ABB/Combustion Engineering while Secondary data analysis was performed by Rockridge. Both Primary and Secondary data analysis was performed remotely via LAN/WAN at the ABB Combustion Engineering Data Center , and Rockridge offices. The ABB Data Center was contracted to Duke Power Company at their McGuire office complex near Charlotte, NC.

WORK SCOPE

The examination program was conducted to meet all the necessary requirements of the Plant Technical Specifications and specific requirements of the utility steam generator engineering group. A examination was performed utilizing bobbin probe testing examining approximately 30% of the open tubes in each of the three steam generators. Examinations included peripheral tubes, and included 100% of the open pre-heater tubes which have a roll expansion at the second and third baffle support structure. Testing was performed from the outlet and inlet side of the steam generator.

Motorized Rotating Coil (MRPC) examinations utilizing the pancake and Plus Point® coils were performed on the inlet side of all three steam generators at the top-of-tubesheet roll transitions of all open tubes[2]. MRPC inspections were also performed on a sample of pre-heater roll transitions (26 tubes) in steam generator "A", dented intersections, buff marks and row one, two and three u-bends in all three steam generators. MRPC inspections were used to diagnose bobbin coil indications (special interest).

Component: SG #A

Steam Generator Inspection Summary

Inspection type	No. of Tubes
Bobbin probe	1377[3]
MRPC Top-of-Tubesheet	4560
MRPC U-Bend	69
MRPC Special Int. HL	16
MRPC Special Int. CL	18
MRPC Pre-Heater Int.	26
Diagnostic MRPC	11[4]

[2]There are 4578 tubes in each of the three D4 series steam generators.

[3] Bobbin Inspections of rows 1 & 2 are straight sections of Hot and Cold leg only.
[4] Diagnostic exams may also be included in Special Interest exams from historic data.

Component: SG #B

Steam Generator Inspection Summary

Inspection type	No. of Tubes
Bobbin probe	1383
MRPC Top-of-Tubesheet	4569
MRPC U-Bend	69
MRPC Special Int. HL	19
MRPC Special Int. CL	16
Diagnostic MRPC	5

Component: SG #C

Steam Generator Inspection Summary

Inspection type	No. of Tubes
Bobbin probe	1471
MRPC Top-of-Tubesheet	4559
MRPC U-Bend	69
MRPC Special Int. HL	21
MRPC Special Int. CL	26
Diagnostic MRPC	6

Probes Utilized

Bobbin Probe	A610MULC	.610" diameter magnetic bias
	A590SFRM	.580" diameter spring flex magnetic bias
	A560SFRM	.560" diameter spring flex magnetic bias
MRPC Probe	P620MRPC3C[5]	.620" dia. three coil (0.115" pancake; plus; HF plus.)
	P590MRPC3C	.590" dia. three coil (0.115" pancake; plus; HF plus)
	P580MRPC1C	.580" dia.single plus coil (u-bend)

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 ~30% sample of tubes throughout all three steam generators. Tube indications reported were compared to previous data from past inspections to investigate any possible flaw growth.

All previous Manufacturing Buff Marks (MBM's) from history were compared to data from the baseline inspection to validate that these indications were in fact buff marks. Other potential manufacturing indications were also reviewed and dispositioned based on the base line data. All of the base line data was stored on hard disk drive and used during the RFO-7 inspection to further disposition indications which had not been recorded previously. All remaining MBM's and Hot Leg Dented Intersections were examined with MRPC probe, as well as any unrecorded indications. *None of the MBM's or dented intersections reported any recordable indications.*

Indications of wear at AVB's and preheater locations were reported in the <20% range, ≥20 to 39% range and ≥40% range. A summary of the 1997 outage % Through-wall indications sorted by RFO-7 indication size follows this section.

MRPC three-coil examinations of the hot leg top-of-tube-sheet transitions were performed on all open tubes in all three steam generators. Inspections in this area reported Axial and Circumferential indications which were subsequently repaired.

All suspect bobbin coil indications were examined for disposition by the MRPC probe utilizing a pancake and Plus Point coil. Indications were dispositioned by use of the MRPC results or by reviewing the inspection history of the indication as far back as the 1984 baseline data. The following criteria was applied concluding the MRPC exam:

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[5] A three coil was also used where the HF plus coil was substituted with a 0.80" pancake. HF coils were introduced for ID sizing and confirmation only and were not specifically required.

1)	Wear (%)	If no indication is found - NDD (No Detectable Degradation) If indication confirms - place WAR in the % column and match the location of the bobbin probe.
2)	DSI	If not indication is found - INR/INF at the bobbin location If indication is present - enter SAI, SCI or as appropriate If indication is present but is the same in history - enter (NDD) blank with DSH in Utility 1 field.
3)	NQI	If not indication is found - INR/INF at bobbin location IF indication is present - enter SAI, SCI, NDH or as appropriate If indication is present but is the same in history - enter (NDD) blank with NQH in Utility 1 field
4)	MBM	If no reportable indication is found - NDD If no reportable indication is found but is the same in history - MBH in Utility 1 field If indication is found - enter VOL, add MBH if same in history
5)	DNT	If no indication is found - NDD If indication is found - enter appropriate flaw call

Definition of above codes in chronological order

WAR Wear indication
DSI Distorted Support Indication
INR Indication Not Reportable according to current guideline
INF Indication Not Found
DSH Distorted Support indication found in Historic review
SAI Single Axial Indication determined by MRPC examination
SCI Single Circumferential Indication determined by MRPC examination
NQI Non-Quantifiable Indication according to current guideline
NQH Non-Quantifiable indication found in Historic review
MBM Manufacturing Buff Mark
MBH Manufacturing Buff mark found in Historic review
DNT Dent Indication

ABB

Document No: IR-ISI-164

Shearon Harris Repair History

The following tables list the repair history for the Shearon Harris steam generators. Included are the repairs made during RFO-7 by ABB/Combustion Engineering.

Steam Generator "A" Repairs

RFO	Date	Row	Col	Type of Plug HL	Type of Plug CL	Reason Plugged
Shop	3/83	12	2	Welded	Welded	MFG Defect
		19	12	Welded	Welded	MFG Defect
		38	16	Welded	Welded	MFG Defect
RFO-1	9/88	15	3	ABB Rolled I690	ABB Rolled I690	Three tubes plugged for AVB wear, three for other reasons
		2	59	ABB Rolled I690	ABB Rolled I690	
		41	59	ABB Rolled I690	ABB Rolled I690	
		44	59	ABB Rolled I690	ABB Rolled I690	
		47	59	ABB Rolled I690	ABB Rolled I690	
		6	113	ABB Rolled I690	ABB Rolled I690	
RFO-2	11/89	45	59	ABB Rolled I690	ABB Rolled I690	AVB Wear
FO	11/90	9	112	B&W Rolled I690	B&W Rolled I690	AVB Wear
		10	113	B&W Rolled I690	B&W Rolled I690	AVB Wear
RFO-3	4/91	20	99	B&W Rolled I690	B&W Rolled I690	PWSCC
		23	99	B&W Rolled I690	B&W Rolled I690	PWSCC
		6	94	B&W Rolled I690	B&W Rolled I690	PWSCC
RFO-6	9/95	34	32	ABB Rolled I690	ABB Rolled I690	SAI at the TTS & TS
		36	32	ABB Rolled I690	ABB Rolled I690	SAI at the TTS
		25	71	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
				*Stake Installed		
RFO-7	5/97	1	114	ABB Rolled I690	ABB Rolled I690	PLI - Preventive Plug
		2	113	ABB Rolled I690	ABB Rolled I690	SAI at the TTS
		3	87	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		15	112	ABB Rolled I690	ABB Rolled I690	OBS - Preventive Plug
		18	111	ABB Rolled I690	ABB Rolled I690	OBS - Preventive Plug
		20	35	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		20	36	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		22	73	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		22	105	ABB Rolled I690*	ABB Rolled I690	PLI - Preventive Plug
		24	75	ABB Rolled I690*	ABB Rolled I690	MCI at the TTS
		25	72	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		26	66	ABB Rolled I690	ABB Rolled I690	SAI at the TTS
		27	39	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		28	44	ABB Rolled I690*	ABB Rolled I690	SCI at the TTS
		49	56	ABB Rolled I690	ABB Rolled I690*	PLP above 02C
		49	59	ABB Rolled I690	ABB Rolled I690*	PLP above 02C
		49	61	ABB Rolled I690	ABB Rolled I690*	PIT at 09C - Preventive
				*Stake Installed	* Stake Installed	

Steam Generator "B" Repairs

RFO	Date	Row	Col	Type of Plug HL	CL	Reason Plugged
Shop	3/83	49 49	81 82	Welded Welded	Welded Welded	MFG Defect MFG Defect
RFO-1	9/88	43 44	59 59	ABB Rolled I690 ABB Rolled I690	ABB Rolled I690 ABB Rolled I690	AVB Wear AVB Wear
RFO-5	4/94	49 47 12	34 51 85	W Rolled I690 W Rolled I690 W Rolled I690	W Rolled I690 W Rolled I690 W Rolled I690	50% Free Span CL 49% Free Span CL Axial Indication in TS
RFO-6	9/95	39 43	81 46	ABB Rolled I690 ABB Rolled I690	ABB Rolled I690 ABB Rolled I690	SAI at the TTS MAI in the TS
RFO-7	5/97	1 1 10 23 37 38 45 49	5 16 85 72 60 41 86 31	ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690* ABB Rolled I690 ABB Rolled I690* ABB Rolled I690 ABB Rolled I690 Stake Installed	ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690	OBS - Preventive Plug OBS - Preventive Plug MAI in the TS MCI at the TTS SAI at the TTS SCI at the TTS SAI at the TTS PLI at 02c - Preventive

Steam Generator "C" Repairs

RFO	Date	Row	Col	Type of Plug HL	CL	Reason Plugged
Shop	3/83	27 27	21 22	Welded Welded	Welded Welded	MFG Defect MFG Defect
Base Line	1/85	23 23 24 24	30 31 30 31	W Rolled I600 W Rolled I600 W Rolled I600 W Rolled I600	W Rolled I600 W Rolled I600 W Rolled I600 W Rolled I600	Tube Guides left during fabrication
RFO-1	9/88	42 45	56 59	ABB Rolled I690 ABB Rolled I690	ABB Rolled I690 ABB Rolled I690	AVB Wear AVB Wear
RFO-2	11/89	47 33	66 100	ABB Rolled I690 ABB Rolled I690	ABB Rolled I690 ABB Rolled I690	Other Other
RFO-3	4/91	29	45	B&W Rolled I690	B&W Rolled I690	AVB Wear
RFO-4	10/92	22 27	73 62	Welded I690 Welded I690	B&W Rolled I690 B&W Rolled I690	Tube Pull-Stabilizer Tube Pull
RFO-5	4/94	23 23 24 24	30 31 30 31	W Rolled I690 W Rolled I690 W Rolled I690 W Rolled I690	W Rolled I690 W Rolled I690 W Rolled I690 W Rolled I690	Removal of I600 plug Removal of I600 plug Removal of I600 plug Removal of I600 plug

RFO-6	9/95	23 23 24 24 15 22 23 32 46 47	30 31 30 31 48 71 71 84 59 59	Welded I690 Welded I690 Welded I690 Welded I690 ABB Rolled I690* ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 * Stake Installed	 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690	Removal of Leaking W I690 plugs SCI at the TTS SAI at the TTS SAI at the TTS SAI at the TTS 47% AV2, 42% AV3** 41% AV1** ** Wear
RFO-7	5/97	2 2 6 6 14 19 20 20 20 21 21 22 22 23 24 26 27 30 30 36 41	38 43 41 43 78 66 49 67 71 42 44 44 99 73 45 95 105 44 45 59 52	ABB Rolled I690* ABB Rolled I690* ABB Rolled I690* ABB Rolled I690* ABB Rolled I690 ABB Rolled I690* ABB Rolled I690* ABB Rolled I690 ABB Rolled I690 ABB Rolled I690* ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690* ABB Rolled I690* ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690 ABB Rolled I690* *Stake Installed	ABB Rolled I690 ABB Rolled I690	SCI at the TTS SCI at the TTS SCI at the TTS SCI at the TTS VOL - Preventive plug SCI at the TTS SCI at the TTS SAI at the TTS SAI at the TTS SCI at the TTS SAI at the TTS SAI at the TTS PLI - Preventive plug SCI at the TTS MCI at the TTS SAI at the TTS SAI at the TTS 39% at AV2 42% at AV1 PLI - Preventive plug SCI at the TTS

None of the defective (≥39%) ***wear signals*** *reported during this inspection indicated any growth of previous indications greater than 10%.* Other wear indications less than 39% did not change more than 10%. Several small wear indications were reported during RFO-7 which were not previously recordable. These indications will be added to the list of tubes to be monitored each outage for wear growth.

Several indications of wear were reported in the **pre-heater section** of the steam generators. Those that indicated wear were subsequently examined with the bobbin probe after calibrating for wear depth using the special wear scar calibration standard. *None of the wear scars indicated wear in excess of 20% through wall.*

Another aspect of this outage, was the inspection of **dented intersections** with three-coil MRPC technique. A selection of the dented intersections greater than five volts as reported during RFO-6 or previous were examined, not including those examined during RFO-6. The selection included all of the straight section hot leg tubes in steam generators "A" and "B", and "C", as well as a selection of straight section cold leg tubes in all three steam generators. *None of the dented intersections reported any indications indicative of degradation.* All dents reported with the bobbin probe (CDS) were recorded at a threshold of 2 volts utilizing the industry standard of establishing voltage on the primary mix channel. All bobbin data was screened for dents.

A sample of 20% (twenty six) tubes were inspected in steam generator "A" at the **cold leg pre-heater expansions.** The three-coil MRPC coil was utilized and included both expansion transitions at 02C and 03C. *None of the expanded intersections reported any indications indicative of degradation other than one tube (49/59) which showed wear from a loose part (additional information below)..*

A sample of 20% of the **row one, two and three U-bend** locations were examined utilizing a single coil (pancake) MRPC probe. The area examined ranged from 07H-07C. *None of the U-bends reported any indications indicative of degradation.*

A sample of tubes were examined in steam generator "A" for possible **drilled support ligament cracking** (approx 300 tubes). Ligament cracking is described in the analysis guideline and has been a concern at certain foreign plants of like design. *No indications of ligament cracking were noted.*

Upon careful review of MRPC and bobbin probe data it was discovered that a **possible loose part was detected** at the entrance to the "T" slot in steam generator "A". A wear indication was also reported at one of the contacted tubes. With further review of all three steam generators in the same suspect area there was an additional indication discovered near the periphery but at the same elevation as the first part in SG "A" (cold leg baffle #2). Both loose parts were subsequently removed from the SG. The contacted tube (49/59) with wear indicated was preventively plugged, as well as the adjacent tube (49/56) which indicated imbedded material in the tube. *No additional loose parts were discovered by ECT in this area of the steam generator or in SG's "B" and "C".*

Additional information may be found by reviewing the ISIS database text and graphic tubesheet maps found in the following sections. These include:

Tubes Examined with Bobbin Probe by probe size
Tubes Examined with Bobbin Probe which exhibit % Through wall Indications
Tubes Examined with MRPC Probe for Special Interest (previous indications)
Tubes Examined with MRPC Probe for U-bend Locations
Tubes Examined with MRPC Probe for Pre-Heater transitions (SG "A" only)
Tubes Examined with MRPC Probe exhibiting MCI, SCI, MAI or SAI indications (TTS)
Tubes Examined with MRPC Probe exhibiting PLP and PLI indications.
Tubes Examined which indicate repairable indications.

ASEA BROWN BOVERI

Tuesday, July 01, 1997

To: Chip Bach - CP&L Steam Generator Engineer

From: Tom Bipes - ABB CENO Eddy Current Level III

Subject: Loose Part Indications during RFO-7

At the conclusion of the steam generator inspection program, several tubes in each of the three generators contained loose part indications. These indications were classified as PLP (Possible Loose Part) and PLI (Possible Loose part with an Indication).

Loose part signals are interpreted utilizing the low frequency channels of the eddy current data, and appear similar to the support structures. With the bobbin probe it is difficult to detect a loose part indication if it is small and is in contact with a support structure. With MRPC probe technology, loose part indications are more readily detected even if in close contact with the support structure or top of tube sheet.

Indications which show a volumetric wear-type signal near the top of a structure or in the presense of a loose part indication are reported as PLI. With pre-RFO-7 sizing techniques, it was permitted to size PLI indications with the bobbin probe sizing technique. With changes in recommendations from EPRI, these sizing techniques must be qualified with acutal pulled tube data or lab samples. Loose part indications are not currently qualified to be sized with either the bobbin coil or MRPC coil techniques. Therefore, all PLI indications were removed from service with an installed mechanical tube plug as recommended.

The following table shows a summary of all loose part indications for each of the three steam generators. Based on a RFO-6 post inspection data review, all PLP indications were present during the RFO-6 inspection (except R49 C56, SG"A") and show no change. This could indicate that the loose part is in a fixed position and appears to be non-threatening, or that the loose part indication may be another anomaly such as compacted sludge or other ferritic deposit. In either case, it can be assumed the loose part signal is not a threat since it has not changed over two cycles.

During subsequent visual inspection, a loose part was found in SG "A" resting near R49 C56 and R49 C59. Both of these tubes were preventively plugged.

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Row	Col	IND	Support	Elevation	1995	Change?	Location	Comment
Steam Generator "A"								
1	114	PLI	TSH	0.14	yes	no	Bundle	
14	10	PLP	TSH	1.01	yes	no	Bundle	
14	100	PLP	TSH	0.20	yes	no	Bundle	
14	102	PLP	TSH	0.00	yes	no	Bundle	
15	10	PLP	TSH	1.22	yes	no	Bundle	
22	105	PLI	01H	0.97	no	yes	Bundle	Preventive Plug
23	105	PLP	07H	1.12	yes	no	Bundle	
39	53	PLP	TSH	0.14	yes	no	Bundle	
41	50	PLP	TSH	0.06	yes	no	Bundle	
43	50	PLP	TSH	0.10	yes	no	Bundle	
49	56	PLP	02C	2.89	no	yes	T-slot	Preventive Plug
49	59	PLI	02C	2.70	no	yes	T-slot	Preventive Plug

Row	Col	IND	Support	Elevation	1995	Change?	Location	Comment
Steam Generator "B"								
7	112	PLP	TSH	0.30	yes	no	Periph.	Possible Indication in Baseline
21	109	PLP	TSH	0.27	yes	no	Periph.	
22	109	PLP	TSH	0.30	yes	no	Periph.	
28	55	PLP	TSH	0.19	yes	no	T-slot	
28	56	PLP	TSH	0.15	yes	no	T-slot	
35	28	PLP	TSH	0.26	yes	no	T-slot	
49	31	PLI	02C	2.38	yes	no	Periph.	Preventive Plug

Row	Col	IND	Support	Elevation	1995	Change?	Location	Comment
Steam Generator "C"								
22	99	PLI	01H	0.18	yes	no	Bundle	Preventive Plug
36	59	PLI	TSH	1.14	no	yes	T-slot	Preventive Plug
49	42	PLP	TSH	0.53	yes	no	Periph.	
49	43	PLP	TSH	0.28	yes	no	Periph.	
49	44	PLP	TSH	0.31	yes	no	Periph.	
49	55	PLP	TSH	0.37	yes	no	Periph.	
49	56	PLP	TSH	0.31	yes	no	Periph.	
49	70	PLP	TSH	0.64	yes	no	Periph.	

PLP: Possible Loose Part
PLI: Loose Part Indication
TSH: Hot Leg top of tube sheet
01H: First Hot Leg Support (baffle plate)
07H: Seventh Support Plate (total of 11)
02C: Second Cold Leg Support (pre-heater baffle

5/4/97 Final (edited 11/10/97)

Shearon Harris
RFO-7
Top-of-Tubesheet Crack Summary

SG:A

	Row	Col	Type	Location	Elev.	Length	Degrees	Voltage Int.
1	2	113	SAI	TSH	-3.37	0.24		0.31
2	3	87	SCI	TSH	-0.17	0.21	33	0.07
3	20	35	SCI	TSH	-0.03	0.42	65	0.13
4	20	36	SCI	TSH	-0.01	0.65	100	0.13
5	22	73	SCI	TSH	-0.19	0.49	75	0.17
6	24	75	SCI	TSH	0.00	0.51	79	0.14
7	25	72	SCI	TSH	-0.07	0.60	92	0.18
8	26	66	SAI	TSH	-0.02	0.15		0.11
9	27	39	SCI	TSH	-0.05	0.42	65	0.12
10	28	44	SCI	TSH	-0.05	0.27	42	0.03

SG:B

	Row	Col	Type	Location	Elev.	Length	Degrees	Voltage Int.
1	10	85	MAI	TEH	10.43	0.23		0.58
2	23	72	SCI	TSH	-0.15	1.31	203	0.28
3	37	60	SAI	TSH	0.00	0.18		0.11
4	38	41	SCI	TSH	-0.07	0.27	42	0.11
5	45	86	SAI	TSH	-2.31	0.16		0.17

SG:C

	Row	Col	Type	Location	Elev.	Length	Degrees	Voltage Int.
1	2	38	SCI	TSH	-0.32	0.24	37	0.08
2	2	43	SCI	TSH	-0.38	0.34	53	0.04
3	6	41	SCI	TSH	-0.27	0.21	33	0.02
4	6	43	SCI	TSH	-0.34	0.37	58	0.04
5	19	66	SCI	TSH	-0.29	0.16	25	0.02
6	20	49	SCI	TSH	-0.27	0.45	70	0.15
7	20	67	SAI	TSH	-0.10	0.18		0.06
8	20	71	SAI	TSH	-0.11	0.19		0.11
9	21	42	SCI	TSH	-0.27	0.30	47	0.05
10	21	44	SAI	TSH	-0.17	0.19		0.06
11	22	44	SAI	TSH	-0.05	0.22		0.11
12	23	73	SCI	TSH	-0.25	0.22	33	0.08
13	24	45	MCI	TSH	-0.27	0.78	122	0.06
14	26	95	SAI	TSH	-0.13	0.20		0.29
15	27	105	SAI	TSH	-0.90	0.14		0.08
16	41	52	SCI	TSH	-0.19	0.19	29	0.02

31 Total

May , 1997

Chip Bach
Shearon Harris Nuclear Plant
5413 Shearon Harris Rd.
New Hill, NC 27562

Dear Mr. Bach:

The list of tubes represents tubes recommended to be removed from service in Steam Generator "A" based on Analysis of the Eddy Current data collected during the RFO-7 inspection. A signature below releases these tubes for repair.

Row	Column	IND	Location	Comments
1	114	PLI	TSH + 0.14	Possible loose part indication. Preventive Plug **Plug**
2	113	SAI	TSH - 3.37	Axial Indication below the top of tube sheet transition. **Plug**
3	87	SCI	TSH - 0.10"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
15	112	OBS	11H	Obstructed tube. Preventive Plug **Plug**
18	111	OBS	11H	Obstructed tube. Preventive Plug **Plug**
20	35	SCI	TSH - 0.03"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
20	36	SCI	TSH - 0.01"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
22	73	SCI	TSH - 0.12"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
22	105	PLI	01H + 0.97"	Possible loose part indication. Preventive Plug **Plug**
24	75	MCI	TSH - 0.08"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
25	72	SCI	TSH - 0.00"	Circumferential Indication at the tube sheet transition. **Plug & Stake**

26	66	SAI	TSH - 0.02"	Axial Indication at the tube sheet transition. **Plug**
27	39	SCI	TSH - 0.24"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
28	44	SCI	TSH - 0.23"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
49	59	PLI	02C + 2.70	Possible Loose Part Indication above the second cold leg baffle plate. Preventive Plug **Plug**
49	61	PIT	09C + 0.14	Pit like Indication at the 9th cold leg support. Preventive Plug **Plug**

Thomas U. Bipes LV. III — 5-4-97

Thomas U. Bipes
ABB/CE Senior Analyst

Date

5/4/97

CP&L Representative

Date

CP&L

Memo

To:	Sam Shock, Tom Bipes	ABB/CE
From:	Chip Bach	CP&L
Date:	May 4, 1997	
Subject:	Additional Tube to be plugged in SG A	

As a result of the video inspection in SG A, and further review of the ECT data, I would like SG tube 49-56 plugged in addition to the repair list previously developed. The reason for plugging 49-56 is due to the appearance of embedded material into the tube surface from the foreign object observed on 5/4/97. This tube does not exhibit any wear indication from ECT data review, so it will be classified as a preventative plug.

Repairs listed on the previously submitted plugging list should be followed with the following additions:

Row	Column	Comments
49	56	Add "Preventative plug with Stake in cold leg" to the previous plugging list
49	59	Add "Stake in cold leg" to the previous plugging list
49	61	Add "Stake in cold leg" to the previous plugging list
1	114	Add "Stake in hot leg" to the previous plugging list
22	105	Add "Stake in hot leg" to the previous plugging list

NRBach

May 3, 1997

Chip Bach
Shearon Harris Nuclear Plant
5413 Shearon Harris Rd.
New Hill, NC 27562

Dear Mr. Bach:

The list of tubes represents tubes recommended to be removed from service in Steam Generator "B" based on Analysis of the Eddy Current data collected during the RFO-7 inspection. A signature below releases these tubes for repair.

Row	Column	IND	Location	Comments
1	5	OBS	11H	Obstructed to a .590 bobbin probe. RPC data not obtainable. Preventive Plug **Plug**
1	16	OBS	11H	Obstructed to a .590 bobbin probe. RPC data not obtainable. Preventive Plug. **Plug**
10	85	MAI	TEH + 10.43"	Axial Indication within the tube sheet. **Plug**
23	72	MCI	TSH - 0.09"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
37	60	SAI	TSH - 0.00"	Axial Indication at the tube sheet transition. **Plug**
38	41	SCI	TSH - 0.18"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
45	86	SAI	TSH - 2.26"	Axial Indication below the tube sheet transition. **Plug**
49	31	PLI	02C + 2.38"	Loose Part Indication above the second baffle plate. **Plug**

Thomas U. Bipes — 5-3-97
Thomas U. Bipes
ABB/CE Senior Analyst — Date

CP&L Representative — 5/3/97
Date

May 2, 1997

Chip Bach
Shearon Harris Nuclear Plant
5413 Shearon Harris Rd.
New Hill, NC 27562

Dear Mr. Bach:

The list of tubes represents tubes recommended to be removed from service in Steam Generator "C" based on Analysis of the Eddy Current data collected during the RFO-7 inspection. A signature below releases these tubes for repair.

Row	Column	IND	Location	Comments
2	38	SCI	TSH - 0.45"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
2	43	SCI	TSH - 0.41"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
6	41	SCI	TSH - 0.33"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
6	43	SCI	TSH - 0.32"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
14	78	VOL	02C + 0.68	Volumetric indication from large dent signal - Preventive Plug **Plug**
19	66	SCI	TSH - 0.39"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
20	49	SCI	TSH - 0.36"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
20	67	SAI	TSH - 0.00"	Axial Indication at the tube sheet transition. **Plug**
20	71	SAI	TSH + 0.13"	Axial Indication at the tube sheet transition. **Plug**
21	42	SCI	TSH - 0.00"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
21	44	SAI	TSH + 0.07	Axial Indication at the tube sheet transition. **Plug**
22	44	SAI	TSH + 0.00	Axial Indication at the tube sheet transition. **Plug**

22	99	PLI	01H + 0.18	Possible Loose Part Indication above the Hot Leg baffle plate. Preventive Plug **Plug**
23	73	SCI	TSH - 0.36"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
24	45	MCI	TSH - 0.09"	Circumferential Indication at the tube sheet transition. **Plug & Stake**
26	95	SAI	TSH + 0.11"	Axial Indication at the tube sheet transition. **Plug**
27	105	SAI	TSH - 0.12	Axial Indication at the tube sheet transition. **Plug**
30	44	39%	AV2	AVB wear (grown less than 10%) Prev. Plug. **Plug**
30	45	42%	AV1	AVB wear (grown less than 10%) **Plug**
36	59	PLI	TSH + 0.74	Possible Loose Part Indication above the top of tube sheet. Preventive Plug **Plug**
41	52	SCI	TSH - 0.01"	Circumferential Indication at the tube sheet transition. **Plug & Stake**

Thomas U. Bipes LV III
5-2-97

Thomas U. Bipes
ABB/CE Senior Analyst
Date

5/2/97

CP&L Representative
Date

C P & L
Shearon Harris
COMPONENT: SG A

1997 Plugged Tubes with Historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
1 114	1H083			PID		TSH +0.0	P620MRPC3C	TSH+2	97AMRPC	6	
	9704	0.1	8	PLP	0	TSH +0.0	P620MRPC3C	TSH+2			
	9704	0.7	P 1	PLI	0	TSH +0.1	P620MRPC3C	TSH+2			
	9704	0.0		INR	0	TSH +0.2	A610MULC	11HTEH			
	9509	0.1	11	PLP	0	TSH +0.2	B620MRPC3C	TSHTSH			
	9509	1.1	P1	23	23	TSH +0.2	B620MRPC3C	TSHTSH			
2 113	1H083			PID		TSH -3.4	P620MRPC3C	TSH+2	97AMRPC	6	
	9704	1.7	2	SAI	0	TSH -3.4	P620MRPC3C	TSH+2			
3 87	1H083			PID		TSH -0.1	P620MRPC3C	TSH+2	97AMRPC	5	
	9704	0.6	P 2	SCI	0	TSH -0.1	P620MRPC3C	TSH+2			
15 112	1H085			OBS		11H +0.1	P580MRPC1C		97ASI/HL	6	
	9704	110.4	P 1	DNT	0	11H +1.0	A560SFRM	TEHTEC			
	9509	111.8	P1	DNT	0	11H +0.2	A560SFRM	TEHTEC			
	9404	107.0	M1	DNT	0	11H +0.2	590-EC	TEHTEC			
	9210	94.4	P 1	DNT	0	11H +0.4	540SF	TECTEH			
	9104	124.6	17	DNT	0	11H +0.5	540SM	TECTEH			
	8910	102.5	M1	DNT	0	11H +0.4	540SM	TECTEH			
	8808	62.1	M1	DNT	0	11H +0.2	540SM	TECTEH			
18 111	1H085			OBS		10H +0.0	P580MRPC1C		97ASI/HL	12	
	9404	0.0		TRS	0	10H +0.0	590-ZC	10H			
20 35	1H083			PID		TSH -0.0	P620MRPC3C	TSH+2	97AMRPC	8	
	9704	0.3	P 2	SCI	0	TSH -0.0	P620MRPC3C	TSH+2			
20 36	1H083			PID		TSH -0.0	P620MRPC3C	TSH+2	97AMRPC	8	
	9704	0.3	P 2	SCI	0	TSH -0.0	P620MRPC3C	TSH+2			
22 73	1H083			PID		TSH -0.1	P620MRPC3C	TSH+2	97AMRPC	10	
	9704	0.7	P 2	SCI	0	TSH -0.1	P620MRPC3C	TSH+2			
22 105	1H083			PID		01H +1.0	P620MRPC3C	TSH+2	97ASI/HL	12	
	9704	0.6	P 1	PLI	0	01H +1.0	P620MRPC3C	01HTSH			
	9704	0.3	8	PLP	0	01H +1.1	P620MRPC3C	01HTSH			
	9704	0.6	1	NQI	0	01H +1.0	A610MULC	TEHTEC			
	9509	0.6	1	13	13	01H +1.0	A610MULC	TEHTEC			
	9404	0.5	1	17	17	01H +1.1	610-EC	TEHTEC			
24 75	1H083			PID		TSH -0.1	P620MRPC3C	TSH+2	97AMRPC	10	
	9704	0.8	P 2	MCI	0	TSH -0.1	P620MRPC3C	TSH+2			
25 72	1H083			PID		TSH +0.0	P620MRPC3C	TSH+2	97AMRPC	10	
	9704	0.3	P 2	SCI	0	TSH +0.0	P620MRPC3C	TSH+2			
26 66	1H083			PID		TSH -0.0	P620MRPC3C	TSH+2	97AMRPC	10	
	9704	2.0	2	SAI	0	TSH -0.0	P620MRPC3C	TSH+2			
27 39	1H083			PID		TSH -0.2	P620MRPC3C	TSH+2	97AMRPC	9	
	9704	0.7	P 2	SCI	0	TSH -0.2	P620MRPC3C	TSH+2			
28 44	1H083			PID		TSH -0.2	P620MRPC3C	TSH+2	97AMRPC	9	
	9704	0.2	P 2	SCI	0	TSH -0.2	P620MRPC3C	TSH+2			
49 56	1C006	3.8	8	PLP		02C +2.8	A610MULC	TEHTEC	97ABOBBIN	14	
	Preventively Plugged by Utility										
49 59	1C030			PID		02C +2.7	P620MRPC3C	03C02C	97AEXP/PP	15	
	9704	0.1	8	PLP	0	02C +0.4To +2.9	P620MRPC3C	03C02C			
	9704	0.3	2	PLI	0	02C +2.7	P620MRPC3C	03C02C			
49 61	1C018		2	PID		09C +0.1	P620MRPC3C	09C09C	97ABOBBIN	15	
	9704	1.4	P 1	DSI	0	09C +0.1	A610MULC	TEHTEC			
	9704	1.8	P 1	PIT	0	09C +0.1	P620MRPC3C	09C09C			
	9509	1.8	P1	30	30	09C +0.1	A610MULC	TEHTEC			
	9404	0.7	M1	31	31	09C +0.2	610-EC	TEHTEC			

NUMBER OF TUBES REPORTED: 17

C P & L
Shearon Harris
COMPONENT: SG A

Report Date: 06/24/97
Page: 1

1997 Special Interest exams with historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
1 114	1H081	0.7	P 1	PLI		TSH +0.1	P620MRPC3C	TSH+2	97ASI/HL	6	
	9704	0.0		INR	0	TSH +0.2	A610MULC	11HTEH			
	9509	0.1	11	PLP	0	TSH +0.2	B620MRPC3C	TSHTSH			
	9509	1.1	P1	23	23	TSH +0.2	B620MRPC3C	TSHTSH			
3 62	1C023			INF		01C +5.3	P620MRPC3C	02CTSC	97ASI/CL	4	
	9509	4.6	1	MBM	0	01C +5.3	A610MULC	TEHTEC			
	9404	2.9	1	11	11	01C +5.1	610-EC	11HTEC			
	9404	3.1	1	14	14	01C +5.4	610-EC	11HTEC			
	9210	2.9	1	20	20	01C +5.6	610UL	TECTEH			
	9104	2.7	1	23	23	01C +5.9	610UL	TECTEH			
6 58	1C029			INF		01C +2.6	P620MRPC3C	02C01C	97ASI/CL	4	
	9509	7.2	1	MBM	0	01C +2.6	A610MULC	TEHTEC			
	9404	4.3	1	20	20	01C +2.3	610-EC	TEHTEC			
	9404	4.3	1	22	22	01C +2.0	610-EC	TEHTEC			
	9210	4.3	1	26	26	01C +2.1	610UL	TECTEH			
	9104	4.4	1	31	31	01C +2.1	610UL	TECTEH			
8 88	1C017	1.9	1	VOL		01C +3.2	P620MRPC3C	02C01C	97ASI/CL	5	
	9704	13.1	1	MBM	0	01C +2.8	A610MULC	TEHTEC			
	9509	15.7	1	9	9	01C +3.1	A610MULC	TEHTEC			
	9404	12.2	1	9	9	01C +3.2	610-EC	TEHTEC			
	9404	12.3	1	19	19	01C +3.1	610-EC	TEHTEC			
	9210	11.6	1	19	19	01C +3.4	610UL	TECTEH			
	9104	14.2	1	19	19	01C +3.0	610UL	TECTEH			
10 79	1C017			INF		TEC +13.3	P620MRPC3C	TSCTEC	97ASI/CL	5	
	9509	3.0	P1	NQI	0	TEC +13.3	A610MULC	TEHTEC			
	9509	0.0	1	DMR	0	TEC +13.3	B620MRPC3C	TECTSC			
	9509	4.6	P1	NQI	0	TEC +13.3	A610MULC	TEHTEC			
14 62	1H072	0.1	P 2	VOL		08H +32.6	P620MRPC3C	09H08H	97ASI/HL	4	MBH
	9509	0.6	1	MBM	0	08H +33.4	A610MULC	TEHTEC			
	9404	0.5	1	12	12	08H +33.3	610-EC	TEHTEC			
	8808	0.5	1	INR	0	08H +32.2	610SM	TECTEH			
	1H072	0.7	1	VOL		09H +26.5	P620MRPC3C	09H08H	97ASI/HL	4	MBH
	9509	1.2	1	MBM	0	09H +25.9	A610MULC	TEHTEC			
	8808	0.9	1	INR	0	09H +27.5	610SM	TECTEH			
15 86	1H072	0.7	1	VOL		10H +14.5	P620MRPC3C	11H10H	97ASI/HL	5	MBH
	8910	0.8	1	INR	0	10H +14.6	610SL	TECTEH			
	8808	0.7	1	MBM	0	10H +14.6	610SM	TECTEH			
15 112	1H085			OBS		11H +0.1	P580MRPC1C		97ASI/HL	6	
	9704	110.4	P 1	DNT	0	11H +1.0	A560SFRM	TEHTEC			
	9509	111.8	P1	DNT	0	11H +0.2	A560SFRM	TEHTEC			
	9404	107.0	M1	DNT	0	11H +0.2	590-EC	TEHTEC			
	9210	94.4	P 1	DNT	0	11H +0.4	540SF	TECTEH			
	9104	124.6	17	DNT	0	11H +0.5	540SM	TECTEH			
	8910	102.5	M1	DNT	0	11H +0.4	540SM	TECTEH			
	8808	62.1	M1	DNT	0	11H +0.2	540SM	TECTEH			
16 46	1H073	1.1	1	VOL		01H +7.0	P620MRPC3C	05H01H	97ASI/HL	3	MBH
	9509	0.4	1	MBM	0	01H +9.7	A610MULC	TEHTEC			

C P & L
Shearon Harris
COMPONENT: SG A

1997 Special Interest exams with historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
18 77	1C017	1.3	1	VOL		07C +18.1	P620MRPC3C	08C07C	97ASI/CL	11	MBH
	9404	0.4	1	MBM	0	07C +18.0	610-EC	TEHTEC			
18 111	1H085			OBS		10H +0.0	P580MRPC1C		97ASI/HL	12	
	9404	0.0		TRS	0	10H +0.0	590-ZC	10H			
21 68	1H072	0.9	1	INR		09H +31.4	P620MRPC3C	10H09H	97ASI/HL	10	
	9704	0.5	1	MBM	0	09H +31.3	A610MULC	TEHTEC			
	9509	0.5	1	MBM	0	09H +31.2	A610MULC	TEHTEC			
	9404	0.4	1	12	12	09H +31.4	610-EC	TEHTEC			
	9210	0.4	1	19	19	09H +31.2	610UL	TECTEH			
22 12	1H073	1.3	1	VOL		03H +3.2	P620MRPC3C	05H03H	97ASI/HL	7	MBH
	9404	0.5	1	MBM	0	03H +4.2	610-EC	TEHTEC			
	9210	0.5	1	7	7	03H +4.2	610UL	TECTEH			
22 105	1H072	0.3	8	PLP		01H +1.1	P620MRPC3C	01HTSH	97ASI/HL	12	
	1H072	0.6	P 1	PLI		01H +1.0	P620MRPC3C	01HTSH	97ASI/HL	12	
	9704	0.6	1	NQI	0	01H +1.0	A610MULC	TEHTEC			
	9509	0.6	1	13	13	01H +1.0	A610MULC	TEHTEC			
	9404	0.5	1	17	17	01H +1.1	610-EC	TEHTEC			
27 64	1C017	0.8	1	VOL		05C +16.3	P620MRPC3C	06C05C	97ASI/CL	10	MBH
	9509	1.0	1	MBM	0	05C +15.7	A610MULC	TEHTEC			
	9404	0.5	1	10	10	05C +15.6	610-EC	TEHTEC			
	8808	0.7	1	INR	0	05C +16.4	610SM	TECTEH			
27 75	1H072	1.1	1	VOL		08H +21.0	P620MRPC3C	09H08H	97ASI/HL	10	MBH
	9704	0.3	1	MBM	0	08H +21.5	A610MULC	TEHTEC			
	9404	2.6	6	MBM	0	08H +21.0	610-EC	TEHTEC			
28 97	1H072	1.3	1	INR		03H +31.8	P620MRPC3C	05H03H	97ASI/HL	12	
	8910	0.5	1	INR	0	03H +32.0	610SL	TECTEH			
	8808	0.5	1	MBM	0	03H +32.0	610SM	TECTEH			
33 93	1C017	0.6	1	VOL		08C +33.0	P620MRPC3C	09C08C	97ASI/CL	16	MBH
	9404	0.8	1	MBM	0	08C +32.9	610-EC	TEHTEC			
37 16	1H073	0.9	1	VOL		01H +0.7	P620MRPC3C	01HTEH	97ASI/HL	13	NQH
	9704	0.4	1	NQI	0	01H +1.0	A610MULC	TEHTEC			
	9509	1.2	1	25	25	01H +1.0	A610MULC	TEHTEC			
40 56	1H073			INR		TSH -1.2	P620MRPC3C	TSHTEH	97ASI/HL	14	
	9509	0.0		DMR	0	TSH -1.2	B620MRPC3C	TSHTSH			
	9509	1.3	P3	NQI	0	TSH -1.2	A610MULC	TEHTEC			

1997 Special Interest exams with historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
40 97	1C017	0.6	1	VOL		10C +20.8	P620MRPC3C	11C10C	97ASI/CL	16	
	9704	0.0	1	MBM	0	10C +20.9	A610MULC	TEHTEC			
	9509	0.5	1	MBM	0	10C +20.0	A610MULC	TEHTEC			
	9404	0.3	1	5	5	10C +20.8	610-EC	TEHTEC			
41 74	1H072	1.3	1	VOL		09H +40.1	P620MRPC3C	10H09H	97ASI/HL	15	MBH
	9509	0.7	1	MBM	0	09H +40.4	A610MULC	TEHTEC			
	9404	0.6	1	14	14	09H +40.6	610-EC	TEHTEC			
	8910	0.9	1	INR	0	09H +40.4	610SL	TECTEH			
	8808	0.8	1	MBM	0	09H +40.4	610SM	TECTEH			
45 82	1C017	0.3	1	VOL		08C +27.1	P620MRPC3C	09C08C	97ASI/CL	16	MBH
	9404	0.3	1	MBM	0	08C +26.9	610-EC	TEHTEC			
	9210	0.4	1	MBM	0	08C +27.0	610UL	TECTEH			
46 76	1C043	1.6	1	VOL		07C +22.6	P620MRPC3C	08C07C	97ASI/CL	15	MBH
	9404	0.2	1	MBM	0	07C +22.5	610-EC	TEHTEC			
	9210	0.2	1	MBM	0	07C +22.7	610UL	TECTEH			
47 71	1C017	0.9	1	VOL		07C +20.2	P620MRPC3C	08C07C	97ASI/CL	15	MBH
	9509	0.8	1	MBM	0	07C +20.0	A610MULC	TEHTEC			
	9404	0.7	1	21	21	07C +20.0	610-EC	TEHTEC			
	9210	0.7	1	14	14	07C +20.1	610UL	TECTEH			
48 59	1C017	0.4	1	VOL		07C +39.2	P620MRPC3C	08C07C	97ASI/CL	15	
	9704	0.3	1	MBM	0	07C +39.0	A610MULC	TEHTEC			
	9509	0.5	1	MBM	0	07C +38.9	A610MULC	TEHTEC			
	9404	2.3	6	MBM	0	07C +39.2	610-EC	TEHTEC			
	9210	0.5	1	11	11	07C +38.9	610UL	TECTEH			
	1H072	2.1	1	INR		09H +18.4	P620MRPC3C	10H09H	97ASI/HL	15	
	9704	0.3	1	MBM	0	09H +19.0	A610MULC	TEHTEC			
	9509	0.6	1	MBM	0	09H +18.6	A610MULC	TEHTEC			
48 82	1C017	0.6	1	VOL		09C +30.4	P620MRPC3C	10C09C	97ASI/CL	16	MBH
	9404	0.4	1	MBM	0	09C +30.1	610-EC	TEHTEC			
	9210	0.4	1	16	16	09C +30.1	610UL	TECTEH			
	1C017	0.6	1	VOL		09C +25.6	P620MRPC3C	10C09C	97ASI/CL	16	MBH
	9404	0.4	1	MBM	0	09C +25.3	610-EC	TEHTEC			
	9210	0.3	1	MBM	0	09C +25.5	610UL	TECTEH			
49 38	1C017			INF		TEC +6.1	P620MRPC3C	TSCTEC	97ASI/CL	13	
	9704	3.1	P 3	DRI	0	TEC +6.6	A610MULC	TEHTEC			
	9509	0.0	1	DMR	0	TEC +6.1	B620MRPC3C	TECTSC			
	9509	4.1	P3	NQI	0	TEC +6.1	A610MULC	TEHTEC			
	9104	3.8	17	DRS	0	TEC +6.8	610UL	TECTEH			
49 43	1C017	1.3	1	WAR		07C +0.4	P620MRPC3C	07C07C	97ASI/CL	14	
	9704	1.3	P 5		14	07C +0.0	A610MULC	TEHTEC			
	9509	0.6	P2	26	26	07C +0.4	A610MULC	TEHTEC			
	9404	0.7	M2	20	20	07C +0.4	610-EC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
49 46	1C017	0.8	P 1	WAR		07C +0.3	P620MRPC3C	07C07C	97ASI/CL	14	
	9704	0.3	P 2		17	07C +0.4	A610MULC	TEHTEC			
	9509	0.4	P2	19	19	07C +0.4	A610MULC	TEHTEC			
	9404	0.6	M2	14	14	07C +0.3	610-EC	TEHTEC			
49 61	1C017	1.8	P 1	PIT		09C +0.1	P620MRPC3C	09C09C	97ASI/CL	15	
	9704	1.4	P 1	DSI	0	09C +0.1	A610MULC	TEHTEC			
	9509	1.8	P1	30	30	09C +0.1	A610MULC	TEHTEC			
	9404	0.7	M1	31	31	09C +0.2	610-EC	TEHTEC			
49 84	1C017	0.1	1	VOL		03C +25.8	P620MRPC3C	05C03C	97ASI/CL	16	
	9704	0.3	1	MBM	0	03C +25.8	A610MULC	TEHTEC			
	9509	0.2	1	34	34	03C +25.8	A610MULC	TEHTEC			
	9404	0.3	1	37	37	03C +25.8	610-EC	TEHTEC			

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Row/Col		Reel / Outage	Volts		CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
8	88	1C014	13.1		1	MBM		01C	+2.8	A610MULC	TEHTEC	97ABOBBIN	5	MBH
		9509	15.7		1	9	9	01C	+3.1	A610MULC	TEHTEC			
		9404	12.2		1	9	9	01C	+3.2	610-EC	TEHTEC			
		9404	12.3		1	19	19	01C	+3.1	610-EC	TEHTEC			
		9104	14.2		1	19	19	01C	+3.0	610UL	TECTEH			
14	62	1H072	0.7		1	VOL		09H	+26.5	P620MRPC3C	09H08H	97ASI/HL	4	MBH
		1H072	0.1	P	2	VOL		08H	+32.6	P620MRPC3C	09H08H	97ASI/HL	4	MBH
15	86	1H072	0.7		1	VOL		10H	+14.5	P620MRPC3C	11H10H	97ASI/HL	5	MBH
16	46	1H073	1.1		1	VOL		01H	+7.0	P620MRPC3C	05H01H	97ASI/HL	3	MBH
18	77	1C017	1.3		1	VOL		07C	+18.1	P620MRPC3C	08C07C	97ASI/CL	11	MBH
		9404	0.4		1	MBM	0	07C	+18.0	610-EC	TEHTEC			
21	68	1C011	0.5		1	MBM		09H	+31.3	A610MULC	TEHTEC	97ABOBBIN	10	MBH
		9509	0.5		1	MBM	0	09H	+31.2	A610MULC	TEHTEC			
		9404	0.4		1	12	12	09H	+31.4	610-EC	TEHTEC			
		9210	0.4		1	19	19	09H	+31.2	610UL	TECTEH			
22	12	1H073	1.3		1	VOL		03H	+3.2	P620MRPC3C	05H03H	97ASI/HL	7	MBH
26	60	1C011	0.3		1	MBM		04C	+12.4	A610MULC	TEHTEC	97ABOBBIN	10	MBH
		9404	0.0		1	INR	0	04C	+12.5	610-EC	TEHTEC			
		9210	0.3		1	12	12	04C	+12.5	610UL	TECTEH			
27	64	1C017	0.8		1	VOL		05C	+16.3	P620MRPC3C	06C05C	97ASI/CL	10	MBH
27	75	1C011	0.3		1	MBM		08H	+21.5	A610MULC	TEHTEC	97ABOBBIN	10	MBH
		1H072	1.1		1	VOL		08H	+21.0	P620MRPC3C	09H08H	97ASI/HL	10	MBH
		9404	2.6		6	MBM	0	08H	+21.0	610-EC	TEHTEC			
33	93	1C017	0.6		1	VOL		08C	+33.0	P620MRPC3C	09C08C	97ASI/CL	16	MBH
		9404	0.8		1	MBM	0	08C	+32.9	610-EC	TEHTEC			
34	30	1C005	3.7		1	MBM		08C	+23.9	A610MULC	TEHTEC	97ABOBBIN	13	MBH
34	59	1C008	0.3	P	2		17	06C	+0.3	A610MULC	TEHTEC	97ABOBBIN	15	
37	16	1H073	0.9		1	VOL		01H	+0.7	P620MRPC3C	01HTEH	97ASI/HL	13	NQH
		9509	1.2		1	25	25	01H	+1.0	A610MULC	TEHTEC			
		1C005	0.4		1	NQI		01H	+1.0	A610MULC	TEHTEC	97ABOBBIN	13	NQH
		9509	1.2		1	25	25	01H	+1.0	A610MULC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
38 56	1C006	0.4	1	MBM		10H +35.2	A610MULC	TEHTEC	97ABOBBIN	14	MBH
	1C006	0.5	1	MBM		08C +10.0	A610MULC	TEHTEC	97ABOBBIN	14	MBH
39 64	1C008	0.2	P 2		14	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.8	P2	20	20	AV3 +0.0	A610MULC	TEHTEC			
	9404	0.9	M2	19	19	AV3 +0.0	610-EC	TEHTEC			
40 56	1C006	11.6	P 1	DRI		TEH +20.2	A610MULC	TEHTEC	97ABOBBIN	14	DRH
40 59	1C008	0.2	P 2		15	AV4 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.8	P2	21	21	AV4 -0.0	A610MULC	TEHTEC			
	9404	0.8	M2	20	20	AV4 +0.0	610-EC	TEHTEC			
	9210	0.9	P 2	20	20	AV4 +0.0	610UL	TECTEH			
	9104	0.6	18	19	19	AV4 +0.0	610UL	TECTEH			
40 97	1C010	0.0	1	MBM		10C +20.9	A610MULC	TEHTEC	97ABOBBIN	16	MBH
	9404	0.3	1	5	5	10C +20.8	610-EC	TEHTEC			
41 74	1H072	1.3	1	VOL		09H +40.1	P620MRPC3C	10H09H	97ASI/HL	15	MBH
	9509	0.7	1	MBM	0	09H +40.4	A610MULC	TEHTEC			
	9404	0.6	1	14	14	09H +40.6	610-EC	TEHTEC			
42 59	1C008	0.2	P 2		12	AV1 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.7	P2	19	19	AV1 -0.0	A610MULC	TEHTEC			
	9404	0.5	M2	14	14	AV1 +0.0	610-EC	TEHTEC			
	9210	0.5	P 2	11	11	AV1 +0.0	610UL	TECTEH			
	1C008	0.2	P 2		14	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.9	P2	23	23	AV3 +0.1	A610MULC	TEHTEC			
	9404	1.2	M2	24	24	AV3 +0.0	610-EC	TEHTEC			
	9210	0.8	P 2	16	16	AV3 +0.0	610UL	TECTEH			
43 45	1C006	0.4	1	MBM		09C +23.5	A610MULC	TEHTEC	97ABOBBIN	14	MBH
43 59	1C008	0.2	P 2		12	AV1 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.6	P2	16	16	AV1 +0.2	A610MULC	TEHTEC			
	9404	0.5	M2	13	13	AV1 +0.0	610-EC	TEHTEC			
	9210	0.7	P 2	14	14	AV1 +0.0	610UL	TECTEH			
45 82	1C017	0.3	1	VOL		08C +27.1	P620MRPC3C	09C08C	97ASI/CL	16	MBH
	9404	0.3	1	MBM	0	08C +26.9	610-EC	TEHTEC			
	9210	0.4	1	MBM	0	08C +27.0	610UL	TECTEH			
46 59	1C008	0.3	P 2		19	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.6	P2	17	17	AV3 +0.1	A610MULC	TEHTEC			
	9404	0.7	M2	17	17	AV3 +0.0	610-EC	TEHTEC			
	9210	0.9	P 2	20	20	AV3 +0.0	610UL	TECTEH			
	9104	0.5	18	14	14	AV3 +0.0	610UL	TECTEH			
	1C008	0.4	P 2		22	AV4 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.9	P2	23	23	AV4 +0.1	A610MULC	TEHTEC			
	9404	1.3	M2	26	26	AV4 +0.0	610-EC	TEHTEC			
	9210	0.7	P 2	15	15	AV4 +0.0	610UL	TECTEH			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
46 76	1C043	1.6	1	VOL		07C +22.6	P620MRPC3C	08C07C	97ASI/CL	15	MBH
	9404	0.2	1	MBM	0	07C +22.5	610-EC	TEHTEC			
	9210	0.2	1	MBM	0	07C +22.7	610UL	TECTEH			
47 56	1C006	0.2	P 2		11	AV1 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.2	P2	9	9	AV1 +0.0	A610MULC	TEHTEC			
	1C006	0.5	P 2		24	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.5	P2	21	21	AV3 +0.0	A610MULC	TEHTEC			
	9404	0.7	M2	16	16	AV3 +0.0	610-EC	TEHTEC			
	1C006	0.4	P 2		20	AV2 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.7	P2	26	26	AV2 +0.0	A610MULC	TEHTEC			
	9404	1.0	M2	21	21	AV2 +0.0	610-EC	TEHTEC			
	9210	0.8	P 2	17	17	AV2 +0.2	610UL	TECTEH			
	9104	0.6	18	15	15	AV2 +0.0	610UL	TECTEH			
	1C006	0.4	P 2		20	AV4 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.7	P2	26	26	AV4 +0.0	A610MULC	TEHTEC			
	9404	1.0	M2	21	21	AV4 +0.0	610-EC	TEHTEC			
47 71	1C017	0.9	1	VOL		07C +20.2	P620MRPC3C	08C07C	97ASI/CL	15	MBH
	9509	0.8	1	MBM	0	07C +20.0	A610MULC	TEHTEC			
	9404	0.7	1	21	21	07C +20.0	610-EC	TEHTEC			
	9210	0.7	1	14	14	07C +20.1	610UL	TECTEH			
48 59	1C008	0.3	1	MBM		07C +39.0	A610MULC	TEHTEC	97ABOBBIN	15	MBH
	9509	0.5	1	MBM	0	07C +38.9	A610MULC	TEHTEC			
	9404	2.3	6	MBM	0	07C +39.2	610-EC	TEHTEC			
	9210	0.5	1	11	11	07C +38.9	610UL	TECTEH			
	1C008	0.3	P 1	DSI		11C +0.5	A610MULC	TEHTEC	97ABOBBIN	15	DSH
	1C008	0.3	1	MBM		09H +19.0	A610MULC	TEHTEC	97ABOBBIN	15	MBH
	9509	0.6	1	MBM	0	09H +18.6	A610MULC	TEHTEC			
48 61	1C008	0.3	P 1	DSI		10H -0.2	A610MULC	TEHTEC	97ABOBBIN	15	DSH
48 82	1C017	0.6	1	VOL		09C +25.6	P620MRPC3C	10C09C	97ASI/CL	16	MBH
	9404	0.4	1	MBM	0	09C +25.3	610-EC	TEHTEC			
	9210	0.3	1	MBM	0	09C +25.5	610UL	TECTEH			
	1C017	0.6	1	VOL		09C +30.4	P620MRPC3C	10C09C	97ASI/CL	16	MBH
	9404	0.4	1	MBM	0	09C +30.1	610-EC	TEHTEC			
	9210	0.4	1	16	16	09C +30.1	610UL	TECTEH			
49 37	1C031	1.0	P 5		12	07C +0.0	A610MULC	TEHTEC	97ABOBBIN	13	
49 38	1C005	3.1	P 3	DRI		TEC +6.6	A610MULC	TEHTEC	97ABOBBIN	13	DRH
	9104	3.8	17	DRS	0	TEC +6.8	610UL	TECTEH			
	9104	7.5	19	DRS	0	TEC +6.8	610UL	TECTEH			
	1C031	1.1	P 5		13	07C +0.0	A610MULC	TEHTEC	97ABOBBIN	13	

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Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
49	39	1C006	0.3	P 2		14	07C	+0.4	A610MULC	TEHTEC	97ABOBBIN	14	
49	43	1C031	1.3	P 5		14	07C	+0.0	A610MULC	TEHTEC	97ABOBBIN	14	
		9509	0.6	P2	26	26	07C	+0.4	A610MULC	TEHTEC			
		9404	0.7	M2	20	20	07C	+0.4	610-EC	TEHTEC			
49	44	1C006	0.2	P 2		10	07C	+0.4	A610MULC	TEHTEC	97ABOBBIN	14	
49	45	1C031	0.9	P 5		10	07C	+0.0	A610MULC	TEHTEC	97ABOBBIN	14	
49	46	1C006	0.3	P 2		17	07C	+0.4	A610MULC	TEHTEC	97ABOBBIN	14	
		9509	0.4	P2	19	19	07C	+0.4	A610MULC	TEHTEC			
		9404	0.6	M2	14	14	07C	+0.3	610-EC	TEHTEC			
49	84	1C009	0.3	1	MBM		03C	+25.8	A610MULC	TEHTEC	97ABOBBIN	16	MBH
		9509	0.2	1	34	34	03C	+25.8	A610MULC	TEHTEC			
		9404	0.3	1	37	37	03C	+25.8	610-EC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
47 56	1C006	0.5	P 2		24	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.5	P2	21	21	AV3 +0.0	A610MULC	TEHTEC			
	9404	0.7	M2	16	16	AV3 +0.0	610-EC	TEHTEC			
46 59	1C008	0.4	P 2		22	AV4 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.9	P2	23	23	AV4 +0.1	A610MULC	TEHTEC			
	9404	1.3	M2	26	26	AV4 +0.0	610-EC	TEHTEC			
	9210	0.7	P 2	15	15	AV4 +0.0	610UL	TECTEH			
47 56	1C006	0.4	P 2		20	AV2 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.7	P2	26	26	AV2 +0.0	A610MULC	TEHTEC			
	9404	1.0	M2	21	21	AV2 +0.0	610-EC	TEHTEC			
	9210	0.8	P 2	17	17	AV2 +0.2	610UL	TECTEH			
	9104	0.6	18	15	15	AV2 +0.0	610UL	TECTEH			
	1C006	0.4	P 2		20	AV4 +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.7	P2	26	26	AV4 +0.0	A610MULC	TEHTEC			
	9404	1.0	M2	21	21	AV4 +0.0	610-EC	TEHTEC			
46 59	1C008	0.3	P 2		19	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.6	P2	17	17	AV3 +0.1	A610MULC	TEHTEC			
	9404	0.7	M2	17	17	AV3 +0.0	610-EC	TEHTEC			
	9210	0.9	P 2	20	20	AV3 +0.0	610UL	TECTEH			
	9104	0.5	18	14	14	AV3 +0.0	610UL	TECTEH			
34 59	1C008	0.3	P 2		17	06C +0.3	A610MULC	TEHTEC	97ABOBBIN	15	
49 46	1C006	0.3	P 2		17	07C +0.4	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.4	P2	19	19	07C +0.4	A610MULC	TEHTEC			
	9404	0.6	M2	14	14	07C +0.3	610-EC	TEHTEC			
40 59	1C008	0.2	P 2		15	AV4 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.8	P2	21	21	AV4 -0.0	A610MULC	TEHTEC			
	9404	0.8	M2	20	20	AV4 +0.0	610-EC	TEHTEC			
	9210	0.9	P 2	20	20	AV4 +0.0	610UL	TECTEH			
	9104	0.6	18	19	19	AV4 +0.0	610UL	TECTEH			
39 64	1C008	0.2	P 2		14	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.8	P2	20	20	AV3 +0.0	A610MULC	TEHTEC			
	9404	0.9	M2	19	19	AV3 +0.0	610-EC	TEHTEC			
42 59	1C008	0.2	P 2		14	AV3 +0.0	A610MULC	TEHTEC	97ABOBBIN	15	
	9509	0.9	P2	23	23	AV3 +0.1	A610MULC	TEHTEC			
	9404	1.2	M2	24	24	AV3 +0.0	610-EC	TEHTEC			
	9210	0.8	P 2	16	16	AV3 +0.0	610UL	TECTEH			
49 39	1C006	0.3	P 2		14	07C +0.4	A610MULC	TEHTEC	97ABOBBIN	14	
49 43	1C031	1.3	P 2		14	07C +0.0	A610MULC	TEHTEC	97ABOBBIN	14	
	9509	0.6	P2	26	26	07C +0.4	A610MULC	TEHTEC			
	9404	0.7	M2	20	20	07C +0.4	610-EC	TEHTEC			

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1997 Wear indications with history

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
49	38	1C031	1.1	P 5		13	07C	+0.0	A610MULC	TEHTEC	97ABOBBIN	13	
42	59	1C008	0.2	P 2		12	AV1	+0.0	A610MULC	TEHTEC	97ABOBBIN	15	
		9509	0.7	P2	19	19	AV1	-0.0	A610MULC	TEHTEC			
		9404	0.5	M2	14	14	AV1	+0.0	610-EC	TEHTEC			
		9210	0.5	P 2	11	11	AV1	+0.0	610UL	TECTEH			
43	59	1C008	0.2	P 2		12	AV1	+0.0	A610MULC	TEHTEC	97ABOBBIN	15	
		9509	0.6	P2	16	16	AV1	+0.2	A610MULC	TEHTEC			
		9404	0.5	M2	13	13	AV1	+0.0	610-EC	TEHTEC			
		9210	0.7	P 2	14	14	AV1	+0.0	610UL	TECTEH			
49	37	1C031	1.0	P 2		12	07C	+0.0	A610MULC	TEHTEC	97ABOBBIN	13	
47	56	1C006	0.2	P 2		11	AV1	+0.0	A610MULC	TEHTEC	97ABOBBIN	14	
		9509	0.2	P2	9	9	AV1	+0.0	A610MULC	TEHTEC			
49	44	1C006	0.2	P 2		10	07C	+0.4	A610MULC	TEHTEC	97ABOBBIN	14	
49	45	1C031	0.9	P 2		10	07C	+0.0	A610MULC	TEHTEC	97ABOBBIN	14	

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MBM Indications with related MRPC calls

Row/Col	Year Examined	Reel	Voltage	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested
3 62	09/01/95	1C010	4.6	1	MBM		01C +5.3	A610MULC	TEHTEC
	RPC DATA	1C023			INF		01C +5.3	P620MRPC3C	02CTSC
6 58	09/01/95	1C010	7.2	1	MBM		01C +2.6	A610MULC	TEHTEC
	RPC DATA	1C029			INF		01C +2.6	P620MRPC3C	02C01C
8 88	05/03/97	1C014	13.1	1	MBM		01C +2.8	A610MULC	TEHTECMBH
	RPC DATA	1C017	1.9	1	VOL		01C +3.2	P620MRPC3C	02C01C
14 62	09/01/95	1C009	0.6	1	MBM		08H +33.4	A610MULC	TEHTEC
	RPC DATA	1H072	0.7	1	VOL		09H +26.5	P620MRPC3C	09H08H
	RPC DATA	1H072	0.1	P 2	VOL		08H +32.6	P620MRPC3C	09H08H
	09/01/95	1C009	1.2	1	MBM		09H +25.9	A610MULC	TEHTEC
	RPC DATA	1H072	0.7	1	VOL		09H +26.5	P620MRPC3C	09H08H
	RPC DATA	1H072	0.1	P 2	VOL		08H +32.6	P620MRPC3C	09H08H
16 46	09/01/95	1C001	0.4	1	MBM		01H +9.7	A610MULC	TEHTEC
	RPC DATA	1H073	1.1	1	VOL		01H +7.0	P620MRPC3C	05H01H
21 68	05/03/97	1C011	0.5	1	MBM		09H +31.3	A610MULC	TEHTECMBH
	RPC DATA	1H072	0.9	1	INR		09H +31.4	P620MRPC3C	10H09H
26 60	05/03/97	1C011	0.3	1	MBM		04C +12.4	A610MULC	TEHTECMBH
27 64	09/01/95	1C009	1.0	1	MBM		05C +15.7	A610MULC	TEHTEC
	RPC DATA	1C017	0.8	1	VOL		05C +16.3	P620MRPC3C	06C05C
27 75	05/03/97	1C011	0.3	1	MBM		08H +21.5	A610MULC	TEHTECMBH
	RPC DATA	1H072	1.1	1	VOL		08H +21.0	P620MRPC3C	09H08H
40 97	05/03/97	1C010	0.0	1	MBM		10C +20.9	A610MULC	TEHTECMBH
	RPC DATA	1C017	0.6	1	VOL		10C +20.8	P620MRPC3C	11C10C
41 74	09/01/95	1C008	0.7	1	MBM		09H +40.4	A610MULC	TEHTEC
	RPC DATA	1H072	1.3	1	VOL		09H +40.1	P620MRPC3C	10H09H
47 71	09/01/95	1C008	0.8	1	MBM		07C +20.0	A610MULC	TEHTEC
	RPC DATA	1C017	0.9	1	VOL		07C +20.2	P620MRPC3C	08C07C
48 59	04/28/97	1C008	0.3	1	MBM		09H +19.0	A610MULC	TEHTECMBH
	RPC DATA	1H072	2.1	1	INR		09H +18.4	P620MRPC3C	10H09H
	09/01/95	1C007	0.5	1	MBM		07C +38.9	A610MULC	TEHTEC
	RPC DATA	1C017	0.4	1	VOL		07C +39.2	P620MRPC3C	08C07C
49 84	05/03/97	1C009	0.3	1	MBM		03C +25.8	A610MULC	TEHTECMBH
	RPC DATA	1C017	0.1	1	VOL		03C +25.8	P620MRPC3C	05C03C

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DNT Indications with related MRPC calls

Row/Col	Year Examined	Reel	Voltage	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested
15 112	05/02/97	1C037	110.4	P 1	DNT		11H	+1.0	A560SFRM	TEHTEC
	RPC DATA	1H073			RES				P620MRPC3C	
	RPC DATA	1H085			OBS		11H	+0.0	P580MRPC1C	
15 112	05/02/97	1C037	74.9	P 1	DNT		10H	+0.7	A560SFRM	TEHTEC
	RPC DATA	1H036							B620MRPC3C	10H10H
18 111	05/02/97	1C037	52.1	P 1	DNT		11H	-0.3	A560SFRM	TEHTEC
	RPC DATA	1H072			RES		11H	+1.4	P620MRPC3C	
	RPC DATA	1H085			OBS		10H	+0.0	P580MRPC1C	
22 105	04/28/97	1C010	8.3	P 1	DNT		07H	+0.4	A610MULC	TEHTEC
	RPC DATA	1H035							B620MRPC3C	07H07H
23 105	04/28/97	1C010	12.3	P 1	DNT		07H	+0.4	A610MULC	TEHTEC
	RPC DATA	1H035	0.5	11	PLP		07H	+1.4	B620MRPC3C	07H07H
38 99	05/02/97	1C037	13.4	P 1	DNT		08H	-0.3	A560SFRM	TEHTEC
	RPC DATA	1H036							B620MRPC3C	08H07H

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1997 Diagnostic exams with originating Bobbin data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
18 95	1C018			INR		TEC +5.5	P620MRPC3C	01CTEC	97ABOBBIN	11	
	9704	2.7	P 1	DRI	0	TEC +5.5	A610MULC	TEHTEC			
30 95	1H084			INF		TEH +3.7	P620MRPC3C	TEHTSH	97ABOBBIN	11	
	9704	2.6	P 1	DRI	0	TEH +3.7	A610MULC	TEHTEC			
40 56	1H084			INF		TSH -1.2	P620MRPC3C	TEHTSH	97ABOBBIN	14	
48 59	1C018	0.4	P 1	WAR		11C +0.5	P620MRPC3C	11C11C	97ABOBBIN	15	
	9704	0.3	P 1	DSI	0	11C +0.5	A610MULC	TEHTEC			
48 61	1H084			INF		10H -0.2	P620MRPC3C	10H10H	97ABOBBIN	15	
	9704	0.3	P 1	DSI	0	10H -0.2	A610MULC	TEHTEC			
49 37	1C018	0.7	P 1	WAR		07C +0.2	P620MRPC3C	07C07C	97ABOBBIN	13	
	9704	0.3	P 2	RWS	0	07C +0.3	A610MULC	TEHTEC			
	9704	1.0	P 5		12	07C +0.0	A610MULC	TEHTEC			
49 38	1C018	0.6	P 1	WAR		07C +0.3	P620MRPC3C	07C07C	97ABOBBIN	13	
	9704	0.4	P 2	RWS	0	07C +0.3	A610MULC	TEHTEC			
	9704	1.1	P 5		13	07C +0.0	A610MULC	TEHTEC			
	1C018			INR		TEC +6.6	P620MRPC3C	TSCTEC	97ABOBBIN	13	
	9704	3.1	P 3	DRI	0	TEC +6.6	A610MULC	TEHTEC			
49 43	1C018	0.3	P 2	WAR		07C +0.4	P620MRPC3C	07C07C	97ABOBBIN	14	
	9704	0.7	P 2	RWS	0	07C +0.4	A610MULC	TEHTEC			
	9704	1.3	P 5		14	07C +0.0	A610MULC	TEHTEC			
49 45	1C018	0.8	P 1	WAR		07C +0.3	P620MRPC3C	07C07C	97ABOBBIN	14	
	9704	0.3	P 2	RWS	0	07C +0.3	A610MULC	TEHTEC			
	9704	0.9	P 5		10	07C +0.0	A610MULC	TEHTEC			
49 61	1C018		2	PID		09C +0.1	P620MRPC3C	09C09C	97ABOBBIN	15	
	9704	1.4	P 1	DSI	0	09C +0.1	A610MULC	TEHTEC			
49 83	1C041	0.8	1	PIT		05C +19.1	P620MRPC3C80	07C05C	97ABOBBIN	16	
	9704	0.9	1	NQI	0	05C +19.1	A610MULC	TEHTEC			

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1997 Plugged Tubes with Historic data

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
1	5	2H072			OBS		11H	-0.2	P620MRPC3C	11H11H	97BSI/HL	1	
		9704	0.0		OBS	0	11H	-0.2	P620MRPC3C	11H11H			
		9404	21.3	M1	DNT	0	11H	-0.2	590-EC	11H10C			
		9210	15.1	P 1	DNT	0	11H	-0.3	590SM	11CTEH			
		8910	15.5	M1	DSS	0	11H	+0.3	590SM	11CTEH			
		8808	13.9	M1	DSS	0	11H	+0.3	590SM	11CTEH			
1	16	2H065			OBS		11H	+0.0	A560SFRM	11CTEH	97BBOB/HL	1	
		9704	0.0		OBS	0	11H	+0.0	A560SFRM	11CTEH			
		9404	23.5	M1	DNT	0	11H	-0.2	590-EC	11H10C			
		9210	15.9	P 1	DNT	0	11H	-0.2	590SM	11CTEH			
		8910	12.3	M1	DSS	0	11H	-0.5	590SM	11CTEH			
		8808	16.4	M1	DSS	0	11H	-0.8	590SM	11CTEH			
10	85	2H068	5.7	2	MAI		TEH	+10.4	P620MRPC3C	TSHTEH	97BBOBBIN	5	
		9704	0.0		PID	0	TEH	+10.6	P620MRPC3C	TSHTEH			
		9704	5.7	2	MAI	0	TEH	+10.4	P620MRPC3C	TSHTEH			
		9704	6.8	P 1	DRI	0	TEH	+10.6	A610MULC	TEHTEC			
		8605	687.8		OXP	0	TEH	+7.3To+10.4	630CF	01HTEH			
23	72	2H016	0.3	P 2	MCI		TSH	-0.1	P620MRPC3C	TSH+2	97BMRPC	10	
		9704	0.3	P 2	MCI	0	TSH	-0.1	P620MRPC3C	TSH+2			
		9704	0.0		PID	0	TSH	-0.1	P620MRPC3C80	TSH+2			
		8605	677.2		TMR	0	TSH	+0.1	630CF	01HTEH			
		8605	665.4		NOM	0	TSH	+2.3	630CF	01HTEH			
37	60	2H062	0.9	2	SAI		TSH	+0.0	P620MRPC3C	TSH+2	97BMRPC	15	
		9704	0.9	2	SAI	0	TSH	+0.0	P620MRPC3C	TSH+2			
		9704	0.0		PID	0	TSH	-0.0	P620MRPC3C	TSH+2			
		8605	664.2		NOM	0	TSH	+2.3	630CF	01HTEH			
		8605	679.9		TMR	0	TSH	+0.1	630CF	01HTEH			
38	41	2H023	0.5	P 2	SCI		TSH	-0.2	P620MRPC3C	TSH+2	97BMRPC	14	
		9704	0.5	P 2	SCI	0	TSH	-0.2	P620MRPC3C	TSH+2			
		9704	0.0		PID	0	TSH	-0.2	P620MRPC3C80	TSH+2			
		8605	679.5		TMR	0	TSH	+0.0	630CF	01HTEH			
		8605	666.1		NOM	0	TSH	+2.3	630CF	01HTEH			
45	86	2H030	1.0	2	SAI		TSH	-2.3	P620MRPC3C	TSH+2	97BMRPC	16	
		9704	1.0	2	SAI	0	TSH	-2.3	P620MRPC3C	TSH+2			
		9704	0.0		PID	0	TSH	-2.3	P620MRPC3C80	TSH+2			
		8605	677.6		TMR	0	TSH	-0.4	630CF	01HTEH			
		8605	676.4		ETL	0	TSH	+0.5	630CF	01HTEH			
		8605	663.4		NOM	0	TSH	+2.3	630CF	01HTEH			
49	31	2C031	1.0	2	PLI		02C	+2.4	P620MRPC3C	03C02C	97BBOBBIN	13	
		9704	0.0		PID	0	02C	+2.5	P620MRPC3C	03C02C			
		9704	1.0	2	PLI	0	02C	+2.4	P620MRPC3C	03C02C			
		9704	0.9	1	NQI	0	02C	+2.5	A610MULC	TEHTEC			
		9210	88.9	P 1	EXP	0	02C	+0.0	610UL	TECTEH			
		8910	93.8	M1	EXP	0	02C	+0.0	610SL	TECTEH			
		8808	83.2	M1	EXP	0	02C	+0.0	610SM	TECTEH			
		8408	147.4	1	EXP	0	02C	+0.0	610SM	TECTEH			

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1997 Special Interest exams with historic data

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
1	5	2H072			OBS		11H	-0.2	P620MRPC3C	11H11H	97BSI/HL	1	
		9404	21.3	M1	DNT	0	11H	-0.2	590-EC	11H10C			
		9210	15.1	P 1	DNT	0	11H	-0.3	590SM	11CTEH			
		8910	15.5	M1	DSS	0	11H	+0.3	590SM	11CTEH			
		8808	13.9	M1	DSS	0	11H	+0.3	590SM	11CTEH			
4	43	2H055			INR		01H	+3.6	P620MRPC3C	03H01H	97BSI/HL	3	
		9404	6.6	5	MBM	0	01H	+3.6	610-EC	11HTEH			
		9210	3.2	1	INR	0	01H	+1.7	610UL	TECTEH			
5	1	2C015	0.6	1	VOL		08C	+6.6	P620MRPC3C	10C08C	97BSI/CL	1	
		9704	0.8	1	MBM	0	08C	+6.6	A610MULC	TEHTEC			
		9509	0.9	1	MBM	0	08C	+6.6	A610MULC	TEHTEC			
		9404	2.4	6	MBM	0	08C	+6.8	610-EC	TEHTEC			
		9210	0.9	1	8	8	08C	+6.7	610UL	TECTEH			
		2C015	0.9	1	VOL		09C	+18.1	P620MRPC3C	10C08C	97BSI/CL	1	
		9704	0.5	1	MBM	0	09C	+17.8	A610MULC	TEHTEC			
		9509	0.7	1	MBM	0	09C	+17.8	A610MULC	TEHTEC			
		9404	4.1	6	MBM	0	09C	+17.8	610-EC	TEHTEC			
		9210	0.8	1	5	5	09C	+17.9	610UL	TECTEH			
5	62	2C015	0.8	1	VOL		10C	+15.8	P620MRPC3C	11C10C	97BSI/CL	4	MBH
		9509	0.5	1	MBM	0	10C	+15.6	A610MULC	TEHTEC			
		9404	0.7	1	6	6	10C	+15.7	610-EC	11HTEC			
6	92	2H054			INF		03H	+18.1	P620MRPC3C	05H03H	97BSI/HL	5	
		9509	0.3	1	MBM	0	03H	+18.1	A610MULC	TEHTEC			
		9404	0.2	1	12	12	03H	+18.0	610-EC	TEHTEC			
7	79	2C015	1.6	1	VOL		09C	+35.3	P620MRPC3C	10C09C	97BSI/CL	5	MBH
		9509	0.6	1	MBM	0	09C	+35.2	A610MULC	TEHTEC			
		9404	0.6	1	6	6	09C	+35.2	610-EC	TEHTEC			
9	98	2C015			INR		04C	+12.7	P620MRPC3C	05C04C	97BSI/CL	6	
		9509	0.5	1	MBM	0	04C	+12.7	A610MULC	TEHTEC			
		9404	0.5	1	5	5	04C	+12.8	610-EC	TECTEH			
11	48	2H055	0.5	1	VOL		03H	+12.8	P620MRPC3C	05H03H	97BSI/HL	3	MBH
		9509	0.4	1	MBM	0	03H	+13.2	A610MULC	TEHTEC			
		9404	0.5	1	14	14	03H	+13.1	610-EC	TEHTEC			
		9210	0.5	1	9	9	03H	+12.9	610UL	TECTEH			
12	16	2C015	1.8	1	VOL		09C	+17.1	P620MRPC3C	10C09C	97BSI/CL	1	MBH
		9404	5.7	6	MBM	0	09C	+17.1	610-EC	TEHTEC			
		8910	1.4	1	INR	0	09C	+16.9	610SL	TECTEH			
		8808	1.3	1	MBM	0	09C	+17.0	610SM	TECTEH			
12	57	2H055	1.2	1	VOL		07H	+30.9	P620MRPC3C	08H07H	97BSI/HL	3	MBH
		9509	0.7	1	MBM	0	07H	+31.5	A610MULC	TEHTEC			
		9404	0.7	1	10	10	07H	+31.2	610-EC	TEHTEC			
13	61	2C015	1.3	1	VOL		05C	+16.7	P620MRPC3C	06C05C	97BSI/CL	4	MBH
		9509	0.6	1	MBM	0	05C	+16.5	A610MULC	TEHTEC			
		9404	0.6	1	7	7	05C	+16.4	610-EC	TEHTEC			
13	67	2C015	1.0	1	VOL		09C	+29.5	P620MRPC3C	10C09C	97BSI/CL	4	MBH
		9509	0.4	1	MBM	0	09C	+29.5	A610MULC	TEHTEC			
		9404	0.5	1	17	17	09C	+29.2	610-EC	TEHTEC			
		8910	0.6	1	INR	0	09C	+29.2	610SL	TECTEH			
		8808	0.7	1	MBM	0	09C	+29.2	610SM	TECTEH			
		8408	0.9	1	16	16	09C	+29.0	610SM	TECTEH			

1997 Special Interest exams with historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
14 109	2H054			INR		10H +11.3	P620MRPC3C	10H11H	97BSI/HL	6	
	9509	1.0	1	MBM	0	10H +11.3	A610MULC	TEHTEC			
	8808	1.6	1	INR	0	10H +10.3	610SM	TECTEH			
	8408	1.7	1	16	16	10H +10.3	610SM	TECTEH			
15 12	2H056			INR		TSH +3.6	P620MRPC3C	TSHTSH	97BSI/HL	1	
	9509	1.4	1	MBM	0	TSH +3.6	B620MRPC3C	TSHTSH			
	8605	677.2		TMR	0	TSH +0.1	630CF	01HTEH			
	8605	663.8		NOM	0	TSH +2.3	630CF	01HTEH			
15 48	2H055	0.6	1	VOL		01H +14.9	P620MRPC3C	03H01H	97BSI/HL	3	MBH
	9404	37.5	6	MBM	0	01H +14.2To+23.2	610-EC	TEHTEC			
	9404	0.0	1	INR	0	01H +14.7	610-EC	TEHTEC			
	8910	2.1	1	INR	0	01H +14.4To+22.4	610SL	TECTEH			
	8408	0.0	1	UDS	0	01H +13.9	610SM	TECTEH			
15 50	2H055	1.1	1	VOL		07H +25.5	P620MRPC3C	08H07H	97BSI/HL	3	
	9704	0.6	1	MBM	0	07H +26.3	A610MULC	TEHTEC			
	9509	0.7	1	MBM	0	07H +26.3	A610MULC	TEHTEC			
	9404	0.7	1	12	12	07H +26.0	610-EC	TEHTEC			
	8808	0.7	1	INR	0	07H +24.8	610SM	TECTEH			
	8408	1.1	1	23	23	07H +24.8	610SM	TECTEH			
15 62	2H054	0.7	1	VOL		05H +30.1	P620MRPC3C	07H03H	97BSI/HL	4	MBH
	9509	0.6	1	MBM	0	05H +30.1	A610MULC	TEHTEC			
	8910	1.0	1	INR	0	05H +29.6	610SL	TECTEH			
	8808	0.8	1	MBM	0	05H +29.6	610SM	TECTEH			
	8408	1.1	1	26	26	05H +28.7	610SM	TECTEH			
	2H054	0.7	1	VOL		03H +20.6	P620MRPC3C	07H03H	97BSI/HL	4	
	9509	0.6	1	MBM	0	03H +20.6	A610MULC	TEHTEC			
	9404	0.7	1	14	14	03H +20.6	610-EC	TEHTEC			
	8910	0.8	1	INR	0	03H +20.6	610SL	TECTEH			
	8808	0.7	1	MBM	0	03H +20.6	610SM	TECTEH			
	8408	1.1	1	24	24	03H +19.7	610SM	TECTEH			
15 67	2C015	0.9	1	VOL		03C +14.8	P620MRPC3C	04C03C	97BSI/CL	4	MBH
	9509	0.6	1	MBM	0	03C +14.6	A610MULC	TEHTEC			
	9404	0.6	1	9	9	03C +14.7	610-EC	TEHTEC			
	8910	0.5	1	INR	0	03C +14.7	610SL	TECTEH			
	8808	0.7	1	MBM	0	03C +14.7	610SM	TECTEH			
	8408	1.1	1	17	17	03C +14.7	610SM	TECTEH			
15 80	2C015	0.8	1	VOL		07C +5.2	P620MRPC3C	08C07C	97BSI/CL	5	
	9704	0.3	1	MBM	0	07C +5.5	A610MULC	TEHTEC			
	9509	0.3	1	MBM	0	07C +5.5	A610MULC	TEHTEC			
	9404	0.4	1	15	15	07C +5.6	610-EC	TEHTEC			
16 72	2C015	0.9	1	VOL		07C +5.6	P620MRPC3C	08C07C	97BSI/CL	4	MBH
	9509	0.3	1	MBM	0	07C +5.3	A610MULC	TEHTEC			
	9404	0.3	1	10	10	07C +5.7	610-EC	TEHTEC			
	9210	0.3	1	11	11	07C +5.7	610UL	TECTEH			
17 78	2H054	1.2	1	VOL		TSH +2.7	P620MRPC3C	01HTSH	97BSI/HL	11	MBH
	9509	1.5	1	MBM	0	TSH +2.7	B620MRPC3C	TSHTSH			
	8605	676.8		TMR	0	TSH +0.0	630CF	01HTEH			
	8605	665.4		NOM	0	TSH +2.3	630CF	01HTEH			
19 86	2C015	1.0	1	VOL		10C +26.6	P620MRPC3C	11C10C	97BSI/CL	11	MBH
	9509	0.6	1	MBM	0	10C +26.4	A610MULC	TEHTEC			
	9404	0.4	1	5	5	10C +26.4	610-EC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
20 45	2H055	1.9	1	VOL		10H +34.8	P620MRPC3C	11H10H	97BSI/HL	9	
	9704	0.6	1	MBM	0	10H +35.4	A610MULC	TEHTEC			
	9404	4.8	6	MBM	0	10H +35.2	610-EC	TEHTEC			
	8808	0.7	1	INR	0	10H +33.4	610SM	TECTEH			
	8408	0.9	1	18	18	10H +33.4	610SM	TECTEH			
29 67	2C015	1.8	1	VOL		10C +3.4	P620MRPC3C	11C10C	97BSI/CL	10	
	9704	0.8	1	MBM	0	10C -1.2	A610MULC	TEHTEC			
	9704	0.6	1	MBM	0	10C +3.7	A610MULC	TEHTEC			
	9509	0.6	1	MBM	0	10C +3.7	A610MULC	TEHTEC			
	9509	0.7	1	19	19	10C -0.8	A610MULC	TEHTEC			
	9404	0.7	1	14	14	10C -0.9	610-EC	TEHTEC			
	2C015	1.8	1	VOL		10C -0.9	P620MRPC3C	11C10C	97BSI/CL	10	
	9704	0.8	1	MBM	0	10C -1.2	A610MULC	TEHTEC			
	9704	0.6	1	MBM	0	10C +3.7	A610MULC	TEHTEC			
	9509	0.6	1	MBM	0	10C +3.7	A610MULC	TEHTEC			
	9509	0.7	1	19	19	10C -0.8	A610MULC	TEHTEC			
	9404	0.7	1	14	14	10C -0.9	610-EC	TEHTEC			
33 46	2H055	1.3	1	VOL		10H +37.5	P620MRPC3C	11H10H	97BSI/HL	14	MBH
	9509	1.1	1	MBM	0	10H +37.9	A610MULC	TEHTEC			
	9404	1.2	1	3	3	10H +38.5	610-EC	TEHTEC			
	8808	1.2	1	INR	0	10H +36.4	610SM	TECTEH			
	8408	1.9	1	14	14	10H +36.4	610SM	TECTEH			
	2H055	2.7	1	VOL		10H +26.0	P620MRPC3C	11H10H	97BSI/HL	14	MBH
	9509	1.2	1	MBM	0	10H +26.8	A610MULC	TEHTEC			
	9404	1.2	1	16	16	10H +27.3	610-EC	TEHTEC			
	8808	1.3	1	INR	0	10H +25.6	610SM	TECTEH			
	8408	2.5	1	25	25	10H +25.6	610SM	TECTEH			
39 18	2H055			INR		11H +0.4	P620MRPC3C	11H11H	97BSI/HL	13	
	9704	0.6	P 1	DSI	0	11H +0.4	A610MULC	TEHTEC			
	9509	0.3	P2	15	15	11H +0.4	A610MULC	TEHTEC			
40 96	2C015			INR		02C +0.5	P620MRPC3C	02C02C	97BSI/CL	16	
	9704	0.7	P 5		12	02C +0.7	A610MULC	TEHTEC			
	9509	0.8	P2	25	25	02C +0.5	A610MULC	TEHTEC			
41 55	2H055	2.8	1	VOL		08H +7.9	P620MRPC3C	09H08H	97BSI/HL	14	
	9704	0.6	1	MBM	0	08H +8.4	A610MULC	TEHTEC			
	9404	5.3	6	MBM	0	08H +8.3	610-EC	TEHTEC			
	9210	1.0	1	6	6	08H +8.3	610UL	TECTEH			
	8808	1.1	1	INR	0	08H +8.6	610SM	TECTEH			
	8408	1.6	1	20	20	08H +8.6	610SM	TECTEH			
47 72	2C015			INR		05C +0.6	P620MRPC3C	05C05C	97BSI/CL	15	
	9704	0.2	P 2		18	05C +0.3	A610MULC	TEHTEC			
	9509	0.4	P2	16	16	05C +0.6	A610MULC	TEHTEC			
	9404	0.4	M2	15	15	05C +0.1	610-EC	TEHTEC			
	9210	0.4	P 2	5	5	05C +0.3	610UL	TECTEH			
	9210	1.0	P 2	WAR	0	05C +0.4	610UL	TECTEH			
48 72	2C015			INR		05C +0.5	P620MRPC3C	05C05C	97BSI/CL	15	
	9509	0.3	P2	12	12	05C +0.5	A610MULC	TEHTEC			
	9404	0.6	M2	19	19	05C +0.2	610-EC	TEHTEC			
	9210	0.4	P 2	6	6	05C +0.4	610UL	TECTEH			
	9210	0.9	P 2	WAR	0	05C +0.5	610UL	TECTEH			

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Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
49	48	2C015			INF		07C	+0.3	P620MRPC3C	08C07C	97BSI/CL	14	
		9704	0.4	P 5		7	07C	+0.3	A610MULC	TEHTEC			
		9509	0.8	P1	MBM	0	07C	+0.3	A610MULC	TEHTEC			
		9404	0.5	M1	7	7	07C	+0.2	610-EC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
2 16	2H060	0.4	1	MBM		01H +24.9	A610MULC	11HTEH	97BBOB/HL	1	MBH
2 89	2C013	0.9	1	MBM		09C +31.6	A610MULC	11CTEC	97BBOBBIN	5	MBH
2 99	2C013	0.7	1	MBM		07C +4.0	A610MULC	11CTEC	97BBOBBIN	6	MBH
5 1	2C003	0.8	1	MBM		08C +6.6	A610MULC	TEHTEC	97BBOBBIN	1	MBH
	9509	0.9	1	MBM	0	08C +6.6	A610MULC	TEHTEC			
	9404	2.4	6	MBM	0	08C +6.8	610-EC	TEHTEC			
	9210	0.9	1	8	8	08C +6.7	610UL	TECTEH			
	2C003	0.5	1	MBM		09C +17.8	A610MULC	TEHTEC	97BBOBBIN	1	MBH
	9509	0.7	1	MBM	0	09C +17.8	A610MULC	TEHTEC			
	9404	4.1	6	MBM	0	09C +17.8	610-EC	TEHTEC			
	9210	0.8	1	5	5	09C +17.9	610UL	TECTEH			
5 62	2C015	0.8	1	VOL		10C +15.8	P620MRPC3C	11C10C	97BSI/CL	4	MBH
	9509	0.5	1	MBM	0	10C +15.6	A610MULC	TEHTEC			
	9404	0.7	1	6	6	10C +15.7	610-EC	11HTEC			
7 79	2C015	1.6	1	VOL		09C +35.3	P620MRPC3C	10C09C	97BSI/CL	5	MBH
	9509	0.6	1	MBM	0	09C +35.2	A610MULC	TEHTEC			
	9404	0.6	1	6	6	09C +35.2	610-EC	TEHTEC			
10 85	2C013	6.8 P	1	DRI		TEH +10.6	A610MULC	TEHTEC	97BBOBBIN	5	DRH
11 48	2H055	0.5	1	VOL		03H +12.8	P620MRPC3C	05H03H	97BSI/HL	3	MBH
	9509	0.4	1	MBM	0	03H +13.2	A610MULC	TEHTEC			
	9404	0.5	1	14	14	03H +13.1	610-EC	TEHTEC			
	9210	0.5	1	9	9	03H +12.9	610UL	TECTEH			
12 16	2C015	1.8	1	VOL		09C +17.1	P620MRPC3C	10C09C	97BSI/CL	1	MBH
	9404	5.7	6	MBM	0	09C +17.1	610-EC	TEHTEC			
12 57	2H055	1.2	1	VOL		07H +30.9	P620MRPC3C	08H07H	97BSI/HL	3	MBH
	9404	0.7	1	10	10	07H +31.2	610-EC	TEHTEC			
13 61	2C015	1.3	1	VOL		05C +16.7	P620MRPC3C	06C05C	97BSI/CL	4	MBH
	9509	0.6	1	MBM	0	05C +16.5	A610MULC	TEHTEC			
	9404	0.6	1	7	7	05C +16.4	610-EC	TEHTEC			
13 67	2C015	1.0	1	VOL		09C +29.5	P620MRPC3C	10C09C	97BSI/CL	4	MBH
	9509	0.4	1	MBM	0	09C +29.5	A610MULC	TEHTEC			
	9404	0.5	1	17	17	09C +29.2	610-EC	TEHTEC			
15 48	2H055	0.6	1	VOL		01H +14.9	P620MRPC3C	03H01H	97BSI/HL	3	MBH
	9404	0.0	1	INR	0	01H +14.7	610-EC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
15 50	2C005	0.6	1	MBM		07H +26.3	A610MULC	TEHTEC	97BBOBBIN	3	MBH
	9509	0.7	1	MBM	0	07H +26.3	A610MULC	TEHTEC			
	9404	0.7	1	12	12	07H +26.0	610-EC	TEHTEC			
15 62	2H054	0.7	1	VOL		05H +30.1	P620MRPC3C	07H03H	97BSI/HL	4	MBH
	9509	0.6	1	MBM	0	05H +30.1	A610MULC	TEHTEC			
15 67	2C015	0.9	1	VOL		03C +14.8	P620MRPC3C	04C03C	97BSI/CL	4	MBH
	9509	0.6	1	MBM	0	03C +14.6	A610MULC	TEHTEC			
	9404	0.6	1	9	9	03C +14.7	610-EC	TEHTEC			
15 80	2C013	0.3	1	MBM		07C +5.5	A610MULC	TEHTEC	97BBOBBIN	5	MBH
	9509	0.3	1	MBM	0	07C +5.5	A610MULC	TEHTEC			
	9404	0.4	1	15	15	07C +5.6	610-EC	TEHTEC			
16 72	2C015	0.9	1	VOL		07C +5.6	P620MRPC3C	08C07C	97BSI/CL	4	MBH
	9509	0.3	1	MBM	0	07C +5.3	A610MULC	TEHTEC			
	9404	0.3	1	10	10	07C +5.7	610-EC	TEHTEC			
	9210	0.3	1	11	11	07C +5.7	610UL	TECTEH			
17 78	2H054	1.2	1	VOL		TSH +2.7	P620MRPC3C	01HTSH	97BSI/HL	11	MBH
	9509	1.5	1	MBM	0	TSH +2.7	B620MRPC3C	TSHTSH			
19 86	2C015	1.0	1	VOL		10C +26.6	P620MRPC3C	11C10C	97BSI/CL	11	MBH
	9509	0.6	1	MBM	0	10C +26.4	A610MULC	TEHTEC			
	9404	0.4	1	5	5	10C +26.4	610-EC	TEHTEC			
20 45	2C007	0.6	1	MBM		10H +35.4	A610MULC	TEHTEC	97BBOBBIN	9	MBH
	9404	4.8	6	MBM	0	10H +35.2	610-EC	TEHTEC			
21 30	2C006	0.1	1	NQI		07H +14.6	A610MULC	TEHTEC	97BBOBBIN	8	NQH
	9404	0.1	1	UDS	0	07H +14.6	610-EC	TEHTEC			
28 97	2C010	0.4	P 2		25	AV4 +0.1	A610MULC	TEHTEC	97BBOBBIN	12	
	9509	0.5	P2	22	22	AV4 +0.2	A610MULC	TEHTEC			
	9404	0.6	M2	20	20	AV4 +0.0	610-EC	TEHTEC			
	9210	0.5	P 2	22	22	AV4 +0.0	610UL	TECTEH			
29 25	2C006	0.2	1	MBM		07C +10.0	A610MULC	TEHTEC	97BBOBBIN	8	MBH
29 67	2C011	0.8	1	MBM		10C -1.2	A610MULC	TEHTEC	97BBOBBIN	10	MBH
	9509	0.7	1	19	19	10C -0.8	A610MULC	TEHTEC			
	9404	0.7	1	14	14	10C -0.9	610-EC	TEHTEC			
	2C011	0.6	1	MBM		10C +3.7	A610MULC	TEHTEC	97BBOBBIN	10	MBH
	9509	0.6	1	MBM	0	10C +3.7	A610MULC	TEHTEC			
33 46	2H055	1.3	1	VOL		10H +37.5	P620MRPC3C	11H10H	97BSI/HL	14	MBH
	9509	1.1	1	MBM	0	10H +37.9	A610MULC	TEHTEC			
	2H055	2.7	1	VOL		10H +26.0	P620MRPC3C	11H10H	97BSI/HL	14	MBH

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Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
38	35	2C008	0.4	1	MBM		07H	+16.6	A610MULC	TEHTEC	97BBOBBIN	13	MBH
40	96	2C026	0.7	P 5		12	02C	+0.7	A610MULC	TEHTEC	97BBOBBIN	16	
		9509	0.8	P2	25	25	02C	+0.5	A610MULC	TEHTEC			
41	38	2C008	0.2	P 2		16	AV3	+0.0	A610MULC	TEHTEC	97BBOBBIN	13	
		9509	0.4	P2	17	17	AV3	-0.1	A610MULC	TEHTEC			
		9404	0.6	M2	18	18	AV3	+0.0	610-EC	TEHTEC			
41	55	2C008	0.6	1	MBM		08H	+8.4	A610MULC	TEHTEC	97BBOBBIN	14	MBH
		9404	5.3	6	MBM	0	08H	+8.3	610-EC	TEHTEC			
		9210	1.0	1	6	6	08H	+8.3	610UL	TECTEH			
42	56	2C008	0.2	P 2		16	AV2	+0.0	A610MULC	TEHTEC	97BBOBBIN	14	
		9509	0.7	P2	25	25	AV2	-0.0	A610MULC	TEHTEC			
		9404	0.8	M2	23	23	AV2	+0.0	610-EC	TEHTEC			
		9404	1.1	M1	BDA	0	AV2	+0.0	610-EC	TECTEH			
		9210	0.5	P 2	21	21	AV2	+0.0	610UL	TECTEH			
45	59	2C009	0.5	P 2		32	AV1	-0.0	A610MULC	TEHTEC	97BBOBBIN	15	
		2C009	0.5	P 2		30	AV4	+0.0	A610MULC	TEHTEC	97BBOBBIN	15	
46	59	2C009	0.4	P 2		26	AV2	+0.2	A610MULC	TEHTEC	97BBOBBIN	15	
		9509	0.9	P2	27	27	AV2	+0.0	A610MULC	TEHTEC			
		9404	1.0	M2	25	25	AV2	+0.0	610-EC	TEHTEC			
		9210	0.8	P 2	26	26	AV2	+0.0	610UL	TECTEH			
		2C009	0.3	P 2		23	AV4	+0.0	A610MULC	TEHTEC	97BBOBBIN	15	
		9509	0.5	P2	18	18	AV4	+0.0	A610MULC	TEHTEC			
47	72	2C009	0.2	P 2		18	05C	+0.3	A610MULC	TEHTEC	97BBOBBIN	15	
		9509	0.4	P2	16	16	05C	+0.6	A610MULC	TEHTEC			
		9404	0.4	M2	15	15	05C	+0.1	610-EC	TEHTEC			
		9210	0.4	P 2	5	5	05C	+0.3	610UL	TECTEH			
		9210	1.0	P 2	WAR	0	05C	+0.4	610UL	TECTEH			
48	71	2C009	0.1	P 2		12	05C	-0.4	A610MULC	TEHTEC	97BBOBBIN	15	
49	48	2C026	0.4	P 5		7	07C	+0.3	A610MULC	TEHTEC	97BBOBBIN	14	
		9509	0.8	P1	MBM	0	07C	+0.3	A610MULC	TEHTEC			
		9404	0.5	M1	7	7	07C	+0.2	610-EC	TEHTEC			
49	84	2C010	0.2	P 2		17	07C	-0.2	A610MULC	TEHTEC	97BBOBBIN	16	

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45	59	2C009	0.5	P 2		32	AV1	-0.0	A610MULC	TEHTEC	97BBOBBIN	15	
		2C009	0.5	P 2		30	AV4	+0.0	A610MULC	TEHTEC	97BBOBBIN	15	
46	59	2C009	0.4	P 2		26	AV2	+0.2	A610MULC	TEHTEC	97BBOBBIN	15	
		9509	0.9	P2	27	27	AV2	+0.0	A610MULC	TEHTEC			
		9404	1.0	M2	25	25	AV2	+0.0	610-EC	TEHTEC			
		9210	0.8	P 2	26	26	AV2	+0.0	610UL	TECTEH			
28	97	2C010	0.4	P 2		25	AV4	+0.1	A610MULC	TEHTEC	97BBOBBIN	12	
		9509	0.5	P2	22	22	AV4	+0.2	A610MULC	TEHTEC			
		9404	0.6	M2	20	20	AV4	+0.0	610-EC	TEHTEC			
		9210	0.5	P 2	22	22	AV4	+0.0	610UL	TECTEH			
46	59	2C009	0.3	P 2		23	AV4	+0.0	A610MULC	TEHTEC	97BBOBBIN	15	
		9509	0.5	P2	18	18	AV4	+0.0	A610MULC	TEHTEC			
47	72	2C009	0.2	P 2		18	05C	+0.3	A610MULC	TEHTEC	97BBOBBIN	15	
		9509	0.4	P2	16	16	05C	+0.6	A610MULC	TEHTEC			
		9404	0.4	M2	15	15	05C	+0.1	610-EC	TEHTEC			
		9210	0.4	P 2	5	5	05C	+0.3	610UL	TECTEH			
		9210	1.0	P 2	WAR	0	05C	+0.4	610UL	TECTEH			
49	84	2C010	0.2	P 2		17	07C	-0.2	A610MULC	TEHTEC	97BBOBBIN	16	
41	38	2C008	0.2	P 2		16	AV3	+0.0	A610MULC	TEHTEC	97BBOBBIN	13	
		9509	0.4	P2	17	17	AV3	-0.1	A610MULC	TEHTEC			
		9404	0.6	M2	18	18	AV3	+0.0	610-EC	TEHTEC			
42	56	2C008	0.2	P 2		16	AV2	+0.0	A610MULC	TEHTEC	97BBOBBIN	14	
		9509	0.7	P2	25	25	AV2	-0.0	A610MULC	TEHTEC			
		9404	0.8	M2	23	23	AV2	+0.0	610-EC	TEHTEC			
		9404	1.1	M1	BDA	0	AV2	+0.0	610-EC	TECTEH			
		9210	0.5	P 2	21	21	AV2	+0.0	610UL	TECTEH			
40	96	2C026	0.7	P 5		12	02C	+0.7	A610MULC	TEHTEC	97BBOBBIN	16	
		9509	0.8	P2	25	25	02C	+0.5	A610MULC	TEHTEC			
48	71	2C009	0.1	P 2		12	05C	-0.4	A610MULC	TEHTEC	97BBOBBIN	15	
49	48	2C026	0.4	P 5		7	07C	+0.3	A610MULC	TEHTEC	97BBOBBIN	14	
		9509	0.8	P1	MBM	0	07C	+0.3	A610MULC	TEHTEC			
		9404	0.5	M1	7	7	07C	+0.2	610-EC	TEHTEC			

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MBM Indications with related MRPC calls

Row/Col	Year Examined	Reel	Voltage	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested
5 1	09/01/95	2C014	0.9	1	MBM		08C +6.6	A610MULC	TEHTEC
	RPC DATA	2C015	0.6	1	VOL		08C +6.6	P620MRPC3C	10C08C
	09/01/95	2C014	0.7	1	MBM		09C +17.8	A610MULC	TEHTEC
	RPC DATA	2C015	0.9	1	VOL		09C +18.1	P620MRPC3C	10C08C
5 62	09/01/95	2C011	0.5	1	MBM		10C +15.6	A610MULC	TEHTEC
	RPC DATA	2C015	0.8	1	VOL		10C +15.8	P620MRPC3C	11C10C
6 92	09/01/95	2C005	0.3	1	MBM		03H +18.1	A610MULC	TEHTEC
	RPC DATA	2H054			INF		03H +18.1	P620MRPC3C	05H03H
7 79	09/01/95	2C005	0.6	1	MBM		09C +35.2	A610MULC	TEHTEC
	RPC DATA	2C015	1.6	1	VOL		09C +35.3	P620MRPC3C	10C09C
9 98	09/01/95	2C002	0.5	1	MBM		04C +12.7	A610MULC	TEHTEC
	RPC DATA	2C015			INR		04C +12.7	P620MRPC3C	05C04C
11 48	09/01/95	2C001	0.4	1	MBM		03H +13.2	A610MULC	TEHTEC
	RPC DATA	2H055	0.5	1	VOL		03H +12.8	P620MRPC3C	05H03H
12 57	09/01/95	2C010	0.7	1	MBM		07H +31.5	A610MULC	TEHTEC
	RPC DATA	2H055	1.2	1	VOL		07H +30.9	P620MRPC3C	08H07H
13 61	09/01/95	2C010	0.6	1	MBM		05C +16.5	A610MULC	TEHTEC
	RPC DATA	2C015	1.3	1	VOL		05C +16.7	P620MRPC3C	06C05C
13 67	09/01/95	2C010	0.4	1	MBM		09C +29.5	A610MULC	TEHTEC
	RPC DATA	2C015	1.0	1	VOL		09C +29.5	P620MRPC3C	10C09C
14 109	09/01/95	2C003	1.0	1	MBM		10H +11.3	A610MULC	TEHTEC
	RPC DATA	2H054			INR		10H +11.3	P620MRPC3C	10H11H
15 50	05/03/97	2C005	0.6	1	MBM		07H +26.3	A610MULC	TEHTECMBH
	RPC DATA	2H055	1.1	1	VOL		07H +25.5	P620MRPC3C	08H07H
15 62	09/01/95	2C010	0.6	1	MBM		05H +30.1	A610MULC	TEHTEC
	RPC DATA	2H054	0.7	1	VOL		05H +30.1	P620MRPC3C	07H03H
	09/01/95	2C010	0.6	1	MBM		03H +20.6	A610MULC	TEHTEC
	RPC DATA	2H054	0.7	1	VOL		03H +20.6	P620MRPC3C	07H03H
15 67	09/01/95	2C010	0.6	1	MBM		03C +14.6	A610MULC	TEHTEC
	RPC DATA	2C015	0.9	1	VOL		03C +14.8	P620MRPC3C	04C03C
15 80	09/01/95	2C005	0.3	1	MBM		07C +5.5	A610MULC	TEHTEC
	RPC DATA	2C015	0.8	1	VOL		07C +5.2	P620MRPC3C	08C07C

MBM Indications with related MRPC calls

Row/Col		Year Examined	Reel	Voltage	CH	Ind. Desc. %TWD	Indication Location		Probe	Extent Tested
16	72	09/01/95	2C010	0.3	1	MBM	07C	+5.3	A610MULC	TEHTEC
		RPC DATA	2C015	0.9	1	VOL	07C	+5.6	P620MRPC3C	08C07C
19	86	09/01/95	2C005	0.6	1	MBM	10C	+26.4	A610MULC	TEHTEC
		RPC DATA	2C015	1.0	1	VOL	10C	+26.6	P620MRPC3C	11C10C
20	45	05/03/97	2C007	0.6	1	MBM	10H	+35.4	A610MULC	TEHTECMBH
		RPC DATA	2H055	1.9	1	VOL	10H	+34.8	P620MRPC3C	11H10H
29	67	04/30/97	2C011	0.6	1	MBM	10C	+3.7	A610MULC	TEHTECMBH
		RPC DATA	2C015	1.8	1	VOL	10C	+3.4	P620MRPC3C	11C10C
		05/03/97	2C011	0.8	1	MBM	10C	-1.2	A610MULC	TEHTECMBH
		RPC DATA	2C015	1.8	1	VOL	10C	-0.9	P620MRPC3C	11C10C
33	46	09/01/95	2C009	1.1	1	MBM	10H	+37.9	A610MULC	TEHTEC
		RPC DATA	2H055	1.3	1	VOL	10H	+37.5	P620MRPC3C	11H10H
		09/01/95	2C009	1.2	1	MBM	10H	+26.8	A610MULC	TEHTEC
		RPC DATA	2H055	2.7	1	VOL	10H	+26.0	P620MRPC3C	11H10H
41	55	05/03/97	2C008	0.6	1	MBM	08H	+8.4	A610MULC	TEHTECMBH
		RPC DATA	2H055	2.8	1	VOL	08H	+7.9	P620MRPC3C	09H08H
49	48	09/01/95	2C009	0.8	P1	MBM	07C	+0.3	A610MULC	TEHTEC
		RPC DATA	2C015			INF	07C	+0.3	P620MRPC3C	08C07C

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DNT Indications with related MRPC calls

Row/Col		Year Examined	Reel	Voltage	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested
1	3	04/28/97	2C004	5.0	P 1	DNT		02C	-0.4	A610MULC	11CTEC
		RPC DATA	2C023							B620MRPC3C	02C02C
1	4	04/28/97	2C004	2.7	P 1	DNT		02C	-0.4	A610MULC	11CTEC
		RPC DATA	2C025							P580MRPC1C	11H11C
1	5	04/28/97	2C004	2.1	P 1	DNT		04C	+0.3	A610MULC	11CTEC
		RPC DATA	2H072			OBS		11H	-0.2	P620MRPC3C	11H11H
2	1	04/28/97	2C004	5.0	P 1	DNT		02C	-0.4	A610MULC	11CTEC
		RPC DATA	2C023							B620MRPC3C	02C02C
6	1	04/28/97	2C003	2.2	P 1	DNT		11H	+0.3	A610MULC	TEHTEC
		RPC DATA	2H052							B620MRPC3C	11H11H
6	1	04/28/97	2C003	15.0	P 1	DNT		11H	-0.1	A610MULC	TEHTEC
		RPC DATA	2H052							B620MRPC3C	11H11H
25	108	09/01/95	2C003	11.9	P1	DNT		07H	+0.3	A610MULC	TEHTEC
		RPC DATA	2H031							B620MRPC3C	07H07H
		RPC DATA	019		1					610-EC	07H07H
27	74	09/01/95	2C010	5.8	P1	DNT		05H	+0.2	A610MULC	TEHTEC
		RPC DATA	2H054							P620MRPC3C	05H05H
30	10	04/28/97	2C006	4.2	P 1	DNT		02C	+0.5	A610MULC	TEHTEC
		RPC DATA	2C023							B620MRPC3C	02C02C
38	99	05/01/97	2C032	17.7	P 1	DNT		11H	-0.6	A560SFRM	TEHTEC
		RPC DATA	2H031							B620MRPC3C	11H11H

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1997 Diagnostic exams with originating Bobbin data

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
10	85	2H071			PID		TEH +10.6	P620MRPC3C	TSHTEH	97BBOBBIN	5	
		2H068	5.7	2	MAI		TEH +10.4	P620MRPC3C	TSHTEH	97BBOBBIN	5	
		9704	6.8 P	1	DRI	0	TEH +10.6	A610MULC	TEHTEC			
21	30	2H058			INR		07H +14.6	P620MRPC3C80	08H07H	97BBOBBIN	8	
		9704	0.1	1	NQI	0	07H +14.6	A610MULC	TEHTEC			
33	65	2C029			INF		02C +0.8	P620MRPC3C	02C02C	97BBOBBIN	15	
		9704	0.4	1	NQI	0	02C +0.8	A610MULC	TEHTEC			
39	18	2H058			INR		11H +0.4	P620MRPC3C80	11H10H	97BBOBBIN	13	
		9704	0.6 P	1	DSI	0	11H +0.4	A610MULC	TEHTEC			
49	31	2C031	1.0	2	PLI		02C +2.4	P620MRPC3C	03C02C	97BBOBBIN	13	
		9704	0.9	1	NQI	0	02C +2.5	A610MULC	TEHTEC			
		2C034			PID		02C +2.5	P620MRPC3C	03C02C	97BBOBBIN	13	

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1997 Plugged Tubes with Historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
2 38	3H005	0.6	P 2	SCI		TSH -0.4	P620MRPC3C	TSH+2	97CMRPC	2	
	9704	0.0		PID	0	TSH -0.4	P620MRPC3C	TSH+2			
	9704	0.6	P 2	SCI	0	TSH -0.4	P620MRPC3C	TSH+2			
	8605	673.2		TMR	0	TSH -0.1	630CF	01HTEH			
	8605	663.0		NOM	0	TSH +2.3	630CF	01HTEH			
2 43	3H005	0.3	P 2	SCI		TSH -0.4	P620MRPC3C	TSH+2	97CMRPC	3	
	9704	0.0		PID	0	TSH -0.4	P620MRPC3C	TSH+2			
	9704	0.3	P 2	SCI	0	TSH -0.4	P620MRPC3C	TSH+2			
	8605	674.8		TMR	0	TSH -0.2	630CF	01HTEH			
	8605	662.6		NOM	0	TSH +2.3	630CF	01HTEH			
6 41	3H005	0.2	P 2	SCI		TSH -0.3	P620MRPC3C	TSH+2	97CMRPC	3	
	9704	0.2	P 2	SCI	0	TSH -0.3	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.3	P620MRPC3C	TSH+2			
	8605	678.0		TMR	0	TSH -0.2	630CF	01HTEH			
	8605	665.4		NOM	0	TSH +2.3	630CF	01HTEH			
6 43	3H005	0.4	P 2	SCI		TSH -0.3	P620MRPC3C	TSH+2	97CMRPC	3	
	9704	0.4	P 2	SCI	0	TSH -0.3	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.3	P620MRPC3C	TSH+2			
	8605	677.2		TMR	0	TSH -0.2	630CF	01HTEH			
	8605	665.4		NOM	0	TSH +2.3	630CF	01HTEH			
14 78	3C027	4.3	2	VOL		02C +0.7	P620MRPC3C	02C02C	97CSI/CL	5	
	9704	0.0	1	PID	0	02C +0.5	P580MRPC1C	02C02C			
	9704	4.3	2	VOL	0	02C +0.7	P620MRPC3C	02C02C			
	9704	14.8	P 1	DSI	0	02C +0.6	A610MULC	TEHTEC			
	9704	0.0		INR	0	02C -0.0	A610MULC	TEHTEC			
	9704	5.9	P 1	DNT	0	02C -0.9	A610MULC	TEHTEC			
	9704	3.3	P 1	DNT	0	02C -0.6	A610MULC	TEHTEC			
	9704	7.4	P 1	DNT	0	02C -0.3	A610MULC	TEHTEC			
	9509	42.2	1	15	15	02C -0.0	A610MULC	TEHTEC			
	9404	19.1	M1	7	7	02C +0.6	610-EC	TEHTEC			
	9210	29.6	P 1	9	9	02C +0.6	610UL	TECTEH			
	8408	62.9	M1	BLG	0	02C +0.0	610SM	TECTEH			
19 66	3H030	0.4	P 2	SCI		TSH -0.4	P620MRPC3C	TSH+2	97CMRPC	10	
	9704	0.4	P 2	SCI	0	TSH -0.4	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.4	P620MRPC3C	TSH+2			
20 49	3H014	0.2	P 2	SCI		TSH -0.4	P620MRPC3C	TSH+2	97CMRPC	9	
	9704	0.2	P 2	SCI	0	TSH -0.4	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.4	P620MRPC3C	TSH+2			
20 67	3H029	0.2	2	SAI		TSH +0.0	P620MRPC3C	TSH+2	97CMRPC	10	
	9704	0.2	2	SAI	0	TSH +0.0	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH +0.0	P620MRPC3C	TSH+2			
20 71	3H043	0.2	2	SAI		TSH +0.0	P620MRPC3C	TSH+2	97CMRPC	10	
	9704	0.2	2	SAI	0	TSH +0.0	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH +0.0	P620MRPC3C	TSH+2			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
21 42	3H042	0.2	P 2	SCI		TSH +0.0	P620MRPC3C	TSH+2	97CMRPC	9	
	9704	0.2	P 2	SCI	0	TSH +0.0	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH +0.0	P620MRPC3C	TSH+2			
21 44	3H042	0.3	2	SAI		TSH +0.1	P620MRPC3C	TSH+2	97CMRPC	9	
	9704	0.3	2	SAI	0	TSH +0.1	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH +0.1	P620MRPC3C	TSH+2			
22 44	3H042	0.4	2	SAI		TSH +0.0	P620MRPC3C	TSH+2	97CMRPC	9	
	9704	0.4	2	SAI	0	TSH +0.0	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH +0.0	P620MRPC3C	TSH+2			
22 99	3H047	0.4	2	PLI		01H +0.2	P620MRPC3C	01HTSH	97CSI/HL	12	
	9704	0.0	P 1	PID	0	01H +0.4	P620MRPC3C	01HTSH			
	9704	0.4	2	PLI	0	01H +0.2	P620MRPC3C	01HTSH			
	9704	1.7	P 1	DSI	0	01H +0.6	A610MULC	TEHTEC			
	9509	2.3	P1	37	37	01H +0.7	A610MULC	TEHTEC			
	9404	1.8	M1	37	37	01H +0.6	610-EC	TEHTEC			
23 73	3H030	0.6	P 2	SCI		TSH -0.4	P620MRPC3C	TSH+2	97CMRPC	10	
	9704	0.6	P 2	SCI	0	TSH -0.4	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.4	P620MRPC3C	TSH+2			
24 45	3H014	0.2	P 2	MCI		TSH -0.1	P620MRPC3C	TSH+2	97CMRPC	9	
	9704	0.2	P 2	MCI	0	TSH -0.1	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.1	P620MRPC3C	TSH+2			
26 95	3H026	1.0	2	SAI		TSH +0.1	P620MRPC3C	TSH+2	97CMRPC	11	
	9704	1.0	2	SAI	0	TSH +0.1	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH +0.1	P620MRPC3C	TSH+2			
27 105	3H025	0.4	2	SAI		TSH -0.1	P620MRPC3C	TSH+2	97CMRPC	12	
	9704	0.4	2	SAI	0	TSH -0.1	P620MRPC3C	TSH+2			
	9704	0.0		PID	0	TSH -0.1	P620MRPC3C	TSH+2			
30 44	3C011	1.4	P 2		39	AV2 -0.1	A610MULC	TEHTEC	97CBOBBIN	9	
	9704	0.0		PID	0	AV2 -0.1	A610MULC	TEHTEC			
	9704	1.4	P 2		39	AV2 -0.1	A610MULC	TEHTEC			
	9509	1.7	P2	37	37	AV2 -0.0	A610MULC	TEHTEC			
	9404	1.9	M2	29	29	AV2 +0.0	610-EC	TEHTEC			
	9210	1.3	P 2	28	28	AV2 +0.0	610UL	TECTEH			
30 45	3C011	1.8	P 2		42	AV1 +0.0	A610MULC	TEHTEC	97CBOBBIN	9	
	9704	0.0		PID	0	AV1 +0.0	A610MULC	TEHTEC			
	9704	1.8	P 2		42	AV1 +0.0	A610MULC	TEHTEC			
	9509	2.3	P2	39	39	AV1 +0.0	A610MULC	TEHTEC			
	9404	2.5	M2	33	33	AV1 +0.0	610-EC	TEHTEC			
	9210	1.8	P 2	34	34	AV1 +0.0	610UL	TECTEH			

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1997 Plugged Tubes with Historic data

Row/Col	Reel / Outage	Volts CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
36 59	3H021	0.6 P 2	PLI		TSH +1.1	P620MRPC3C	TSH+2	97CMRPC	15	
	9704	0.3 8	PLP	0	TSH +1.2	P620MRPC3C	TSH+2			
	9704	0.6 P 2	PLI	0	TSH +1.1	P620MRPC3C	TSH+2			
	9704	0.9 P 2	NQI	0	TSH +0.7	A610MULC	TEHTEC			
	9704	0.6 2	PID	0	TSH +1.1	P620MRPC3C	TSH+2			
	9704	0.0	PID	0	TSH +1.2	P620MRPC3C	TSHTEH			
	9509	0.6 1	26	26	TSH +1.2	A610MULC	TEHTEC			
41 52	3H021	0.1 P 2	SCI		TSH +0.0	P620MRPC3C	TSH+2	97CMRPC	14	
	9704	0.1 P 2	SCI	0	TSH +0.0	P620MRPC3C	TSH+2			
	9704	0.0	PID	0	TSH +0.0	P620MRPC3C	TSH+2			

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1997 Special Interest exams with historic data

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
2 84	3C027	2.2	1	VOL		04C +8.5	P620MRPC3C	06C04C	97CSI/CL	5	
	9704	0.0		INF	0	04C +4.4	A610MULC	11CTEC			
	9704	1.3	1	MBM	0	04C +8.5	A610MULC	11CTEC			
	9509	1.3	1	MBM	0	04C +4.4	A610MULC	11CTEC			
	9404	0.9	1	15	15	04C +4.3	610-EC	11HTEC			
	3C027	0.6	1	VOL		04C +31.9	P620MRPC3C	06C04C	97CSI/CL	5	MBH
4 105	3C027			INR		01C +1.7	P620MRPC3C	01CTSC	97CSI/CL	6	
	9704	0.3	1	INR	0	01C +1.7	A610MULC	TEHTEC			
	9509	0.3	1	36	36	01C +1.6	A610MULC	TEHTEC			
	9404	0.2	1	39	39	01C +1.6	610-EC	11HTEC			
5 23	3C027	1.8	1	VOL		09C +31.3	P620MRPC3C	10C09C	97CSI/CL	2	MBH
	9509	1.2	1	MBM	0	09C +31.2	A610MULC	TEHTEC			
	9404	0.9	1	8	8	09C +31.4	610-EC	11HTEC			
	8910	1.1	1	INR	0	09C +31.2	610SL	TECTEH			
	8808	1.0	1	MBM	0	09C +31.2	610SM	TECTEH			
	8408	1.3	1	16	16	09C +32.6	610SM	TECTEH			
5 53	3C027	2.7	1	VOL		08C +17.6	P620MRPC3C	09C08C	97CSI/CL	3	MBH
	9509	1.0	1	MBM	0	08C +17.7	A610MULC	TEHTEC			
	9404	1.0	1	18	18	08C +17.5	610-EC	11HTEC			
	8910	1.3	1	INR	0	08C +17.6	610SL	TECTEH			
	8808	0.7	1	MBM	0	08C +17.6	610SM	TECTEH			
	8408	2.2	1	14	14	08C +19.2	610SM	TECTEH			
6 73	3C027	0.9	1	VOL		06C +4.4	P620MRPC3C	07C06C	97CSI/CL	4	MBH
	9404	0.7	1	MBM	0	06C +5.3	610-EC	TECTEH			
	9404	0.0	M1	INF	0	06C +3.6	610-EC	TECTEH			
	8808	0.6	1	INR	0	06C +3.6	610SM	TECTEH			
	8408	0.9	1	23	23	06C +3.6	610SM	TECTEH			
6 74	3C027			INF		04C +6.8	P620MRPC3C	05C04C	97CSI/CL	4	
	9704	0.0		INF	0	04C +6.8	A610MULC	TSHTEC			
	9704	0.0		INF	0	04C +6.8	A610MULC	TEHTEC			
	9509	1.2	1	6	6	04C +6.8	A610MULC	TEHTEC			
7 74	3C027	1.0	1	VOL		04C +6.9	P620MRPC3C	05C04C	97CSI/CL	4	MBH
	9509	1.2	1	MBM	0	04C +6.8	A610MULC	TEHTEC			
	9404	0.8	1	10	10	04C +6.8	610-EC	TECTEH			
	8910	1.1	1	INR	0	04C +6.9	610SL	TECTEH			
	8808	0.8	1	MBM	0	04C +6.8	610SM	TECTEH			
	8408	1.3	1	17	17	04C +8.0	610SM	TECTEH			
8 36	3H049	1.6	1	VOL		03H +16.2	P620MRPC3C	05H03H	97CSI/HL	2	MBH
	9509	1.9	1	MBM	0	03H +16.3	A610MULC	TEHTEC			
	9404	1.2	1	34	34	03H +16.5	610-EC	TECTEH			
	9210	1.5	1	21	21	03H +16.2	610UL	TECTEH			
8 51	3C027	1.9	1	VOL		08C +13.7	P620MRPC3C	09C08C	97CSI/CL	3	MBH
	9509	1.3	1	MBM	0	08C +13.6	A610MULC	TEHTEC			
	9404	1.3	1	15	15	08C +13.8	610-EC	TEHTEC			
8 92	3C027	2.2	1	VOL		10C +9.4	P620MRPC3C	11C10C	97CSI/CL	5	MBH
	9509	0.4	1	MBM	0	10C +9.4	A610MULC	TEHTEC			
	9404	0.3	1	21	21	10C +9.3	610-EC	TECTEH			
8 99	3C027	1.0	1	VOL		10C +5.4	P620MRPC3C	11C10C	97CSI/CL	6	MBH
	9509	0.6	1	MBM	0	10C +5.6	A610MULC	TEHTEC			
	9404	0.5	1	23	23	10C +6.6	610-EC	TECTEH			
	8808	0.5	1	INR	0	10C +5.2	610SM	TECTEH			
	8408	1.0	1	24	24	10C +5.2	610SM	TECTEH			

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9 102	3C027	2.6	1	VOL		08C +4.6	P620MRPC3C	09C08C	97CSI/CL	6	MBH
	9404	0.5	1	MBM	0	08C +4.6	610-EC	TECTEH			
14 77	3C027	1.1	2	VOL		02C +1.9	P620MRPC3C	02C02C	97CSI/CL	5	
	9704	1.9	1	NQI	0	02C +1.8	A610MULC	TEHTEC			
	9509	2.3	1	29	29	02C +1.9	A610MULC	TEHTEC			
	9404	1.7	1	32	32	02C +1.7	610-EC	TEHTEC			
	9210	1.7	1	33	33	02C +1.9	610UL	TECTEH			
	8910	1.5	1	31	31	02C +1.9	610SL	TECTEH			
	8808	1.9	1	20	20	02C +1.8	610SM	TECTEH			
	8408	2.2	1	26	26	02C +1.6	610SM	TECTEH			
	8408	2.4	1	22	22	02C +2.2	610SM	TECTEH			
14 78	3C027	4.3	2	VOL		02C +0.7	P620MRPC3C	02C02C	97CSI/CL	5	
	9704	14.8	P 1	DSI	0	02C +0.6	A610MULC	TEHTEC			
	9704	0.0		INR	0	02C -0.0	A610MULC	TEHTEC			
	9704	5.9	P 1	DNT	0	02C -0.9	A610MULC	TEHTEC			
	9704	3.3	P 1	DNT	0	02C -0.6	A610MULC	TEHTEC			
	9704	7.4	P 1	DNT	0	02C -0.3	A610MULC	TEHTEC			
	9509	42.2	1	15	15	02C -0.0	A610MULC	TEHTEC			
	9404	19.1	M1	7	7	02C +0.6	610-EC	TEHTEC			
	9210	29.6	P 1	9	9	02C +0.6	610UL	TECTEH			
	8408	62.9	M1	BLG	0	02C +0.0	610SM	TECTEH			
15 51	3C027	3.0	1	VOL		10C +28.9	P620MRPC3C	11C10C	97CSI/CL	3	MBH
	9404	6.5	6	MBM	0	10C +29.2	610-EC	TEHTEC			
19 26	3H049			INF		3H +16.7	P620MRPC3C	05H03H	97CSI/HL	8	
22 97	3C027	1.8	1	VOL		08C +36.2	P620MRPC3C	09C08C	97CSI/CL	12	MBH
	9509	0.6	1	MBM	0	08C +36.3	A610MULC	TEHTEC			
	9404	0.7	1	3	3	08C +36.4	610-EC	TEHTEC			
22 99	3H047	0.4	2	PLI		01H +0.2	P620MRPC3C	01HTSH	97CSI/HL	12	
	9704	1.7	P 1	DSI	0	01H +0.6	A610MULC	TEHTEC			
	9509	2.3	P1	37	37	01H +0.7	A610MULC	TEHTEC			
	9404	1.8	M1	37	37	01H +0.6	610-EC	TEHTEC			
25 36	3C027	1.1	1	VOL		10C +33.2	P620MRPC3C	11C10C	97CSI/CL	8	MBH
	9404	0.9	1	MBM	0	10C +33.1	610-EC	TEHTEC			
	9210	0.9	1	11	11	10C +33.1	610UL	TECTEH			
28 85	3H054			INR		09H -1.1	P620MRPC3C	09H09H	97CSI/HL	11	
	9704	11.3	P 1	DNT	0	09H -0.3	A610MULC	TEHTEC			
	8910	9.3	M1	DNT	0	09H -0.4	610SL	TECTEH			
	8808	9.4	M1	DNT	0	09H -0.3	610SM	TECTEH			
29 29	3C027	2.9	1	VOL		10C +1.8	P620MRPC3C	11C10C	97CSI/CL	8	MBH
	9509	1.8	1	MBM	0	10C +1.1	A610MULC	TEHTEC			
	9404	1.2	1	23	23	10C +2.1	610-EC	TEHTEC			
	8808	1.3	1	INR	0	10C +1.9	610SM	TECTEH			
	8408	1.9	1	22	22	10C +1.9	610SM	TECTEH			
31 77	3C029	1.7	1	VOL		07C +2.0	P620MRPC3C	08C07C	97CSI/CL	11	MBH
	9509	0.6	1	MBM	0	07C +1.9	A610MULC	TEHTEC			
	9404	0.5	1	16	16	07C +1.7	610-EC	TEHTEC			
32 36	3H049	2.5	1	VOL		07H +40.4	P620MRPC3C	08H07H	97CSI/HL	8	MBH
	9404	0.6	1	MBM	0	07H +40.3	610-EC	TEHTEC			
	9210	0.6	1	17	17	07H +40.6	610UL	TECTEH			

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33	77	3C027	1.2	1	VOL		09C +6.6	P620MRPC3C	10C09C	97CSI/CL	16	MBH
		9404	0.5	1	MBM	0	09C +6.3	610-EC	TEHTEC			
34	59	3C028	0.9	P 1	WAR		03C +0.1	P620MRPC3C	03C03C	97CSI/CL	15	
		9704	0.5	P 2		19	03C +0.3	A610MULC	TEHTEC			
		9509	1.2	P1	5	5	03C +0.0	A610MULC	TEHTEC			
		9404	1.0	M1	19	19	03C +0.0	610-EC	TEHTEC			
34	64	3H047			INF		TEH +9.7	P620MRPC3C	TSHTEH	97CSI/HL	15	
		9509	6.6	P1	NQI	0	TEH +9.7	A610MULC	TEHTEC			
		9509	0.0		DMR	0	TEH +9.7	B620MRPC3C	TSHTEH			
		8605	681.5		OXP	0	TEH +9.0To+10.5	630CF	01HTEH			
36	28	3H048	2.4	1	VOL		05H +25.7	P620MRPC3C	07H05H	97CSI/HL	13	MBH
		3H058			INR		05H +24.3	P620MRPC3C	07H05H	97CSI/HL	13	
		9509	1.0	1	MBM	0	05H +24.3	A610MULC	TEHTEC			
		9404	0.8	1	11	11	05H +24.1	610-EC	TEHTEC			
36	59	3H047			PID		TSH +1.2	P620MRPC3C	TSHTEH	97CSI/HL	15	
		9704	0.9	P 2	NQI	0	TSH +0.7	A610MULC	TEHTEC			
		9509	0.6	1	26	26	TSH +1.2	A610MULC	TEHTEC			
37	24	3C027	1.4	1	VOL		10C +19.0	P620MRPC3C	11C10C	97CSI/CL	13	MBH
		9404	0.3	1	MBM	0	10C +18.9	610-EC	TEHTEC			
		9210	0.3	1	19	19	10C +18.9	610UL	TECTEH			
37	36	3C027	1.4	1	VOL		10C +19.5	P620MRPC3C	11C10C	97CSI/CL	13	MBH
		9509	0.8	1	MBM	0	10C +19.3	A610MULC	TEHTEC			
		9404	0.5	1	23	23	10C +19.2	610-EC	TEHTEC			
38	26	3C027	1.4	1	VOL		10C +13.6	P620MRPC3C	11C10C	97CSI/CL	13	MBH
		9404	0.6	1	MBM	0	10C +13.3	610-EC	TEHTEC			
43	56	3C027			INF		09C -0.4	P620MRPC3C	09C09C	97CSI/CL	14	
		9704	0.3	P 2		11	09C -0.3	A610MULC	TEHTEC			
		9509	0.6	P2	18	18	09C -0.4	A610MULC	TEHTEC			
		9404	0.8	M2	17	17	09C -0.4	610-EC	TEHTEC			
49	67	3C028	0.7	P 1	WAR		07C -0.3	P620MRPC3C	07C07C	97CSI/CL	15	
		9704	0.4	P 2		16	07C -0.3	A610MULC	TEHTEC			
		9509	0.4	P2	14	14	07C -0.3	A610MULC	TEHTEC			

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2 84	3C027	0.6	1	VOL		04C +31.9	P620MRPC3C	06C04C	97CSI/CL	5	MBH
	3C010	1.3	1	MBM		04C +8.5	A610MULC	11CTEC	97CBOBBIN	5	MBH
5 23	3C027	1.8	1	VOL		09C +31.3	P620MRPC3C	10C09C	97CSI/CL	2	MBH
	9509	1.2	1	MBM	0	09C +31.2	A610MULC	TEHTEC			
	9404	0.9	1	8	8	09C +31.4	610-EC	11HTEC			
5 53	3C027	2.7	1	VOL		08C +17.6	P620MRPC3C	09C08C	97CSI/CL	3	MBH
	9509	1.0	1	MBM	0	08C +17.7	A610MULC	TEHTEC			
	9404	1.0	1	18	18	08C +17.5	610-EC	11HTEC			
6 73	3C027	0.9	1	VOL		06C +4.4	P620MRPC3C	07C06C	97CSI/CL	4	MBH
7 74	3C027	1.0	1	VOL		04C +6.9	P620MRPC3C	05C04C	97CSI/CL	4	MBH
	9509	1.2	1	MBM	0	04C +6.8	A610MULC	TEHTEC			
	9404	0.8	1	10	10	04C +6.8	610-EC	TECTEH			
8 36	3H049	1.6	1	VOL		03H +16.2	P620MRPC3C	05H03H	97CSI/HL	2	MBH
	9509	1.9	1	MBM	0	03H +16.3	A610MULC	TEHTEC			
	9404	1.2	1	34	34	03H +16.5	610-EC	TECTEH			
	9210	1.5	1	21	21	03H +16.2	610UL	TECTEH			
8 51	3C027	1.9	1	VOL		08C +13.7	P620MRPC3C	09C08C	97CSI/CL	3	MBH
	9509	1.3	1	MBM	0	08C +13.6	A610MULC	TEHTEC			
	9404	1.3	1	15	15	08C +13.8	610-EC	TEHTEC			
8 92	3C027	2.2	1	VOL		10C +9.4	P620MRPC3C	11C10C	97CSI/CL	5	MBH
	9509	0.4	1	MBM	0	10C +9.4	A610MULC	TEHTEC			
	9404	0.3	1	21	21	10C +9.3	610-EC	TECTEH			
8 99	3C027	1.0	1	VOL		10C +5.4	P620MRPC3C	11C10C	97CSI/CL	6	MBH
	9509	0.6	1	MBM	0	10C +5.6	A610MULC	TEHTEC			
9 102	3C027	2.6	1	VOL		08C +4.6	P620MRPC3C	09C08C	97CSI/CL	6	MBH
	9404	0.5	1	MBM	0	08C +4.6	610-EC	TECTEH			
14 77	3C010	1.9	1	NQI		02C +1.8	A610MULC	TEHTEC	97CBOBBIN	5	NQH
	9509	2.3	1	29	29	02C +1.9	A610MULC	TEHTEC			
	9404	1.7	1	32	32	02C +1.7	610-EC	TEHTEC			
	9210	1.7	1	33	33	02C +1.9	610UL	TECTEH			
14 78	3C010	14.8	P 1	DSI		02C +0.6	A610MULC	TEHTEC	97CBOBBIN	5	DSH
	9404	19.1	M1	7	7	02C +0.6	610-EC	TEHTEC			
	9210	29.6	P 1	9	9	02C +0.6	610UL	TECTEH			
15 51	3C027	3.0	1	VOL		10C +28.9	P620MRPC3C	11C10C	97CSI/CL	3	MBH
	9404	6.5	6	MBM	0	10C +29.2	610-EC	TEHTEC			

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18	45	3C011	1.3	P 1	DSI		11H	+0.2	A610MULC	TEHTEC	97CBOBBIN	9	DSH
22	97	3C027	1.8	1	VOL		08C	+36.2	P620MRPC3C	09C08C	97CSI/CL	12	MBH
		9509	0.6	1	MBM	0	08C	+36.3	A610MULC	TEHTEC			
		9404	0.7	1	3	3	08C	+36.4	610-EC	TEHTEC			
22	99	3C009	1.7	P 1	DSI		01H	+0.6	A610MULC	TEHTEC	97CBOBBIN	12	DSH
		9509	2.3	P1	37	37	01H	+0.7	A610MULC	TEHTEC			
		9404	1.8	M1	37	37	01H	+0.6	610-EC	TEHTEC			
25	36	3C027	1.1	1	VOL		10C	+33.2	P620MRPC3C	11C10C	97CSI/CL	8	MBH
		9404	0.9	1	MBM	0	10C	+33.1	610-EC	TEHTEC			
		9210	0.9	1	11	11	10C	+33.1	610UL	TECTEH			
28	45	3C011	0.4	P 2		21	AV1	-0.0	A610MULC	TEHTEC	97CBOBBIN	9	
		9509	0.5	P2	15	15	AV1	+0.0	A610MULC	TEHTEC			
		9404	0.8	M2	15	15	AV1	+0.0	610-EC	TEHTEC			
29	29	3C027	2.9	1	VOL		10C	+1.8	P620MRPC3C	11C10C	97CSI/CL	8	MBH
		9404	1.2	1	23	23	10C	+2.1	610-EC	TEHTEC			
30	44	3C011	1.4	P 2		39	AV2	-0.1	A610MULC	TEHTEC	97CBOBBIN	9	
		9509	1.7	P2	37	37	AV2	-0.0	A610MULC	TEHTEC			
		9404	1.9	M2	29	29	AV2	+0.0	610-EC	TEHTEC			
		9210	1.3	P 2	28	28	AV2	+0.0	610UL	TECTEH			
30	45	3C011	1.8	P 2		42	AV1	+0.0	A610MULC	TEHTEC	97CBOBBIN	9	
		9509	2.3	P2	39	39	AV1	+0.0	A610MULC	TEHTEC			
		9404	2.5	M2	33	33	AV1	+0.0	610-EC	TEHTEC			
		9210	1.8	P 2	34	34	AV1	+0.0	610UL	TECTEH			
30	46	3C011	0.5	P 2		23	AV1	-0.4	A610MULC	TEHTEC	97CBOBBIN	9	
		9509	0.7	P2	22	22	AV1	-0.4	A610MULC	TEHTEC			
		9404	0.6	M2	12	12	AV1	+0.0	610-EC	TEHTEC			
31	45	3C011	1.0	P 2		33	AV1	-0.0	A610MULC	TEHTEC	97CBOBBIN	9	
		9509	1.5	P2	32	32	AV1	+0.0	A610MULC	TEHTEC			
		9404	2.1	M2	30	30	AV1	+0.0	610-EC	TEHTEC			
		9210	1.5	P 2	31	31	AV1	+0.0	610UL	TECTEH			
31	77	3C029	1.7	1	VOL		07C	+2.0	P620MRPC3C	08C07C	97CSI/CL	11	MBH
		9509	0.6	1	MBM	0	07C	+1.9	A610MULC	TEHTEC			
		9404	0.5	1	16	16	07C	+1.7	610-EC	TEHTEC			
32	36	3H049	2.5	1	VOL		07H	+40.4	P620MRPC3C	08H07H	97CSI/HL	8	MBH
		9404	0.6	1	MBM	0	07H	+40.3	610-EC	TEHTEC			
		9210	0.6	1	17	17	07H	+40.6	610UL	TECTEH			

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32	60	3C007	9.2	P 1	DRI		TEH	+14.4	A610MULC	TEHTEC	97CBOBBIN	10	DRH
		3C007	3.4	P 1	DRI		TEH	+5.7	A610MULC	TEHTEC	97CBOBBIN	10	DRH
		9210	6.3	P 1	INR	0	TEH	+5.3	610UL	TECTEH			
33	43	3C020	0.3	P 2		15	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.5	P2	15	15	AV3	+0.1	A610MULC	TEHTEC			
		9404	0.9	M2	17	17	AV3	+0.0	610-EC	TEHTEC			
		9210	0.7	P 2	19	19	AV3	+0.0	610UL	TECTEH			
33	45	3C020	0.4	P 2		17	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.5	P2	15	15	AV3	-0.1	A610MULC	TEHTEC			
		9404	0.7	M2	13	13	AV3	+0.0	610-EC	TEHTEC			
		3C020	0.6	P 2		23	AV1	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.8	P2	21	21	AV1	-0.0	A610MULC	TEHTEC			
		9404	0.7	M2	13	13	AV1	+0.0	610-EC	TEHTEC			
		9210	0.6	P 2	18	18	AV1	+0.0	610UL	TECTEH			
33	77	3C027	1.2	1	VOL		09C	+6.6	P620MRPC3C	10C09C	97CSI/CL	16	MBH
		9404	0.5	1	MBM	0	09C	+6.3	610-EC	TEHTEC			
34	44	3C016	1.0	P 2		30	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9404	1.5	M2	24	24	AV2	+0.0	610-EC	TEHTEC			
		9210	0.7	P 2	19	19	AV2	+0.0	610UL	TECTEH			
34	45	3C020	0.3	P 2		14	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.5	P2	15	15	AV3	-0.2	A610MULC	TEHTEC			
		9404	0.8	M2	15	15	AV3	+0.0	610-EC	TEHTEC			
		9210	0.8	P 2	20	20	AV3	+0.0	610UL	TECTEH			
34	46	3C016	1.4	P 2		36	AV3	-0.1	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	1.7	P2	17	17	AV3	-0.3	A610MULC	TEHTEC			
		9404	1.6	M2	25	25	AV3	+0.0	610-EC	TEHTEC			
		9210	1.3	P 2	28	28	AV3	+0.0	610UL	TECTEH			
34	59	3C006	0.5	P 2		19	03C	+0.3	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	1.2	P1	5	5	03C	+0.0	A610MULC	TEHTEC			
		9404	1.0	M1	19	19	03C	+0.0	610-EC	TEHTEC			
36	28	3H048	2.4	1	VOL		05H	+25.7	P620MRPC3C	07H05H	97CSI/HL	13	MBH
36	59	3C006	0.9	P 2	NQI		TSH	+0.7	A610MULC	TEHTEC	97CBOBBIN	15	NQH
		9509	0.6	1	26	26	TSH	+1.2	A610MULC	TEHTEC			
37	24	3C027	1.4	1	VOL		10C	+19.0	P620MRPC3C	11C10C.	97CSI/CL	13	MBH
		9404	0.3	1	MBM	0	10C	+18.9	610-EC	TEHTEC			
		9210	0.3	1	19	19	10C	+18.9	610UL	TECTEH			

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1997 flaws with history

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
37	36	3C027	1.4	1	VOL		10C	+19.5	P620MRPC3C	11C10C	97CSI/CL	13	MBH
		9509	0.8	1	MBM	0	10C	+19.3	A610MULC	TEHTEC			
		9404	0.5	1	23	23	10C	+19.2	610-EC	TEHTEC			
38	26	3C027	1.4	1	VOL		10C	+13.6	P620MRPC3C	11C10C	97CSI/CL	13	MBH
		9404	0.6	1	MBM	0	10C	+13.3	610-EC	TEHTEC			
39	74	3C006	0.2	P 2		10	AV3	-0.2	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.4	P2	11	11	AV3	+0.0	A610MULC	TEHTEC			
39	86	3C005	1.3	P 2		32	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	16	
		9509	1.1	P2	27	27	AV3	+0.0	A610MULC	TEHTEC			
		9404	1.5	M2	25	25	AV3	+0.0	610-EC	TEHTEC			
		9210	1.0	P 2	24	24	AV3	+0.0	610UL	TECTEH			
40	19	3C020	0.6	P 2		24	AV4	+0.0	A610MULC	TEHTEC	97CBOBBIN	13	
		9509	0.9	P2	25	25	AV4	-0.2	A610MULC	TEHTEC			
		9404	1.2	M2	20	20	AV4	+0.0	610-EC	TEHTEC			
40	56	3C020	0.5	P 2		20	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		3C020	0.5	P 2		20	AV1	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
40	60	3C006	0.3	P 2		11	AV2	+0.1	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.3	P2	10	10	AV2	+0.0	A610MULC	TEHTEC			
		9404	0.6	M2	13	13	AV2	-0.2	610-EC	TEHTEC			
41	20	3C017	1.5	P 2		34	AV4	+0.0	A610MULC	TEHTEC	97CBOBBIN	13	
		9509	1.8	P2	33	33	AV4	+0.0	A610MULC	TEHTEC			
		9404	2.1	M2	31	31	AV4	+0.0	610-EC	TEHTEC			
		9210	1.5	P 2	33	33	AV4	+0.0	610UL	TECTEH			
41	56	3C016	0.6	P 2		22	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.6	P2	19	19	AV2	+0.0	A610MULC	TEHTEC			
		9404	1.3	M2	23	23	AV2	+0.0	610-EC	TEHTEC			
		9210	0.8	P 2	21	21	AV2	+0.0	610UL	TECTEH			
43	56	3C016	0.3	P 2		11	09C	-0.3	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.6	P2	18	18	09C	-0.4	A610MULC	TEHTEC			
		9404	0.8	M2	17	17	09C	-0.4	610-EC	TEHTEC			
43	59	3C006	0.3	P 2		15	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.6	P2	15	15	AV2	-0.1	A610MULC	TEHTEC			
		9404	0.6	M2	12	12	AV2	+0.0	610-EC	TEHTEC			
44	59	3C006	0.7	P 2		27	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	1.0	P2	23	23	AV2	+0.0	A610MULC	TEHTEC			
		9404	1.3	M2	23	23	AV2	+0.0	610-EC	TEHTEC			
		9210	0.6	P 2	17	17	AV2	+0.0	610UL	TECTEH			

1997 flaws with history

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
45	56	3C016	0.6	P 2		22	AV4	-0.4	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.8	P2	24	24	AV4	+0.0	A610MULC	TEHTEC			
		9404	0.7	M2	14	14	AV4	+0.0	610-EC	TEHTEC			
		9210	0.7	P 2	19	19	AV4	+0.0	610UL	TECTEH			
		3C016	1.3	P 2		34	AV1	+0.0	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	1.6	P2	35	35	AV1	+0.0	A610MULC	TEHTEC			
		9404	2.1	M2	31	31	AV1	+0.0	610-EC	TEHTEC			
		9210	1.9	P 2	34	34	AV1	+0.0	610UL	TECTEH			
47	50	3C016	0.4	P 2		16	07C	-0.3	A610MULC	TEHTEC	97CBOBBIN	14	
48	40	3C016	0.4	P 2		14	03C	-0.2	A610MULC	TEHTEC	97CBOBBIN	14	
48	59	3C006	0.3	P 2		11	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
		3C006	0.3	P 2		12	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.3	P2	8	8	AV2	+0.0	A610MULC	TEHTEC			
		3C006	0.4	P 2		16	AV1	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.5	P2	14	14	AV1	-0.0	A610MULC	TEHTEC			
		9404	0.6	M2	13	13	AV1	+0.0	610-EC	TEHTEC			
		9210	0.5	P 2	15	15	AV1	+0.0	610UL	TECTEH			
49	34	3C020	0.2	P 2		8	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	13	
		9509	0.4	P2	12	12	AV2	+0.2	A610MULC	TEHTEC			
		9404	0.7	M2	13	13	AV2	-0.1	610-EC	TEHTEC			
49	38	3C020	0.4	P 2		14	07C	-0.3	A610MULC	TEHTEC	97CBOBBIN	13	
49	50	3C016	0.3	P 2		11	07C	-0.3	A610MULC	TEHTEC	97CBOBBIN	14	
49	67	3C006	0.4	P 2		16	07C	-0.3	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.4	P2	14	14	07C	-0.3	A610MULC	TEHTEC			

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1997 Wear indications with history

Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
30 45	3C011	1.8	P 2		42	AV1 +0.0	A610MULC	TEHTEC	97CBOBBIN	9	
	9509	2.3	P2	39	39	AV1 +0.0	A610MULC	TEHTEC			
	9404	2.5	M2	33	33	AV1 +0.0	610-EC	TEHTEC			
	9210	1.8	P 2	34	34	AV1 +0.0	610UL	TECTEH			
30 44	3C011	1.4	P 2		39	AV2 -0.1	A610MULC	TEHTEC	97CBOBBIN	9	
	9509	1.7	P2	37	37	AV2 -0.0	A610MULC	TEHTEC			
	9404	1.9	M2	29	29	AV2 +0.0	610-EC	TEHTEC			
	9210	1.3	P 2	28	28	AV2 +0.0	610UL	TECTEH			
34 46	3C016	1.4	P 2		36	AV3 -0.1	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	1.7	P2	17	17	AV3 -0.3	A610MULC	TEHTEC			
	9404	1.6	M2	25	25	AV3 +0.0	610-EC	TEHTEC			
	9210	1.3	P 2	28	28	AV3 +0.0	610UL	TECTEH			
41 20	3C017	1.5	P 2		34	AV4 +0.0	A610MULC	TEHTEC	97CBOBBIN	13	
	9509	1.8	P2	33	33	AV4 +0.0	A610MULC	TEHTEC			
	9404	2.1	M2	31	31	AV4 +0.0	610-EC	TEHTEC			
	9210	1.5	P 2	33	33	AV4 +0.0	610UL	TECTEH			
45 56	3C016	1.3	P 2		34	AV1 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	1.6	P2	35	35	AV1 +0.0	A610MULC	TEHTEC			
	9404	2.1	M2	31	31	AV1 +0.0	610-EC	TEHTEC			
	9210	1.9	P 2	34	34	AV1 +0.0	610UL	TECTEH			
31 45	3C011	1.0	P 2		33	AV1 -0.0	A610MULC	TEHTEC	97CBOBBIN	9	
	9509	1.5	P2	32	32	AV1 +0.0	A610MULC	TEHTEC			
	9404	2.1	M2	30	30	AV1 +0.0	610-EC	TEHTEC			
	9210	1.5	P 2	31	31	AV1 +0.0	610UL	TECTEH			
39 86	3C005	1.3	P 2		32	AV3 +0.0	A610MULC	TEHTEC	97CBOBBIN	16	
	9509	1.1	P2	27	27	AV3 +0.0	A610MULC	TEHTEC			
	9404	1.5	M2	25	25	AV3 +0.0	610-EC	TEHTEC			
	9210	1.0	P 2	24	24	AV3 +0.0	610UL	TECTEH			
34 44	3C016	1.0	P 2		30	AV2 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9404	1.5	M2	24	24	AV2 +0.0	610-EC	TEHTEC			
	9210	0.7	P 2	19	19	AV2 +0.0	610UL	TECTEH			
44 59	3C006	0.7	P 2		27	AV2 +0.0	A610MULC	TEHTEC	97CBOBBIN	15	
	9509	1.0	P2	23	23	AV2 +0.0	A610MULC	TEHTEC			
	9404	1.3	M2	23	23	AV2 +0.0	610-EC	TEHTEC			
	9210	0.6	P 2	17	17	AV2 +0.0	610UL	TECTEH			
40 19	3C020	0.6	P 2		24	AV4 +0.0	A610MULC	TEHTEC	97CBOBBIN	13	
	9509	0.9	P2	25	25	AV4 -0.2	A610MULC	TEHTEC			
	9404	1.2	M2	20	20	AV4 +0.0	610-EC	TEHTEC			
30 46	3C011	0.5	P 2		23	AV1 -0.4	A610MULC	TEHTEC	97CBOBBIN	9	
	9509	0.7	P2	22	22	AV1 -0.4	A610MULC	TEHTEC			
	9404	0.6	M2	12	12	AV1 +0.0	610-EC	TEHTEC			

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Row/Col	Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested	Dataset	Zone	HIST
33 45	3C020	0.6	P 2		23	AV1 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	0.8	P2	21	21	AV1 -0.0	A610MULC	TEHTEC			
	9404	0.7	M2	13	13	AV1 +0.0	610-EC	TEHTEC			
	9210	0.6	P 2	18	18	AV1 +0.0	610UL	TECTEH			
41 56	3C016	0.6	P 2		22	AV2 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	0.6	P2	19	19	AV2 +0.0	A610MULC	TEHTEC			
	9404	1.3	M2	23	23	AV2 +0.0	610-EC	TEHTEC			
	9210	0.8	P 2	21	21	AV2 +0.0	610UL	TECTEH			
45 56	3C016	0.6	P 2		22	AV4 -0.4	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	0.8	P2	24	24	AV4 +0.0	A610MULC	TEHTEC			
	9404	0.7	M2	14	14	AV4 +0.0	610-EC	TEHTEC			
	9210	0.7	P 2	19	19	AV4 +0.0	610UL	TECTEH			
28 45	3C011	0.4	P 2		21	AV1 -0.0	A610MULC	TEHTEC	97CBOBBIN	9	
	9509	0.5	P2	15	15	AV1 +0.0	A610MULC	TEHTEC			
	9404	0.8	M2	15	15	AV1 +0.0	610-EC	TEHTEC			
40 56	3C020	0.5	P 2		20	AV3 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	3C020	0.5	P 2		20	AV1 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
34 59	3C006	0.5	P 2		19	03C +0.3	A610MULC	TEHTEC	97CBOBBIN	15	
	9509	1.2	P1	5	5	03C +0.0	A610MULC	TEHTEC			
	9404	1.0	M1	19	19	03C +0.0	610-EC	TEHTEC			
33 45	3C020	0.4	P 2		17	AV3 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	0.5	P2	15	15	AV3 -0.1	A610MULC	TEHTEC			
	9404	0.7	M2	13	13	AV3 +0.0	610-EC	TEHTEC			
47 50	3C016	0.4	P 2		16	07C -0.3	A610MULC	TEHTEC	97CBOBBIN	14	
48 59	3C006	0.4	P 2		16	AV1 +0.0	A610MULC	TEHTEC	97CBOBBIN	15	
	9509	0.5	P2	14	14	AV1 -0.0	A610MULC	TEHTEC			
	9404	0.6	M2	13	13	AV1 +0.0	610-EC	TEHTEC			
	9210	0.5	P 2	15	15	AV1 +0.0	610UL	TECTEH			
49 67	3C006	0.4	P 2		16	07C -0.3	A610MULC	TEHTEC	97CBOBBIN	15	
	9509	0.4	P2	14	14	07C -0.3	A610MULC	TEHTEC			
33 43	3C020	0.3	P 2		15	AV3 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	0.5	P2	15	15	AV3 +0.1	A610MULC	TEHTEC			
	9404	0.9	M2	17	17	AV3 +0.0	610-EC	TEHTEC			
	9210	0.7	P 2	19	19	AV3 +0.0	610UL	TECTEH			
43 59	3C006	0.3	P 2		15	AV2 +0.0	A610MULC	TEHTEC	97CBOBBIN	15	
	9509	0.6	P2	15	15	AV2 -0.1	A610MULC	TEHTEC			
	9404	0.6	M2	12	12	AV2 +0.0	610-EC	TEHTEC			
34 45	3C020	0.3	P 2		14	AV3 +0.0	A610MULC	TEHTEC	97CBOBBIN	14	
	9509	0.5	P2	15	15	AV3 -0.2	A610MULC	TEHTEC			
	9404	0.8	M2	15	15	AV3 +0.0	610-EC	TEHTEC			
	9210	0.8	P 2	20	20	AV3 +0.0	610UL	TECTEH			

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1997 Wear indications with history

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
48	40	3C016	0.4	P 2		14	03C	-0.2	A610MULC	TEHTEC	97CBOBBIN	14	
49	38	3C020	0.4	P 2		14	07C	-0.3	A610MULC	TEHTEC	97CBOBBIN	13	
48	59	3C006	0.3	P 2		12	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.3	P2	8	8	AV2	+0.0	A610MULC	TEHTEC			
40	60	3C006	0.3	P 2		11	AV2	+0.1	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.3	P2	10	10	AV2	+0.0	A610MULC	TEHTEC			
		9404	0.6	M2	13	13	AV2	-0.2	610-EC	TEHTEC			
43	56	3C016	0.3	P 2		11	09C	-0.3	A610MULC	TEHTEC	97CBOBBIN	14	
		9509	0.6	P2	18	18	09C	-0.4	A610MULC	TEHTEC			
		9404	0.8	M2	17	17	09C	-0.4	610-EC	TEHTEC			
48	59	3C006	0.3	P 2		11	AV3	+0.0	A610MULC	TEHTEC	97CBOBBIN	15	
49	50	3C016	0.3	P 2		11	07C	-0.3	A610MULC	TEHTEC	97CBOBBIN	14	
39	74	3C006	0.2	P 2		10	AV3	-0.2	A610MULC	TEHTEC	97CBOBBIN	15	
		9509	0.4	P2	11	11	AV3	+0.0	A610MULC	TEHTEC			
49	34	3C020	0.2	P 2		8	AV2	+0.0	A610MULC	TEHTEC	97CBOBBIN	13	
		9509	0.4	P2	12	12	AV2	+0.2	A610MULC	TEHTEC			
		9404	0.7	M2	13	13	AV2	-0.1	610-EC	TEHTEC			

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MBM Indications with related MRPC calls

Row/Col		Year Examined	Reel	Voltage	CH	Ind. %TWD Desc.	Indication Location		Probe	Extent Tested
2	84	09/01/95	3C005	1.3	1	MBM	04C	+4.4	A610MULC	11CTEC
		04/30/97	3C010	1.3	1	MBM	04C	+8.5	A610MULC	11CTECMBH
		RPC DATA	3C027	2.2	1	VOL	04C	+8.5	P620MRPC3C	06C04C
5	23	09/01/95	3C011	1.2	1	MBM	09C	+31.2	A610MULC	TEHTEC
		RPC DATA	3C027	1.8	1	VOL	09C	+31.3	P620MRPC3C	10C09C
5	53	09/01/95	3C002	1.0	1	MBM	08C	+17.7	A610MULC	TEHTEC
		RPC DATA	3C027	2.7	1	VOL	08C	+17.6	P620MRPC3C	09C08C
7	74	09/01/95	3C008	1.2	1	MBM	04C	+6.8	A610MULC	TEHTEC
		RPC DATA	3C027	1.0	1	VOL	04C	+6.9	P620MRPC3C	05C04C
8	36	09/01/95	3C011	1.9	1	MBM	03H	+16.3	A610MULC	TEHTEC
		RPC DATA	3H049	1.6	1	VOL	03H	+16.2	P620MRPC3C	05H03H
8	51	09/01/95	3C002	1.3	1	MBM	08C	+13.6	A610MULC	TEHTEC
		RPC DATA	3C027	1.9	1	VOL	08C	+13.7	P620MRPC3C	09C08C
8	92	09/01/95	3C005	0.4	1	MBM	10C	+9.4	A610MULC	TEHTEC
		RPC DATA	3C027	2.2	1	VOL	10C	+9.4	P620MRPC3C	11C10C
8	99	09/01/95	3C003	0.6	1	MBM	10C	+5.6	A610MULC	TEHTEC
		RPC DATA	3C027	1.0	1	VOL	10C	+5.4	P620MRPC3C	11C10C
22	97	09/01/95	3C004	0.6	1	MBM	08C	+36.3	A610MULC	TEHTEC
		RPC DATA	3C027	1.8	1	VOL	08C	+36.2	P620MRPC3C	09C08C
29	29	09/01/95	3C009	1.8	1	MBM	10C	+1.1	A610MULC	TEHTEC
		RPC DATA	3C027	2.9	1	VOL	10C	+1.8	P620MRPC3C	11C10C
31	77	09/01/95	3C005	0.6	1	MBM	07C	+1.9	A610MULC	TEHTEC
		RPC DATA	3C029	1.7	1	VOL	07C	+2.0	P620MRPC3C	08C07C
36	28	09/01/95	3C009	1.0	1	MBM	05H	+24.3	A610MULC	TEHTEC
		RPC DATA	3H058			INR	05H	+24.3	P620MRPC3C	07H05H
37	36	09/01/95	3C009	0.8	1	MBM	10C	+19.3	A610MULC	TEHTEC
		RPC DATA	3C027	1.4	1	VOL	10C	+19.5	P620MRPC3C	11C10C

Number of Tubes: 13

C P & L

Date: 06/25/97

Shearon Harris

Page: 1

COMPONENT: SG C

DNT Indications with related MRPC calls

Row/Col	Year Examined	Reel	Voltage	CH	Ind. Desc.	%TWD	Indication Location	Probe	Extent Tested
14 78	04/29/97	3C010	7.4	P 1	DNT		02C -0.3	A610MULC	TEHTEC
	RPC DATA	3C027	4.3	2	VOL		02C +0.7	P620MRPC3C	02C02C
	RPC DATA	3C030		1	PID		02C +0.5	P580MRPC1C	02C02C
15 84	09/01/95	3C004	14.8	P1	DNT		01H +0.5	A610MULC	TEHTEC
	RPC DATA	3H026						B620MRPC3C	01H01H
	RPC DATA	023		1				620-ZC	01H01H
21 110	04/29/97	3C009	5.2	P 1	DNT		06C +0.5	A610MULC	TEHTEC
	RPC DATA	3C021						B620MRPC3C	06C06C
	04/29/97	3C009	20.1	P 1	DNT		04C +0.6	A610MULC	TEHTEC
	RPC DATA	3C021						B620MRPC3C	04C04C
25 108	09/01/95	3C004	12.8	P1	DNT		01H -0.4	A610MULC	TEHTEC
	RPC DATA	3H058						P620MRPC3C	01H01H
	RPC DATA	3H048						P620MRPC3C	01HTSH
26 60	04/29/97	3C007	5.9	P 1	DNT		11H +0.7	A610MULC	TEHTEC
	RPC DATA	3H047						P620MRPC3C	11H11H
	RPC DATA	017		1				620-ZC	11H10H
28 84	09/01/95	3C004	25.8	P1	DNT		09H -0.4	A610MULC	TEHTEC
	RPC DATA	3H025						B620MRPC3C	09H09H
	RPC DATA	3H026						B620MRPC3C	09H09H
	RPC DATA	019		1				620-ZC	09H09H
28 85	04/28/97	3C008	11.3	P 1	DNT		09H -0.3	A610MULC	TEHTEC
	RPC DATA	3H054			INR		09H -1.1	P620MRPC3C	09H09H
	RPC DATA	3H048						P620MRPC3C	09H09H
29 84	09/01/95	3C004	17.4	P1	DNT		09H -0.2	A610MULC	TEHTEC
	RPC DATA	3H026						B620MRPC3C	09H09H
	RPC DATA	019		1				620-ZC	09H09H
29 85	04/28/97	3C008	8.1	P 1	DNT		09H -0.3	A610MULC	TEHTEC
	RPC DATA	3H026						B620MRPC3C	09H09H
38 16	04/30/97	3C014	14.4	P 1	DNT		09H -0.3	A610MULC	TEHTEC
	RPC DATA	3H027						B620MRPC3C	09H09H
	RPC DATA	017		1				620-ZC	09H09H
42 25	04/30/97	3C015	3.6	P 1	DNT		11H -0.3	A610MULC	TEHTEC
	RPC DATA	3H057						P590MRPC3C	11H11H
	RPC DATA	3H048						P620MRPC3C	11H11H

DNT Indications with related MRPC calls

Row/Col		Year Examined	Reel	Voltage	CH	Ind. %TWD Desc.	Indication Location		Probe	Extent Tested
45	70	04/29/97	3C006	3.6	P 1	DNT	11H	+0.1	A610MULC	TEHTEC
		RPC DATA	017		1				620-ZC	11H10H
47	79	09/01/95	3C006	13.3	P1	DNT	03H	+0.3	A610MULC	TEHTEC
		RPC DATA	3H026						B620MRPC3C	03H03H
		RPC DATA	021		1				620-ZC	03H03H
48	29	04/30/97	3C015	70.2	P 1	DNT	08H	+0.9	A610MULC	TEHTEC
		RPC DATA	3H057						P590MRPC3C	08H08H
		RPC DATA	3H028						B620MRPC3C	08H08H
		RPC DATA	017			TRS	08H	+0.0	620-ZC	08H08H
		RPC DATA	047						590-ZC	08H08H
48	79	09/01/95	3C006	7.8	P1	DNT	11H	-0.5	A610MULC	TEHTEC
		RPC DATA	3H026						B620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H11H
		09/01/95	3C006	8.2	P1	DNT	03H	+0.4	A610MULC	TEHTEC
		RPC DATA	3H026						B620MRPC3C	03H03H
		RPC DATA	019		1				620-ZC	03H03H
48	80	04/29/97	3C005	8.9	P 1	DNT	11H	-0.3	A610MULC	TEHTEC
		RPC DATA	3H047						P620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H11H
48	85	09/01/95	3C004	5.5	P1	DNT	11H	-0.3	A610MULC	TEHTEC
		RPC DATA	3H047						P620MRPC3C	11H11H
48	86	04/29/97	3C005	3.7	P 1	DNT	11H	-0.6	A610MULC	TEHTEC
		RPC DATA	3H025						B620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H10H
		RPC DATA	066	14.3	1	DNG	10H	+40.3	610-EC	TEHTEC
		RPC DATA	066	25.6	1	DNG	10H	+40.9	610-EC	TEHTEC
49	31	04/30/97	3C015	11.2	P 1	DNT	08H	+0.8	A610MULC	TEHTEC
		RPC DATA	3H026						B620MRPC3C	08H08H
		RPC DATA	017		1				620-ZC	08H08H
49	36	04/30/97	3C015	24.0	P 1	DNT	11C	-0.4	A610MULC	TEHTEC
		RPC DATA	017		1				620-ZC	11H10H
		RPC DATA	024	14.6	1	DNG	10H	+27.9	610-EC	TEHTEC
		RPC DATA	024	5.6	1	DNG	10H	+27.3	610-EC	TEHTEC
		RPC DATA	024	5.7	1	DNG	10H	+36.8	610-EC	TEHTEC
49	38	04/30/97	3C015	10.1	P 1	DNT	11C	-0.5	A610MULC	TEHTEC
		RPC DATA	017		1				620-ZC	11H10H
		RPC DATA	028	7.6	M1	DNG	10H	+35.5	610-EC	TEHTEC
		RPC DATA	028	12.2	M1	DNG	10H	+36.3	610-EC	TEHTEC

DNT Indications with related MRPC calls

Row/Col		Year Examined	Reel	Voltage	CH	Ind. %TWD Desc.	Indication Location		Probe	Extent Tested
49	69	04/29/97	3C006	9.8	P 1	DNT	11H	-0.9	A610MULC	TEHTEC
		RPC DATA	3H047						P620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H10H
		RPC DATA	037	6.6	M1	DNG	10H	+29.3	610-EC	TECTEH
		RPC DATA	037	16.0	M1	DNG	10H	+40.8	610-EC	TECTEH
		RPC DATA	037	6.9	M1	DNG	10H	+40.2	610-EC	TECTEH
		RPC DATA	037	7.8	1	DNG	10H	+41.9	610-EC	TECTEH
		RPC DATA	037	5.3	1	DNG	10H	+41.4	610-EC	TECTEH
49	73	04/29/97	3C006	5.1	P 1	DNT	11H	-0.5	A610MULC	TEHTEC
		RPC DATA	3H026						B620MRPC3C	11H11H
49	75	04/29/97	3C006	7.2	P 1	DNT	11H	+0.3	A610MULC	TEHTEC
		RPC DATA	3H026						B620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H11H
49	77	04/29/97	3C005	2.5	P 1	DNT	11H	-0.3	A610MULC	TEHTEC
		RPC DATA	3H047						P620MRPC3C	11H11H
		RPC DATA	3H026						B620MRPC3C	11H10H
		RPC DATA	019		1				620-ZC	11H10H
		RPC DATA	058	7.1	M1	DNG	10H	+33.4	610-EC	TEHTEC
		RPC DATA	058	6.4	M1	DNG	10H	+34.0	610-EC	TEHTEC
		RPC DATA	058	6.3	M1	DNG	10H	+37.3	610-EC	TEHTEC
		RPC DATA	058	13.0	M1	DNG	10H	+38.1	610-EC	TEHTEC
49	80	04/29/97	3C005	4.9	P 1	DNT	11H	-0.1	A610MULC	TEHTEC
		RPC DATA	3H047						P620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H11H
49	82	09/01/95	3C004	9.0	P1	DNT	11H	-0.3	A610MULC	TEHTEC
		RPC DATA	3H047						P620MRPC3C	11H11H
		RPC DATA	019		1				620-ZC	11H11H

Number of Tubes: 27

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Shearon Harris
COMPONENT: SG C

Report Date: 06/25/97
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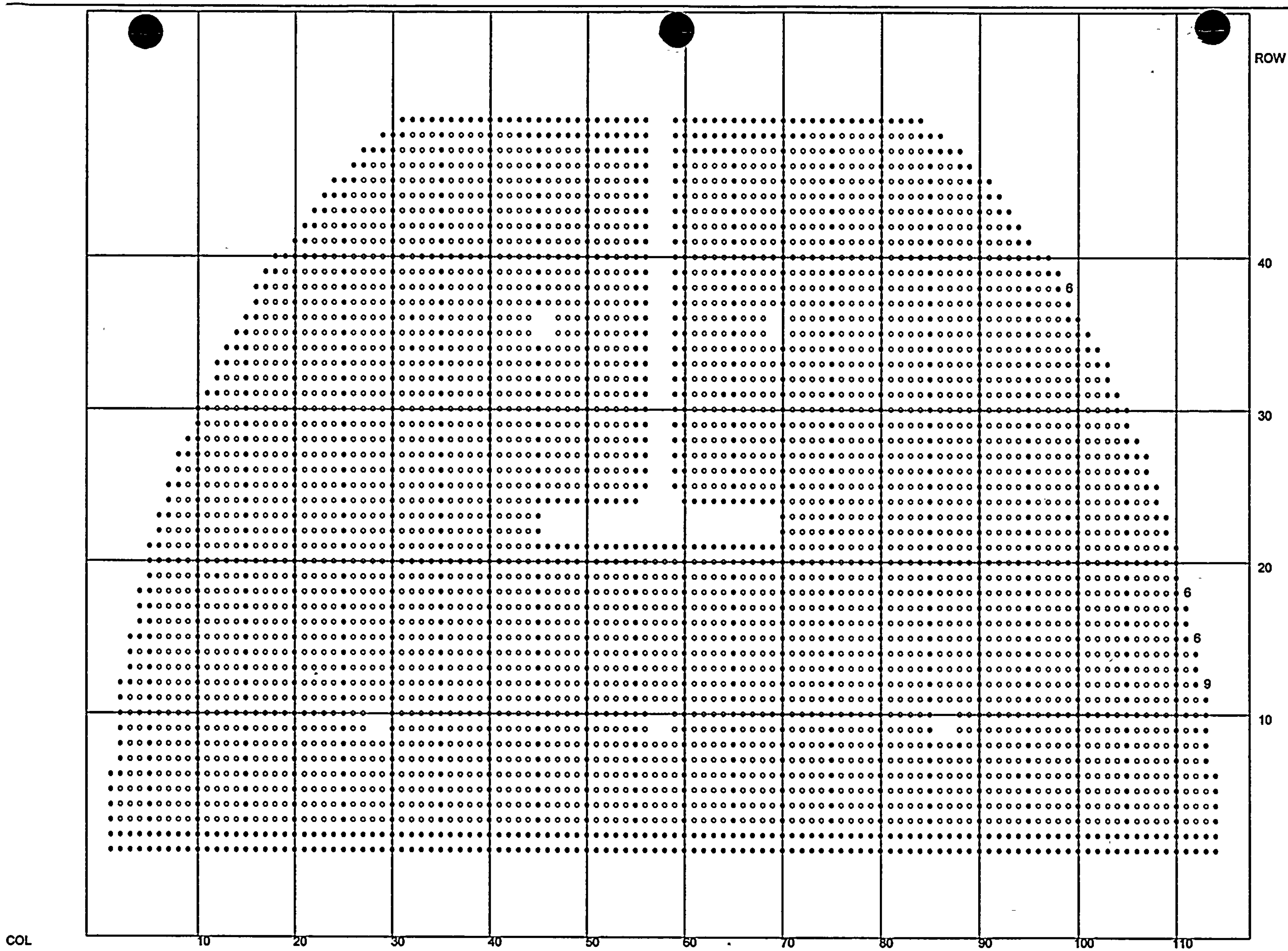
1997 Diagnostic exams with originating Bobbin data

Row/Col		Reel / Outage	Volts	CH	Ind. Desc.	%TWD	Indication Location		Probe	Extent Tested	Dataset	Zone	HIST
11	15	3H053			INR		09H	+0.1	P620MRPC3C	09H09H	97CBOBBIN	1	
		9704	0.3	P 1	DSI	0	09H	+0.1	A610MULC	TEHTEC			
14	78	3C030		1	PID		02C	+0.5	P580MRPC1C	02C02C	97CBOBBIN	5	
		9704	14.8	P 1	DSI	0	02C	+0.6	A610MULC	TEHTEC			
18	45	3H053	0.5	P 1	VOL		11H	+0.2	P620MRPC3C	11H11H	97CBOBBIN	9	
		9704	1.3	P 1	DSI	0	11H	+0.2	A610MULC	TEHTEC			
22	99	3H053		P 1	PID		01H	+0.4	P620MRPC3C	01HTSH	97CBOBBIN	12	
		9704	1.7	P 1	DSI	0	01H	+0.6	A610MULC	TEHTEC			
32	60	3H053			INF		TEH	+5.7	P620MRPC3C	TSHTEH	97CBOBBIN	10	
		9704	3.4	P 1	DRI	0	TEH	+5.7	A610MULC	TEHTEC			
38	80	3C032			INF		06C	+0.4	P620MRPC3C80	06C06C	97CBOBBIN	16	
		9704	0.5	P 1	DSI	0	06C	+0.4	A610MULC	TEHTEC			

NUMBER OF TUBES REPORTED: 6

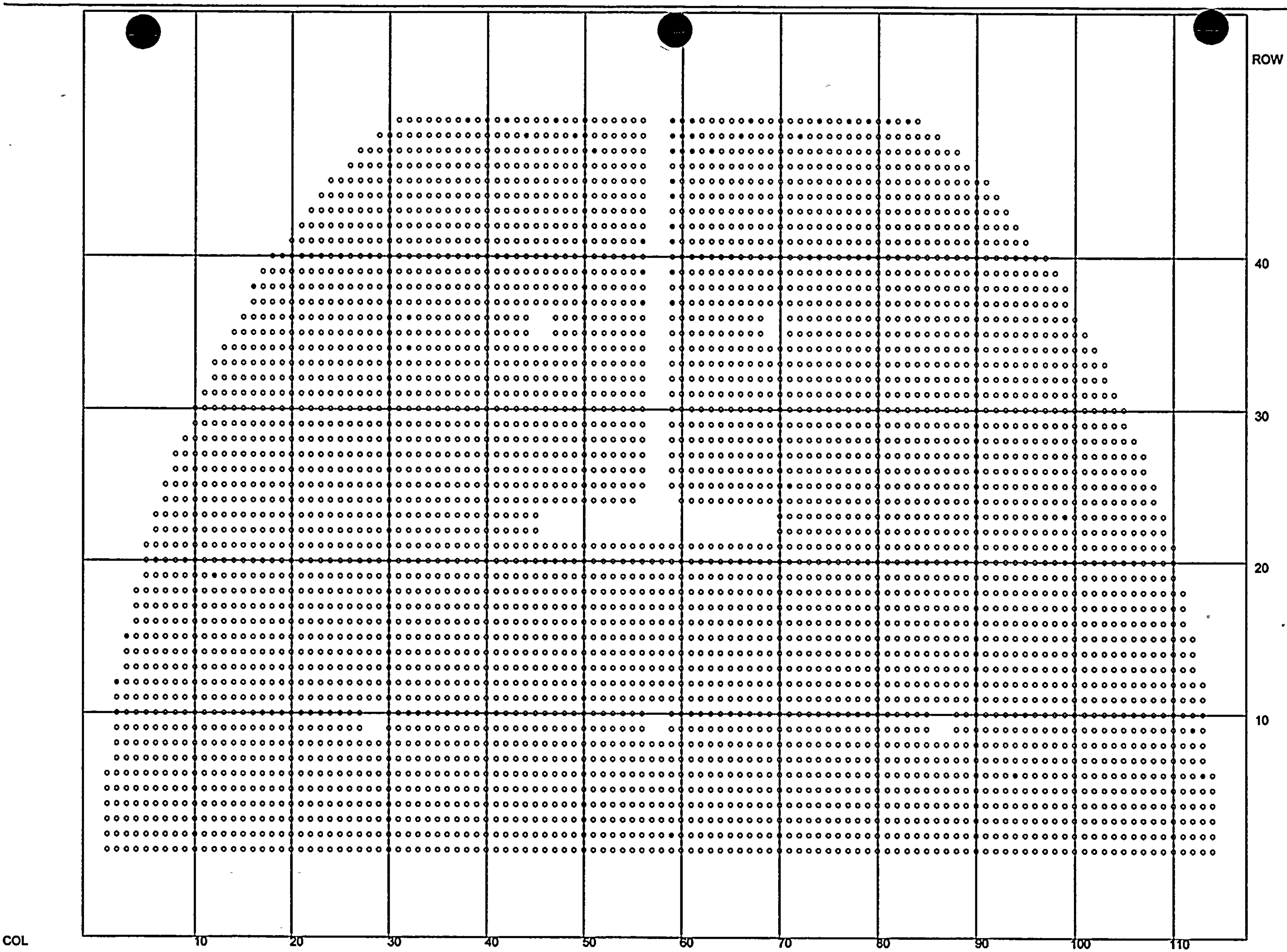


: 1373: A610MULC bobbin probe
9: 1: A590SFRM bobbin probe
6: 3: A560SFRM bobbin probe

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/30/97 Inlet

Applied Computer Resources, Inc.

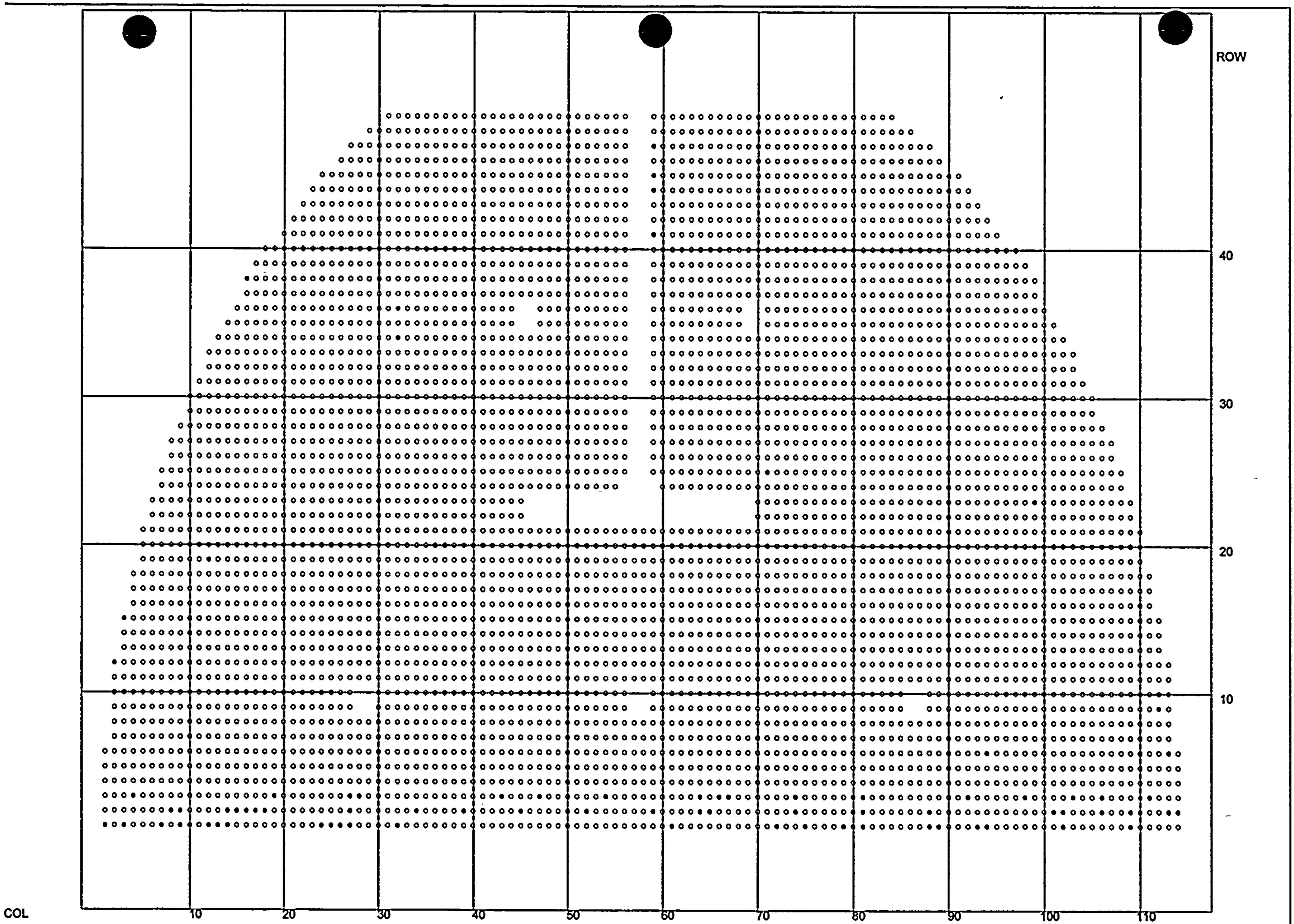


: 30: Pre Heater 03C & 02C MRPC examinations

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

18 Plugged

Applied Computer Resources, Inc.

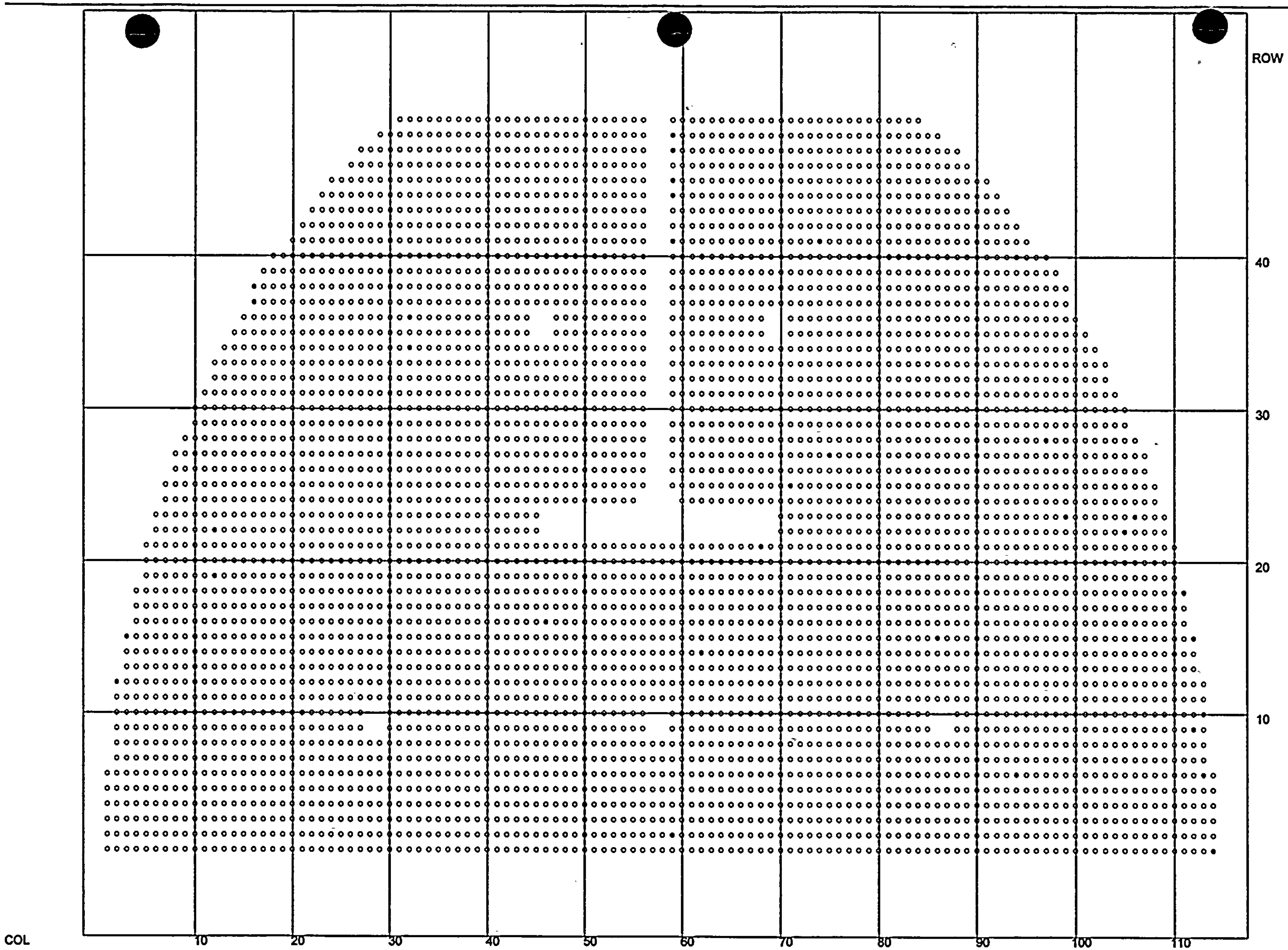


: 69: U-bend MRPC examinations

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

Applied Computer Resources, Inc.

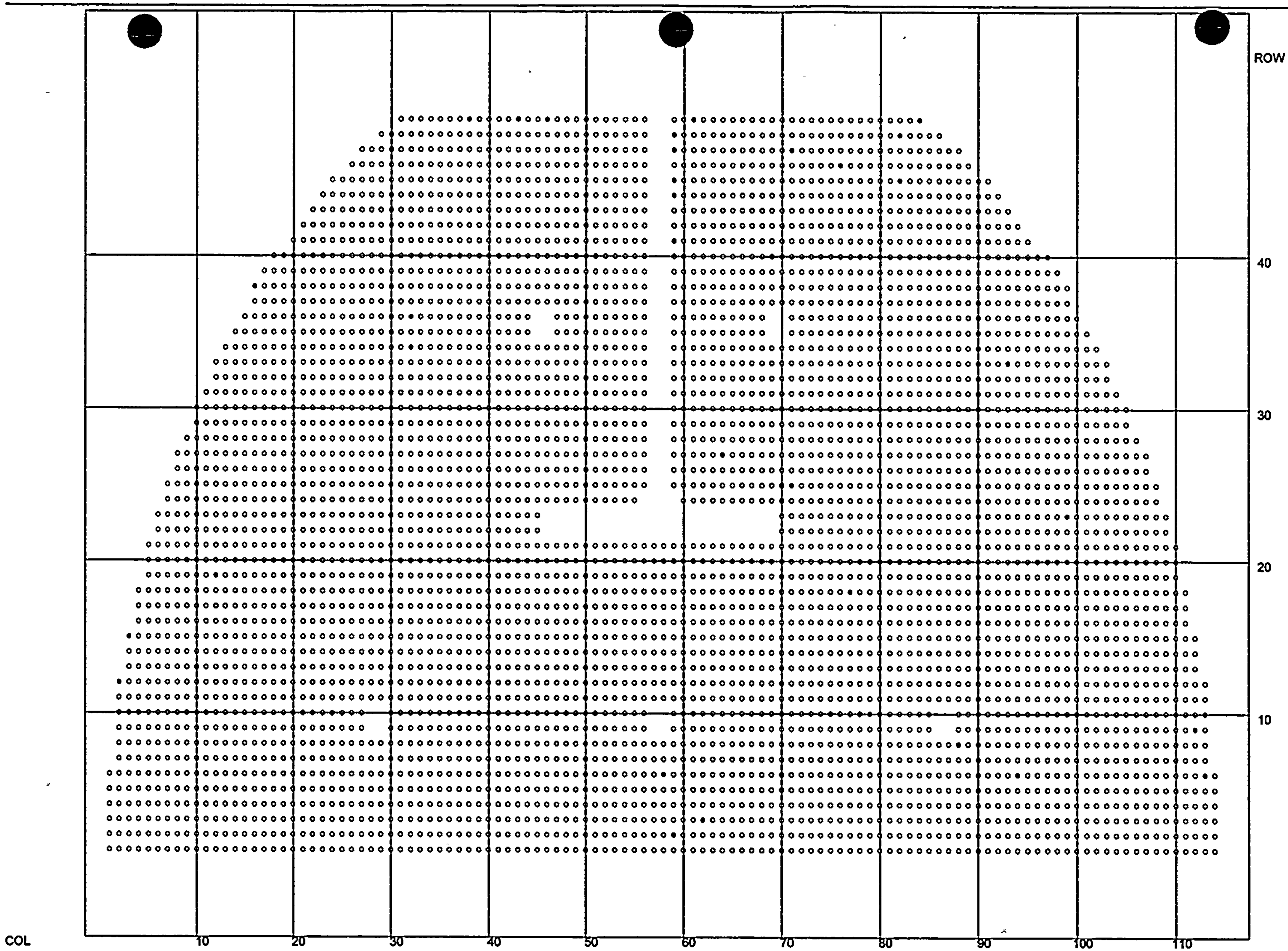


: 16: Special Interest Hot Leg Exams - Pre Outage

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

18 Plugged

Applied Computer Resources, Inc.

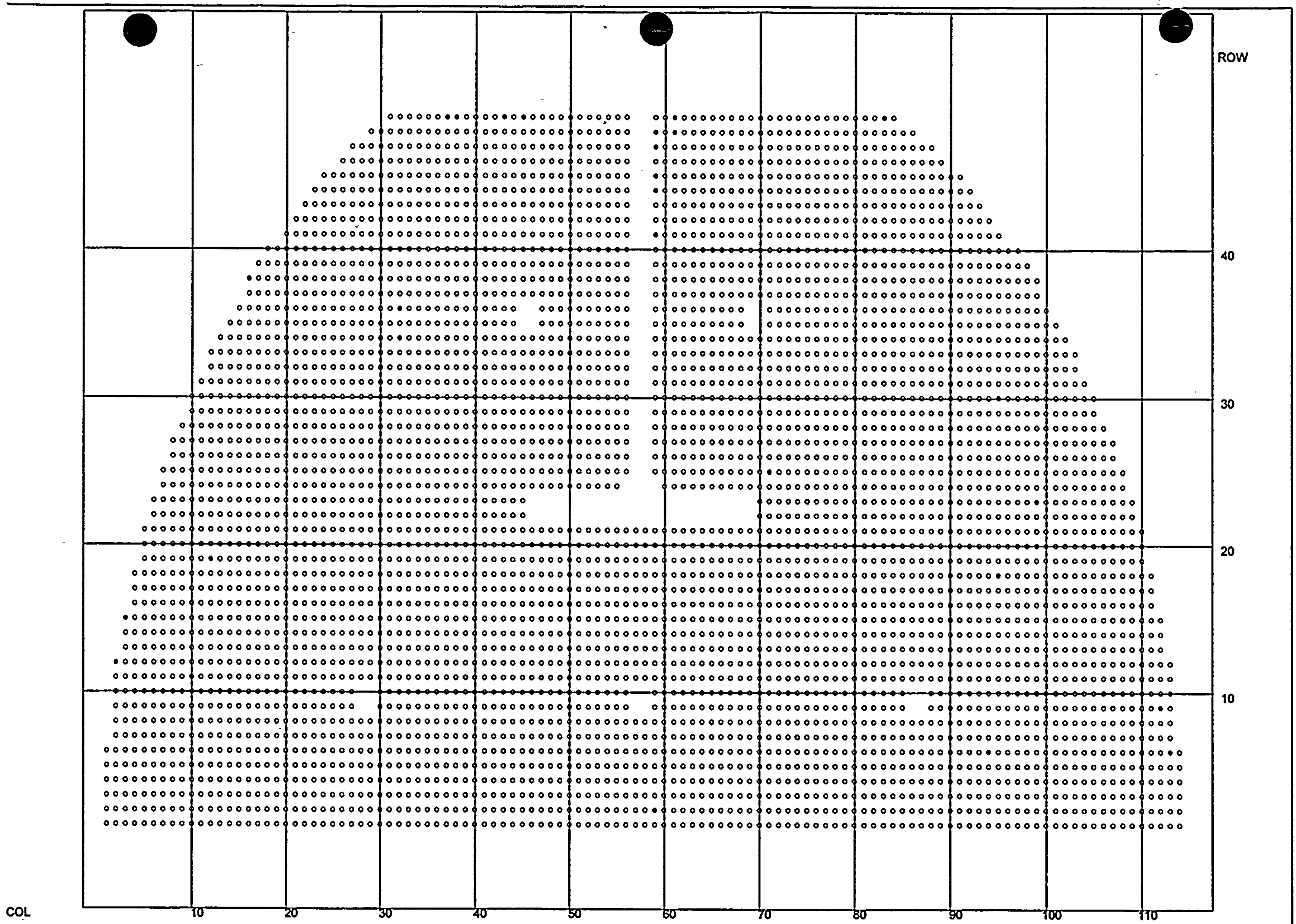


: 18: Special Interest Cold Leg Exams - Pre Outage

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

Applied Computer Resources, Inc.

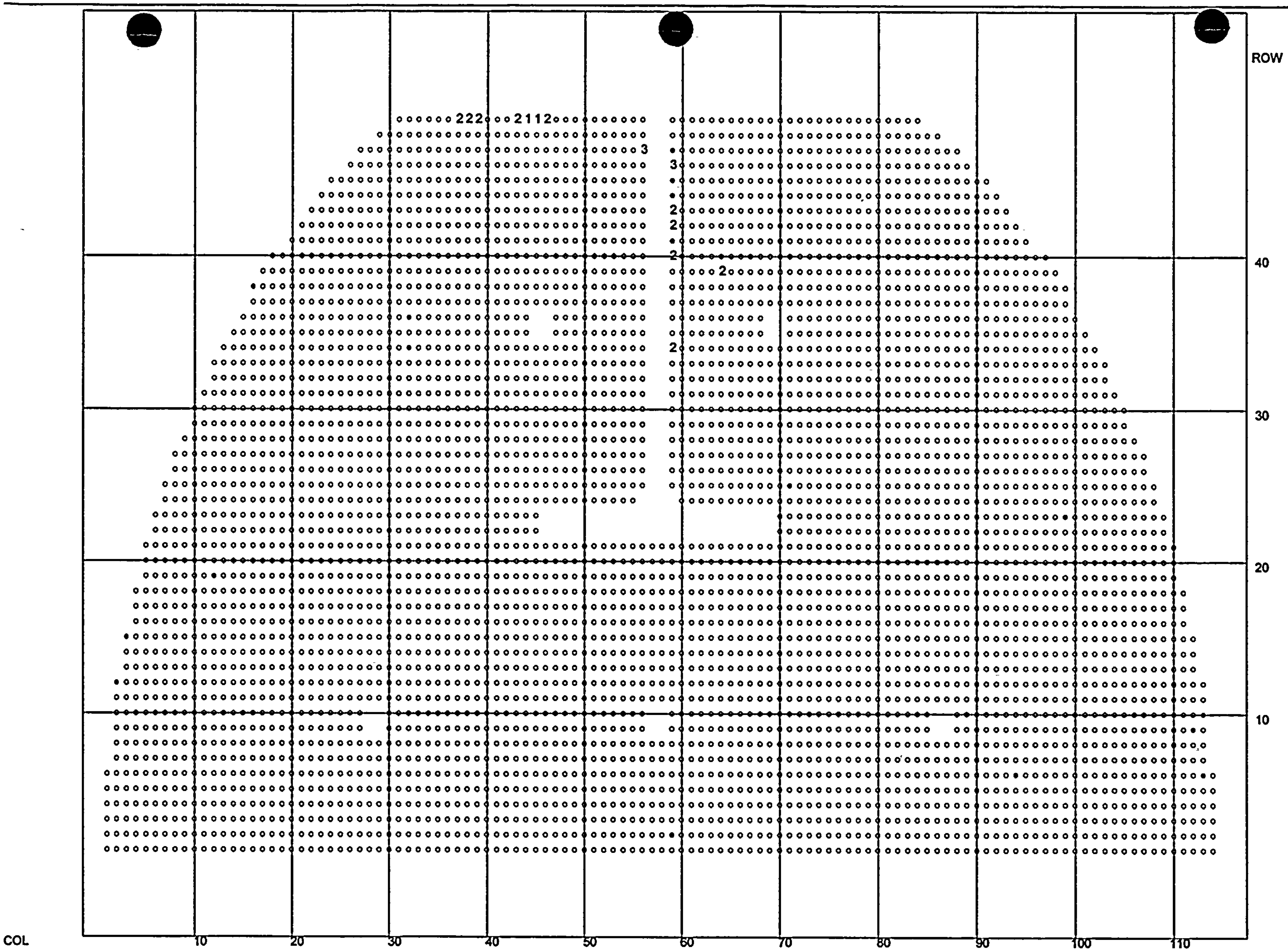


: 11: Diagnostic Exams during RFO-7

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

18 Plugged

Applied Computer Resources, Inc.

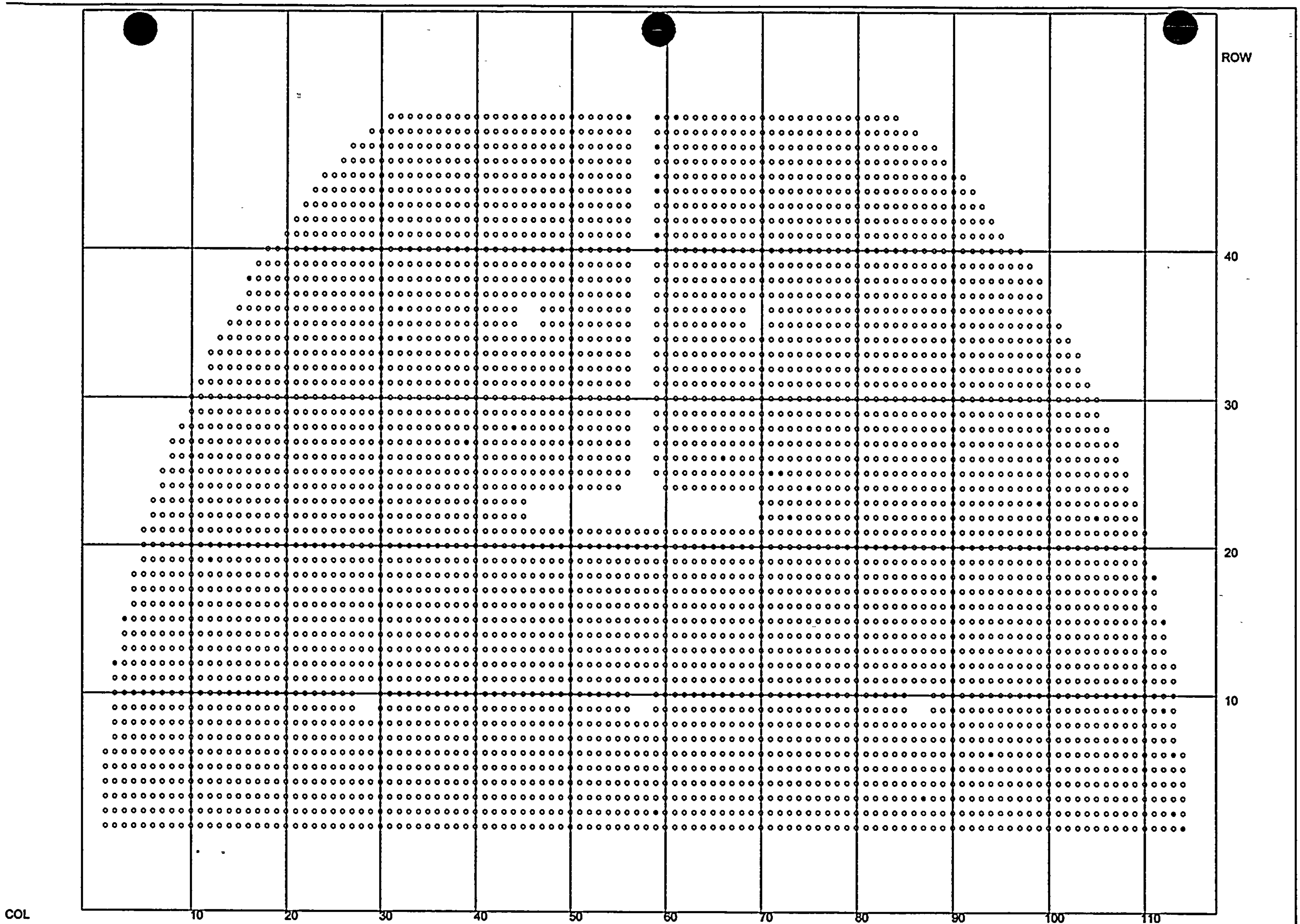


1: 2: Wear 1-10%
2: 10: Wear 11-20%
3: 2: Wear 21-30%
4: 0: Wear 31-38%
5: 0: Wear 39% and higher

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/30/97 Inlet

Applied Computer Resources, Inc.

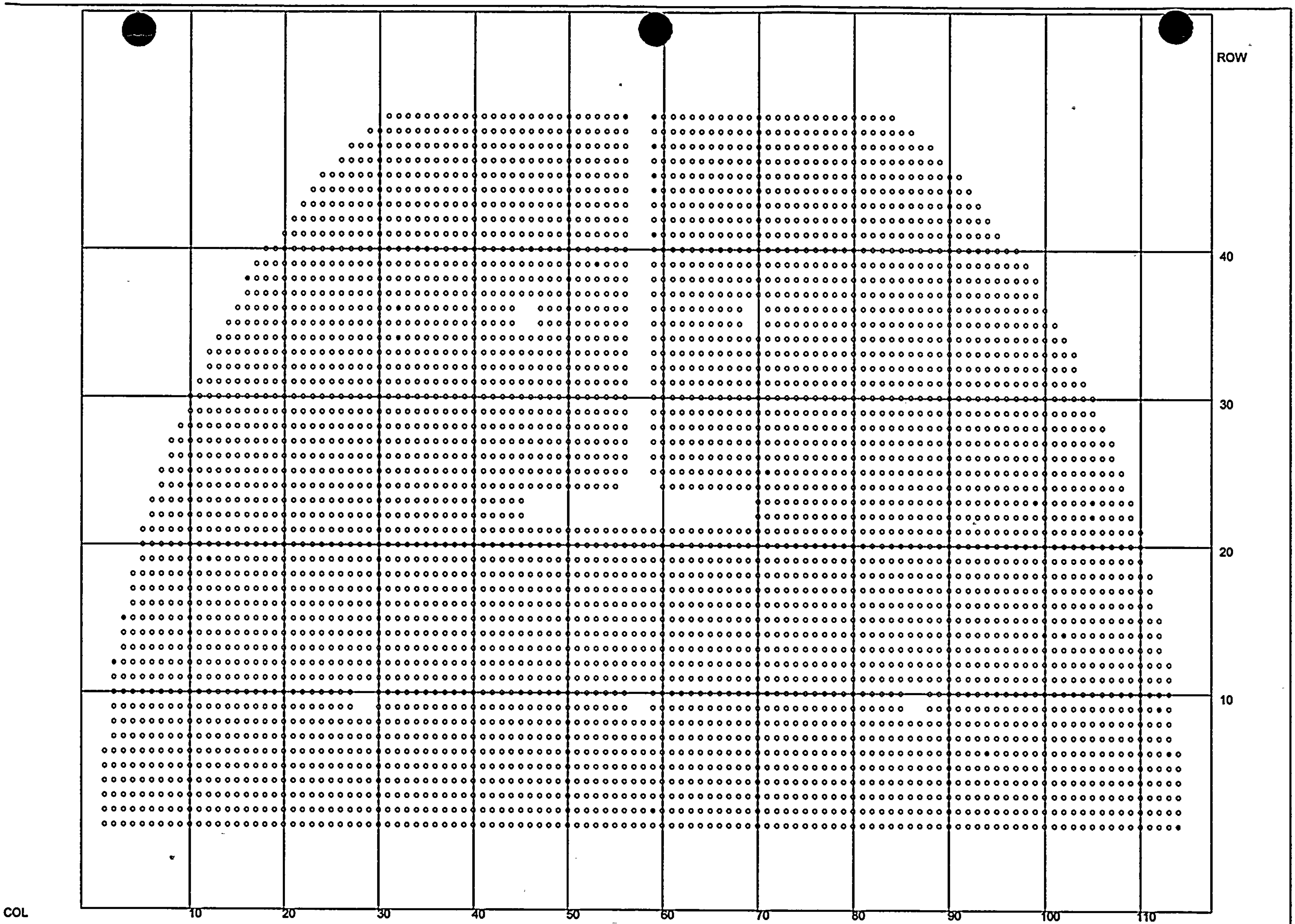


: 17: Tubes repaired (plugged) during RFO-7

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

Applied Computer Resources, Inc.

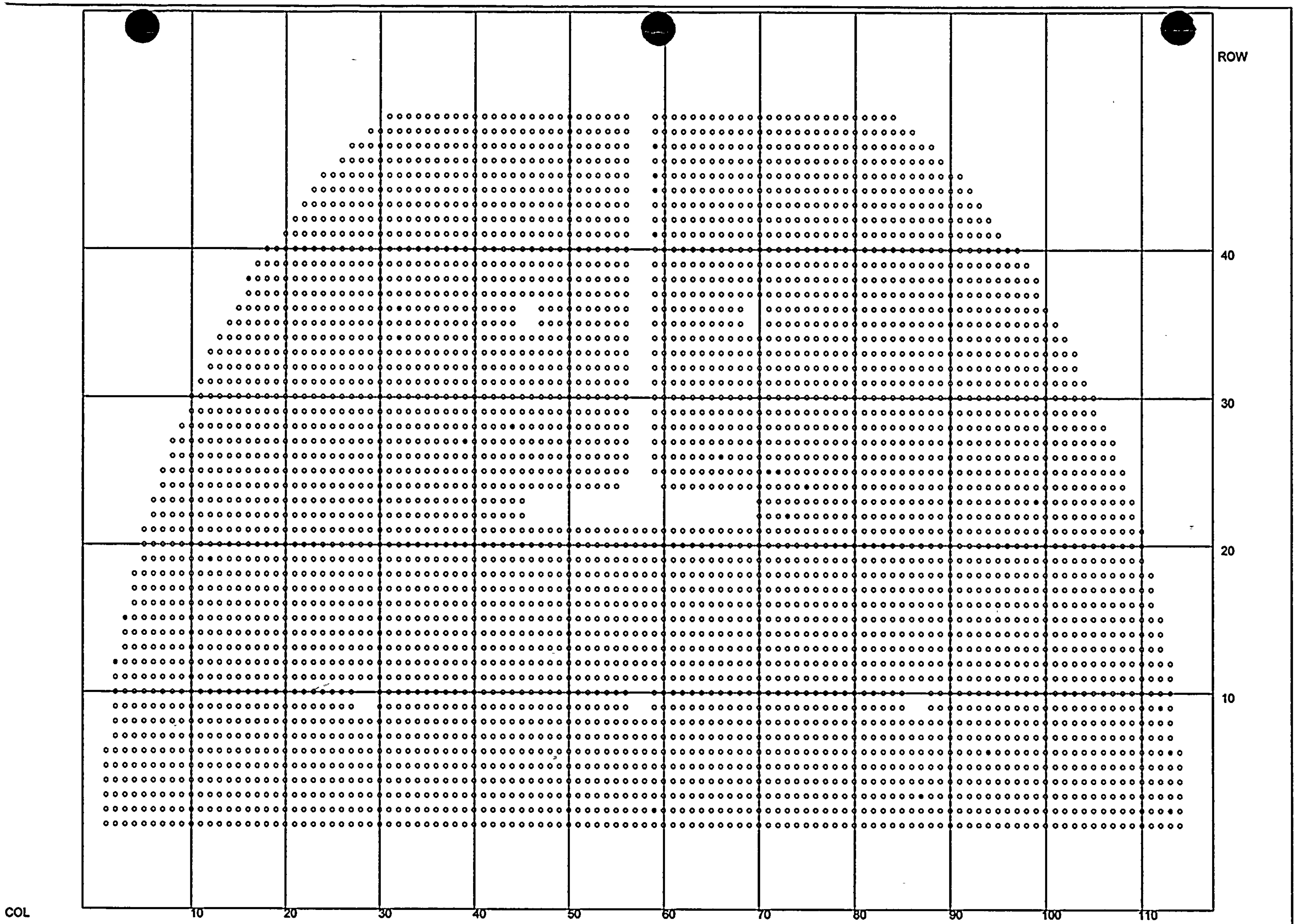


: 9: Tubes with Possible Loose Parts (PLP)
: 3: Tubes with Possible Loose part Indication

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

Applied Computer Resources, Inc.

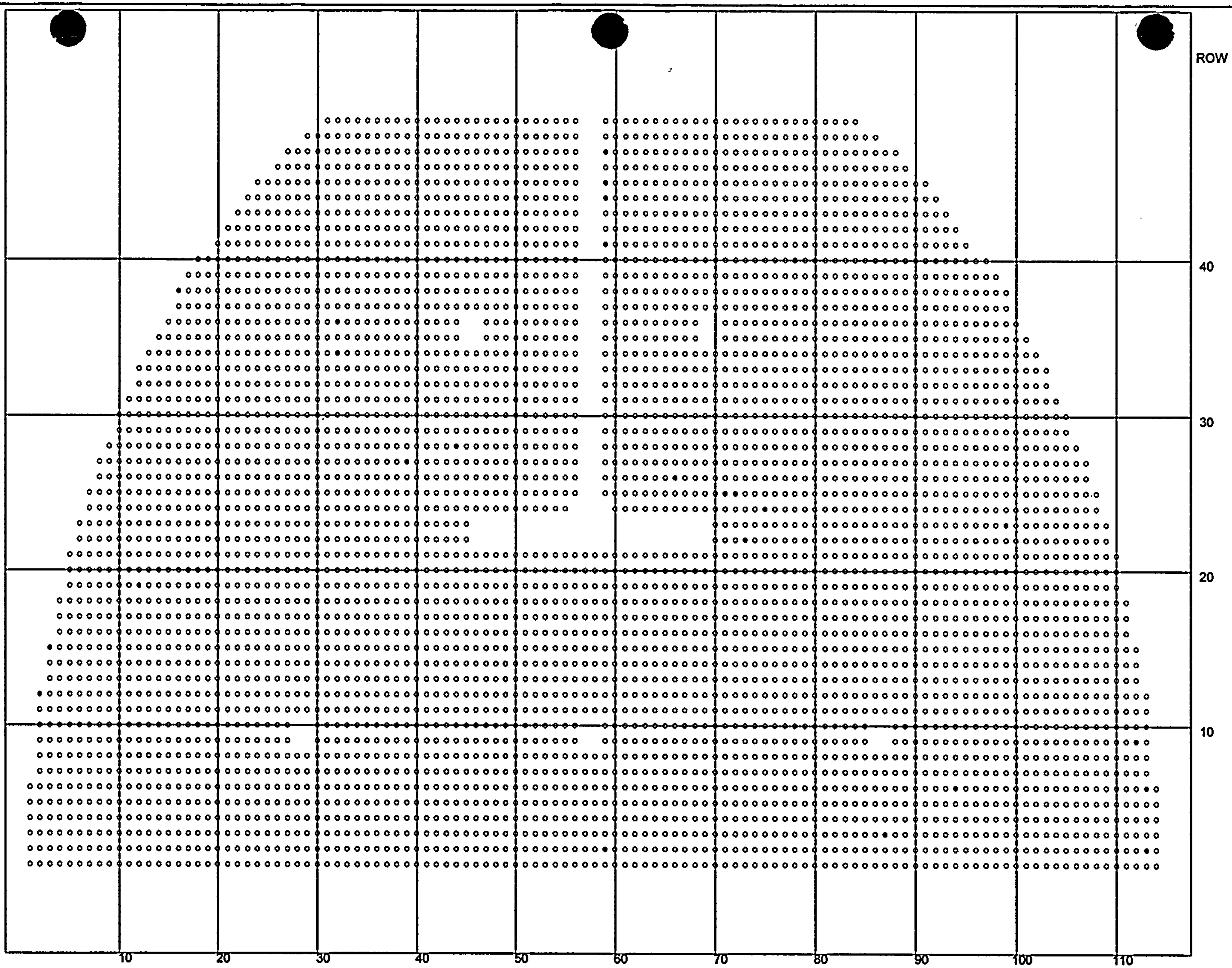


: 8: Tubes with Circumferential Indications
: 2: Tubes with Axial Indications

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

Applied Computer Resources, Inc.

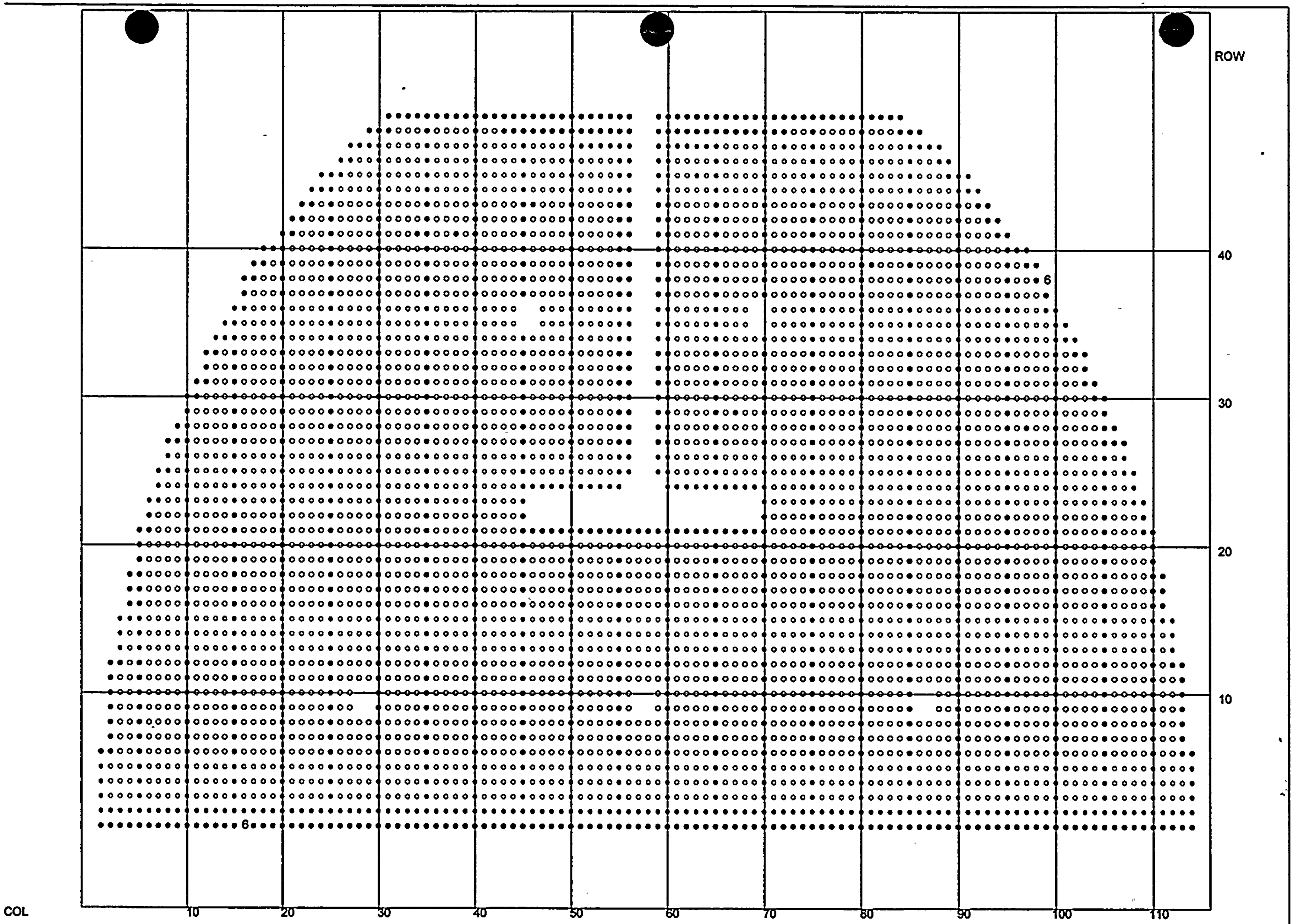


: 8: Tubes with Circumferential Indications
: 2: Tubes with Axial Indications

18 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator A 06/25/97 Inlet

Applied Computer Resources, Inc.

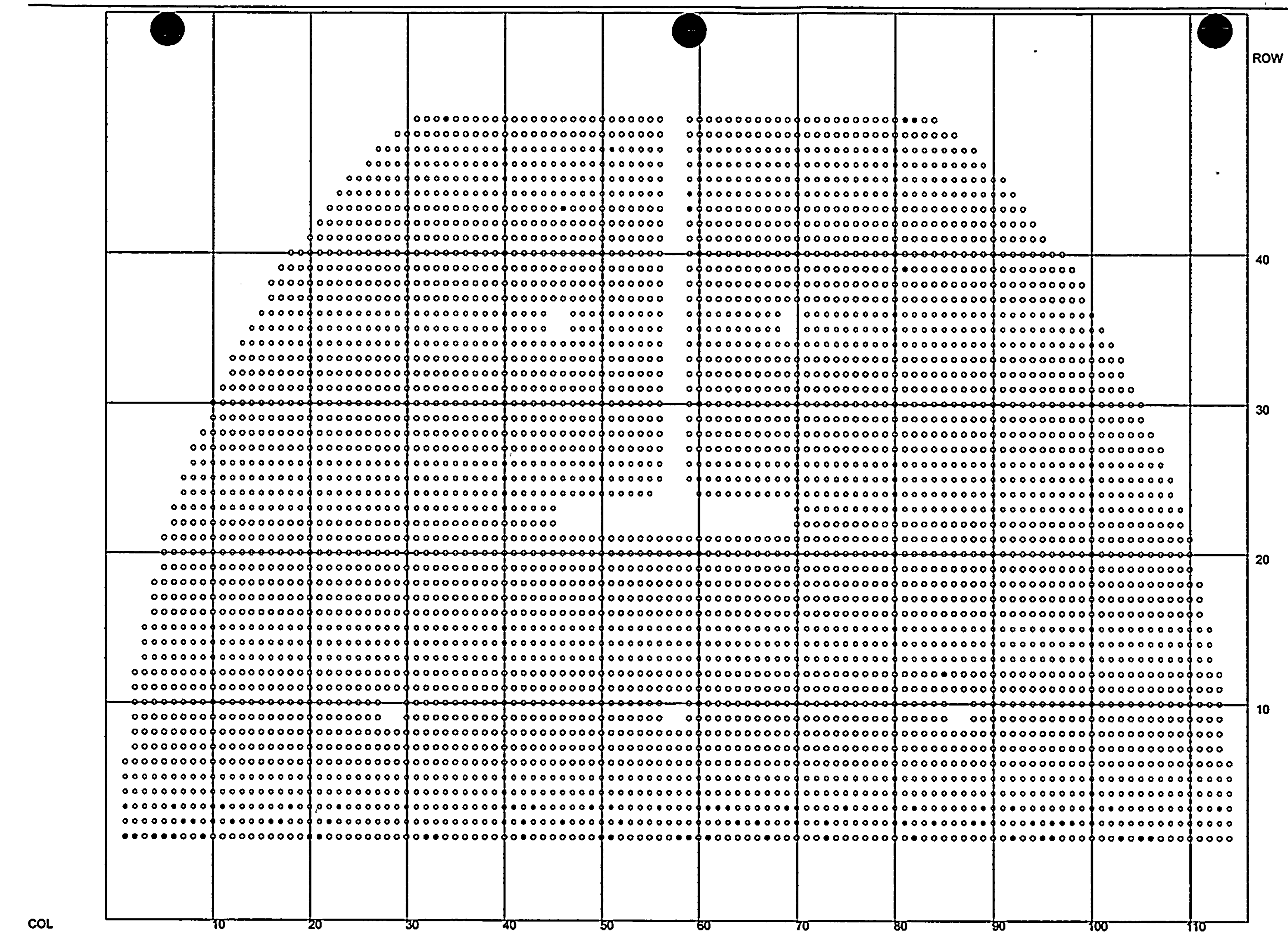


: 1381: A810MULC bobbin probe
9: 0: A590SFRM bobbin probe
6: 2: A560SFRM bobbin probe

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

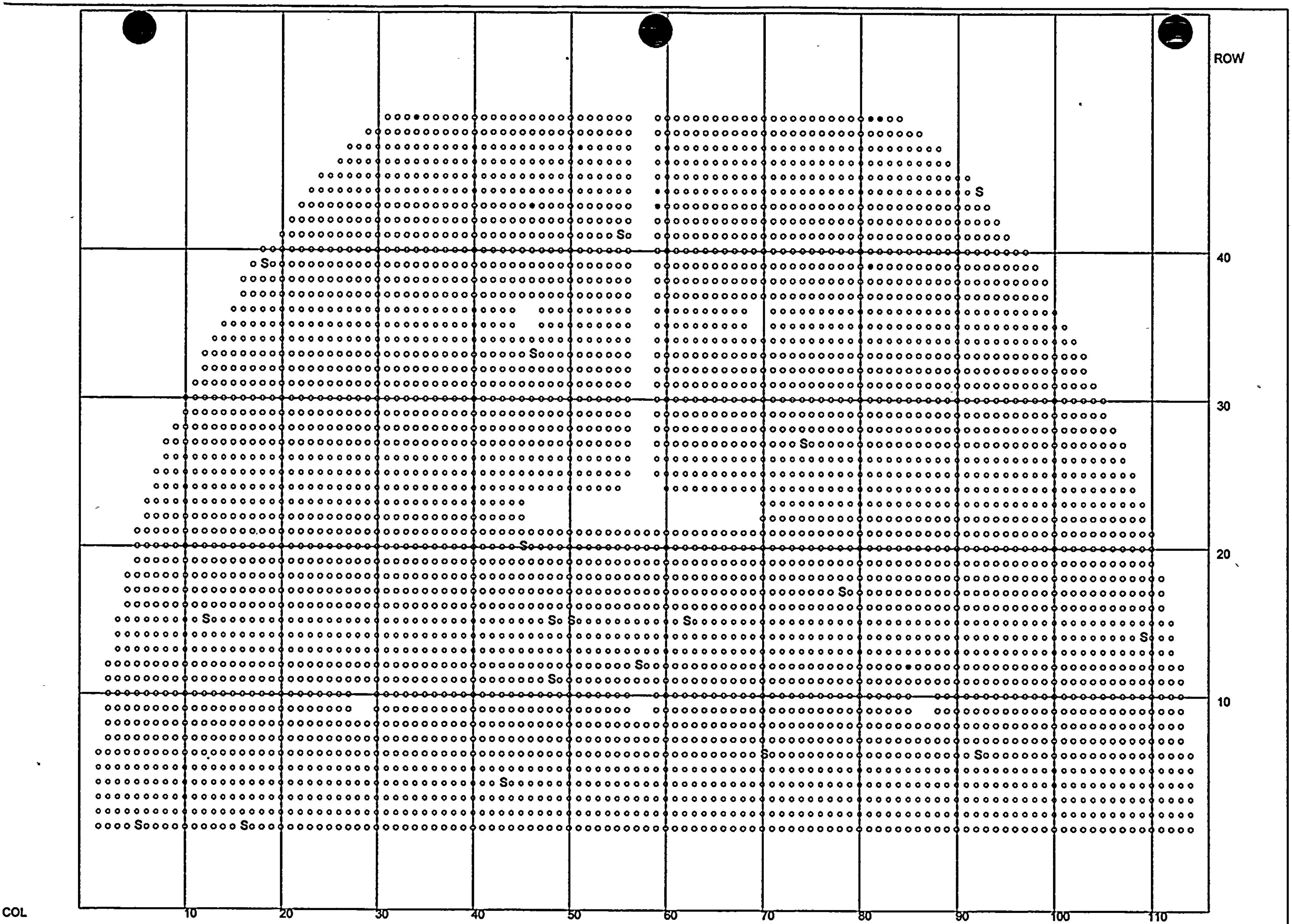


: 69: U-bend MRPC examinations

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

9 Plugged

Applied Computer Resources, Inc.

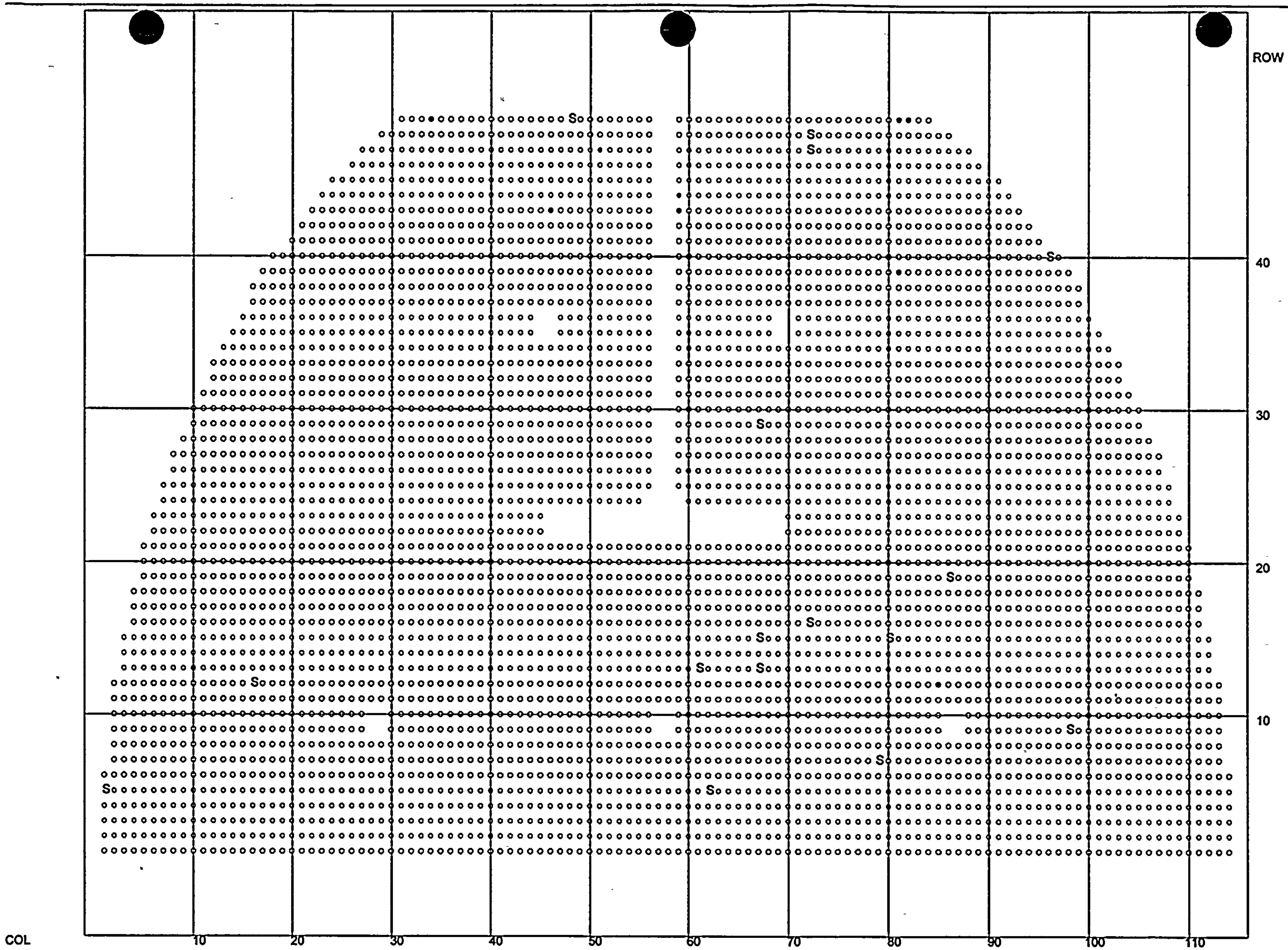


S: 19: Special Interest Hot Leg Exams - Pre Outage

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

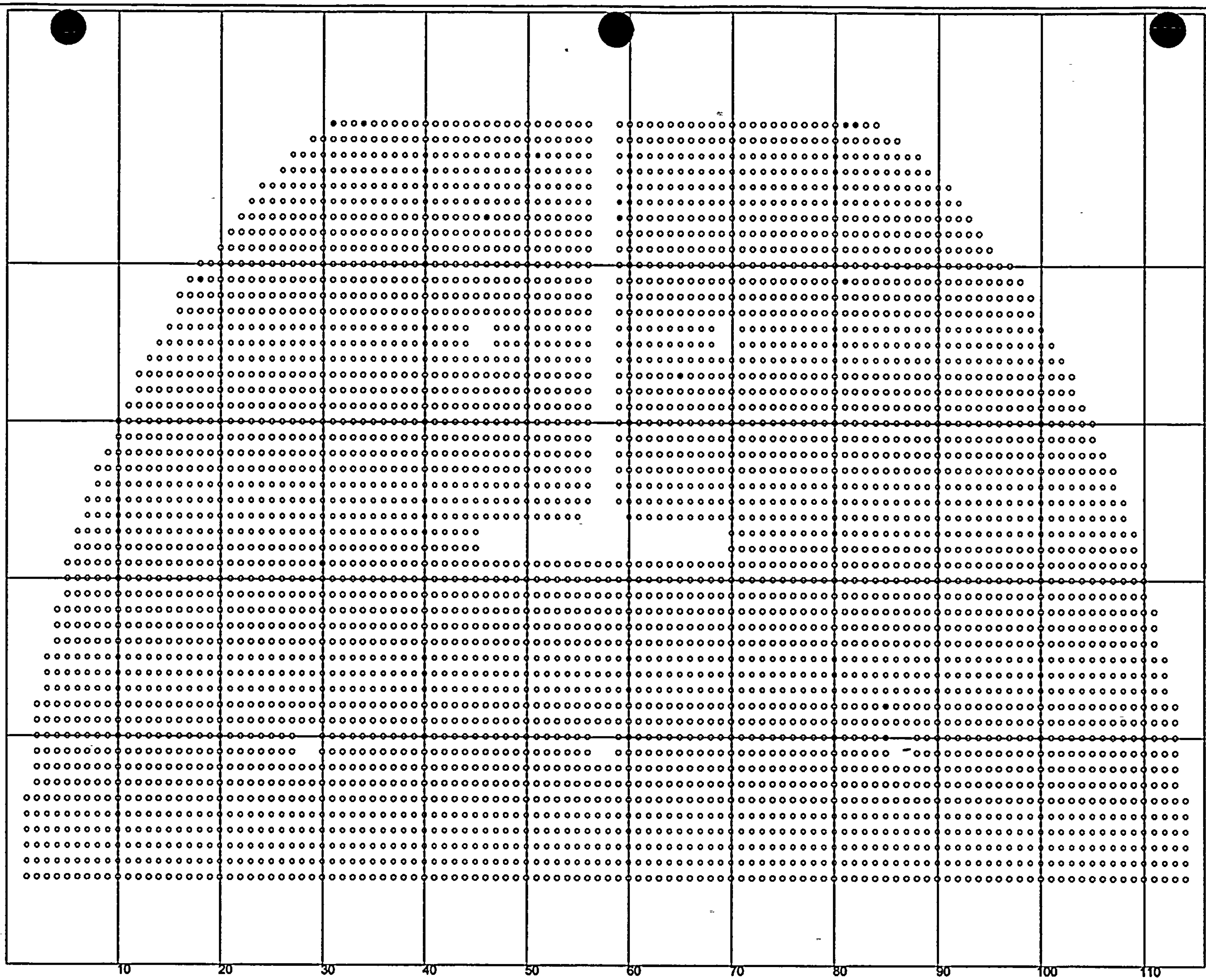


S: 16: Special Interest Cold Leg Exams - Pre Outage

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

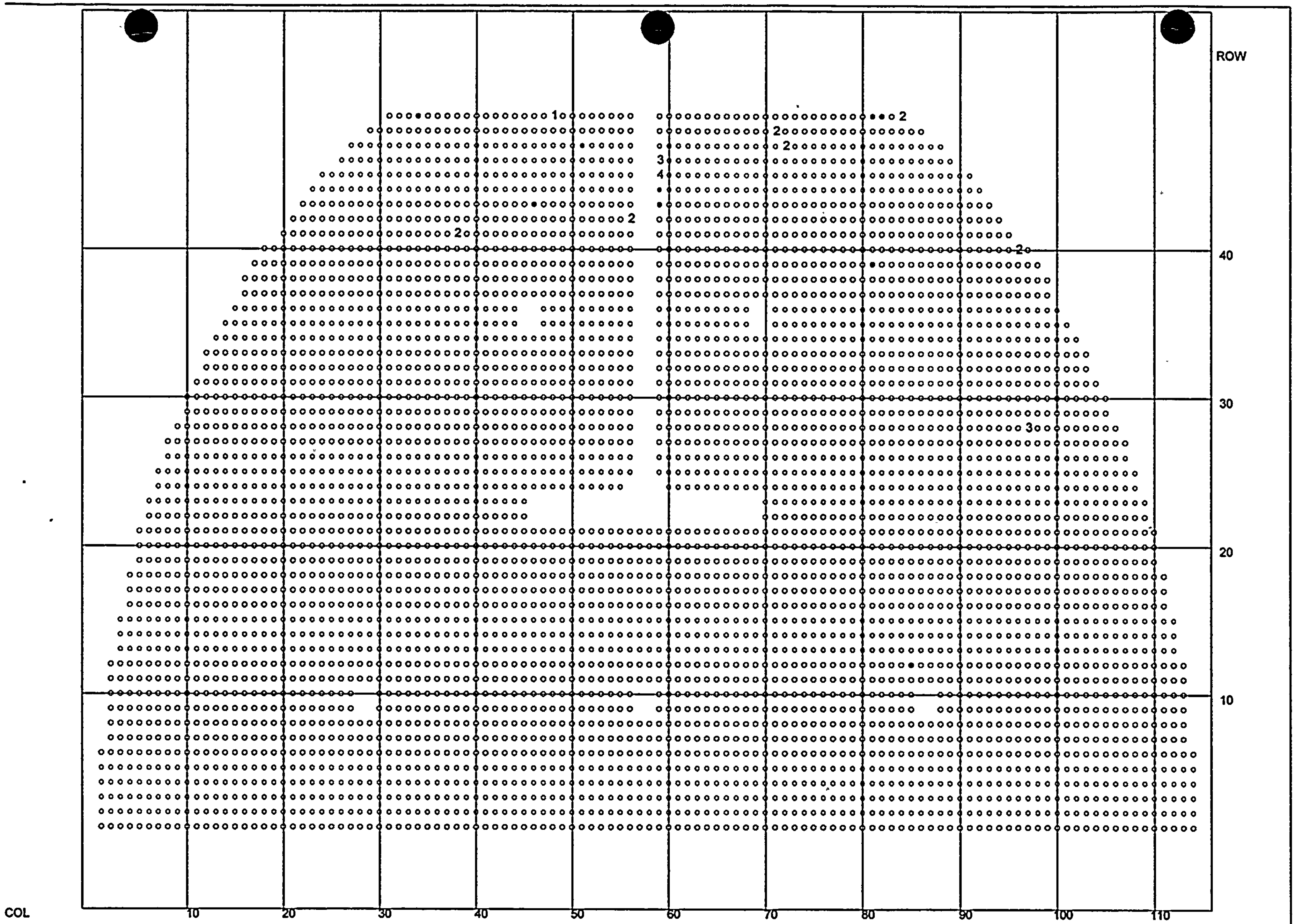


: 5: Diagnostic Exams During RFO-7

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

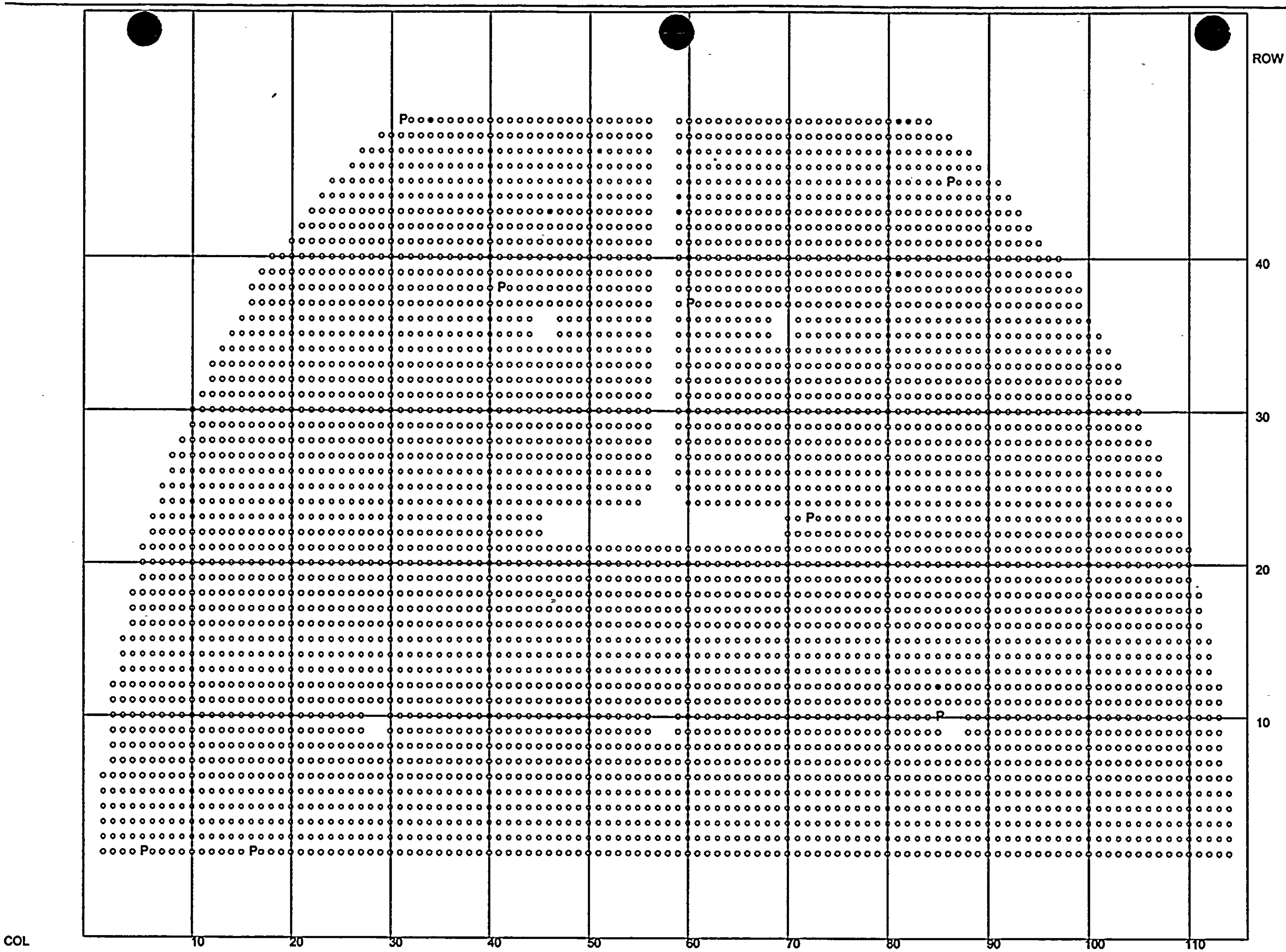


1: 1: Wear 1-10%
2: 6: Wear 11-20%
3: 2: Wear 21-30%
4: 1: Wear 31-38%
5: 0: Wear 39% and higher

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

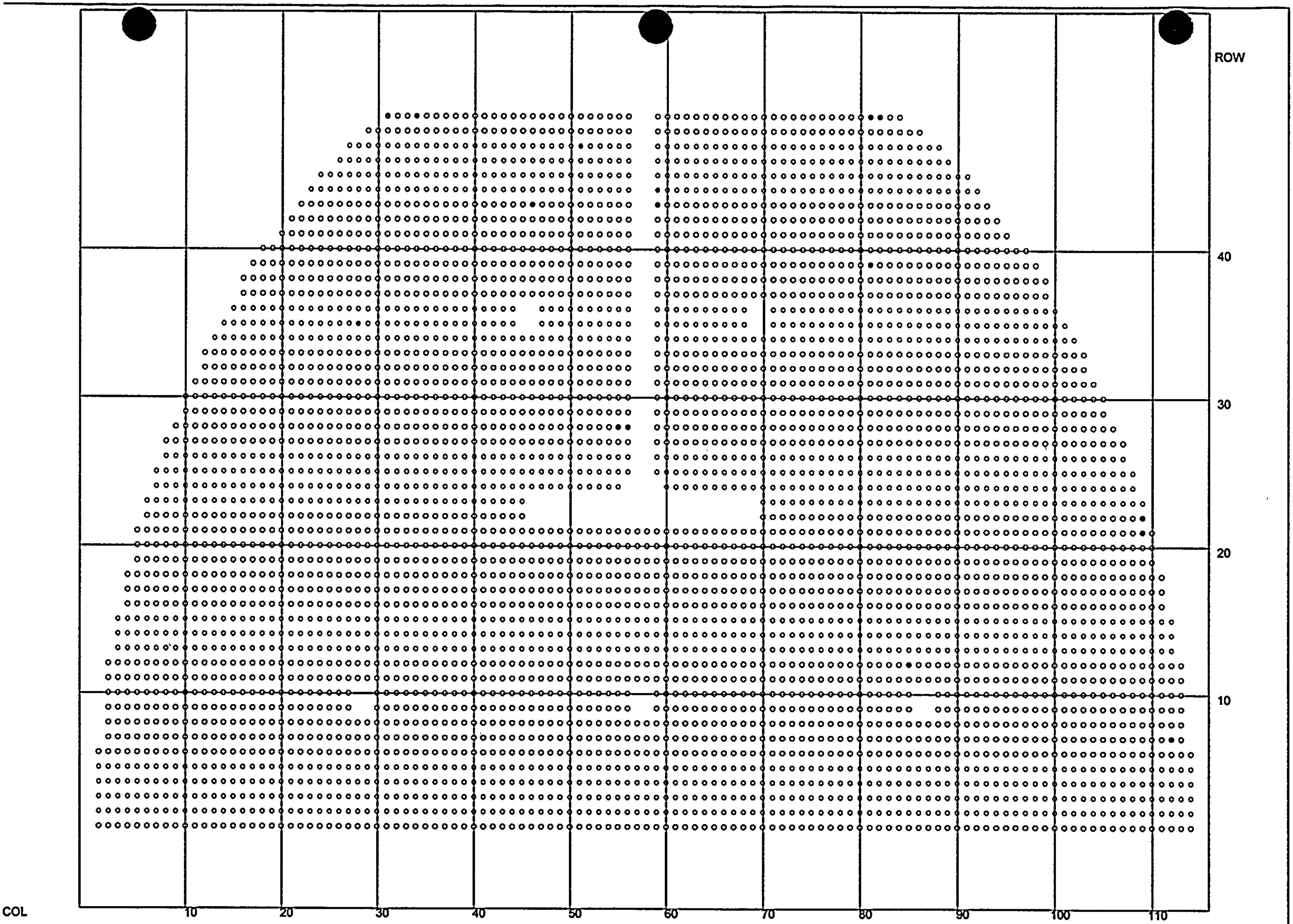


P: 8: Tubes repaired (plugged) during RFO-7

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

9 Plugged

Applied Computer Resources, Inc.

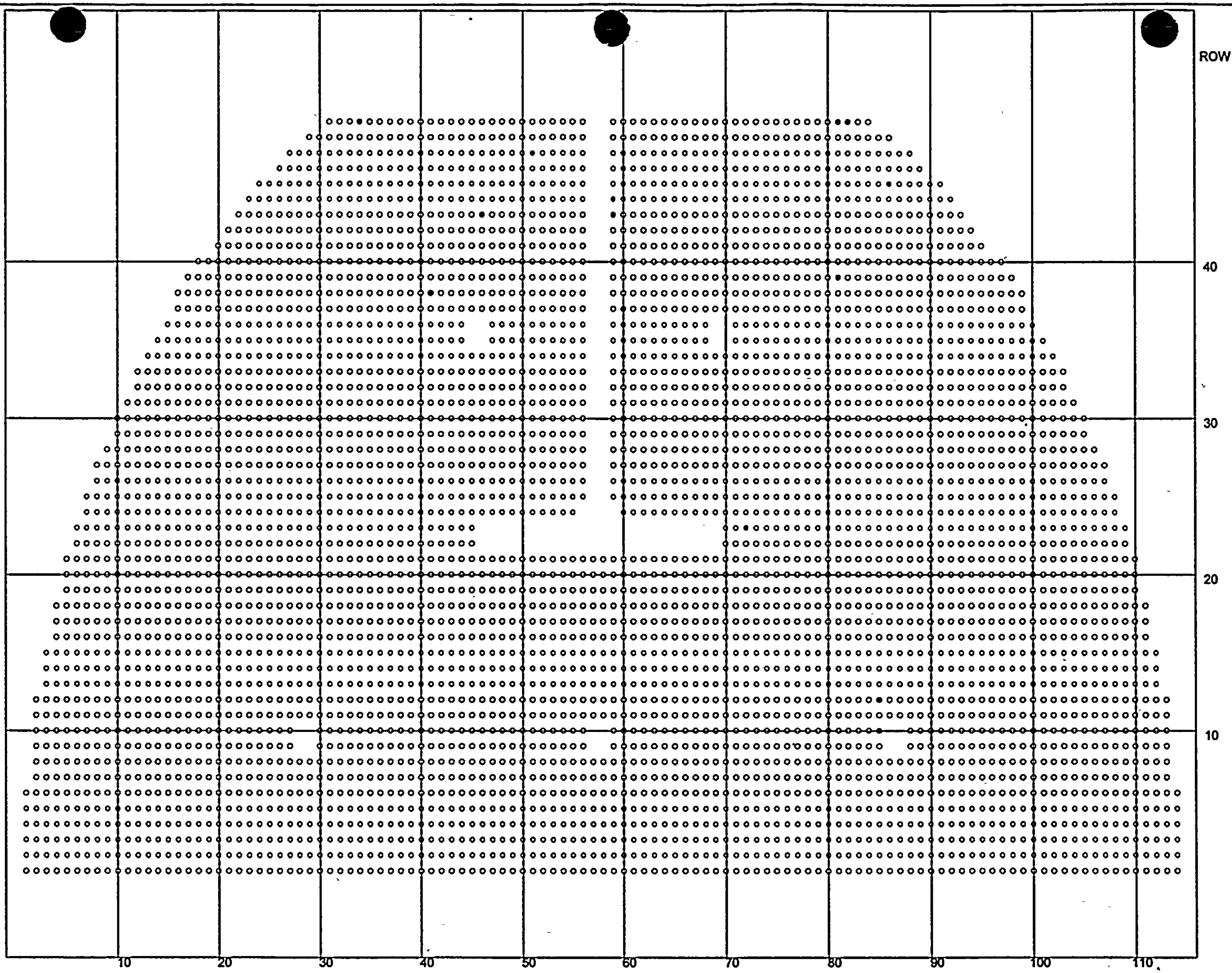


: 6: Tubes with Possible Loose Parts (PLP)
: 1: Tubes with Possible Loose part Indication (PLI)

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

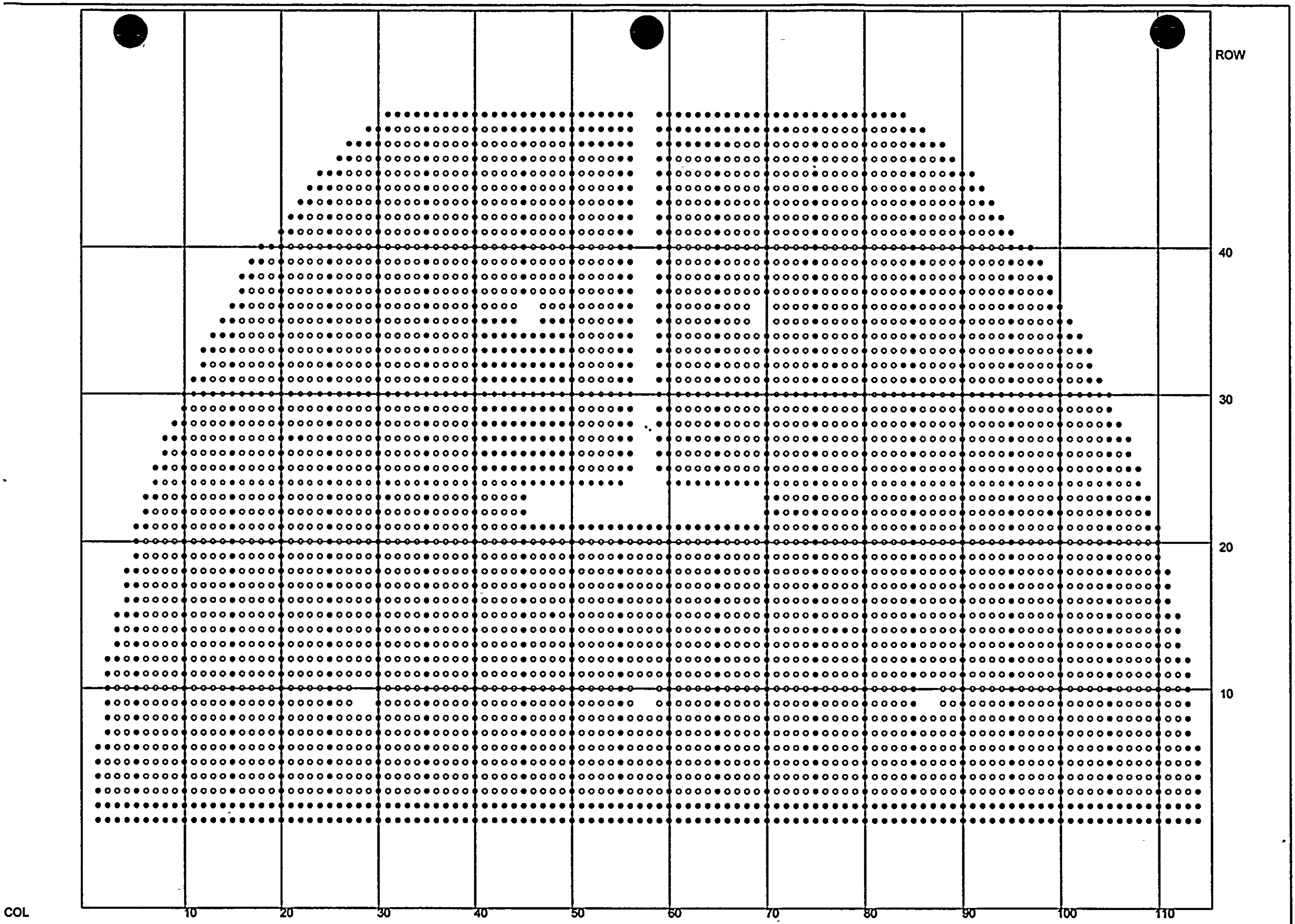


: 2: Tubes with Circumferential Indications
: 3: Tubes with Axial Indications

9 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator B 06/30/97 Inlet

Applied Computer Resources, Inc.

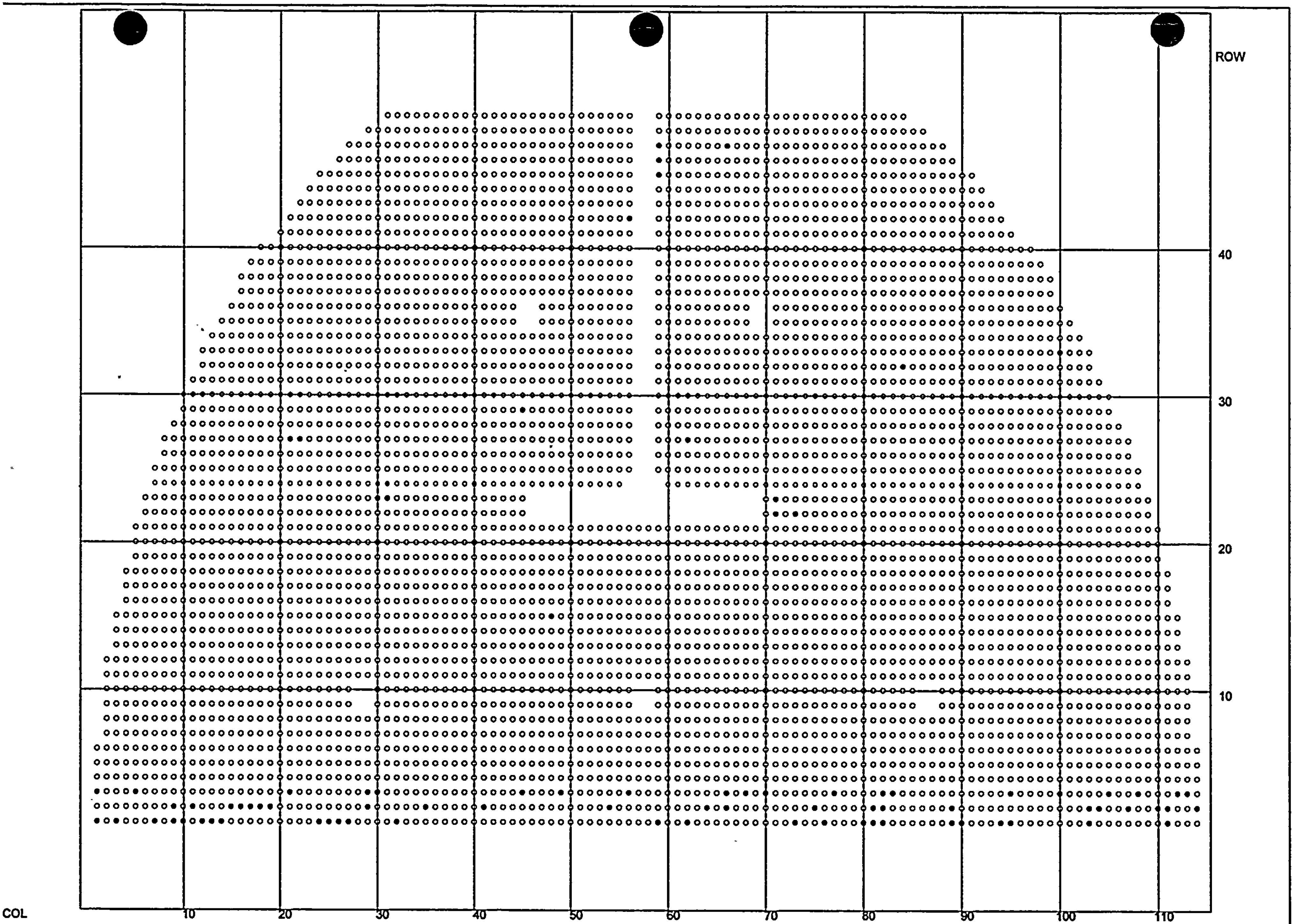


: 1471: A610MULC bobbin probe
9: 0: A590SFRM bobbin probe
6: 0: A560SFRM bobbin probe

19 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

Applied Computer Resources, Inc.

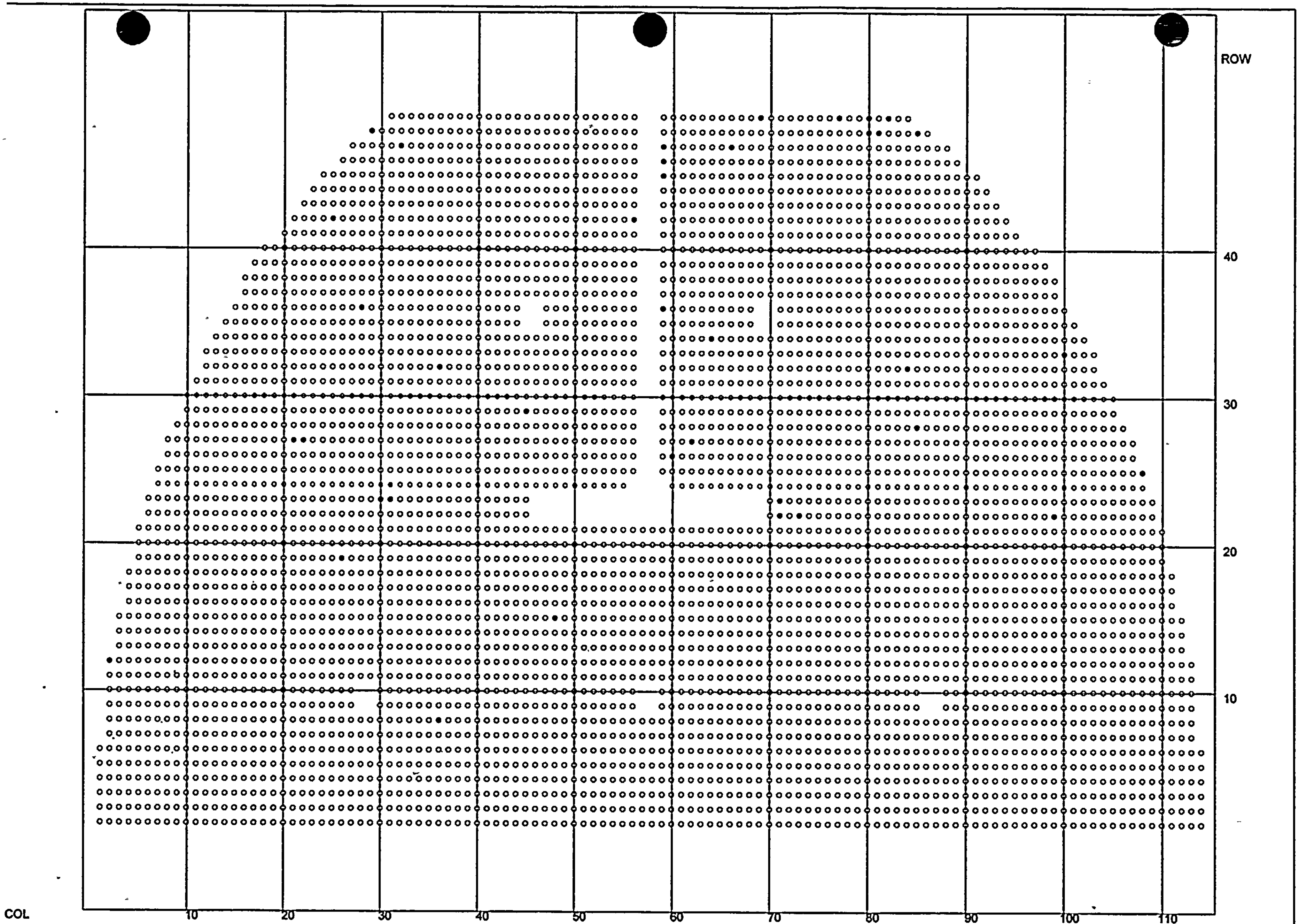


: 69: U-bend MRPC examinations

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

Applied Computer Resources, Inc.

19 Plugged

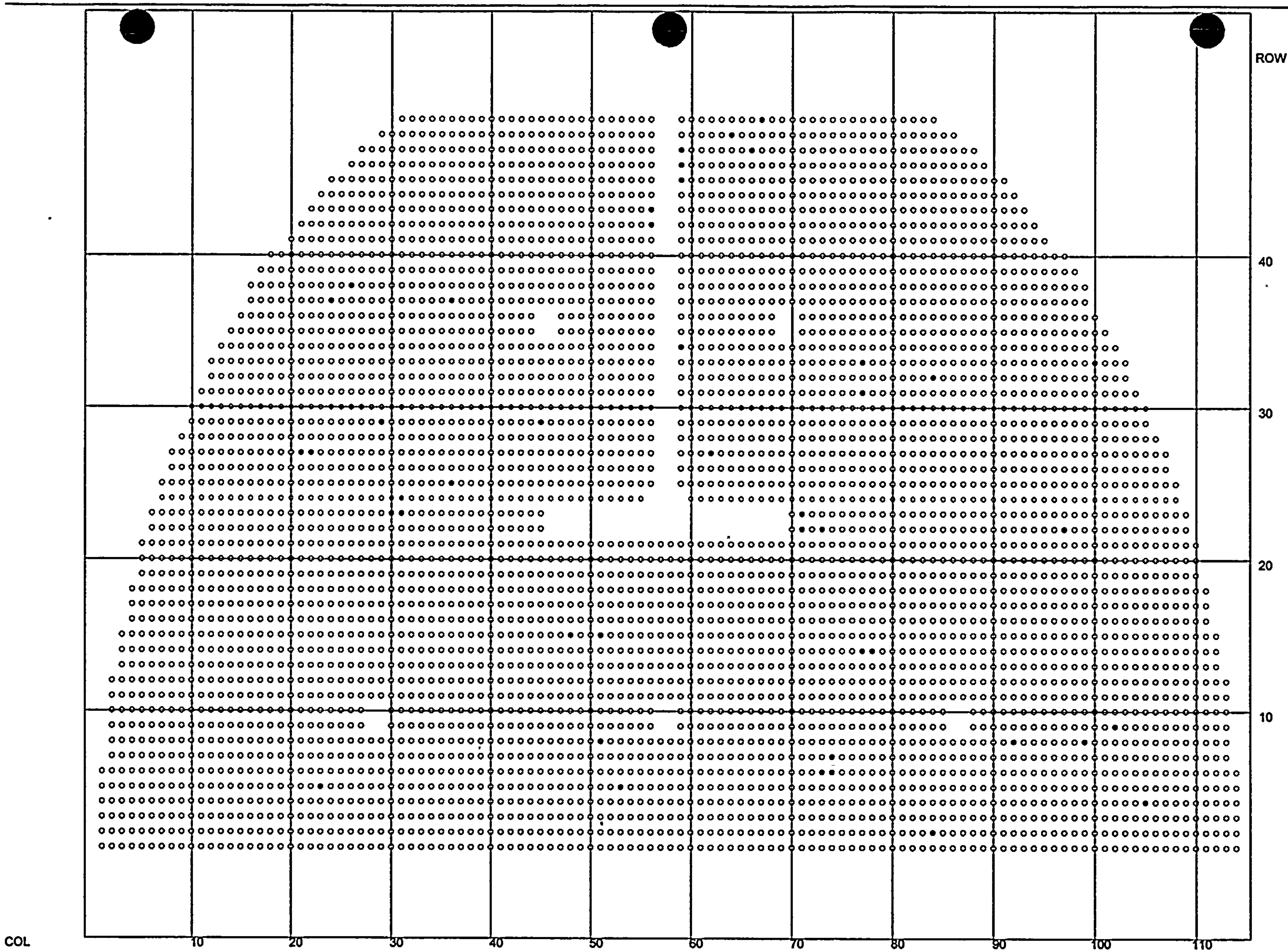


: 21: Speical Interest Hot Leg Exams - Pre Outage

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

19 Plugged

Applied Computer Resources, Inc.

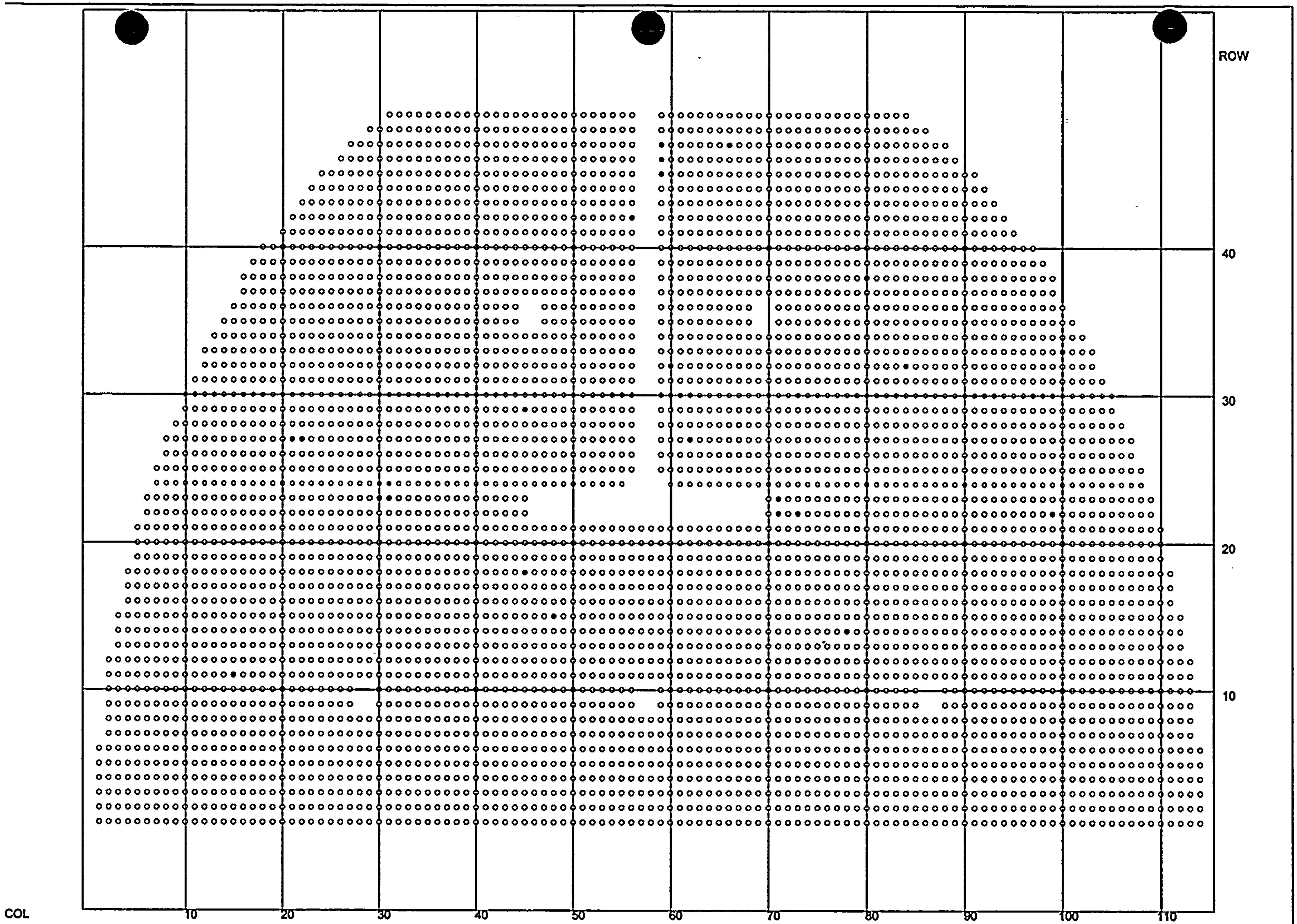


: 26: Speical Interest Cold Leg Exams - Pre Outage

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

19 Plugged

Applied Computer Resources, Inc. 1

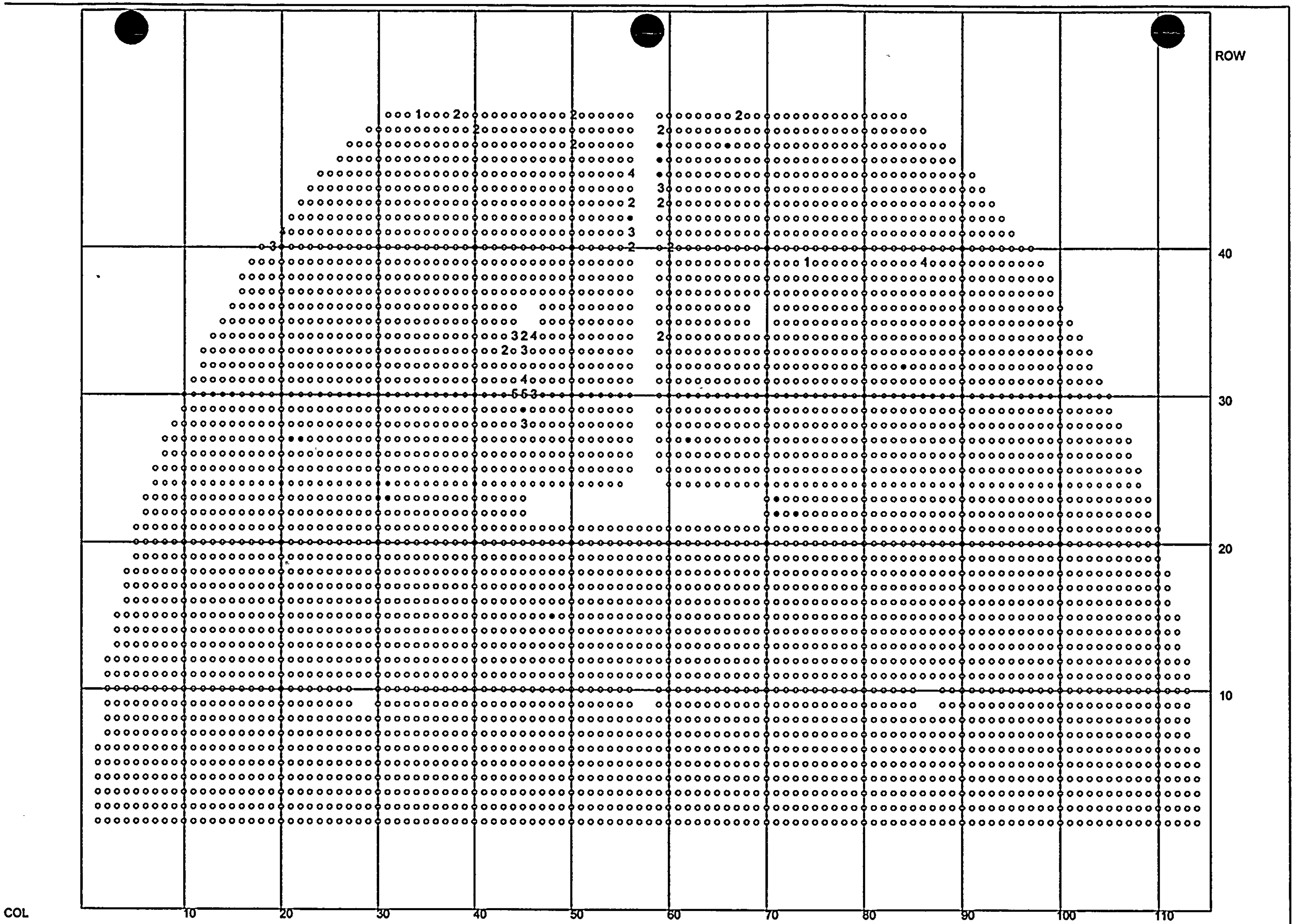


: 6: Diagnostic Exams During RFO-7

19 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

Applied Computer Resources, Inc.

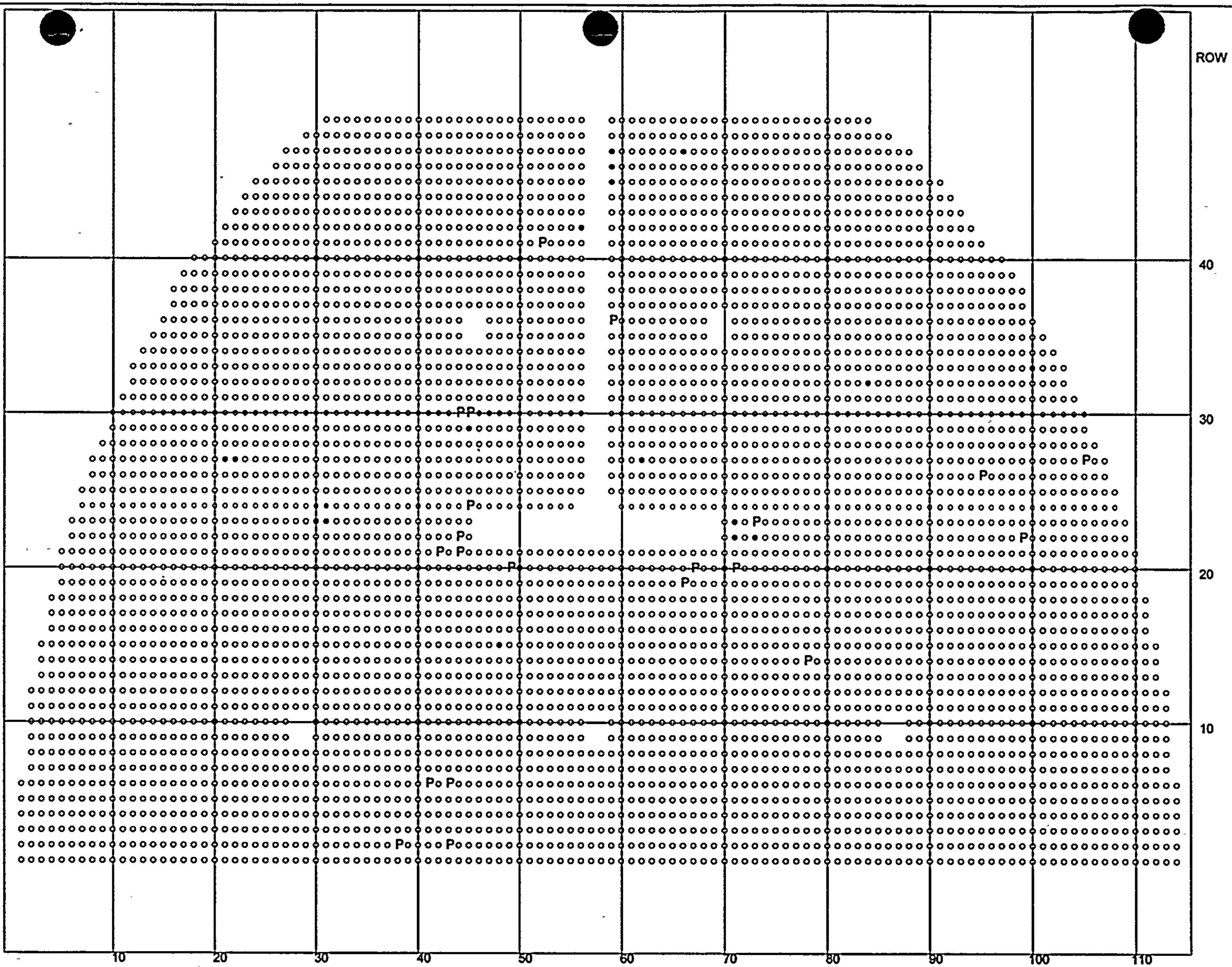


1: 2: Wear 1-10%
2: 13: Wear 11-20%
3: 7: Wear 21-30%
4: 5: Wear 31-38%
5: 2: Wear 39% and higher

19 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

Applied Computer Resources, Inc.

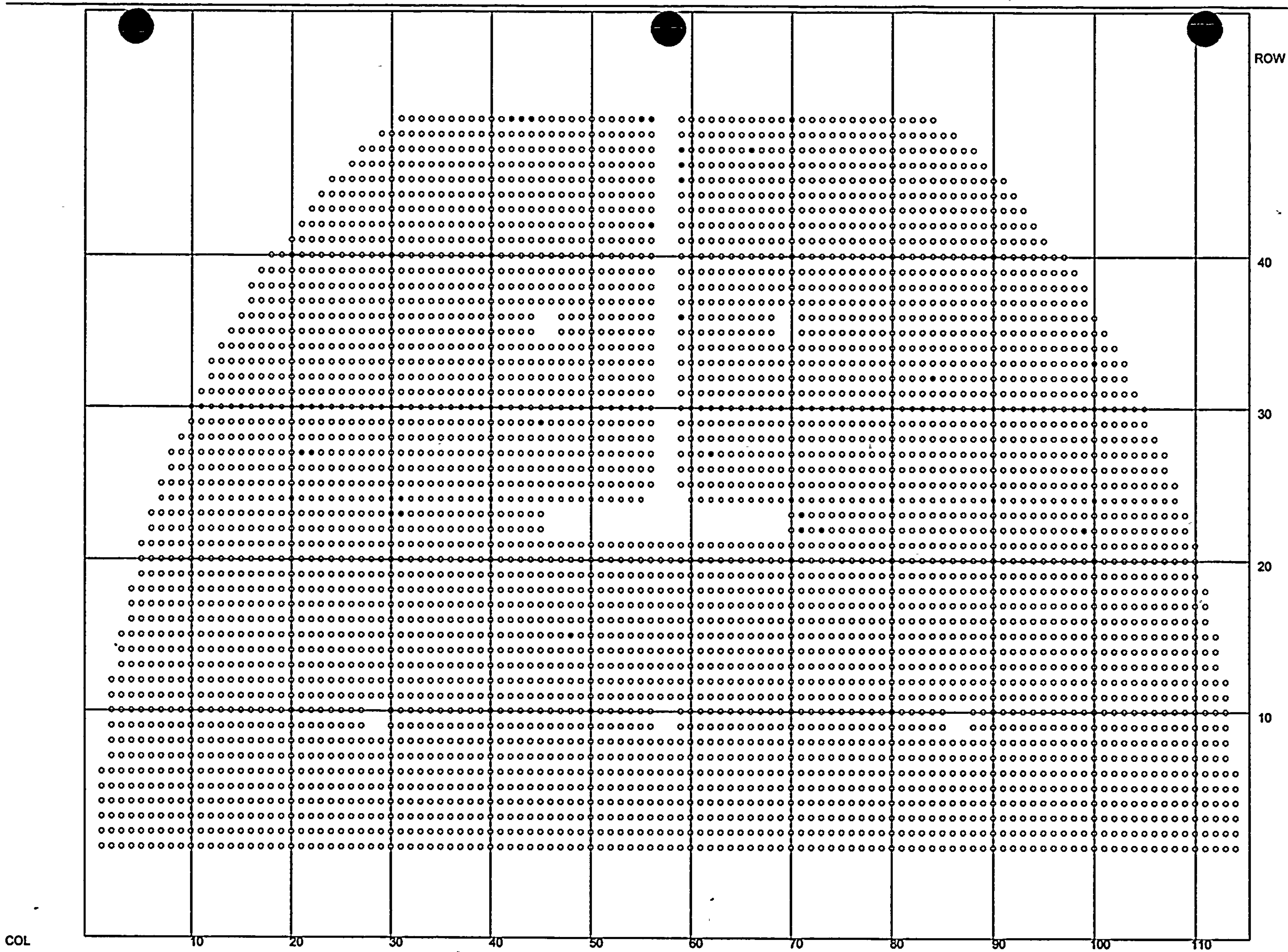


P: 21: Tubes repaired (plugged) during RFO-7

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

19 Plugged

Applied Computer Resources, Inc.

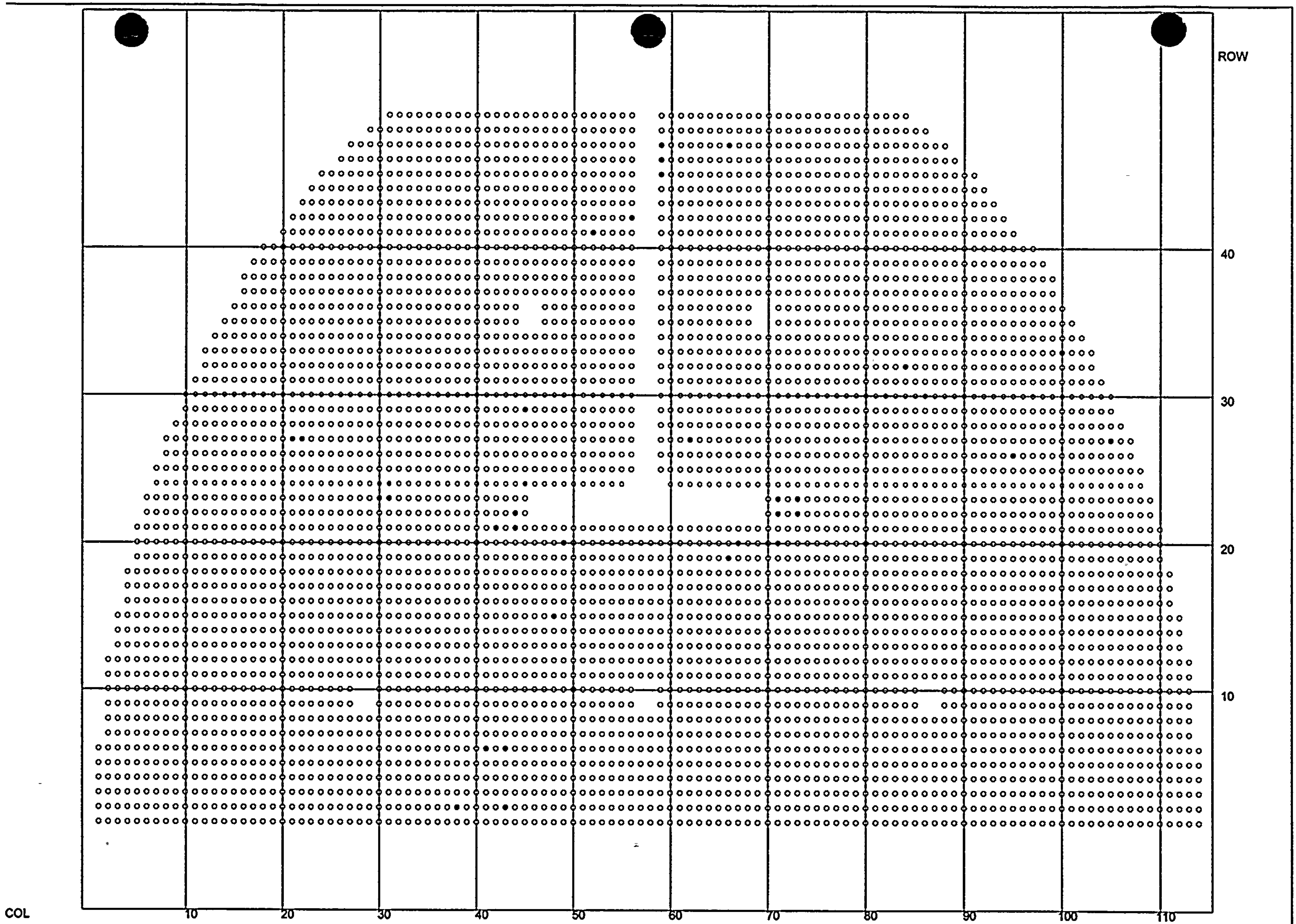


: 6: Tubes with Possible Loose Parts (PLP)
: 2: Tubes with Possible Loose part Indication (PLI)

19 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

Applied Computer Resources, Inc.



: 10: Tubes with Circumferential Indications
: 6: Tubes with Axial Indications

19 Plugged

ABB/Combustion Engineering
Carolina Power & Light Co. Shearon Harris
Steam Generator C 06/30/97 Inlet

Applied Computer Resources, Inc.

ABB

Multi - Frequency Eddy Current Inspection
Set up Instructions
Miz-30 / MIZ-30 A

Site	Unit	Component	Side		Date
Shearon Harris	1	S/G A, B, C	Hot	Cold	17-Apr-97

Probe Type	Calibration Standard (circle of describe other)
RPC Plus Point Single coil	ASME OTHER

Procedure	Test Purpose
HNP-100-004	Plus Point single coil for U-bends and other special exams

MIZ - 30 / MIZ-30 A CONFIGURATION

Number: Samples Per Second: see note below Trigger:
Name: rpc1 OFF

			Board# 1				Board# 2				Board# 3				Board# 4			
Number of Probes:	1		Probe# 1				Probe# 1				Probe# 2				Probe# 2			
			Drive				Drive				Drive				Drive			
			A	D	B	C	A	D	B	C	A	D	B	C	A	D	B	C
Drive polarity			n			n												
Group number			1			1												
Coil number			1			4												
Freq # 1	timeslot # 1		D															
400 Khz	G: x2	16																
Freq # 2	timeslot # 2		D															
200 Khz	G: x2	16																
Freq # 3	timeslot # 3		D			D												
100 Khz	G: x2	16																
Freq # 4	timeslot # 4		D															
10 Khz	G: x2	16																
Freq # 5	timeslot # 5																	
Khz	G: x2	12																
Freq # 6	timeslot # 6																	
Khz	G: x2	12																
Freq # 7	timeslot # 7																	
Khz	G: x2	12																
Freq # 8	timeslot # 8																	
Khz	G: x1	12																

			Board#				Board#				Board#				Board#			
Number of Probes:	1		Probe#				Probe#				Probe#				Probe#			
			Drive				Drive				Drive				Drive			
			A	D	B	C	A	D	B	C	A	D	B	C	A	D	B	C
Drive polarity																		
Group number																		
Coil number																		
Freq # 1	timeslot # 1																	
400 Khz	G: x2	16																
Freq # 2	timeslot # 2																	
200 Khz	G: x2	16																
Freq # 3	timeslot # 3																	
100 Khz	G: x2	16																
Freq # 4	timeslot # 4																	
10 Khz	G: x2	16																
Freq # 5	timeslot # 5																	
Khz	G: x2	12																
Freq # 6	timeslot # 6																	
Khz	G: x2	12																
Freq # 7	timeslot # 7																	
Khz	G: x2	12																
Freq # 8	timeslot # 8																	
Khz	G: x1	12																

Special Note to Operator / Analyst:

Pull Speeds/Sample rates to meet EPRI Appendix H - A224
0.1"/sec. axial pull speed (max.), 180 RPM rotation speed (max.) at 800 samples/sec. minimum
0.2"/sec. axial pull speed (max.) 360 RPM rotation speed (max.) at 1600 samples/sec. (min.)
Pull speeds for a minimum of 30 samples/inch both circumferentially and axially
All exams in the U-bend on the pull unless otherwise noted
Other boards may be used as required.

Probe cable length - 50' - Probe extension cable - 50' low loss

See Appendix n/a for Setup Instructions.

Prepared by: [signature] Level III Date 4-22-97

Approved by: [signature] HNPSG Syst Eng. Level NA Date 4/22/97

MZ30RPC1.XLS

ABB

Multi - Frequency Eddy Current Inspection
Set up Instructions
Miz-30 / MIZ-30 A

Site	Unit	Component	Side		Date
Shearon Harris	1	S/G A, B, C	Hot	Cold	17-Apr-97

Probe Type	Calibration Standard (circle of describe other)
Bobbin Probe - various types	ASME OTHER

Procedure	Test Purpose
HNP-100-004	Bobbin probe test plans

MIZ - 30 / MIZ-30 A CONFIGURATION

Number: Samples Per Second: see note below Trigger:

Name: Bobbin 1 OFF

Number of Probes: 1

	Board# 1	Board# 2	Board# 3	Board# 4	Board#	Board#	Board#	Board#
Probe#	1	1	2	2				

		Board 1 Drive A	D	B	C	Board 2 Drive A D B C	Board 3 Drive A D B C	Board 4 Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C
Drive polarity		n		n								
Group number		1		1								
Coil number		1		5								
Freq # 1, 550 Khz	timeslot # 1, G: x2 12	D		A								
Freq # 2, 270 Khz	timeslot # 2, G: x2 12	D		A								
Freq # 3, 130 Khz	timeslot # 3, G: x2 12	D		A								
Freq # 4, 35 Khz	timeslot # 4, G: x2 12	D		A								
Freq # 5, Khz	timeslot # 5, G: x2 12											
Freq # 6, Khz	timeslot # 6, G: x2 12											
Freq # 7, Khz	timeslot # 7, G: x2 12											
Freq # 8, Khz	timeslot # 8, G: x1 12											

Special Note to Operator / Analyst:

Pull Speeds/Sample rates to meet EPRI Appendix H - A233, A41, A18
12"/sec. set to 400 samples/sec. minimum (to achieve 33 samples/in. minimum)
22"/sec. set to 800 samples/sec. minimum
44"/sec. set to 1600 samples/sec. minimum

Other boards may be used as required.
Bobbin probe extensions and probe length not to exceed 183'

See Appendix n/a for Setup Instructions.

Prepared by: Thomas W. Brown Level III Date 4-22-97

Approved by: N M Bal HNP SG Syst. Eng. Level NA Date 4/22/97

MZ30BOB1.XLS

ABB

Multi - Frequency Eddy Current Inspection
Set up Instructions
Miz-30 / MIZ-30 A

Site	Unit	Component	Side	Date
Shearon Harris	1	S/G A, B, C	Hot Cold	17-Apr-97

Probe Type	Calibration Standard (circle of describe other)
RPC Plus Point Three coil	ASME OTHER

Procedure	Test Purpose
HNP-100-004	Pancake and Plus Point coil(s) for straight section and special exams

MIZ - 30 / MIZ-30 A CONFIGURATION

Number: Samples Per Second: see note below Trigger: OFF

Name: rpc2

			Board# 1				Board# 2				Board# 3				Board# 4			
Number of Probes: 1or2			Probe# 1				Probe# 1				Probe# 2				Probe# 2			
			Drive				Drive				Drive				Drive			
			A	D	B	C	A	D	B	C	A	D	B	C	A	D	B	C
Drive polarity			n			n	n		n		n			n	n		n	
Group number			1			1	1		1		2			2	2		2	
Coil number			1			4	5		7		1			4	5		7	
Freq # 1	timeslot #	1	D				D				D				D			
400 Khz	G: x2	16																
Freq # 2	timeslot #	2	D				D				D				D			
200 Khz	G: x2	16																
Freq # 3	timeslot #	3	D			D	D				D			D	D			
100 Khz	G: x2	16																
Freq # 4	timeslot #	4	D								D							
10 Khz	G: x2	16																
Freq # 5	timeslot #	5							D								D	
700 Khz	G: x2	16																
Freq # 6	timeslot #	6																
Khz	G: x2	12																
Freq # 7	timeslot #	7																
Khz	G: x2	12																
Freq # 8	timeslot #	8																
Khz	G: x1	12																

	Board#				Board#				Board#				Board#			
	Probe#				Probe#				Probe#				Probe#			
	Drive				Drive				Drive				Drive			
	A	D	B	C	A	D	B	C	A	D	B	C	A	D	B	C
Drive polarity																
Group number																
Coil number																
Freq # 1																
Freq # 2																
Freq # 3																
Freq # 4																
Freq # 5																
Freq # 6																
Freq # 7																
Freq # 8																

Special Note to Operator / Analyst:

Pull Speeds/Sample rates to meet EPRI Appendix H - A106, A121, A246, A85, A112,
0.2"/sec. axial (max.), 300 rpm (max.), 400 samples/sec. (min)
0.6"/sec. axial (max.), 900 rpm (max.), 1200 samples/sec. (min)
0.8"/sec. axial (max.), 1200 rpm (max.), 1500 samples/sec. (min)
All testing on the PUSH unless otherwise specified - calibration run same as data run
Other boards may be used as required.

Probe extension - 50' low loss

See Appendix n/a for Setup Instructions.

Prepared by:	Thomas W Bri[illegible]	Level	III	Date	4-22-97
Approved by:	[illegible] HNP SG Syst Eng	Level	NA	Date	4/22/97

MZ30RPC2.XLS

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 9

Procedure Type: Engineering Periodic Test

Number: EPT-242T

Title: ABB/Combustion Engineering XS10370016, Temporary Procedure for Eddy Current Examination of Steam Generator Tubes (Expires:12/31/98)

Revision 1

NOTE: This procedure has been screenedper PLP-100 criteria and determined to be a Case III procedure. No additional management involvement is required.

RECEIVED
APR 29 1997
HNP
DOCUMENT CONTROL

List of Effective Pages

Procedure Number	Procedure Name	Pages	Rev
HNP-100-004	Procedure for Multifrequency ECE of Nonferromagnetic SG tubing using MIZ-18/MIZ-30 Equipment	1-36	1
	Attachment 1	1-3	1
HNP-006	Procedure for Control of EC Data for use with Mulitforth or Eddynet Acquisition Systems	1-26	0
HNP-100-005	Steam Generator Eddy Current Interpretation Guidelines	1-120	1
	Change 1	1-4	0
	Change 2	1-2	0
	Change 3	1	0

Major Revision

STEAM GENERATOR

EDDY CURRENT

INTERPRETATION GUIDELINES

HNP-100-005

Carolina Power & Light Company

Shearon Harris Nuclear Plant

Revision 1

Prepared by:	ECT Level III	Date:	4-4-97
Approved by:	Cognizant Manager	Date:	4/7/97
Approved by:	Quality Operations	Date:	4/7/97
Approved by:	Utility Representative	Date:	4/8/97

Major Revision

STEAM GENERATOR

EDDY CURRENT

INTERPRETATION GUIDELINES

EPT-242T

HNP-100-005

Carolina Power & Light Company

Shearon Harris Nuclear Plant

Revision 1

Prepared by:	______________________ ECT Level III	Date:	______________
Approved by:	______________________ Cognizant Manager	Date:	______________
Approved by:	______________________ Quality Operations	Date:	______________
Approved by:	______________________ Utility Representative	Date:	______________

Table of Contents

Appendices

Section 1.0
Scope

The scope of this Steam Generator Eddy Current Analysis Guideline is to provide the qualified Analyst with the optimum methods of recognizing and reporting eddy current data collected from the Shearon Harris steam generator inspection.

These Guidelines will assure that:

1) The most appropriate analysis practices are used

2) Data is analyzed and recorded in a consistent and repeatable manner.

3) The validity and accuracy of the results are optimum.

In conjunction with this document, training data and documentation are available for each of the test methods.

Section 2.0
References

2.1 EPRI NP-6201, Rev. 4, PWR Steam Generator Examination Guidelines.

2.2 Zetec Eddynet Global Menu & Administrative Functions User Guide - EN-138 or current version.

2.3 Zetec Eddynet Analysis User Guide - EN-101-EM or current version.

Section 3.0
Definitions

Anti-Vibration Bar:

A structure placed between the tubes in the u-bend section used to minimize vibration of the tube bundle.

Base Frequency (ies):

Individual frequencies used to configure the test system. Any combination of these may be mixed during analysis to eliminate unwanted interference from signals generated from events such as copper deposits.

Bulge Signal:

An expansion of the tube from the inside outward, as occurs at the top of the tubesheet region, can cause these signals. They are, for the most part, horizontal in phase and initiate in an opposite direction to Dent signals.

Chatter Signal:

Chatter signals can occur in a tube at any location and typically appear as uniform horizontal noise signals. Pilgering, during the manufacturing process, can cause these signals.

Copper: (as in secondary side copper, copper corrosion, copper chloride, and copper chloride attack)

The presence of copper in the steam generator is due to the corrosion of copper-based materials within the balance-of-plant heat exchangers such as condensers and feedwater heaters. Copper, when coupled with the appropriate faulted secondary side chemistry, works to promote denting, SCC, and pitting.

Defect:

A tube wall loss condition which exceeds the predetermined minimum structural requirements plus the allowance for growth between refueling outages. Repair is required prior to operation. The Plant's Technical Specification describes this as a wall loss of greater than or equal to 40 percent.

Denting:

Plastic deformation of tubes typically resulting from the buildup of carbon steel support plate corrosion products (Magnetite) in the tube-to-tube support plate annuli and at the top of the tubesheet.

Dent Signal:

A signal caused by a reduction of the nominal tube diameter, as occurs at tube supports which experience denting. They are, for the most part, horizontal in phase and initiate in an opposite direction to Bulge signals. (With phase set according to this guideline, dents will initiate to the left on the primary channel, or primary mix channel.)

Distorted Roll Indication (DRI):

An indication associated with the upper tubesheet expansion. Evidence on 550 KHz and the 3-frequency mix. These indications are sometimes attributed to circumferential cracks.

Distorted Signal:

An indication with poor definition and depth evaluation correlation between frequencies, which is believed to be caused by a flaw equal to or greater than 40 percent through wall.

Distorted Tubesheet Signal:

A typical tubesheet signal which forms abnormally and is suspected to be due to a flaw condition which is coincident with a dent located at or just above the top of the tubesheet region. This condition requires the use of a special 3-frequency mix for analysis.

False Positive:

A signal which displays the characteristics of a typical flaw indication, but which is actually caused by the combined signals from other features in the generator such as deposits, sludge, expansion transition, bends, secondary structures, or manufacturing marks.

Final Report:

The report produced by each data analyst which provides the results of the data analysis for each tube examined.

Flaw (or Degradation):

A condition which represents a deviation from the as designed structure: Flaw conditions can be created during manufacturing, transportation, installation, and service. many common flaws are not considered "defects" requiring repair, but their indication signals may require measurement such that changes or growth can be monitored as a preventative maintenance measure.

Incomplete Test:

This is when a tube or tubes are not inspected to the predetermined extent as stated in the approved inspection program for a given outage.

Intergranular Attack:

This is a general term denoting the corrosive attack of grain boundaries in Inconel 600 with no preferential (stress-related) orientation.

Magnetite:

Carbon steel corrosion products located in the tube-to-tube support annuli. Magnetite forms the bulk of the sludge pile.

No Distinguishable Discontinuity:

Defines the tube as having no signal responses which meet the minimum reporting criteria for indications established by the Data Interpretation Guidelines.

Tube Noise:

Any undesired signal or signals that may obscure for interpretation, those signals that are of interest. It may be generated from electrical variations, from specimen dimensional variations, or material property variations.

Obstructed Tube:

This designation is given to a tube which will not allow a probe with a diameter of .540 inches or smaller to pass to a given location. Tubes which contain obstructions in the straight section of tubes in the plenum of probe entry will be removed from service.

Permeability:

Permeability describes the intrinsic willingness of material to conduct magnetic flux lines. Signals, due to permeability variations (PVN), may go up or down first and typically do not show normal phase correlation between the different frequencies as would degradation. Most PVN indications at Shearon Harris are eliminated by magnetically biased test probes.

Pitting:

Localized attack on tubing resulting from nonuniform corrosion rates caused by the formation of local corrosion cells.

Restriction:

This designation is assigned to the location in a tube which the tube geometry prevents the passage of an eddy current probe.

Setup Span:

A minimum span requirement for analysis software which is based upon the calibration standard signal size and which assures a proper lissajous presentation to meet the intent of ASME Section XI sensitivity requirements.

Sludge:

This is a buildup of material on top of the tubesheet resulting from corrosion products. This material is considered undesirable because it can act as a concentrating environment for aggressive chemical impurities and it cuts down heat transfer surface area.

Stress Corrosion Cracking:

Cracking of stressed tubes, without reference to a causative chemical agent.

Threshold:

A level of some indication characteristic (i.e. voltage, depth) above or below which it is possible to clearly distinguish it from noise requiring it to be reported.

Unresolved Signal:

An indication which cannot be resolved as being caused by either a flaw or a non-flaw condition.

Retest:

The Data Analyst may request a retest of a tube if it is felt that such a test would provide additional information necessary to assess the condition of the tube. Retests may be requested for conditions such as lower than acceptable signal to noise ratios or incomplete tests.

Wastage:

Secondary side corrosion caused by chemical attack from residues concentrated in low flow areas such as under the sludge pile.

Section 4.0
Personnel Qualification Requirements and Responsibilities

4.1 Qualification Requirements

This section discusses the requirements which personnel must meet in order to evaluate the steam generator tube eddy current examination results at Shearon Harris.

4.1.1 The evaluation of the results of the eddy current examinations must be conducted by personnel certified to a minimum of Level II with specific training for the evaluation of data from nonferromagnetic steam generator tubing. Data analyst's shall have a current EPRI QDA certification.

4.1.2 Each person performing data analysis will be certified in accordance with the employer's written practice and approved by Carolina Power & Light Company.

4.1.3 The Data Analyst shall have successfully passed an annual practical examination specific to the Shearon Harris steam generators unless specifically waived by CP&L.

4.2 Responsibilities

This section discusses and defines the analyst hierarchy and analyst responsibilities.

4.2.1 Senior Analyst

One individual will be selected as the Senior Analyst. The Senior Analyst is responsible for:

4.2.1.1 Evaluating eddy current data in a manner consistent with the analysis guidelines presented herein.

4.2.1.2 Modifying the analysis guidelines during the inspection - with the concurrence of the utility - to accommodate new or unanticipated circumstances. The Analyst Guidelines Change Form, in Figure 4.1, should be used to document modifications to the Guidelines. The Analyst Guidelines Change Acknowledgement Form, Figure 4.2, should be used to document Analyst acknowledgment of the modifications. The Senior Analyst is responsible to disseminate any guideline changes to each data analyst prior to any analyst performing work subject to the change in question.

4.2.1.3 Making the other data Analysts aware of any and all modifications to the analysis guidelines.

4.2.1.4 The Senior Analyst may resolve discrepancies between Lead Analysts with concurrence from the utility representative.

4.2.1.5 The Senior Analyst may also assume the role of a Lead Analyst or Analyst.

4.2.1.6 With concurrence from the utility representative, the Senior Analyst or a designee will review all data in which there is futher action required. This review will include but is not limited to all potential pluggable indications recorded by primary or secondary anlysis. Any changes made by the Senior Analyst as a result of this review will be subsequently reviewed by another analyst (from the secondary review team) or the utility representative, and signed as required. The Senior Analyst may not make any changes independently.

4.2.1.7 Certain duties of the Senior Analyst may be delegated to other analysts as approved by the utility representative.

4.2.2 Lead Analyst

Each shift will have two Lead Analysts; one for primary analysis and one for secondary analysis. The Lead Analyst is responsible for:

4.2.2.1 Evaluating eddy current data in a manner consistent with the analysis guidelines presented herein.

4.2.2.2 Alerting the Senior Analyst to conditions present in the data which are not addressed by the analysis guidelines.

4.2.2.3 Resolving discrepancies identified between Analysts in a manner defined by Section 8.0

4.2.3 Analyst

The Analyst (Primary or Secondary) is responsible for :

4.2.3.1 Evaluating eddy current data in a manner consistent with the analysis guidelines presented herein.

4.2.3.2 Alerting the Lead Analyst to conditions present in the data which are not addressed by the analysis guidelines.

4.2.3.3 Submitting a Final Report that is complete and free of editorial errors.

Primary and Secondary Data Analysis shall perform an independent review of the ECT data. The independent review may be performed by individual groups or companies as designated by the Utility or monitored by the Senior Analyst. No discussion of the data review shall take place between primary and

secondary groups without approval of the Senior Analyst and concurrence of the Utility representative.

ANALYST GUIDELINES CHANGE FORM

Outage: _______ **Change No.** _____

Description of Change:

Reason for Change:

Technical Basis:

Authorization:

Senior Analyst ______________________________ **Date:** ________________

Shearon Harris Engineer _____________________ **Date:** ________________

Figure 4.1 - Analyst Guidelines Change Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: _____ Change No. _____

Effective Date of Change: ________________

Analyst Signature	Date	Analyst Signature	Date

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

Section 5.0
General Information

5.1 Steam Generator Design

The general design of the steam generator is shown in figure 5.1. The model D4 SG's were built by Westinghouse and the plant started operations in 1987. There are 3 SG's each having 4578 tubes. The tubes are mill annealed Inconel 600 with dimensions of 0.75" OD x 0.043" wall thickness. Supports include carbon steel drilled supports; eight on the hot leg side and eleven on the cold leg side and anti-vibration bars in the u-bend section.

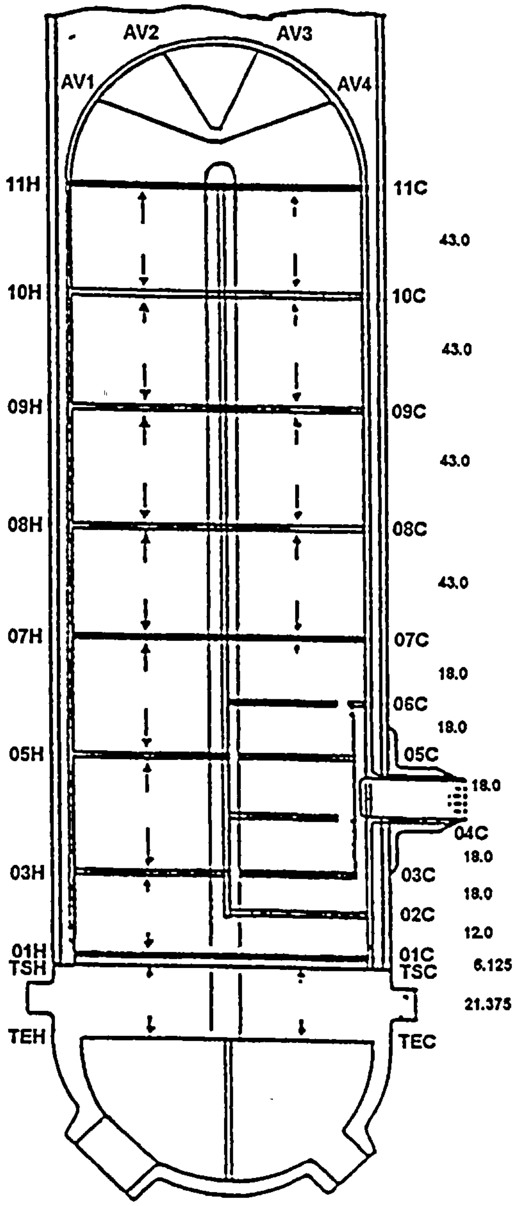


Figure 5.1 - Model D4 SG

The tube sheet is drilled on a square pitch with 1.0625" spacing. Each tube is identified by a row and column number; there are 49 rows and 114 columns in each steam generator.

The drill holes in the supports are nominally 0.771", whereas the drill holes in the baffle plates (1st support) are nominally .825 -.885" on the hot leg and .888 - .900 on the cold leg. This diameter variation may cause a slight difference in the displayed signal from the baffle support versus the remaining drilled supports.

Figure 5.2 shows a typical tube sheet map. Full depth rolls were used during generator fabrication to expand tubes within the tube sheet.

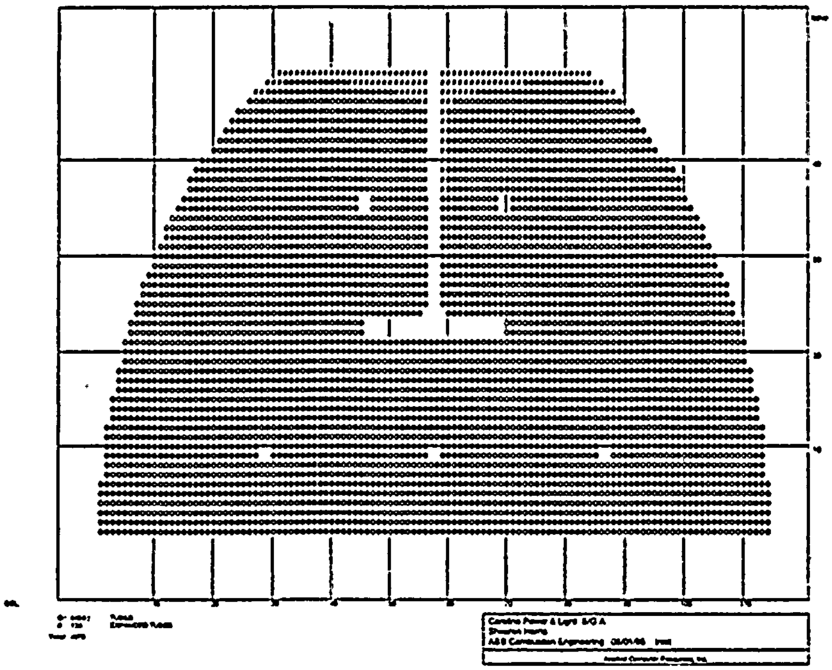
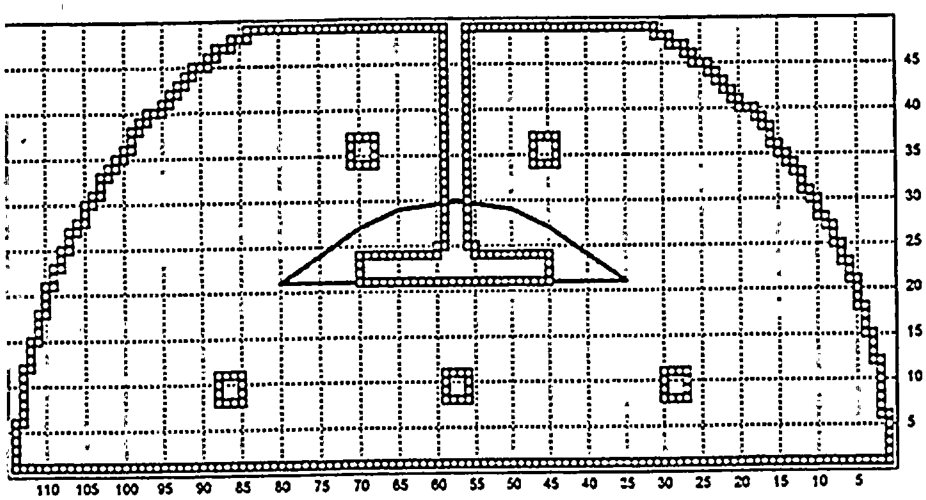


Figure 5.2
Tubesheet Map including Expanded Tubes

To minimize wear in the pre-heater section, the tubing at the 2nd and 3rd tube support intersections on the cold leg were hydraulically expanded into the support plate baffles. The expansion was only performed on the peripheral tubes in the pre-heater area.

It may also be noted that the baffle support does not cover 100% of the tube bundle. There is a "half-moon" cutout in the center of the steam generator (see figure 5.2a). The analyst should be aware of this when locating the first support (baffle).

Approximate location of the "Moon" Cutout in the FDB (1H) at HNP



Numerous preventative efforts have been made to prolong the life of the HNP SG's. These preventative measures were based on industry experience with alloy 600 LTMA tubing and were recognized, at the time of implementation, as state of the art improvements. The major preventative measures are described in the following table.

HNP STEAM GENERATOR MAJOR PREVENTATIVE MAINTENANCE MEASURES				
Measure	Description	Vendor	Date	Reference
Preheater Vibration Mods	Resulted in 80/20 feedflow split and Preheater tube expansion	Westinghouse	9/83 (preservice)	NUREG-1014 FCR-M-00836 Rev. 1
Roto-peening	Hot Leg only	Westinghouse	3/86 (preservice)	WCAP-11072
U-Bend Heat Treatment	Rows 1 and 2	Westinghouse	5/86 (preservice)	WCAP-11152
Shot-peening	Cold Leg only	BWNT	3/91 (RFO-3)	PCR-5345
Westinghouse I600 Plugs	All removed RFO-5	Westinghouse	4/94 (RFO-5)	WCAP-12244
T_{hot} Reduction	From 618°F to 611°F	Westinghouse	6/94 (BOC6)	WCAP-13985

5.2 Operating Experience

A listing of operating Westinghouse plants with Model D and E steam generators is shown in Figure 5.3[1]. There are several mechanisms that affect Model D steam generators: Preheater wear, AVB wear, and primary water stress corrosion cracking (PWSCC) in the tube sheets and row 1 u-bends. Some units have experienced secondary side IGA/SCC at hot leg support plates and in the hot leg sludge pile. A few plants have also experienced circumferential SCC at the top of the hot leg tube sheets.

Plant	Comm. Ops	Model	Mfr	Loops	# Tube /SG	Thinning	Wear	IGA/SCC	PWSCC	Pitting	Fatigue	Denting
Ringhals 3	9/81	D3-2	W	3	4674		x(1,6)	x(2)	x(3,7)			
Almaraz 1	10/81	D3-1	W	3	4674		x(1,6)	x(2)	x(3)			x
McGuire 1	12/81	D2-1	W	4	4674		x(1,6)	x(2,3,6)	x(3,7)			x
Krsko	1/83	D4-2	W	2	4578		x(1,6)	x(2)	x(3)			
Asco 1	9/83	D3-1	W	3	4674		x(1)	x(2,3)	x(3)			x
Ringhals 4	11/83	D3-1	W	3	4674		x(1,6)	x(2)	x(3,7)			
Summer	1/84	D3-1	W	3	4674		x(1,6)	x(2)	x(3,7)			
Almaraz 2	2/84	D3-2	W	3	4674		x(1,6)	x(2)	x(3,7)			
McGuire 2	3/84	D3-1	W	4	4674		x(1,6)	x(2,6)	x(3,7)			
Angra 1	12/84	D3-1	W	2	4674		x(1)	x(2,3)	x(3)	x(4)		x(5)
Catawba 1	6/85	D3-2	W	4	4674		x(1)	x(2)	x(3,7)			
Doel 4	6/85	E1	C	3	4864		x(1,6)	x(2,3,4)	x(3)			
Byron 1	9/85	D4	W	4	4578		x(1)	x(2,3)	x(7)			
Tihange 3	9/85	E1	C	3	4864		x(1,6)	x(2,3)	x(3)			
Asco 2	2/86	D3-2	W	3	4674		x(1)	x(2,3)	x(3)			x
Catawba 2	8/86	D5	W	4	4530		x(1)		x(3)			
Shearon Harris 1	5/87	D4-1	W	3	4578		x(1)		x(3)			
Byron 2	8/87	D5	W	4	4530		x(1)					
Braidwood 1	6/88	D4	W	4	4578		x(1)	x(2,3)				
South Texas 1	8/88	E2	W	4	4851		x(1,6)	x(3)				
Braidwood 2	10/88	D5	W	4	4530		x(1)					
South Texas 2	6/89	E2	W	4	4851		x(1)					
Comanche Peak 1	8/90	D4-2	W	4	4578							

Figure 5.3

Notes:
(1) AVB's
(2) Tube support plates
(3) Expansion transitions
(4) Sludge pile
(5) SCC diagnosed at dents
(6) Baffle--plates
(7) Inner row U-bends

[1]Table taken from the Steam Generator Eddy Current Data Analysis Performance Demonstration Review Material, October 1995 revision.

5.2.1 Shearon Harris Damage Mechanisms

Wear at the AVB intersections

Wear at the Preheater intersections

AVB Wear

First discovered during the initial inservice examination in August/September 1988.

Preheater Wear

First discovered during the second inservice examination in October 1989.

PWSCC

Multiple axial cracking found in the tubesheet region and near the top-of-tubesheet transition in 1995.

ODSCC

Two small Circumferentially oriented cracks found at the top-of-tubesheet transition in 1995. One in SG "A" and one in SG "C".

Miscellaneous

Loose Parts damage - leaker outage in 1990 (two tubes affected)

5.2.2 Shearon Harris Repair History

1983 Seven Tubes Plugged During Fabrication

1985 Four Tubes Plugged During Fabrication

1988 First Inservice - Seven Tubes Plugged for AVB wear, one for a restriction, one for an over-expansion, and one for a >40% indication at 11H support.

1989 Second Inservice - One Tube plugged for AVB wear, one for a cold leg support indication >40% and one for a hot leg support indication >40%

1990 Leaker Outage - Two tubes plugged for loose part wear.

1991 Third Inservice - One tube plugged for AVB wear and three tubes plugged for suspected PWSCC

1992 Fourth Inservice - Two tubes plugged after tube pull

1994 Fifth Inservice - Three tubes plugged for suspect indications, four tubes plugged after removal of previous Westinghouse plugs.

1995 Sixth Inservice - Four plugs which were initially installed in SG "C" in 1985 were replaced due to leakage. Two tubes in SG "A" were plugged for axial indications, one was plugged and staked for a small circumferential indication. Two tubes were plugged in SG "B" for axial indications. Three tubes were plugged in SG "C" for axial indications, while one tube was plugged and staked for a circumferential indication. Two tubes were plugged for AVB wear in SG "C".

5.3 Reporting Requirements

5.3.1 All indications of tube wall degradation detected with the bobbin probe shall be reported, other than wear at AVB and Preheater intersections, which need not be reported until the depth estimate exceeds 10%.

5.3.2 The voltage, phase angle, percent through wall and axial position above the center of the nearest support shall be reported for each flaw. Flaw location measurements should be from the center of the flaw for bobbin probe examinations, and from the lowest point of the flaw for rotating coil exams, unless in the tubesheet, which would be the uppermost location unless otherwise specifically noted. The tube support distance measurements in Figure 5.1 shall be used to establish the axial distance.

5.3.3 The sign convention used to designate flaw location is always positive except: if the flaw is located within the tubesheet, if the flaw is located between the center and bottom of the tube support or if a test is incomplete and an indication lies beyond the last completed intersection in the opposite plenum.

5.3.4 The tested extent of each tube shall be reported to include the last support tested.

5.3.5 All dents greater than 2 volts (Primary Mix differential channel) shall be reported[2]. Due to geometry variations in various U-bends, the threshold in the U-bend area will be 5 volts. Any changes to voltage requirements during the inspection will be noted by the Senior Analyst

5.3.6 Incomplete test extents shall be reported with the exact location where the probe stops. This shall be done on a best effort basis.

5.3.7 Sludge heights shall be reported as directed by the Utility representative on selected tubes.

5.4 Probe Speed Verification

5.4.1 The probe speed should be checked by the Analyst on the first tube of each calibration group and the first tube following a probe change.

5.4.2 The desired withdrawal speed for the bobbin test is 22 to 24 inches per second at 800 samples per second, unless otherwise stated in the acquisition procedure or other approved documentation.

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[2]Dents may be reported with CDS or by primary or secondary analysis. The Senior Analyst will direct which method will be utilized.

5.4.3 Probe speed may be checked using the appropriate software method as outlined in the Eddynet operator manual. If probe speed should be verified manually, the following procedure may be used:

5.4.3.1 Establish the axial scale between two supports or other landmarks. (i.e., 02C to 03C is 18 inches)

5.4.3.2 Set the software to manual locate, and position the cursor centered on the first landmark.

5.4.3.3 Initiate the first landmark by mouse clicking and sliding until the appropriate landmark appears.

5.4.3.4 Position at the next landmark and click and hold the right mouse button to adjust the scale to the correct setting.

5.4.3.5 Right click in the Landmarks label and the probe speed should be indicated in the lissajous box.

5.4.3.6 Should the speed fall below 22 inches per second or exceed 24 inches per second, the Analyst should notify the Lead Analyst.

5.5 Calibration Standards

5.5.1 Calibrations require the use of the as-built dimensions to set analysis calibration curves. If other standards are utilized, be sure to use the correct as-built drawings.

5.6 Equipment/Software Requirements

The analysis of digital ECT data is accomplished with the use of computer programs (software) and computer systems (hardware). Programs and computers may be utilized which are the equivalent or superior to those listed below if there is no diminution in the capabilities to detect, measure and record flaw indications.

5.6.1 Computer Analysis Programs

Zetec Eddynet95 Version 3.13 or later as approved[3]
Other Approved Software

5.6.2 Hardware

HP 400/700 series computer with graphics display

[3]All software for Analysis must be approved by ABB/CE. Validation and Verification will be performed prior to software acceptance.

Appropriate LAN hardware for interconnection
Appropriate Hard disk drives, optical media storage drives and other equipment as required by the current software version. Requirements for file servers and workstations may vary slightly.

Section 6.0
Bobbin Probe Calibration and Evaluation

6.1 Probe Description and Frequency Selection

6.1.1 Probe Description

The probes used for the inspection are standard bobbin coil probes, with coil spacing and widths of .060" permitting detection of incipient damage mechanisms. The .540", .560", .580" and .610" diameter probes provide fill factors of 66%, 71%, 76% and 84% respectively.

A .610" diameter magnetic u-bend long cone probe (A610MULC) is used to test large diameter rows. Probes of .560" and .580" diameter spring-flex ring magnet (A560SFRM, A580SFRM) are used to test small diameter rows. Other probes may be used as approved by CP & L.

6.1.2 Frequency Selection

The current frequency selection for bobbin probes is as follows:

550 KHz differential and absolute
270 KHz differential and absolute
130 KHz differential and absolute
35 KHz differential and absolute

The purpose of each test frequency is as follows:

6.1.2.1 550 KHz differential

This is the inspection frequency used to satisfy the ASME code requirement for the "basis frequency". The basis frequency "provides responses from the 20% flat bottom holes and the 100% through-the-wall hole references in the calibration tube standard that have a phase angle difference between 50 deg. and 120 deg."

6.1.2.2 550 KHz absolute

Used as a mix component

6.1.2.3 130 KHz differential

Used as a mix component and confirmation channel.

6.1.2.4 130 KHz absolute

Used for sludge height measurements, a mix component and for indication confirmation.

6.1.2.5 **270 KHz differential**

Used as a mix component and confirmation channel.

6.1.2.6 **270 KHz absolute**

Used as a mix component and confirmation channel.

6.1.2.7 **35 KHz differential**

Used for CDS and support structure location

6.1.2.8 **35 KHz absolute**

Used for location of support structures and sludge height measurements

6.1.3 Mix for Carbon Steel Support Suppression

6.1.3.1 **Mix #1 - 550/130 Differential**

This mix is displayed on the CRT strip chart and is used to detect/size flaws at carbon steel support structures.

6.1.3.2 **Mix #2 - 550/130 Absolute**

This mix is used for absolute signals near carbon steel structures.

6.1.4 Mix for Dent/Transition & Carbon Steel Suppression

6.1.4.1 **Mix #3 - 550/270/130 Differential**

Used to screen support structures & Top of the Tubesheet

6.2 Calibration

*Note - Some graphic displays may use 400 and 100 KHz instead of 550 and 130 KHz. These graphics are for illustration only, and do not affect actual data displays.

6.2.1 Load the ASME calibration run into RAM.

6.2.2 550 KHz differential

6.2.2.1 Place the 100 percent through wall hole in the window. See figure 6.1

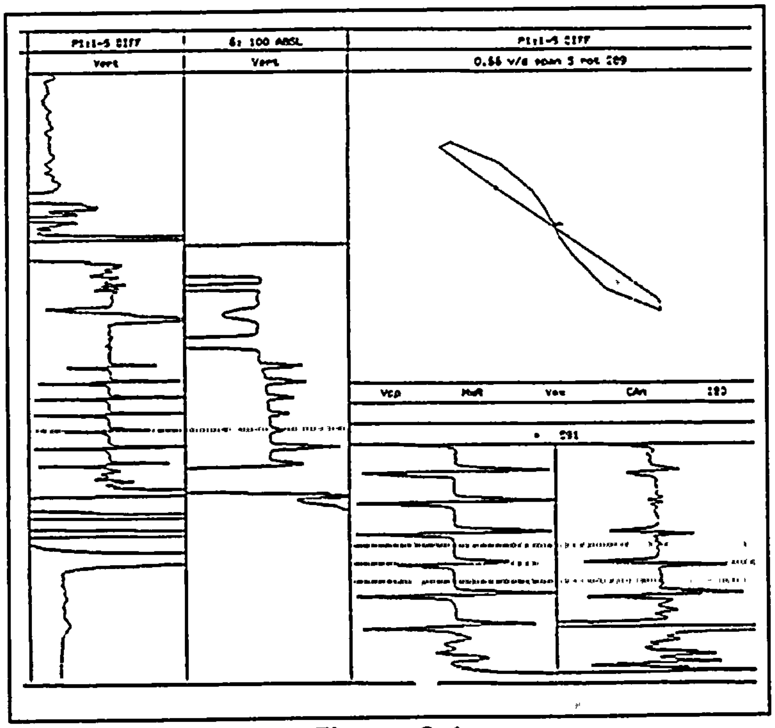


Figure 6.1

100% Through-wall hole - ASME Standard

6.2.2.2 Rotate the transition signal to approximately zero degrees. See figure 6.2

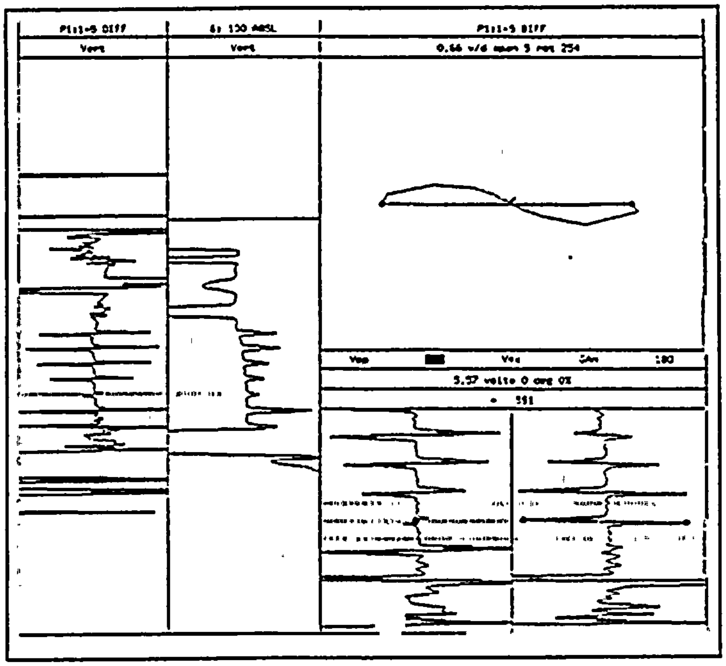


Figure 6.2
Transition signal at zero degrees

6.2.2.3 Adjust the signal span to approximately six grid divisions. See figure 6.3

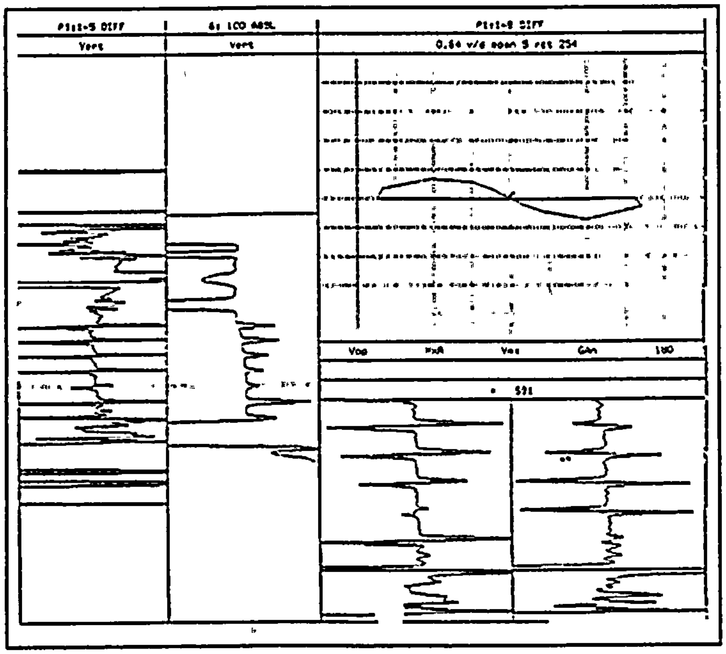


Figure 6.3
Span to ~6 grid divisions

6.2.2.4 Rotate the transition signal to 40° ±2°. See figure 6.4

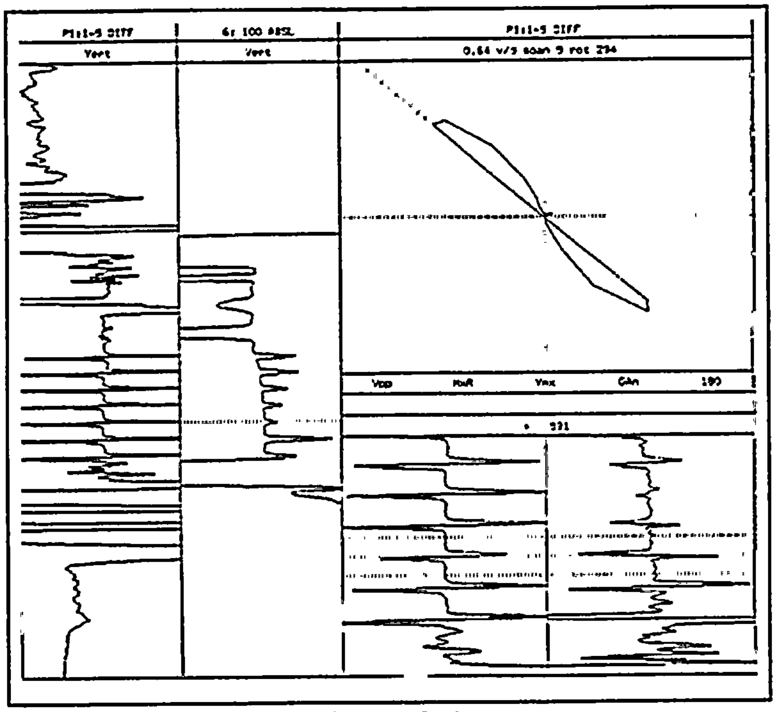


Figure 6.4

Transition signal to 40°

6.2.2.5 Establish the phase versus depth curve using the actual values for the 100, 60, and 20% O.D. flaws. Use the maximum rate of the transition to define the phase angle.

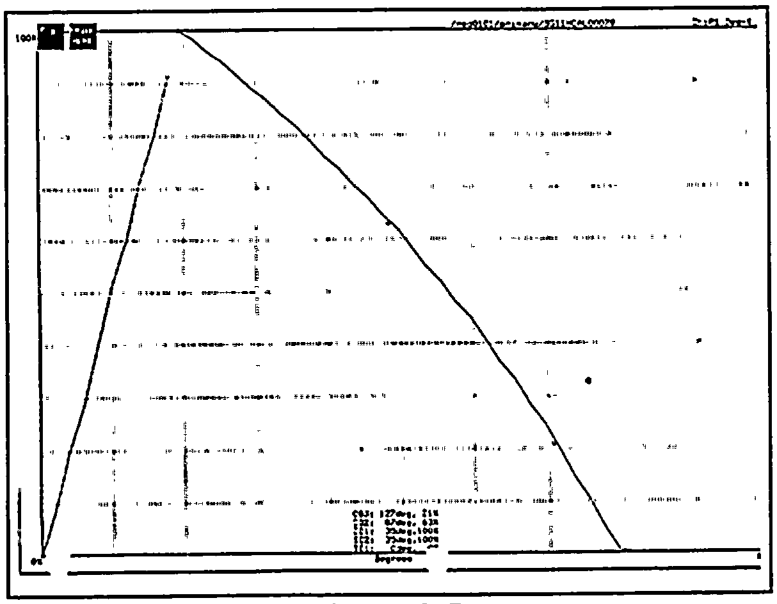


Figure 6.5

Typical Calibration curve

6.2.2.6 Probe motion typically lies at 1° to 5°. See figure 6.6

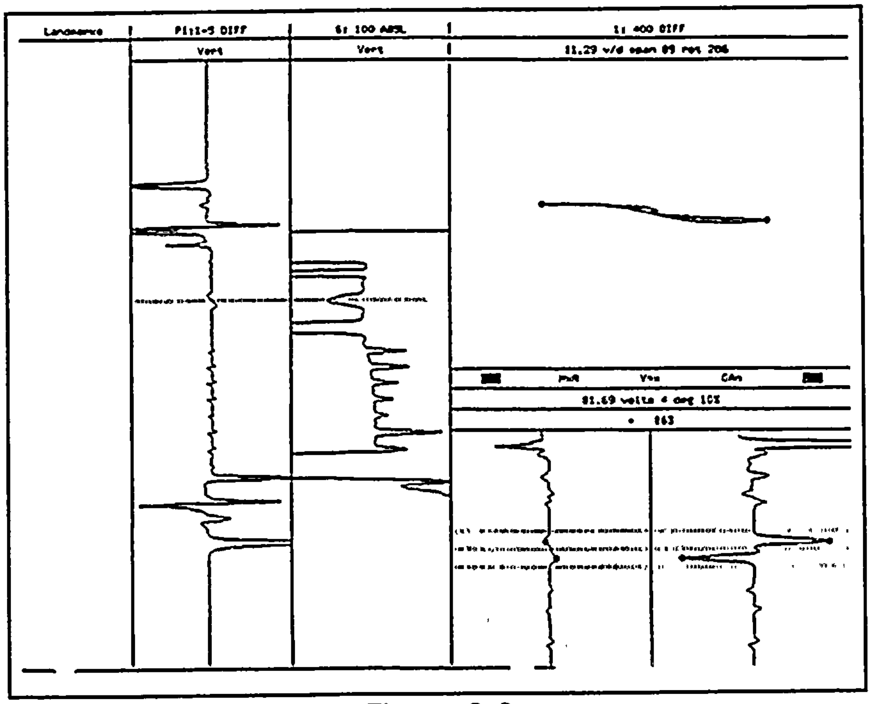


Figure 6.6

Probe motion signal

6.2.3 550 KHz Absolute

6.2.3.1 Place the dent from the ASME standard in the window.[4]

6.2.3.2 Adjust the phase such that the initial signal excursion is to the right at 180 ±5°.

6.2.3.3 Place 4 x 20% ASME flat bottom holes in the window.

6.2.3.4 Set the span such that the signal occupies approximately 2 grid divisions. See figure 6.8

6.2.3.5 Observe that the ASME flaw signals go up and are not saturated on the screen.

6.2.3.6 See paragraph 6.2.14 for setting volts.

6.2.4 130 KHz differential

[4] If a dent is not available, rotate so probe motion is horizontal.

Repeat steps 6.2.2.1 through 6.2.2.5. **Peak to peak is normally used to define the phase angle.

6.2.5 130 KHz absolute

Repeat steps 6.2.3.1 through 6.2.3.6.

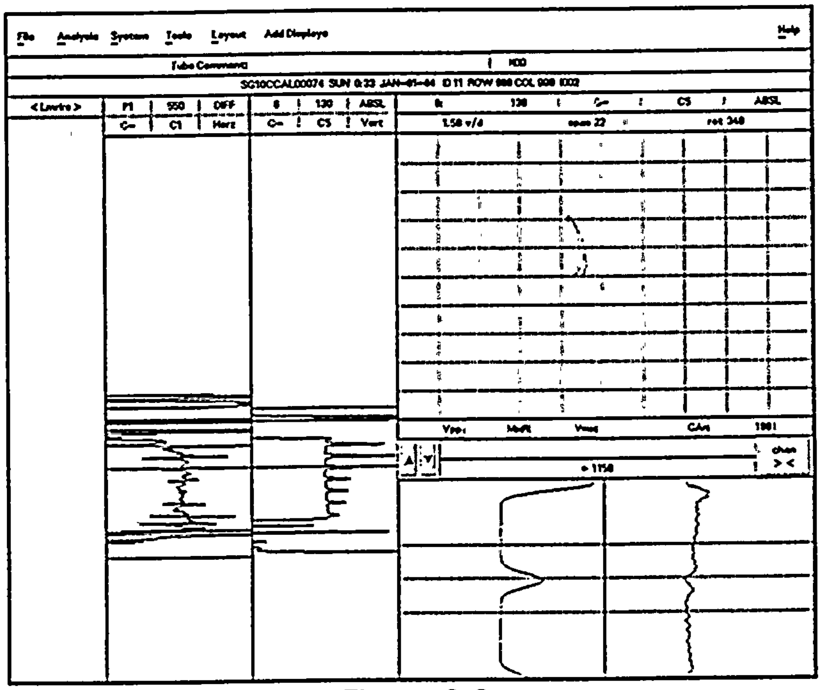


Figure 6.8
Set span of 4 x 20% ASME FBH to 2 grids

6.2.6 270 KHz differential

Repeat steps 6.2.2.1 through 6.2.2.5.

6.2.7 270 KHz absolute

Repeat steps 6.2.3.1 through 6.2.3.6.

6.2.8 35 KHz differential

6.2.8.1 Place the tube support ring in the window.

6.2.8.2 Adjust the phase such that the initial excursion is up to the right.

6.2.8.3 Adjust the span such that the entire signal occupies approximately six grid divisions. See figure 6.10.

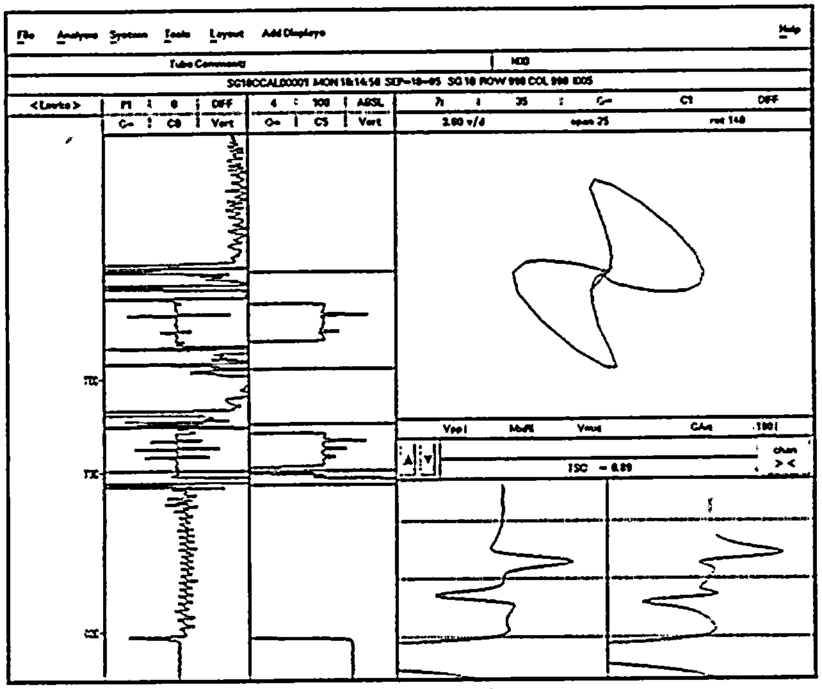


Figure 6.10
Support Ring on 35 KHz differential

6.2.9 35 KHz Absolute

6.2.9.1 Place the tube support ring in the window.

6.2.9.2 Adjust the phase such that the initial signal excursion is vertical starting downward.

6.2.9.3 Adjust the span such that the entire signal occupies 3 to 4 grid divisions. See figure 6.11.

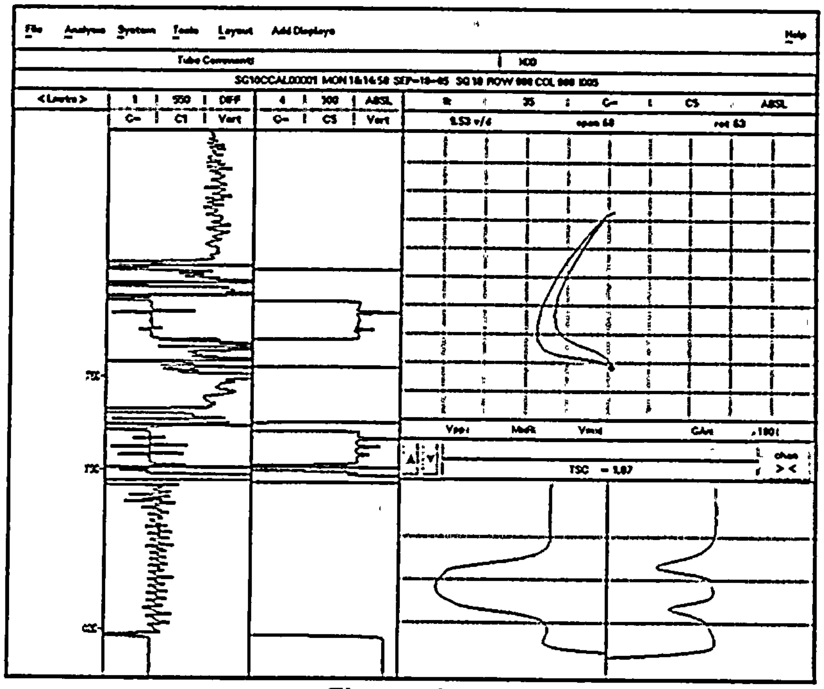


Figure 6.11

Support ring on 35 KHz absolute

6.2.10 Mix 1 - 550/130 Khz Differential (tube support suppression)

6.2.10.1 Select the 550 and 130 KHz differential channels (Channels 1 and 5[5]) from the process channels menu. Be sure the "keep channel" is set to the 550 KHz channel. Proceed to the "Adjust Mix" menu.

6.2.10.2 Null the instrument between flaws in the ASME standard. See figure 6.12.

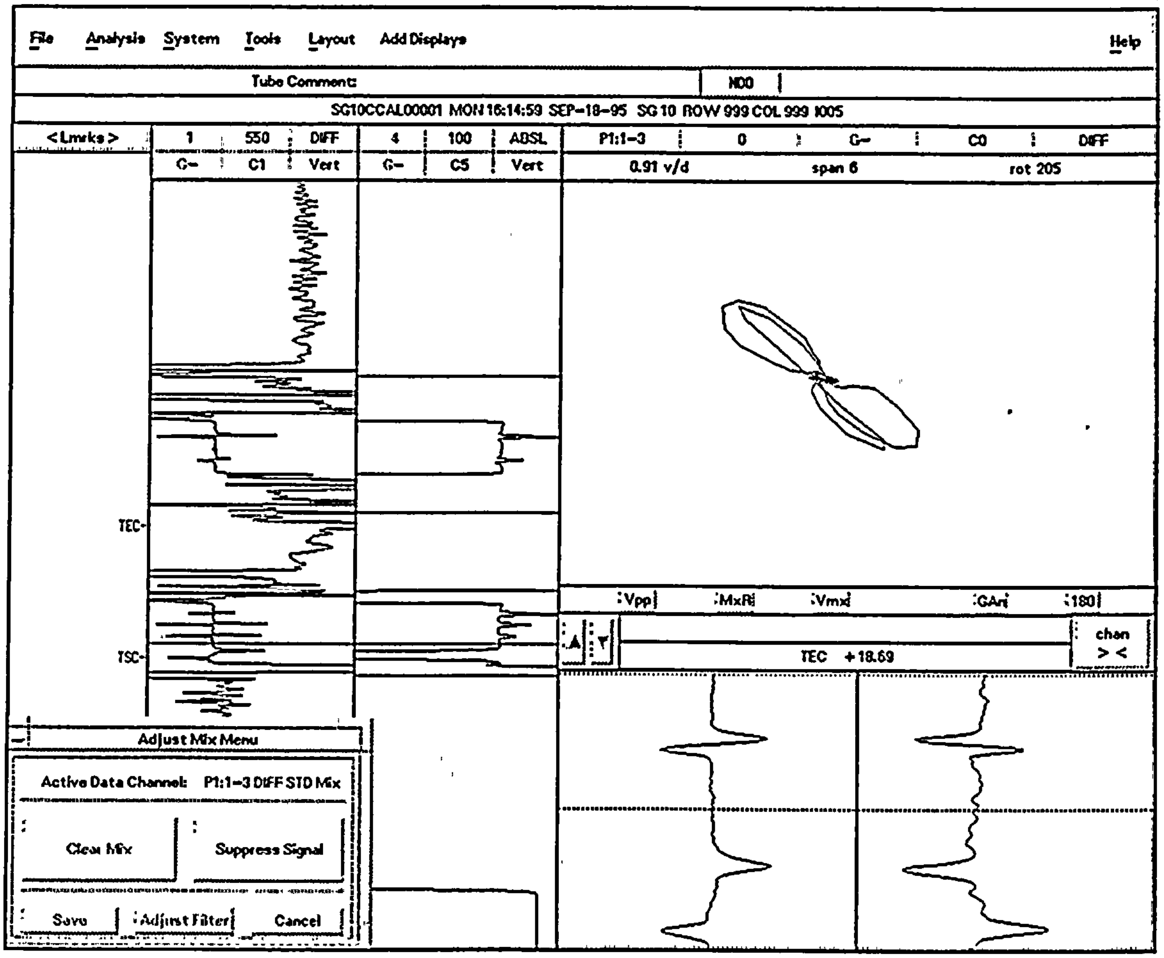


Figure 6.12
Null point for support suppression

[5]Channels other than 1 and 5 may be used if a different frequency array is utilized. See the Senior analyst for details.

6.2.10.3 Place tube support ring in the window. Allow only the TSP signal between the cursers. See figure 6.13.

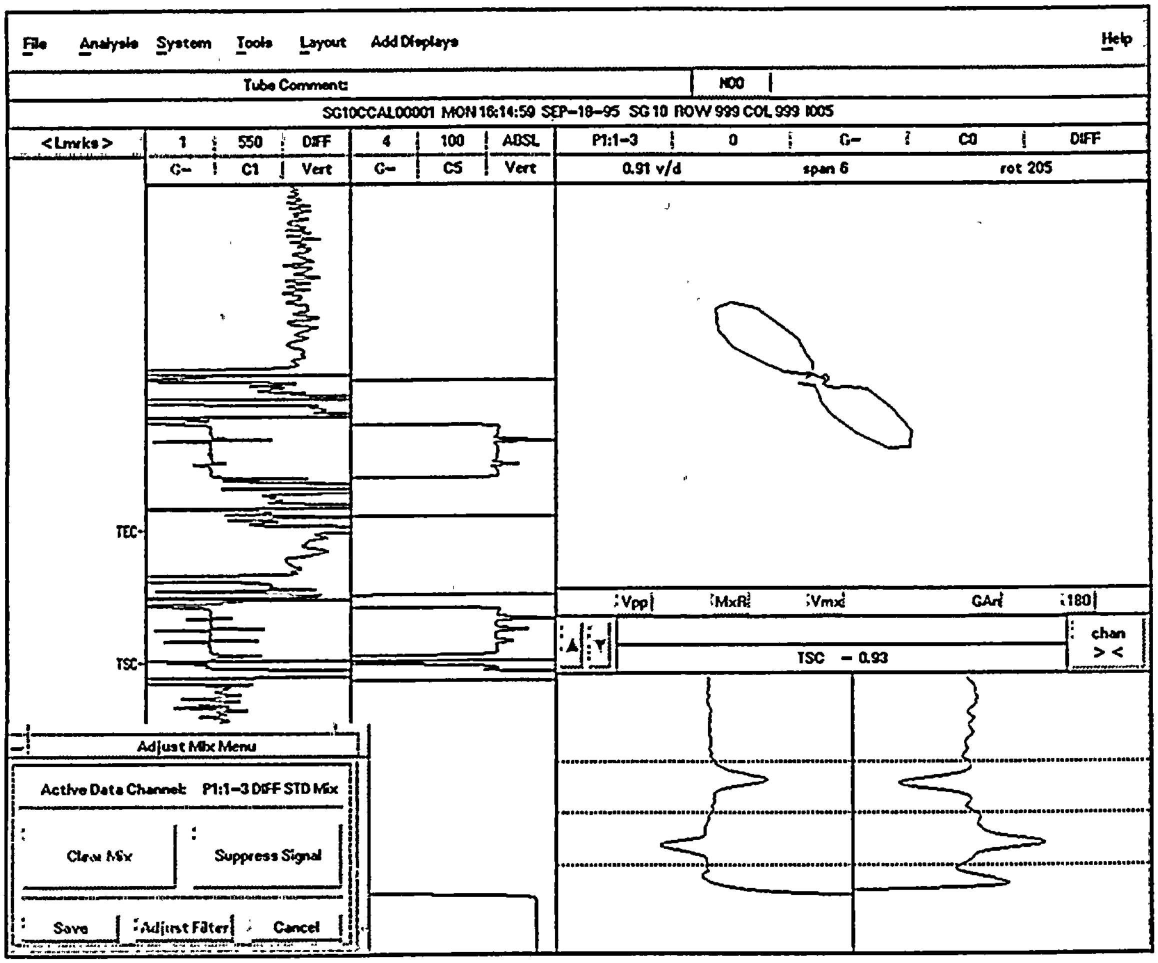


Figure 6.13
Support Ring Signal in Window

6.2.10.4 Mix on the TSP signal. Exit by selecting "SAVE".

6.2.10.5 Place the 100% through wall hole in the window

6.2.10.6 Rotate the transition to approximately zero degrees.

6.2.10.7 Adjust the span such that the entire signal occupies five grid divisions. Make note of the numeric span value. This is the setup span.

6.2.10.8 Rotate the display such that noise (or a dent signal) is horizontal.

6.2.10.9 Establish a phase versus depth curve using the actual values for the 100%, 60% and 20% O.D. flaws. Peak-to-Peak is normally used to define the phase angle. See figure 6.14

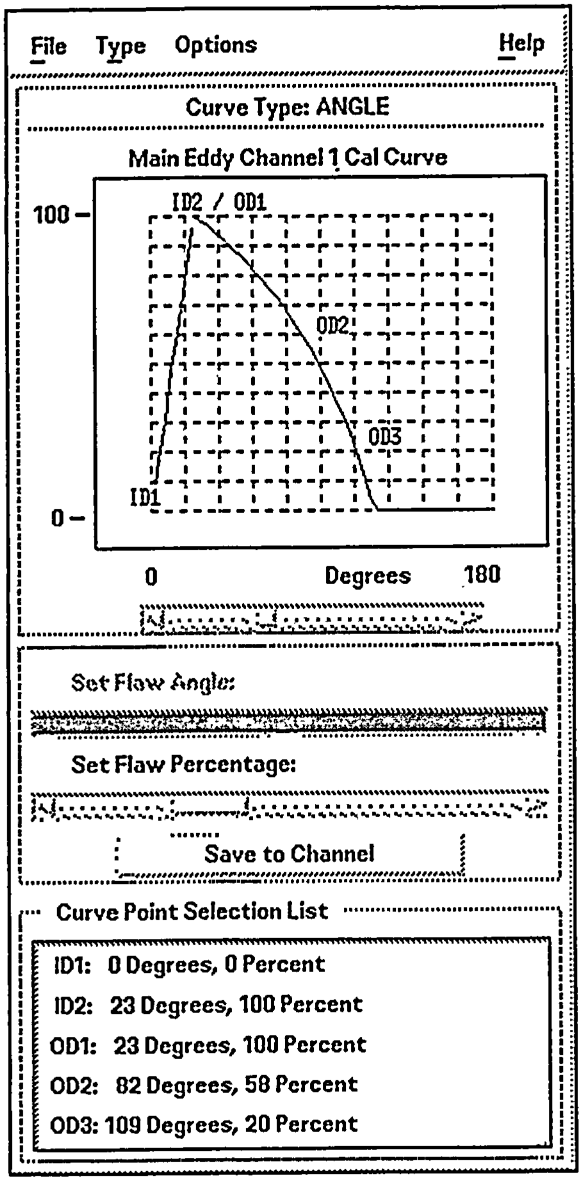


Figure 6.14
Calibration curve for 550 KHz Mix

6.2.11 Mix 2 - 550/130 KHz Absolute (Carbon Steel Suppression)

6.2.11.1 Select the 550 and 130 KHz absolute channels with the "keep channel" on the 550 KHz channel. Proceed to "Adjust mix". Null the instrument between flaws in the ASME standard. See figure 6.18.

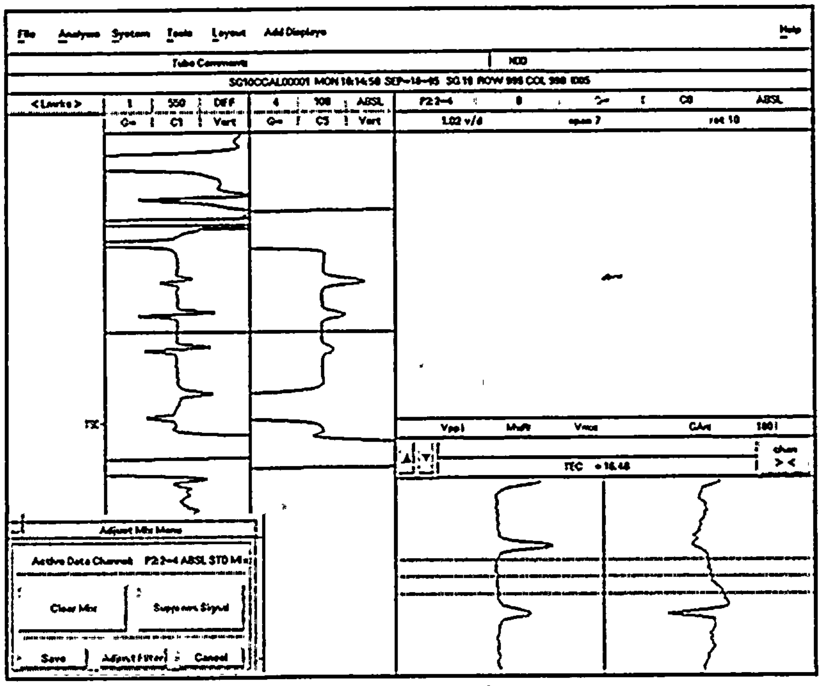


Figure 6.18
Null between flaws on the ASME standard

6.2.11.2 Place the tube support ring in the window. Allow only the TSP signal between the cursers. See figure 6.19.

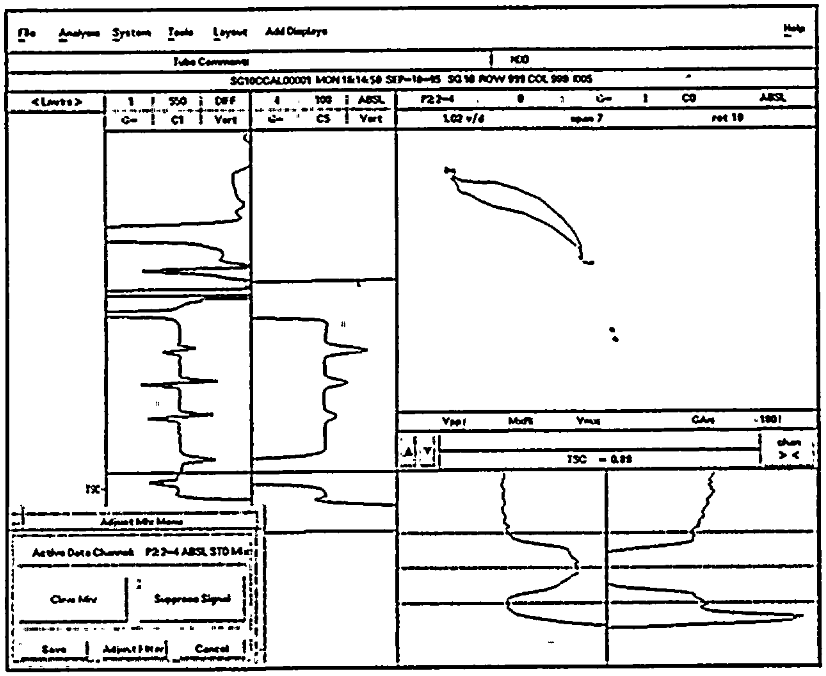


Figure 6.19
Carbon steel support ring signal in window.

6.2.11.3 Mix on the TSP signal. Exit by selecting "OK keep".

6.2.11.4 Place the dent from the ASME standard in the window[6].

6.2.11.5 Adjust the phase such that the initial signal excursion is to the right at 180 ±5°. See figure 6.20.

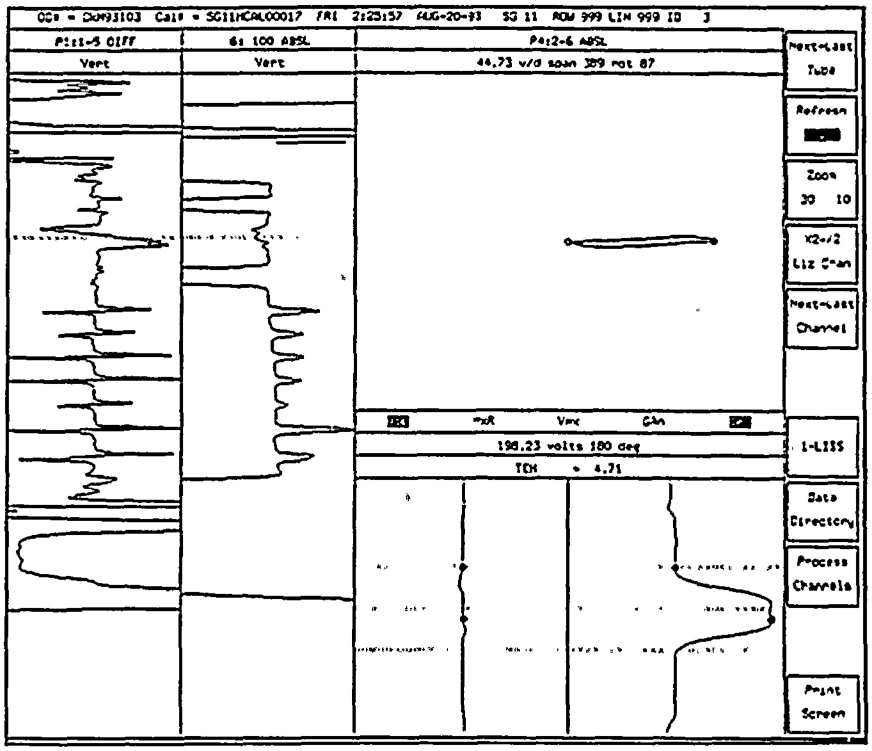


Figure 6.20
ASME dent to 180 degrees

6.2.11.6 Place the 4 x 20% ASME flaw in the window.

[6]Rotate noise horizontal if a dent signal is not available.

6.2.11.7 Set the span such that the signal occupies 2 grid divisions. See figure 6.21.

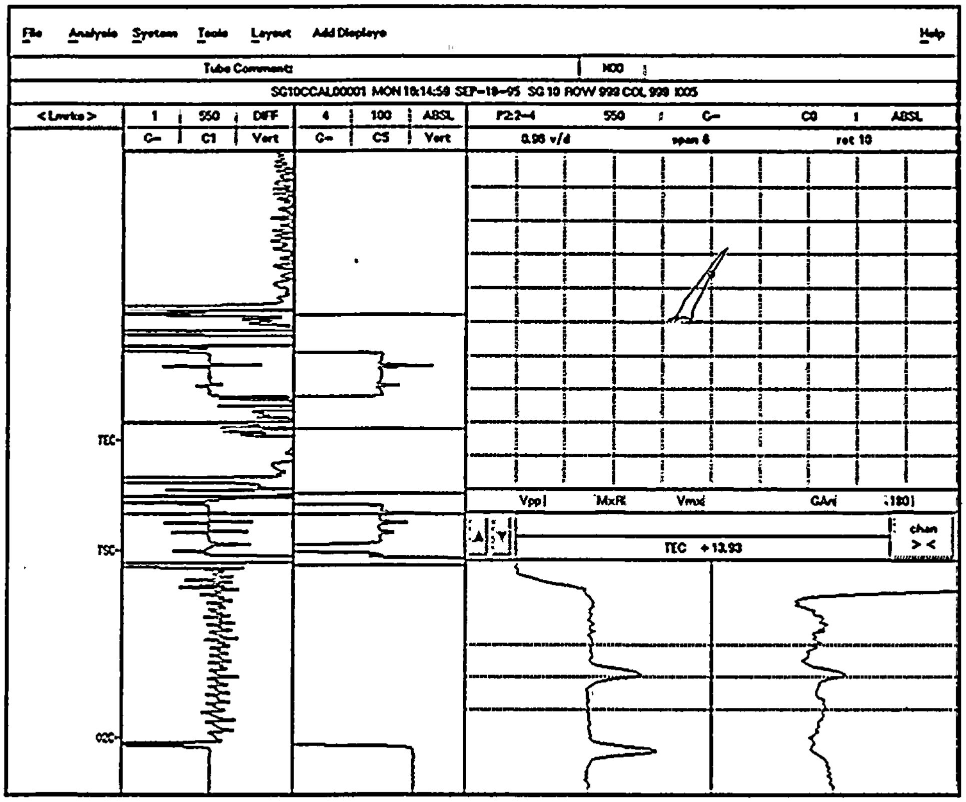
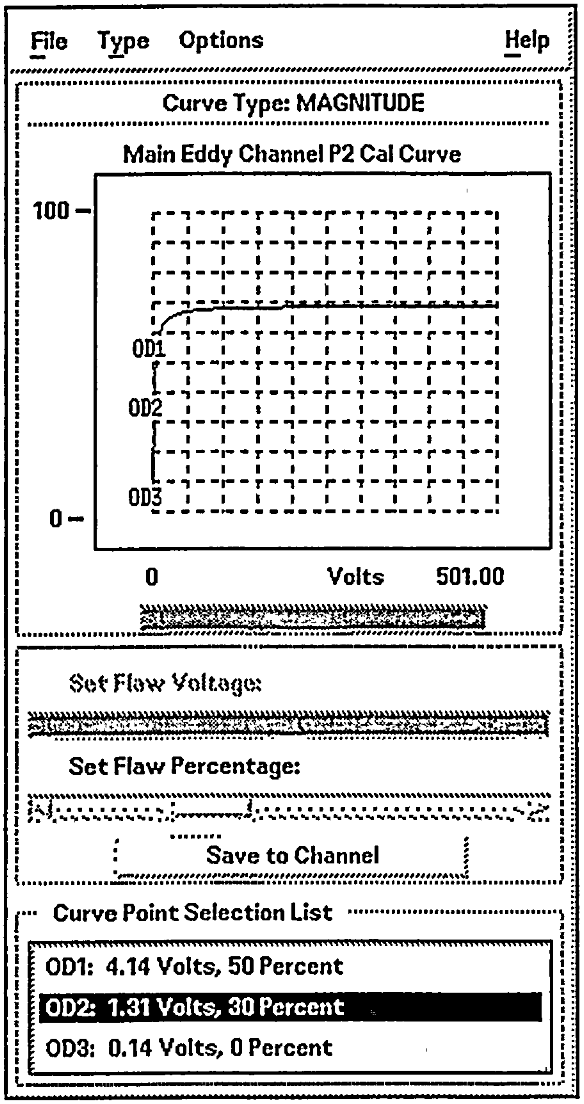


Figure 6.21
Setting span of 4 x 20% ASME flaw to 2 div.

6.2.11.8 Establish a voltage amplitude versus depth curve (V-Max) using the actual values of the wear scar flaws from the calibration standard. Be sure to set voltage parameters before establishing your calibration curve (see section 6.2.14).



P2 Volt Curve

6.2.12 Mix 3 - 550/270/130 KHz Differential (Dent/Transition & Carbon steel suppression)[if used]

The desired mix output is one in which there is a minimum of 40° phase separation between the 60% and 20% O.D. flaws with a minimum vertical residual from the simulated tube support ring, copper ring and radial dent. The following step should be performed to establish a proper mix #3.

6.2.12.1 Select the 550, 270 and 130 KHz differential channels with the "keep channel" being the 550 KHz channel. By selecting more than two frequencies, the software will automatically enter into a multi-frequency mix (turbo mix) mode. Proceed to "Adjust Mix".

6.2.12.2 Select "Clear All Signals" to clear the mix processor.

6.2.12.3 Using the cursor, select a clean section of the standard and null the response.

6.2.12.4 Scroll to the 100% ASME flaw and place it alone in the window.

6.2.12.5 Select "Save Signal" to save the response into the mix buffer.

6.2.12.6 Repeat the last step for all ASME flaws; 100% - 20%.

6.2.12.7 Scroll to the carbon steel support signal and place it alone in the window.

6.2.12.8 Select "Suppress Signal" to suppress the support signal.

6.2.12.9 Repeat the last step for the ASME dent signal[7].

6.2.12.10 Set the span of the 60% flaw to 4 screen divisions peak-to-peak.

6.2.12.11 Set the Dent/Transition residual horizontal. (The 60% flaw starting down and vertical.)

6.2.12.12 Establish a phase versus depth curve[8] using the actual values of the 60%, 40% and 20% ASME flaws from the calibration standard. The max-rate of the transition should be used to define the phase angle of the signals. See figure 6.17.

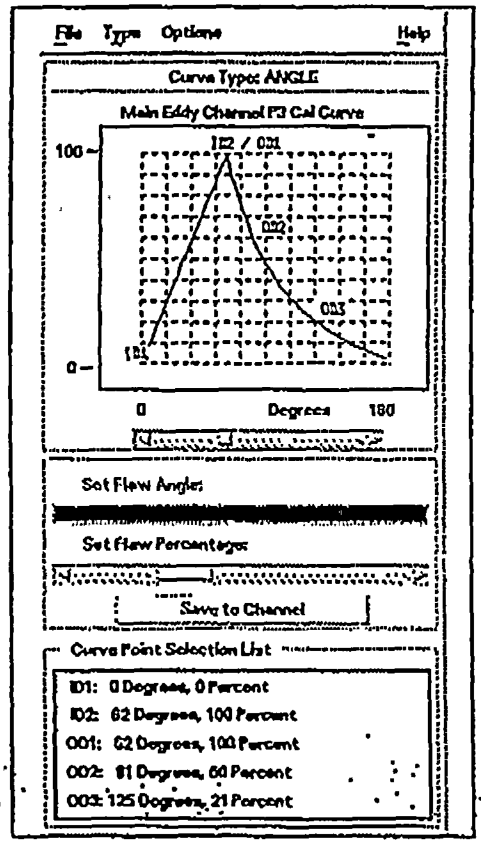


Figure 6.17

Calibration curve for Mix 3

[7] If the dent is not available, keep the current mix output, play in an actual tube of data, and use the top-of-tubesheet transition. See the Senior Analyst for details.

[8] A phase versus depth curve may not be required if the mix is used for information only, and not for sizing. Verify this with the Senior Analyst.

6.2.14 Setting Voltages

*Note: Voltage settings should be established before any voltage related parameters are finalized, such as locating parameters, volt curves, etc.

6.2.14.1 Select channel 1 (550 KHz differential) and place the ASME standard 4 x 20% signal in the window.

6.2.14.2 Select Peak-to-Peak to set the voltage measurement feature. See figure 6.22.

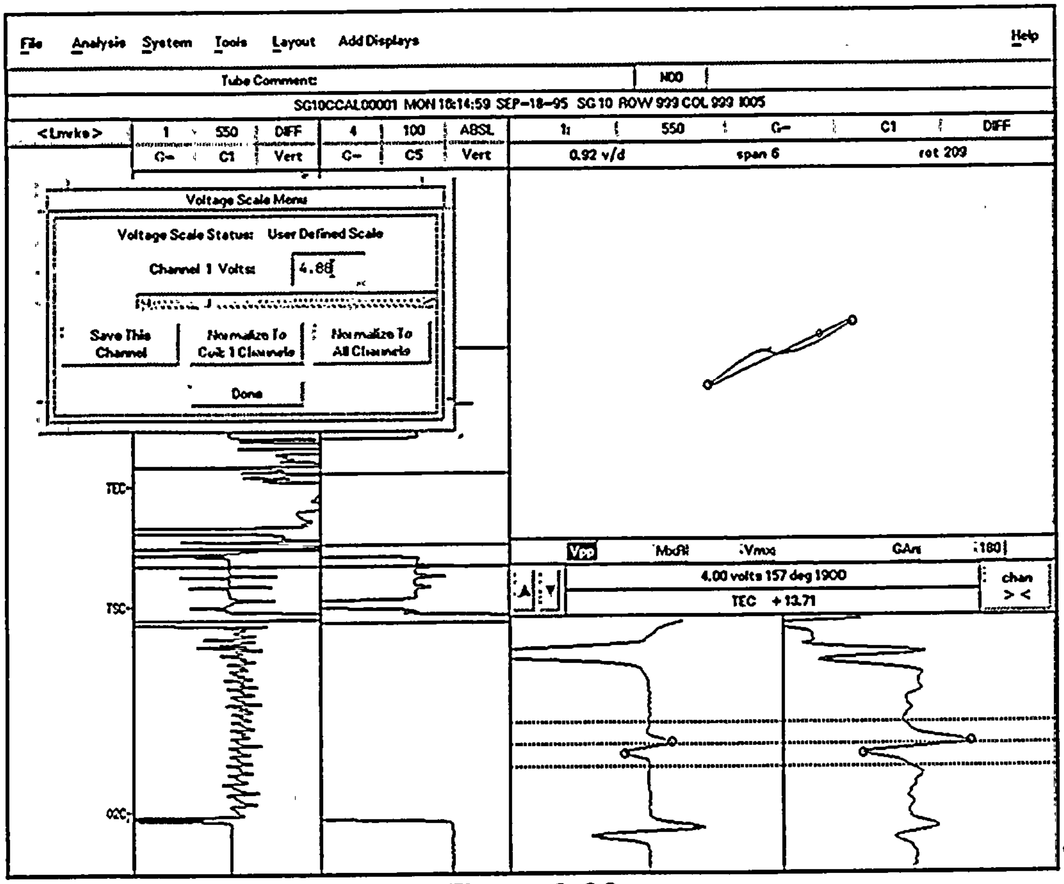


Figure 6.22
Voltage set up for ASME standard

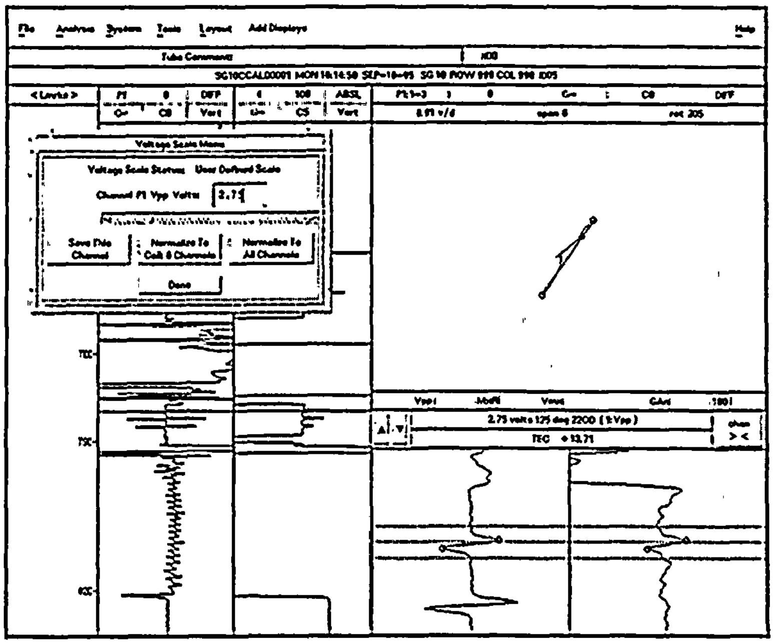
6.2.14.3 Proceed to the "Set Voltages" menu.

6.2.14.4 Click and hold the mouse in the "Enter Volts" selection until the voltage reading is approximately 4.00 volts. Save the voltage value using the "Save This Value" option, then select "Store to All" to store the voltage and normalize the remaining channels.

6.2.14.5 Change to the primary mix channel (550/130 KHz differential).

6.2.14.6 Locate the 4 x 20% signal in the windows

6.2.14.7 Select Peak-to-Peak and adjust the voltage to 2.75 volts. This voltage setting is used to standardize dent sizing and other parameters with industry standards to date.



P1 volt settings

6.2.14.8 Store your setup at this point[9].

6.2.15 **Miscellaneous Setup parameters**

6.2.15.1 Determine where the "results" files will be stored and select the proper location in the "operator selectables" section.

6.2.15.2 Other selections in "operator selectables" must be selected, such as which leg you are testing from, expanded chart length, number of extent letters, etc. See the Senior analyst for details. It is important that results are stored properly, or data may be lost.

[9]Storing your setup often is recommended during the establishment of your setup variables.

6.2.15.3 The appropriate landmarks table must be used for automatic support location abilities. Insure you have selected the proper table and locating options. Figure 6.23 shows some typical settings for most steam generators.

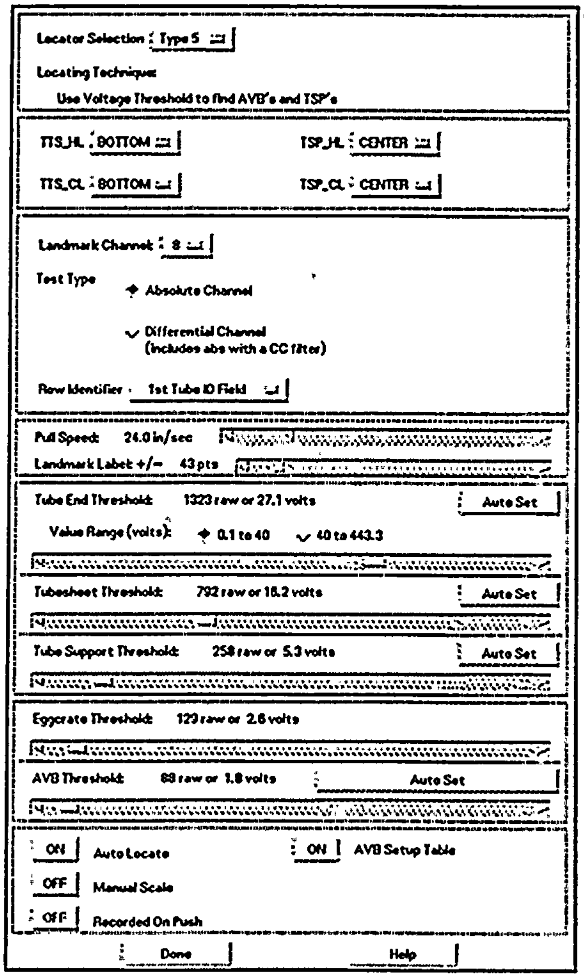


Figure 6.23
Locating Parameters

6.2.16 Full Length Bobbin examination Test Calibration Parameters

BOBBIN FULL-LENGTH ANALYSIS SUMMARY							
DIFFERENTIAL CHANNELS							
Channel	1	3	5	7	Mix 1	Mix 3	
Span	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div	4-5 div	
Phase	40 deg	40 deg	40 deg	vertical	PM horiz.	PM horiz	
Cal Std	100% ASME	100% ASME	100% ASME	Support ring	100% ASME	60% ASME	
Curve	Degree	Degree	Degree	N/A	Degree	[Degree]	
Volts	20% - 4v	Norm.	Norm.	Norm.	20%-2.75v	Norm.	
ABSOLUTE CHANNELS							
Channel	2	4	6	8	Mix 2		
Span	2 div	2 div	2 div	4 div	2 div		
Phase	PM horiz.	PM horiz.	PM horiz.	vertical	PM horiz.		
Cal Std	4 x 20%	4 x 20%	4 x 20%	Support ring	4 x 20%		
Curve	N/A	N/A	N/A	N/A	Volt/VMax		
Volts	Norm.	Norm.	Norm.	Norm.	Norm.		

DATA SCREENING

Left Strip Chart: CH Mix 1 Vert   Right Strip Chart: CH 6 Vert   Liss.: CH 1

Notes:
Above spans are a minimum
Voltage normalized to channel 1 except for primary mix
Mix 1 = 550/130 Diff support mix
Mix 2 = 550/130 Abs. support mix copper mix
Mix 3 = 550/270/130 Diff support/dent mix

RECORDING REQUIREMENTS

Graphics: Generated by Resolution unless otherwise indicated

Recording:

Channel 1: Degradation
Mix 1: Degradation (support influenced), PVN, Dents
Mix 2: Degradation (wear)
Mix 3: Distorted TTS/Dented indications

Table 6.1
Bobbin Coil Analysis Parameters

6.3 EVALUATION

6.3.1 General Evaluation Requirements

The guidelines address specific regions of the SG where flaws are known to have occurred. However, all of the data for the other examined regions of the tube is to be analyzed using standard analysis practices. Initial screening of the data will be performed at the setup spans. The use of setup spans for initial screening of the data is meant to maximize the detection of large flaws by the Analyst. The Analyst may use lower span settings as needed for a complete analysis of the data.

The regions of the SG which are addressed with specific analysis methods include:

- the top of the tubesheet
- the tube supports and baffle structures
- the anti-vibration bars (AVB)

Evaluation of the top of the tubesheet - Two types of flaws are known to occur at or above the top of the tubesheet, OD corrosion and primary side stress corrosion cracking. In the absence of deposits on the tube OD, the data is scrolled observing the 550 KHz lissajous. In the presence of deposits the data is scrolled observing the Mix 1 (550/130 KHz support mix). Take care to examine the entire tube entry signal at the set up span for distorted signals indicative of cracking. At present the bobbin probe has limited detection capabilities for ID cracking at the top of the tubesheet. Any detection capability is based on distorted signals or three frequency mix output at the top of tubesheet transition. OD corrosion has limited occurance at Shearon Harris top of tubesheet/sludge pile area, but should be screened for.

Evaluation of the Tube Supports - OD cracking has been known to occur at the tube supports. In the absence of dents the data is scrolled observing the Mix 1 (550/130 KHz support mix). In the presence of dents the data is scrolled observing Mix 3 (550/270/130 KHz support/dent suppression mix). Mechanical wear and fretting have been detected at the cold leg support baffles at Shearon Harris. The 500/130 KHz absolute mix is used to scroll the baffle supports.

Evaluation of Anti-Vibration Bars (AVB's) - Mechanical fretting and wear have occurred at the AVB's at Shearon Harris. The data is scrolled using the Mix 2 (550/130 KHz support mix).

Free Span Flaws - Any free span indication should be reported as a NQI for further evaluation. Further study may include historic comparison or rotating coil examination. Free span indications should be flaw-like, however, and should not include other anomalies such as permeability variations.

6.3.2 Evaluation of the Top of Tubesheet

The following figures give examples of evaluations in the sludge pile region.

6.3.2.1 This example shows a large indication just below the top of tubesheet transition. Due to its size and clarity, it is most likely PWSCC in the axial direction.

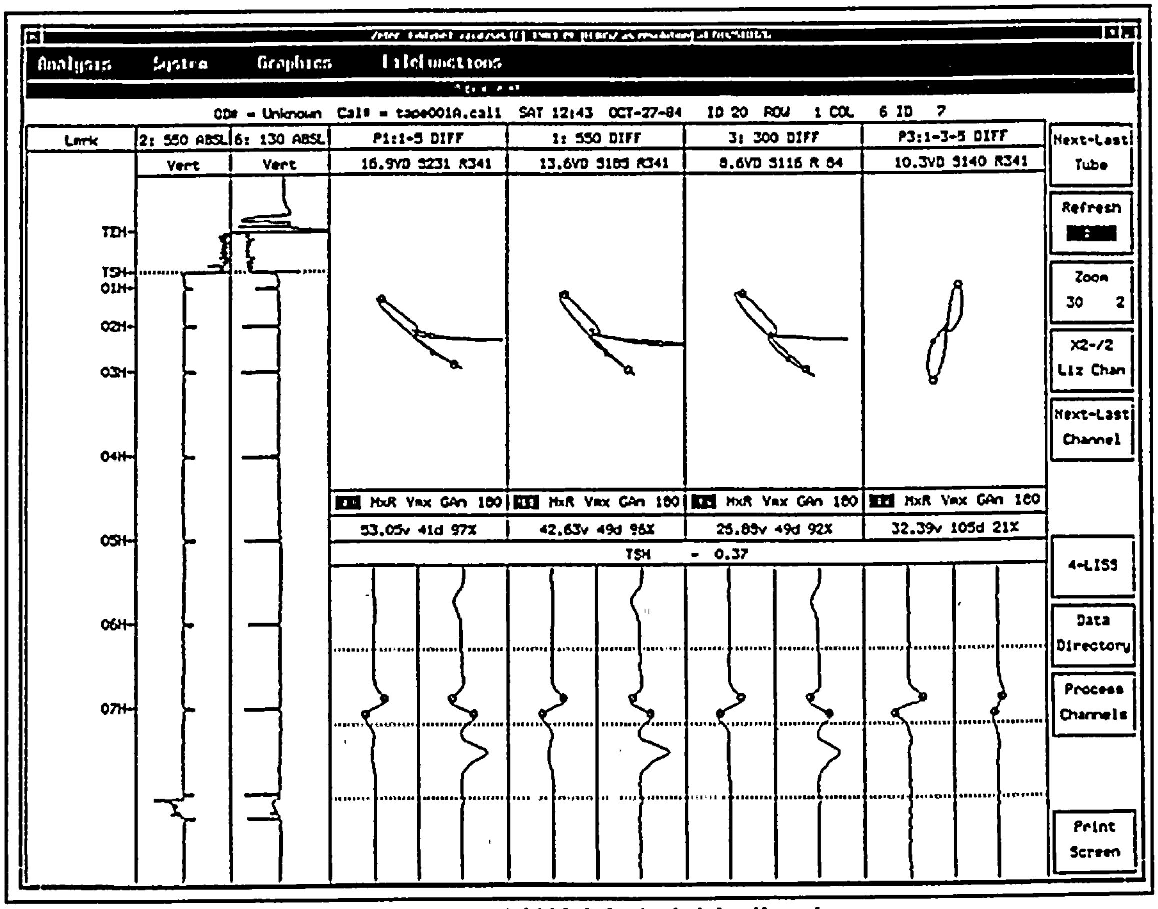


Figure 6.31 - PWSCC Axial Indication

6.3.2.2 Other indications may be present lower in the tubesheet, or at the tube roll transition.

6.3.3 Evaluation of the Tube Supports

6.3.3.1 A flaw is detected on either the 550 KHz, 130 KHz or the strip charts. Change the lissajous to 550 differential or absolute and observe whether there is a dent component (horizontal) to the signal.

6.3.3.2 Change the lissajous to Mix 1 and scroll the flaw. Place the measuring points on the flaw. If a clear transition is apparent on the 550 KHz differential channel, it may be used to measure the flaw. (If a dent was detected as in the previous paragraph, change to Mix 3 and use max-rate.)

Figure 6.32 shows an example of an indication near the edge of hot leg support no. 1. This is an unknown mechanism, but may be due to a loose part.

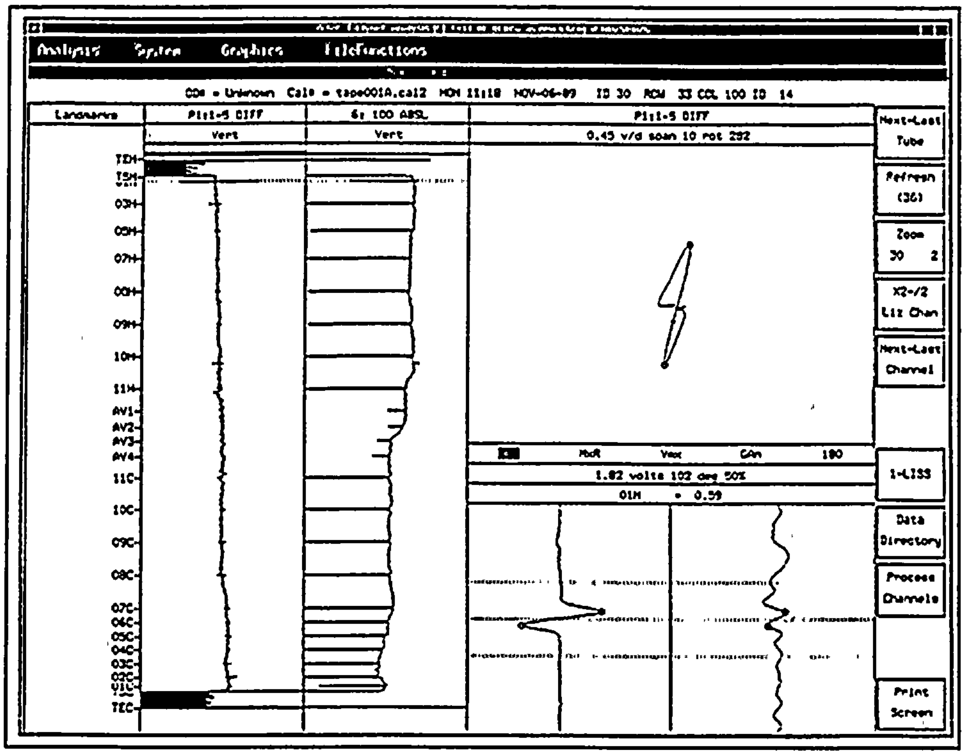


Figure 6.32 - Support Indication

6.3.3.3 If a clear transition is not apparent, the indication may still require recording for review by the Lead Analyst for flaw history comparison or further evaluation. Record the flaw on the Mix 1 channel with a DSI in the percent field.

6.3.3.4 Certain Westinghouse steam generators in European plants and some U.S. plants have had occrences of support plate ligament cracking due to magnetite buildup and subsequent denting. Shearon Harris has not active magnetite buildup or resulting dents, however a sample of support indications may be screened for support anomalies. Figures 6.32a and 6.32b show normal and distorted support signals from series 51 tubing with the suspected ligament cracking. Special instructions will be given to each data analyst screening the bobbin data for these signals.

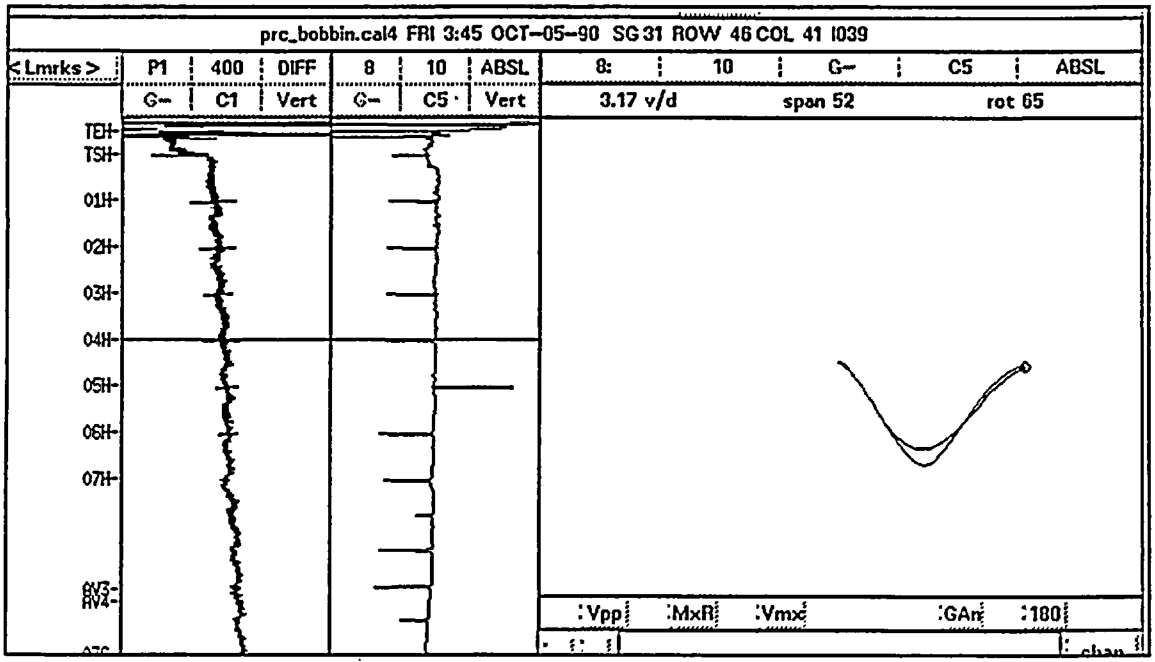


Figure 6.32a - Normal Support

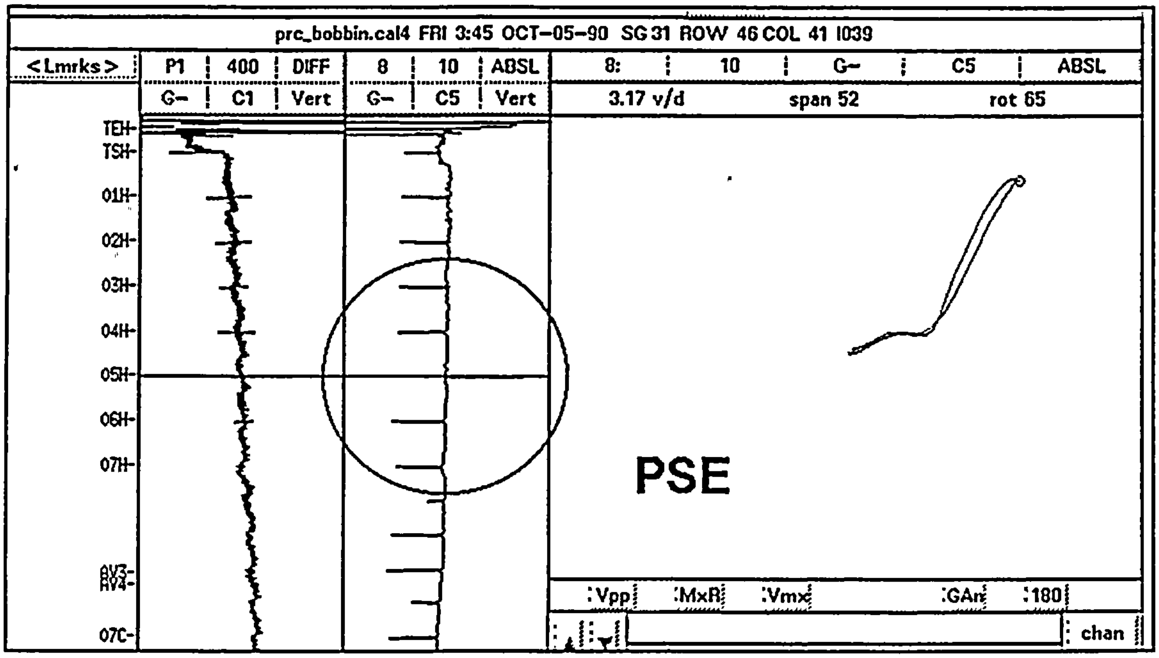


Figure 6.32b - Abnormal support - PSE

6.3.4 Evaluation of AVB's and Cold Leg Baffles

The following figures give examples of evaluations in the Anti-Vibration Bar and Cold Leg Baffle areas:

6.3.4.1 A flaw is detected with the 550 KHz differential or 550/130 differential mix channel. Wear or fretting flaws are considered to be volumetric, and therefore are measured using a voltage or volumetric depth curve (mix P2). Figure 6.33 shows an example of an AVB flaw measured with mix 2.

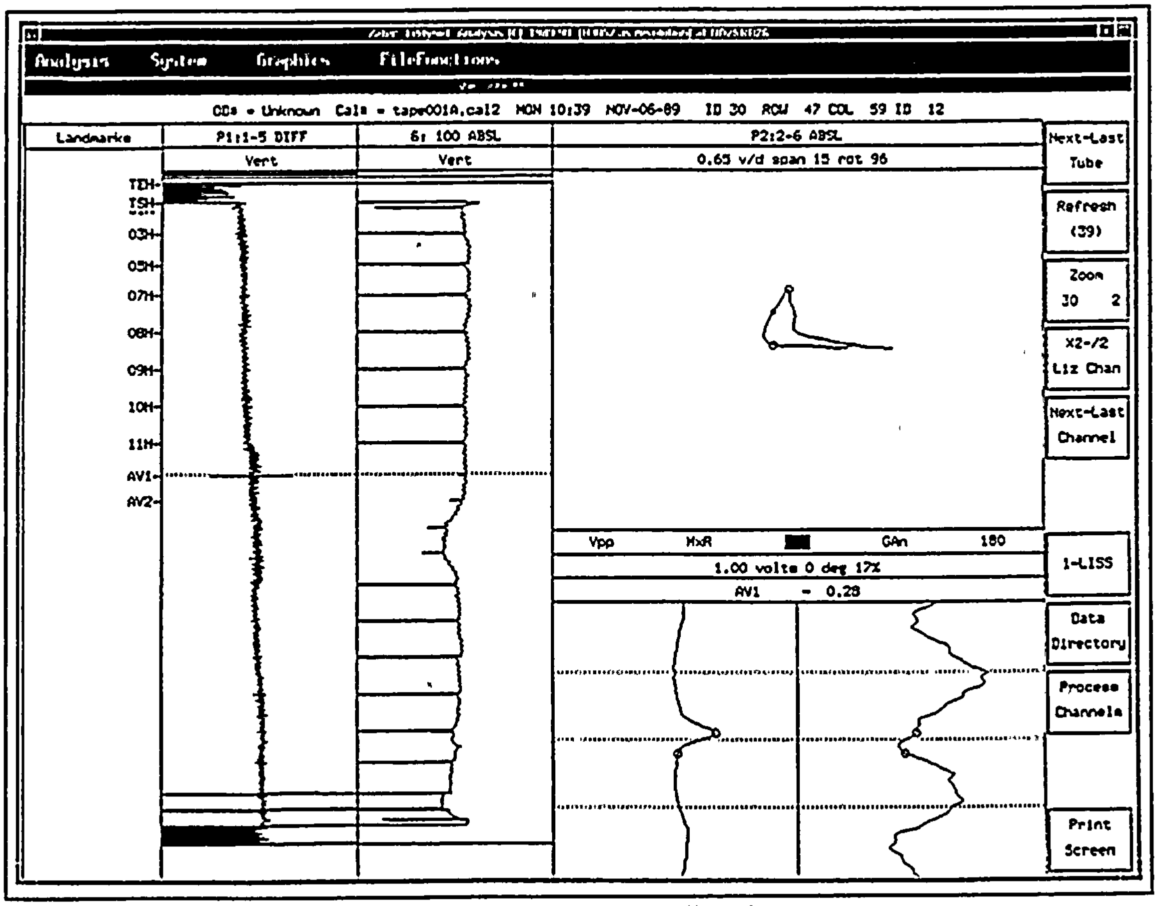


Figure 6.33 - AVB Indication

6.3.4.2 Likewise, indications at the cold leg baffle supports in the pre-heater region have been known to wear due to the turbulent flow in this region. An example of baffle wear is shown in figure 6.34.

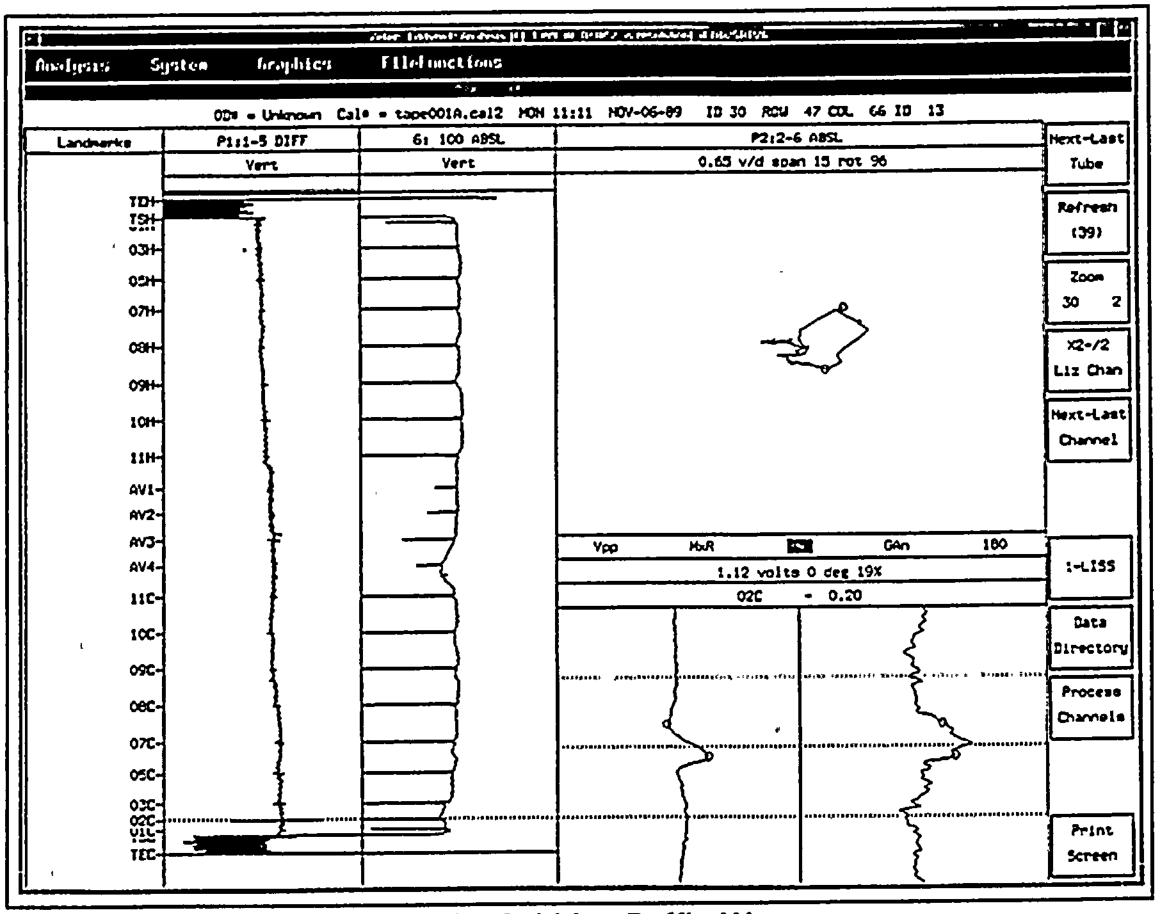


Figure 6.34 - Cold leg Baffle Wear scar

6.3.4.3 To prevent wear at suspect tubes in the preheater baffles, supports number 02C and 03C have been hydraulically rolled into the baffle plate (see section 5 for tubesheet map). This roll produces a large bulge-like signal, and should not be confused with a dent or other flaws. See figure 6.35 for an example of a roll expanded area.

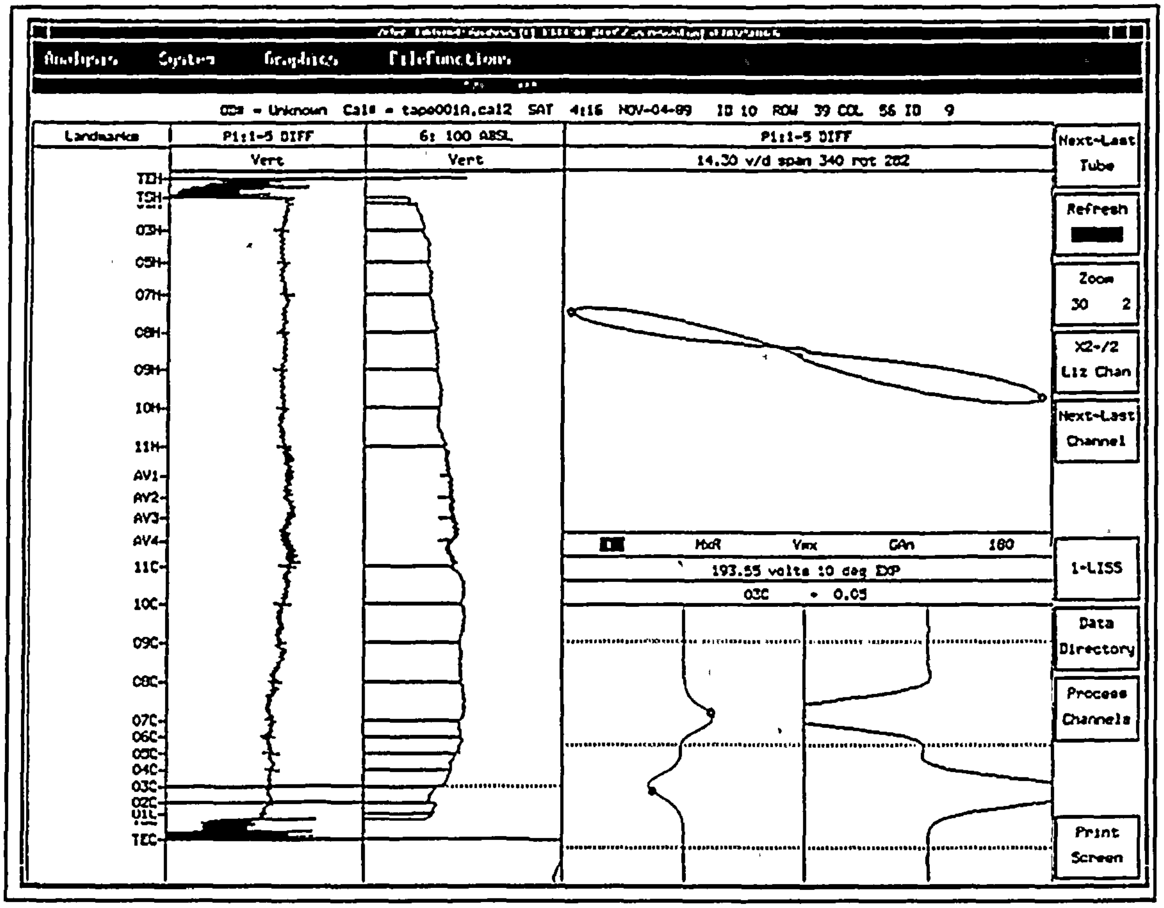


Figure 6.35 - Baffle Roll Transition Indication

Section 7.0

Bobbin Probe Recording Requirements & Acronyms

7.1 Final Report

The following information (subject to changes) will be recorded in the final report section of the data analysis program.

7.1.1 The Header information should be recorded using the report builder software in Eddynet. The Header should contain the probe designation, calibration number, analyst name and level, and the date. Unless otherwise specified, the date field should be the date the data is analyzed, which may differ from the acquired date due to shift changes, etc. A fourth line may be used to designate other information such as the optical disk label, as directed by data management. See figure 7.1.

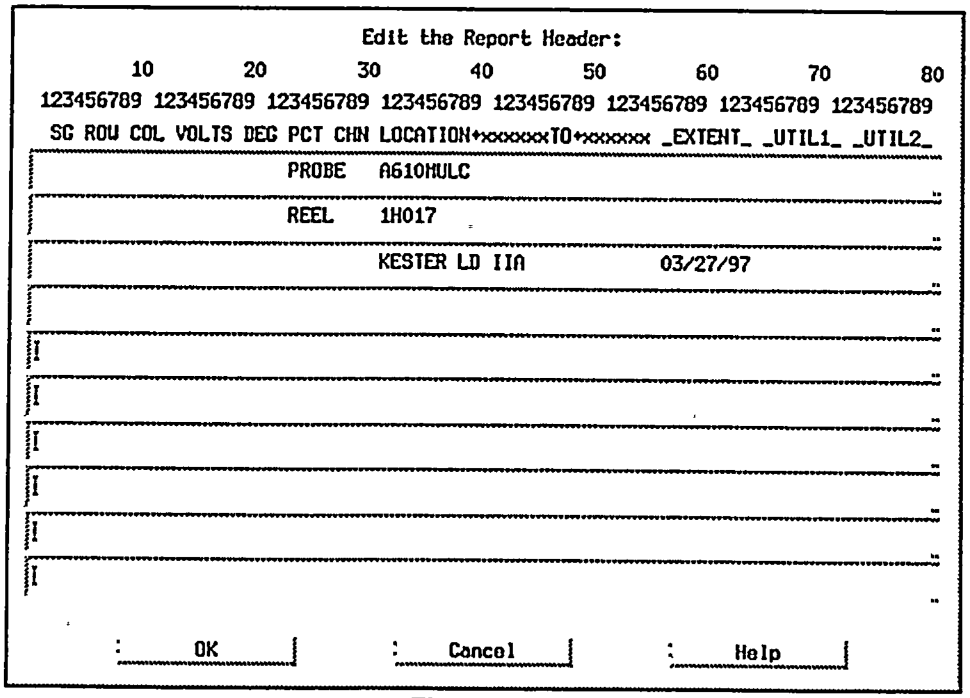


Figure 7.1

Final Report Header Format example

7.1.2 For each tube evaluated with no indications an entry must be made that contains the SG ID (from Acquisition), Row, Line and Extent.

7.1.3 For each indication evaluated an entry must be made that includes the SG ID, Row, Line, Volts, Degrees, Percent depth or acronym, Location and Extent.

7.1.4 For any restricted or incomplete tubes, the correct retest (R__ code) acronym should be placed in the percent column, and the last tested extent in the Extent column.

7.1.5 No blank lines should appear on the report.

7.1.6 Messages may be inserted within the body of the report as required. The Analyst's signature and data shall accompany every page of the printed report. See figure 7.2.

```
Aug 04 16:50 1995      /rod0102/.../B3052.res       Page 1

File=resolution/tape001A.cal2  User=B3052  Date=8/4/95 16:50
Disc Label = Unknown
                                 A610MULC
                                 AH001
                                 BIPES TU III               07/05/95
                                 H95001
 10   39   56 179.8    9 EXP  17 02C     +  0.00            TECTEH
 10   39   56 189.8    9 EXP  17 03C     +  0.00            TECTEH
 10   40   59 136.7    7 EXP  17 02C     +  0.00            TECTEH
 10   40   59 172.3    7 EXP  17 03C     +  0.00            TECTEH
 10   40   59  0.36    0  19  18 AV4     +  0.06            TECTEH
 10   40   58                                               TECTEH
 10   40   56                                               TECTEH
 30   47   66  1.07    0  36  18 02C     +  0.00            TECTEH
 30   33  100  1.80 103   51  17 01H     +  0.94            TECTEH
 30   32   99                                               TECTEH
 30   32   98                                               TECTEH
```

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Figure 7.2

Example Final Report Printout

7.2 Computer Graphics

Computer graphics format will be finalized at the beginning of the analysis project. Graphic formats may change due to changing outage parameters, software requirements, etc. Typically, the Analyst's assigned to the resolution process will generate the computer graphics needed for the final report.

7.3 Reporting Acronyms

The acronyms listed below are used in the percent column of the Final Report to describe a particular condition. Other acronyms may be used as directed by the Senior Analyst or Utility representative. The codes are grouped in categories as follows:

Category I:	No further action required.
Category II:	Possible flaw - futher action required
Category III:	Possible loose part - futher action required
Category IV:	Futher action required - Retest condition
Category V:	No further action required - Non-Relevant signals

Acronym Condition

Category I:

NDD No Detectable Degradation (blank)

PLG Plug location.

Category II:

DRI Distorted Roll Indication - indicates a distorted roll transition signal at the top of the tubesheet.

DSI Distorted Support Indication - indicates a distorted support signal

DTI Distorted Tubesheet Indication - indicates a distorted tubesheet transition which may be investigated further for possible cracking.

LAR Lead Analyst Review - This notation is used by the Analyst when an indication is found which is not specifically addressed in the Guidelines. The Lead Analyst is required to review data from all indications designated LAR by the Analyst.

NQI Non-Quantifiable Indication - This notation is used to record an indication which may be indicative of a flaw but does not show good frequency correlation or is distorted. This flag will indicate to the lead analyst that history should be reviewed for this tube, or further evaluation may be required, possibly with alternative examination techniques.

PLI Possible Loose part with an Indication - a signal from a loose part which indicates a possible flaw.

PSE Possible Support Anomaly - support ligament crack or other distortion - requires further investigation

Category III:

PLP Possible Loose Part - foreign object on secondary side

Category IV:

RBD Retest Bad Data - No Extent Required

REC Retest Encode problem - used when conflicting information is found regarding tube identification - No Extent Required

RES Retest for Restriction - Extent Required

RND Retest No Data present - No Extent Required

RFX Retest for Fixture - Fixture is blocking the tube - No Extent Required

RIC Retest Tube Incomplete - Extent Required

Category V:

ADR Absolute Drift - A 130 KHz absolute baseline drift in the positive vertical plane.

APT Absolute Positive Trace - An abrupt indication evidenced only on absolute channels.

BLG Bulge

CUD Copper Deposit

DNT Dent indication

EXP EXPanded tube - this indicates the location of an expansion at the second or third cold leg support in the baffle region.

IDV Inside Diameter Variation

INF Indication Not Found - previously reported indication is not found during the current analysis.

INR Indication Not Reportable - previously reported indication is not recordable according to the present guideline parameters.

OBS Obstructed - Used only as a final call when the smallest allowable probe diameter will not pass the location.

PID Positive Identification - Used to verify a pluggable location. Usually performed during a subsequent examination of a flaw indication.

PTE Partial Tube Expansion

PVN Permeability Variation - Reported at >3 volts when using a magnetic bias probe.

SLG Sludge location - used when measuring sludge heights.

7.4 Data Anomalies

The Analyst should be aware of data quality anomalies which may occur during the acquisition of eddy current data. Certain equipment failures, electrical noise interference, etc., can cause data which is unacceptable and must be re-acquired. The following figures show several examples of data anomalies which should be flagged as RBD or Retest for Bad Data.

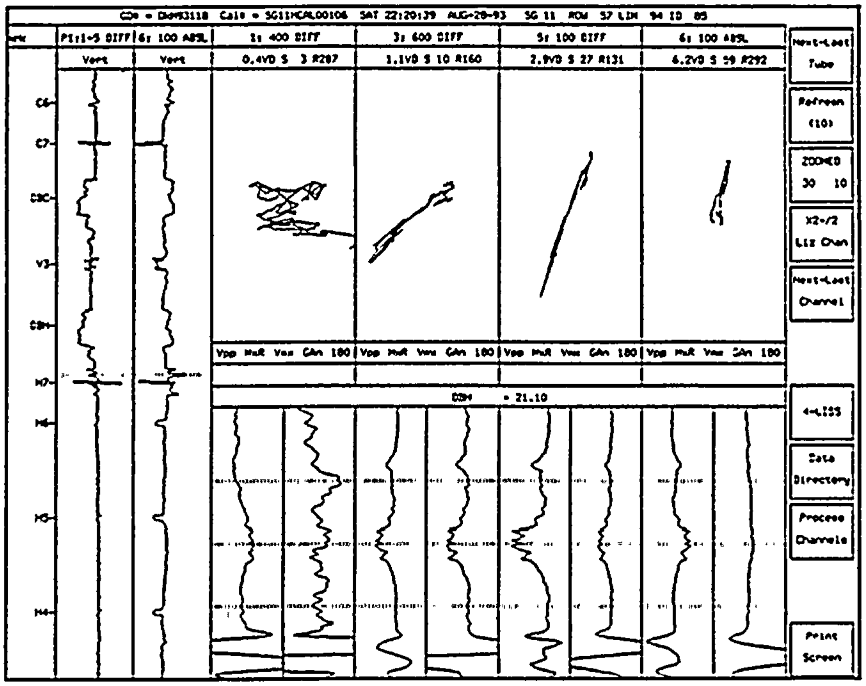

Figure 7.3 - RBD - Noisy data due to cable/electrical

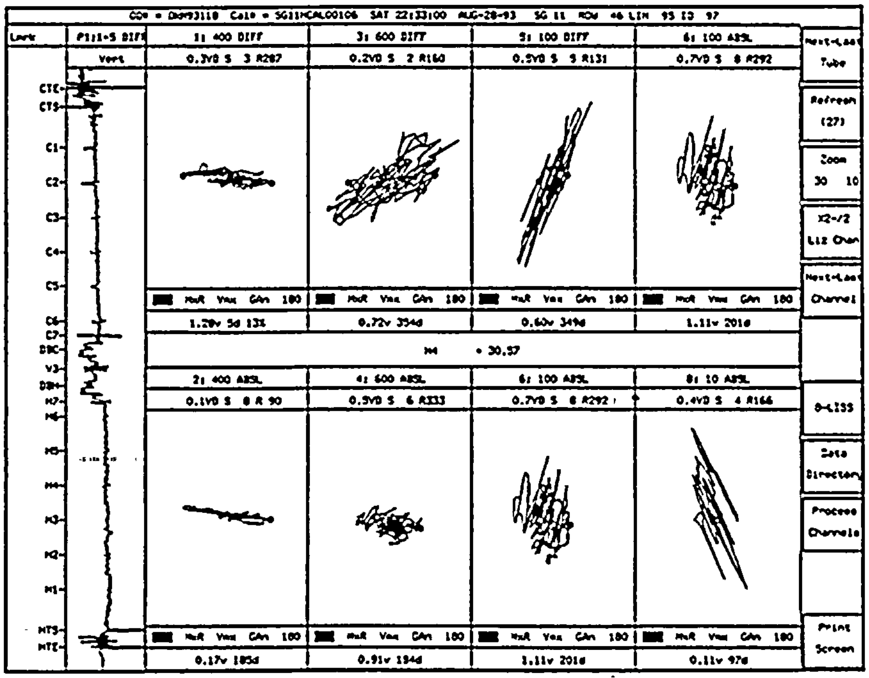

Figure 7.4 - RBD - Electrical noise

Section 8.0

Bobbin Probe Resolutions

8.1 Conditions Requiring Resolution

8.1.1 If either the Primary or Secondary Analyst or both reports a **flaw indication as greater than or equal to 40% through wall**, a Lead Analyst shall review the data tape, resolve the discrepancy or verify the results and document and sign off on the results of this review.

8.1.2 If either the Primary or Secondary Analyst or both reports an unresolved signal indication, the Lead Analyst shall review the bobbin test data tape, determine the nature of the indication, (i.e. flaw, no flaw, dent, etc.) size the indication (if a flaw), document and sign off on the results of the review. If the indication cannot be classified as a non-flaw, it shall be considered to be a flaw, and sized accordingly, except as discussed below

If definitive rotating probe ECT data is available, the Senior Analyst, or his designated Lead Analyst may use this data to resolve the status of the unresolved indication signal.

If definitive data from other special tests (e.g. Ultrasonics, Liquid Penetrant) are available, this data may be used to resolve the status of the unresolved signal indication.

8.1.3 If either the Primary or Secondary Analyst reports a **flaw indication between 20 and 39 percent through wall**, not reported by the other, or if the difference in estimated flaw depth between the two analyses (primary and secondary) exceeds 10 percent, the Lead Analyst shall review the data, resolve the discrepancy, document and sign off on the results of the review.

8.1.4 If, during the course of the resolution review, a Lead Analyst overrules <u>any</u> defect call (i.e., changes a repairable call by the Primary Analyst, Secondary Analyst, or both to a non-repairable call), or changes an unresolved signal indication to a <40% through wall flaw or to no flaw, then the reason for overruling shall be recorded. The Lead Analyst must then analyze all data from that tube for additional defects. A second Lead Analyst is required to review the pertinent data and acknowledge his concurrence by signing the Final Report.

When concurrence between the two Lead Analysts cannot be reached, the most conservative resolution of the discrepancy shall be taken.

In either case, both Lead Analysts are required to sign the Final Report.

8.1.5 Other discrepancies such as inconsistent extent of test, inconsistent calibration identification, etc., shall be resolved by data review if necessary. All resolutions and data modifications should be performed by Lead Analysts, except as defined in paragraph 8.1.6.

8.1.6 The Senior Analyst may designate types of "Administrative" errors which the Primary or Secondary Analysts or the Lead Data Management Operator/Systems Administration personnel will be allowed to resolve.

8.1.7 Table 8.1 provides a listing of error conditions.

8.1.8 Table 8.2 provides a listing of discrepancy conditions.

8.1.9 Volumetric indications require historic data review to determine origin and assist in indication characterization. Buff mark indications which have not been rotating probe tested should be validated by a review of the baseline or other historic data as applicable. Historic review and resolution should be documented and presented to the Senior Analyst for record keeping.

8.2 Resolution Documentation

The following steps shall be used in resolving errors and discrepancies between Primary and Secondary analysis results:

8.2.1 The analyst will correct errors by using the Resolution analysis selection of the Eddynet software. Results and the final report will be generated separately from the Primary or Secondary results, although the Primary or Secondary report may be appended for non-resolved calls.

8.2.2 A "Compare Report" will be issued by the Eddynet compare program, or other approved vendor data management software listing discrepant conditions. This report will be used to document the Lead Analyst edits to the Final Report.

8.2.3 If no discrepant conditions occur between Primary and Secondary analysis, there may be no compare report generated.

8.2.4 The Lead Analyst will use the appropriate data and compare reports when resolving discrepancies.

8.2.5 The Lead Analyst will indicate when the Primary or Secondary or both analysis results are accepted without resolution by annotating the compare report with "PS" for primary call stands or "SS" for secondary call stands.

8.2.6 If the Primary or Secondary call is correct except for a change of one or more parameters in the call, the annotation "PC" for primary call change or "SC" for secondary call change may be used.

8.2.7 The Lead Analyst shall annotate "FC" for Final resolution Call if the resolved answer is different from the Primary Analyst, Secondary Analyst or both. See figure 8.1 for an example of a typical compare report.

```
user1
nd25bb26.nd25bb26.diskless
/rod0101/primary/SG11HCAL00017  VS.  /rod0101/secondary/SG11HCAL00017

FIELD SELECTION:

VOLTAGE          NO
PHASE ANGLE      NO
PERCENTAGE       YES   +/-  10
LOCATION         YES   +/-  1.00
 -ranges         YES   +/-  0.50
CHANNEL          NO

LOWER PERCENTAGE THRESHOLD   <   20

UPPER PERCENTAGE THRESHOLD   >   40

FIELD 6 SUPPRESSION :

FIELD 6 HIGHLIGHT    : DRI NQI

NUMBER OF ENTRIES ON THIS PRINTOUT =   15

*********************************

11  24  43                                    CTE    pri
11  24  43  0.58 117  39   1 HTS    + 10.30   CTE    sec       PS

11  38  43                                    CTE    pri
11  38  43  0.53 129  28   1 H1     +  2.46   CTE    sec       SS

11  27  44  0.80 121  37   1 HTS    +  8.87   CTE    pri
11  27  44  0.80 110  45   1 HTS    +  8.84   CTE    sec_____T PS

11  24  45  0.53 138  21   1 CTS    +  8.20   CTE    pri
11  24  45                                    CTE    sec       PS

                 .34  101  37  P 1
11  26  47  0.65 114  43   1 CTS    +  3.80   CTE    pri
11  26  47  0.65 112  44   1 CTS    +  3.83   CTE    sec_____T PC

11  33  48              DUPE  ENTRY           CTE    sec

11  50  55  0.86 114  43   1 CTS    + 10.63   CTE    pri
11  50  55  0.86 111  45   1 CTS    + 10.60   CTE    sec_____T PS
```

Figure 8.1

Typical Primary/Secondary Analysis Compare Report

8.2.8 The Lead Analyst should thoroughly review <u>all</u> available data on each tube for which a discrepancy is identified. All results should be listed under the Lead Analyst's name in the Resolution final report.

8.2.9 As specified earlier in 8.1.4, if the 1st Lead Analyst dispositions a greater than 40% flaw or undefined signal (e.g. NQI) to a less than 40% flaw or no flaw, a 2nd Lead Analyst must review the data. Both lead analysts will sign the compare report.

Whenever concurrence in resolution cannot be reached, the most conservative call shall be retained. If the result is that a ≥40% or an undefined type indication is resolved to less than 40%, the reason must be specified on the Discrepancy Compare Report.

8.2.10 A Lead Analyst may not act as the 1st Analyst in resolving his own analysis results if he also acted as an Analyst (Primary or Secondary) for a particular calibration group. He may, however, assume the role of a 2nd Lead Analyst during resolution.

8.2.11 All ≥40% and other repairable indications and all dispositioned calls which were originally repairable shall be reviewed by the Senior Analyst or a designee other than the original Lead Analysts. Final disposition from this third review will be forwarded to the utility representative for review and concurrence.

TABLE 8.1

DATA RECORDING ERROR CONDITIONS

1. The reported steam generator identification is something other than "1", "2" or "3".

2. The SG identification does not agree with the SG identification code in the calibration number.

3. The reported tube does not exist

4. The reported row number is something other than 1 through 49.

5. The reported column number is something other than 1 through 114.

6. Missing probe or calibration designation

7. The reported flaw location is beyond the reported extent of the test.

8. Extents of test and flaw elevations which do not conform with the fact that there are eleven tube supports and four AVB's in the Shearon Harris Steam Generators.

9. The reported test extent is incorrect.

10. The extent of test in not reported.

11. Tubes reported as restricted or incomplete which do not have a corresponding extent of test.

12. Use of a three-letter reporting acronym with no established definition.

13. The final report header is not in the correct columns.

14. A plugged tube is reported as tested.

Table 8.2

RECORDING DISCREPANCIES BETWEEN DATA ANALYSIS

1. Flaw wall loss estimates differ by more than 10% through wall.

2. Either the Primary Analyst or Secondary Analyst or both reports a flaw as greater than or equal to 40% through wall.

3. Either the Primary Analyst or Secondary Analyst or both reports an anomalous indication (i.e., NQI, DRI, etc.) in which the data suggests a reasonable probability that a flaw exists.

4. One Analyst reports a tube not reported by the other Analyst.

5. One Analyst reports a flaw indication not reported by the other analyst, but is greater than the lower threshold limit.

   NOTE: Flaw locations reported by primary and secondary analysts must be within 1.0 inches of each other to be considered the same flaw.

6. The reported test extents are not in agreement.

7. The reported calibration identifications are not in agreement.

8. The reported steam generator identifications are not in agreement.

9. The reported probe entry sides are not in agreement.

10. The three-letter reporting acronyms are not in agreement.

8.3 Resolution Reporting

The resolution final report will be generated when all resolutions from the compare report are complete. The resolution header should contain the same information as the Primary or Secondary Analyst as indicated in section 7.

8.3.1 The Lead analyst should log in to the Eddynet software using the "RESOLUTION" analyst function. This process allows the compare process to be activated, and allows editing of the primary and secondary results into the resolution or "final" results.

8.3.2 Edits will be made during the compare process as documented in section 8.2.

8.3.3 When all compare edits are completed, the final report should be generated using the "BUILD REPORT" menu. The Lead analyst should select "APPEND PRIMARY" and "REPORT ALL USERS" to insure all entries are built into the report, including un-edited primary results[10].

8.3.4 The Lead analyst should check all entries on the compare report vs. the compiled final report to insure all resolutions were addressed.

8.3.5 The final report shall be signed by the Lead Analyst. If a resolution required another Lead Analyst, a second signature shall be included on the final report.

[10]If special circumstances arise, Secondary results may be appended rather than Primary. The Senior Analyst should be contacted for any changes.

Section 9.0

SINGLE COIL MRPC PROBE CALIBRATION AND EVALUATION

9.1 Probe Description

The Single Coil U-bend probe is used to examine the U-bend radius of the steam generator tubes. The preferred technique for U-bend inspection is a single coil plus-point probe, however a single coil pancake coil may be used as approved. Section 10 describes 3-coil MRPC coil data for the straight sections of the tubes.

The MRPC pancake probe used for these examinations is shown in figure 9.1. The probe designation is B580MRPCPH[11] (Pancake coil 0.115" diameter - 580 = .580" diameter probe) The plus point probe designation is P580MRPC1C or as directed by the senior analyst. The device is rotated by a motorized "wand" which provides a "trigger" signal after each revolution. Axial translation of the probe through the tube is done by a probe pusher with speeds down to as low as 0.05"/sec. The result is a helical scan of the tube area of interest with a pitch of about 0.030"[12].

It is very important that the calibration standard runs and the test runs are performed at the same rotational and axial translation speeds. Failure to do so will cause errors in axial position and flaw length measurements. Data Analysts should check all calibration runs and periodically check tube tests for consistency of test speeds.

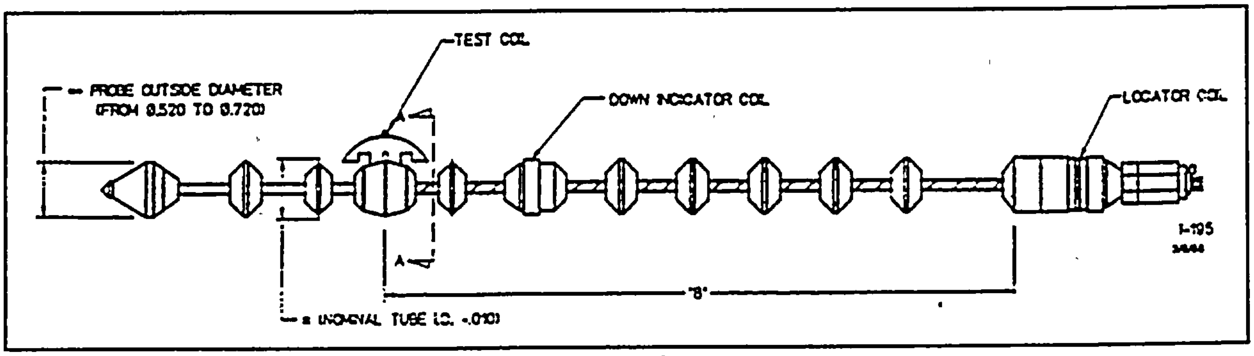

Figure 9.1

Single Coil MRPC probe head

[11]Other probe sizes may be used if required, but will follow a similar probe designation scheme.

[12]Probe rotation and axial traverse speeds will be based on EPRI recommended qualified techniques unless otherwise approved by the utility.

Note: Some graphics used in this section may be from three-coil data including other frequencies/mixes, however, setup for the pancake coil of the three-coil data is the same as a single coil pancake probe, and graphic displays will be similar.

9.2 Frequency Applications

9.2.1 400 KHz

9.2.1.1 This is the optimum frequency for plotting terrain maps and clip plots. This frequency has an optimum phase separation for the ASME flaws. It is not adversely affected by deposits on the OD of the tube.

9.2.1.2 This is the primary frequency used for plotting the lissajous signal from which the voltage, phase angle and depth are reported.

9.2.2 200 KHz

9.2.2.1 This frequency may be used for data evaluation and signal confirmation.

9.2.2.2 This frequency is also used as a secondary plotting channel.

9.2.3 100 KHz

9.2.3.1 This frequency may be used for data evaluation and signal confirmation.

9.2.4 10 KHz

9.2.4.1 This frequency is used for structure location.

9.2.5 700 KHz

9.2.5.1 This frequency may be used for high frequency matched coils such as the high frequency plus point coil.

9.3 Calibration

9.3.1 Span and Rotation Settings

9.3.1.1 Load the calibration standard into RAM.

9.3.1.2 Rotate the displays for each pancake coil so probe noise is horizontal. You will note that this process may need to be repeated for each tube, as tube noise is not always consistent.

9.3.1.3 Rotate the low frequency (10 KHz) channel so the carbon steel support structures[13] move in vertical fashion when encountered.

9.3.1.4 Note the trigger channel (square pulse signal) which will be used to adjust operator parameters for the C-scan display.

9.3.1.5 Find the largest of the 60% Flat bottom hole signals, and place it alone in the window. See figure 9.2.

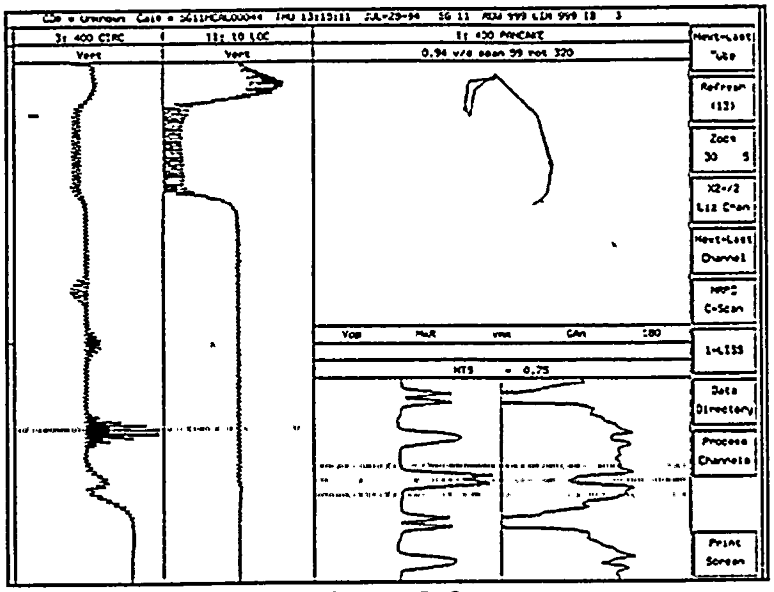

Figure 9.2
60% FBH in window

9.3.1.6 Adjust the span so the signal occupies 4-5 grid divisions. Repeat this step for all applicable pancake coils.

9.3.1.7 When utilizing a plus point coil, rotate the displays for each plus coil so the ID Circ notch is approximately 190 degrees, allowing

[13]Depending on the actual calibration standard used, other signals may be used for setting axial scale as required. The Senior analyst or designee will provide actual drawings and settings to use.

axial indications to form upward, and circumferential indications to form downward on the base channels. Process channels may be used to orient circumferential signals upward as required.

9.3.2 Axial Measurement Scale

9.3.2.1 Using the manual locating option, set the zero point by placing the cursor on the first reference point, and selecting a support structure in the landmarks column using the left mouse button.

9.3.2.2 Scroll to the next signal with a known scale, and adjust the scale reading by clicking and dragging the right mouse button in the landmarks column. Store your settings with the file save function.

In figure 9.2, the scale is set between the 4 x 20% flaws and the 100-60-40 flaws which are 0.75" away.

9.3.3 Voltage Setting

9.3.3.1 Select the 400 KHz pancake coil or plus point coil channel as required.

9.3.3.2 To set voltage, scroll the largest signal of the 100% axial notch and set peak-to-peak points.

9.3.3.3 As in bobbin coil examination, go to the "Set Volt Units" menu and adjust the voltage to 20.00 volts. Save and store this setting to all coils which will normalize the voltage.

9.3.4 Calibration Curves

9.3.4.1 Set a three-point calibration curve[14] with the 400 KHz channel utilizing the 100 - 60 - 40% flaws in the calibration standard. Use the actual values from the as-built drawing for the values. The pancake and plus coils (400 KHz) should be used for calibration curves.

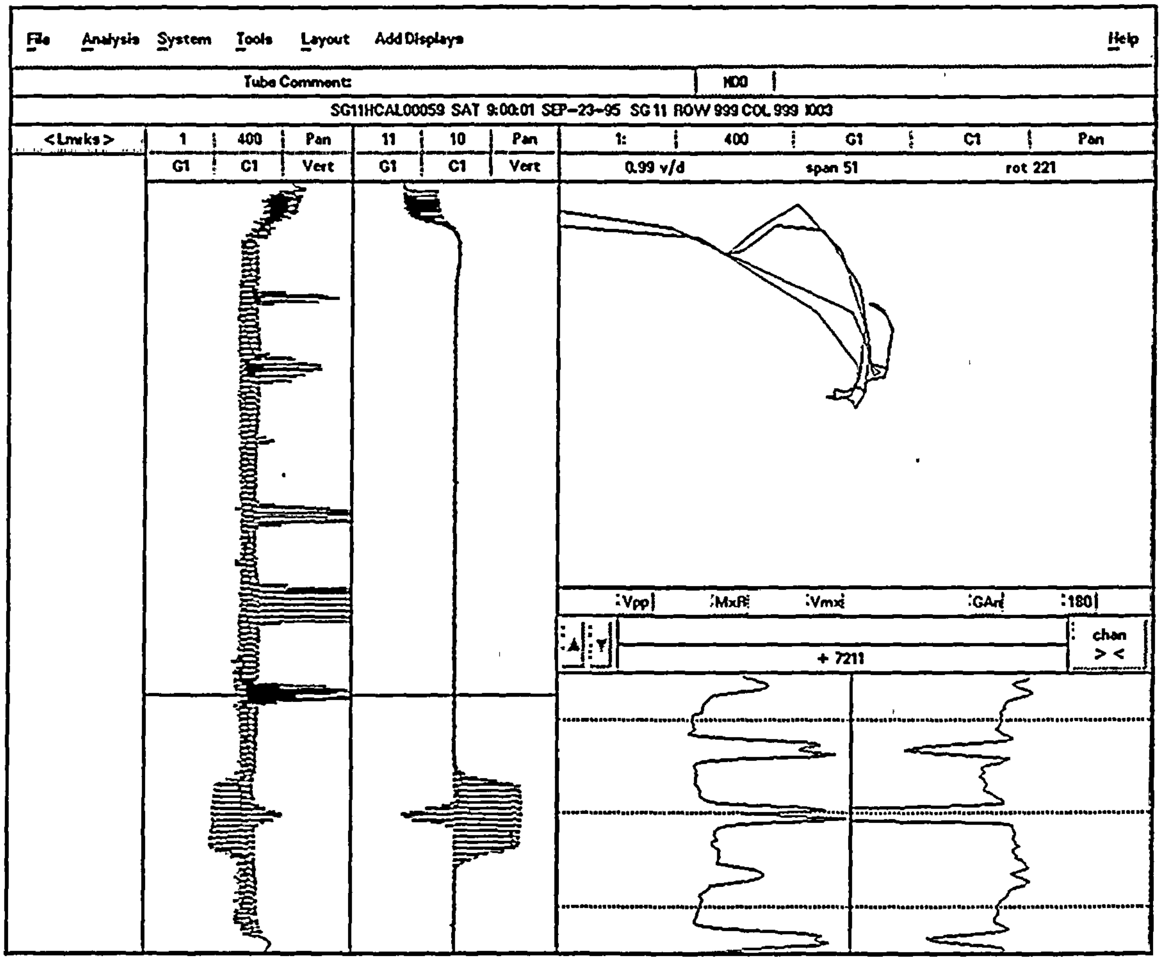

Figure 9.4
Calibration curve for 400 KHz Pancake coil

9.3.5 Down Locator Coil

9.3.5.1 If a down-locator coil is utilized, adjust the display for a positive vertical deflection from the four responses.

9.3.5.2 Adjust the span so the largest of the down-locator signals is within screen saturation.

---

[14]Used for information only. Lead or Senior Analyst may use as appropriate.

9.3.6 Set Up Terrain Mapping

The first step in setting the terrain mapping parameters has been accomplished by setting the axial scale.

9.3.6.1 Select the MRPC menu and proceed to "User Select" to select several MRPC parameters.

9.3.6.2 Adjust the trigger channel to that which was noted earlier in this section.

9.3.6.3 Auto trigger and Same Channel may be selected as the Analyst desires.

9.3.6.4 Tubing diameter should be set to 0.750", representing the OD of the tube.

9.3.6.5 The data slewing function should be disabled for single coil operation.

9.3.6.6 Return to the C-scan display and adjust the cursor and window to encompass a section of the standard which contains several flat bottom holes.

9.3.6.7 Adjust the X rotation to 70, and the Z rotation to 315. These values may change depending on specific plot parameters.

9.3.6.8 Select "CIC/AXL CSCAN" to display a terrain plot of the desired area. An acceptable plot should be displayed. See figure 9.6.

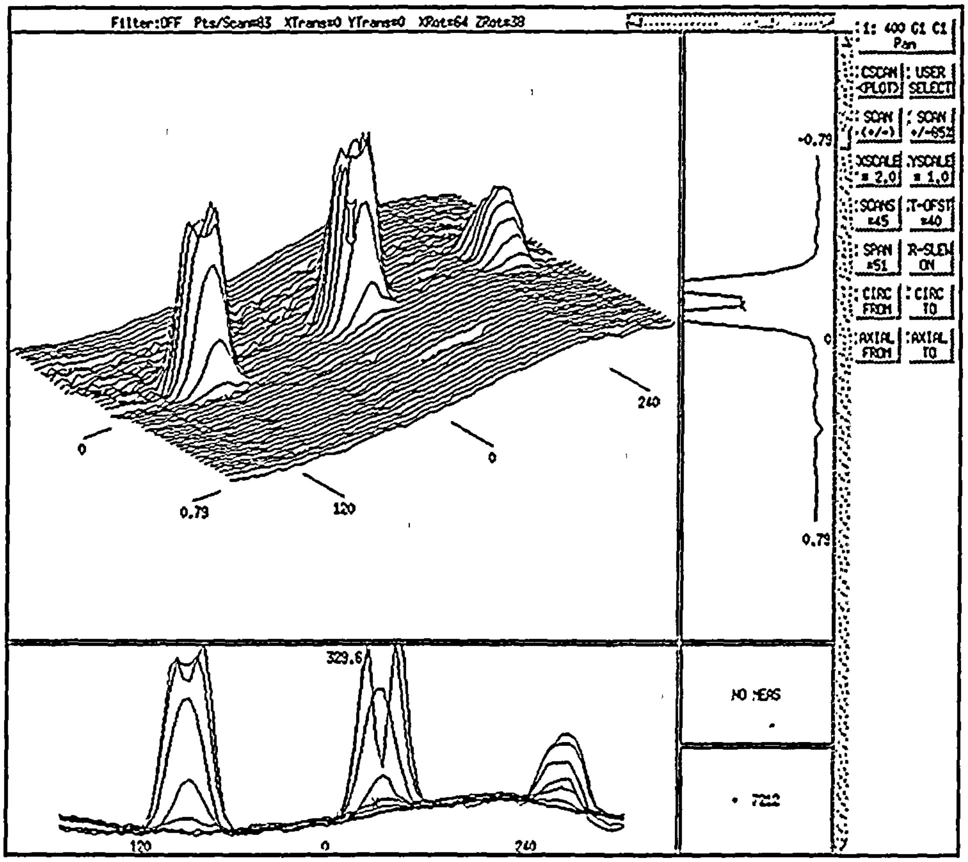

Figure 9.6

Example C-Scan Terrain plot of calibration standard

9.3.7 Clip Plot Set up[15]

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[15]Clip plot scans may be used as directed by the senior analyst.

9.4 DATA SCREENING

All data observed on the strip charts and the lissajous will be evaluated. A terrain plot of the entire strip chart will be performed to insure full evaluation of the entire length of data and area of interest. Axial filtering may be performed to aid in minimizing the distortion from the roll transition at the top-of-tubesheet.

9.4.1 Strip Charts

9.4.1.1 Set the left strip chart to 400 KHz vertical and the right strip chart to 100 KHz vertical. Both of these should be at the set-up spans established previously.

9.4.1.2 If span settings seem inappropriate, consult the Senior Analyst for alternate setting acceptance.

9.4.2 Lissajous

9.4.2.1 Set the lissajous to 400 KHz at the set-up span established previously. Final report values for voltage, depth, and axial position will be taken from this channel.

9.4.3 Use of Filters

9.4.3.1 A band-pass or other approved filtering method may be used to assist in flaw detection, however, initial screening must be accomplished without their use. For certain cases, such as expansion transitions, an axial line or axial average filter may be used to improve S/N. In no case shall any measurements be taken from filtered data without permission from the Senior Analyst. See Table 9.1 for Single Coil MRPC set-up parameter summary.

9.5 EVALUATION

9.5.1 Initial Screening of the data will be performed at set-up span settings.

9.5.2 Check the 100 or 10 KHz strip chart for the presence of support structures and locate them manually with the appropriate names. See figure 9.9

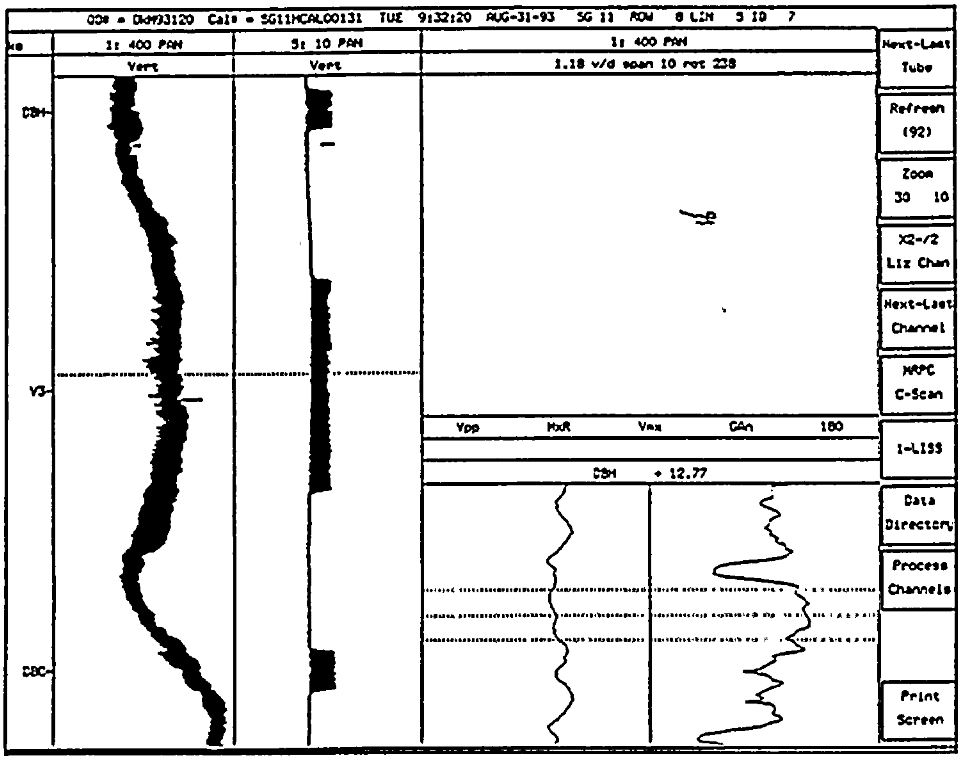


Figure 9.9
Locating structures

9.5.3 A terrain plot of the entire strip chart will be performed to insure full evaluation of the entire length of data and area of interest.

9.5.4 Suspect indications should be evaluated using lissajous, terrain plots and clip plots in order to determine whether the signal is of a flaw or deposit origin.

9.5.5 Record all indications in accordance with section 11.

9.5.6 Single Coil MRPC Examination Calibration Parameters

MRPC SINGLE-COIL ANALYSIS SUMMARY							
CHANNELS							
Channel	1	2	3	4	5	P1	
Span	5-6 div	5-6 div	5-6 div	5-6 div	2-3 div	Full Screen	
Phase[16]	PM Horiz	PM Horiz	PM Horiz	vertical	vertical	PM Horiz	
Cal Std	60% ASME	60% ASME	60% ASME	Trigger	support ring	60% ASME	
Curve	Degree	N/A	N/A	N/A	N/A	N/A	
Volts	100% axl 20v	Norm.	Norm.	N/A	Norm.	Norm.	

DATA SCREENING

Left Strip Chart: 400 KHz PAN Vert   Right Strip Chart: 100/10 KHz Vert   Liss.: CH 1 (400 KHz)

Notes:
Above spans are a minimum for initial screening
Voltage normalized to channel 1
P1 channel for plus coil phase reversal (ID Circ @ 10°)

RECORDING REQUIREMENTS

Graphics: Generated by Resolution unless otherwise indicated

Recording:

Channel 1: Degradation, NQI, POS

Table 9.1

Single Coil Analysis Parameters

[16] For the Plus coil: replace PM Horiz with ID CIRC @190°

Section 10.0

THREE COIL MRPC PROBE CALIBRATION AND EVALUATION

10.1 Probe Description

The three-coil probe is used to examine the straight sections of the SG tubes, however, three-coil probes may be used for bend areas also.

The three-coil 'Delta' probe used for these examinations is shown in figure 10.1. A three coil plus point coil is shown in 10.2. This device rotates the three coil probe head with pancake and plus point or oriented coils, and marks each revolution with a trigger signal. Axial translation of the probe through the SG tube is done by a probe pusher. The net result of the simultaneous axial and circumferential probe translations is a helical scan with a pitch of about 0.040 inches.

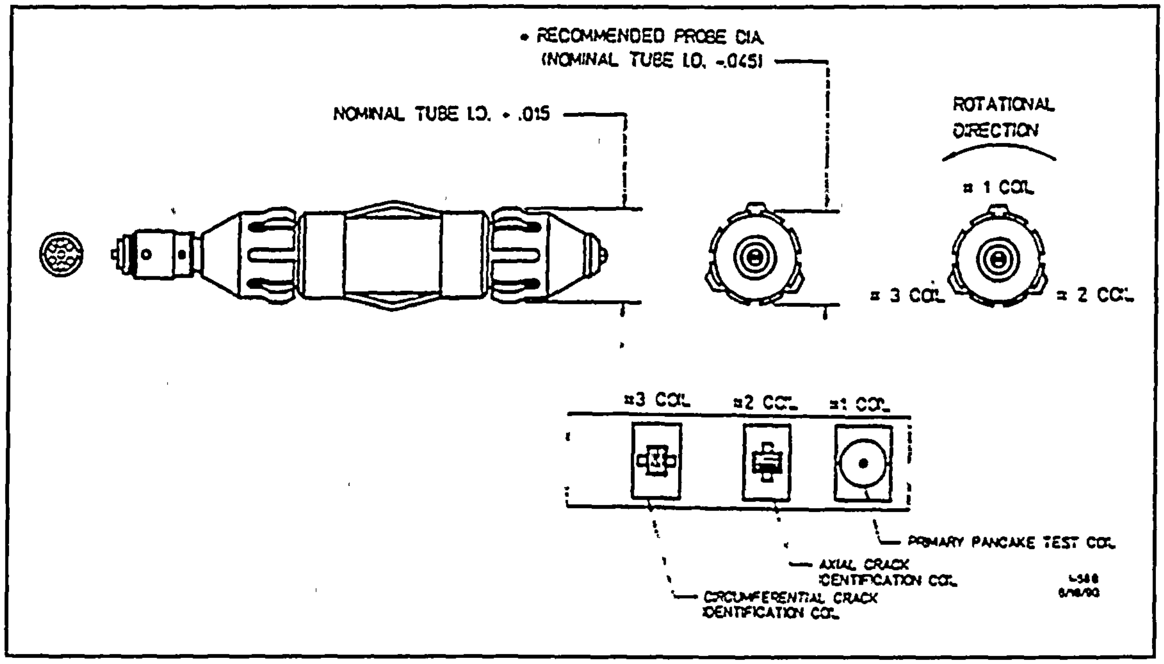
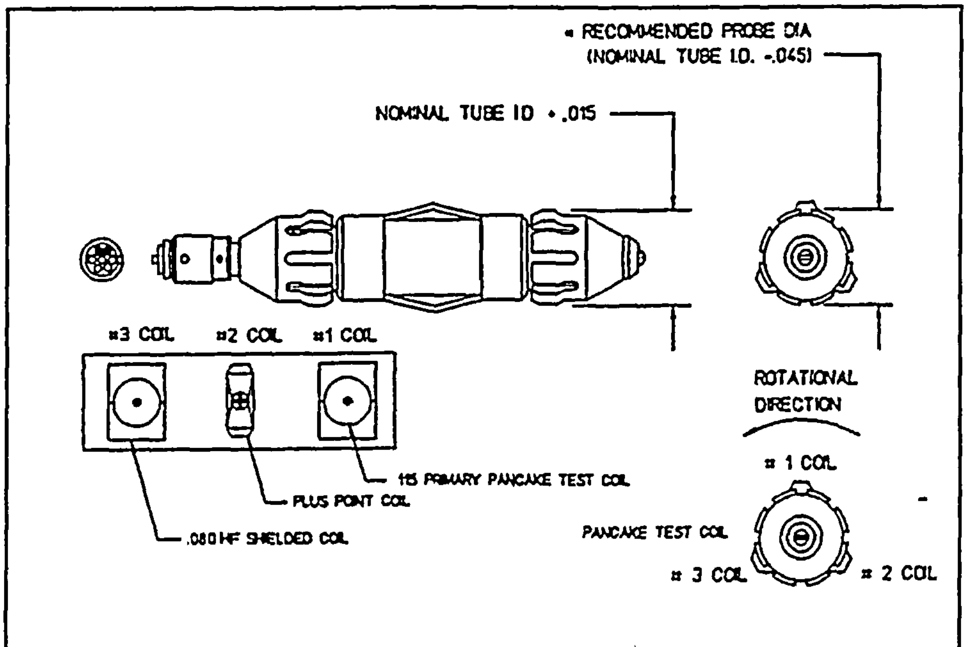


Figure 10.1
Three coil MRPC probe head showing oriented coils

It is very important that the calibration standard runs and test runs are performed at the same rotational and axial translation speeds. Failure to do so will cause errors in axial position and flaw length measurements. Data Analysts should check all calibration runs and periodically check tube tests for consistency and speed.



+Point™ coil for characterization of flaws (circ. vs. axial)

Figure 10.2 Typical plus coil

10.3 Frequency Applications

10.3.1 400 KHz

10.3.1.1 This is the optimum frequency for plotting terrain maps and clip plots. This frequency has an optimum phase separation for the ASME flaws. It is not adversely affected by deposits on the OD of the tube.

10.3.1.3 This is the primary frequency used for plotting the lissajous signal from which the voltage, phase angle and depth are reported.

10.3.3 700 KHz

10.3.3.1 This frequency may be used for data evaluation and signal confirmation. This is near the optimum frequency for the high-frequency plus point coil or 0.080" coil.

10.3.3.3 This frequency is also used as a secondary plotting channel.

10.3.3 100 KHz

10.3.3.1 This frequency may be used for data evaluation and signal confirmation.

10.3.4 10 KHz

10.3.4.1 This frequency is used for structure location.

10.3.5 200 KHz

10.3.5.1 This frequency may be used for data evaluation and signal confirmation.

10.4 Calibration

10.4.1 Span and Rotation Settings

10.4.1.1 Load the calibration standard into RAM.

10.4.1.3 Rotate the displays for each pancake coil so probe noise is horizontal and flaws upward. Rotate the displays for the plus coil(s) so the ID circ notch is approximately 190 degrees. This will allow axial indications to form upward and circumferential indications to form downward. Process channels may be set up for circ. channels to be oriented upward as required.

10.4.1.3 Rotate the low frequency (10 KHz) channel so the carbon steel support structures move in vertically when encountered.

10.4.1.4 Note the trigger channel (square pulse signal) which will be used to adjust operator parameters for the C-scan display. The channel number will be required for terrain plot set-up.

10.4.1.5 Find the largest of the 60% ID circ notch[17] signals (hits), and place it alone in the window using the 400 KHz pancake coil.

10.4.1.6 Adjust the span so the signal occupies 2-3 grid divisions. Repeat this step for all applicable pancake coils.

10.4.1.7 Change to the 400 KHz plus coil.

10.4.1.8 Adjust the span so the signal occupies full screen. Repeat this step for all applicable plus coils.

10.4.2 Axial Measurement Scale

Use the 10 KHz pancake coil for axial measurement to structures; if calibration standard indications are used for scale setting, use a higher frequency pancake coil to locate the indications.

[17]Another notch may be used as applicable to the calibration standard. See specific instruction provided by the Senior Analyst.

10.4.2.1 Using the manual locating option, set the zero point by placing the cursor on the first reference point, and selecting a support structure in the landmarks column using the left mouse button.

10.4.2.2 Scroll to the next signal with a known scale, and adjust the scale reading by clicking and dragging the right mouse button in the landmarks column. Store your settings with the file save function.

In figure 10.2, the scale is set between the 4 x 20% flaws and the 100-60-40 flaws which are 0.75" away.

10.4.3 Voltage Setting

Use the 400 KHz pancake coil to set initial voltage.

10.4.3.1 To set voltage, scroll the largest signal of the 100% axial notch.

10.4.3.2 As in single coil examination, go to the "Set Volt Units" menu and adjust the voltage to **20.00 volts**. Save and store this setting to all pancake coils which will normalize the voltage for the pancake coil.

10.4.3.3 Repeat step 10.4.3.2 for the plus coil(s).

10.4.4 **Calibration Curves**

10.4.4.1 Set a three-point calibration curve with the 400 KHz pancake coil channel utilizing the 100 - 60 - 40% flaws in the calibration standard. Use the actual values from the as-built drawing for the values.

10.4.5 **Set Up Terrain Mapping**

The first step in setting the terrain mapping parameters has been accomplished by setting the axial scale.

10.4.5.1 Select the MRPC menu and proceed to "User Select" to select several MRPC parameters.

10.4.5.2 Adjust the trigger channel to that which was noted earlier in this section.

10.4.5.3 Tubing diameter should be set to 0.750", representing the OD of the tube.

10.4.6.4 The "Rotate Data" function should enabled for three coil operation. This allows efficient comparison between coils without the physical 120 degree offset.

10.4.6.5 Return to the C-scan display and adjust the cursor and window to encompass a section of the standard which contains several flat bottom holes.

10.4.6.6 Adjust the X rotation to 70, and the Z rotation to 315. These values may change depending on specific plot parameters.

10.4.6.7 Select "CIC/AXL CSCAN" to display a terrain plot of the desired area. An acceptable plot should be displayed. See figure 10.6.

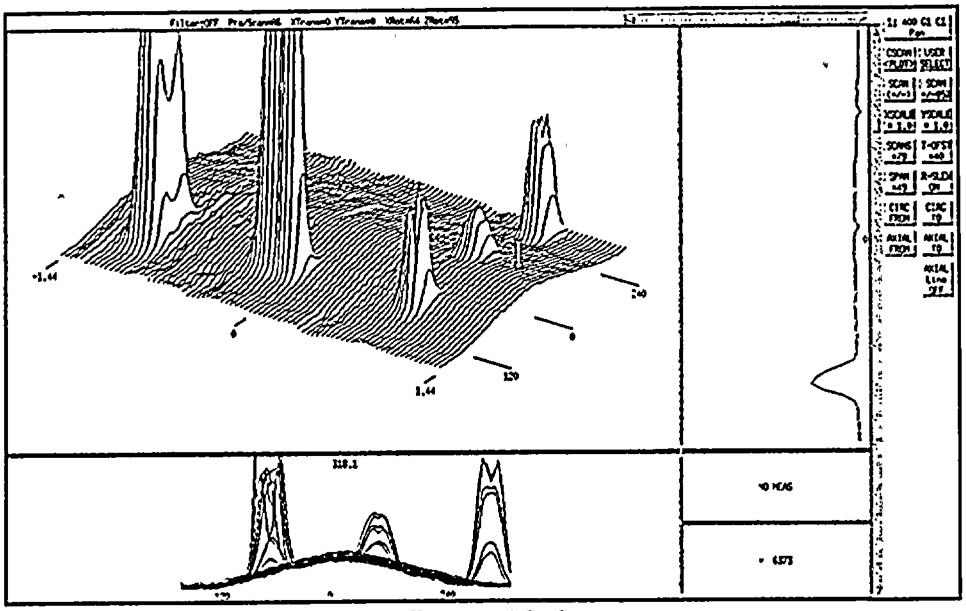


Figure 10.6

Example C-Scan Terrain plot of calibration standard

10.5 DATA SCREENING

All data observed on the strip charts and the lissajous will be evaluated. **A terrain plot of the entire strip chart will be performed to insure full evaluation of the entire length of data and area of interest.**

10.5.1 Strip Charts

10.5.1.1 Set the left strip chart to 400 KHz PLUS vertical and the right strip chart to 100 KHz PAN[18] vertical. Both of these should be at the set-up spans established previously.

10.5.1.2 If span settings seem inappropriate, consult the Senior Analyst for alternate setting acceptance.

10.5.2 Lissajous

10.5.2.1 Set the lissajous to 400 KHz PAN or Plus coil at the set-up span established previously. Final report values for voltage, depth, and axial position will be taken from the primary channel or as directed.

10.5.3 Use of Filters

10.5.3.1 A band-pass or other approved filtering method may be used to assist in flaw detection, however, initial screening must be accomplished without their use. *In no case* shall any measurements be taken from filtered data without permission from the Senior Analyst. See Table 10.1 or 10.2 for a summary of Three Coil MRPC set-up parameters.

[18]Plus coils or process channels should be substituted where applicable.

10.6 EVALUATION

10.6.1 Initial Screening of the data will be performed at set-up span settings.

10.6.2 Check the 100 or 10 KHz strip chart for the presence of support structures and locate them manually with the appropriate names. See figure 10.9 for a typical Top-of-Tubesheet location.

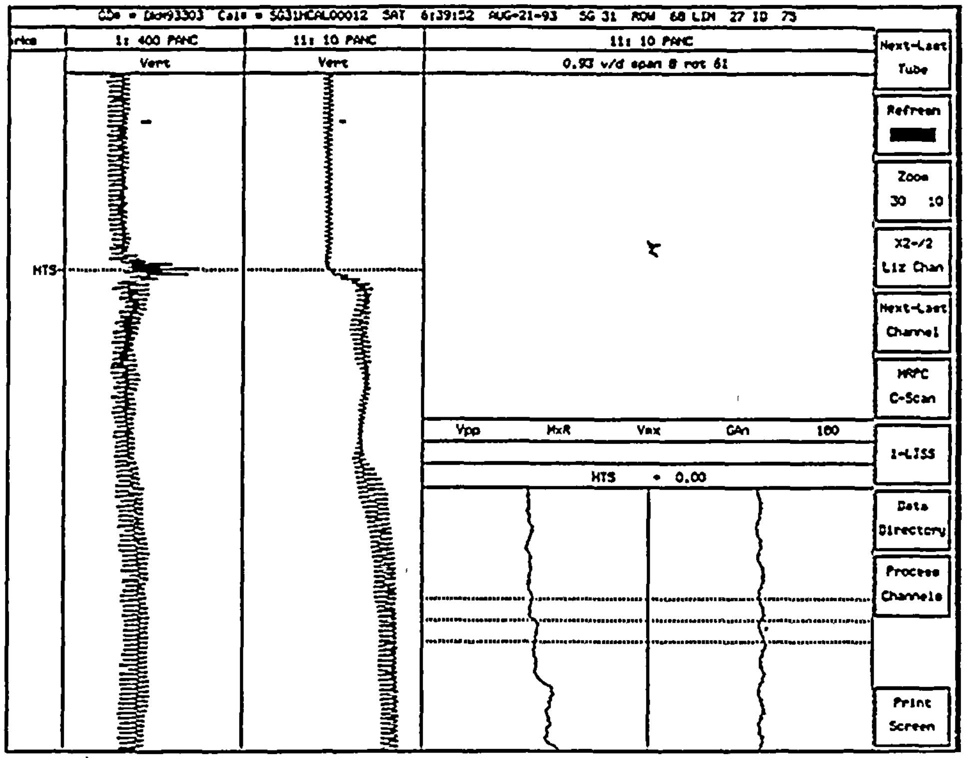


Figure 10.9
Locating structures

10.6.3 A minimum of a plus coil and .115 pancake coil terrain plot of the entire strip chart will be performed to insure full evaluation of the entire length of data and area of interest Subsequent terrain plots with other frequencies and coils may be used to augment analysis. See Appendix A for further details.

10.6.4 Suspect indications should be evaluated using lissajous, terrain plots, axial filtering and clip plots in order to determine whether the signal is of a flaw or deposit origin.

10.6.5 Record all indications in accordance with section 11.

10.6.6 Oriented Three - Coil MRPC Examination Calibration Parameters

MRPC THREE - COIL ANALYSIS SUMMARY

CHANNELS

Channel	400 Pan	400 Axl	400 Cir	200 Pan	200 Axl	200 Cir	100 Pan
Span	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div
Phase	PM Horiz	PM Horiz	PM Horiz	PM Horiz	PM Horiz.	PM Horiz	PM Horiz
Cal Std	60% ASME	60% ASME	60% ASME	60% ASME	60% ASME	60% ASME	60% ASME
Curve	Degree	N/A	N/A	N/A	N/A	N/A	N/A
Volts	100% axial 20v	100% axial 20v	100% axial 20v	Norm. CH 1	Norm. CH 2	Norm. CH 3	Norm. CH 1

CHANNELS

Channel	Trg	100 Axl	100 Cir	Low Freq.	Process 1		
Span	4 div	5-6 div	5-6 div	2 div	5-6 div		
Phase	vertical	PM Horiz	PM Horiz	CS Vert	PM Horiz		
Cal Std	Trigger	60% ASME	60% ASME	Support ring	60% ASME		
Curve	N/A	N/A	N/A	N/A	N/A		
Volts	N/A	Norm. CH 2	Norm. CH 3	N/A	Norm. CH 1		

DATA SCREENING

Left Strip Chart: 400 KHz PAN Vert   Right Strip Chart: 100/10 KHz PAN Vert   Liss.: CH 1 (400 KHz)

Notes:
Above spans are a minimum for initial screening
Voltage normalized for each coil

RECORDING REQUIREMENTS

Graphics: Generated by Resolution unless otherwise indicated

Recording:

Channel 1: Degradation, NQI, POS

Table 10.1

Three -Coil Analysis Parameters

10.6.7 Plus coil Three - Coil MRPC Examination Calibration Parameters

MRPC PLUS - COIL ANALYSIS SUMMARY

CHANNELS

Channel	400 Pan	400 Pls	700 Pan	700 Pls HF	200 Pan	200 Pls	100 Pan
Span	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div	5-6 div
Phase	PM Horiz	60% ID 190°	PM Horiz	60% ID 190°	PM Horiz.	60% ID 190°	PM Horiz
Cal Std	60% ASME	60% ASME	60% ASME	60% ASME	60% ASME	60% ASME	60% ASME
Curve	Degree	N/A	N/A	N/A	N/A	N/A	N/A
Volts	100% axial 20v	100% axial 20v	100% axial 20v	Norm. CH 3	Norm. CH 1	Norm. CH 2	Norm. CH 1

CHANNELS

Channel	100	100 Pls	35 Pan	P1 (CH1)	P2 (CH2)		
Span	4 div	5-6 div	2 div	5-6 div	5-6 div		
Phase	vertical	60% ID 190°	CS Vert	PM Horiz	60% ID 10°		
Cal Std	Trigger	60% ASME	Support Ring	60% ASME	60% ASME		
Curve	N/A	N/A	N/A	N/A	N/A		
Volts	N/A	Norm. CH 2	N/A	Norm. CH 1	Norm. CH 2		

DATA SCREENING

Left Strip Chart: 400 KHz Pls Vert **Right Strip Chart: 100/10 KHz PAN Vert** **Liss.: CH 2 (400 Pls)**

Notes:
Above spans are a minimum for initial screening
Voltage normalized for each coil
The Mid Freq. Plus Coil and .115 Pancake coil are required for detection

RECORDING REQUIREMENTS

Graphics: Generated by Resolution unless otherwise indicated

Recording:

Channel 1: Degradation, POS
Channel 2: Degradation, POS, SAI, MAI, MMI
Channel P2: Degradation, POS, SCI, MCI

Table 10.2

Three -Coil Analysis Parameters

SECTION 11.0

MRPC Probe Recording Requirements and Acronyms

11.1 RECORDING NDD RESULTS

Tubes having no recordable indications are considered NDD tubes.

11.1.1 Graphic printouts will be generated as directed by the Lead or Senior Analysts.

11.1.3 Record a NDD result in the final report. Be sure to enter the proper extent according with the established recording format.

11.3 RECORDING FLAW INDICATIONS - SINGLE COIL - U-BEND DATA

All suspect flaw-like signals shall be recorded for further evaluation by the resolution team(s). If the data Analyst (Primary or Secondary) is unsure of a signal, orientation, etc., a POS acronym may be used to insure the indication is evaluated further.

11.3.1 Graphic printouts will be generated as directed by the Lead or Senior Analysts. See figures 11.1 - 11.3 for example graphics of single-coil MRPC displays.

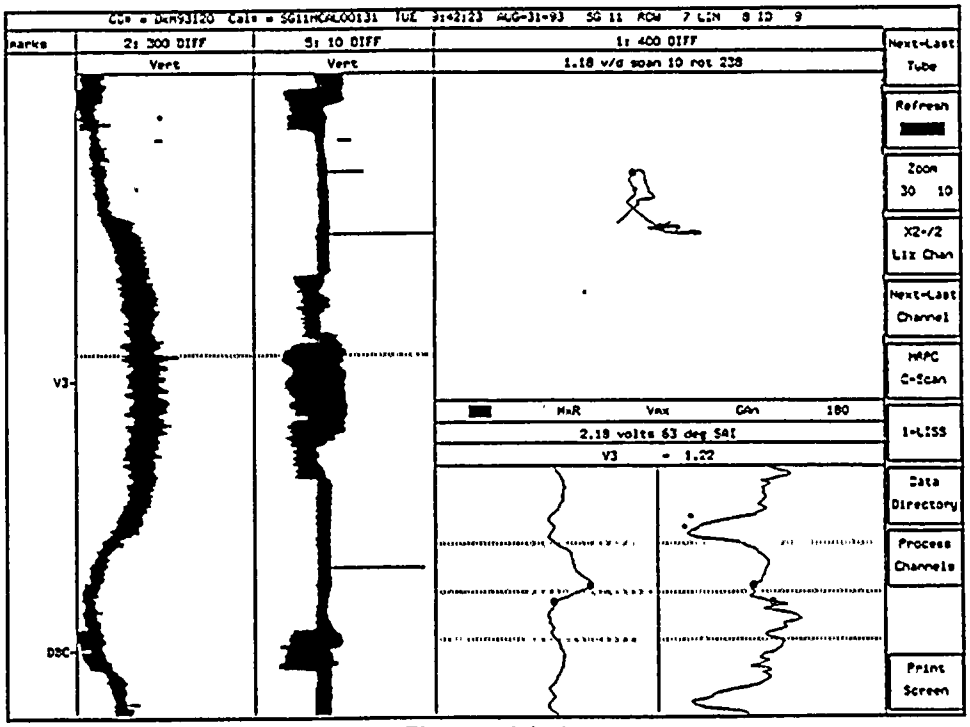


Figure 11.1
Example SAI Lissajous

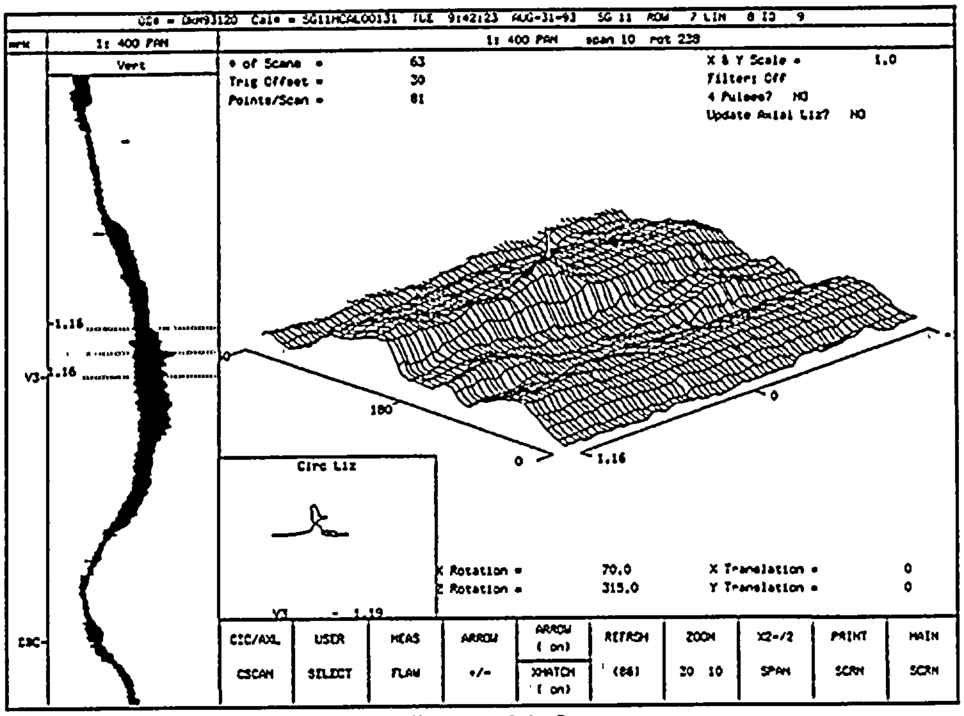


Figure 11.2
Sample SAI Terrain Map

11.3.2 Record the 400 KHz peak-to-peak results into the report, insuring the proper location, voltage and extent. See figure 11.3.

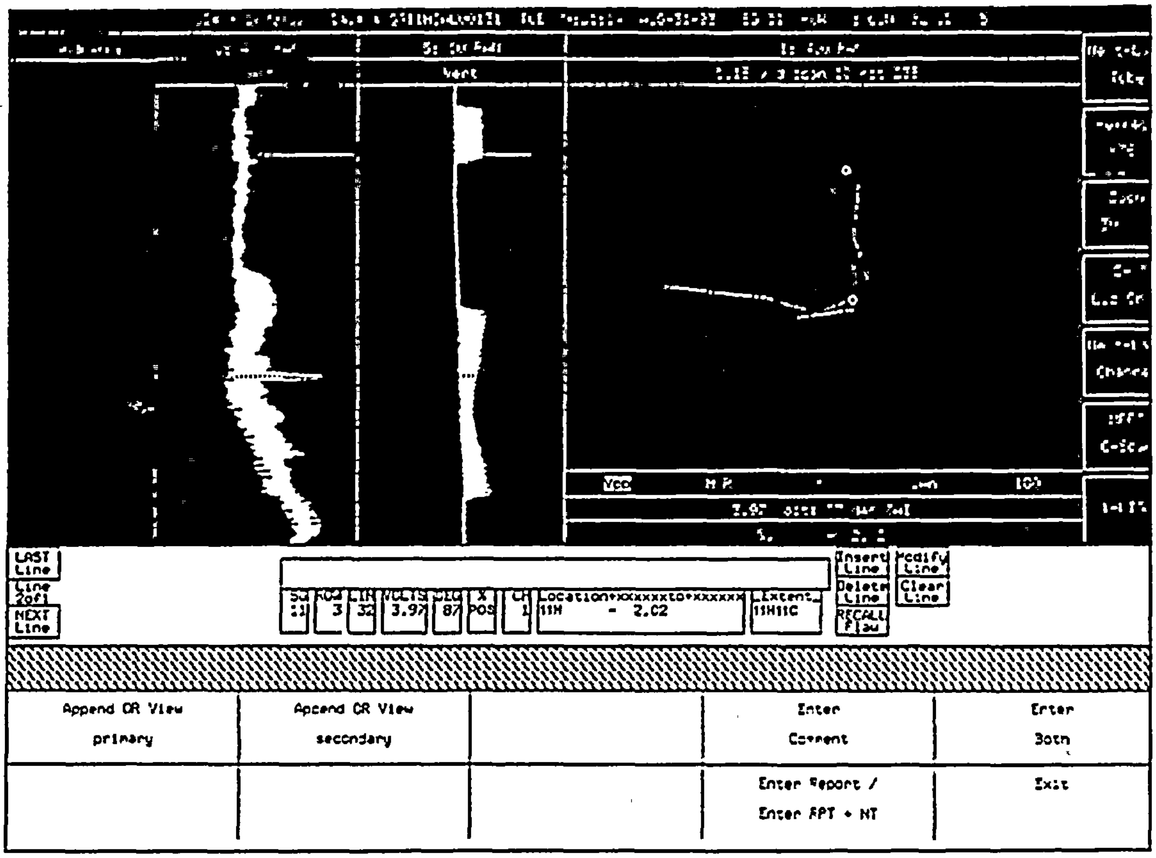


Figure 11.3
Example report entry for SAI flaw

11.3.3 Change the "%" column to the appropriate "SAI", "POS" etc.

11.3.4 If multiple axial indications are located along the same plane, record the largest indication using "MAI" in the "%" column.

11.3.5 Multiple axial indications along the axis of the tube should be recorded separately using "SAI" or "POS".

11.4 RECORDING FLAW INDICATIONS - THREE COIL - Top-of-Tubesheet DATA

All suspect flaw-like signals shall be recorded for further evaluation by the resolution team(s). If the data Analyst (Primary or Secondary) is unsure of a signal, orientation, etc., a POS acronym may be used to insure the indication is evaluated further. See Appendix A for further details.

11.4.1 Graphic printouts will be generated as directed by the Lead or Senior Analysts. See figures 11.4 - 11.9 to follow.

11.4.2 Record the 400 KHz peak-to-peak results into the report, insuring the proper location, voltage and extent.

11.4.3 Change the "%" column to "SAI", "SCI", "POS" etc.

11.4.4 If multiple circumferential indications are located along the same plane, record the largest indication using "MCI" in the "%" column.

11.4.5 Multiple circumferential indications along the axis of the tube should be recorded separately using "SCI".

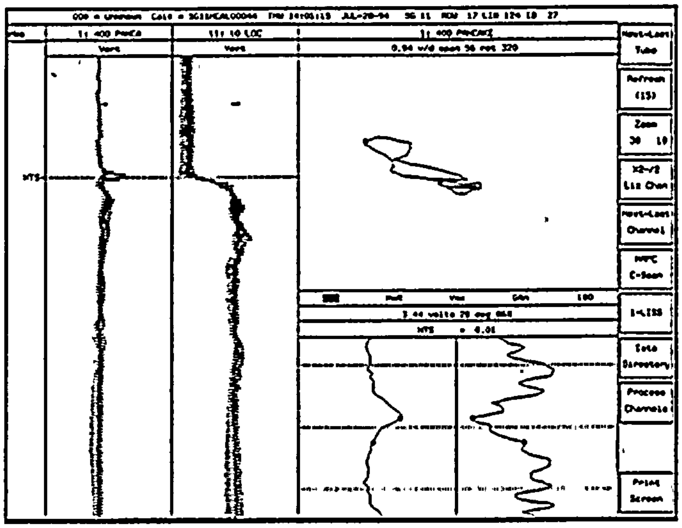


Figure 11.4 - Pancake Lissajous

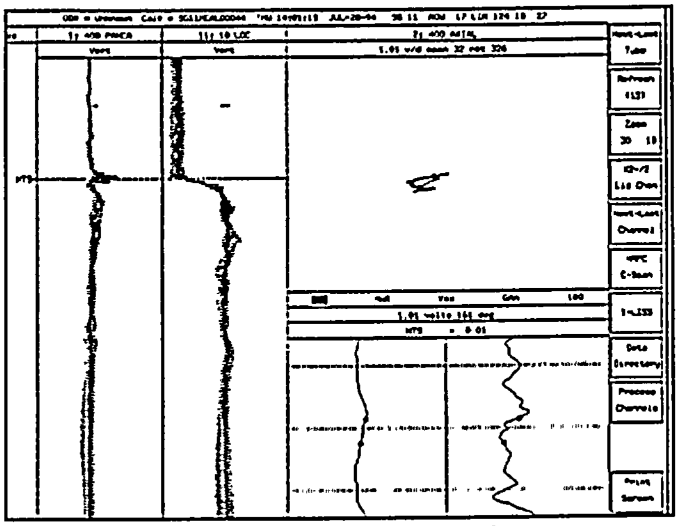


Figure 11.5 - Axial Lissajous

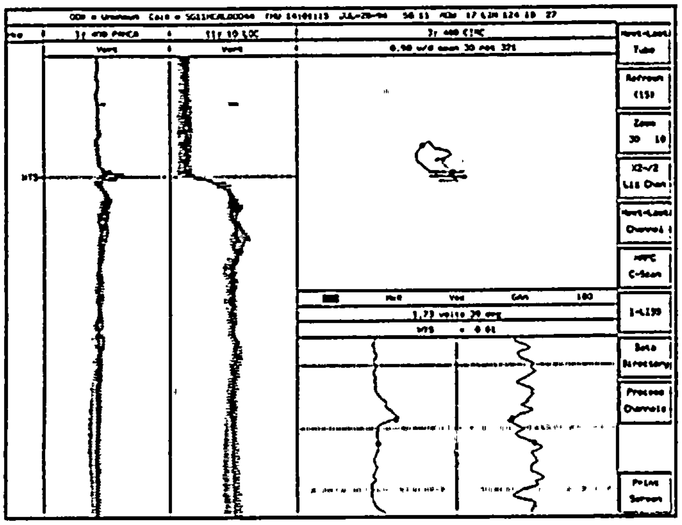


Figure 11.6 - Circ. Lissajous

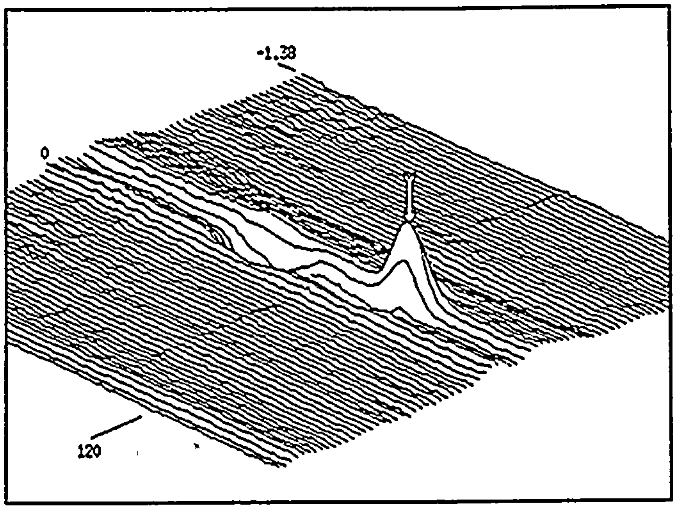


Figure 11.7 - Plus coil Axl Terrain plot

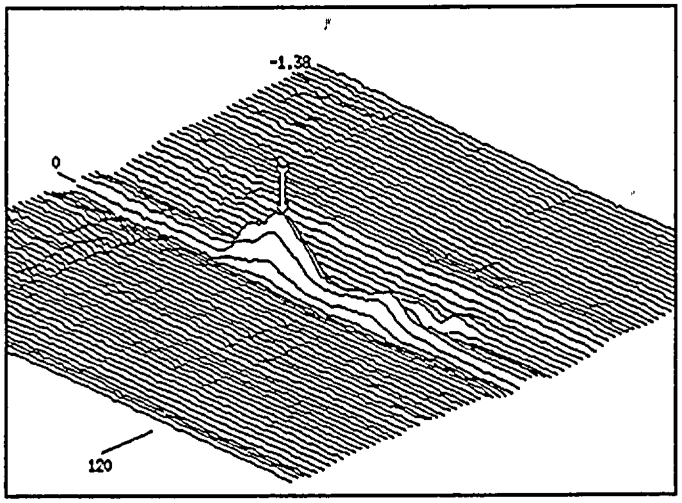


Figure 11.8
Plus coil Cir Terrain plot

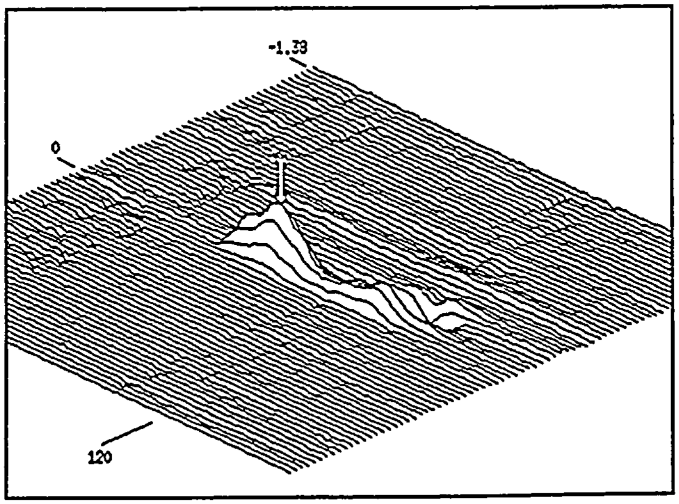


Figure 11.9
Cir Terrain Plot with Axial Line Filter

11.5 RECORDING FLAW INDICATIONS - THREE COIL - Support Intersection DATA

All suspect flaw-like signals shall be recorded for further evaluation by the resolution team(s). If the data Analyst (Primary or Secondary) is unsure of a signal, orientation, etc., a POS acronym may be used to insure the indication is evaluated further.

11.5.1 Graphic printouts will be generated as directed by the Lead or Senior Analysts. See figures 11.10 - 11.16 to follow.

11.5.2 Record the 400 KHz peak-to-peak results into the report, insuring the proper location, voltage and extent.

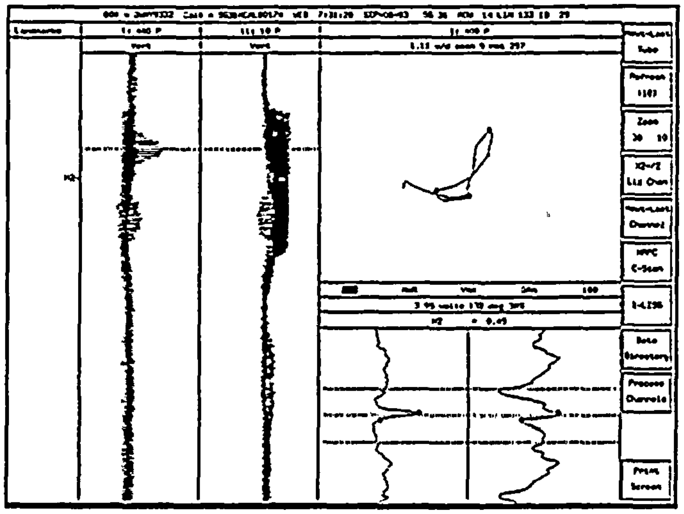


Figure 11.10 - Locate P-P on PAN Lissajous

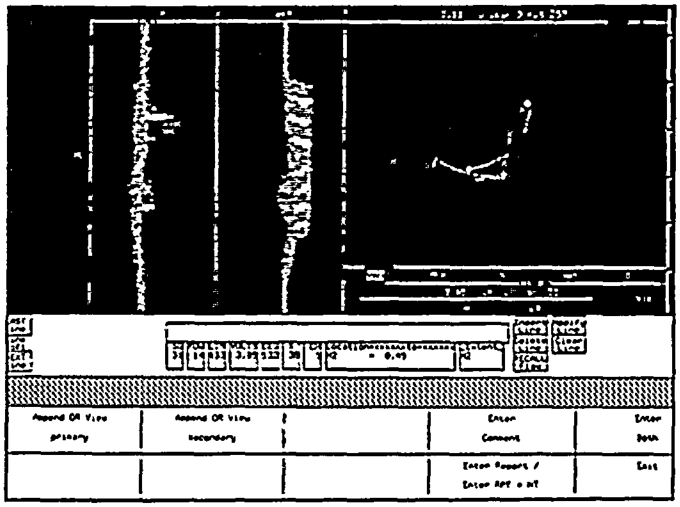


Figure 11.11 - Edit "%" call to "POS"

11.5.3 Change the "%" column to the appropriate "POS", "SAI", "MAI", etc.

11.5.4 If multiple axial indications are located along the same plane, record the largest indication using "POS" or "MAI" in the "%" column.

11.5.5 Multiple axial indications along the axis of the tube should be recorded separately using "POS" or "SAI".

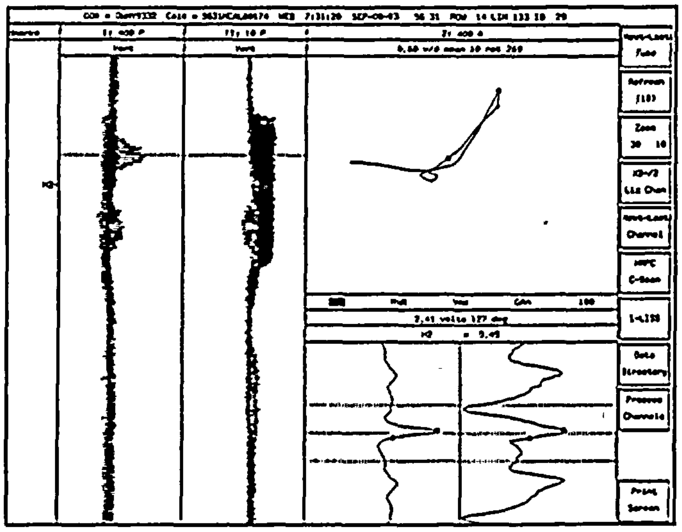


Figure 11.12
Axial Lissajous for Support Flaw

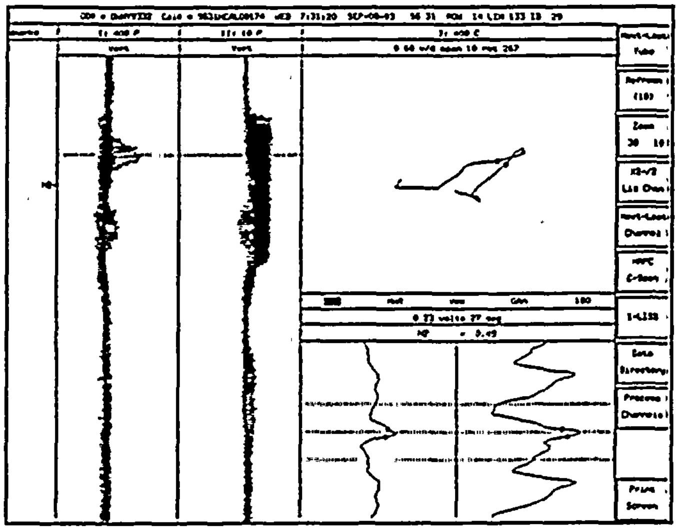


Figure 11.13
Circ. Lissajous for Support Flaw

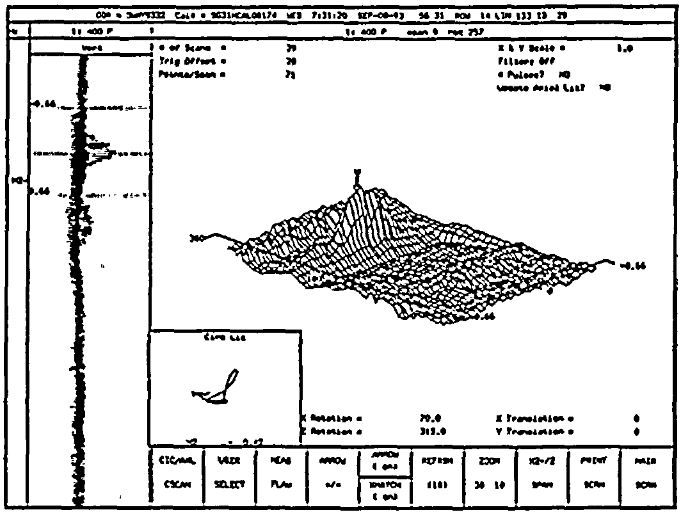


Figure 11.14
Pancake Terrain Plot of Support Flaw

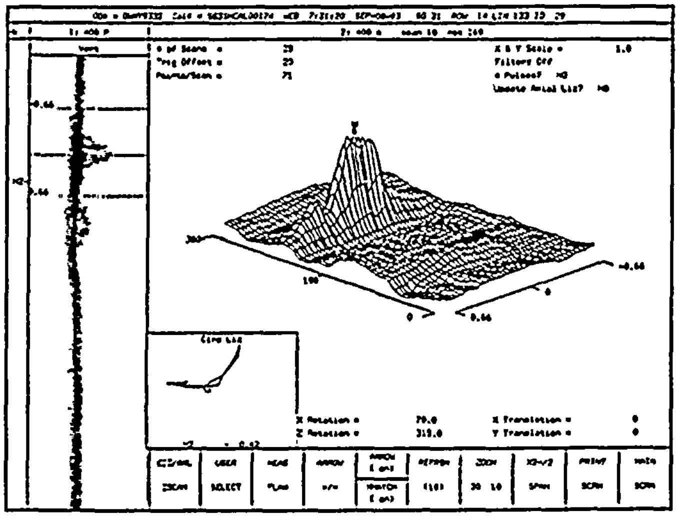


Figure 11.15
Axial Terrain Plot of Support flaw

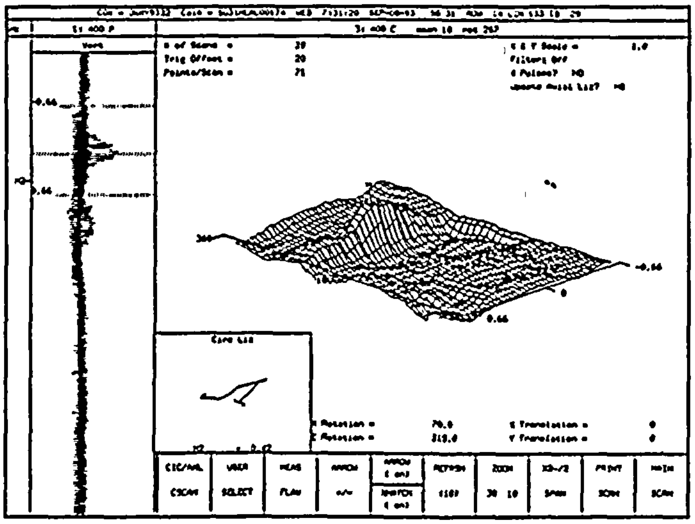


Figure 11.16
Circ. Terrain Plot of Support Flaw

11.6 Final Report

The following information (subject to changes by data management) will be recorded in the final report section of the data analysis program.

11.6.1 The Header information should be recorded using the report builder software in Eddynet. The header should contain the same information as for bobbin data. See section 7.1 for details.

11.6.2 For each tube evaluated with no indications an entry must be made that contains the SG ID (from Acquisition), Row, Line and Extent.

11.6.3 For each indication evaluated an entry must be made that includes the SG ID, Row, Line, Volts, Degrees, Percent depth or acronym, Location and Extent.

11.6.4 For any restricted or incomplete tubes, the correct retest (R__ code) acronym should be placed in the percent column, and the last tested extent in the Extent column.

11.6.5 No blank lines should appear on the report.

11.6.6 Messages may be inserted within the body of the report as required. The Analyst's signature and data shall accompany every page of the printed report. See figure 7.2.

11.7 Reporting Acronyms

The acronyms listed below are used in the percent column of the Final Report to describe a particular condition for MRPC results. Other acronyms may be used as listed in the Bobbin Probe Section (7.2).

<u>Acronym Condition</u>

Category I:

NDD No Detectable Degradation (blank)

Category II:

SAI Single Axial Indication

MAI Multiple Axial Indication - more than one indication in the same axial plane

SCI Single Circumferential Indication

MCI Multiple Circumferential Indication - more than one indication in the same circumferential plane

MMI Mixed Mode Indication - more than one indication in the axial and circumferential detection plane.

POS POSsible Indication - Used to flag an indication for Lead Analyst review

PIT Acronym to describe a volumetric indication indicating a pit-type flaw

VOL Volumetric Indication - this code may be used for certain indications such as MBM (Manufacturing Buff/Burnish Mark). Disposition of these indications will be based on historic review, flaw location, etc.

11.8 Data Anomalies

The Analyst should be aware of data quality anomalies which may occur during the acquisition of eddy current data. Certain equipment failures, electrical noise interference, etc., can cause data which is unacceptable and must be re-acquired. The following figures show several examples of data anomalies which should be flagged as RBD or Retest for Bad Data.

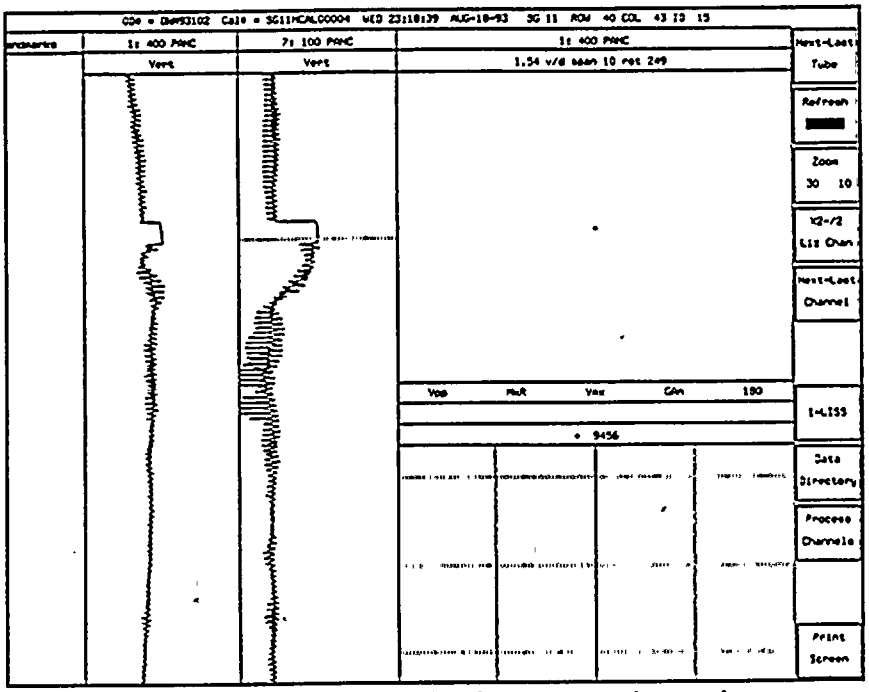


Figure 11.17 - RBD - Probe stopped rotating.

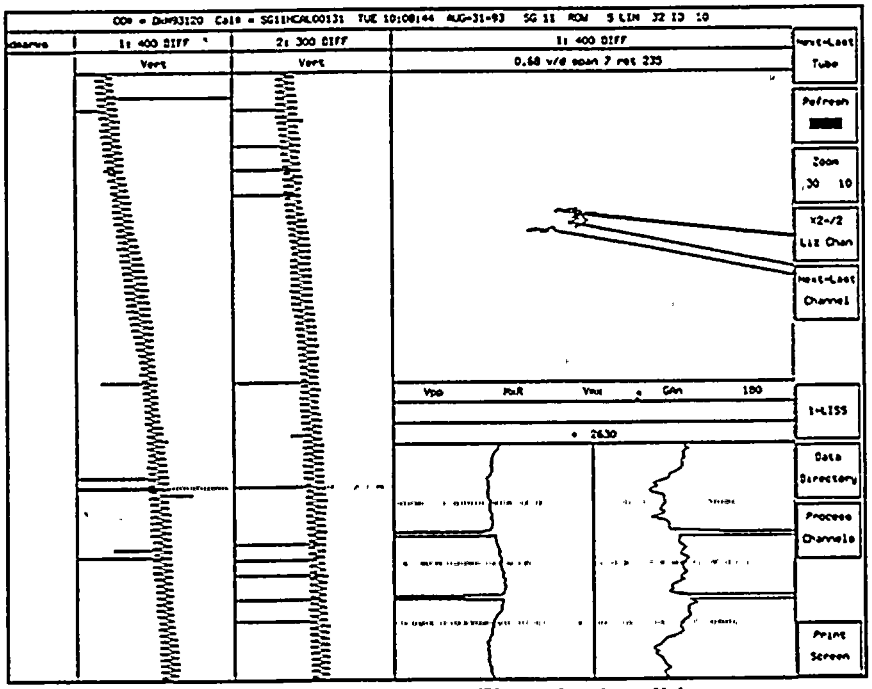


Figure 11.18 - RBD - Electrical spiking

SECTION 12.0

MRPC PROBE RESOLUTIONS

12.1 Conditions Requiring Resolution

12.1.1 If either the Primary or Secondary Analyst or both reports a flaw indication as SAI, MAI, SCI, MCI, POS or LAR, a Lead Analyst shall review the data tape, resolve the discrepancy or verify the results and document and sign off on the results of this review.

12.1.2 If either the Primary or Secondary Analyst or both reports an unresolved signal indication, the Lead Analyst shall review the bobbin test data tape, determine the nature of the indication, (i.e. flaw, no flaw, geometry, etc.) size the indication (if a flaw), document and sign off on the results of the review. If the indication cannot be classified as a non-flaw, it shall be considered to be a flaw, and sized accordingly, except as discussed below

If definitive data from other special tests (e.g. Ultrasonics, Liquid Penetrant) are available, this data may be used to resolve the status of the unresolved signal indication.

12.1.3 If, during the course of the resolution review, a Lead Analyst overrules any defect call (i.e., changes a repairable call by the Primary Analyst, Secondary Analyst, or both to a non-repairable call), or changes an unresolved signal indication to a <40% equivalent through wall flaw or to no flaw, then the reason for overruling shall be recorded. The Lead Analyst must then analyze all data from that tube for additional defects. A second Lead Analyst is required to review the pertinent data and acknowledge his concurrence by signing the Final Report.

When concurrence between the two Lead Analysts cannot be reached, the most conservative resolution of the discrepancy shall be taken. In either case, both Lead Analysts are required to sign the Final Report.

12.1.5 Other discrepancies such as inconsistent extent of test, inconsistent calibration identification, etc., shall be resolved by data review if necessary. All resolutions and data modifications should be performed by Lead Analysts, except as defined in paragraph 12.1.6.

12.1.6 The Senior Analyst may designate types of "Administrative" errors which the Primary or Secondary Analysts or the Lead Data Management Operator/Systems Administration personnel will be allowed to resolve.

12.1.7 Table 12.1 provides a listing of error conditions.

12.1.8 Table 12.2 provides a listing of discrepancy conditions.

12.2 Resolution Documentation

The following steps shall be used in resolving errors and discrepancies between Primary and Secondary analysis results:

12.2.1 The analyst will correct errors by using the Resolution analysis selection of the Eddynet software. Results and the final report will be generated separately from the Primary or Secondary results, although the Primary or Secondary report may be appended for non-resolved calls.

12.2.2 A "Compare Report" will be issued by the Eddynet compare program, or other approved vendor data management software listing discrepant conditions. This report will be used to document the Lead Analyst edits to the Final Report.

12.2.3 If no discrepant conditions occur between Primary and Secondary analysis, there may be not compare report generated.

12.2.4 The Lead Analyst will use the appropriate data and compare reports when resolving discrepancies.

12.2.5 The Lead Analyst will indicate when the Primary or Secondary or both analysis results are accepted without resolution be annotating the compare report with "PS" for primary call stands or "SS" for secondary call stands.

12.2.6 If the Primary or Secondary call is correct except for a change of one or more parameters in the call, the annotation "PC" for primary call change or "SC" for secondary call change may be used.

12.2.7 The Lead Analyst shall annotate "FC" for Final resolution Call if the resolved answer is different from the Primary Analyst, Secondary Analyst or both. See figure 12.1 for an example of a typical compare report.

Dec 14 15:22 1994 /tmp/.../ Page 1

ser1
nd25bb26.nd25bb26.diskless
/rod0101/primary/SG31HCAL00173 VS. /rod0101/secondary/SG31HCAL00173

FIELD SELECTION:

VOLTAGE	NO	
PHASE ANGLE	NO	
PERCENTAGE	YES	+/- 10
LOCATION	YES	+/- 0.50
-ranges	YES	+/- 0.50
CHANNEL	YES	No Tolerance

LOWER PERCENTAGE THRESHOLD < 20

UPPER PERCENTAGE THRESHOLD > 40

FIELD 6 SUPPRESSION :

FIELD 6 HIGHLIGHT : SAI MAI SCI MCI POS NQI LAR

NUMBER OF ENTRIES ON THIS PRINTOUT = 7

****

31	6	113								C6	pri	PS
31	6	113	2.47	205	~~SAI~~	1	V3	+	1.96	C6	sec	
31	6	123	1.49	160	~~PID~~	1	V3	+	0.67	C6	pri	SS
31	6	123	5.87	0	SAI	1	V3	+	1.40	C6	sec	
31	6	127						(−)	2.00	C6	pri	SC
31	6	127	1.70	125	SAI	1	V3	~~+~~	~~3.04~~	C6	sec	
31	6	127	~~21.21~~	~~15~~	~~SAI~~	~~1~~	~~V3~~	~~-~~	~~2.39~~	C6	sec	

Figure 12.1

Typical Primary/Secondary Analysis Compare Report

12.2.8 The Lead Analyst should thoroughly review <u>all</u> available data on each tube for which a discrepancy is identified. All results should be listed under the Lead Analyst's name in the Resolution final report.

12.2.9 As specified earlier in 12.1.3, if the 1st Lead Analyst dispositions a greater than 40% flaw or undefined type signal to a less than 40% flaw, a 2nd Lead Analyst must review the data. The second Lead Analyst acknowledges his concurrence by signing the Final Report.

Whenever concurrence in resolution cannot be reached, the most conservative call shall be retained. If the result is that a ≥40% or an undefined type indication is resolved to less than 40%, the reason must be specified on the Discrepancy Compare Report.

12.2.10 A Lead Analyst may not act as the 1st Analyst in resolving his own analysis results if he also acted as an Analyst (Primary or Secondary) for a particular calibration group. He may, however, assume the role of a 2nd Lead Analyst during resolution.

12.2.11 All ≥40% and other repairable indications and all dispositioned calls which were originally repairable shall be reviewed by the Senior Analyst or a designee other than the original Lead Analysts. Final disposition from this third review will be forwarded to the utility representative for review and concurrence.

TABLE 12.1

DATA RECORDING ERROR CONDITIONS

1. The reported steam generator identification is something other than "1", "2" or "3".
2. The SG identification does not agree with the SG identification code in the calibration number.
3. The reported tube does not exist
4. The reported row number is something other than 1 through 49.
5. The reported column number is something other than 1 through 114.
6. Missing probe or calibration designation
7. The reported flaw location is beyond the reported extent of the test.
8. Extents of test and flaw elevations which do not conform with the fact that there are eleven tube supports and four AVB's in the Shearon Harris Steam Generators.
9. The reported test extent is incorrect.
10. The extent of test in not reported.
11. Tubes reported as restricted or incomplete which do not have a corresponding extent of test.
12. Use of a three-letter reporting acronym with no established definition.
13. The final report header is not in the correct columns.
14. A plugged tube is reported as tested.

Table 12.2

RECORDING DISCREPANCIES BETWEEN DATA ANALYSIS

1. Either the Primary Analyst or Secondary Analyst or both reports a flaw as SAI, MAI, SCI, MCI or LAR.

2. Either the Primary Analyst or Secondary Analyst or both reports an anomalous indication (i.e., NQI, POS, etc.) in which the data suggests a reasonable probability that a flaw exists.

3. One Analyst reports a tube not reported by the other Analyst.

   NOTE: Flaw locations reported by primary and secondary analysts must be within 0.5 inches of each other to be considered the same flaw.

4. The reported test extents are not in agreement.

5. The reported calibration identifications are not in agreement.

6. The reported steam generator identifications are not in agreement.

7. The reported probe entry sides are not in agreement.

8. The three-letter reporting acronyms are not in agreement.

12.3 Resolution Reporting

The resolution final report will be generated when all resolutions from the compare report are complete. The resolution header should contain the same information as the Primary or Secondary Analyst as indicated in section 7.

12.3.1 The Lead analyst should log in to the Eddynet software using the "RESOLUTION" analyst function. This process allows the compare process to be activated, and allows editing of the primary and secondary results into the resolution or "final" results.

12.3.2 Edits will be made during the compare process as documented in section 12.2.

12.3.3 When all compare edits are completed, the final report should be generated using the "BUILD REPORT" menu. The Lead analyst should select "APPEND PRIMARY" and "REPORT ALL USERS" to insure all entries are built into the report, including un-edited primary results[19].

12.3.4 The Lead analyst should check all entries on the compare report vs. the compiled final report to insure all resolutions were addressed.

12.3.5 The final report shall be signed by the Lead Analyst. If a resolution required another Lead Analyst, a second signature shall be included on the final report.

---

[19]If special circumstances arise, Secondary results may be appended rather than Primary. The Senior Analyst should be contacted for any changes.

12.4 Resolution of Three-Coil Indications

The three-coil probe offers information valuable in resolving indications which are difficult to quantify due to extraneous noise of various types. This section is intent to be a guide to assist the Lead Analyst in resolving certain three-coil data indications from pancake and oriented coils **Plus coil data is not included in this section.**

As indicated in the SG History in the forepart of this document, similar plants have experienced PWSCC Circumferential cracking at the top-of-tubesheet transition. Because of the geometry of the tube transition, edge of the tubesheet itself, and other secondary side phenomena, possible ID indications are sometimes difficult to detect and quantify. The following examples should assist the Lead Analyst in data resolution.

12.4.1 A Circumferential ID indication will appear on the Lissajous display of the Pancake coil and Circumferential coil, but should be diminished on the Axial coil. See figures 12.2 - 12.4

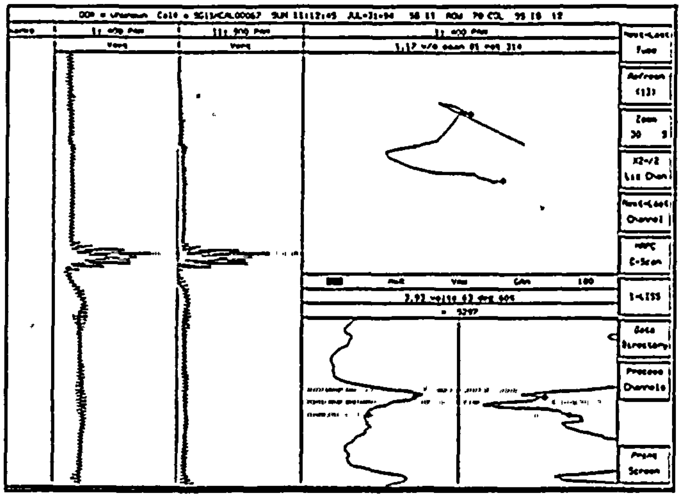


Figure 12.2 - Circ. Crack - 400 KHz PAN Lissajous

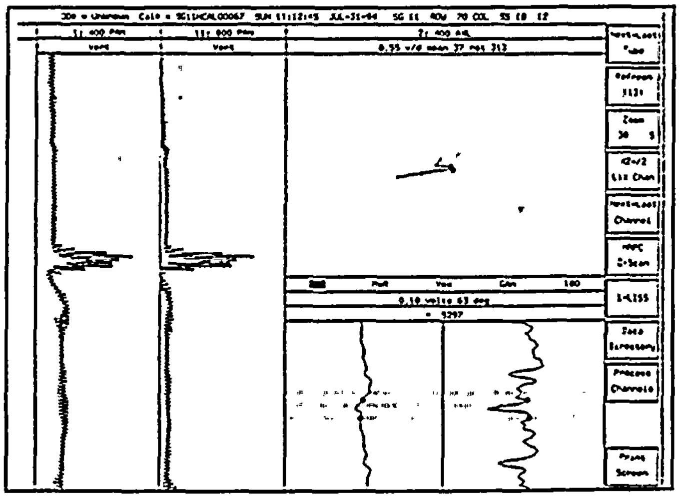


Figure 12.3 - Circ. Crack - 400 KHz AXL Lissajous

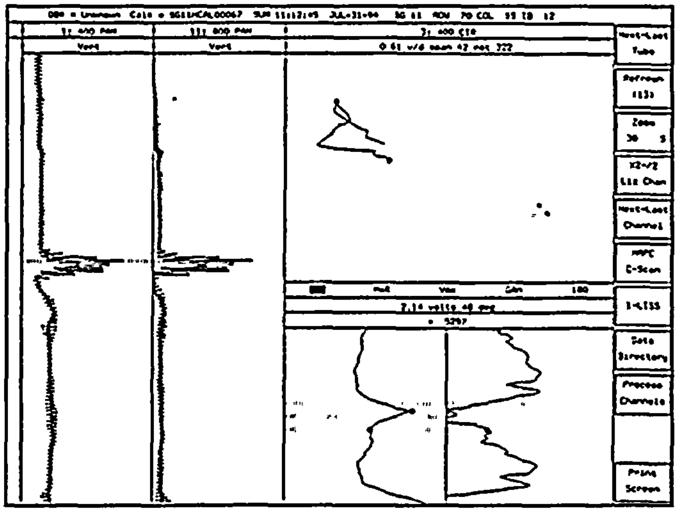


Figure 12.4
Circ. Crack - 400 KHz Circ. Lissajous

12.4.2 Likewise utilizing the terrain plot, the same relation as described in paragraph 12.4.1 is true. See figures 12.5 - 12.7.

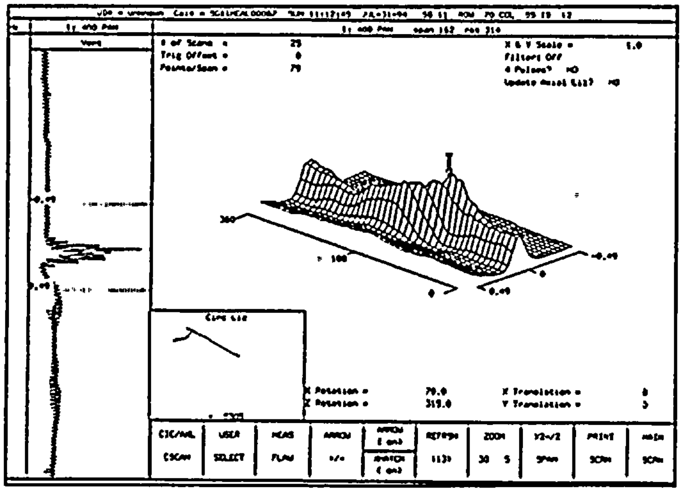


Figure 12.5 - Circ. Crack - PAN Terrain plot

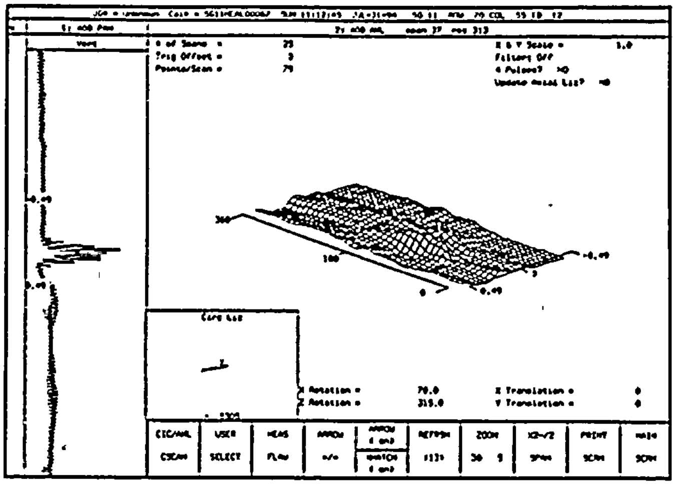


Figure 12.6 - Circ. Crack - AXL Terrain plot

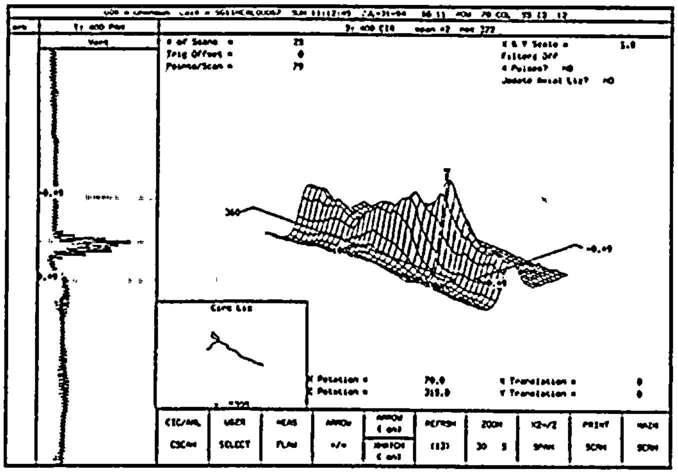


Figure 12.7 - Circ. Crack - Circ. Terrain plot

With other indications, the 3-coil relationship is not as defined. Other parameters must be used to define a flaw-like signal from geometry or other anomalies. One method which gives a good indication the signal is indeed a crack versus geometry, is to compare the voltage ratio between the circumferential coil and the axial coil. It is important that the correct voltage set-up is used to validate the results of this method.

12.4.3 After verifying the correct voltage set-up for the calibration group the Analyst is resolving, scroll the indication for the largest signal on the pancake coil.

12.4.4 With the coil rotation enabled (coil 5 at 120 and coil 7 at 240), go to the axial coil and note the voltage peak-to-peak. If the correct data points are not highlighted by the measuring points, reset to the proper data points.

12.4.5 Repeat step 12.4.4 for the circ. coil. If the voltage of the circ. coil is at least 2/1 between that of the axial coil, it is evident that the indication is likely to be a flaw, and not geometry. See figures 12.8 - 12.9.

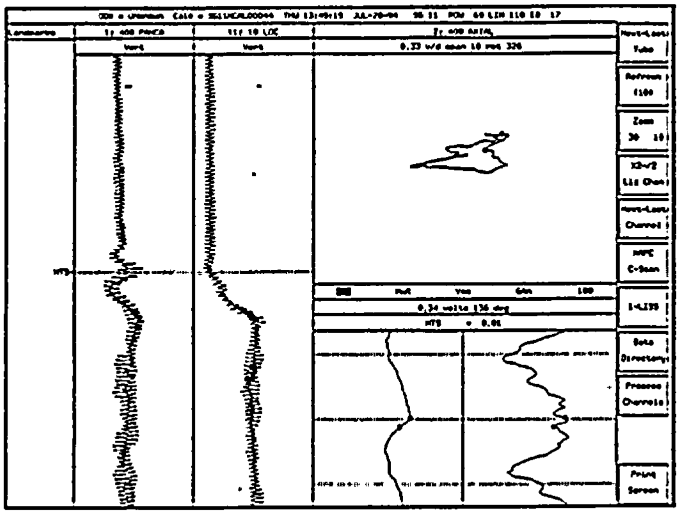


Figure 12.8
Axial voltage of potential Circ. indication

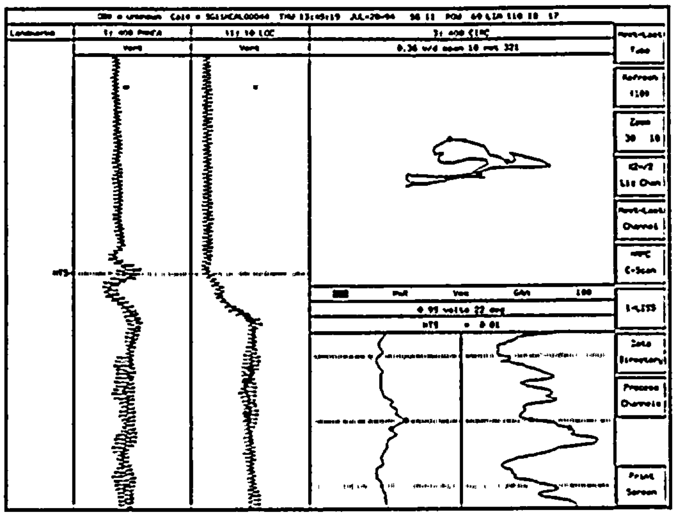


Figure 12.9
Circ. voltage of potential Circ. Indication

Figure 12.8 shows a voltage of 0.34v on the axial lissajous, and figure 12.9 shows a voltage of 0.95v. This is a ratio of approximately 3/1.

Another method to assist in determining the validity of an indication, is to view the terrain plots; PAN, AXL & CIR for the indication in question. If the circumferential terrain plot is well defined, or shows a "rough edge" rather than a smooth transition, it is likely the indication is from a crack and not geometry.

12.4.6 Set the span settings to reference spans set during calibration, or insure the axial and circumferential coil spans are somewhat equal if reference spans are inappropriate.

12.4.7 View the PAN, AXL, and CIR terrain plots. If the PAN and CIR plot show a defined crack-like signal, and the AXL does not, you may determine the indication to be a flaw, and not geometry. See figures 12.10 - 12.12.

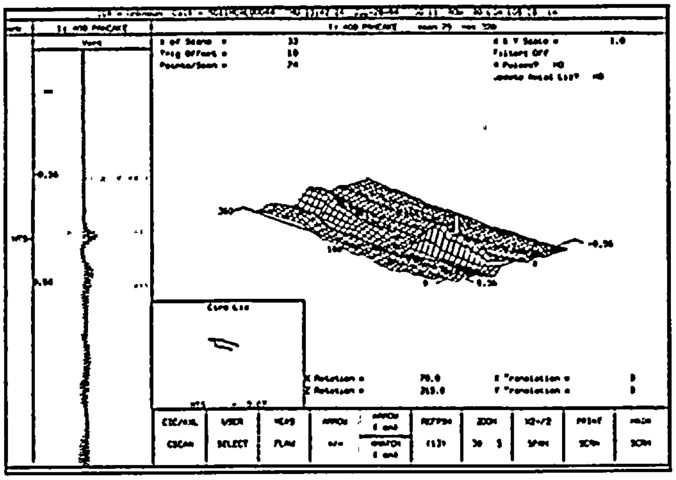


Figure 12.10
PAN Terrain Plot

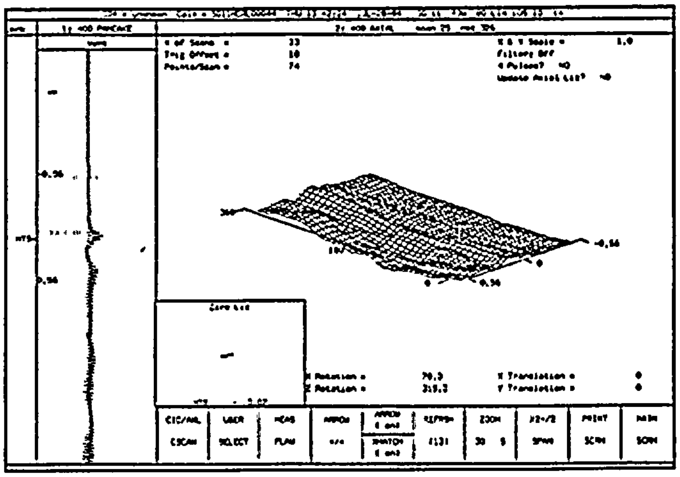


Figure 12.11
AXL Terrain plot

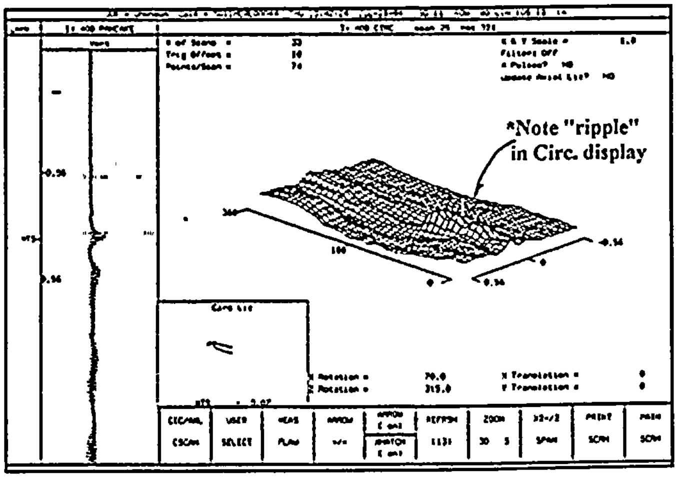


Figure 12.12
CIR Terrain Plot

12.4.8 Historical data for indications should be reviewed to determine if a change has occurred. If no apparent change has occurred, and the indication is minimal with a poor voltage ratio and display, it can be determined the indication is geometry or another anomaly.

APPENDICES

A. Supplemental Westinghouse plant Information

B. Computer Data Screening

C. Performance Demonstration

APPENDIX A

SUPPLEMENTAL WESTINGHOUSE PLANT INFORMATION

Substantial effort has been put into this guideline to insure a complete analysis of the eddy current data for detection steam generator degradation as early as possible. In the past, this has not always been achievable, due to rapid flaw growth and other extenuating circumstances.

It is imperative that all suspect indications be reviewed. If the analyst is unsure of any indication, it should be brought to the attention of the Lead or Senior analyst for further disposition.

The following examples show an indication from a plant which was not recorded during a scheduled inspection. The Indication grew rapidly and leaked under an in-situ hydro test. Even though the indication did not follow normal frequency phase correlation between channels, and no response on the mix channel, it grew into a recordable indication before the next scheduled cycle inspection. The analyst must use other information present in the data to disposition such an indication. This information is present as follows:

Figure A1 shows the 400 KHz Pancake coil indication during it's final stages, prior to leak testing and subsequent plugging. This indication is a circumferential crack at the top-of-tubesheet roll transition.

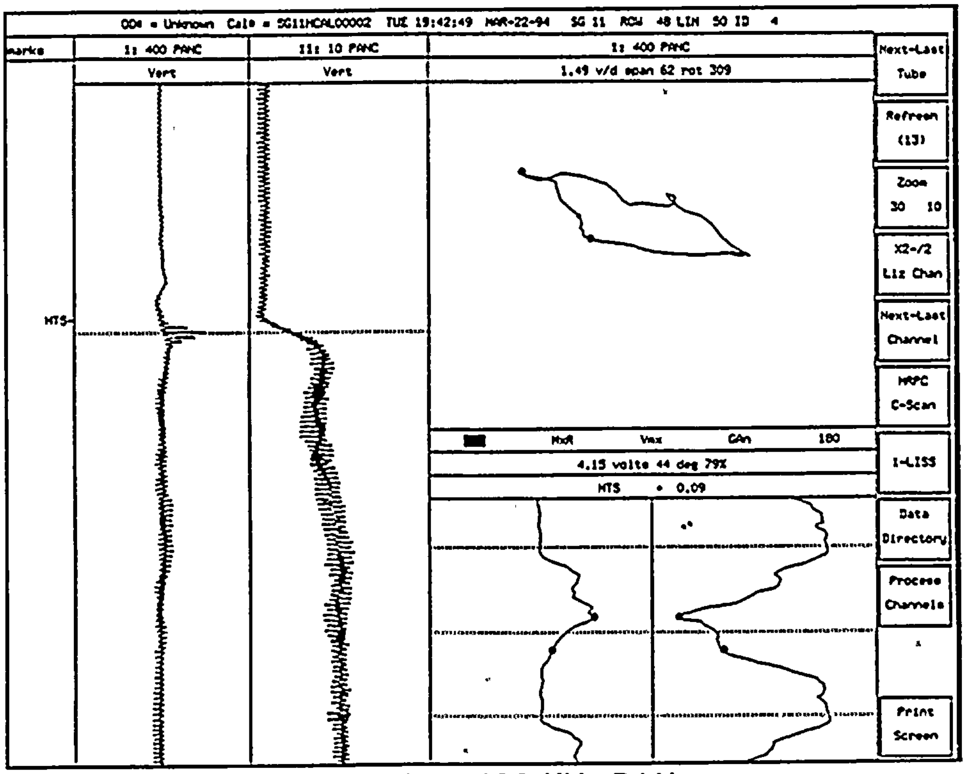


Figure A1 - 400 KHz PAN

Figure A2 - A3 show the Axial and Circumferential lissajous display of the same indication in Figure A1. Note the relation between the three coils.

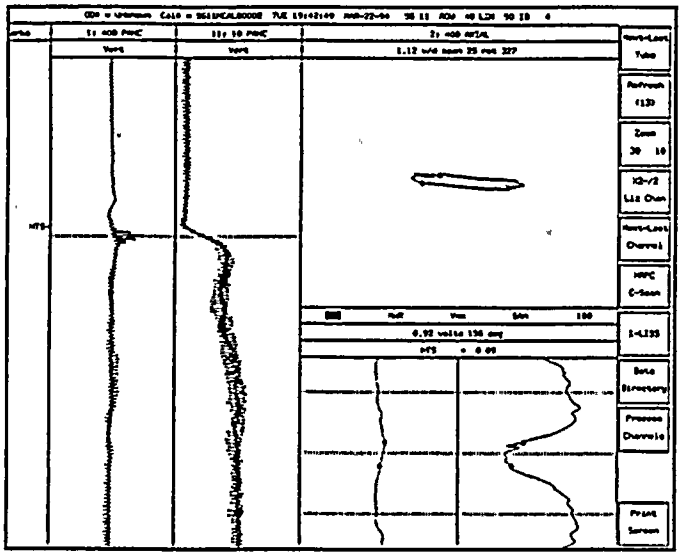


Figure A2 - 400 KHz AXL coil display

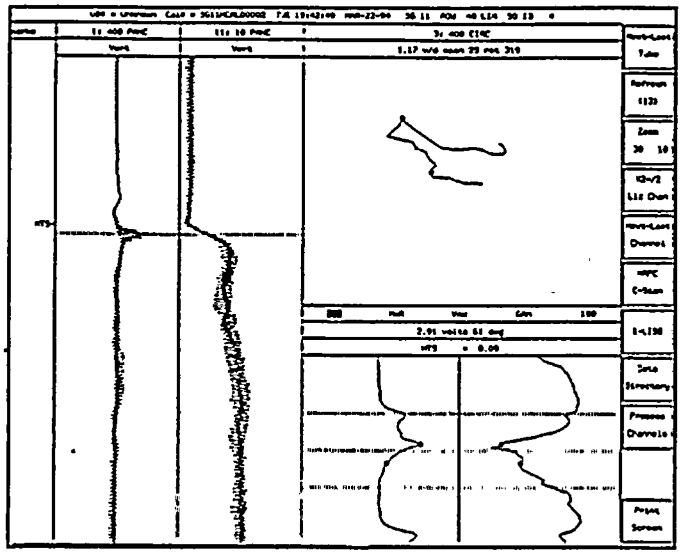


Figure A2 - 400 KHz CIRC display

Figure A4 shows the frequency phase relation between the pancake coils for the same indication in figures A1 - A3. Note the signal on the mix channel also.

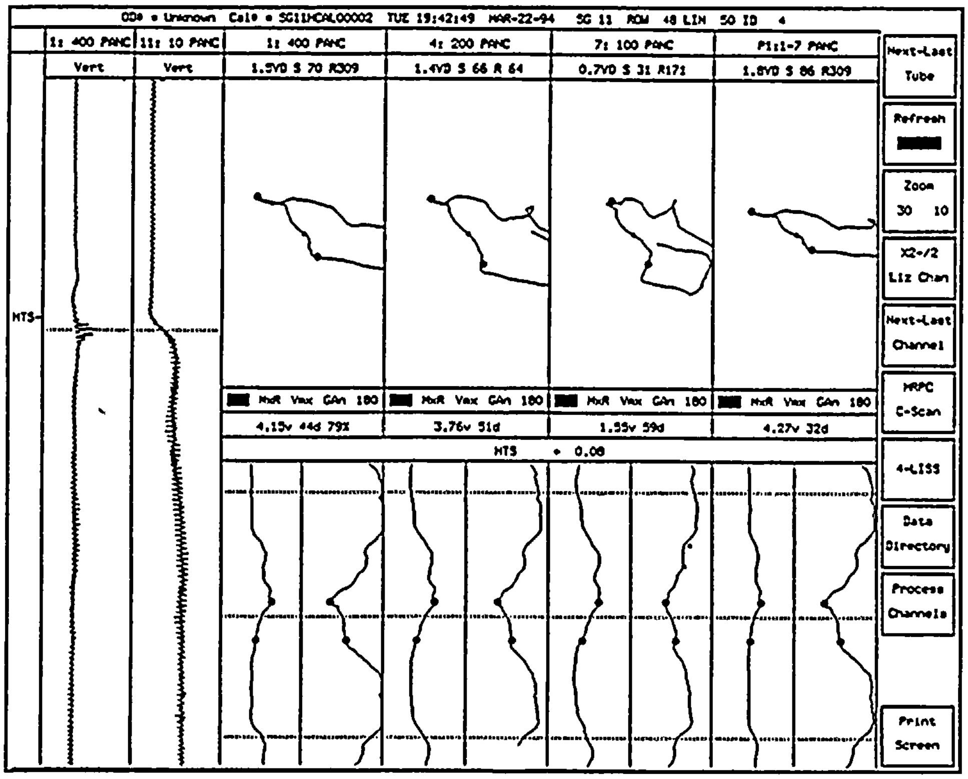


Figure A4 - Phase relation for Circ. Indication

Figures A5 - A7 show the Terrain plot for the indication shown in Figures A1 - A4. Note the relationship between coils for the Circumferential indication.

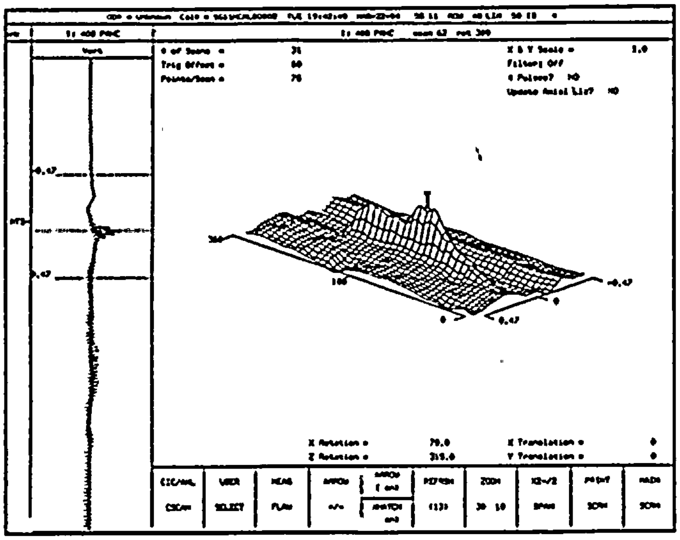


Figure A5 - 400 Khz PAN Terrain plot

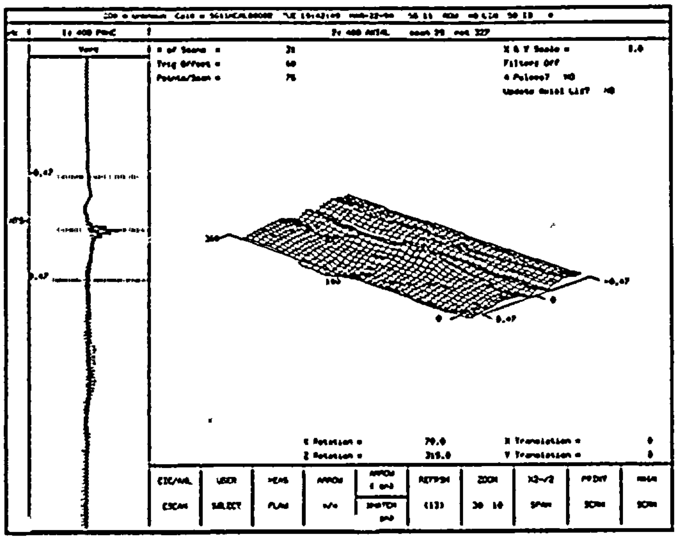


Figure A6 - 400 KHz AXL Terrain plot

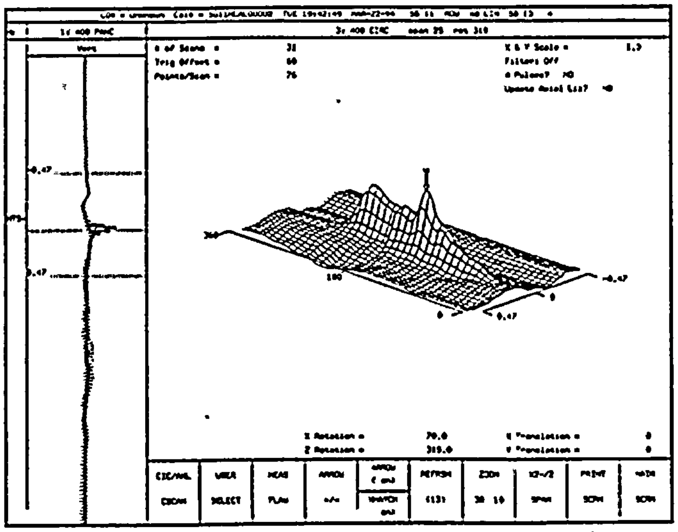


Figure A7 - 400 KHz CIRC Terrain plot

Figure A8 - A10 shows the Lissajous display for the same indication during the previous inspection outage in which it was not recorded. Note the diminished display and ambiguity of the signal on the three coils.

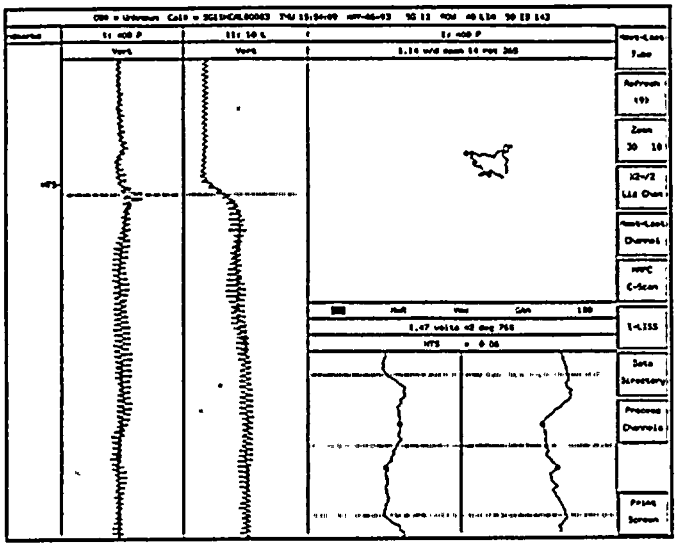


Figure A8 - 400 KHz PAN Lissajous

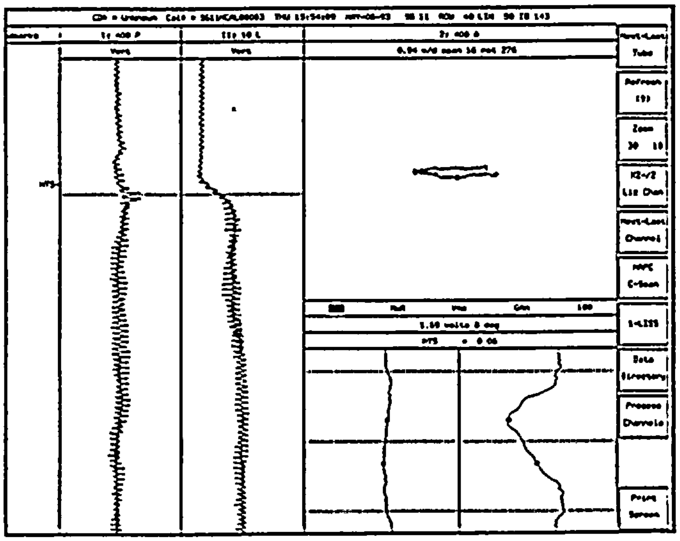


Figure A9 - 400 KHz AXL Lissajous

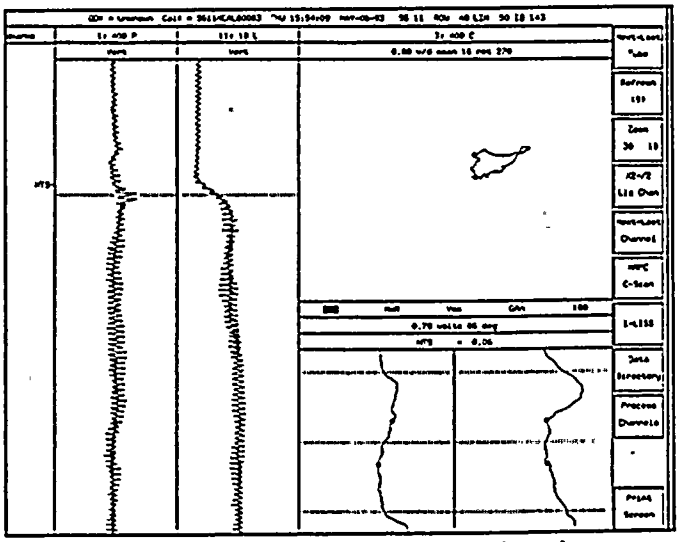


Figure A10 - 400 KHz CIRC Lissajous

Similar signals are noted in the area above the top-of-tubesheet, which are assumed to be deposit indications.

Figure A11 shows a poor correlation between pancake coil frequencies, and literally no indication on the mix channel. This type signal may lead the analyst to believe the indication is a deposit, geometry, or combined non-flaw signal.

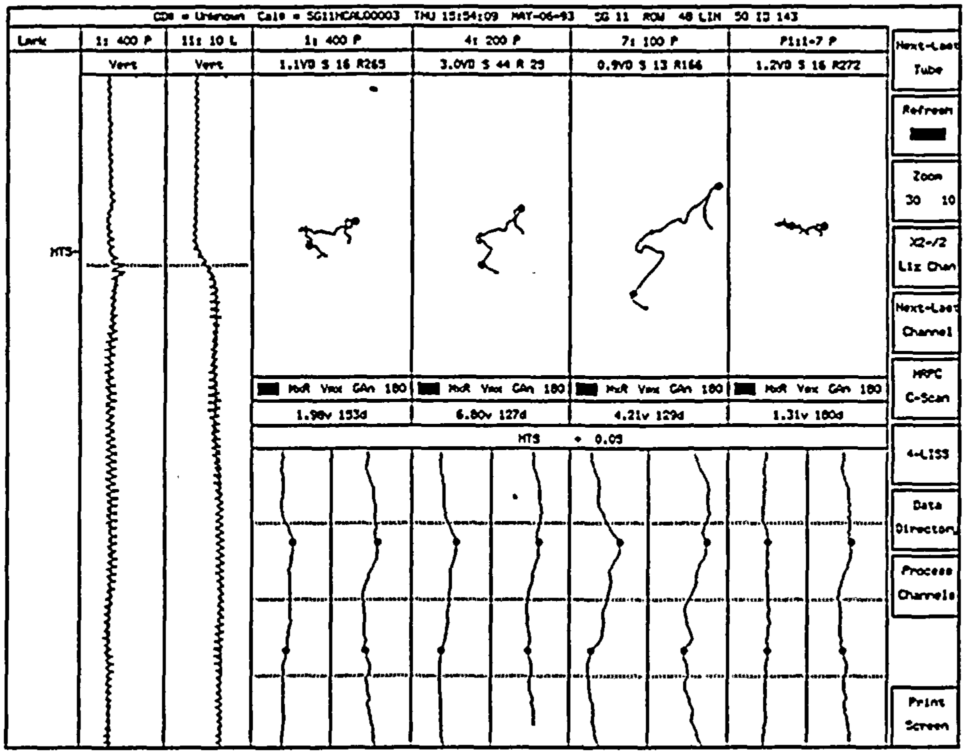


Figure A11 - Frequency phase relation and Mix

Figure A12 shows the Terrain plot of the pancake coil mix channel, indicating a non-flaw signal.

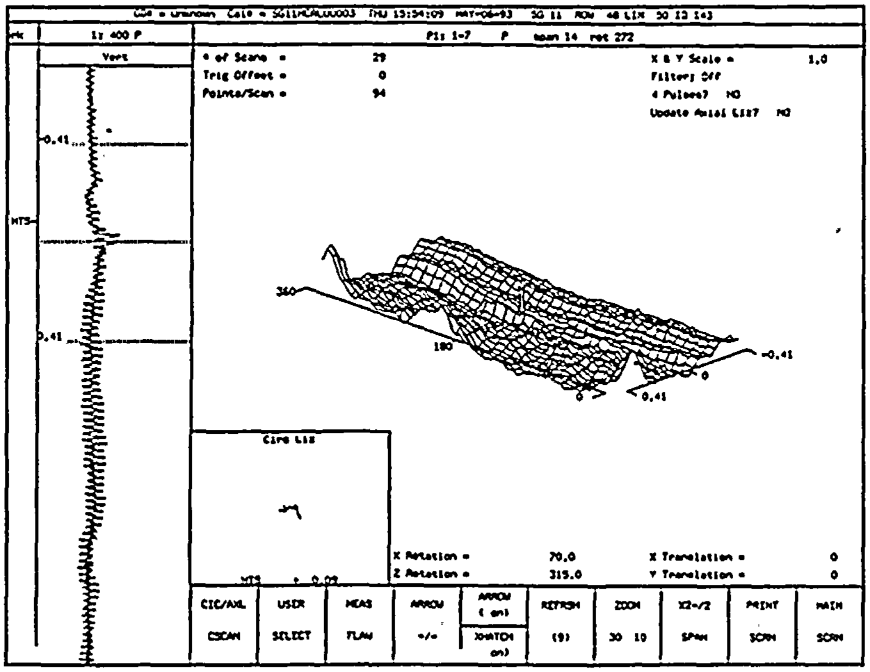


Figure A12 - Mix channel Terrain plot

The next figures show an indication which was resolved as non-reportable during a regular refuel outage. Less than one year later, the flaw had grown significantly. It is important to report this type of flaw signal at its early stages.

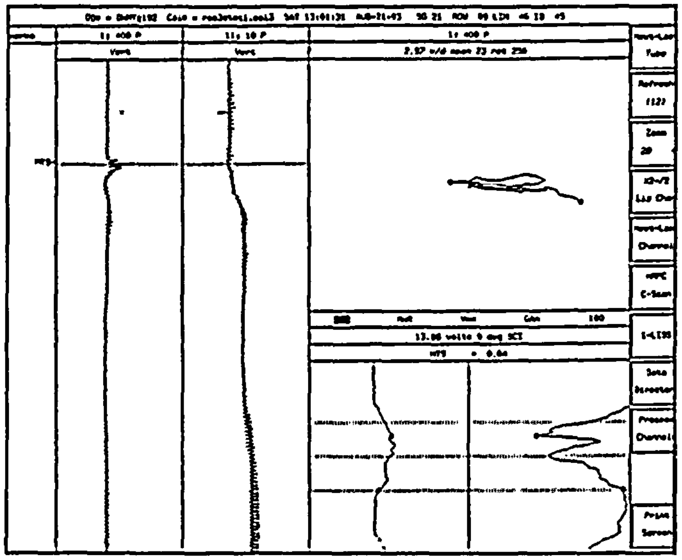


Figure A13 - 400 PAN 1993

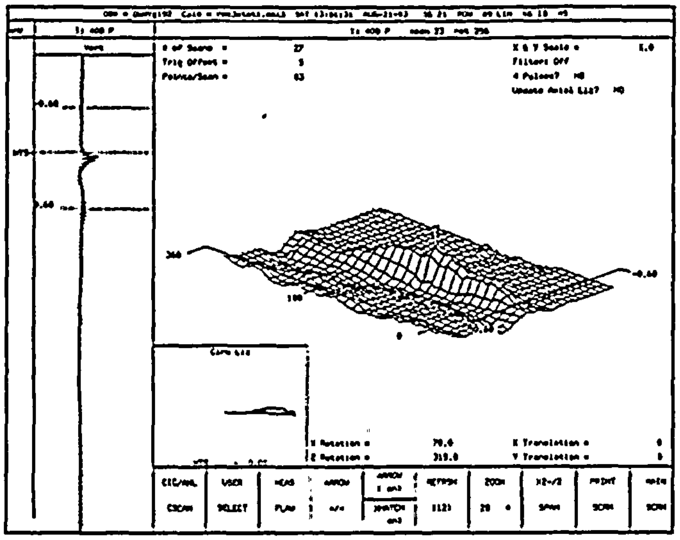


Figure A14 - 400 PAN Terrain plot

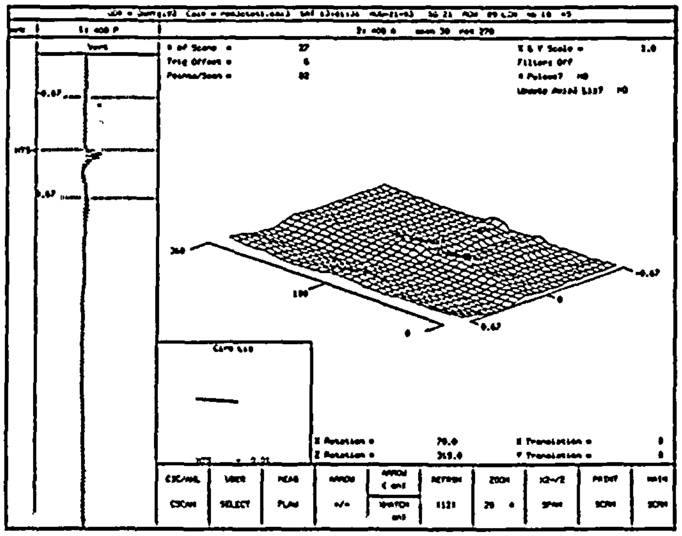


Figure A15 - 400 AXL Terrain plot

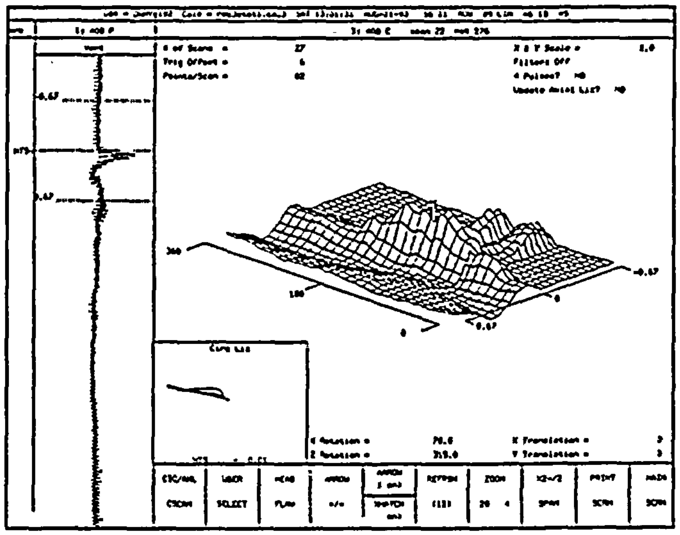


Figure A16 - 400 CIR Terrain plot

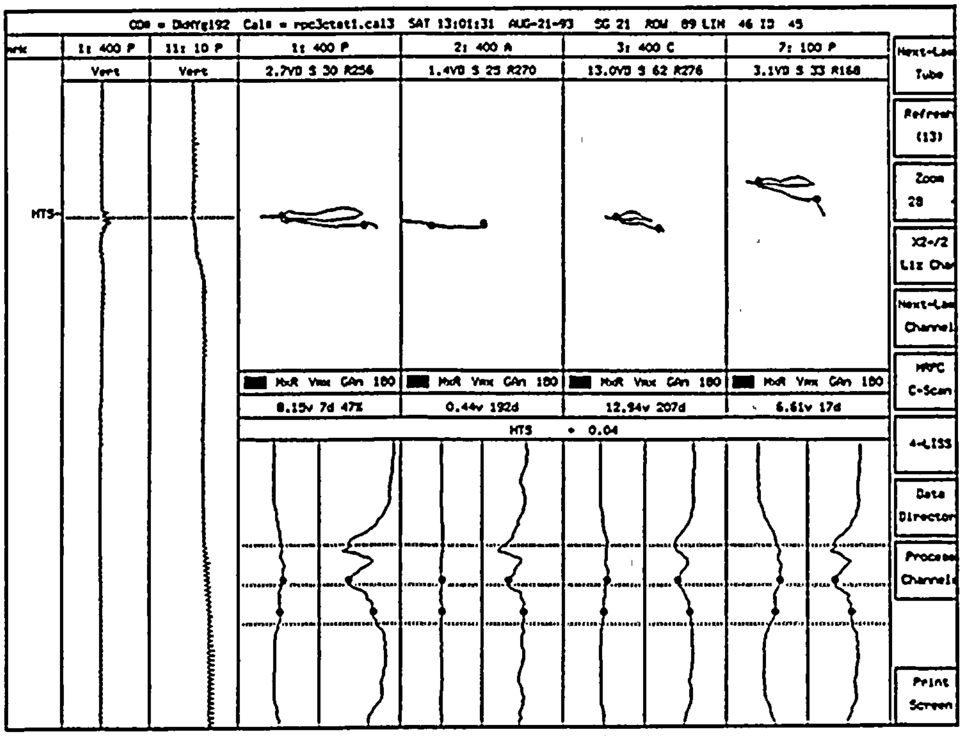


Figure A17 - 4 LISS display

The next set of figures is the same flaw less than one year later. This shows a much larger signal, and the need to report the indication as soon as it is detectable.

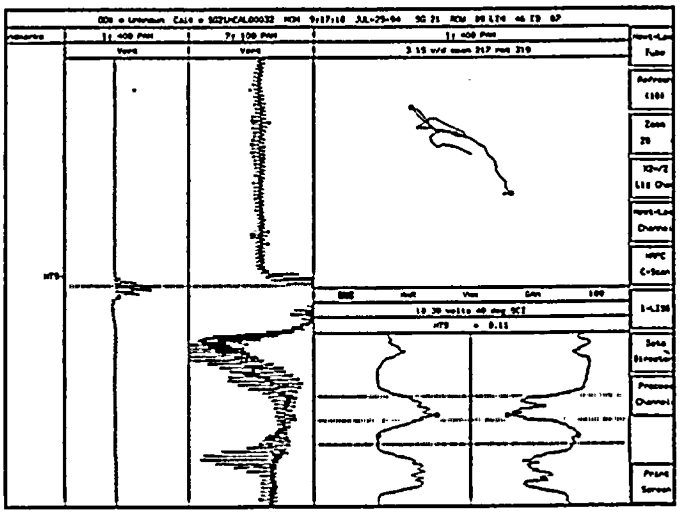


Figure A18 - 400 PAN Lissajous

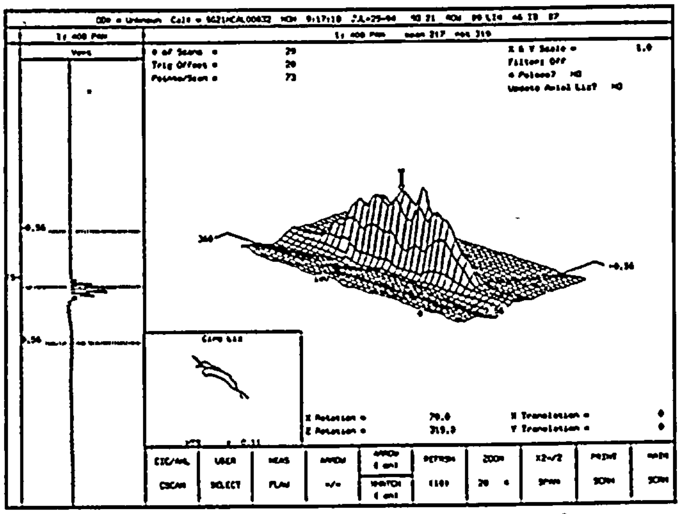


Figure A19 - 400 PAN Terrain plot

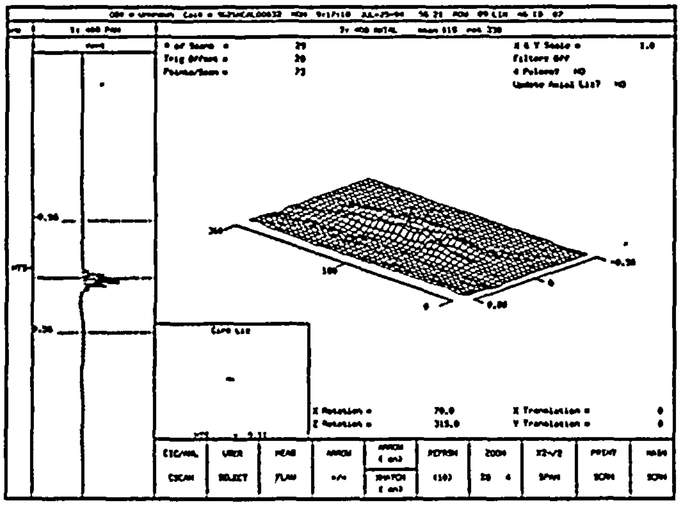


Figure A20 - 400 AXL Terrain plot

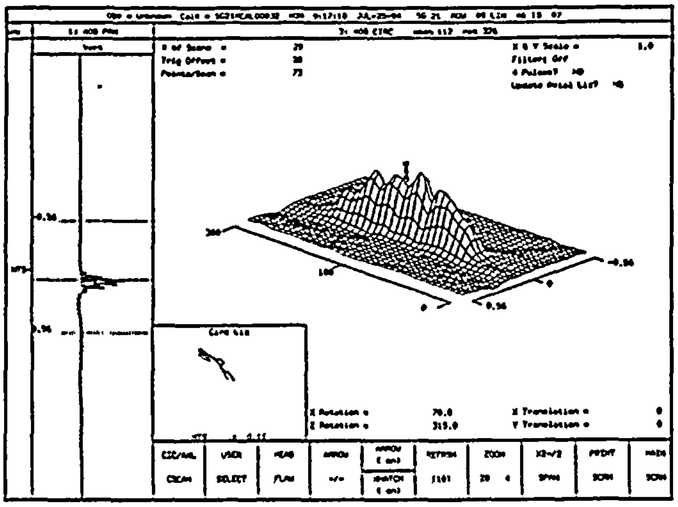


Figure A21 - 400 CIR Terrain plot

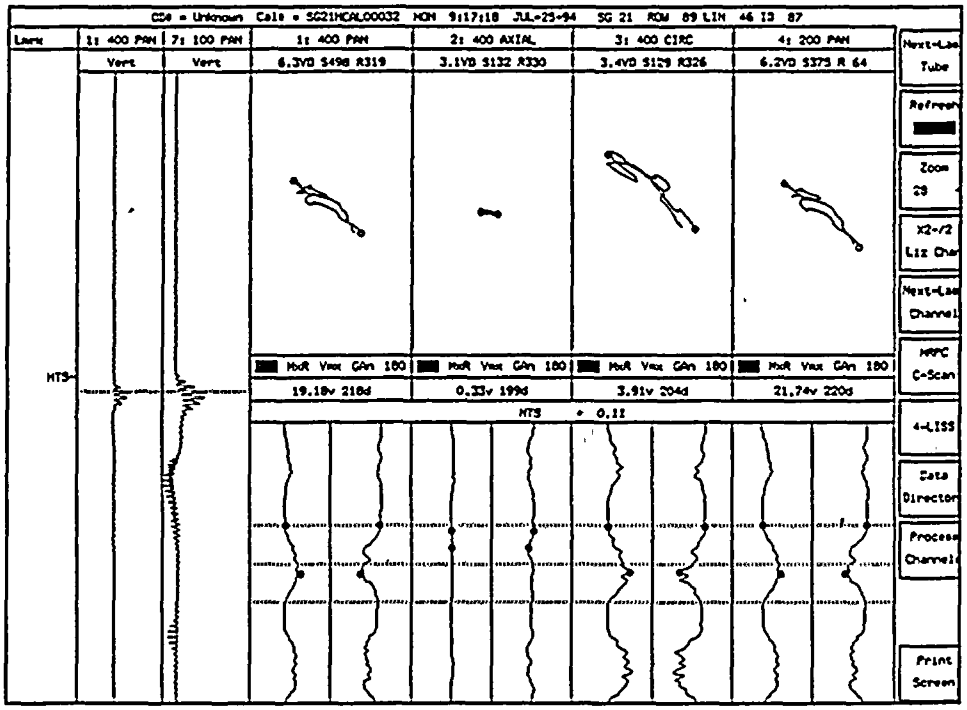


Figure A22 - 4 LISS display

The span settings for the previous plots were adjusted to fit on the display. You will note a large difference between the latter graphics and the original graphics for the same indication. The size is not only much larger, but the increase in phase angle is also apparent.

Because of the previous information shown, it is possible for the analyst to conclude the indication is not reportable. However, as previously mentioned, this indication rapidly became a reportable pluggable flaw. The analyst must use other information to review the indication to insure it is reported, therefore allowing the Lead analysts to review the indication using historic as well as other information to disposition the indication.

Upon reviewing the Terrain plots for the indication in question, the analyst will clearly see a "ridge" indication, following the circumference of the tube, in the expansion transition. This type of indication, although diminished as it is, should be reported for further disposition. See Figures A23 - A25.

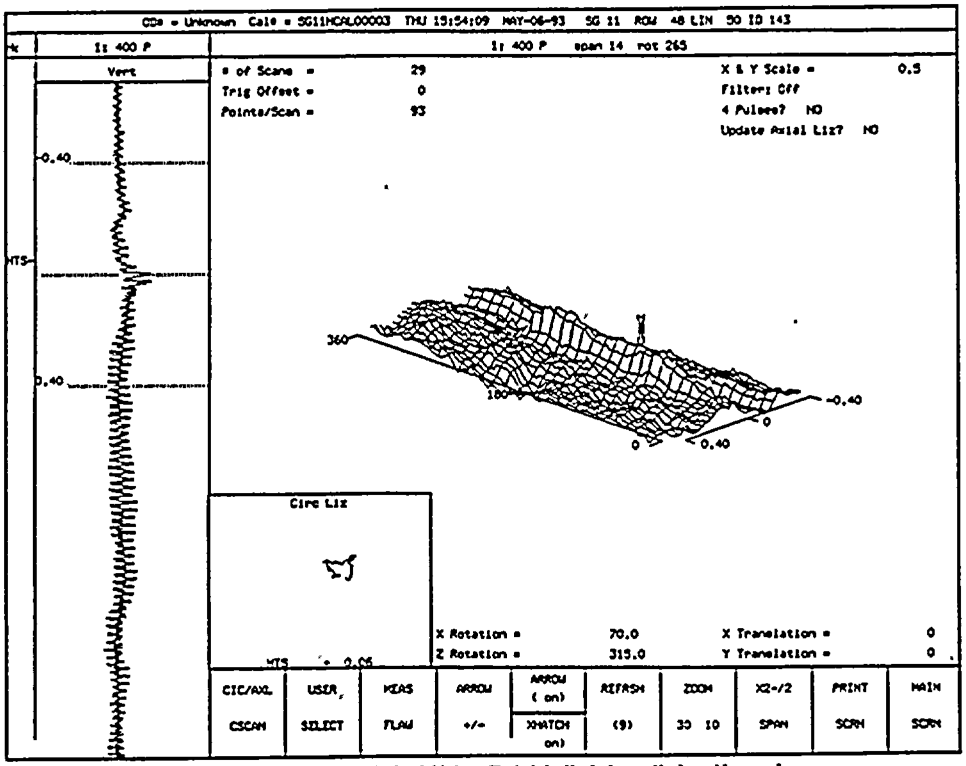


Figure A23 - 400 KHz PAN "ridge" indication

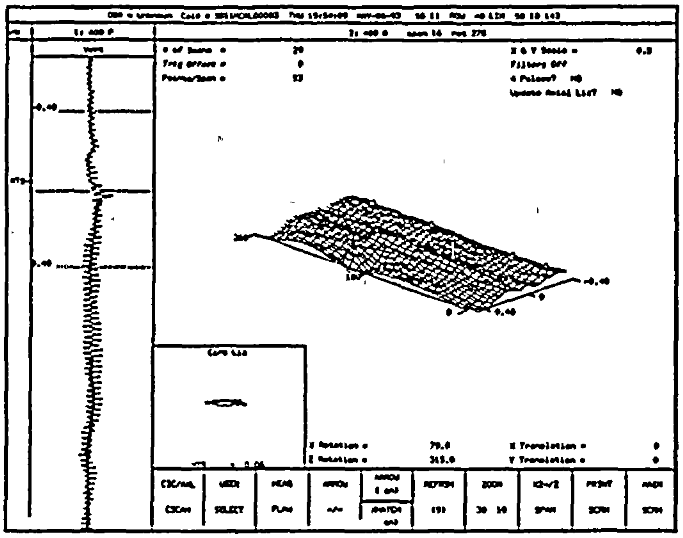


Figure A24 - 400 KHz AXL Terrain plot

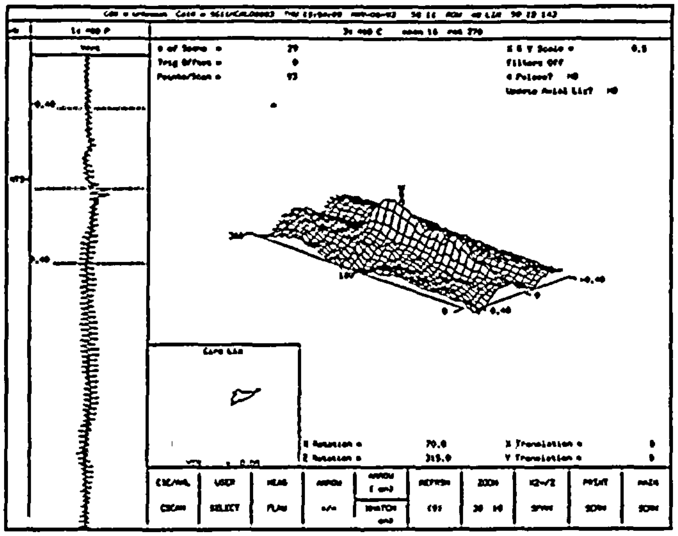


Figure A25 - 400 KHz CIRC Terrain plot

Given this information and graphic examples, the analyst should apply this technique to analyze the top-of-tubesheet area of the Shearon Harris steam generators. Other information and examples may be presented in the Performance Demonstration practice and examination data.

APPENDIX B

COMPUTER DATA SCREENING

Computer Data Screening (CDS) is a method of enhancing the eddy current data analysis of bobbin data by automating the steam generator tube flaw signal analysis, final report creation, and graphics dump output. The CDS system is operated by an Analyst who is familiar with both flaw and nonflaw eddy current signals from the Shearon Harris steam generators. The Analyst continues to establish the analysis variables as per the Shearon Harris Data Interpretation Guidelines. In addition, a set of CDS variables called the CDS Sorts must be established through a qualification program using Shearon Harris eddy current data. The sorts will allow flaw calls to be confirmed and may point out the need to adjust the sort parameters based upon the current condition of the steam generator tubes. In practice, one Analyst may operate multiple CDS systems simultaneously. The benefits of CDS include: the elimination of the effects of Analyst fatigue, consistent test results which can be duplicated and the use of <u>all</u> appropriate frequencies and mixes on each and every signal.

It is not the purpose of this section of the Shearon Harris Data Interpretation Guidelines to duplicate the Eddynet Operation Guide (Zetec, Inc.) or to train the Analyst in the use of CDS. Analysts performing CDS at Shearon Harris should be familiar with the contents of the CDS portion of the operating guide and the operation of the CDS system.

I System & Software

Eddynet CDS software is currently a part of the Eddynet package which is installed on the system file server. Appropriate software modules or licensing must be maintained in order to used the CDS portion of the software. Any system which utilizes the entire Eddynet software package should be applicable to run the CDS portion, providing the licensing stipulations are met as discussed.

II Analysis Variables

Analysis variables are established for each data section in accordance with the Shearon Harris Steam Generator Eddy Current Data Interpretation Guidelines. Additional mix channels may need to be added to supplement the CDS sort criteria. Mixes may be added to the primary or secondary analyst responsibilities to insure consistency and ease of implementation.

III CDS Sorts

The CDS sorts are part of the computer program instructions to perform the data screening. Sorts will be established during a rigorous qualification using actual Shearon Harris eddy current data. CDS sorts must be approved by the utility prior to use in screening Shearon Harris steam generator data.

A log book of CDS sorts should be established to control changes or revisions to the sort parameters. No changes shall be made to the sort parameters unless they are verified by system qualification and utility approval. All changes should be logged in and disseminated to all CDS system operators.

IV Operating Steps

At this time the operating steps for CDS are not established. Approved operating steps, CDS sorts and other documentation will be provided supplement to this appendix.

APPENDIX C

ANALYST PERFORMANCE DEMONSTRATION

To be accepted as a Data Analyst for Shearon Harris steam generator eddy current data, the Analyst must successfully complete a performance demonstration for both bobbin and mrpc data. A review of the Data Analysis Guidelines and practice data will be required before completing the performance demonstration.

The Senior Analyst should be contacted before beginning preparation for the performance demonstration, to insure the latest revisions to the guideline, data or other documentation is in place. During the data analysis of the actual steam generator outage data, the Analyst should be aware of any changes made to the Guideline and acknowledge those changes or revisions.

A copy of the practice data, data results, graphic displays and setup variables will be provided, along with a copy of the most recent version of the analysis guidelines.

I. <u>PERFORMANCE DEMONSTRATION PROCESS</u>

A. This guideline has been prepared in accordance with the EPRI PWR Steam Generator Examination Guidelines: Revision 4. Changes made to this guideline may be performed by completing the guidelines change form and obtaining the proper approvals.

B. The Performance Demonstration included as a part of this guideline, was also prepared according to the EPRI PWR Steam Generator Examination Guidelines. As recommended, plant specific data from CP&L Shearon Harris has been selected for use in the practice and examination data. Other data from similar Westinghouse plants has also been included to prepare the data analyst for defect mechanisms which may occur in the Westinghouse model D4 steam generators. This data includes data from Westinghouse series 51, D and E models. Indications from Harris which have been recorded include Manufacturing Buff Marks (MBM), AVB wear, and certain oriented flaws. Other data includes small manufacturing indications which are being tracked. Additional data from similar plants include PWSCC at the top of tubesheet, support interfaces, and low-row U-bend areas. Plus point data has been added to the review process to familiarize the analyst with current industry data.

The performance demonstration will be administered through the utility by the primary vendor's Level III senior analyst or a designee. A lecture class to review the analysis guidelines should be held and attended by all qualified data analysts involved with the inspection. The preparation of the guideline, performance demonstration materials and lecture should be performed by the primary vendor's Level III senior analyst or other designee as approved by the utility. The practical or written examination will also be administered by this individual. The preparer need not qualify to the test he/she has prepared, but should be qualified to EPRI Appendix G and have experience with similar model steam generator analysis.

II. REVIEW OF PRACTICE DATA

1. Attend a lecture class on the Shearon Harris ECT Analysis Guideline. Sign attendance roster. Complete the written exam based on this guide.

2. Obtain practice data assignment from system administrator.

3. Check summary for probe size, type and calibration standard(s) S/N's.

4. Set up analysis variables as required. (For review of practice data and for test purposes, use the variables stored on the optical disk.)

5. Data should be screened using the setup variables.

6. Review data. Results and graphics for practice data are in the Practice Data Handbook (located at each data station).

III. WRITTEN EXAM

1. After completing a review of the guideline and attendance of the guideline lecture class, the written exam may be completed. The practical exam may not be taken until the written exam is successfully completed with a score of 80% minimum. If the exam is not successfully completed, the analyst will review the material and take the exam a second time.

IV. PRACTICAL TEST

1. Obtain test data assignment from system administrator.

2. Check summary for probe size, type and calibration standard(s) S/N's.

3. Upon completion of the practical test, submit the following to the project lead or lead analyst:

    - copy of final report, signed, dated and level of certification
    - copy of unedited final report (CDS only).

ANALYST GUIDELINES CHANGE FORM

Outage: RFO-7 Change No. 1

Description of Change:

1) Add WAR to list of acceptable MRPC recording acronyms (sec. 11.7)

   If a wear call from bobbin inspection is run with Rotating Coil technology for diagnostic evaluation, and a wear indication is confirmed, WAR should be entered into the RC report line to confirm the wear indication. The same location information should be entered as shown in the original bobbin record.

2) Add DSH, MBH and NQH recording acronymns for addressing history

   The codes DSH, MBH and NQH will be used by the Resolution team for disposition of certain DSI, MBM and NQI calls which are present in the historic data. If the baseline or other approved historic data confirms an indication from the RFO-7 inspection, the resolution team will enter the code in the UTILITY 1 field to disposition the call. The line will be entered into the database for record.

3) Add criteria for MBM call when reporting bobbin indications:

   MBM indications have been recorded during past inspections and will be recorded during RFO-7. The criteria used for a MBM is a flaw-like response on the primary channel as well as a large volumetric signal on the 100/130 kHz absolute channel, usually of appreciable length. The data analyst should treat the MBM as a flaw, unless historic data has been reviewed from the baseline to support the final MBM call. If baseline history indicates a MBM, the code MBH will be added to the data report line during the resolution process. The code will be added to the UTILITY 1 field and loaded to the database. If the data analyst cannot determine if a history MBM call exists, the proper flaw code should be entered (e.g. NQI, DSI, etc.).

4) Add Memo dated 4/3/97 from Thomas U. Bipes, Subject: HNP Guideline update

(continued next page)

Reason for Change:

1) Specific instructions for Wear calls are not included in the guideline

2) Specific instructions to disposition historic calls are not included in the guideline.

3) Specific instructions for calling MBM signals are not included in the guideline.

Technical Basis:

The disposition of certain flaw calls can be made based on history from baseline or other historic data. Redundant or unnecessary inspections may be overted based on review of historic data.

Authorization:

Senior Analyst [signature] III **Date:** 4-23-97

Shearon Harris Engineer [signature] **Date:** 4/23/94

ABB

Memo

Public ?

To:
cc:
From: Thomas U. Bipes/CENO/USNUS/ABB
(Phone: +1 423 752 2197)
Date: 04/03/97 10:42:51 AM
Subject: HNP Guideline update

In conjunction with your comments on the guideline, I would like to add the following information to the appropriate sections:

Bobbin Codes:
DSH - A DSI call which can be traced to history
MBH - A MBM call which can be traced to history
NQH - A NQI call which can be traced to history

These new codes will be entered in the UTILITY1 field in Eddynet95, and will be picked up by ISIS automatically. They will then become part of the database for archival and retrieval during future inspections.

The following notes will be added to the bobbin section of the guideline for Primary/Secondary analysis:

Wear will be called when >= 10% on channel P2. If addressing a historic wear call, the indication percent depth will be called, or INR if the indication is not recordable due to inspection transients, or INF if the indication is not found. Both INR and INF will include location and test extent.

MBM indications must meet the current guideline criteria to be called. If addressing historic MBM calls, the same information as wear should be applied (INR & INF).

Free-span indications - will be called NQI for further investigation. If addressing historic calls, INR or INF may be used as appropriate.

When performing Rotating Coil (RC) analysis of bobbin indications (diagnostics) the following indications should be addressed as indicated:

Wear (%) If no indication is found - NDD
If indication confirms - place WAR in the % column, and match the bobbin location

DSI (spt) If no indication is found - INR/INF at bobbin location

If indication is present, address as SAI, MAI, SCI, MCI or as appropriate
If indication is present but is the same in history, enter (NDD) blank line with DSH in UTILITY1

NQI (free) — If no indication is found - INR/INF at bobbin location
If indication is present, address as SAI, MAI, SCI, MCI or as appropriate
If indication is present but is the same in history, enter (NDD) blank line with NQH in UTILITY1

MBM — If no ~~indication~~ REPORTABLE indication is found - (NDD) blank line
If no indication is found but same in history - enter (NDD) with MBH in UTILITY1
If indication is found - enter VOL, add MBH if same in history

(initials) 4-22-97

DNT — If no indication is found - (NDD) blank line
If indication is found - enter appropriate flaw call

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 1

Effective Date of Change: 4/21/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	4/23/97		
[illegible]	4/23/97		
[illegible]	4/23/97		
[illegible]	4-24-97		
[illegible]	4/24/97		
[illegible]	4/27/97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE
ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 1

Effective Date of Change: 4/21/97

Analyst Signature	Date	Analyst Signature	Date
[illegible] Barnes	4/23/97	Terry G. Washburn	4-27-97
[illegible]	4/23/97	[illegible]	4/27/97
Laurence E. [illegible]	4-26-97		
AC [illegible]	4/26/97		
David [illegible]	4/26/97		
Thomas [illegible]	4-26-97		
John C. [illegible]	4-26-97		
[illegible]	4/27/97		
[illegible] Honeycutt	4/27/97		
[illegible] Everett	04-27-97		
[illegible]	4/27/97		
W E Brooks-Crocker	4/27/97		
Jeffery S Schwenn	4/27/97		
Kimble Bush	4/27/97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ABB

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 1

Effective Date of Change: 4/21/97

Analyst Signature	Date	Analyst Signature	Date
David [illegible]	4/23/97	[illegible]	4/29/97
Richard [illegible]	4/23/97	Thomas D. Trontina	4-29-97
[illegible]	4/23/97		
[illegible]	4/23/97		
[illegible]	4/23/97		
Paul Blocklin	4/23/97		
Rick Williams	4/26/97		
[illegible]	4-26-97		
[illegible]	4-26-97		
T. B. Callison	4/27/97		
[illegible]	4-27-97		
[illegible]	4-27-97		
[illegible]	4-27-97		
Donald Wayne Benson	4-28-97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE FORM

Outage: RFO-7 Change No. 2

Description of Change:

1) Add DRH and DTH recording acronymns for addressing history

The codes DRH and DTH will be added to DSH, MBH and NQH and will be used by the Resolution team for disposition of certain DRI, and DTI calls which are present in the historic data. If the baseline or other approved historic data confirms an indication from the RFO-7 inspection, the resolution team will enter the code in the UTILITY 1 field to disposition the call. The line will be entered into the database for record.

2) Change reference 2.1 from "NP-6201" to "TR-106589-V1"

3) Where MRPC phase angle calibration is referenced, change the reference to 200 degrees for the axial channel and 20 degrees for the circumferential channels. Also change the reference from "ID Circ" to "60% ID Circ" as required.

4) Add to table 10.1 and 10.2 under Notes: "Process channel P1 shall be set as a pancake coil mix channel using the 400/100 kHz channels or other frequencies as appropriate. Other process channels may be added as required by the Senior Analyst or designee.

Reason for Change:

1) Specific instructions to disposition historic calls are not included in the guideline.

2) Guideline did not reference the EPRI document change.

3) Phase rotation did not reflect adequate detection for ID signals.

4) Guideline did not include specific instructions for Mix channels or process channels.

Technical Basis:

The disposition of certain flaw calls can be made based on history from baseline or other historic data. Redundant or unnecessary inspections may be overted based on review of historic data.

Authorization:

Senior Analyst ____________ Date: 4-25-97

Shearon Harris Engineer ____________ Date: 4/25/97

Figure 4.1 - Analyst Guidelines Change Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 2

Effective Date of Change: 4/25/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	4-26-97	[illegible]	4/29/97
[illegible]	4-26-97	[illegible]	4-29-97
[illegible]	4-26-97		
[illegible]	4-26-97		
[illegible]	4-26-97		
[illegible]	4-26-97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4-27-97		
[illegible]	4-27-97		
[illegible]	4-27-97		
[illegible]	4-29-97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 2

Effective Date of Change: 4/25/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	4/26/97		
[illegible]	4-26-97		
[illegible]	4/26/97		
[illegible]	4-26-97		
[illegible]	4-26-97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	04-27-97		
[illegible]	4/27/97		
W.E. Brooks-Crocker	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 2

Effective Date of Change: 4/25/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	4/26/97		
[illegible]	4/26/97		
[illegible]	4/26/97		
[illegible]	4/26/97		
[illegible]	4/26/97		
[illegible]	4/27/97		
[illegible]	4-27-97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE FORM

Outage: RFO-7 **Change No.** 3

Description of Change:

Remove Sentence "The Lead Analyst must then analyze all data from that tube for additional defects." from section 8.1.4 and 12.1.3. Add the following to the end of the same paragraphs: "If a primary or secondary analyst does not analyze a tube, a resolution analyst must analyze the tube, however it must be an analyst not performing the resolution process for the data in question.

Reason for Change:

Guideline instructions were incorrectly interpreted due to ambiguity of the aforementioned statement.

Technical Basis:

none

Authorization:

Senior Analyst [signature] **Date:** 4-27-97

Shearon Harris Engineer [signature] **Date:** 4/27/97

Figure 4.1 - Analyst Guidelines Change Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 3

Effective Date of Change: 4/27/97

Analyst Signature	Date	Analyst Signature	Date
R.L. [illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
Gary [illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4-27-97		
[illegible]	4-27-97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 3

Effective Date of Change: 4/27/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	4/27/97	[illegible]	4/24/97
Paul R Cochli[illegible]	4/27/97	Thomas D. Troutman	4-29-97
[illegible]	4/27/97		
[illegible]	4-27-97		
Rick Williams	4-27-97		
[illegible]	4/27/97		
[illegible]	4/27/97		
[illegible]	4/27/97		
T.R. Collins	4/27/97		
[illegible]	4-27-97		
[illegible]	4·27·97		
[illegible]	4-27-97		
Terry L. Tate	4-28-97		
David Wayne Benson	4-28-97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE FORM

Outage: RFO-7 **Change No.** 4

Description of Change:

Add RWS to the list of acceptable reporting codes. Add to sections discussing wear "If an indication of wear is found in the pre-heater section of the steam generator (02C - 11C) and it is greater than or equal to 20% though wall, measure the flaw with channel P2 (AVB wear standard) but change the reporting code to RWS (Retest with Wear Scar standard)." Tubes with this reporting code should then be re-run with bobbin coil utilizing the wear scar standard during the calibration run..

Reason for Change:

Wear inidications in the pre-heater area are conservatively sized with the AVB wear standard. Re-running the tubes with the Wear Scar standard will more accurately size the wear.

Technical Basis:

Based on industry experience and EPRI documentation, the wear scar standard will give a more accurate depth measurement of the pre-heater wear.

Authorization:

Senior Analyst [signature] **Date:** 4-30-97

Shearon Harris Engineer [signature] for NFB **Date:** 30Apr97

Figure 4.1 - Analyst Guidelines Change Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 4

Effective Date of Change: 4/30/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	04/30/97		
[illegible]	4/30/97		
[illegible]	4-30-97		
[illegible]	4-30-97		
[illegible]	4/30/97		
[illegible]	5/1/97		
[illegible]	5/1/97		
[illegible]	5/1/97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 4

Effective Date of Change: 4/30/97

Analyst Signature	Date	Analyst Signature	Date
W E Brooks - Crocker	4/30/97		
Jeffrey S Schwenn	4/30/97		
[illegible]	4/30/97		
[illegible]	4/30/97		
M L Everett	04-30-97		
[illegible]	4/30/97		
[illegible]	4/30/97		
Teresa J. Washburn	4/30/97		
Lawrence E Cobb	4-30-97		
KWBurch	4-30-97		
[illegible] C. [illegible]	4-30-97		
[illegible]	4-30-97		
[illegible]	5-1-97		
[illegible]	5-2-97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

ANALYST GUIDELINES CHANGE ACKNOWLEDGMENT FORM

Description of Change:

Outage: RFO-7 **Change No.** 4

Effective Date of Change: 4/30/97

Analyst Signature	Date	Analyst Signature	Date
[illegible]	4-30-97	[illegible]	4/30/97
Donald Wayne Benson	4-30-97		
[illegible]	4-30-97		
[illegible]	4-30-97		
[illegible]	4-30-97		
[illegible]	4/30/97		
[illegible]	4-30-97		
[illegible]	5/1/97		
[illegible]	5/1/97		
Paul R Cocklin	5/1/97		
[illegible]	5/1/97		
[illegible]	5/1/97		
[illegible]	5/2/97		

Figure 4.2 - Analyst Guidelines Change Acknowledgment Form

Shearon Harris RFO-7 Signature Log

Name (print)	Name (sign)	User ID	Initials	Title
THOMAS W. BIPES	Thomas W. Bipes	B3052	TWB	S
LYNN HOVER	Lynn Hover	H1274	LH	SP
Gary Terning	Gary Terning	T5028	GAT	RP
DON DAHNKE	Don Dahnke	D4825	DCD	RP
Tim Shutler	Tim Shutler	S4256	TJS	SP
Robert BARNES	Robert L Barnes	B0690	RLB	RS
JOSEPH JACOBS	JJacobs	J5670	JJ	RP
RichardH. Merriman	Richard H. Merriman	M7006	R	RS
RUSSELL L. NEYHAN	R.L. Neyman	N0942	RLN	RS

Title:

S = Senior Analyst
RP = Resolution Analyst Primary
RS = Resolution Analyst Secondary
SP = Special Projects Analyst
P = Primary Analyst
S = Secondary Analyst

Shearon Harris RFO-7 Signature Log

Name (print)	Name (sign)	User ID	Initials	Title
JOHN C. OLIVER	John C. Oliver	01057	JCO	Sec
Wanda E. Brooks-Crocker	W.E.Brooks-Crocker	B2860	WEB	Sec
Mark W. Downs	[illegible]	D1933	MWD	Sec
JEFFERY S. SCHWENN	Jeffery S. Schwenn	51848	JSS	Sec
David R. Petty	David R. Petty	P2272	DRP	Sec
Todd A. Richards	[illegible]	R9615	TAR	Sec
LAWRENCE E. Glass	Lawrence E. Glass	C9318	LEG	Sec
Thomas H. Munsterman	[illegible]	M8912	TM	Sec
ALFRED C. MARTINEZ	Alfred C. Martinez	M2421	ACM	Sec
Teresa G. Washburn	Teresa G. Washburn	W4892	TGW	Sec
C.R. Honeycutt	C. Honeycutt	H3921	[illegible]	Sec.
Barry L Everett	B.L. Everett	E2448	BE	Sec
Kimble Burch	Kimble Burch	B3905	KWB	Sec
John C. Deddens	[illegible]	D7949	JCD	Sec

Title:

S = Senior Analyst
RP = Resolution Analyst Primary
RS = Resolution Analyst Secondary
SP = Special Projects Analyst
P = Primary Analyst
Sec = Secondary Analyst

Shearon Harris Unit 1 RFC-7 4-24-97 PRIMARY

Name (print)	Name (sign)	User ID	Initials
Richard D Rehak	Richard D Rehak	R5555	RDR
Leonard D Kester	Leonard D Kester	K1903	LDK
Paul R Cocklin	Paul R Cocklin	C3556	PRC
Daniel Folsom	Daniel Folsom	F8805	DF
Donald Wayne Benson	Donald Wayne Benson	B2153	DWB
Carla W Keziah ~~Carla W Keziah~~	Carla W Keziah	K3270	CWK
Ed Ericson	Ed Ericson	E4963	EE
Thomas M. Barnes	Thomas M. Barnes Jr	B4370	TMB
Rodney Scott Miller	[illegible]	M8902	RSM
Michael S. Dohse	Michael S. Dohse	D6818	MSD
Stephen J. Beehner	[illegible]	B4838	SJB
B.C. Moon	[illegible]	M0155	BCM
Rick S. Williams	Rick Williams	W9658	RSW
Talmadge P. Callison	Talmadge P. Callison	C6308	TPC
Terry L. Tate	Terry L. Tate	T9924	TLT
Thomas D. Troutman	Thomas D. Troutman	T4180	TDT

REMOTE INSTALLATION, CALIBRATION AND REMOVAL

OF SM-22 MANIPULATOR

PROCEDURE NO.

STD-400-160

REVISION 0

ABB COMBUSTION ENGINEERING NUCLEAR OPERATIONS

Windsor, CT
Chattanooga, TN

PREPARED BY: P.K. Lang DATE: 7-13-95

APPROVED BY: [signature] DATE: 7-14-95
Quality Operations

APPROVED BY: [signature] DATE: 7/13/95
Manager, Primary Support Technology

TABLE OF CONTENTS

1.0 OBJECTIVE

1.1 This procedure provides the general instruction for Installation, Calibration and Removal of the SM-22 Manipulator.

2.0 REFERENCE

2.1 ZETEC Eddynet Fixture Control for SM-10, SM-16, SM-20 and SM-22 Fixtures, EN-112-EM.

2.3 ABB CENO Quality Assurance Manual, QAM-100.

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. A HEPA system shall be installed and operating on one leg of the generator at all times.

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° 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 S/G 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 cold leg 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-22 will involve hooking up fixture cables to the appropriate locations on the SM-22 control box; booting the ACQUISITION and FIXTURE CONTROL software, mounting the trunk assembly to the manway, setting an encoder offset; installing the arm assembly, installing the guide tube with conduit attached, leveling the arm assembly inside the steam generator and calibrating the fixture.

4.2 Computer Interface

4.2.1 Remove power from all instruments, with the exception of the controlling computer, **before** connecting or disconnecting cables

4.3 Fixture Interface

4.3.1 The SM-22 Controller can be located up to 100 feet from the fixture. It is connected with extension cables, which can be "daisy-chained" as required.

4.4 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. Verify the video is operational

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 Plug in the LAN Interface Box or MIZ-30. The SM-22 is now ready for computer control.

4.6 <u>Initial Check-Out</u>

4.6.1 Apply power to all components of the system.

4.6.2 The system will boot to X-Windows with the Eddynet Global Menu at the top.

4.6.3 Select Acquisition, Setup Acquisition, and type in the LAN interface number (LAN Box serial number). Select *Use* to enter the information and exit the window.

4.6.4 Select Acquisition, Fixture Control. This will initialize control of the fixture.

4.6.5 Select File, Modify Setup and enter values required. The Modify Setup window contains information on generator type/leg, fixture type/layout, manway location, graphic window layout, specifics on tube number and pitch distances and fixture lengths. Select *Use* to enter the information.

4.6.6 Select Tools, Enable Control from the Fixture Control window. This will establish control of the fixture. Press the LAN RESET button.

NOTE: Enable Control must be accomplished prior to any other control function.

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 SM-22 Trunk Functional Check

1. Connect the trunk extension cable to the trunk

2. From the TOOLS menu select LEVEL TILT

3. Click the mouse buttons on the MANUAL TILT buttons for both up and down. Verify that the tilt motor is operating correctly.

4. Verify that the inclinometer lights are operating properly by having the containment personnel physically tilt the up and down (upper set) as well as from side to side (lower set).

5. Disconnect the trunk extension cable from the trunk connector.

4.6.8 SM-22 Arms Functional Check

1. Open the UTILITIES MENU, ENCODER VALUES.

2. Working with the containment personnel, verify that when the POLE and ARM are moving that the encoder values change in a steady manner, increasing in one direction and decreasing in the other direction. Check the following functions using the Control Buttons in the FREE RUN mode.

Pole CW, CCW-use all four arrow buttons for the pole rotational control. With the Pole Clockwise buttons, the encoder values will increase; with the Pole Counterclockwise buttons, the values will decrease.

Arm CW, CCW-use all four buttons for the arm rotational control. With the Arm Clockwise buttons, the encoder values will increase; with the Arm Counterclockwise, the values will decrease.

3. Have the containment personnel raise the mast assembly. An audible click indicates that the assembly is locked in the up position.

4. Verify that the lift motor is operating correctly with the LIFT UP,.DOWN buttons in FIXTURE CONTROL. Make sure that you fully extend and lower the lift motor in order to check the microswitches at each end of the mast assembly.

5. Install the camera on the mast assembly. Turn camera on and verify the camera settings by watching the monitor. Make adjustments as necessary.

6. Verify that the fixture's light is working. Have the containment personnel check both lights by flipping the Lamp 1 and Lamp 2 toggle switch on the SM-22 Fixture Controller.

7. Position the camera arm over the pole arm using the control buttons in FIXTURE CONTROL.

8. Have the containment personnel install the Offset Guide Tube Assembly on the end of the camera head assembly.

9. Using the control buttons in FIXTURE CONTROL, rotate the camera arm and lower the lift motor until the Offset Guide Tube is centered directly over the pole arm gearbox. A recessed circle is machined into the gearbox cover as an offset mark. Have the containment personnel verify that the Offset Guide Tube is directly over the recessed circle by looking through the tube. See Figure 1.

NOTE: THE SET OFFSET PROCEDURE IS CRITICAL FOR PROPER OPERATION OF THE SM-22 FIXTURE.

10. In FIXTURE CONTROL, select TOOLS and view SET OFFSET menu. Select the ARM & POLE option to set the offset. Setting the fixture's offset establishes the known zero point for fixture calibration.

NOTE: A SUCCESSFUL CALIBRATION CANNOT BE PERFORMED UNLESS THE OFFSET IS DONE CORRECTLY.

11. Remove the Offset Guide Tube assembly from the camera head and remove the camera head assembly from the camera arm. Lower the mast assembly by pulling up on the latch. The SM-22 is now ready to be moved to the platform

4.9 Remove AC power from the SM-22 controller before disconnecting cables. The fixture cables can be disconnected at this point and the fixture can be transported to the steam generator platform for installation.

5.0 Installation Sequence

5.1 Installing the SM-22 Trunk

The trunk has already been checked out and transported to the platform

5.1.1 Set the trunk swing to zero degrees by turning the trunk pivot with a 9/16 box end wrench.

NOTE: DO NOT USE A CRESCENT WRENCH AS IT CAN DAMAGE THE TRUNK PIVOT.

5.1.2 With the trunk on its side slide it into the manway until the trunk flange is flush with the manway surface.

5.1.3 Rotate the trunk 90 degrees. See Figure 2

5.1.4 Install the four manway bolts. Tighten all of them by hand so that the trunk flange remains flush with the manway surface mount, but the fixture still rotates for final adjustment.

5.1.5 With the trunk pivot, rotate the trunk until it just touches the divider plate. Back off from the divider plate by rotating the fixture the number of degrees recommended for the specific generator type and leg. See Figure 3.

5.1.6 Tighten the five socket head screws with a 1/4 inch hex driver or allen wrench. These screws prevent the trunk from further rotation after it is set.

5.1.7 Connect the trunk extension cables.

5.1.8 Using a 9/16 inch box wrench, rotate the manway rack until the fixture's level light (lower green) is lit. See Figure 4.

5.1.9 Install the manway clamp as far up the track as possible, ensuring that the top of the clamp assembly securely contracts the flat surface of the manway. Adjust the clamp as necessary so a tight fit is made when the manway clamp lever is pushed all the way up.

5.1.10 Tighten the two upper manway bolts again using a 1-1/4 inch boxend wrench. Next, tighten the two lower manway bolts again. Verify that the lower green light is on.

5.1.11 When the trunk installation is complete, the lower green light should be steady. If it is not, loosen the bolts, remove the clamp, and repeat steps 5.1.8 through 5.1.10.

NOTE: THE TRUNK IS NOT CORRECTLY INSTALLED UNTIL THE CLAMP IS IN, THE BOLTS ARE TIGHTENED, AND THE LOWER GREEN LIGHT IS LIT. NEVER FULLY TIGHTEN THE MANWAY BOLTS, UNLESS THE MANWAY CLAMP IS SECURELY INSTALLED. THE CLAMP SIMULATES STRESS AND PROVIDES SUPPORT FOR THE ENTIRE TRUNK.

5.2 Installing the SM-22 Arm Assembly

5.2.1 Remove the manway clamp

5.2.2 Engage the carriage assembly wheels in the track and carefully slide the arm assembly up along the trunk. Make sure the cable feeds smoothly into the manway.

NOTE: RUN THE CABLES ALONG THE SIDE OF THE TRUNK OPPOSITE THE DIVIDER PLATE.

NOTE: ENSURE THAT ALL OF THE CABLE SLACK IS INSIDE THE GENERATOR BOWL BEFORE PUSHING THE ARM ASSEMBLY UP THE TRUNK.

5.2.3 Attach the "nukie" stick to the ball on the end of the pole assembly. See Figure 5.

5.2.4 Using the "nukie" stick, continue to slide the arm assembly all the way up until it reaches the end of the trunk. At this point it should reach the carriage lock and remain supported by this latch.

5.2.5 Flip the air valve switch to the lock position and remove the "nukie" stick.

5.2.6 With FIXTURE CONTROL in FREE RUN, use the control buttons to position the Pole and Camera Arms for attaching the camera head, guide tube and conduit.

5.2.7 Reach up and raise the mast assembly until the lock clicks.

5.2.8 Install the guide tube and conduit assembly on the camera head. Verify that the guide tube can be seen on the monitor.

5.2.9 Attach the camera head and guide tube with the conduit assembly to the mast assembly.

NOTE: RUN THE CONDUIT ALONG THE SIDE OF THE TRUNK OPPOSITE THE DIVIDER PLATE.

5.2.10 Reinstall the manway clamp.

5.2.11 With the camera head installed, use FIXTURE CONTROL TOOLS menu to select LEVEL TILT dialogue box. Click the mouse on AUTO LEVEL in the dialogue box to level the tilt motor. Wait until you see the following message in the message box of FIXTURE CONTROL. AUTO TILT UP COMPLETED. The tilt motor should now be positioned as shown in Figure 6.

5.2.12 Have the platform personnel verify that both the upper and lower green lights are lit. An occasional flicker between green and red is acceptable.

5.3 The SM-22 is now installed.

6.0 CALIBRATION

After the fixture is installed and leveled, it needs to be orientated with fixed locations or calibration points. The calibration points are stored to the setup file.

NOTE: Fixture calibration is done in the FREE RUN mode. AS calibration points are located and added it is very important ensure that the calibration point location is correctly input. The arm must be "broken" correctly when locating each calibration point or the calibration will be invalid.

6.1 Use the LIFT UP control button to bring the guide tube closer to the tubesheet.

6.2 With FIXTURE CONTROL, view the UTILITIES pull down menu and click on the SUGGESTED CALIBRATION POINTS line to view the dialogue box. Move the dialogue box somewhere on the screen that is easily referenced without interfering with the calibration process.

6.3 In the FREE RUN mode use the control buttons to position the guide tube under the first calibration point. Add this known location to the setup file with the ADD CAL. POINT dialogue box.

6.3.1 To view the ADD CAL. POINT dialogue box, click on TOOLS pull down menu then the ADD CAL. POINT function.

6.3.2 Verify that the row and column or row and line identifiers are the same as the calibration point.

6.3.3 Click on the USE button. The program reads and saves the encoder values for that row and column or row and line to the setup file as well as closing the ADD CAL. POINT dialogue box.

Repeat steps 6.3 through 6.3.3 for the second calibration point and any other calibration points required on the same side of the tube sheet.

6.4 Break the arm by positioning the guidetube at the corner of the tube sheet, for example, row 1 column 1 or the opposite corner depending which area has the most clearance.

6.5 Move the camera arm out of the corner first and continue to the other side of the generator.

6.6 Repeat the ADD CAL. POINT steps (6.3 through 6.3.3) on the alternate side of the generator until all the required calibration points are saved in the setup file.

6.7 Check the setup file to ensure that the calibration points are correct. To view the FIXTURE CONTROL CALIBRATION SETUP dialogue box, click on UTILITIES button then on the VIEW SETUP LINE. Scroll through the file with the scroll bar on the right-hand side of the dialogue box checking the following lines:

6.7.1 NUMCALPOINTS="x" (where "x" equals the number of calibration points added)

6.7.2 CALIBRATIONPOINT="y","Y" (where "y" and "Y" equals one CALIBRATION_POINT entry for each added calibration point for the arm and pole encoder values and counts for each location)

6.8 If the setup file is correct, archive the calibration to the setup file by selecting Archive, Archive calibration. This function copies the current setup file to the hard drive. The default path name is:

/$JOBDIR/setup/fix_ctrl/fix_ctrl.'hostname'.arc

6.9 Input the new file name in the ARCHIVE SELECTED text field and click OK. This saved setup can be loaded at anytime using the LOAD ARCHIVE CAL. dialogue box.

6.10 Once the fixture is calibrated, open the FIXTURE GRAPHICS dialogue box. The dialogue box updates during acquisition to show the relationship of the fixture's arms within the bowl.

7.0 <u>OPERATION</u>

7.1 The fixture is controlled in three different modes-FREE RUN, MANUAL and INSPECTION. To use any mode, the fixture must be enabled. The FREE RUN mode allows the operator direct control over fixture motors. To run under MANUAL mode the fixture must be calibrated. With the calibrated fixture, MANUAL mode allows random access to the tube sheet by specifying a specific tube. The INSPECTION mode requires a database to be loaded. After a database is loaded a test list can be run.

7.2 To operate the fixture in the free run mode, from the Fixture Control window, select <u>M</u>ode, <u>F</u>ree Run. This mode is useful for moving the fixture to a general area such as the manway or for breaking the arm to the opposite side of the tubesheet.

7.3 The rotational control buttons move the arm and pole motors in a clockwise or counterclockwise direction.To move the fixture in free run mode, with the mouse, click the large rotational control buttons for continuous movement. Click and hold the small buttons for jog movement. The small buttons will only move the fixture when pressed and held. The location of the guide tube will be displayed under *Actual*.

7.4 The linear controls move the fixture in a linear pattern as compared to a rotational (angular) move. The linear control is active only after a calibration is complete.

7.5 After calibration, use the wrist control buttons to position the second guide tube under the tube of interest while in the FREE RUN mode. These buttons function the same as the arm and pole with the larger being toggle buttons-press and release to start, press and release again to stop-and the smaller being push buttons-press and hold to run.

7.6 To stop movement of the fixture click the *STOP* button in the bottom of the Fixture Control box.

7.7 To raise and lower the fixture, click the Lift arrow buttons.

7.8 To operate the fixture in the **manual mode**, from the Fixture Control window, select Mode, Manual. This mode allows inputting of "Desired" locations.

7.9 To move the fixture to a specific location, click the cursor to the "Desired" row or column box. Type the location and click *Move Fixture*.

7.10 The arrow buttons can also be used to input the desired location. Each click of an arrow button increments the desired location by one (up or down). Click *Move Fixture* to send the fixture to the next location.

7.11 The Lift arrow and the *STOP* buttons are in the same location in the manual mode as the free run mode and perform the same task.

7.12 If the guide tube needs to be centered or moved less than a tube pitch the *Jog* arrow buttons can be used. Clicking these arrows will add or subtract a distance to offset the *Actual* location. This is displayed under *Error*. Each time an arrow is pressed the adjustment is made by the amount of the jog increment (*Jog Inc.*). If the amount of *Error* is changed after the fixture is on condition, *Move Fixture* must be pressed to move the fixture the amount of the error induced. Care must be taken not to adjust the error too much so as to move the guide to an entire pitch and thus inspect the wrong tube.

7.13 To operate the fixture in the **inspection mode**, a preprogrammed inspection plan or data base must have been inputted prior to using the mode. To retrieve the inspection plan or data base, select File, Database, then either Select Test Plan or Select Database bringing up the respective selection window. Choose the appropriate file by clicking and clicking *Use*.

7.14 If Test Plan is chosen, the sort method must also be chosen. Click on *Select Sort Method*. Select the test pattern (test along rows or columns) and the starting point (low number to high number or high number to low number). Click on *Use*.

7.15 Select Mode; Inspection. The test plan will be displayed with a highlight bar across the *Selected Test*. Click on *Selected Test* to move the fixture. Click on *Next Test* to move fixture to the next entry. The highlight bar will move to the next entry as well as the fixture. The actual location will be displayed under *Actual*.

7.16 The *Jog*, *Lift* arrow, and *STOP* buttons operate as in the manual mode. Adjustments to the jog increment are performed in the manual mode.

8.0 REMOVAL OF FIXTURE

8.1 Position the fixture for guide tube removal by selecting Tools, Guide Tube Pickup from the Fixture Control window.

NOTE: If the arm is not on the correct side of the generator (toward divider plate), break the arm to the correct side.

8.2 Remove the manway clamp.

Remove the guide tube, conduit assembly and camera head.

Attach the "nukie" stick to the ball stud on the end of the camera arm. Turn air solenoid switch to the "UNLOCK" position.

8.3 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 Position yourself in such a way that you can use both hands on the "nukie: stick to carefully roll the arm down to the lower latch.

8.5 Remove the "nukie" stick from the arm.

8.6 Position the fixture for removal.

8.7 Reach inside the manway and grasp the end of the pole. 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.

CAUTION: DO NOT HOLD IT ON TOP OF THE MOTOR OR YOU WILL PINCH YOUR HAND WHEN IT COMES DOWN THE TRUNK.

8.8 Slowly lower the arm down the trunk, making sure the cable does not hang up on the end of the trunk. Disengage the wheels from the track and set the arm aside. Remove trunk extension cable and air line.

8.9 Remove the manway bolts.

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

FIGURE 1

Setting the Offset for the SM-22 Fixture.

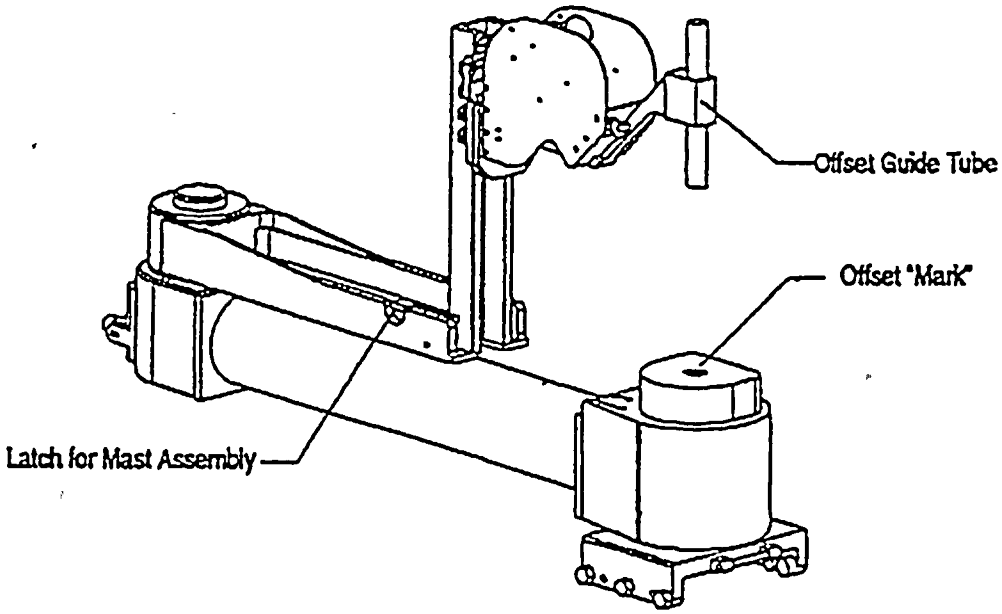


FIGURE 2

Installing the Trunk.

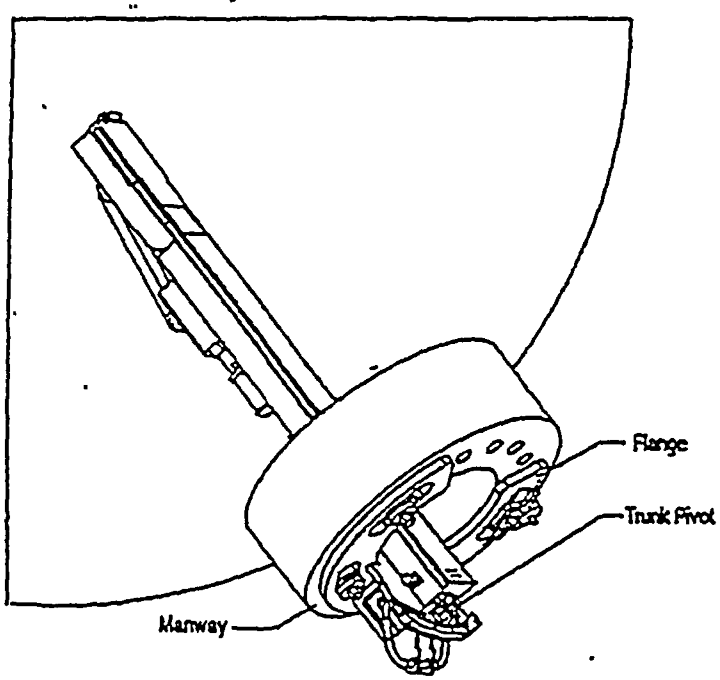


FIGURE 3

Attaching the Manway Ring and Rotating the Trunk.

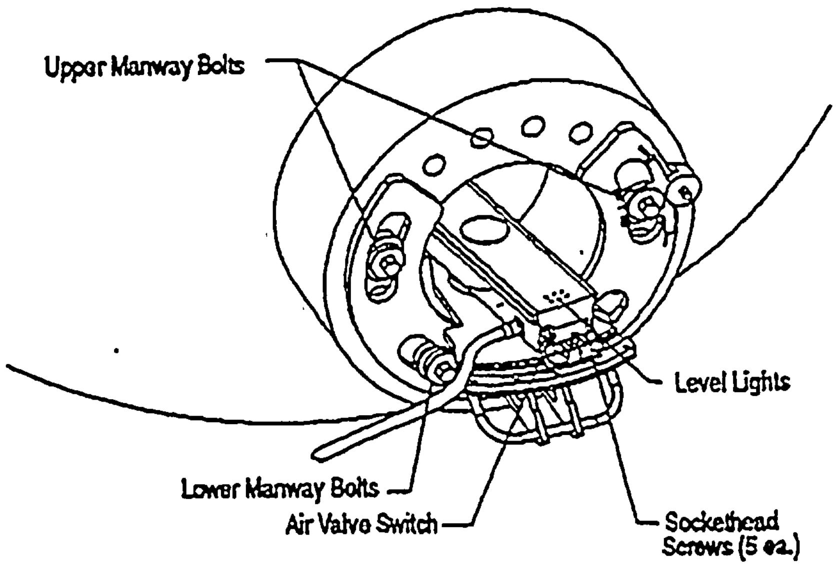


FIGURE 4

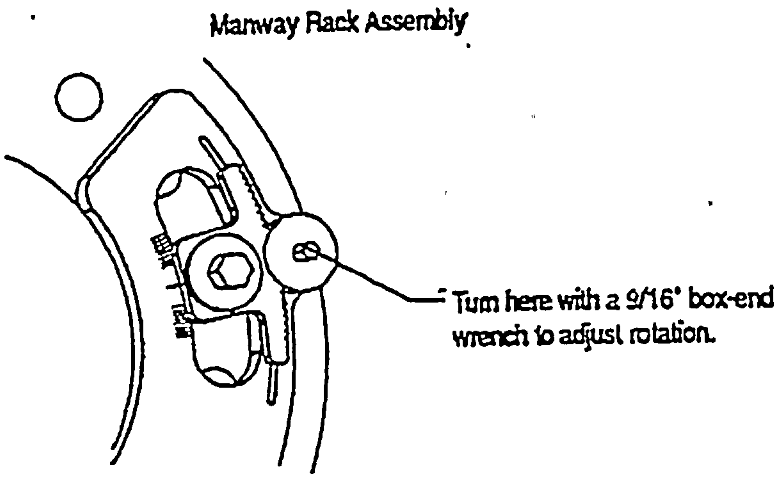

Manway Rack Assembly
Turn here with a 9/16" box-end wrench to adjust rotation.

FIGURE 5

SM-22—Arm Assembly Parallel with Tube Sheet.

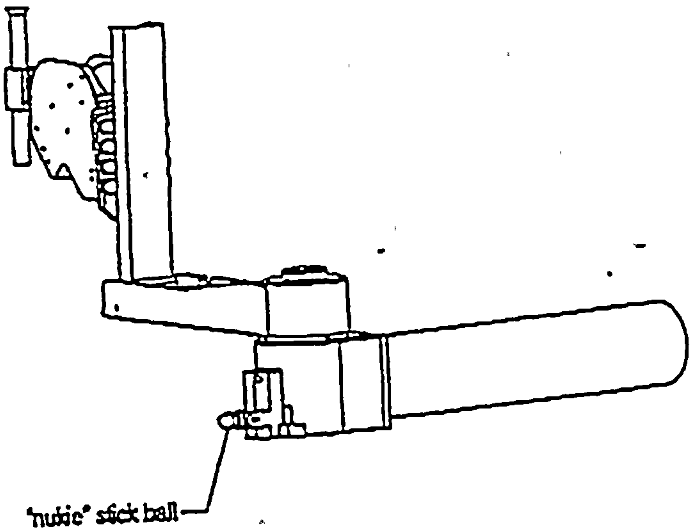
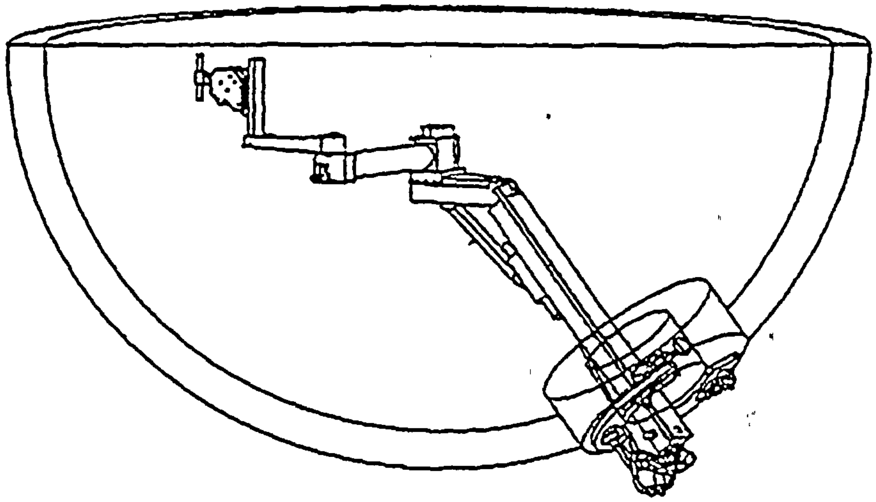


FIGURE 6

SM-22 Fixture Installed in Generator.



ABB

Procedure No.: HNP-100-004
Revision No.: 1
Page No.: 1of 36

Project No.:________________

PROCEDURE FOR MULTIFREQUENCY EDDY CURRENT EXAMINATION OF NONFERROMAGNETIC STEAM GENERATOR TUBING USING MIZ-18/MIZ-30 EQUIPMENT

CAROLINA POWER & LIGHT CO.

SHEARON HARRIS

ABB COMBUSTION ENGINEERING NUCLEAR OPERATIONS
Windsor, CT
Chattanooga, TN

APPROVED BY: ________________ DATE: 3-25-97
T. U. Bipes
Level III

APPROVED BY: ________________ DATE: 4/2/97
Quality Assurance

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1.0 OBJECTIVE:

Eddy current examination 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 inspections. The eddy current equipment operator is responsible for proper equipment interconnection, equipment setup and collection of eddy current data. The shift supervisor will provide additional technical support during all these activities. The evaluation of the results will be performed in accordance with the procedure and guideline referenced in reference 3.6 and 3.7.

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 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", 1983 Edition, summer 1983 addenda.

3.0 REFERENCES:

3.1 ABB Combustion Engineering Nuclear Operations, Quality Assurance Manual, QAM-100, latest revision.

3.2 ABB Combustion Engineering Nuclear Operations, Quality Assurance Procedure Manual, QAM-101, latest revision.

3.3 Zetec Eddynet MIZ-18 Acquire Program User Guide.

3.4 Zetec Eddynet MIZ-30 Acquire 30D Program User Guide.

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

3.6 Steam Generator Eddy Current Interpretation Guidelines, HNP-100-005, latest revision.

3.7 Procedure for control of Eddy Current Data for use with Multiforth or Eddynet Acquisition Systems, HNP-100-006, latest revision.

4.0 PERSONNEL REQUIREMENTS:

ABB Combustion Engineering (ABB-CE) personnel shall be certified in accordance with ABB Combustion Engineering 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 event ABB-CE utilizes a subcontractor, ABB-CE 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 record the results. He shall receive the necessary guidance or supervision from a certified ET Level II or III.

4.2 A Level I trainee shall work with a certified individual (minimum Level I) while operating the eddy current test equipment (i.e. MIZ-18/MIZ-30).

4.3 The initial equipment set-up at the start of the test program shall be verified by a certified ET Level II or III.

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

4.5 Certification, including eye certification shall be verified for testing personnel and an entry made in Attachment 1 Procedure Sign-off, Section 1.

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 shall be set up in an area designated by the ABB-CE Shift Supervisor and approved by site personnel. All equipment set-ups will be at the direction of the ABB-CE Shift Supervisor or his designee. Figure 1 is an example of a typical ECT equipment set-up. (Attachment 1 sign-off)

5.3.1 If a Remote Data Acquisition and Analysis Trailer (RDAAT) is utilized, all 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° F or less). (Attachment 1 sign-off)

5.5 The secondary side of the steam generator shall be cooled down to the extent that the temperature of the tubes and tubesheet are 120° F or less. (Attachment 1 sign-off)

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.). (Attachment 1 sign-off)

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 (Exhibit A) shall list all the tubes that are to be inspected. The Eddy Current Test Operator shall initial or check (✓) the sheet after each tube inspection. If multiple tubes are listed on one line, such as for dual guide tubes, one check will suffice for both tubes, if tested simultaneously. If tested individually, a check should be performed for each tube, using the appropriate column. If a tube cannot be inspected (or only partially tested), the disposition shall be noted in the comment section of the examination sheet, and in a message on the recording media. Data control is maintained in accordance with Reference 3.8 or as applicable. (Attachment 1 sign-off)

5.9 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 indicating no further action was taken.

5.10 A communication system shall be set up between the Eddy Current Instrument Operator, the steam generator platform, and health physics personnel (containment). (Attachment 1 sign-off)

5.11 The primary piping nozzle openings shall have been sealed prior to installing ECT equipment in the steam generator. This is accomplished with nozzle dams or nozzle covers establishing a foreign material exclusion boundary to the primary system. (Attachment 1 sign-off)

6.0 CALIBRATION STANDARDS:

6.1 The calibration standard shall 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 support rings, copper rings, and other features as needed to provide signals for subsequent multi-parameter frequency mixing by the data analyst. Fabrication of the calibration standards shall meet the requirements of the ASME Code.

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

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

6.3.1 Single hole drilled 100% through wall 0.052 in. diameter.

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

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

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

6.3.5 Four flat-bottomed drill hole 3/16 in. diameter, 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.

6.3.8 Carbon steel ring, simulated support plate.

6.4 Other special calibration standards (when used) shall contain a variety of notches, holes and grooves for calibration of special setups such as high resolution bobbin and rotating probes.

6.5 Calibration standards used shall be logged in section 4.0 of Attachment 1 Procedure Sign-off.

7.0 EQUIPMENT:

All eddy current test equipment provided by ABB Combustion Engineering shall be certified to be equivalent or exceed the applicable requirements of the ASME Code, Section XI, Appendix IV, paragraph IV-3000, with Code Case N-401-1 addressing the use of digital examination equipment. ABB Combustion Engineering may utilize equipment provided by subcontractors that is certified to the above requirements. Documentation of calibration will be provided prior to the start of the inspection and be logged on Attachment 1 Procedure Sign-off. A typical equipment list is provided below.

7.1 HP Server Work Station 400 or 700 series computer or equivalent with hard disc drive, Eddynet Acquisition Software Installation Disc and Eddynet Acquisition Module or license.

7.2 Optical Disc Drive HP model 650A, 1.3, 2.6 or equivalent and a supply of properly formatted optical disks.

7.3 MIZ-18/MIZ-30* Remote Data Acquisition Unit (RDAU). Certificate of Calibration required.

7.4 LAN Interface Box* (not required when using MIZ-30.

7.5 LAN Reset Box.

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

7.7 Remote controlled manipulator* (optional), eg. SM-10, SM-20, SM-22, Genesis.

7.8 Mechanical probe pusher and flexible probe guide material.

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

7.10 Eddy Current Examination Sheets.

7.11 Video Monitoring Equipment.

7.12 Communication System.

*NOTE: Equipment noted with an asterisk shall be logged on Attachment 1. In the event that equipment is replaced, replacement equipment shall be logged also.

8.0 EQUIPMENT SETUP:

8.1 Satisfy applicable requirements specified in Section 5.0 (Precautions and Prerequisites).

8.2 Set up communications between steam generator platform and data station as required. (Attachment 1 sign-off)

8.3 Install the remote manipulator into the steam generator primary head as required. (Attachment 1 sign-off)

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

8.5 Interconnect the acquisition system as shown in Figure 1 and 3 described as follows:

8.5.1 Connect the monitor to the rear of the system processing unit (SPU) by using the appropriate cable and attaching it to the video card on the SPU.

8.5.2 Connect the mouse to the keyboard, then connect the keyboard to the SPU with the appropriate cable.

8.5.3 Connect the Eddynet Acquisition Module.

8.5.4 Connect the hard drive to the SPU with the small computer systems interface (SCSI) cable. (Required if the hard drive is separate from the SPU)

8.5.5 Connect the Optical Disc Drive to the SCSI connector on the hard drive with the SCSI cables. Terminate the SCSI bus by placing a terminator at the appropriate location.

8.5.6 Connect the Local Area Network (LAN) connector on the rear of the SPU to the LAN Interface Box with approved LAN cables. The MIZ-30 has an internal LAN Interface Box.

8.5.7 Connect the LAN Reset Box to the LAN Interface Box with approved LAN interconnect cables. The MIZ-30's LAN Reset Box connects to the MIZ-30. (RG-58 A/U type of equivalent).

8.5.8 Install Termination Caps on each end of the LAN at appropriate locations (if 10base2 cable is used).

8.5.9 Connect the LAN Interface Box to the RDAU using the appropriate (IEEE-488 type) connector and cables (Omit this step for MIZ-30). Interconnect the probe pusher controller to the RDAU.

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

8.5.11 If data is to be spooled "send data" from the acquisition station to the analysis station, use appropriate networking device (HP Router or equivalent) along with LAN cable or Fiber-Optics cable to interconnect both systems. (Attachment 1 sign-off)

8.6 When a reference probe is required for absolute data attach the reference probe to the connector labeled 'ref'. The reference probe shall be placed in a reference standard. Extension cables may be used with equal amounts connected to the test probe and reference probe. Extension cables and cable lengths must be in compliance with the approved setup sheets based on EPRI recommended ACTS.

8.7 Perform a functional check out to verify that the eddy current system if operating correctly. This can be achieved by recording a calibration standard and reviewing the data. (Attachment 1 sign-off)

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 thru C. The appropriate Appendix will be selected based on the particular type of inspection and reference to the EPRI qualified techniques, Appendix H, or as approved by the utility. The operator will be provided written instruction by the shift supervisor with the issue of a completed "Set Up Instruction" Form. See Exhibits B and B1.

9.1 Zetec Eddynet Data Acquisition System.

NOTE: HP-UX and EDDYNET files must be installed on the system hard drive before starting eddynet data acquisition. Refer to the appropriate Zetec Operation User Guide (Reference 3.3) for installation instructions.

9.1.1 Power up the CPU and select the appropriate bootable system code number per the designated system administrator (eg. P0, P1). Verify the correct time and date. The system administrator shall have input the proper system communication protocol. Polling the clusters should not be necessary. Answer 'Y' to search and remove cores. After the boot up sequence the login prompt will appear. Type the proper user number (eg. user1) as designated by the system administrator.

9.1.2 After login, the system will be in the X-Windows or HP VUE environment. The Eddynet menu will appear at the top of the screen or be generated with the appropriate icon.

9.1.3 Insert the optical storage disc into the optical disc drive (or use other appropriate media). Insure that the optical storage disc is not write protected.

9.1.4 'Mount' the optical storage disc by using the 'mount widget.' With the mouse, open the mount widget by selecting File, Administration, and Mount/unmount or similar commands.

9.1.5 Choose *Local* and select the scsi device and rod number to be mounted by clicking in the appropriate boxes.

9.1.6 Click on MOUNT Read/Write.

9.1.7 If the data is to be spooled from the acquisition station to the analysis station via a LAN, choose *Remote* and select the scsi device and rod number to be mounted by clicking in the appropriate boxes. Exit the mount widget by clicking *Quit* or Icon the widget.

9.1.8 From the Eddy Menu, select Acquisition, and Setup Acquisition. Enter the LAN box serial number in the *LAN interface number*

selection. Choose either MIZ-18 or MIZ-30 and setup the 4-hour clock if desired. Click on *Use* when finished.

9.1.9 Establish contact to the LAN Interface Hub by selecting Acquisition, Acquisition.

9.1.10 The Main Screen contains several boxes which when clicked on perform various functions. These include: Process Channels, Message Form, Summary Form, Zoom, Refresh, Next-Last Tube, Start Acquiring, File Functions, System Config and Print-FF Screen. Refer to the appropriate Zetec Operation Guidelines for information on using these functions.

9.1.11 Set up Eddynet acquisition system according to the appropriate Zetec Eddynet MIZ-18 or MIZ-30 Acquire Program User Guide. (Reference 3.3 MIZ-18 or 3.4 MIZ-30).

9.1.12 Change the acquisition setup parameters to the appropriate settings for the identi-fication of system variables. e.g.; S/G designator, Row and Column designators, printer enable, printer type, etc.

9.1.13 Configure system frequencies and operating modes (absolute or differential) as required by the appendices for examination to be performed as directed by the shift supervisor. Changes to the test frequencies, sampling rate and probe pusher speed may be accomplished through the initiation of the Set Up Instruction Form (Exhibit B MIZ-18, B1 MIZ-30).

9.1.14 Pull the probe through the calibration standard and adjust spans and rotations for all channels as described in the appendix utilized in paragraph 9.1.13.

NOTE: Check the set up menu options to insure proper pull speeds and rotation speeds.

9.1.15 Complete the summary with the following plant specific information supplied by the shift supervisor and by documenting the equipment being utilized. Specific information for reporting CAL groups will be provided by cognizant data management personnel prior to starting data acquisition.

Owner	Calibration Standard
Plant and Unit No.	S/N (S)

Date	Procedure/Revision No.
Component ID & Side	ET Operator Name/Cert.
Recording Tape No. (or equivalent)	Level
	Company Affiliation
Computer S/N	Tubing Size
Probe ID, Size and Length	RDAU S/N
	Length of Cables (as required)

NOTE: When completing the line "ET Operator Name" use the operator's last name followed by the operator's initials. EXAMPLE: "JONES JR" For consistency, no punctuation should be used.

9.1.16 Record data from the calibration standard onto the recording media at the probe speed required for the examination as defined in the applicable appendix.

9.1.17 Complete the eddy current calibration sheet recording the appropriate information and calibration time (See Exhibit C).

10.0 PROBE SPEED ADJUSTMENT:

10.1 Verify the proper speed has been input from the proper appendix by checking *Display speeds* in the probe pusher menu. Insert the probe into the tube to a known position.

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

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 one second intervals.

NOTE: Eddynet acquisition will only display one second interval marks while in the acquire (*Start Acquiring*) mode. Marks will not display in the review mode. The analysis software will calculate the average probe speed. Questions should be addressed to analysis.

10.5 The rotation speed is verified (Eddynet only) in the Acquire window by clicking File, Check rotation and input the information requested.

10.6 Bobbin testing probe speed shall not exceed 28 in./sec. for MIZ-18 testing. Faster speed may be used for MIZ-30 testing provided the proper sample rate is achieved and meets the minimum requirements of the setup form. Probe speed should be adjusted to approximately 12 in./sec. for testing row 1 and row 2 tubes, or as required by the appendix utilized in paragraph 9.0. Check the appropriate appendix for test speeds other than bobbin.

11.0 CALIBRATION VERIFICATION: (Interval/Span and Rotation Settings)

A calibration check must be recorded at the following intervals:

11.1. Within 4 hours of the previous calibration check.

NOTE: A four hour warning can be setup in the Acquisition Setup widget.

11.2 At the beginning and end of each calibration group.

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 discrepancy in calibration interval should occur in Section 11.1 - 11.3 the shift supervisor or an eddy current Level II or III shall identify the discrepancy on the eddy current calibration sheet. 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 four hour calibration.

NOTE: Should the system be found to be out of calibration, re-calibration will be required (Out of calibration per ASME Section V Article 8 Appendix I section I-862). 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 Activate the acquisition computer system.

12.3 Properly identify tube location on the acquisition system.

NOTE: When using an SM10/2x manipulator with an inspection plan, the location is automatically input. Verify the proper location with the Eddy Current Examination Sheet.

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

12.5 Retract the probe while recording the entire length of tube to be inspected on tape or equivalent recording medium. Take special care not to start the probe retraction or stop the data recording device too quickly (this may result in an incomplete examination). See the appropriate operating guidelines for details of operation.

12.6 Ensure the tubes to be tested are indicated as completed on the Eddy Current Examination Sheet. If a tube or portion of a tube is not inspectable, note any apparent cause on the Eddy Current Examination Sheet and on the acquisition system message area.

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 recording 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.

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

13.4 The optical disks shall be labeled as directed by the cognizant data management personnel.

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 11" = S/G #A on the inlet side eq. "S/G 20" = S/G #B on the outlet side, etc.

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

13.7 Typically whenever a calibration is required, three calibration pulls are recorded. Certain tests (eg. MRPC), may not require three calibration pulls due to factors, such as, radiation dose to platform worker, etc. The calibration should be review to ensure that a complete and acceptable recording has been made. In the event that the recording is incomplete or unacceptable due to probe snap, etc., another calibration shall be recorded. A minimum of one acceptable recording is required. In the event that an acceptable recording cannot be made, the lead analyst shall be consulted for a disposition.

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 examination sheets similar to Exhibit A. 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, the operator shall make an entry on the Examination Sheet (See Exhibit A) and a message made on the recording media. Verifications need only be made at required verifications points (see 14.2).

14.2 Position verification is required:

a. Prior to eddy current work in the generator.

b. At the beginning of each Zone and the bottom of an eddy current examination sheet.
c. If problems occur with the positioner.
d. Upon concluding eddy current work in the generator.

14.3 Position verification is recommended:

a. When returning to the tube sheet after lowering the arm to the manway.
b. When "breaking the arm" to the opposite side of the plenum.
c. 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 situations.

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 position verification recorded on the examination sheet must be reexamined.

15.0 RECORDING CRITERIA:

All data from the examination shall be recorded on the appropriate recording medium. The recording medium will contain at a minimum the information defined in paragraph 9.1.15.

16.0 EVALUATION:

The data analysis shall be conducted in accordance with reference 3.6.

17.0 REPORTING CRITERIA:

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

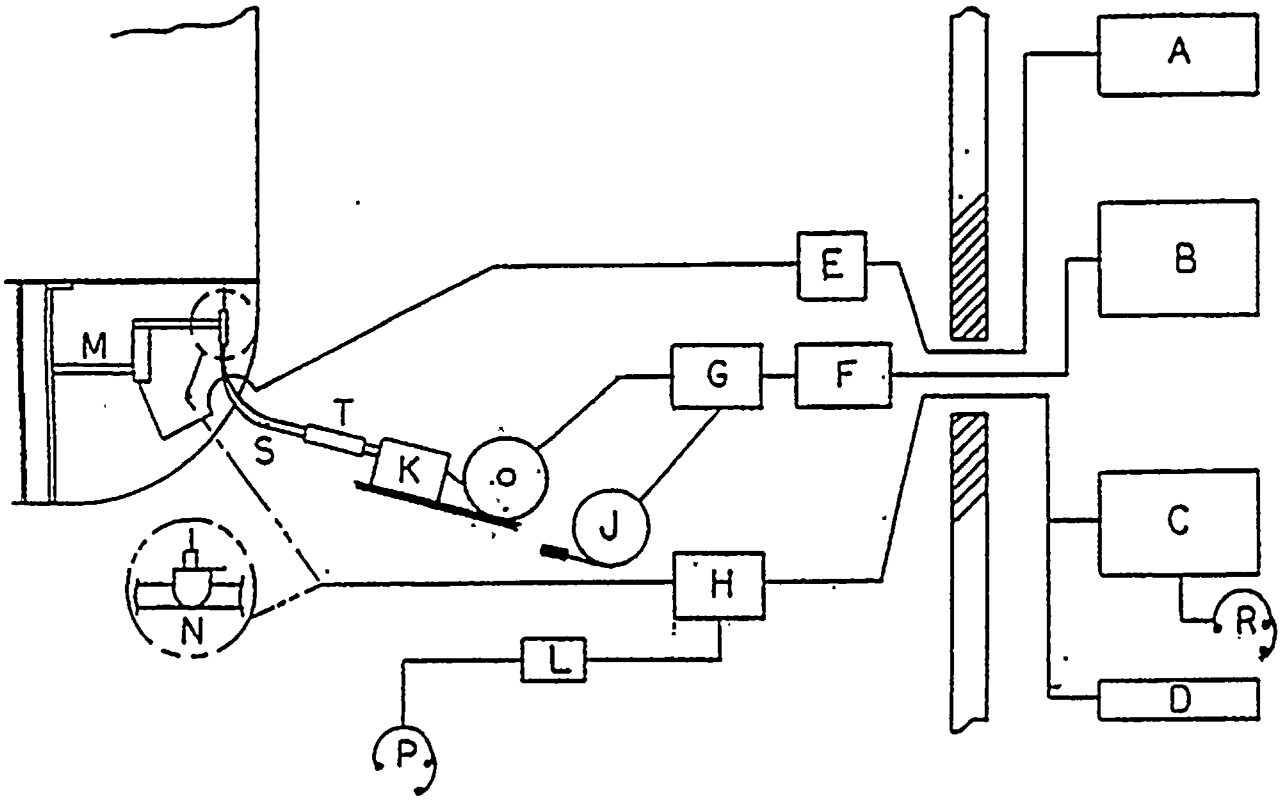
17.1 All detectable tube wall degradations.

17.2 All detectable tube dents known to obstruct probe passage.

17.3 Any detectable loose part indication

17.4 Any additional conditions that the data analyst deems necessary.

FIGURE 1



TYPICAL EDDY CURRENT TEST EQUIPMENT SET-UP DIAGRAM

A - POSITIONER CONTROLS
B - COMPUTER ACQUISITION SYSTEM
C - AUDIO/VIDEO CONTROLS
D - VCR
E - POSITIONER RELAY BOX
F - PM-1or3/SM10/20 CONTROLLER
G - MIZ-18/MIZ-30
H - AUDIO/VIDEO JUNCTION BOX
J - REFERENCE PROBE
K - PROBE PUSHER W/TEST PROBE
L - AUDIO JUNCTION BOX
M - MANIPULATOR FIXTURE
N - VIDEO CAMERA
P - PLATFORM HEADSET
R - CONTROL STATION HEADSET
S - FLEXIBLE CONDUIT
T - CALIBRATION STANDARD

FIGURE 2

TYPICAL ASME CALIBRATION STANDARD

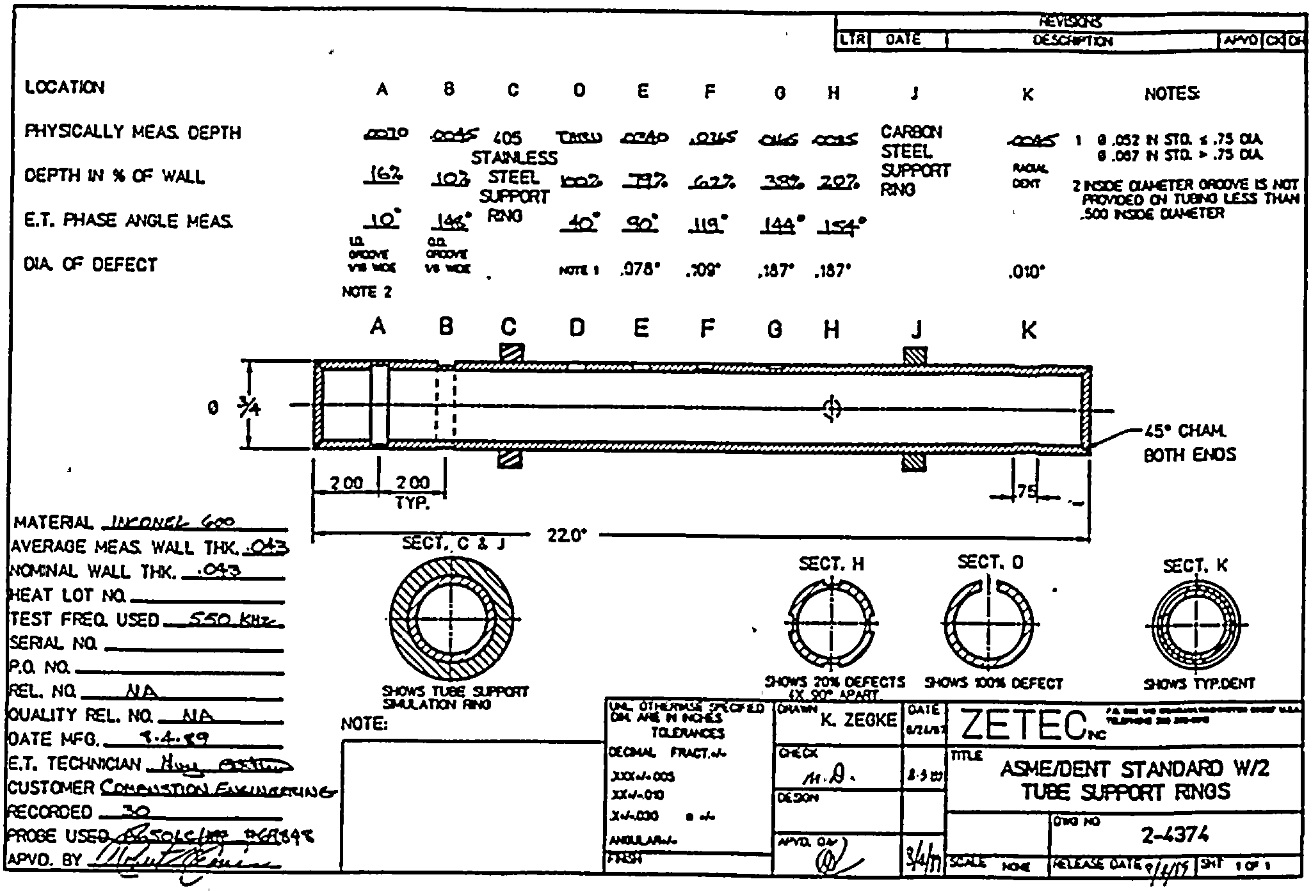


FIGURE 3

TYPICAL MIZ-18 INTERCONNECTION SCHEMATIC

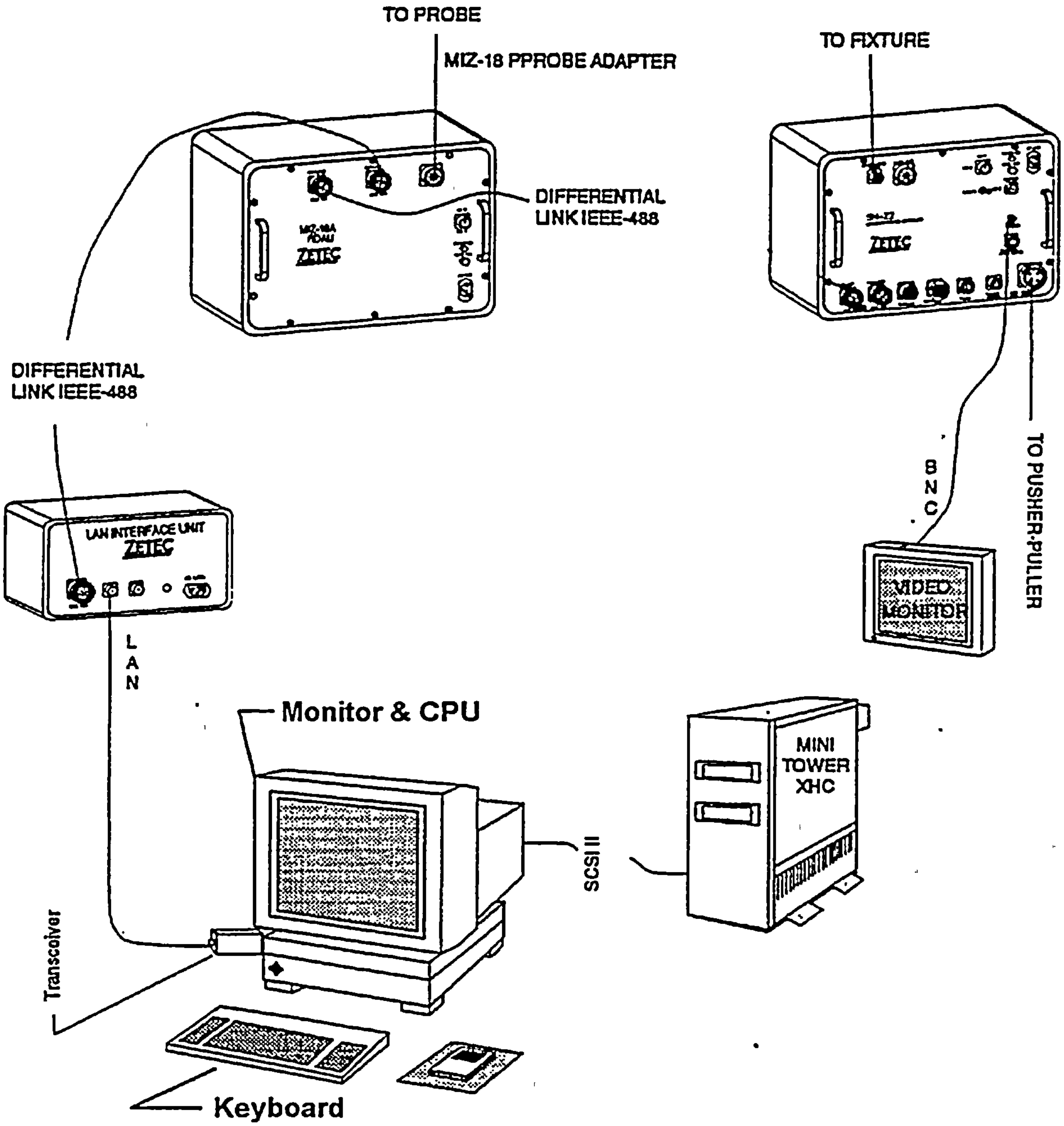
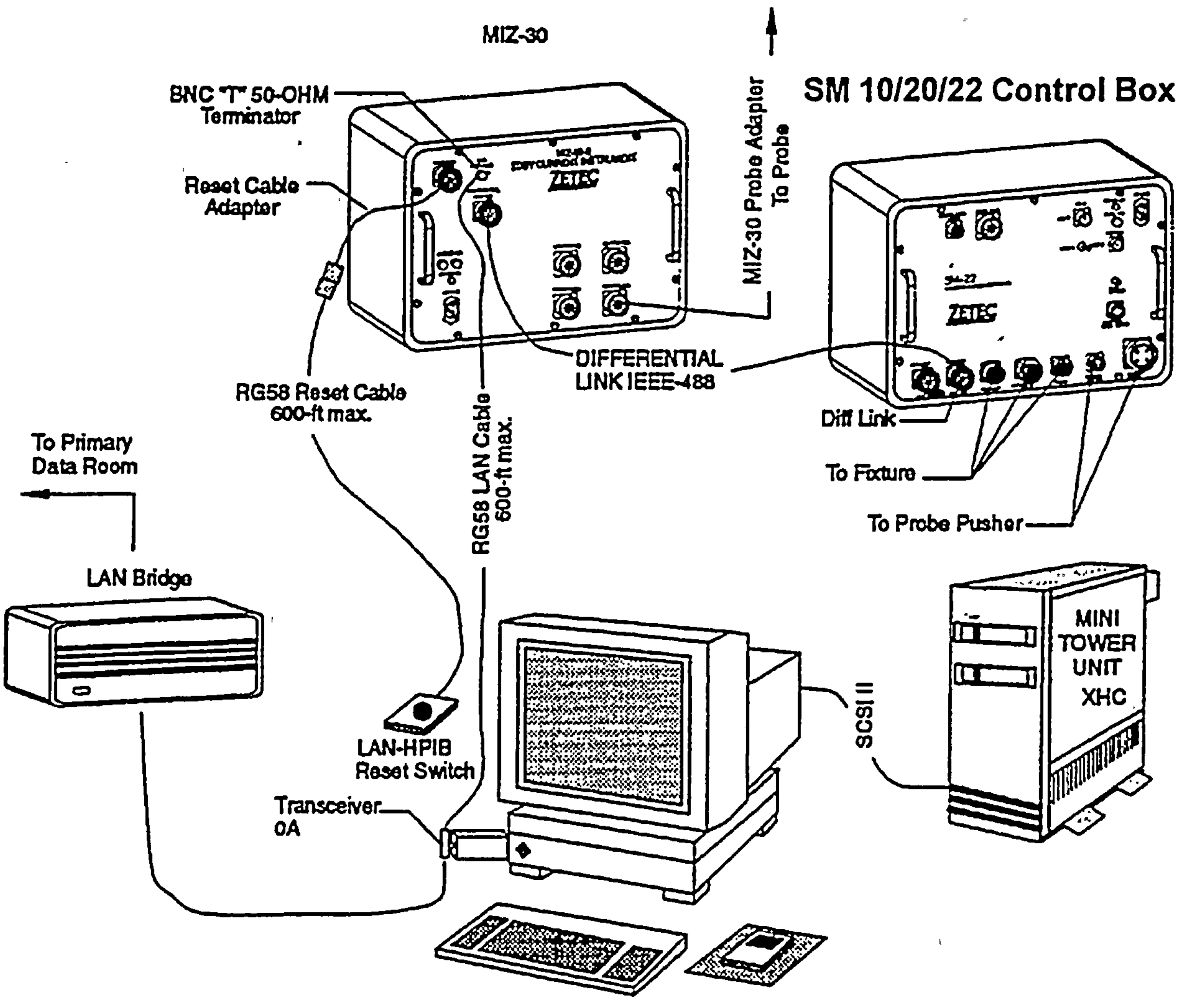


FIGURE 4



HP 400/700 Series

TYPICAL MIZ-30 INTERCONNECTION SCHEMATIC

EXHIBIT A

TYPICAL EDDY CURRENT EXAMINATION SHEET

COMBUSTION ENGINEERING EDDY CURRENT EXAMINATION SHEET

PAGE: 3

OWNER: C P & L
PLANT/UNIT: SHEARON HARRIS
S/G #
PROBE: A610MULC
FREQUENCY: 550/100/800/35 KHz
PROCEDURE: HNP-004 R0
ECT DESCRIPTION: Bobbin Full Length Exam
LEG: HOT
DATASET: SAMPLE1
ZONE:
TEST EXTENT: F/L

ROW	COL	REQ EXT	OPER INIT	REEL	TESTED DATE	COMMENTS		PREVIOUS EXAMINATION RESULTS DATE	CH	PROBE	LOCATION	VOLTS	DEG	%
14	4	F/L	TB	3H02	5-30-95									
15	4	F/L	✓											
16	4	F/L	✓											
18	5	F/L	✓											
17	5	F/L	✓											
16	5	F/L	✓											
15	5	F/L	✓					10/02/93	2	A720MULC	2H 21.6	2.8	157	MBM
14	5	F/L	✓											
13	5	F/L	✓											
12	5	F/L	✓											
11	5	F/L	✓											
10	5	F/L	✓											
9	5	F/L	✓											
8	5	F/L	TB											
7	5	F/L	FB					11/04/90	4	A720MULC	1C 27.4	5.2	87	MBM
6	5	F/L	✓											
5	5	F/L	✓											
4	5	F/L	✓											
3	5	F/L	✓											
2	5	F/L	✓											
1	5	F/L	✓											
1	6	F/L	✓											
2	6	F/L	✓											
3	6	F/L	✓											
4	6	F/L	✓					04/28/92 11/04/90	4 4	A700SFRM A720MULC	3H 9.1 3H 8.8	10.9 10.1	109 274	MBM MBM
5	6	F/L	✓											
6	6	F/L	✓											
7	6	F/L	✓					04/28/92	8	A720MULC	CTS 0.5	7.0	156	SLG
8	6	F/L	✓											
9	6	F/L	FB			PV								

Running Total of Exams: 74 This page: 30

EXHIBIT B

TYPICAL MIZ-18 SET UP INSTRUCTION FORM

MULTI-FREQUENCY EDDY CURRENT INSPECTION
SET UP INSTRUCTION
MIZ-18A

SITE:	UNIT:	COMPONENT:	SIDE: HOT COLD	DATE: / /

PROBE:	CALIBRATION STANDARD ASME: OTHER: (describe other)
PROCEDURE	TEST PURPOSE:

MIZ-18A CONFIGURATION

NUMBER: *SAMPLES PER SECOND:*
NAME:

FREQ. 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 Instruction Details

Prepared by: ______________________________ *Level* ________ *Date* __________

Approved by: ______________________________ *Level* ________ *Date* __________

EXHIBIT B-1

TYPICAL MIZ-30 SET UP INSTRUCTION FORM

Multi - Frequency Eddy Current Inspection
Set up Instructions
Miz-30

Site	Unit	Component S/G #	Side Hot Cold	Date / /
Probe Type		Calibration Standard (Circle or Describe Other) ASME OTHER		
Procedure		Test Purpose		

MIZ - 30 Configuration

Number :
Name :
Samples Per Second:
Trig :

		Board #1	Board #2	Board #3	Board #4	Board #5	Board #6	Board #7	Board #8
		Probe #	Probe #	Probe #	Probe #	Probe #	Probe #	Probe #	Probe #
		Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C	Drive A D B C
Drive polarity									
Group number									
Coil number									
Freq #1	timeslot #1								
	G :								
Freq #2	timeslot #2								
	G :								
Freq #3	timeslot #3								
	G :								
Freq #4	timeslot #4								
	G :								
Freq #5	timeslot #5								
	G :								
Freq #6	timeslot #6								
	G :								
Freq #7	timeslot #7								
	G :								
Freq #8	timeslot #8								
	G :								

Special notes to Opreator / Analyst

See Appendix ______ for Setup Instructions

Prepared by : ______________________ Level __________ Date __________
Approved by: ______________________ Level __________ Date __________

EXHIBIT C

TYPICAL EDDY CURRENT CALIBRATION SHEET

ABB Combustion Engineering	Multi-Frequency Eddy Current Calibration Data Sheet	Disk #	Side

Owner	Site/Unit	Component	Leg	Date

MIZ-18A S/N-	Procedure	Defect Std. (1)	Additional Std. (2)

Cal	Date / Time	Row / Line	Standard Run	Comments	Examiner Init/Level

Additional Comments:

Shift Supervisor Final Review of Acceptance___________________

EXHIBIT D

TYPICAL OPTICAL DISK LABEL

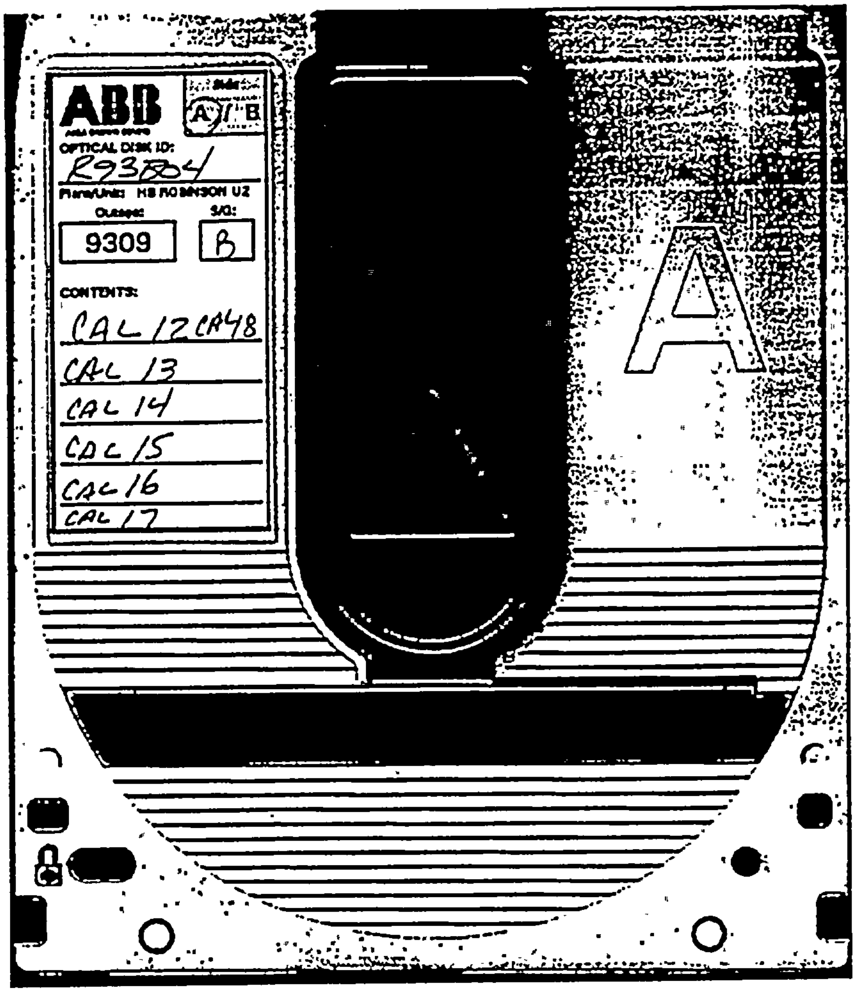


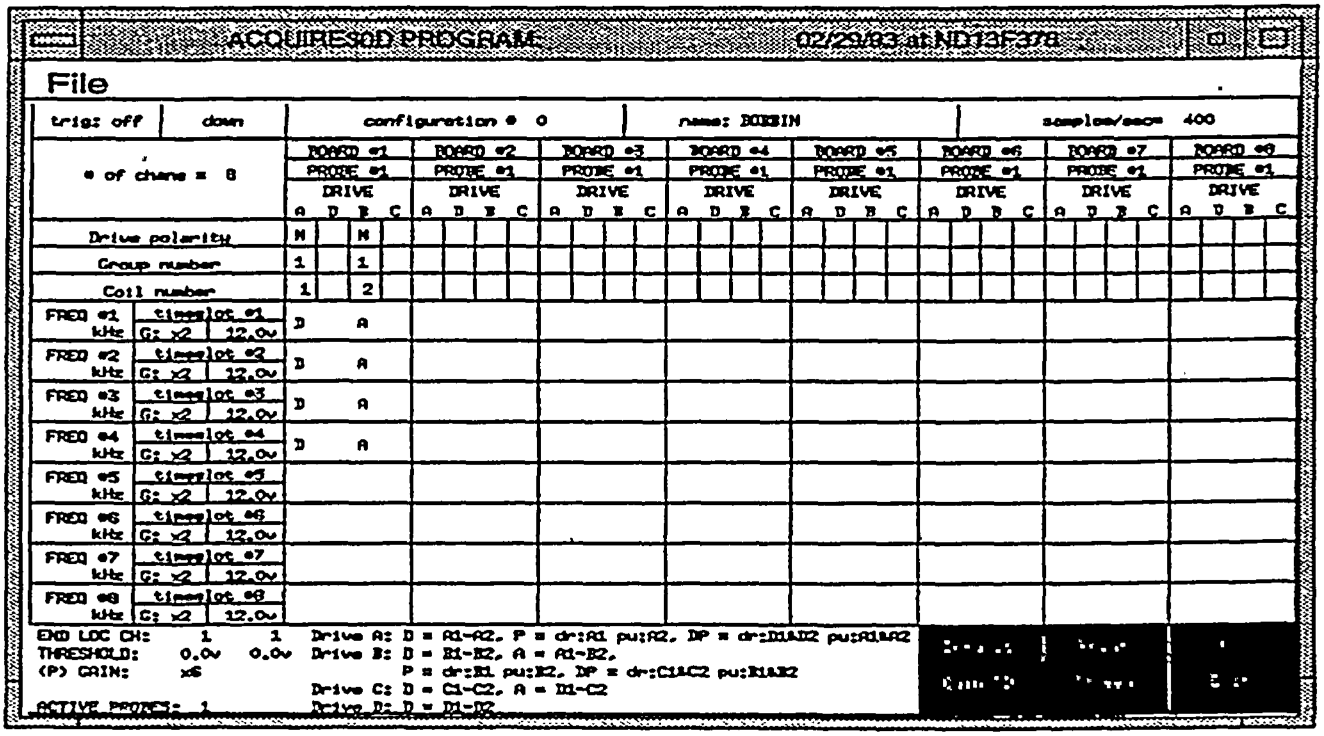
EXHIBIT E

MIZ-18 Configuration

NUMBER: NAME–: 2-4 Pin		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	550 kHz	....				////			
2	100 kHz	....				////			
3	800 kHz	....				////			
4	35 kHz	....				////			

*. Frequencies selected are for example only.
.... differential internal reference
//// absolute external reference

MIZ-18 CONFIGURATION FOR BOBBIN PROBE



MIZ-30 CONFIGURATION FOR BOBBIN PROBE

EXHIBIT F

MIZ-18 CONFIGURATION FOR ROTATING PROBE

NUMBER: NAME--:		SAMPLES per SEC:							
FREQUENCY SEQUENCE		PROBE CHANNEL SELECT							
#	FREQUENCY*	COIL	COIL 2	COIL 3	COIL 4	COIL 5	COIL 6	COIL 7	COIL 8
1	400 kHz	....				xxxx		****	
2	600 kHz	....				xxxx		****	
3	1.00 kHz	....			####	xxxx		****	
4	1 0 kHz	....		////					

*. Frequencies selected are for example only.
.... absolute internal reference (differential internal reference option available)
//// optional encoder axial travel input
trigger pulse (one pulse per 360-degree rotation)
xxxx axial flaw detector coil
**** circumferential flaw detector coil

MIZ-30 CONFIGURATION FOR ROTATING PROBE

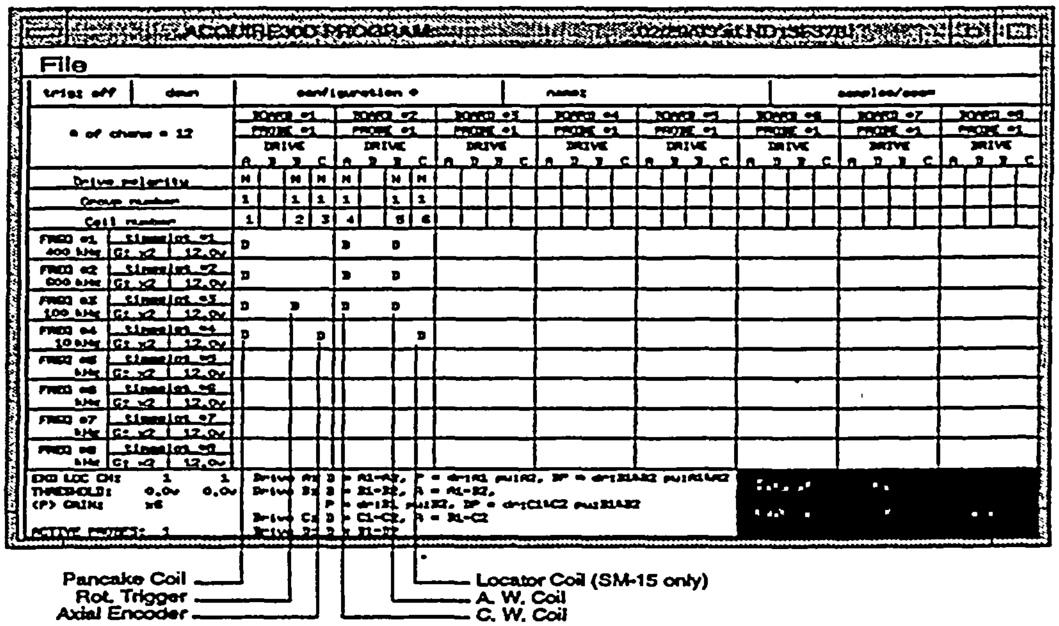
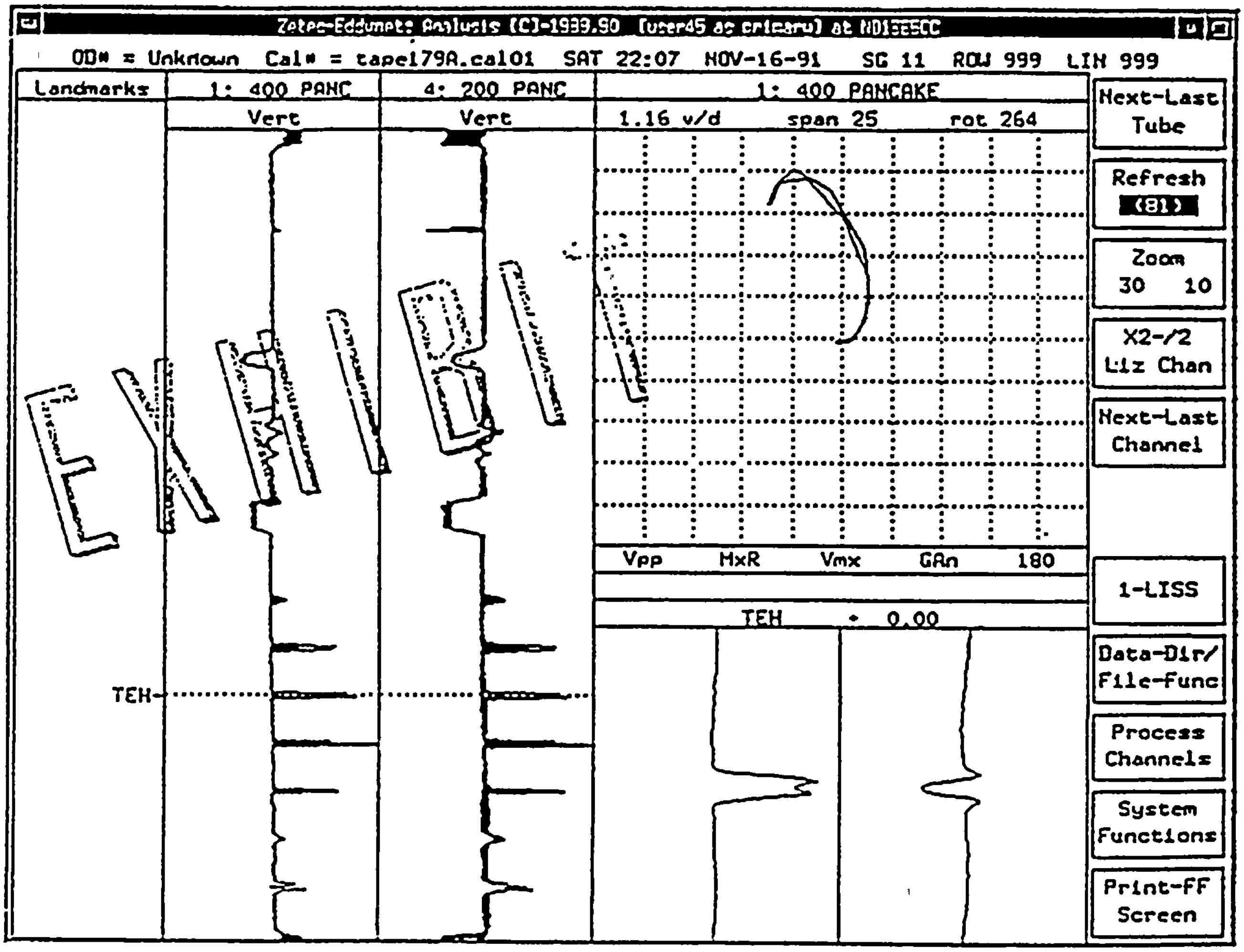


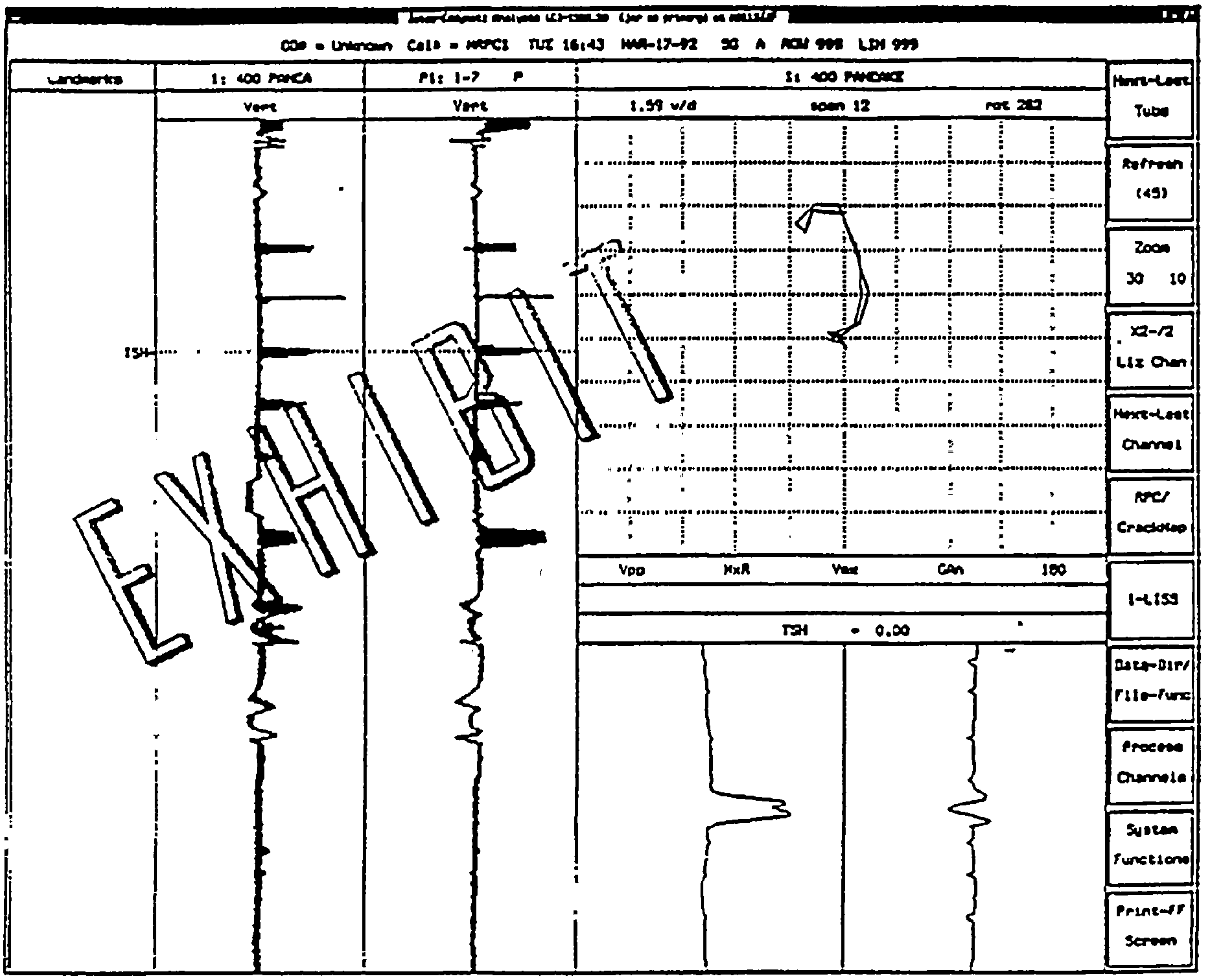
EXHIBIT G

ROTATING PROBE CALIBRATION INFORMATION



60% ASME flaw set with probe motion horizontal and flaw at 4 screen divisions

EXHIBIT H

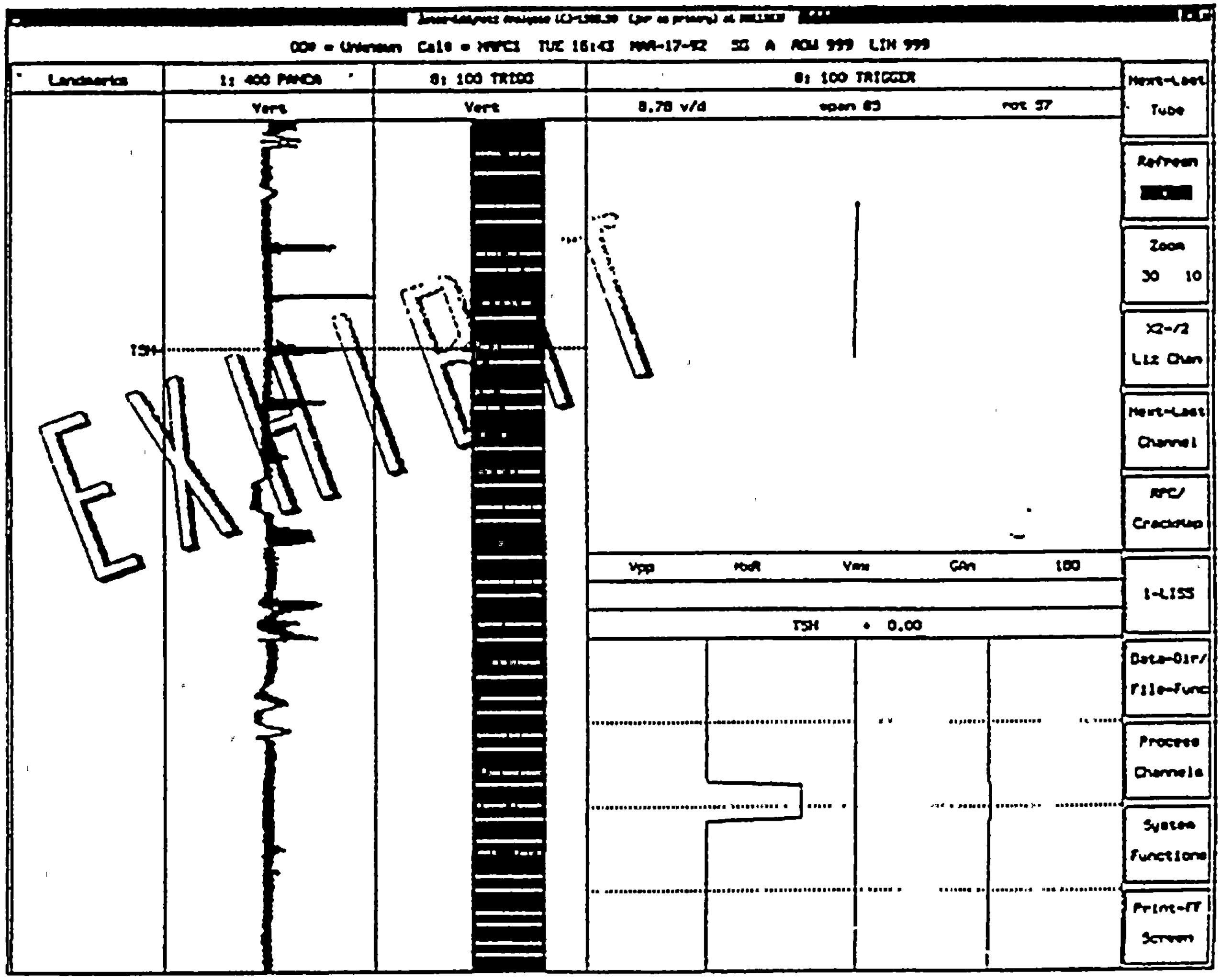


ROTATING PROBE SLIP RING INFORMATION

60% O.D. flaw clearly evident above slip ring noise

EXHIBIT I

ROTATING PROBE PULSE INFORMATION



Rotation pulse set at approximately 90° with signal below screen saturation

EXHIBIT J

MIZ-18 CONFIGURATION FOR HIGH RESOLUTION BOBBIN PROBE

MIZ-18 Configuration

NUMBER: NAME--: 10 Pin		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	400 kHz	....		....		////		////	
2	270 kHz	....		....		////		////	
3	100 kHz	....		....		////		////	
4	600 kHz	....		....		////		////	

*. Frequencies selected are for example only.

.... differential internal reference

//// absolute external reference

APPENDIX A

BOBBIN COIL TEST PARAMETERS

I. Tubing

A. O.D. - 0.750"
B. Wall - 0.043" Nominal
C. Material - Inconel 600

II. Establish the test configuration as per Exhibit E using the following frequencies:

Frequency 1 - 550 kHz Differential and Absolute
Frequency 2 - 270 kHz Differential and Absolute
Frequency 3 - 130 kHz Differential and Absolute
Frequency 4 - 35 kHz Differential and Absolute

III. Set the sample rate to the appropriate number for a probe speed which will achieve at least the minimum requirement of the EPRI recommended technique..

IV. Probes - Typical
Normal Bobbin Program - A610 - A540[1] - MULC, SFRM, or as required

The above frequencies, mixes and probe requirements may be modified through initiation of Exhibit B - Set up Instruction Form by the cognizant ECT Level III.

The following conventions shall be used during data collection:

1. The rotation of all frequencies shall be the such that the 100% through wall hole is at 40° and differential channels form starting down and to the right, absolute channels form up and to the left.

2. Spans of differential channels shall be set such that the amplitude of the 100% through wall signal is at least 50% of screen height. Spans of absolute channels shall be set such that the tube support is not saturated and can be seen.

3. Span of low frequency (50-10 KHz) will be such that the support is below saturation.

4. Data Analyst will determine if tubes need to be retested.

---

[1]The probe with the largest practical fill-factor will be used, unless a restriction or other anomaly forces the use of smaller probes. If a restriction does not pass a .540" probe, it may be recommended to be taken out of service.

APPENDIX B

ROTATING COIL TEST

This examination employs a surface riding pancake, plus, or oriented coil(s) which is(are) rotated as it traverses the tube axis producing a helical scan. Flaw depths can be evaluated using a phase delay or amplitude curve and the indication topography presented in C-Scan graphics.

A. Set-up

1) Establish the test configuration as per Exhibit F using the following frequencies:

   Frequency 1 - 400 kHz
   Frequency 2 - 200 kHz
   Frequency 3 - 100 kHz
   Frequency 4 - 10 kHz
   Frequency 5 - 700 kHz (may be utilized)

2) Set the sample rate to 400 samples per second or as required per EPRI recommended technique ACTS.

3) Set the probe pusher reverse speed to 0.2 inches per second.

4) Set the probe head rotation speed to nominal 300 rpm.

5) Select lissajous presentation and strip chart presentations as instructed by the cognizant shift supervisor or ECT Level III.

   NOTE: The above test frequencies, sampling rate and probe pusher speed may be modified through initiation of Exhibit B by the cognizant ECT Level III.

B. Calibration

1) Certain probe motor units may require the slip ring assembly to "break in". This process takes approximately 5 to 10 minutes.

2) Withdraw the probe through the ASME or other standard including the tube support ring (as applicable).

3) Null the instrument in a non-defective area of the calibration standard.

4) Place the 60% ASME flaw in the display window.

5) Adjust the phases and spans of Coil 1 for Frequencies 1, 2, 3, 4 (and 5) such that with probe motion horizontal the response from the 60% ASME flaw is up with a span of 4 screen divisions (Exhibit G).

Note: When using 3 coil MRPC probe repeat step 5 for coil 5 and coil 7.

6) Place the 60% O.D. flaw in the display window. This signal should be clearly evident above slip ring noise and should resemble Exhibit H. If not, replace either the slip ring assembly or the probe wand.

7) Adjust the phase and span of the rotation pulse signal such that the rotation pulses go up first at approximately 90° and the signal is just below screen saturation (see Exhibit I).

8) Data analyst will determine if retests are necessary.

APPENDIX C

HIGH RESOLUTION BOBBIN SET-UP AND CALIBRATION

A. Set-Up

1) Establish the test configuration as per Exhibit J using the following frequencies:

   Frequency 1 - 400 kHz
   Frequency 2 - 270 kHz
   Frequency 3 - 100 kHz
   Frequency 4 - 600 kHz

2) Coils 1, 3, 5 and 7 should be turned on for all 4 frequencies.

3) Test sampling rate is to be set at 400 points per second.

4) Adjust probe pusher speed such the test pull speed is approximately 6 inches per second.

   NOTE: The above test frequencies, sampling rate and probe pusher speed may be modified through initiation of Exhibit B by the cognizant ECT Level III.

B. Calibration

1) Calibrate each coil using the ASME Standard on the pull.

2) Record signals of all ASME flaws and support ring for each coil.

3) Nulling is to take place in nominal defect for tubing.

4) An in-line calibration will consist of recording the MIZ-18 signals as the probe is pulled through standard and support ring for each of the four (4) coils. The calibration standard should be rotated approximately 90° to insure maximum response for each of the four (4) coils. This will be done at the beginning and end of each tape cartridge and, at a minimum, every four hours.

5) Probe motion should be set horizontal and the signal response from the O.D. grove should be approximately three screen divisions.

6) If the equipment is found to be out of calibration, it shall be recalibrated and noted as such on the calibration sheet.

7) Data analyst will determine if retest is necessary.

ABB

ATTACHMENT 1

PROCEDURE HNP-004 SIGN-OFF

Steam Generator: A / B / C Leg: HOT / COLD

1.0 Personnel Certifications/Qualifications (Section 4.0):

initial/date

1.1 Eddy Current Certifications: MN , 4/27/97

1.2 Eye Exams: 4/27/97 MB, 4/27/97

2.0 Equipment: (MIZ-18, MIZ-30, PM-1, LAN Box, Manipulator, etc.):

Model/Type	S/N	Cal. Due	Dates Used To - From
MIZ-18	N/A	N/A	N/A
MIZ-30	099	8-21-97	4-27-97 - 5-3-97
PM-1/PM-3	006	N/A	4-27-97 - 5-3-97
LAN Box		N/A	-
Manipulator		N/A	-
SM-22	057		4-27-97 - 5-5-97
			-
			-
			-
			-
			-

ABB

3.0 Prerequisites met: initial/date

3.1 Equipment staging area approved (5.3): SAS / 4-26-97

3.2 Steam Generator open at proper temp. <90°F and humidity (5.4): SAS / 4-26-97

3.3 Secondary Side <120°F (5.5): SAS / 4-26-97

3.4 Platform Staged (5.6):

3.4.1 Platform built: SAS /4-26-97

3.4.2 Lighting & power: SAS /4-26-97

3.4.3 Breathing air: N/A

3.4.4 Equipment air: SAS /4-26-97

3.5 Eddy Current Exam Sheets (5.8) : DL /4/27-97

3.6 Communication system set up (5.10): SAS / 4-26-97

3.7 Manway doors installed: SAS / 4-26-97

4.0 Calibration Standards (6.0):

Cal. Std. S/N	Type	Verified
2-14689 Prim	Misc DefECT Stand	DL
2-14090 Sec	Misc Defect Stand	DL

5.0 Eddy Current system set up (8.0) and operational check (9.0): DL /4-27-97

5.1 Spooler operational (Eddynet): DL /4-27-97

ABB

6.0 Manipulator installed: DL 4-27-97

6.1 Position Verification (14.0): DL 4-27-97

Reason	Verification Location	Initial - Date
Installation	R19 L 12, (PL)	DL - 4-27-97
After Equip. Change		-
		-
		-
		-
		-
		-
Before Removal	R18 / 111 PV PERIPHERY TUBE	BCP - 5/5/97

NOTE: All position verifications performed during eddy current testing shall be recorded on the appropriate Eddy Current Examination Sheet.

ATTACHMENT 1

PROCEDURE HNP-004 SIGN-OFF

Steam Generator: A / B / C   Leg: HOT / COLD

1.0 Personnel Certifications/Qualifications (Section 4.0):

initial/date

1.1 Eddy Current Certifications: MKB, 4/27/97

1.2 Eye Exams: MB, 4/27/97

2.0 Equipment: (MIZ-18, MIZ-30, PM-1, LAN Box, Manipulator, etc.):

Model/Type	S/N	Cal. Due	Dates Used To - From
MIZ-18	N/A	N/A	N/A
MIZ-30	095		4-27-97 - 5-2-97
PM-1/PM-3	024	N/A	4-27-97 - 5-2-97
LAN Box	N/A	N/A	-
Manipulator	057	N/A	4-27-97 - 5-5-97
			-
			-
			-
			-
			-
			-

ABB

3.0 Prerequisites met: initial/date

3.1 Equipment staging area approved (5.3): SAS / 4-26-97

3.2 Steam Generator open at proper temp. <90°F and humidity (5.4): SAS / 4-26-97

3.3 Secondary Side <120°F (5.5): SAS / 4-26-97

3.4 Platform Staged (5.6):

3.4.1 Platform built: SAS / 4-26-97

3.4.2 Lighting & power: SAS / 4-26-97

3.4.3 Breathing air: N/A /

3.4.4 Equipment air: SAS / 4-26-97

3.5 Eddy Current Exam Sheets (5.8) : DL / 4-27-97

3.6 Communication system set up (5.10): SAS / 4-26-97

3.7 Manway doors installed: SAS / 4-26-97

4.0 Calibration Standards (6.0):

Cal. Std. S/N	Type	Verified
2-8711	AVB	DL
2-8715	ASME	DL

5.0 Eddy Current system set up (8.0) and operational check (9.0): DL / 4-27-97

5.1 Spooler operational (Eddynet): DL / 4-27-97

6.0 Manipulator installed: 4-27-97 DL

6.1 Position Verification (14.0): DL

Reason	Verification Location	Initial - Date
Installation	8,27	DL ~~4-27-97~~ -5-5-97
After Equip. Change		-
		-
		-
		-
		-
		-
Before Removal	1,114	DL -5-5-97

NOTE: All position verifications performed during eddy current testing shall be recorded on the appropriate Eddy Current Examination Sheet.

ABB

ATTACHMENT 1

PROCEDURE HNP-004 SIGN-OFF

Steam Generator: A / B / C Leg: HOT / COLD

1.0 Personnel Certifications/Qualifications (Section 4.0):

initial/date

1.1 Eddy Current Certifications: MMB , 4/27/97

1.2 Eye Exams: MMB , 4/27/97

2.0 Equipment: (MIZ-18, MIZ-30, PM-1, LAN Box, Manipulator, etc.):

Model/Type	S/N	Cal. Due	Dates Used To - From
MIZ-18	N/A	N/A	N/A -
MIZ-30	Ø85	1-2-98	4-27-97 - ~~5-4-97~~ 4-30-97 LAN 5-5-97
PM-1/PM-3	Ø2Ø	N/A	4-27-97 - 5-4-97
LAN Box	N/A	N/A	4-27-97 - 5-4-97
Manipulator	Ø55	N/A	4-27-97 - 5-5-97
MIZ 30	Ø96	8-22-97	4-27-97 - 5-4-97
			-
			-
			-
			-
			-

3.0 Prerequisites met: initial/date

3.1 Equipment staging area approved (5.3): SP / 4-27-97

3.2 Steam Generator open at proper temp. <90°F and humidity (5.4): SP / 4-27-97

3.3 Secondary Side <120°F (5.5): SP / 4-27-97

3.4 Platform Staged (5.6):

3.4.1 Platform built: SP / 4-27-97

3.4.2 Lighting & power: SP / 4-27-97

3.4.3 Breathing air: / N/A

3.4.4 Equipment air: SP / 4-27-97

3.5 Eddy Current Exam Sheets (5.8) : SP / 4-27-97

3.6 Communication system set up (5.10): SP / 4-27-97

3.7 Manway doors installed: SP / 4-27-97

4.0 Calibration Standards (6.0):

Cal. Std. S/N	Type	Verified
Z-14091	G/T A	[illegible]
Z-14092	G/T B	[illegible]
GT-8712	Bobbin	RBM
AVB-8716	Bobbin	RBM

5.0 Eddy Current system set up (8.0) and operational check (9.0): DJ 4-27-97

5.1 Spooler operational (Eddynet): DJ 4-27-97

6.0 Manipulator installed: RBM 4/27/97

6.1 Position Verification (14.0): RBM 4/27/97

Reason	Verification Location	Initial - Date
Installation	12/85, 21/70, 11/30	RBM - 4/27/97
After Equip. Change (3" spacers in)	37/71, 37/47, 11/60	RBM - 5/2/97
		-
		-
		-
		-
		-
Before Removal	ABB Installed Plugs - 11/88, 11/60	RBM - 5-4-97

NOTE: All position verifications performed during eddy current testing shall be recorded on the appropriate Eddy Current Examination Sheet.

ATTACHMENT 1

PROCEDURE HNP-004 SIGN-OFF

Steam Generator: A / B / C Leg: HOT / COLD

1.0 Personnel Certifications/Qualifications (Section 4.0):

initial/date

1.1 Eddy Current Certifications: MMV. , 4/27/97

1.2 Eye Exams: MMV , 4/27/97

2.0 Equipment: (MIZ-18, MIZ-30, PM-1, LAN Box, Manipulator, etc.):

Model/Type	S/N	Cal. Due	Dates Used To - From
MIZ-18	N/A	—	N/A -
MIZ-30	Ø86	12-5-97	4-27-97 - 5-2-97
PM-1/PM-3	Ø16	N/A	4-27-97 - 5-2-97
LAN Box	N/A	N/A	N/A -
Manipulator	1Ø3	N/A	4-27-97 - 5-3-97
			-
			-
			-
			-
			-
			-

ABB

3.0 Prerequisites met: initial/date

3.1 Equipment staging area approved (5.3): SP 4-27-97

3.2 Steam Generator open at proper temp. <90°F and humidity (5.4): SP 4-27-97

3.3 Secondary Side <120°F (5.5): SP 4-27-97

3.4 Platform Staged (5.6):

3.4.1 Platform built: SP 4-27-97

3.4.2 Lighting & power: SP 4-27-97

3.4.3 Breathing air: N/A

3.4.4 Equipment air: SP 4-27-97

3.5 Eddy Current Exam Sheets (5.8) : SP 4-27-97

3.6 Communication system set up (5.10): SP 4-27-97

3.7 Manway doors installed: SP 4-27-97

4.0 Calibration Standards (6.0):

Cal. Std. S/N	Type	Verified
Z-8716	AVB	[signature]
Z-8712	ASME	[signature]
Z-14085	MRPC	KBM
86234	Wear Scar	KBM

5.0 Eddy Current system set up (8.0) and operational check (9.0): [signature] 4-27-97

5.1 Spooler operational (Eddynet): [signature] 4-27-97

ABB

6.0 Manipulator installed: SP / 4/27/97

6.1 Position Verification (14.0): SP / 4/27/97

Reason	Verification Location	Initial - Date
Installation	39, 81	SP - 4/27/97
After Equip. Change 3" spacers	37/71, 37/47, "/60	KBM - 4/27/97
		-
		-
		-
		-
		-
Before Removal	1, 114	DL - 5-5-97

NOTE: All position verifications performed during eddy current testing shall be recorded on the appropriate Eddy Current Examination Sheet.

ABB

ATTACHMENT 1

PROCEDURE HNP-004 SIGN-OFF

Steam Generator: A / B / C Leg: HOT / COLD

1.0 Personnel Certifications/Qualifications (Section 4.0):

initial/date

1.1 Eddy Current Certifications: MAB, 4/27/97

1.2 Eye Exams: MAB, 4/27/97

2.0 Equipment: (MIZ-18, MIZ-30, PM-1, LAN Box, Manipulator, etc.):

Model/Type	S/N	Cal. Due	Dates Used To - From
MIZ-18	N/A	N/A	N/A
MIZ-30	087	11-SEP-97	4-27-97 - 5-3-97
PM-1/PM-3	021	N/A	4-27-97 - 5-3-97
LAN Box	N/A	N/A	— -
Manipulator	087	N/A	4-27-97 - 5-3-97
			-
			-
			-
			-
			-
			-

3.0 Prerequisites met: initial/date

3.1 Equipment staging area approved (5.3): SAF / 4-26-97

3.2 Steam Generator open at proper temp. <90°F and humidity (5.4): SAF / 4-26-97

3.3 Secondary Side <120°F (5.5): SAF / 4-26-97

3.4 Platform Staged (5.6):

3.4.1 Platform built: SAF / 4-26-97

3.4.2 Lighting & power: SAF / 4-26-97

3.4.3 Breathing air: N/A

3.4.4 Equipment air: SAF / 4-26-97

3.5 Eddy Current Exam Sheets (5.8) : [illegible] / 4-27-97

3.6 Communication system set up (5.10): SAF / 4-26-97

3.7 Manway doors installed: SAF / 4-26-97

4.0 Calibration Standards (6.0):

Cal. Std. S/N	Type	Verified
2-9062 ~~2-14093 [illegible]~~	AVB	[illegible]
2-9047 ~~2-14093 [illegible]~~	ASME	[illegible]
2-14093	Defect Stand	[illegible]
2-14094	Defect Stand.	[illegible]

5.0 Eddy Current system set up (8.0) and operational check (9.0): [illegible], 4-27-97

5.1 Spooler operational (Eddynet): [illegible], 4-27-97

6.0 Manipulator installed: DL, 4-27-97

6.1 Position Verification (14.0): DL, 4-27-97

Reason	Verification Location	Initial - Date
Installation	2-34	~~4-27-97~~ DL 5-2-97
After Equip. Change		-
		-
		-
		-
		-
		-
Before Removal	2-34	DL -5-2-97

NOTE: All position verifications performed during eddy current testing shall be recorded on the appropriate Eddy Current Examination Sheet.

ABB

ATTACHMENT 1

PROCEDURE HNP-004 SIGN-OFF

Steam Generator: A / B / C Leg: HOT / COLD

1.0 Personnel Certifications/Qualifications (Section 4.0):

initial/date

1.1 Eddy Current Certifications: NMB, 4/27/97

1.2 Eye Exams: [illegible], 4/27/97

2.0 Equipment: (MIZ-18, MIZ-30, PM-1, LAN Box, Manipulator, etc.):

Model/Type	S/N	Cal. Due	Dates Used To - From
MIZ-18	N/A	N/A	N/A
MIZ-30	080	30-SEP-97	4-27-97 -
PM-1 PM-3	026	N/A	4-27-97 -
LAN Box	N/A	N/A	N/A -
Manipulator	.044	N/A	4-27-97 -
			-
			-
			-
			-
			-
			-

3.0 Prerequisites met: initial/date

3.1 Equipment staging area approved (5.3): SAS / 4-26-97

3.2 Steam Generator open at proper temp. <90°F and humidity (5.4): SAS / 4-26-97

3.3 Secondary Side <120°F (5.5): SAS / 4-26-97

3.4 Platform Staged (5.6):

3.4.1 Platform built: SAS / 4-26-97

3.4.2 Lighting & power: SAS / 4-26-97

3.4.3 Breathing air: N/A

3.4.4 Equipment air: SAS / 4-26-97

3.5 Eddy Current Exam Sheets (5.8) : BCP / 4/26/97

3.6 Communication system set up (5.10): SAS / 4-26-97

3.7 Manway doors installed: SAS / 4-26-97

4.0 Calibration Standards (6.0):

Cal. Std. S/N	Type	Verified
Z-9047 ASME	ASME	BCP ~~5/5/97~~ BCP 5/6/97 4/28/97
Z-9052 AVB	AVB	BCP ~~5/5/97~~ BCP 5/6/97 4/28/97

5.0 Eddy Current system set up (8.0) and operational check (9.0): BCP / 4/26/97

5.1 Spooler operational (Eddynet): BCP / 4/26/97

ABB

6.0 Manipulator installed: BCP 4/28/97

6.1 Position Verification (14.0): BCP 4/28/97

Reason	Verification Location	Initial - Date
Installation	6/1 PV	BCP - 4/28/97
After Equip. Change	34/55 PV	BCP - 4/30/97
		-
		-
		-
		-
		-
Before Removal	37/44 PV	BCP - 5/2/97

NOTE: All position verifications performed during eddy current testing shall be recorded on the appropriate Eddy Current Examination Sheet.

PROCEDURE FOR THE VISUAL EXAMINATION

OF PREVIOUSLY INSTALLED

TUBE PLUGS

CAROLINA POWER & LIGHT CO.

SHEARON HARRIS

ABB COMBUSTION ENGINEERING NUCLEAR OPERATIONS

HNP-007 REV. 0

Verified
[signature]
4-25-97

APPROVED BY: [signature] DATE 3-12-97
COGNIZANT SUPERVISOR

APPROVED BY: [signature] DATE 3/12/97
QUALITY OPERATIONS

1.0 PURPOSE

To identify the sequence of operations required to perform an initial and post bowl examination of the steam generators and a visual inspection of previously installed tube plugs.

2.0 REFERENCES

2.1 ABB Combustion Engineering Nuclear Operations Quality Assurance Manual, QAM-100, latest revision.

2.2 ABB Combustion Engineering Nuclear Operations Quality Assurance Procedures Manual, QAM-101, latest Revision.

3.0 PREREQUISITES

3.1 Verify the operation of the audio and video operation of the video tape recorder.

3.2 Verify the video quality of the camera to be used for the operation is acceptable.

3.3 A written list of previously plugged tubes has been provided by the utility.

3.4 The steam generator bowl is dry and ventilated.

4.0 INITIAL BOWL SCAN

4.1 Video tape the as found condition of each steam generator plenum and sign off on data sheet 1, noting any discrepancies. Any discrepancies shall be reported to the CP&L system engineer on shift for resolution.

5.0 TUBE PLUG VISUAL INSPECTION

5.1 Video tape the previously installed tube plugs and sign off on data sheet 1, noting any discrepancies. Any discrepancies shall be reported to the CP&L system engineer on shift for resolution. The video inspection can be performed utilizing either the bowl camera or the manipulator camera. Discrepant conditions shall be considered any build up of boron or moisture which would indicate a potentially leaking plug, missing plugs or plugs located where none are required, or plugs which show signs of an abnormal installation.

6.0 POST BOWL INSPECTION

6.1 Video Tape the post maintenance/inspection cleanliness of the steam generator plenum verifying no foreign materials are present. Sign off on data sheet 1.

DATA SHEET 1

Steam Generator A Plenum H/L

4.1 Initial Bowl Scan Initials / Date SP / 4-26-97

Remarks NORMAL

5.1 Mechanical Plug Inspection

Row	Column	Initials / Date	Remarks
12	2	DD / 4-27-97	
19	12	DD / 4/27-97	
38	16	DD / 4/27-97	
15	3	DD / 4/27-97	
2	59	DD / 4/27-97	
41	59	DD / 4-27-97	
44	59	DD / 4-27-97	
47	59	DD / 4-27-97	
6	113	DD / 4-27-97	
45	59	DD / 4-27-97	
9	112	DD / 4-27-97	
10	113	DD / 4-27-97	
20	99	DD / 4-27-97	
23	99	DD / 4-27-97	
6	94	DD / 4-27-97	
34	32	DD / 4/27/97	
36	32	DD / 4/27/97	
25	71	DD / 4/27/97	

6.1 Post Bowl Scan Initials / Date DD 1-5-97

Remarks SM-22 Guide Tube removed. DD.

DATA SHEET 1

Steam Generator A Plenum C/L

4.1 Initial Bowl Scan

Initials / Date SP 4-26-97

Remarks NORMAL

5.1 Mechanical-Plug Inspection

Row	Column	Initials / Date	Remarks
12	2	MEC/4-27-97	
19	12	MEC/4-27-97	
38	16	MEC/4-27-97	
15	3	MEC/4-27-97	
2	59	MEC/4-27-97	
41	59	MEC/4-27-97	
44	59	MEC/4-27-97	
47	59	MEC/4-27-97	
6	113	MEC/4-27-97	
45	59	MEC/4-27-97	
9	112	MEC/4-27-97	
10	113	MEC/4-27-97	
20	99	MEC/4-27-97	
23	99	MEC/4-27-97	
6	94	MEC/4-27-97	
34	32	MEC/4-27-97	
36	32	MEC/4-27-97	
25	71	MEC/4-27-97	

6.1 Post Bowl Scan

Initials / Date MEC 4-27-97

Remarks NORMAL

DP 5-5-97

DATA SHEET 1

Steam Generator ~~A~~ B SP 4-26-97   Plenum H/L

4.1 Initial Bowl Scan   Initials / Date SP 4-27-97

Remarks NORMAL

5.1 Mechanical Plug Inspection

Row	Column	Initials / Date	Remarks
49	81	BCP 5/3/97	
49	82	BCP 5/3/97	
43	59	BCP 5/3/97	
44	59	BCP 5/3/97	
49	34	BCP 5/3/97	
47	51	BCP 5/3/97	
12	85	BCP 5/3/97	
39	81	BCP 5/3/97	
43	46	BCP 5/3/97	

6.1 Post Bowl Scan   Initials / Date [illegible] 5/5/97

Remarks Saw small 3-4" wire which must be removed by ND jumpers. It is located on right top ND cover. Informed Chip Bach

DATA SHEET 1

Steam Generator B C/L Plenum C/L

4.1 Initial Bowl Scan

Initials / Date SP / 4-27-97

Remarks NORMAL

5.1 Mechanical Plug Inspection

Row	Column	Initials / Date	Remarks
49	81	SP 4/27/97	ok
49	82	SP 4/27/97	ok
43	59	SP 4/27/97	ok
44	59	SP 4/27/97	ok
49	34	SP 4/27/97	ok
47	51	SP 4/27/97	ok
12	85	SP 4/27/97	ok
39	81	SP 4/27/97	ok
43	46	SP 4/27/97	ok

6.1 Post Bowl Scan

Initials / Date BM / 5-5-97

Remarks CLEAN

DATA SHEET 1

Steam Generator C   Plenum H/L

4.1 Initial Bowl Scan   Initials / Date SP 4-26-97

Remarks NORMAL

5.1 Mechanical-Plug Inspection

Row	Column	Initials / Date	Remarks
27	21	UK 4-27-97	
27	22	UK 4-27-97	
23	30	UK 4-27-97	
23	31	UK 4-27-97	
24	30	UK 4-27-97	
24	31	UK 4-27-97	
42	56	UK 4-27-97	
45	59	UK 4-27-97	
47	66	UK 4-27-97	
33	100	UK 4-27-97	
29	45	UK 4-27-97	
22	73	UK 4-27-97	
27	62	UK 4-27-97	
15	48	UK 4-27-97	
22	71	UK 4-27-97	
23	71	UK 4-27-97	
32	84	UK 4-27-97	
46	59	UK 4-27-97	
47	59	UK 4-27-97	

6.1 Post Bowl Scan   Initials / Date BM 5/5/97

Remarks ALL FOREIGN MATERIALS WERE CLEARED FME LOG

DATA SHEET 1

Steam Generator C Plenum C/L

4.1 Initial Bowl Scan

Initials / Date
SF 14-26-97

Remarks NORMAL

5.1 Mechanical Plug Inspection

Row	Column	Initials / Date	Remarks
27	21	[illegible] 5.2.97	
27	22	[illegible] 5.2.97	
23	30	[illegible] 5.2.97	
23	31	[illegible] 5.2.97	
24	30	[illegible] 5.2.97	
24	31	[illegible] 5.2.97	
42	56	[illegible] 5.2.97	
45	59	[illegible] 5.2.97	
47	66	[illegible] 5.2.97	
33	100	[illegible] 5.2.97	
29	45	[illegible] 5.2.97	
22	73	[illegible] 5.2.97	
27	62	[illegible] 5.2.97	
15	48	[illegible] 5.2.97	
22	71	[illegible] 5.2.97	
23	71	[illegible] 5.2.97	
32	84	[illegible] 5.2.97	
46	59	[illegible] 5.2.97	
47	59	[illegible] 5.2.97	

6.1 Post Bowl Scan

Initials / Date
LBM 15-5-97

Remarks BOWL AS FOUND CONDITION / NORMAL

PROCEDURE FOR CONTROL
OF
EDDY CURRENT DATA
FOR
USE WITH MULTIFORTH OR EDDYNET
ACQUISITION SYSTEMS

CAROLINA POWER AND LIGHT COMPANY
SHEARON HARRIS

HNP-006

ABB COMBUSTION ENGINEERING NUCLEAR OPERATIONS
CHATTANOOGA, TENNESSEE
WINDSOR, CONNECTICUT

PREPARED BY: A. P. Putnam DATE: 8-4-95
A. P. Putnam
Field Service Technician

APPROVED BY: J. Gann FOR DATE: 8/4/95
J. D. Ford
Quality Assurance

APPROVED BY: [signature] III FOR DATE: 8-4-95
H. L. Labieniec
Manager, Primary Support Technology

REVISION: 0

DATE: 07/12/95

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1.0 OBJECTIVE

Eddy Current Data Management is the tracking, control, uploading, and reporting of eddy current data which has been acquired during an eddy current examination. The eddy current data is tracked from the initial receipt of the acquired data in the data management area to the delivery of the final results to Carolina Power and Light, Shearon Harris Nuclear Station. To prevent data management discrepancies, specific forms and procedures will be used to ensure the efficient routing and control of the acquisition media, optical disks, analysis results, and data management reports.

2.0 REFERENCES

2.1 Zetec Inspection Planning System & Inspection Management System User Guide, latest revision

2.2 Zetec EDDYNET Analysis System Users Guide.

2.3 Carolina Power and Light's Eddy Current Data Analysis Procedure, latest revision.

3.0 PERSONNEL REQUIREMENTS

Each person performing Data Management duties governed by this procedure shall be trained in the use and operation of the data management system in accordance with Reference 2.1 and the specific requirements of this procedure. In addition, each person performing EDDYNET system administration functions shall be trained in the use and operation of the EDDYNET Analysis System in accordance with Reference 2.2.

3.1 The Data Controller shall be responsible for all editing performed within the data management system. The Data Controller will assign specific editing actions to an analyst, trained in accordance with reference 2.3, when edits to the results files are required on the EDDYNET storage media.

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 client.

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 ABB Combustion Engineering Analysis and Data Management Team.

4.2 Data Management checkoff sheets will be used to document tracking of the eddy current data throughout the data management and analysis process.

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

4.4 The data management system will be pre-programmed with site specific information prior to the start of data input. This includes, but is not limited to, input of all analysis acronyms, and data checks.

4.5 The data management system setup will be verified by the Data Management Shift Coordinator prior to the start of data entry for the inspection. The verification shall be performed in accordance with Section 9.1 and documented on Form DM-6.

4.6 The data management system setup shall be re-verified under the following conditions and documented on Form DM-6:

4.6.1 Following the restoration of software executables from a backup disk.

4.6.2 Following any software updates.

5.0 SEQUENCE OF OPERATIONS

The following describes the sequence of operations to be followed in order to properly control the eddy current data, and to successfully load completed EDDYNET results files to the data management system.

5.1 (Acquisition) Deliver the eddy current data package to the data management area. At a minimum, the eddy current data package shall consist of:

5.1.1 Acquisition to DCR Tape.

1. Original DCR tape
2. Original operator examination sheets
3. Calibration Sheet

5.1.2 Acquisition to Traveling Optical Disk

1. Traveling Optical Disk
2. Traveling Calibration Sheet
3. Operator examination sheets

5.1.3 Acquisition to Remote Optical

Notification of calibration group completion
Notification of data transfer and destination

5.2 (Data Controller/System Administrator) Log in receipt of tapes/calibrations on form DM-1.

5.3 (System Administrator) Document the transfer of raw eddy current data from acquisition media to analysis media and complete the appropriate logs in accordance with Section 10.1 of this procedure.

5.4 (Data Controller) For data acquired to DCR tape or traveling optical, prepare packages for primary and secondary analysis. As a minimum, the package should include:

5.4.1 Operator examination sheets. (original to primary and a copy to secondary)

5.4.2 T-list, if generated, from raw data transfer.

NOTE: THE FOLLOWING STEPS APPLY TO PRIMARY, SECONDARY, AND FINAL ANALYSIS.

5.5 (Data Analysts) Record initials on form DM-1 at the start of each tape or calibration group analyzed. If primary and secondary analysis is being performed remotely via T1 lines, a similar tracking form may be used, if required.

5.6 (Data Analysts) Build a report file when analysis is complete for each tape or calibration group. Return the examination sheets and the EDDYNET report printouts to the data management area. Record return of package on form DM-1. If primary and secondary analysis is being performed remotely via T1 lines, a similar tracking form may be used, if required.

CAUTION: If, after returning the completed data package to the data management area, the analyst determines that changes are necessary to the analysis results, the analyst will identify the changes to data management in order to ensure correct file retrieval from the Local Area Network. All edits to FINAL results will be done in accordance with Step 5.8.

NOTE: THE FOLLOWING STEPS APPLY TO FINAL ANALYSIS.

5.7 (Data Controller) Review the EDDYNET report printout for correct format and information.

5.8 (Data Analysts) If the information is in error, the EDDYNET file will be corrected by the analyst, and a new EDDYNET report printout will be generated. If the error requires tracking, the appropriate information will be recorded on form DM-3.

5.9 (Data Controller) When all information is verified, retrieve the EDDYNET data file from the Local Area Network.

5.10 (Data Controller) When primary and secondary analysis data has been completed for a given tape or calibration group, prepare the data package for resolution and notify the Lead Analyst. The package should contain both primary and secondary analysis folders.

5.11 (Data Controller) Load the EDDYNET file to the appropriate component database and record on form DM-2

5.11.1 If an error file is generated, the EDDYNET file will be edited as in Step 5.8 and the appropriate component database will be corrected.

6.0 VERIFICATION OF COMPLETION

When it has been indicated by Acquisition that the inspection plan in a given steam generator, or a generator subsection, has been completed, the Data Management Shift Coordinator, or a designee, will verify that the requirements of the examination scope have been met prior to approving equipment removal or relocation. The verification process will be tracked using a sheet similar to form DM-4. As a minimum, the following conditions will be verified using computer-generated reports, database queries, and graphic printouts:

6.1 Verify that all tubes in the inspection plan have been tested with the correct probe type.

6.2 Verify that all tubes in the inspection plan have been tested and analyzed to the required extent.

6.3 Verify that no reported retest is outstanding, and that all data necessary to complete each tube requiring a retest exam has been acquired and analyzed.

6.4 Verify that all analysis codes requiring further action, such as examination with another probe, or additional review, have been addressed appropriately.

NOTE: ANALYSIS CODES REQUIRING FURTHER ACTION WILL BE DEFINED IN, AND USED IN ACCORDANCE WITH, REFERENCE 2.3, THE CAROLINA POWER AND LIGHT'S STEAM GENERATOR EDDY CURRENT ANALYSIS GUIDELINES.

6.5 Verify that all technical specification requirements for additional testing have been satisfied.

NOTE: ANY CONDITIONS NOT SATISFIED WILL BE REPORTED IMMEDIATELY TO THE SENIOR ANALYST AND/OR TASK MANAGER FOR CORRECTIVE ACTION.

7.0 REPORTING CRITERIA

Reports of accumulated eddy current data shall be prepared by the Data Controller or a properly trained designee. Status reports and final reports will be generated in a timely fashion, and in accordance with client requirements. Whenever possible, report formats will be established before the start of work.

8.0 DATA MANAGEMENT SHIFT LOG

The Data Management Shift Coordinator shall maintain a log of the events occurring on each shift. Figure 5 displays a typical Data Management Log Sheet. The log book will function as the primary method of disseminating information between shifts. As a guideline, appropriate log book entries may include, but are not limited to, the following:

8.1 Problem and Trouble Shooting Documentation

8.1.1 Document all problems encountered with database hardware and software. Whenever possible, include the nature of the problem, problem duration, problem resolution, and action taken to prevent recurrence.

8.1.2 Document all problems encountered with reports, reporting formats, and report generation.

8.2 Requests for Information

Document any requests for information from outside of data management. Include any specific time commitments, formats, and the requesting party.

8.3 Changes to Reports or Screen formats

Document any additions or modifications to existing screens, menus, or reports. Include any specific instructions for using reports or input screens.

8.4 Changes Affecting Analysis Result Files

Document any changes to report formats, acronym usage, and report parameters that affect the reporting of results by analysis. This information is to be provided to the Lead Analyst for inclusion in shift turnover in accordance with Reference 2.3.

9.0 Database Setup Verification and Performance Demonstration

9.1 Input the correct data acceptance parameters into the data management system and document on Form DM-6.

9.1.1 Enter acceptable indication codes and identify all retest codes listed in Reference 2.3.

NOTE: EVENTS MAY REQUIRE A DEVIATION FROM THE ABOVE SETUP. PROPOSED CHANGES MUST BE APPROVED BY THE LEAD ANALYST PRIOR TO ADJUSTING THE DATA PARAMETERS. DOCUMENT UPDATES TO THE ABOVE SCREENS ON FORM DM-6.

9.2 Data Management System Performance Evaluation

9.2.1 Perform the following steps to demonstrate the data management system's ability to properly load analysis results and screen for data errors. Performance will be demonstrated for any extent type to be used during the exam.

Step 1 Open an outage called TEST.

Step 2 Schedule tubes in a dataset named TEST using the performance demo data disks.

Step 3 Load final data test files to the data management system from the performance demo data disks.

Step 4 Using the answer sheets from the performance demo, verify that all expected errors have been identified by the data management system.

Step 5 Document the results of the performance demo on form DM-7.

Step 6 Report any unsatisfactory results to the Lead Analyst.

Step 7 Document any corrective action on form DM-7, and perform the test again until satisfactory results are achieved, or the lead analyst determines that the results are acceptable.

9.2.2 The Lead Analyst shall review the results of the performance runs and indicate acceptance with a signature on form DM-7.

10.0 Eddynet System Administration Guidelines

10.1 Data Tracking and Control

Each Calibration Group initiated by data acquisition shall be tracked by the designated System Administrator (SA) on each shift using form SA-1. This information will also be posted on a white board in the site data room and remote location data rooms as follows:

cal001 P S R D
P=primary analysis
S=secondary analysis
R=resolution
D=data management

The appropriate letter will be circled by the analysts to indicate analysis is being performed, then lined through when analysis is complete. Priorities will be assigned with guidance from Data Management. The steam generator, test leg, server, and ROD will be identified in the space indicated on Form SA-1.

10.1.1 The SA shall enter in the control log the calibration group number, the first tube in the cal group, and the last tube in the calibration group as raw data is received from acquisition.

10.1.2 Primary, secondary, and final analysis results will be copied from the system hard drive to the original acquisition optical disk for each calibration group by the SA. The SA shall enter the date and time of task completion on form SA-1.

NOTE: If it is necessary to modify the results on the hard drive after the copy routine has been completed, the SA will update the results on the optical disk. The date and time of the update shall be documented on form SA-1.

10.1.3 After ensuring that all analysis is complete for a given calibration group, raw data can be removed from the hard drive by the SA. The completion of this task will be documented on form SA-1.

10.3 Eddynet Results Backup

The SA shall back up the Results file as necessary, but at a minimum of every six hours. Each time a backup is performed, the task shall be documented on form SA-3.

FIGURE 1

EXAMPLE ANALYSIS TRACKING LOG

ABB Combustion Engineering
Analysis Tracking Log
Plant: ____________ Component: ____________ Leg: ________

CAL GROUP	Primary		Secondary		P/S	Resolution		Data Input to ISIS
	Start	Finish	Start	Finish	Comp	Start	Finish	
	D/T Init.	D/T Init.	D/T Init.	D/T Init.	D/T Init.	D/T Init.	D/T Init.	

FORM DM-1

FIGURE 2

EXAMPLE DATA MANAGEMENT/EDDYNET FILE TRACKING LOG

DATA MANAGEMENT TRACKING LOG S/G:_____ LEG:______

CAL GROUP	DATA SET	ZONE	FINAL RESOLUTION						ERR	FIX	SUM
			File Retrieved			File Loaded					
			Date	Time	Init	Date	Time	Init			

FORM DM-2

FIGURE 3

EXAMPLE DATA MANAGEMENT/EDDYNET EDIT TRACKING LOG

DATA MANAGEMENT/EDDYNET EDIT TRACKING FORM

OPTICAL DISK: CAL GROUP: ROW/COL:	DATABASE EDIT [ ] EDDYNET FILE [ ] NEW PRINTOUT [ ]
DESCRIPTION OF EDIT:	INITIALS: DATE/TIME:

OPTICAL DISK: CAL GROUP: ROW/COL:	DATABASE EDIT [ ] EDDYNET FILE [ ] NEW PRINTOUT [ ]
DESCRIPTION OF EDIT:	INITIALS: DATE/TIME:

FORM DM-3

FIGURE 4

EXAMPLE TEST PLAN VERIFICATION OF COMPLETION

SHEARON HARRIS
EDDY CURRENT CLOSEOUT CHECKLIST
SEPTEMBER, 1995

S/G ____________ TEST PLAN: ________________________ GROUP: ____________

____________ 1) PRINT ALL INDICATIONS REPORT

____________ 2) VERIFY ALL ANALYSIS CODES REQUIRING FURTHER ACTION HAVE BEEN DISPOSITIONED / CONFIRMED.

____________ 3) PRINT DAILY PROGRESS REPORT

____________ 4) RUN/PRINT RETEST REPORTS AND VERIFY THAT ALL RETESTS HAVE BEEN PROPERLY CLOSED OUT.

____________ 5) PRINT MASTER REPORT FOR EACH GROUP OR TEST PLAN AND CHECK DATA FOR ACCURACY.

____________ 6) PRINT MAP OF COMPLETED EXAMS.

____________ 7) PRINT REPAIR LIST WITH A MAP.

S/G CLOSED: ____
DATE TIME INITIALS

FORM DM-4

FIGURE 5

EXAMPLE DATA MANAGEMENT SHIFT LOG SHEET

DATA MANAGEMENT SHIFT LOG	DATE:
	TIME:
PREPARED BY:	PAGE OF
DISTRIBUTION: ANAL ACQ N/A	

FORM DM-5

FIGURE 6

EXAMPLE DATA PARAMETER SETUP VERIFICATION SHEET

Data Management Data Parameter Setup Verification

Component	Software Version		Revision	
Input Screens	Date	Time	Initials	Printout
Test Extents	______	______	______	______
Retest Codes	______	______	______	______
Analysis Codes	______	______	______	______
PID Setup	______	______	______	______
	______	______	______	______

VERIFICATION REQUIRED FOR:

INITIAL SETUP [ ]
POST FILE RESTORATION [ ]
POST SOFTWARE UPGRADE [ ]
TEST/DATA CHANGE [ ]

PRINTOUTS ATTACHED [ ]

VERIFIED BY: ____________________ DATE: ________
TIME: ________

FORM DM-6

FIGURE 7

EXAMPLE DATA MANAGEMENT SYSTEM PERFORMANCE EVALUATION SHEET

Data Management System Performance Evaluation			
Software Version:	Rev. No.:	Date:	Time:
Group 1			
No. Expected Errors	______	No. Errors Identified	______
Satisfactory	______	Corrective Action Required	______
Group 2			
No. Errors Expected	______	No. Errors Identified	______
Satisfactory	______	Corrective Action Required	______
Group 3			
No. Errors Expected	______	No. Errors Identified	______
Satisfactory	______	Corrective Action Required	______

Printouts Attached [ ]

Reviewed By: ______________________________

Date: ______________ Time: ______________

FORM DM-7

FIGURE 8

EXAMPLE SYSTEM ADMINISTRATION CONTROL LOG

STEAM GENERATOR:		SERVER ID:				
LEG:		RAW DATA STORED ON ROD:				
Calibration Group	Acquisition Optical Disc Number	Raw Data Transferred		Results Transferred		Raw Data Removed from Hard Drive
		Original	Backup	Original Date/Time	Backup Date/Time	Date/Time

FORM SA-1

FIGURE 9

EXAMPLE SYSTEM ADMINISTRATION BACKUP LOG

System Backup Log

Date	Time	Initials	Comments

FORM SA-3

APPENDIX A

PERFORMANCE OF DATA MANAGEMENT AT A REMOTE LOCATION

1.0 PURPOSE

To replace sections 5.0 and 10.0 of Procedure HNP-006.

2.0 APPLICABILITY

This appendix is in effect for an eddy current inspection for which Data Management is being performed at a remote location.

3.0 REFERENCES

3.1 Procedure for Control of Eddy Current Data for use with Multiforth or Eddynet Acquisition Systems, HNP-006.

4.0 DEFINITIONS

4.1 Remote. Location(s) where personnel have been assigned to perform Data Analysis and Management functions, which are physically distanced from the Site, and require special network connections, such as a T-1 line.

4.2 Local. Location(s) on or near the Site where personnel have been assigned to perform Acquisition, Analysis, or System Administration functions.

4.3 Network. Systems which share data, hardware, and software resources.

4.4 Server. A computer which provides file access, login access, files transfer, printing and other services across a network to a defined group of systems.

4.5 Spool. The process of data file transfer between servers on a network.

4.6 T-1 Line. Telephone communication line used to connect computer networks in different locations.

4.7 Results File. A file created on the EDDYNET system by a data analyst at the completion of a Calibration Group which summarizes the analysis results for the tubes in that Calibration Group.

5.0 SEQUENCE OF OPERATIONS

The following describes the sequence of operations required in order to successfully load final result files to the ISIS-TUBE data management system in a remote location.

5.1 (Acquisition) Spool raw data to the designated server in the Local Analysis area.

5.2 (System Administrator) Update Tracking board for incoming data in accordance with Section 10.1 of this Attachment.

5.3 (System Administrator) Spool raw data to remote locations for Primary and Secondary Analysis.

NOTE: THE FOLLOWING STEPS APPLY TO PRIMARY, SECONDARY, AND RESOLUTION ANALYSIS.

5.4 (Data Analyst) At the start and completion of each calibration group analyzed, update the tracking board in accordance with Section 10.1 of this Appendix. Resolution Analysts also record on Form DM-8.

5.5 (Data Analysts) When analysis is complete for each tape or calibration group, build a final report file of results.

5.6 (Data Analyst) Print out final results file at the specified analysis location.

NOTE: THE FOLLOWING STEPS APPLY TO RESOLUTION ANALYSIS.

5.7 (System Administrator) Collate Primary and Secondary reports for each Calibration Group, and provide to Resolution Analysts.

5.8 (Data Analysts) Transfer and print completed results file to the designated Server and for Data Management at the remote location, and record on Form DM-8.

CAUTION: If, after file transfer has occurred, the analyst determines that changes are necessary to the results file, the analyst will contact data management to alert them to the required change. If the change requires tracking, the data manager will complete Form DM-3.

5.9 (Data Manager) Retrieve final results files from the designated Server as they are transferred from Resolution, and complete the appropriate log entry on Form DM-2.

5.10 (Data Manager) Load the EDDYNET file to the appropriate ISIS-TUBE database and record on Form DM-2.

5.10.1 If errors occur, record the number of errors on Form DM-2.

5.10.2 Address each error, take corrective action if appropriate, and document any corrective action in writing, on the Error Log printout.

5.10.3 If corrective action requires an edit to the eddynet results file, complete Form DM-3, and notify the data analyst of the required action.

5.10.4 Corrected final results files will be transferred as in Step 5.8.

5.10.5 View the corrected file on the Server to insure that errors have been corrected, and document on Form DM-3.

5.10.6 After all errors have been satisfactorily resolved, initial the appropriate column on Form DM-2.

5.10.7 Error logs and edit forms shall be maintained for the duration of the inspection.

10.0 Eddynet System Administration Guidelines

10.1 Data Tracking and Control

Each Calibration Group initiated by data acquisition shall be tracked by the designated System Administrator (SA) on each shift using Form SA-1. This information will also be posted on a tracking board in the site data room and remote location data rooms as follows:

cal001 P S R D

P=primary analysis
S=secondary analysis
R=resolution
D=data management

The appropriate letter will be circled by the analysts to indicate analysis is being performed, then lined through when analysis is complete. Priorities will be assigned with guidance from Data Management. The steam generator, test leg, server, and ROD will be identified in the space indicated on Form SA-1.

10.1.1 The SA shall enter in the control log the calibration group number as raw data is received from acquisition.

10.1.2 Primary, secondary, and final analysis results will be copied from the system hard drive to the original acquisition optical disk for each calibration group by the SA. The SA shall enter the date and time of task completion on Form SA-1.

NOTE: **If it is necessary to modify the results on the hard drive after the copy routine has been completed, the SA will update the results on the optical disk. The date and time of the update shall be documented on Form SA-1.**

10.1.3 After ensuring that all analysis is complete for a given calibration group, and that raw data has been spooled to two different hard drives, raw data can be removed from the hard drive by the SA. The completion of this task will be documented on Form SA-1.

10.2 Eddynet Results Backup

The SA shall back up the Results file as necessary, with a recommended minimum of every six hours. Backup tasks performed shall be documented on Form SA-3.

FIGURE 10

EXAMPLE RESOLUTION ANALYSIS TRACKING LOG

ABB Combustion Engineering
Resolution Analysis Tracking Log

SITE:	UNIT:	S/G:	LEG:

CAL GROUP	START			FINISH			FILE SENT
	DATE	TIME	INITIALS	DATE	TIME	INITIALS	REMOTE DM

FORM DM-8

CERTIFICATION PROGRAM FOR NONDESTRUCTIVE EXAMINATION PERSONNEL

Major Revision

1.0 PURPOSE

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

2.0 APPLICABILITY

2.1 This written practice is intended to meet or exceed the requirements of ASNT SNT-TC-1A, 1984 (Reference 5.4) and the ASME BPV Code (Reference 5.2), with the exception of Appendix VII and VIII requirements of Section XI.

2.2 Certifications to other Codes and standards, such as Section XI, Appendix VII, and ASNT CP-189 are addressed (or will be addressed, as needed) in Addenda which supplement this written practice and are shown on the certification document as additional endorsements.

2.3 Certifications issued to NDE personnel prior to adoption of this written practice and based on an approved ABB CE 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.

3.0 PREREQUISITES

3.1 None

4.0 PROCEDURE

4.1 LEVELS OF QUALIFICATION

4.1.1 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.

4.1.2 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. The Level I 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.

a. The Level I Trainee shall have completed the training and examination requirements for Level I, but need not have any experience.

4.1.3 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.).

4.1.4 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. The Level II shall be able to prepare written instructions and to organize and report nondestructive testing investigations. The Level II shall also 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.

4.1.5 Level II A - (Eddy Current Data Analyst for heat exchanger tubing and nonferromagnetic steam generator tubing, except QDA, as defined below) - 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 heat exchanger and nonferromagnetic steam generator tubing.

a. EPRI Qualified Data Analyst (QDA) - (Eddy Current Data Analyst for nonferromagnetic steam generator heat exchanger tubing) - satisfies all of the requirements for an Eddy Level II, is capable of interpreting and evaluating data taken from eddy current examinations of nuclear plant components, has successfully completed the EPRI Steam Generator Eddy Current Performance Demonstration using the Industry Database (IDB) Practical Examination and is qualified in accordance with Addendum B.

4.1.6 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.).

4.1.7 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 Level III may administer qualification examinations of NDE Level I, II and III candidates.

4.1.8 NDE Instructor - shall be responsible for developing course outlines and presenting classroom, laboratory and on-the-job training programs in accordance with written course outlines, approved by a Level III. The NDE Instructor shall be thoroughly familiar with the NDE method being taught and shall be able to effectively present the theoretical, technical and practical aspects of the method.

4.1.9 Principal Level III - shall be designated by management and is responsible for approval and administration of training programs, examinations and the written practice. The administration and grading of examinations may be performed by a Level III or, for written examinations only, by an individual delegated in writing, by the Principal Level III. The Principal Level III shall also be responsible for maintenance of personnel certification records.

4.2 EDUCATION, TRAINING AND EXPERIENCE

4.2.1 Level I and II personnel shall satisfy the education, training and experience requirements of Table 2.4-2, as modified below.

a. 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 2.4-3.

b. 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 2.4-2. No additional experience is required.

c. 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 4.1.

d. Limitations for individuals certified in accordance with Paragraph 4.2.1 (a) shall be noted on their certification record.

4.2.2 Level III personnel shall satisfy one of the following education and experience options:

a. Graduate of a 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 an NDE Level II in the applicable method, or

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

c. High school graduate, or equivalent, plus four (4) years experience in an assignment comparable to that of an NDE Level II in the applicable method.

4.2.3 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.

4.2.4 NDE Instructors shall satisfy the Level III Basic and Method examination requirements of Paragraph 4.3.4 and shall also meet one of the following requirements:

a. The candidate shall maintain a current teacher or vocational instructor certificate issued by a state, municipal, provincial or federal authority, or

b. The candidate shall complete a minimum of forty (40) hours instruction in training and teaching techniques.

4.2.5 Training shall be conducted by an NDE Instructor, except that portions of the training may be conducted by individuals with specialized expertise and designated by the NDE Instructor or Principal Level III.

a. All training obtained prior to implementation of this written practice shall be considered valid. Only training necessary to meet additional training requirements of this written practice shall require an NDE Instructor.

b. Training obtained by an individual before employment by CENS but after implementation of this written practice shall be evaluated by the Principal Level III for acceptability and applicability to this written practice.

4.2.6 To assure that an individual has assimilated the training material presented, the individual shall satisfy the examination requirements of Paragraph 4.3, as applicable.

a. If the qualification examination for certification is not given at the conclusion of training, a final course examination shall be given. A grade of 70% is necessary to receive credit for the training hours.

b. When an individual fails a final course examination, additional training shall be required prior to reexamination. The additional training shall address the areas of weakness exhibited by the individual and shall be documented by the NDE Instructor.

4.2.7 Records used to substantiate education, training and experience shall be identified and maintained in accordance with Paragraph 7.0.

4.3 EXAMINATIONS

4.3.1 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.

4.3.2 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 specified in Table 2.4-4.

b. The Specific Examination shall cover the equipment and operating procedures relative to the applicable test method or technique. The examination shall also cover specifications, codes and acceptance criteria used in the testing procedures. The minimum number of questions shall be as specified in Table 2.4-5.

c. The Practical Examination shall be administered by a Level III and shall demonstrate to the satisfaction of the Level III that the candidate is familiar with and can operate (except surveillance personnel, see Paragraph (d.3) below) the necessary test equipment and can interpret and record the resultant information from at least one (1) test specimen.

d. Additional requirements of the Practical Examination are as follows:

1) At least ten different check points 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) Surveillance personnel shall perform 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) and 2) above shall also apply.

4.3.3 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 ten different check points requiring an understanding of the test variables and procedural requirements shall be included in the examination.

4.3.4 Qualification examinations for Level III certification shall consist of written Basic, Method and Specific Examinations. Candidates for initial Level III certification shall also complete a Practical Examination for Level II in accordance with Paragraph 4.3.2 (c) and (d).

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 5.4), and

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 a written examination containing a minimum of twenty (20) questions relating to specifications, equipment, techniques and procedures applicable to products and methods similar to those utilized by the CENS NDE departments and administration of the NDE written practice.

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

4.3.6 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.

4.3.7 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.

4.3.8 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. Examinations prepared by an outside agency shall use procedures, techniques, etc., similar to those used by CENS. CENS shall retain responsibility for the adequacy of the program of the outside agency.

4.3.9 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.

4.3.10 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.

4.3.11 All levels of NDE personnel shall successfully complete an eye examination to demonstrate natural or corrected near-distance acuity of 20/25 or greater Snellen fraction (Jaeger J-1), with at least one eye, by reading words or identifying characters on a near-distance test chart, such as a Jaeger chart, that meets the requirements of the following table:

Table 2.4-1, Near-Distance Acuity Test Distances and Character Heights

Test Distance, inches	Maximum Lower Case Character Height, inches
12	0.022
13	0.024
14	0.025
15	0.027
16	0.029

NOTE 1: The test distances (eye to chart) and corresponding character heights provide a visual angle of 6.25 minutes, which is equivalent to a Snellen fraction of 20/25.

NOTE 2: A measurement of one of the near-distance test chart characters shall be made once before initial use with an optical comparator (10X or greater) or other suitable instrument to verify that the height of a representative lower case character, without ascender or descender (e.g., a, c, e, o), for the selected type size, meets the requirements of the above table. This measurement shall be documented on the test chart.

a. When required by Code, contract, specification or standard, personnel shall have natural or corrected far-distance acuity equivalent to a Snellen fraction of 20/30 or greater with at least one eye.

b. 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.

c. The eye examination shall be given to all NDE personnel on an annual basis.

d. Eye examinations shall be performed by a Level III, designate, or medical personnel.

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

4.4 CERTIFICATION

4.4.1 A Level III shall certify Level I and II personnel. Certification of Level III personnel shall be by CENS management. All certifications shall be documented on a Certification Record (Exhibit 2.4-2).

4.4.2 The certification period for Levels I and II personnel shall not exceed three (3) years. For Level III personnel, the certification period shall not exceed five (5) years.

4.4.3 Certification of all levels of NDE personnel shall be based on successful completion of the education, training and experience requirements of Paragraph 4.2 and the required examinations of Paragraph 4.3.

a. 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 examination(s) deemed necessary by the responsible Level III or department head prior to reactivating the certification.

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

a. The employee provides proof of prior certifications, or

b. 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 5.4) and this written practice.

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

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

2) 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.

In addition:

c. The employee shall have been working in the test method within six months of termination and is certified within six months after termination.

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

d. The employee successfully completes the examination requirements, as applicable, of Paragraph 4.3.

4.4.5 Certification shall be revoked by the Level III or CENS management 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.

4.5 RECERTIFICATION

4.5.1 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.

4.5.2 Level III personnel shall be recertified at least every five (5) years 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.

4.5.3 Level III personnel to be recertified by examination shall use the written Method and Specific Examinations (plus the Practical Examination, when required). Alternatively, Level III personnel may be recertified using only the written Method and Specific Examinations provided the following conditions are met:

a. The Level III candidate was previously certified or recertified using all the written examinations and the Practical Examination.

b. The Level III candidate is not being recertified due to interrupted service as defined in the employer's written practice.

5.0 REFERENCES

5.1 QAM-100 Quality Assurance Manual

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

5.3 ASME/ANSI NQA-1, including Supplement 2S-2

5.4 SNT-TC-1A - 1984 Recommended Practice for Nondestructive Testing Personnel Qualification and Certification

5.5 QAP 17.1 Records Retention

6.0 DEFINITIONS

6.1 QAM-100 Terms and Definitions, NQA-1 Supplement S-1 and Appendix A of this manual contain definitions for many of the terms utilized herein.

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

6.3 Certification - Written testimony of qualification.

6.4 Certifying Agency - The employer of the individual being certified.

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

6.6 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.

6.7 Outside Agency - An independent company or functionally independent organization/individual that provides NDE Level III services and whose qualifications to provide those services have been reviewed by the employer that engages the company, organization or individual.

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

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

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

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

7.0 RECORDS

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

7.1.1 Name of the certified individual;

7.1.2 Level of certification and test method;

7.1.3 Educational background and experience of the certified individual;

7.1.4 Statement indicating satisfactory completion of training in accordance with this procedure;

7.1.5 Results of the physical examination prescribed in Paragraph 4.3.11;

7.1.6 Current examination copy(s) or evidence of successful completion of the examinations;

7.1.7 Other suitable evidence of satisfactory qualifications when such qualifications are used in lieu of examinations;

7.1.8 Composite grade(s) or suitable evidence of grades;

7.1.9 Date of certification and/or recertification and the date of assignment to NDE;

7.1.10 Signature of employer's designated representative.

7.2 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: Bruce Allen 11/1/93
Principal NDE Level III Date

TABLE 2.4-2. MINIMUM TRAINING and EXPERIENCE for LEVEL I and II

Method	RT		MT		UT		PT		ET		VT		LT							
Level	I	II	I	II	I	II	I	II	I	II	I	II	I				II			
Technique													BT	PCMT	HDLT	MSLT	BT	PCMT	HDLT	MSLT
	TRAINING (HOURS)																			
Comp. of 2 yrs Eng. or Science Study in Univ or College or Tech School	29	35	8	4	24	40	4	4	8	8	8	8	2	16	8	28	2	12	6	16
High School or Equivalent	39	40	12	8	40	40	4	8	12	8	16	24	2	24	12	40	4	16	8	24
Grammar School *	88	80	24	16	40	80	12	16	48	24	20	20	2	60	24	60	4	80	20	80
	TOTAL WORK TIME EXPERIENCE (MONTHS PER LEVEL)																			
All Education Levels as listed above	3	9	1	3	3	9	1	2	1	9	1	3	**	1.5	1.5	4	0.5	4	4	6

NOTES:

1. * - Grammar School graduation, or demonstration of proficiency, or additional training.

2. Training shall be as outlined in Reference 5.4. 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.

3. VT as identified above refers to VT-1 (which includes VT of weldments), VT-2, & VT-3 as defined in Section XI of the ASME BPV Code.

4. 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.

5. One (1) month equals 175 hours.

6. Personnel utilizing methods not covered in Table 2.4-2 above shall be trained and qualified in accordance with SNT-TC-1A and this written practice.

7. BT - Bubble Test, ** indicates 2 Hours; MSLT - Mass Spectrometer Leak Test; PCMT - Pressure Change/Measurement Test; HDLT - Halogen Diode Leak Test.

TABLE 2.4-3. TRAINING and EXPERIENCE for LIMITED CERTIFICATION

TECHNIQUE / ACTIVITY	METHOD	TRAINING (HRS)		EXPERIENCE (HRS)	
		I	II	I	II
Isotope Radiography	RT	N/A	40	N/A	720
Film Interpretation	RT	N/A	20	N/A	520
Data Taking/Equip. Op.	RT	39	N/A	0	N/A
Surveillance	RT	N/A	40	2 surveillance trips for LII	
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/Equip. Op.	MT	12	N/A	0	N/A
Surveillance	MT	N/A	10	1 surveillance trip for LII	
Thickness Readings	UT	10	10	240	240
Contact Testing	UT	N/A	20	N/A	720
Evaluation	UT	N/A	20	N/A	520
Data Taking/Equip. Op.	UT	40	N/A	0	N/A
Surveillance	UT	N/A	40	2 surveillance trips for LII	
Solvent Removable	PT	N/A	4	N/A	130
Evaluation	PT	N/A	4	N/A	130
Data Taking/Equip. Op.	PT	4	N/A	0	N/A
Surveillance	PT	N/A	6	1 surveillance trip for LII	
Weldments	VT	1	2	100	175
Data Taking/Equip. Op.	VT	2	N/A	0	N/A
Surveillance	VT	N/A	6	2 surveillance trips for LII	
Data Taking/Equip. Op.	ET	12	N/A	0	N/A
Surveillance	ET	N/A	12	1 surveillance trip for LII	
Analysis of Fuel Rods	ET	N/A	20	N/A	250, Note 6

Notes:

1. 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.

2. Personnel holding limited certification in Data Taking/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 the test results.

3. The above hours are based on a high school graduate or equivalent. For other education levels, the hours may be adjusted in a ratio based on the hours shown in Table 2.4-2.

4. 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 2.4-2 for unlimited certification requirements.

5. For activities for which limited certification training and experience hours are not included in the table above, the Principal Level III shall establish and document the required training and experience hours prior to initiation of the qualification and certification activities.

6. Experience for ET Fuel Rod Analysis must be gained during a minimum of two field assignments. A knowledge of fuel rod manufacturing and/or design is also required.

TABLE 2.4-4. GENERAL EXAMINATION QUESTIONS

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
Visual	40	20	40	20

TABLE 2.4-5. SPECIFIC EXAMINATION QUESTIONS

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				
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
Visual	25	15	25	15

ABB

EYE EXAMINATION RECORD

NAME: Brian E. Albright DATE: 9/11/93

SSN: 044-45-0123

[X] JAEGER #1 [ ] JAEGER #2 [ ] ORTHORATER

[X] SNELLEN [ ] ISHIHARA [ ] OTHER: ______

EXAMINATION RESULTS:

				TO BE COMPLETED BY NDE DEPARTMENT: ACCEPTABLE	UNACCEPTABLE
NEAR VISION					
NATURAL:	R J-1	L J-1	B J-1	[X]	[ ]
CORRECTED:	R –	L –	B –	[ ]	[ ]
FAR VISION					
NATURAL:	R 20/—	L 20/—	B 20/—	[ ]	[X]
CORRECTED:	R 20/25	L 20/30	B 20/25	[X]	[ ]
COLOR VISION				[X]	[ ]

[X] ISHIHARA [ ] A.O.I.

[ ] OTHER: ______

EXHIBIT

CORRECTIVE LENSES OR AIDS ARE REQUIRED WHILE CONDUCTING EXAMINATIONS:

NEAR VISION: [ ] YES [X] NO

FAR VISION: [X] YES [ ] NO

ADMINISTERED BY: [signature] TITLE: NDE Level III

ACCEPTED BY: [signature] TITLE: NDE Level III

FM020402.3RP

EXHIBIT 2.4-1

ABB

CERTIFICATION RECORD

METHOD: ULTRASONIC

NAME: Brian E. Albright

LEVEL: III

SOC. SEC. NO.: 044-45-0123

CERTIFICATION DATE: 9/12/93

EXPIRATION DATE: 9/12/96

EDUCATION:
Needham High School, Needham, MA - Grad 1968

TRAINING:
US Navy NDT of Metals School, San Diego, CA - August 1980 - Courses in UT Thickness & Silver Braze Inspection
ABB Combustion Engineering, Windsor,CT - August 1981 - 32 Hours UT LII
- May 1982 - 28 Hours UT LII
EPRI NDE Center, Charlotte, NC - December 1983 - 40 Hours IGSCC Sizing
- June 1985 - 40 Hours IGSCC Detection
Hellier Assoc., Niantic, CT - 1992 - 24 Hours UT LIII

EXPERIENCE:
Certified and experienced at ABB CE as a Level I from December 1981 to July 1982, as a Level II from July 1982 to August 1988 and as a Level III from August 1988 to September 1993.

EXHIBIT

EXAMINATION:

ASNT Level III Basic and Method Exams - Passed 11/92

Practical Score : 92.0

General/Basic: 80.0
Specific/Method: 80.0
Practical/Specific: 89.9
Total: 341.9 / 4 = 85.4 COMPOSITE SCORE

The above named individual has completed the qualification/training requirements for certification in the above examination method in accordance with ABB Combustion Engineering Nuclear Services procedure QAP 2.4 revision 2 and only Addenda as anotated below.

CERTIFIED BY: C.S. Blomquist

POSITION: Manager, Nuclear Quality

ADDENDA	REV	REFERENCE	CERTIFIED BY	POSITION	DATE
C	0	ASME Sect XI, App VII	C.S. Blomquist	Mgr Nuc Qual	9/26/93

IM20401RP 6/16/92

EXHIBIT 2.4-2

ADDENDUM B
CERTIFICATION OF EPRI QUALIFIED DATA ANALYST (QDA) PERSONNEL

1.0 PURPOSE

1.1 This addendum modifies the requirements of QAP 2.4 for qualifications of EPRI Qualified Data Analyst (QDA), in accordance with PWR Steam Generator Examination Guidelines: Revision 3, EPRI NP-6201, Appendices G and H, November 1992.

2.0 APPLICABILITY

2.1 This Addendum applies only when required by Code, specification, contract or other governing document.

3.0 PREREQUISITES

3.1 Candidates for certification in accordance with this Addendum shall be certified to a minimum of Level IIA or shall be a Level II and have written permission of the Principal Level III.

MODIFICATIONS/ADDITIONS/DELETIONS

4.0 PROCEDURE

4.2 EDUCATION, TRAINING AND EXPERIENCE [SAME EXCEPT AS NOTED]

change existing paragraph to:

4.2.1 b. For EPRI Qualified Data Analyst (QDA) an additional 40 hours specific training, including examination, in eddy current data analysis is required to supplement the ET Level II training requirements as defined in Table 2.4-2. No additional experience is required.

4.1 EXAMINATIONS [SAME EXCEPT AS NOTED]

change existing paragraph to:

4.3.3 The QDA shall satisfy all of the examination requirements for an Eddy Current Level II or III and, in addition, shall demonstrate proficiency by successful completion of the EPRI Steam Generator Eddy Current Performance Demonstration using the Industry Database (IDB) Practical Examination.

4.5 RECERTIFICATION [SAME EXCEPT AS NOTED]

add the paragraph:

4.5.4 Periodic requalification as a QDA is not required as long as an individual continues to assume actively the duties of a data analyst with no continuous lapse in these duties for a time span longer than fifteen (15) months, as specified in Reference 5.7. Yearly training requirements of a minimum of eight (8) hours as specified in Reference 5.7 must be satisfied as well.

5.0 REFERENCES [SAME EXCEPT AS NOTED]

add the following paragraphs:

5.7 PWR Steam Generator Examination Guidelines: Revision 3, EPRI NP-6201, Appendices G and H, November 1992.

5.8 Industry Database, EPRI Research Project S530, June 1993. (Consists of a written and practical examination and includes data from the three (3) NSSS vendors.)

7.0 RECORDS [SAME EXCEPT AS NOTED]

add the following paragraph:

7.3 Certification Records of Analysts who successfully complete the IDB Practical Examination shall have the designation "EPRI Qualified Data Analyst (QDA)" and the date of completion placed in the Examination Section.

APPROVED: Bruce Allen (signature) 11/1/93
Principal NDE Level III Date

+2032859530 ABB

ZETEC

1370 NW Mall St. • PO Box 140
ıssaquah, WA 98027-0140 USA
(800) 643-1771 • (206) 392-5316
FAX • (206) 392-2086

Z-QA 8A REV. 2

CONDITION CODE: 6	
OWNER: ABB COMBUSTION ENGINEERING	

Zetec. Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument: MIZ-30-8	
Serial Number: 080	

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI. Appendix IV and ASME Section V Article 8, Appendix I. through 1989 Edition December 1990 Addenda.

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED: / 2753 / 093 / 021 / 012 /

CALIBRATION DATE: 30 Sep 1996

CALIBRATED BY: GRIFF NUTTALL

TECHNICIAN

CERTIFICATION DATE: 30 Sep 1996

EXPIRATION DATE: 30 Sep 1997

CERTIFIED BY: BRETT E. PYREN

QUALITY ASSURANCE

COMMENTS: PROCEDURE # CSP-MIZ30 REV.2

PO# 9605824 BCP 10/4/96

CERTIFICATE NUMBER A: 56878

ZETEC
1370 NW Mall St. • PO Box 140
Issaquah, WA 98027-0140 USA
(800) 643-1771 • (206) 392-5316
FAX • (206) 392-2086

CONDITION CODE: B	
OWNER: ABB COMBUSTION ENGINEERING	

Zetec, Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument: MIZ-30-8	
Serial Number: 095	

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI, Appendix IV and ASME Section V Article 8, Appendix I, through 1989 Edition December 1990 Addenda.

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED: / 2745 / 2731 / 056 / 021 /

CALIBRATION DATE: 15 Jan 1997

CALIBRATED BY: GRIFF NUTTALL

TECHNICIAN

CERTIFICATION DATE: 15 Jan 1997

EXPIRATION DATE: 15 Jan 1998

CERTIFIED BY: BRETT E. PYREN

QUALITY ASSURANCE

COMMENTS: PROCEDURE NUMBER: CSP-MIZ-30 REV. 2.

CERTIFICATE NUMBER A: 57131

ZETEC
1370 NW Mall St. • PO Box 140
Issaquah, WA 98027-0140 USA
(800) 643-1771 • (206) 392-5316
FAX • (206) 392-2086

Z-QA 8A REV. 2

CONDITION CODE: B	
OWNER: ABB COMBUSTION ENGINEERING	

Zetec, Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument: MIZ-30-8	
Serial Number: 086	

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI, Appendix IV and ASME Section V Article 8, Appendix I, through 1989 Edition December 1990 Addenda.

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED: / 2667 / 2749 / 0020 / 1137 /

CALIBRATION DATE: 5 Dec 1996

CALIBRATED BY: JOEL B. CHRISTOE

TECHNICIAN

CERTIFICATION DATE: 5 Dec 1996

EXPIRATION DATE: 5 Dec 1997

CERTIFIED BY: WILL REYNOLDS W Reynolds

QUALITY ASSURANCE

COMMENTS: PROCEDURE NUMBER: CSP-MIZ-30 REV.2
P.O. ~~#9605814~~ 9609153

CERTIFICATE NUMBER A: 57014

ZETEC
1370 NW Mall St. • PO Box 140
Issaquah, WA 98027-0140 USA
(800) 643-1771 • (206) 392-5316
FAX • (206) 392-2086

Z-QA 8A REV. 2

CONDITION CODE: 8	
OWNER: ABB COMBUSTION ENGINEERING	

Zetec, Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument: MIZ-30-8	
Serial Number: 096[illegible]	

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI, Appendix IV and ASME Section V Article 8, Appendix I, through 1989 Edition December 1990 Addenda.

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED:	1008/1814 /2015 /2501	
CALIBRATION DATE:	22 Aug 1996	
CALIBRATED BY:	ROB GRAVES	Rob Graves TECHNICIAN
CERTIFICATION DATE:	22 Aug 1996	
EXPIRATION DATE:	22 Aug 1997	
CERTIFIED BY:	GRIFF NUTTALL	Griff Nuttall QUALITY ASSURANCE

COMMENTS: CSP-MIZ-30 REV1

CERTIFICATE NUMBER A: 56760

ZETEC

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Issaquah, WA 98027-0140 USA
(800) 643-1771 • (206) 392-5316
FAX • (206) 392-2086

CONDITION CODE: E	
OWNER: ABB/CE	

Zetec, Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument: MIZ-30-8	
Serial Number: 085	

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI, Appendix IV and ASME Section V Article 8, Appendix I, through 1989 Edition December 1990 Addenda.

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED:	2742 / 2747 / 2665 / 1984	
CALIBRATION DATE:	2 Jan 1997	
CALIBRATED BY:	ERIC MARTIN	E. Martin TECHNICIAN
CERTIFICATION DATE:	2 Jan 1997	
EXPIRATION DATE:	2 Jan 1998	
CERTIFIED BY:	GRIFF NUTTALL	Griff Nuttall QUALITY ASSURANCE

COMMENTS: PROCEDURE ESP-COP MIZ-30-8 REV. 4
P.O.# 9609153

CERTIFICATE NUMBER A: 57064

ZETEC

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ssaquah, WA 98027-0140 USA
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FAX • (206) 392-2086

Z-QA 8A REV. 2

CONDITION CODE:	8
OWNER:	ABB COMBUSTION ENGINEERING

Zetec, Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument:	MIZ-30-8
Serial Number:	087

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI, Appendix IV and ASME Section V Article 8, Appendix I, through 1989 Edition 1989

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED: / 057 / 088 / 1522 / 2748 /

CALIBRATION DATE: 11 Sep 1996

CALIBRATED BY: ED MILLER

Ed Miller
TECHNICIAN

CERTIFICATION DATE: 11 Sep 1996

EXPIRATION DATE: 11 Sep 1997

CERTIFIED BY: JOEL B. CHRISTOE

Joel B. Christoe
QUALITY ASSURANCE

COMMENTS: PROCEDURE NUMBER: ESP-COP MIZ-30-8 REV. 2

PO# 9605824 BCP 9/24/96

CERTIFICATE NUMBER A: 56806

ZETEC

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Issaquah, WA 98027-0140 USA
(800) 643-1771 • (206) 392-5316
FAX • (206) 392-2086

CONDITION CODE: B
OWNER: ABB COMBUSTION ENGINEERING

Zetec, Incorporated hereby certifies that the following instrument meets or exceeds all manufacturer's specifications.

Instrument: MIZ-30-8
Serial Number: 099

The calibration of this instrument is controlled by approved, documented procedures which meet or exceed ASME Section XI, Appendix IV and ASME Section V Article 8, Appendix I, through 1989 Edition December 1990 Addenda.

Calibration has been performed using standards whose accuracies are traceable to the National Institute of Standards and Technology.

STANDARDS USED: / 088 / 096 / 1522 / 2748		
CALIBRATION DATE:	21 Aug 1996	
CALIBRATED BY:	ED MILLER	Ed Miller TECHNICIAN
CERTIFICATION DATE:	21 Aug 1996	
EXPIRATION DATE:	21 Aug 1997	
CERTIFIED BY:	BRETT E. PYREN	Brett E. Pyren QUALITY ASSURANCE

COMMENTS: PROCEDURE NUMBER: CSP-MIZ 30 REV.1
P.O# 9605824

CERTIFICATE NUMBER A: 56756

ZETEC

1370 N.W. Mall, P.O. Box 140, Issaquah, WA 98027-0140 (206) 392-5316 Telex 15 2592 Telecopy (206) 392-2086

CERTIFICATE OF COMPLIANCE

This certifies that, to the best of our knowledge, the material delivered under this purchase agreement is in accordance with the terms of the contract.

Customer: ABB COMBUSTION ENGINEERING

Contract/Purchase Order Number: 9507505

By [signature], on SEPT. 12, 1995
Quality Assurance Representative   Date

☐ See Attachments: ________

COMMENTS: STANDARD SERIAL NUMBERS:

Z-14089 THROUGH Z-14094

CP&L CONTRACT W/ABB XM10370000

WORK AUTHORIZATION XS10370016

ABB QA MGR, RANDY TATE

[signature] 9/15/95

10CFR REQUIREMENTS ARE NOT EXTENDED BEYOND ZETEC FOR COMMERCIAL ITEMS OR MATERIAL SUPPLIED TO ZETEC.

ZETEC

TEST CERTIFICATE

DATE: SEPTEMBER 9, 1993

MATERIAL: SEAMLESS ANNEALED INCONEL 600 SB-163

Heat No.	Description
NX8502	3/4" DIA. X .043 NOM. WALL THICKNESS

CHEMICAL ANALYSIS

C	Si	Mn	P	S	Ni	Cr	Mo	Al	Zn
.034	.26	.240		<.001	75.47	15.4			
Pb	**B**	**Ca**	**Cd**	**Co**	**Cu**	**Fe**	**Nb**	**Ti**	**Other**
					.14	8.20			

TENSILE PROPERTIES

Yield Strength	Ultimate Strength PSI	% Elongation	Rb Hardness
37,600	93,600	55%	HRB60

Expansion	Flattening	Hydrostatic	Surface	Flaring	SPEC
		OK		OK	ASME SB-163

We certify that the above data is as furnished by the producing mill or supplier.

Zetec, Inc.

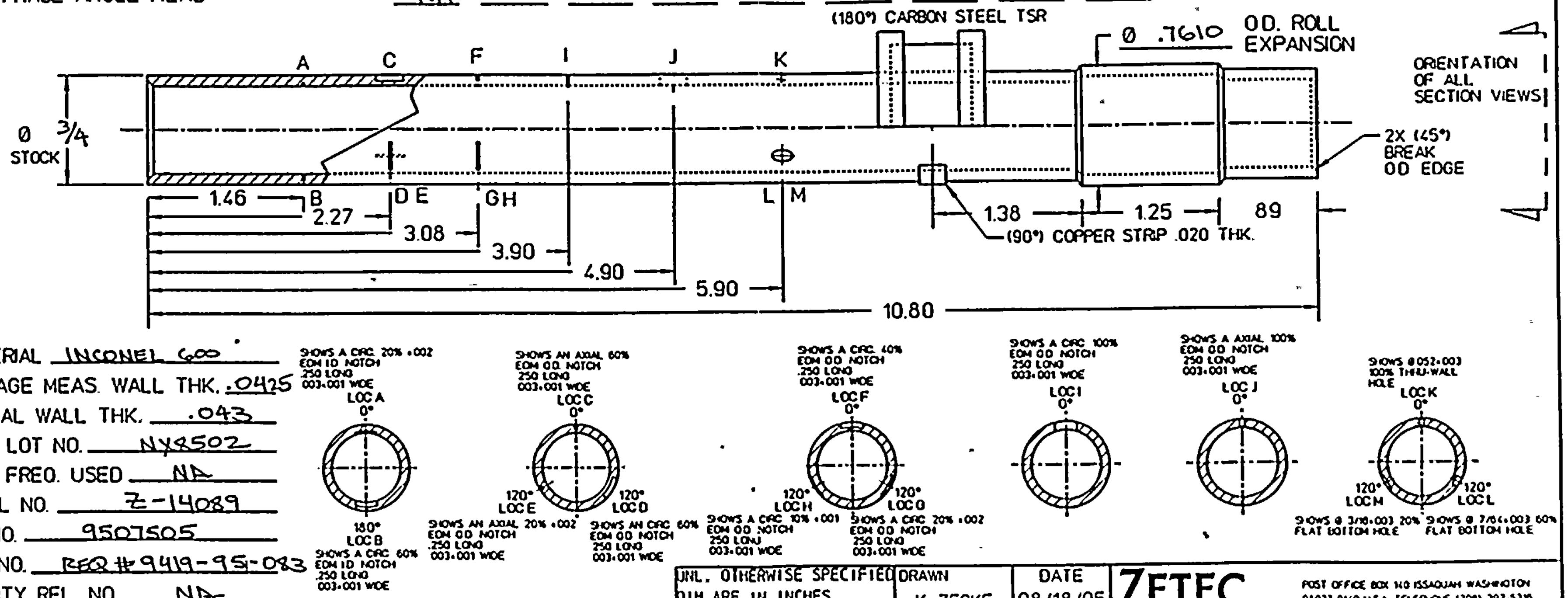
[signature] Date: 10/1/93

ZETEC, INC.
1370 NW Mall Street
PO Box 140
~~Issaquah WA 98027-0140~~
USA
Telephone (206) 392-5316
Telefax (206) 392-2086
Telex 15 2592

				C	REVISIONS	REV STATUS OF SHEETS
				2	SHEET	

REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
C	8/29/95	REDRAWN W/CHANGES.REV SHT #2	[illegible]	[illegible]	KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0095	.0275	.0275	.0250	.0090	.0160	.0085	.0040	THRU	THRU	THRU	.0245	.0090
DEPTH IN % OF WALL	22%	65%	65%	59%	21%	38%	20%	9%	100%	100%	100%	58%	21%
E T PHASE ANGLE MEAS	NA												



MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0425
NOMINAL WALL THK. .043
HEAT LOT NO. NX8502
TEST FREQ. USED NA
SERIAL NO. Z-14089
P.O. NO. 9507505
REL. NO. REQ #9419-95-083
QUALITY REL. NO. NA
DATE MFG. 9-12-95
Q.A. INSP. [signature]
CUSTOMER ABB CE
RECORDED NA
PROBE USED
REVIEWED BY [signature]

NOTE:

UNL. OTHERWISE SPECIFIED
DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ± 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

		DATE
DRAWN	K ZEGKE	08/18/95
CHECK	C.B	8/22/95
DESIGN		
APVD QA	G.A.	8/22/95

ZETEC INC
POST OFFICE BOX 140 ISSAQUAH WASHINGTON 98027-0140 USA TELEPHONE (206) 392-5316

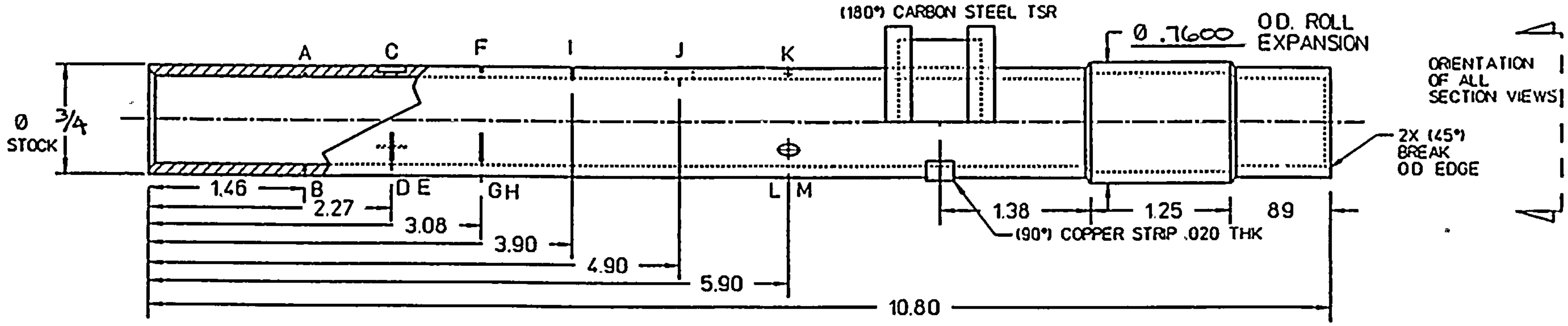
TITLE MISC. DEFECT STANDARD
D#3538-1-A P#2956

SIMILAR
DWG NO 2-421-1007
SCALE NTS
USED ON
SHT 1 OF 2

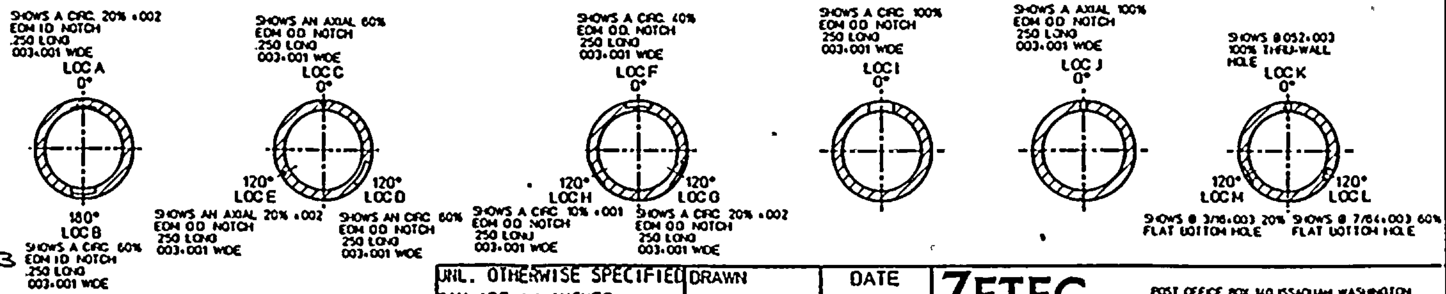
				C	REVISIONS	REV STATUS OF SHEETS
				2	SHEET	

REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
C	8/29/95	REDRAWN W/CHANGES.REV SHT #2			KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0090	.0260	.0265	.0250	.0095	.0175	.0090	.0040	THRU	THRU	THRU	.0240	.0085
DEPTH IN % OF WALL	21%	61%	62%	59%	22%	41%	21%	9%	100%	100%	100%	56%	20%
E.T. PHASE ANGLE MEAS	NA												



MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0425
NOMINAL WALL THK. .043
HEAT LOT NO. NX8502
TEST FREQ. USED NA
SERIAL NO. Z-14090
P.O. NO. 9507505
REL. NO. REQ #9419-95-083
QUALITY REL. NO. NA
DATE MFG. 9-12-95
Q.A. INSP. [signature]
CUSTOMER ABB CE
RECORDED NA
PROBE USED NA
REVIEWED BY [signature]



NOTE:

UNL. OTHERWISE SPECIFIED
DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ± 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

DRAWN	DATE
K. ZEGKE	08/18/95
CHECK C.B.	8/22/95
DESIGN	
APVD QA G.A.	8/22/95

ZETEC INC
POST OFFICE BOX 140 ISSAQUAH WASHINGTON 98027-0140 USA TELEPHONE (206) 392-5316

TITLE
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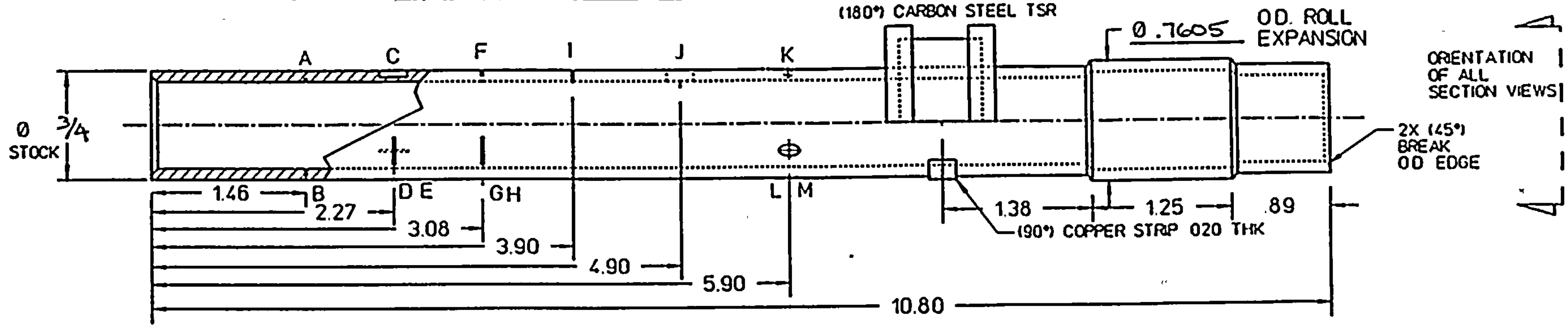
D#3538-1-A P#2956

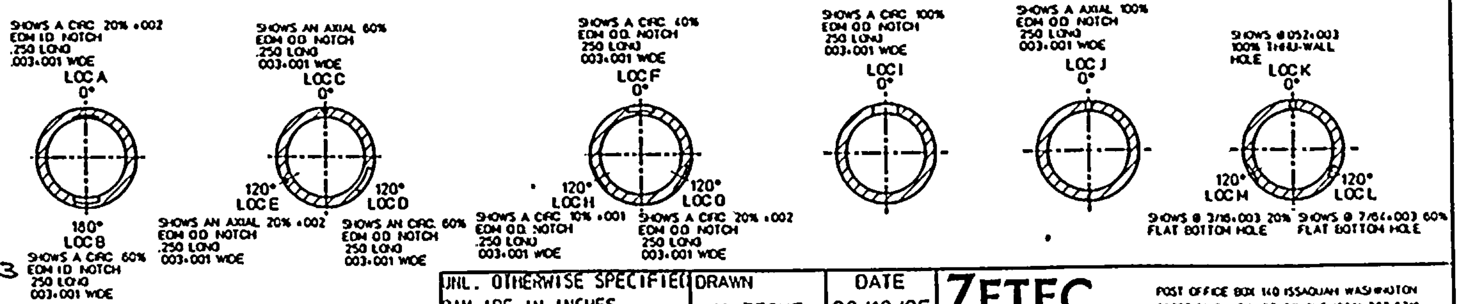
SIMILAR
DWG NO 2-421-1007
SCALE NTS
USED ON
SHT 1 OF 2

				C	REVISIONS	REV STATUS OF SHEETS
				2	SHEET	

REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
C	3/29/95	REDRAWN W/CHANGES, REV SHT #2	[illegible]	[illegible]	KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0085	.0260	.0255	.0260	.0090	.0170	.0085	.0045	THRU	THRU	THRU	.0245	.0080
DEPTH IN % OF WALL	20%	61%	60%	61%	21%	40%	20%	11%	100%	100%	100%	58%	19%
E.T PHASE ANGLE MEAS	NA												





MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0425
NOMINAL WALL THK. .043
HEAT LOT NO. NX8502
TEST FREQ. USED NA
SERIAL NO. Z-14091
P.O. NO. 9507505
REL. NO. REQ #9419-95-083
QUALITY REL. NO. NA
DATE MFG. 9-12-95
QA. INSP. [signature]
CUSTOMER ABB CE
RECORDED NA
PROBE USED NA
REVIEWED BY [signature]

NOTE:

UNL. OTHERWISE SPECIFIED
DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ± 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

DRAWN	K. ZEGKE	DATE 08/18/95
CHECK	CB	8/22/95
DESIGN		
APVD QA	G.A.	8/22/95

ZETEC INC
POST OFFICE BOX 140 ISSAQUAH WASHINGTON 98027-0140 U.S.A. TELEPHONE (206) 392-5316

TITLE
MISC. DEFECT STANDARD
D#3538-1-A P#2956

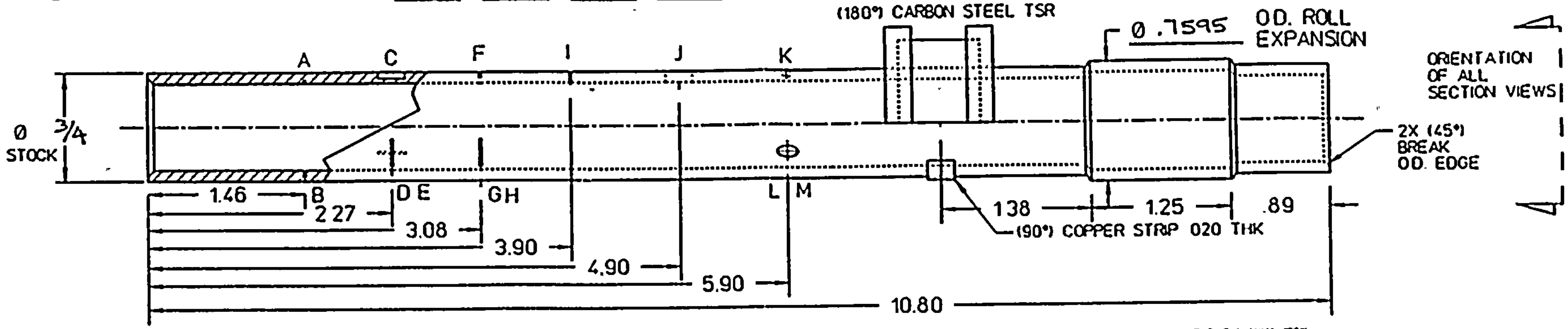
SIMILAR
DWG NO 2-421-1007
SCALE NTS
USED ON
SHT 1 OF 2

				C	REVISIONS	REV. STATUS OF SHEETS
				2	SHEET	

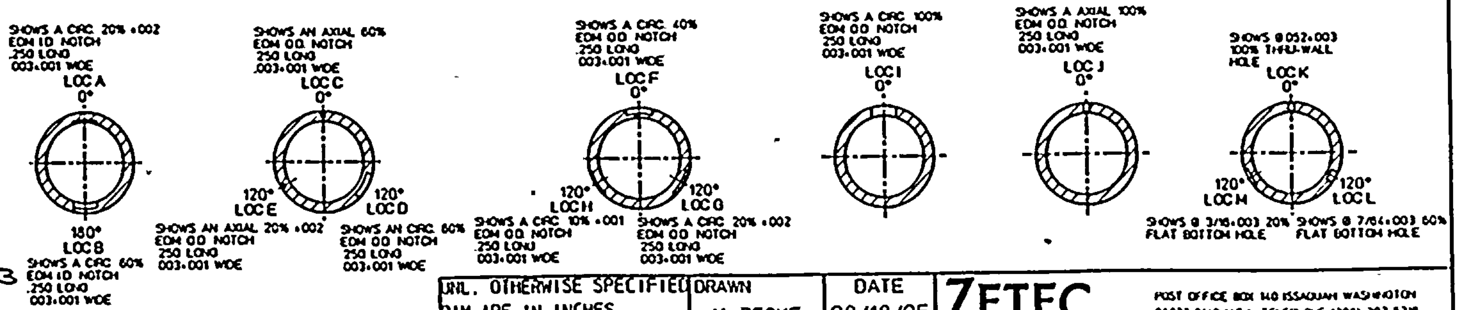
REVISIONS

LTR	DATE	DESCRIPTION	APVD	CK	DR
C	8/29/95	REDRAWN W/CHANGES, REV SHT #2	[illegible]	[illegible]	KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0080	.0260	.0250	.0245	.0085	.0180	.0085	.0045	THRU	THRU	THRU	.0245	.0090
DEPTH IN % OF WALL	19%	61%	59%	58%	20%	42%	20%	11%	100%	100%	100%	58%	21%
E.T. PHASE ANGLE MEAS	NA												



MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0425
NOMINAL WALL THK. .043
HEAT LOT NO. NX8502
TEST FREQ. USED NA
SERIAL NO. Z-14092
P.O. NO. 9507505
REL. NO. REQ # 9419-951083
QUALITY REL. NO NA
DATE MFG. 9-12-95
Q.A. INSP. [signature]
CUSTOMER ABB CE
RECORDED NA
PROBE USED [illegible]
REVIEWED BY [signature]



NOTE:

UNL. OTHERWISE SPECIFIED
DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ± 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

DRAWN	K. ZEGKE	DATE 08/18/95
CHECK	C.B.	8/22/95
DESIGN		
APVD QA	G.A.	8/22/95

ZETEC INC

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D#3538-1-A P#2956

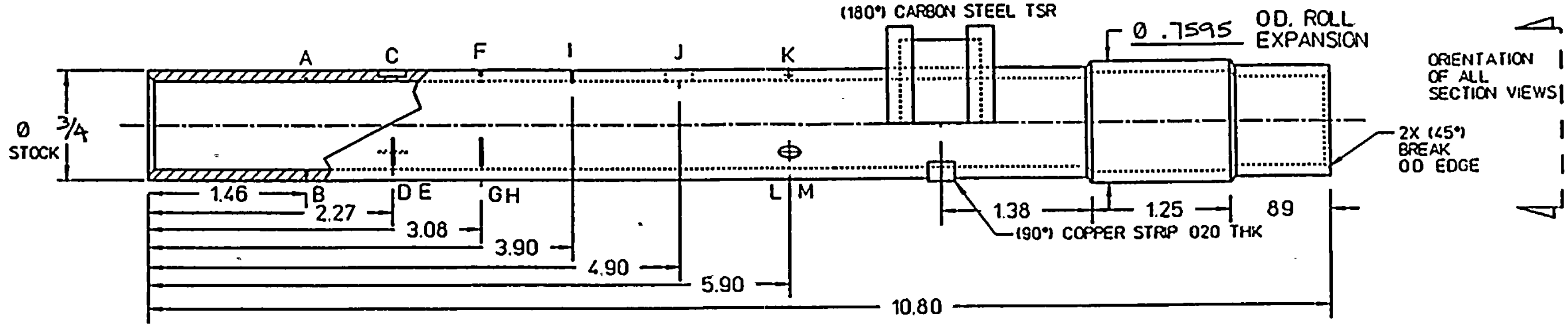
SIMILAR
DWG NO 2-421-1007
SCALE NTS
USED ON
SHT 1 OF 2

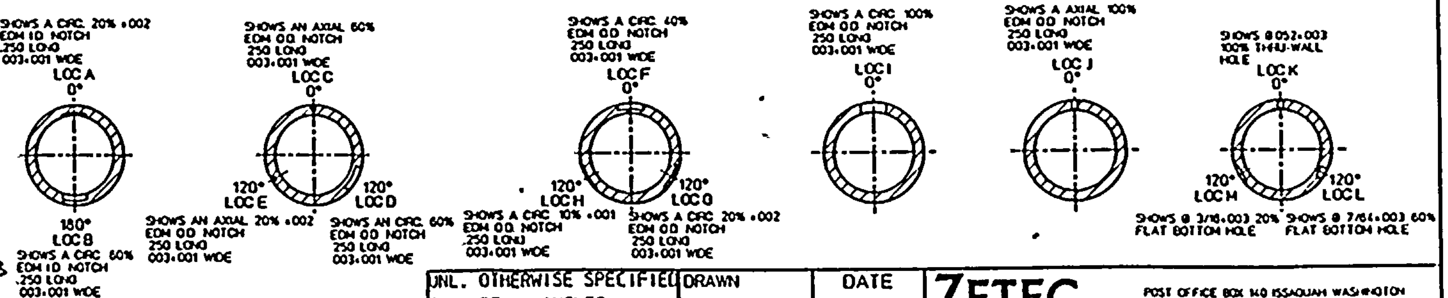
				C	REVISIONS	REV STATUS OF SHEETS
				2	SHEET	

REVISIONS

LTR	DATE	DESCRIPTION	APVD	CK	DR
C	8/29/95	REDRAWN W/CHANGES, REV SHT #2			KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0080	.0260	.0250	.0260	.0090	.0175	.0085	.0045	THRU	THRU	THRU	.0240	.0085
DEPTH IN % OF WALL	19%	61%	59%	61%	21%	41%	20%	11%	100%	100%	100%	56%	20%
E T PHASE ANGLE MEAS	NA												





MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0425
NOMINAL WALL THK. .043
HEAT LOT NO. NX8502
TEST FREQ. USED NA
SERIAL NO. Z-14093
P.O. NO. 9507505
REL. NO. REQ #9419-95-083
QUALITY REL. NO. NA
DATE MFG. 9-12-95
Q.A. INSP.
CUSTOMER ABB CE
RECORDED NA
PROBE USED NA
REVIEWED BY.

NOTE:

UNL. OTHERWISE SPECIFIED DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ± 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

DRAWN	DATE
K. ZEGKE	08/18/95
CHECK C.B.	8/22/95
DESIGN	
APVD QA G.A.	8/22/95

ZETEC INC
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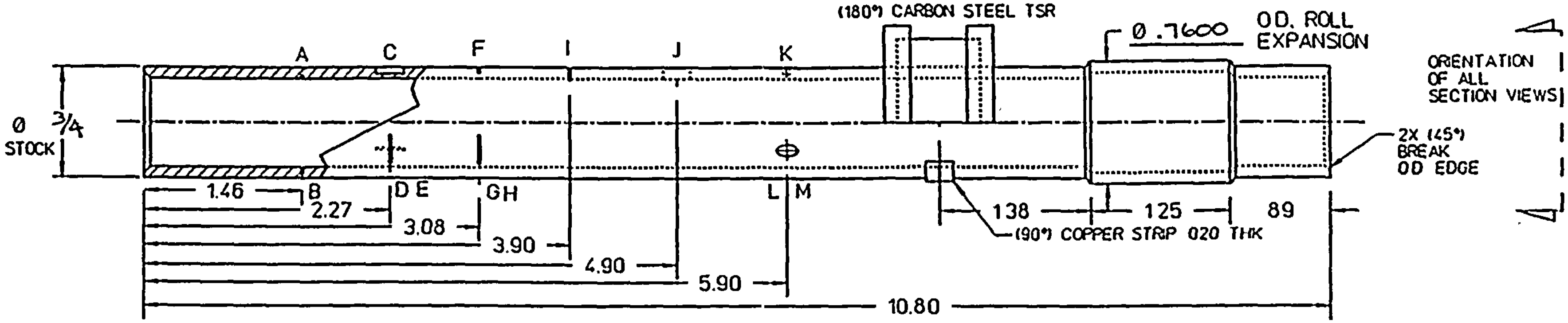
TITLE
MISC. DEFECT STANDARD
D#3538-1-A P#2956

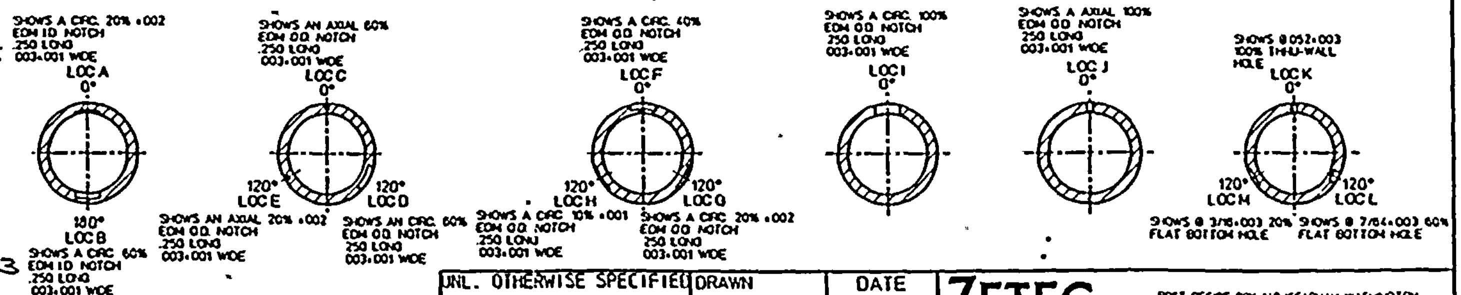
SIMILAR
DWG NO 2-421-1007
SCALE NTS
USED ON
SHT 1 OF 2

				C	REVISIONS	REV. STATUS OF SHEETS
				2	SHEET	

REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
C	8/29/95	REDRAWN W/CHANGES, REV SHT #2			KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0085	.0255	.0250	.0260	.0085	.0170	.0085	.0045	THRU	THRU	THRU	.0245	.0085
DEPTH IN % OF WALL	20%	60%	59%	61%	20%	40%	20%	11%	100%	100%	100%	58%	20%
E T PHASE ANGLE MEAS	NA												





MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0425
NOMINAL WALL THK. .043
HEAT LOT NO. NX8502
TEST FREQ. USED NA
SERIAL NO. Z-14094
P.O. NO. 9507505
REL. NO. REQ #9419-95-083
QUALITY REL. NO. NA
DATE MFG. 9-12-95
Q.A. INSP. [signature]
CUSTOMER ABB CE
RECORDED NA
PROBE USED NA
REVIEWED BY [signature]

NOTE:

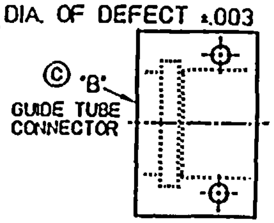
UNL. OTHERWISE SPECIFIED DIM ARE IN INCHES	DRAWN	DATE	ZETEC INC
TOLERANCES	K. ZEGKE	08/18/95	POST OFFICE BOX 140 ISSAQUAH WASHINGTON 98027-0140 U.S.A. TELEPHONE (206) 392-5316
DECIMAL FRACT. ± 1/16	CHECK		TITLE
.XXXX ±.003	C.B	8/22/95	MISC. DEFECT STANDARD
.XXX ±.015	DESIGN		D#3538-1-A P#2956
.XX ±.050			SIMILAR / DWG NO 2-421-1007
% ±.003	APVD. QA		
ANGULAR ±3°	G.A.	8/22/95	SCALE NTS / USED ON / SHT 1 OF 2
FINISH			

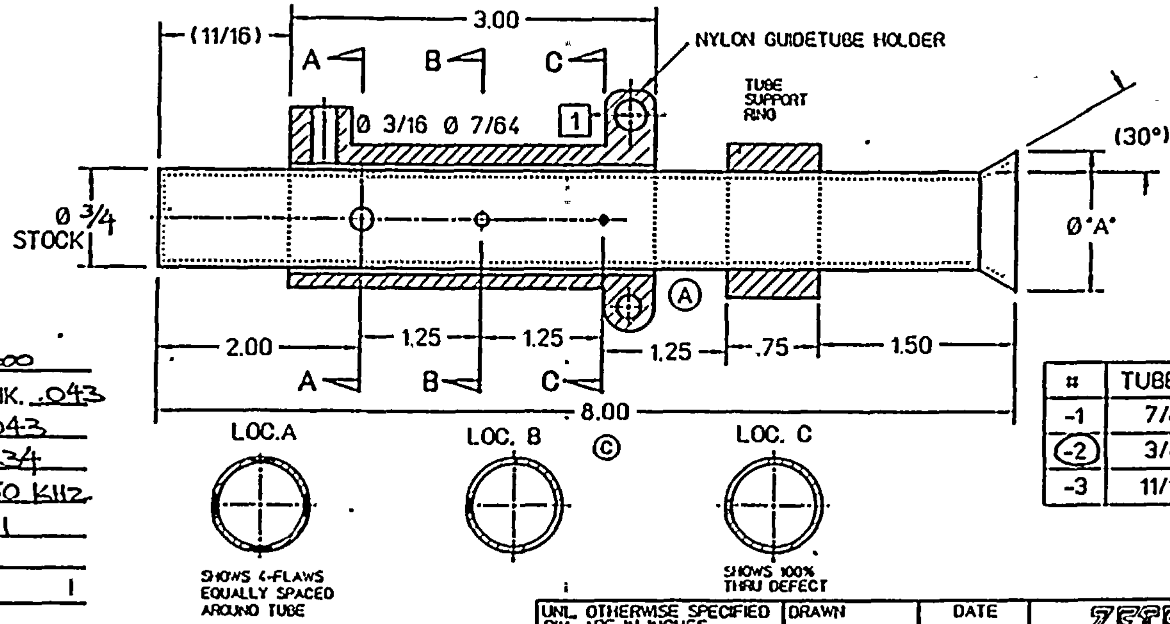
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
C	10/2/90	ALL FLAW LOC. DIM. CHANGED. TOTAL LENGTH WAS 7.00 ADDED "B" REMOVED KNURL	KJW		KZ

LOCATION	A	B	C
PHYSICALLY MEAS. DEPTH	.0090	.0260	THRU
% OF WALL LOSS	21%	60%	100%
PHASE ANGLE MEAS.	153°	107°	40°

SEE DWG#5-001191 FOR TOTAL ASSY.

1 0.052 IN STD. ≤ 0.75
0.067 IN STD. > 0.75





C

#	TUBE Ø	'A'	'B'
-1	7/8	1.10	1-000090
-2	3/4	.950	1-000098
-3	11/16	.930	1-000097

MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .043
NOMINAL WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED 550 KHz
SERIAL NO. Z-8711
P.O. NO. 000544
REL. NO. NA
QUALITY REL. NO. NA
DATE MFG. 11-12-90
Q.A.INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED 32
PROBE USED A650LC/IIF #69848
REVIEWED BY M. DeMartino

NOTE:

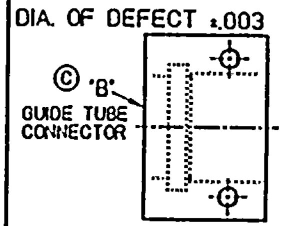
UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES TOLERANCES	DRAWN	DATE	ZETEC INC P.O. BOX 140 ISSAQUAH, WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316	
DECIMAL FRACT.+/-1/16 XXXX ±.003 XXX ±.015 XX ±.050 % ±.003 ANGULAR +/-3°	K.ZEGKE	8/16/90	TITLE SM-10 GUIDE TUBE STD. W/20%,60%,100% FLAWS & TSR A#1189 D#1463-1-A	
	CHECK B.J.	8/16/90		
	DESIGN		DWG NO	2-4463
	APVD. QA			
FINISH	K.WARLICK	8/21/90	SCALE NONE	RELDATE 8/21/90 SHT 1 OF 1

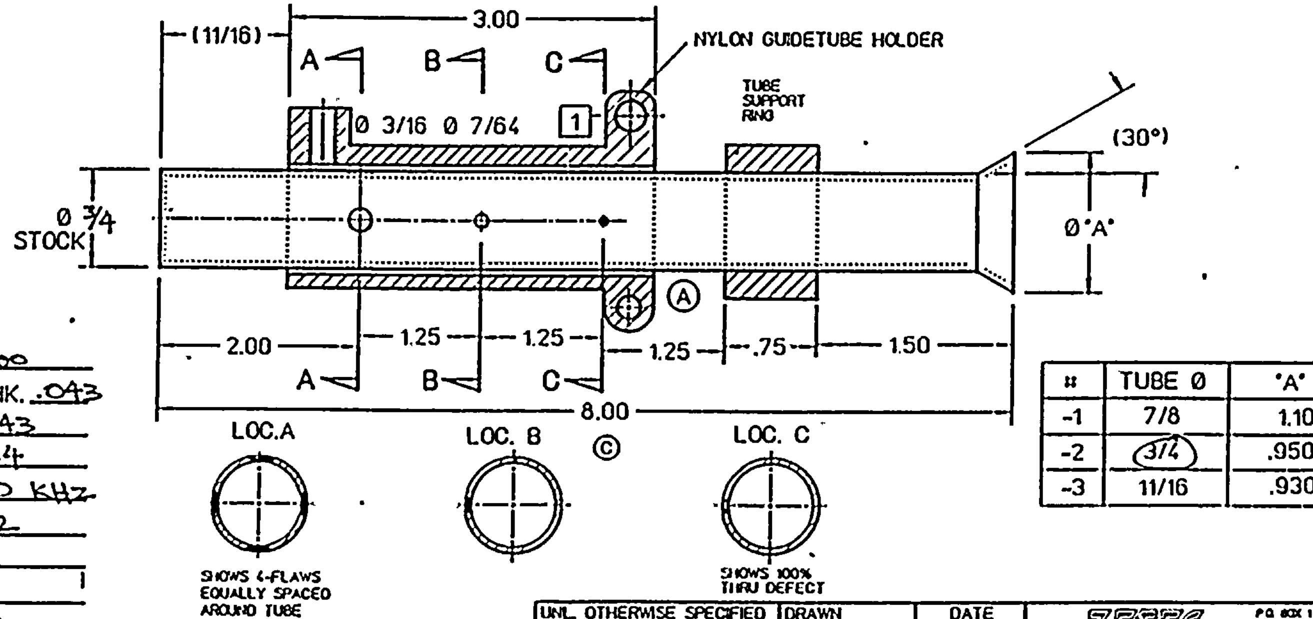
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
C	10/2/90	ALL FLAW LOC. DIM. CHANGED, TOTAL LENGTH WAS 7.00 ADDED "B" REMOVED KNURL	KdW		KZ

LOCATION	A	B	C
PHYSICALLY MEAS. DEPTH	.0095	.0250	THRU
% OF WALL LOSS	22%	58%	100%
PHASE ANGLE MEAS.	150°	110°	40°

SEE DWG#5-001191 FOR TOTAL ASSY.

[1] 0.052 IN STD. ≤ 0.75
0.067 IN STD. > 0.75





©

#	TUBE Ø	'A'	'B'
-1	7/8	1.10	1-000090
-2	3/4	.950	1-000098
-3	11/16	.930	1-000097

MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .043
NOMINAL WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED 550 KHZ
SERIAL NO. Z-8712
P.O. NO. 000544
REL. NO. NA
QUALITY REL. NO. NA
DATE MFG. 11.12.90
Q.A.INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED 32
PROBE USED A650LC/HF #69848
REVIEWED BY M. DeMartino

NOTE:

UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT.+/- 1/16
XXXX ±.003
XXX ±.015
XX ±.050
% ±.003
ANGULAR+/- 3°
FINISH

DRAWN	K.ZEGKE	DATE 8/16/90
CHECK	B.J.	8/16/90
DESIGN		
APVD. QA	K.WARLICK	8/21/90

ZETEC INC. P.O. BOX 140 ISSAQUAH, WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316

TITLE SM-10 GUIDE TUBE STD. W/20%,60%,100% FLAWS & TSR
A#1189 D#1463-1-A

DWG NO 2-4463

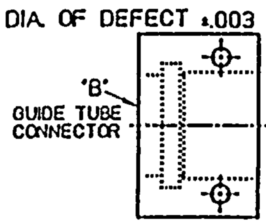
SCALE NONE | REL DATE 8/21/90 | SHT 1 OF 1

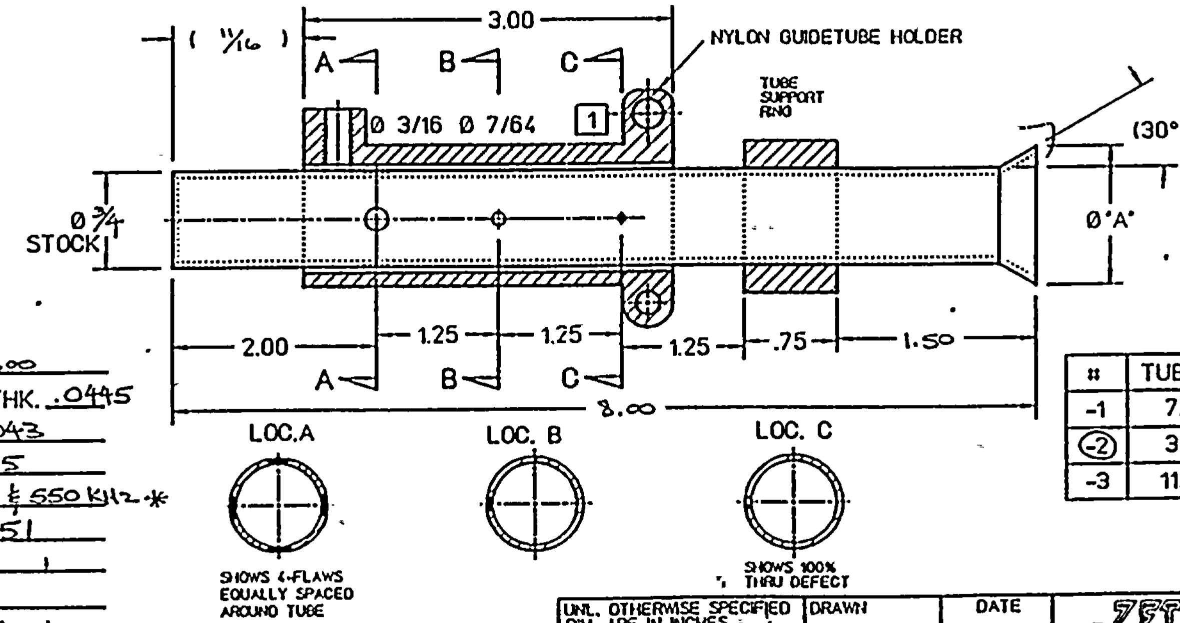
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
D	2/26/92	REMOVED TOTAL LENGTH & END DIM.	Q.A.	[illegible]	KZ

LOCATION		A	B	C
PHYSICALLY MEAS. DEPTH		.0090	.0270	THRU
% OF WALL LOSS		20%	61%	100%
PHASE ANGLE MEAS. *	550 KHZ:	162°	120°	38°
	500 KHZ:	156°	114°	40°

SEE DWG#5-001191 FOR TOTAL ASSY.

[1] 0.052 IN STD. ≤ 0.75
0.067 IN STD. > 0.75





#	TUBE Ø	'A'	'B'
-1	7/8	1.10	1-000090
-2	3/4	.950	1-000098
-3	11/16	.930	1-000097

MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .0445
NOMINAL WALL THK. .043
HEAT LOT NO. 72045
TEST FREQ. USED 500 & 550 KHZ *
SERIAL NO. Z-10951
P.O. NO. MR2195
REL. NO. NA
QUALITY REL. NO. NA
DATE MFG. 10.13.92
Q.A.INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED 35
PROBE USED A650LC/HF #69848
REVIEWED BY [signature]

NOTE:

*THE 550KHZ TEST FREQUENCY IS BASED ON THE NOM. WALL THICKNESS OF .043 AND DOES NOT MEET THE ZETEC ZQA-4.1 CURVE WITH THE 100% FLAW AT 40° ± 3° AND THE 20% FLAW AT 155° ± 5°. THE 500 KHZ TEST FREQUENCY IS BASED ON THE ACTUAL WALL THICKNESS OF .0445 AND MEETS THE ZETEC ZQA-4.1 CURVE.

UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ±1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

DRAWN	DATE
K.ZEGKE	8/16/90
CHECK B.J.	8/16/90
DESIGN	
APVD. QA K.WARLICK	8/21/90

ZETEC INC. P.O. BOX 140 ISSAQUAH WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316

TITLE SM-10 GUIDE TUBE STD. W/20%,60%,100% FLAWS & TSR
A#1189 D#1463-1-A

DWG NO 2-4463

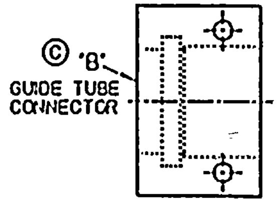
SCALE NONE | RELDATE 8/21/90 | SHT 1 OF 1

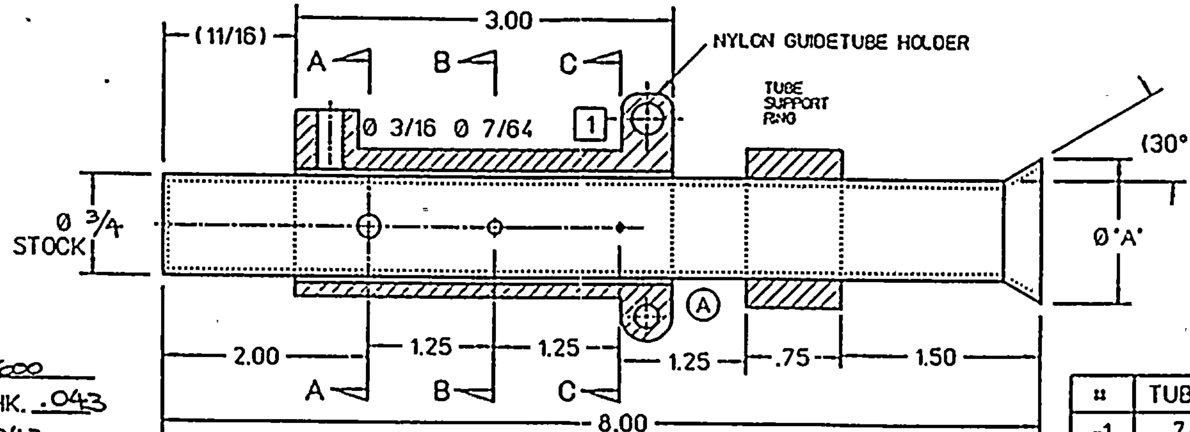
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	C	C
©	10/3/90	ALL FLAW LOC. DIM. CHANGED, TOTAL LENGTH WAS 7.00 ADDED "B" REMOVED WASH.	KW		KZ

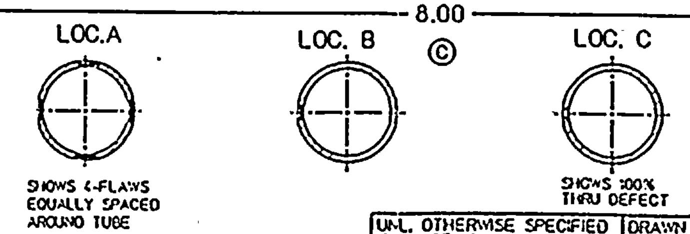
LOCATION	A	B	C
PHYSICALLY MEAS. DEPTH	.0090	.0270	THRU
% OF WALL LOSS	21%	63%	100%
PHASE ANGLE MEAS.	152°	100°	40°

SEE DWG#5-001191 FOR TOTAL ASSY.

[1] 0.052 IN STD. ≤ 0.75
0.067 IN STD. > 0.75







MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .043
NOMINAL WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED 550 KHz
SERIAL NO. Z-9047
P.O. NO. 1129
REL. NO. JOB # EL-0655
QUALITY REL. NO. NA
DATE MFG. 3-5-91
Q.A.INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED 33
PROBE USED A650LC/IIF #69848
REVIEWED BY [signature]

©

#	TUBE Ø	'A'	'B'
-1	7/8	1.10	1-000090
-2	3/4	.950	1-000098
-3	11/16	.930	1-000097

NOTE:

UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES TOLERANCES		DRAWN	DATE
DECIMAL	FRACT. +/- 1/16	K.ZEGKE	8/16/90
.XXXX ±.003		CHECK	
.XXX ±.015		B.J.	8/16/90
.XX ±.050		DESIGN	
% ±.003			
ANGULAR +/- 3°		APVD. QA	
FINISH		K.WARLICK	8/21/90

ZETEC, INC. P.O. BOX 140 ISSAQUAH, WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316

TITLE SM-10 GUIDE TUBE STD. W/20%,60%,100% FLAWS & TSR
A#1189 D#1463-1-A

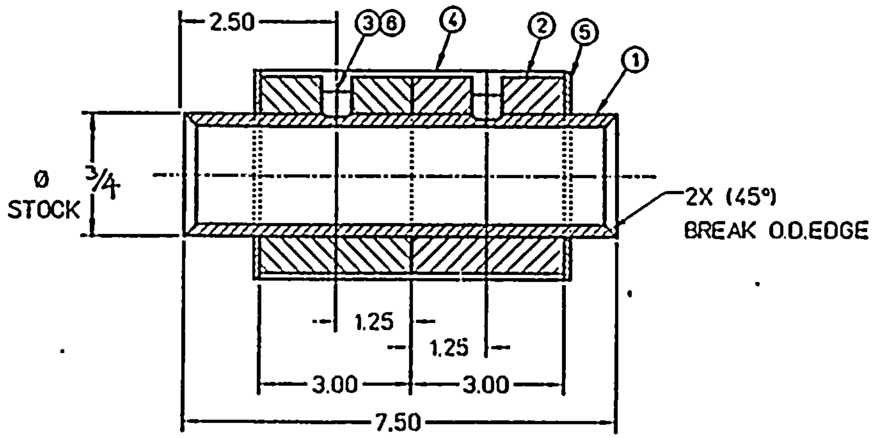
DWG NO 2-4463

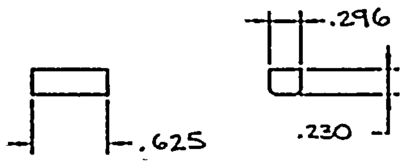
SCALE NONE | RELDATE 8/21/90 | SH 1 OF 1

LOCATION	A	B
PHYSICALLY MEAS. DEPTH	.0130	.0215
% OF WALL LOSS	30%	50%

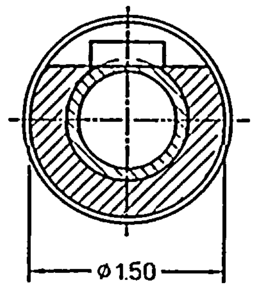
REVISIONS

LTR	DATE	DESCRIPTION	APVD	CK	DR
(A)	10/8/90	CHANGED TOL.BLOCK, ADDED #6	KW	S	K





LOC A & B



A.V.B.MATERIAL CHROME PLATED INCONEL
TUBE MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .043
NOMINAL WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED NA
SERIAL NO. Z-8715
P.O. NO. 000544
REL. NO. NA
QUALITY REL. NO. NA
DATE MFG. 11-12-90
Q.A. INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED NA
PROBE USED NA
REVIEWED BY M. DeMartino

NOTE:

	ITEM NO	DESCRIPTION
(A)	6	BAR-.625 L X .316 W X .230 H INCONEL
	5	DELRIN SPACER FOR LEXAN
	4	LEXAN TUBE - 1 3/4 I.D. X 2.0 O.D.
	3	BAR - .625 X .395 X .750 405 S.S.
	2	DELRIN SPACER 1.50 O.D. X 3.00 LG.
	1	TUBE-INCONEL

(A) UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT. +/- 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR +/- 3°
FINISH

DRAWN	K.ZEGKE	DATE 12/22/89
CHECK	B.J.	12/22/89
DESIGN		
APVD. QA	K.WARLICK	12/28/89

ZETEC INC. P.O. BOX 140 ISSAQUAH, WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316

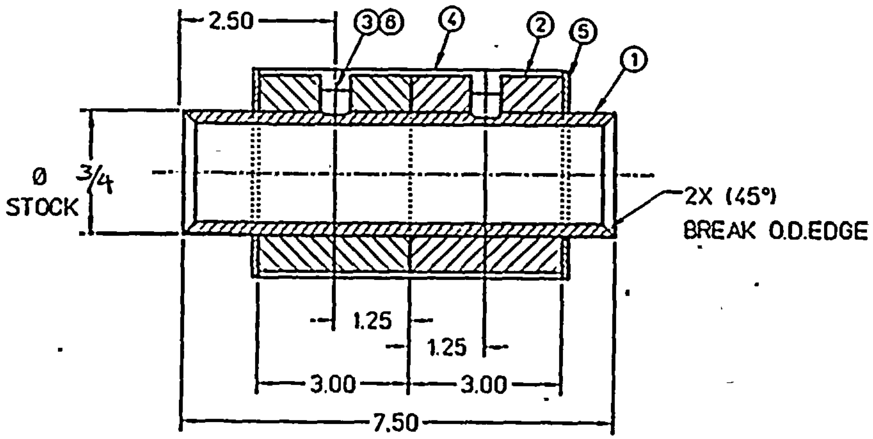
TITLE 2-FLAW A.V.B. NOTCH STD. W/LEXAN COVER
A#0995 D#1258-1-A

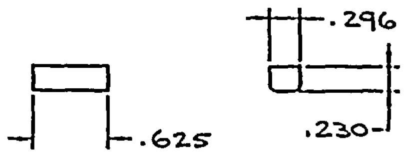
DWG NO 2-4418

SCALE NONE | RELDATE 12/28/89 | SHT 1 OF 1

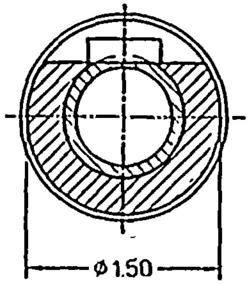
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR
(A)	10/8/90	CHANGED TOL.BLOCK,ADDED #6			KZ

LOCATION	A	B
PHYSICALLY MEAS. DEPTH	.0125	.0205
% OF WALL LOSS	29%	48%





LOC A & B



A.V.B MATERIAL CHROME PLATED INCONEL
TUBE MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .043
NOMINAL WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED NA
SERIAL NO. Z-8716
P.O. NO. 000544
REL. NO. NA
QUALITY REL. NO. NA
DATE MFG. 11.12.90
Q.A. INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED NA
PROBE USED NA
REVIEWED BY M. DeMartino

NOTE:

ITEM NO	DESCRIPTION
6 (A)	BAR-.625 L X .316 W X .230 H INCONEL
5	DELRIN SPACER FOR LEXAN
4	LEXAN TUBE - 1 3/4 ID. X 2.0 OD.
3	BAR - .625 X .395 X .750 405 S.S.
2	DELRIN SPACER 1.50 OD. X 3.00 LG.
1	TUBE-INCONEL

(A) UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT.+/- 1/16
.XXXX ±.003
.XXX ±.015
.XX ±.050
% ±.003
ANGULAR+/- 3°
FINISH

DRAWN	DATE
K.ZEGKE	12/22/89
CHECK B.J.	12/22/89
DESIGN	
APVD. QA K.WARLICK	12/28/89

ZETEC INC. P.O. BOX 140 ISSAQUAH WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316

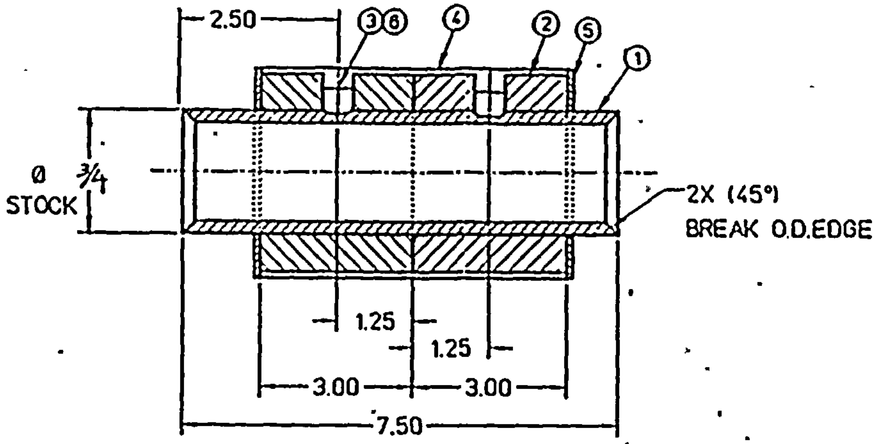
TITLE 2-FLAW A.V.B. NOTCH STD. W/LEXAN COVER
A#0995 D#1258-1-A

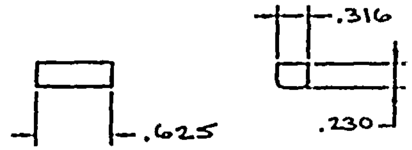
DWG NO 2-4418

SCALE NONE | REL DATE 12/28/89 | SHT 1 OF 1

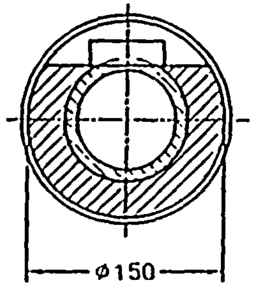
LOCATION	A	B
PHYSICALLY MEAS. DEPTH	.0120	.0210
% OF WALL LOSS	28%	49%

REVISIONS					
LTR	DATE	DESCRIPTION	APVD	C	D
(A)	10/8/90	CHANGED TOL.BLOCK;ADDED #6			K





LOC A & B



A.V.B.MATERIAL INCONEL 600
TUBE MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .043
NOMINAL WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED NA
SERIAL NO. Z-9052
P.O. NO. 1129
REL. NO. JOB # EL-0655
QUALITY REL. NO. NA
DATE MFG. 3.5.91
Q.A. INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED NA
PROBE USED NA
REVIEWED BY [signature]

NOTE:

ITEM NO.	DESCRIPTION
6 (A)	BAR-.625 L X .316 W X .230 H INCONEL
5	DELRIN SPACER FOR LEXAN
4	LEXAN TUBE - 1 3/4 ID. X 2.0 OD.
3	BAR - .625 X .395 X .750 405 S.S.
2	DELRIN SPACER 1.50 OD. X 3.00 LG.
1	TUBE-INCONEL

(A) UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT.+/- 1/16
XXXX ±.003
XXX ±.015
XX ±.050
% ±.003
ANGULAR +/- 3°
FINISH

DRAWN	DATE
K.ZEGKE	12/22/89
CHECK B.J.	12/22/89
DESIGN	
APVD. QA K.WARLICK	12/28/89

ZETEC INC. P.O. BOX 140 ISSAQUAH, WASHINGTON 98027 U.S.A. TELEPHONE 206 392-5316

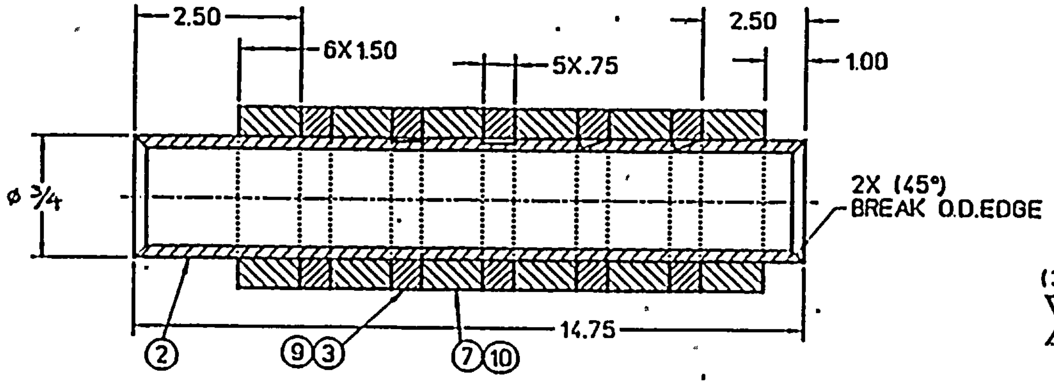
TITLE 2-FLAW A.V.B. NOTCH STD. W/LEXAN COVER
A#0995 D#1258-1-A

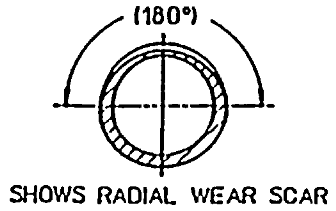
DWG NO 2-4418

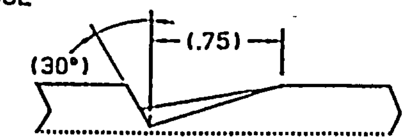
SCALE NONE | REL DATE 12/28/89 | SHT 1 OF 1

LOCATION	A	B	C	D
PHYSICALLY MEAS. DEPTH	.0130	.0215	.0125	.0210
% THRU WALL	30%	49%	29%	48%

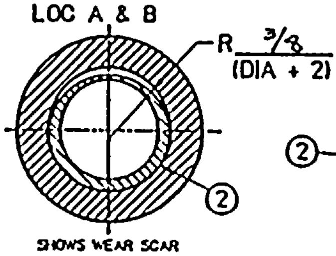
REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DR

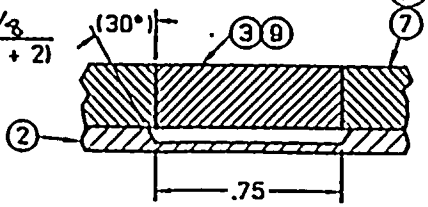






MATERIAL INCONEL 600
ACTUAL MEAS. WALL THK. .0435
NOM/MIN WALL THK. .043
HEAT LOT NO. 86234
TEST FREQ. USED NA
SERIAL NO. Z-9130
P.O. NO. MR001697
REL. NO. JOB # EC-0655
QUALITY REL. NO. NA
DATE MFG. 3.20.91
Q.A. INSPECTION [signature]
CUSTOMER CONAM NUCLEAR
RECORDED NA
PROBE USED NA
REVIEWED BY [signature]





-8	-1	QTY	PART NO	DESCRIPTION
•		6	-10	DELRIN SPACER 1.25 O.D.X.891 I.D.X 1.50 LG.
•		5	-9	TUBE SUPPORT,RING 2-4000-5
•			-8	4 FLAW WEAR SCAR STD. ASSY.(7/8 O.D.)
	•	6	-7	DELRIN SPACER 1.25 O.D.X.761 I.D.X 1.50 LG.
	•	5	-3	TUBE SUPPORT RING 2-4000-4
•	•	1	-2	STANDARD TUBE
	•		-1	4 FLAW WEAR SCAR STD. ASSY.(3/4 O.D.)

NOTE:

UNL OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT.+/-1/16
XXXX ±.003
XXX ±.015
XX ±.050
% ±.003
ANGULAR+/-3°
FINISH

DRAWN	K.ZEGKE	DATE 3/15/91
CHECK	[signature]	3/18/91
DESIGN		
APVD. QA	Q.A.	3/18/91

ZETEC INC
P.O. BOX 140 ISSAQUAH WASHINGTON 98027 U.S.A. TELEPHONE 206 392-6316

TITLE CUSTOM WEAR SCAR STD.
P#1406 D#1681-1-A

DWG NO 2-4513

SCALE NONE | REL DATE 3/18/91 | SH 1 OF 1

ZETEC INC

1370 N.W. Mall, P.O. Box 140, Issaquah, WA 98027-0140 (206) 392-5316 Telex 15 2592 Telecopy (206) 392-2086

CERTIFICATE OF COMPLIANCE

This certifies that, to the best of our knowledge, the material delivered under this purchase agreement is in accordance with the terms of the contract.

Customer: ABB COMBUSTION ENGINEERING

Contract/Purchase Order Number: 9507505

By [signature], on SEPT. 8, 1995
Quality ~~Assurance~~ Representative   Date

☐ See Attachments: ______

COMMENTS: STANDARD SERIAL #Z-14085

10CFR REQUIREMENTS ARE NOT EXTENDED
BEYOND ZETEC FOR COMMERCIAL ITEMS
OR MATERIAL SUPPLIED TO ZETEC.

ZETEC INC

1370 N.W. Mall, P.O. Box 140, Issaquah, WA 98027-0140 (206) 392-5316 Telex 15 2592 Telecopy (206) 392-2086

CERTIFICATE OF COMPLIANCE

This certifies that, to the best of our knowledge, the material delivered under this purchase agreement is in accordance with the terms of the contract.

Customer: ABB CE

Contract/Purchase Order Number: 9701653

By [signature], on 3/27/97
Quality Assurance Representative Date

☐ See Attachments: ______

COMMENTS: SER. # Z-15846 THRU Z-15849
& Z-15851

10CFR REQUIREMENTS ARE NOT EXTENDED BEYOND ZETEC FOR COMMERCIAL ITEMS OR MATERIAL SUPPLIED TO ZETEC.

ZETEC

Telephone (206) 392-5316 Telefax (206) 392-2086

TEST CERTIFICATE

DATE: MARCH 29, 1995

MATERIAL: INCONEL 600, COLD-DRAWN SEAMLESS, BRIGHT ANNEALED

Heat No.	Description
NX8671	3/4" DIA. X .043" WALL THICKNESS

CHEMICAL ANALYSIS

C	Si	Mn	P	S	Ni	Cr	Mo	Al	Zn
.038	.28	.22	.012	.001	76.14	15.31			
Pb	**B**	**Ca**	**Cd**	**Co**	**Cu**	**Fe**	**Nb**	**Ti**	**Other**
					.14	7.62			

TENSILE PROPERTIES

Yield Strength	Ultimate Strength PSI	% Elongation	Rb Hardness
41,120	95,320	48.0%	

Expansion	Flattening	Hydrostatic	Surface	Flaring	SPEC
		OK		OK	ASME SB-163 93 ed.

We certify that the above data is as furnished by the producing mill or supplier.

Zetec, Inc.

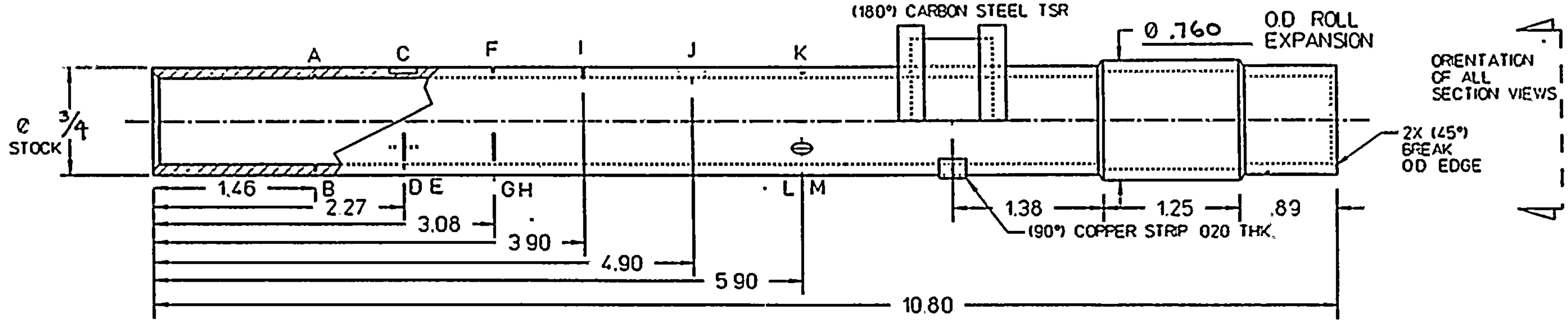
Stephen H. [illegible] Date: 3/30/95

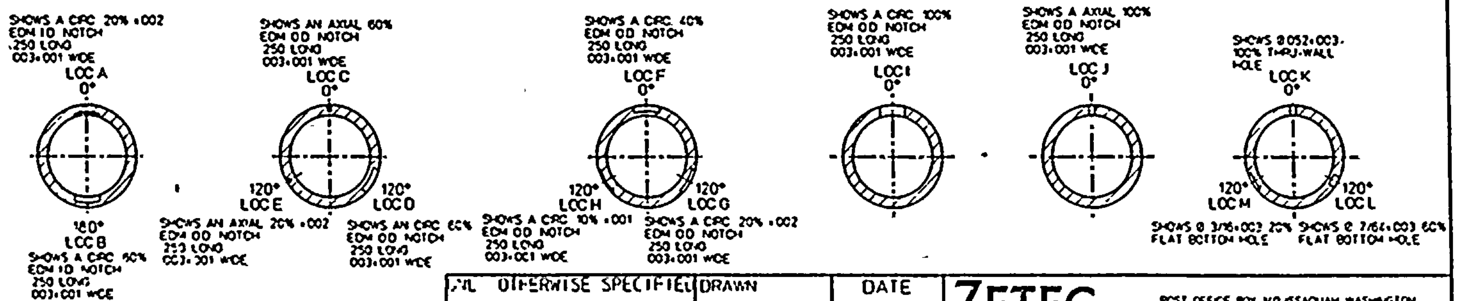
				C	REVISIONS	REV STATUS OF SHEETS
				2	SHEET	

REVISIONS

LTR	DATE	DESCRIPTION	APVD	CK	DR
D	9/23/96	ADDED USED ON 2-421-0002	[illegible]	KB	KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS. DEPTH	.0090	.0265	.0270	.0270	.0090	.0180	.0090	.0045	THRU	THRU	THRU	.0270	.0105
DEPTH IN % OF WALL	20%	59%	60%	60%	20%	40%	20%	10%	100%	100%	100%	60%	23%
E T PHASE ANGLE MEAS.	NA												





MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK. .045
NOMINAL WALL THK. .043
HEAT LOT NO. 96834
TEST FREQ. USED NA
SERIAL NO Z-15851
PO NO 9701653
REL NO REQ #9419-97-012
QUALITY REL NO NA
DATE MFG 3-27-97
QA INSP [signature]
CUSTOMER ABB CE
RECORDED NA
PROBE USED NA
REVIEWED BY [signature]

NOTE

UNL OTHERWISE SPECIFIED
DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT ± 1/16
XXXX ± .003
XXX ± .015
XX ± .050
% ± .003
ANGULAR ± 3°
FINISH

DRAWN K ZEGKE	DATE 08/18/95	ZETEC INC — POST OFFICE BOX 140 ISSAQUAH WASHINGTON 98027-0140 USA TELEPHONE (206) 392 5316
CHECK CB	8/22/95	TITLE MISC. DEFECT STANDARD D=3538-1-A P=2956
DESIGN		SIMILAR / DWG NO 2-421-1007
APVD QA GA	8/22/95	SCALE NTS / USED ON 2-421-0002 / SHT 1 OF 2

ZETEC

TEST CERTIFICATE

DATE: MARCH 27, 1996

MATERIAL: SEAMLESS ANNEALED INCONEL 600

Heat No.	Description
96834	3/4" DIA. X .043 WALL THICKNESS

CHEMICAL ANALYSIS

C	Si	Mn	P	S	Ni	Cr	Mo	Al	Zn
.040	.30	.26		.001	74.91	15.83			
Pb	**B**	**Ca**	**Cd**	**Co**	**Cu**	**Fe**	**Nb**	**Ti**	**Other**
				.023	.01	8.09			

TENSILE PROPERTIES

Yield Strength	Ultimate Strength PSI	% Elongation	Hardness
38,000	93,600	47%	

Expansion	Flattening	Hydrostatic	Surface	Flaring	SPEC
		OK		OK	ASME SB-163

We certify that the above data is as furnished by the producing mill or supplier.

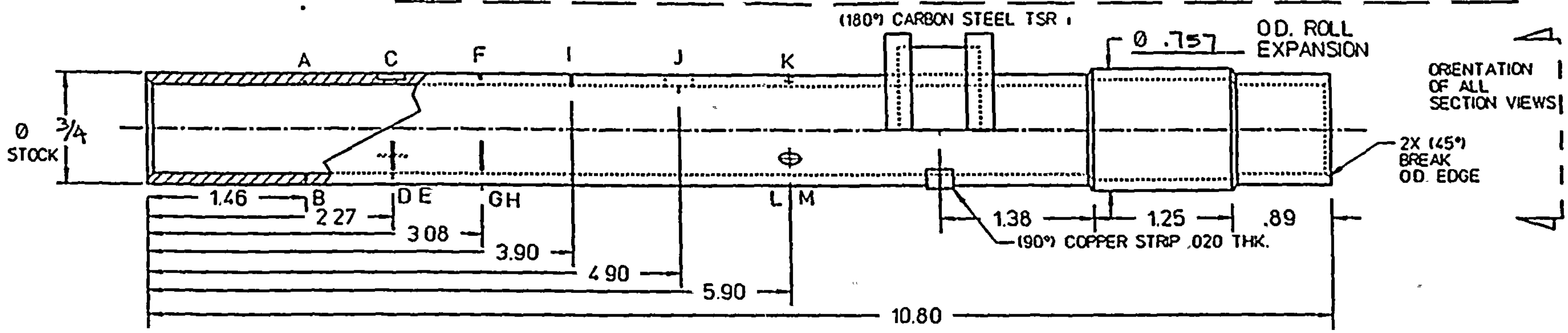
Zetec, Inc.

[signature] Date: 3/27/96

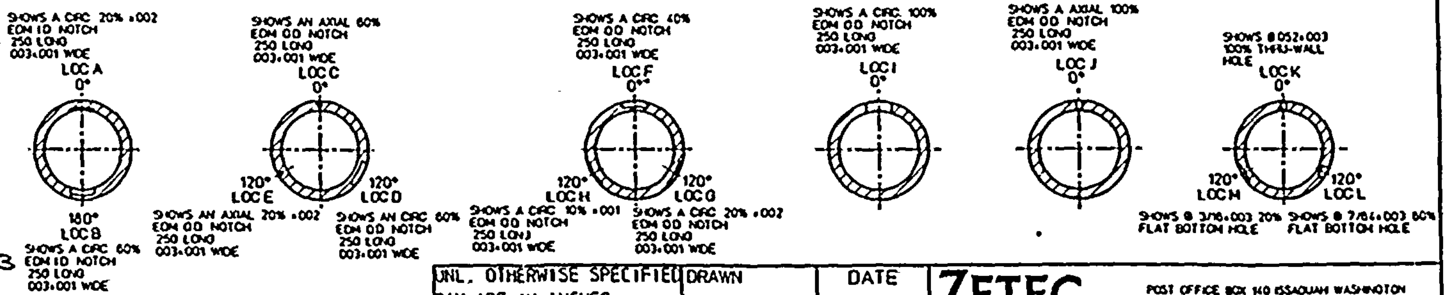
ZETEC, INC.
4370 NW Mall Street
PO Box 140
Issaquah WA 98027-0140
USA
Telephone (206) 392-5316
Telefax (206) 392-2086

								REVISIONS			
				C	REVISIONS	REV STATUS OF SHEETS	LTR	DATE	DESCRIPTION	APVD	CK	DR
				2	SHEET		C	8/29/95	REDRAWN W/CHANGES, REV SHT #2			KZ

LOCATION	A	B	C	D	E	F	G	H	I	J	K	L	M
PHYSICALLY MEAS DEPTH	.0085	.0255	.0260	.0260	.0085	.0175	.0085	.0045	THRU	THRU	THRU	.0255	.0095
DEPTH IN % OF WALL	20%	60%	61%	61%	20%	41%	20%	11%	100%	100%	100%	60%	22%
E T PHASE ANGLE MEAS	NA												



MATERIAL INCONEL 600
AVERAGE MEAS. WALL THK .0425
NOMINAL WALL THK .043
HEAT LOT NO. NX8671
TEST FREQ. USED NA
SERIAL NO Z-14085
P.O. NO. 9507505
REL NO. REQ #9419-95-083
QUALITY REL. NO. NA
DATE MFG. 9-8-95
Q.A. INSP.
CUSTOMER ABB CE
RECORDED NA
PROBE USED NA
REVIEWED BY



NOTE:

UNL. OTHERWISE SPECIFIED
DIM ARE IN INCHES
TOLERANCES
DECIMAL FRACT. ± 1/16
.XXXX ±.003
XXX ±.015
.XX ±.050
% ±.003
ANGULAR ±3°
FINISH

DRAWN K. ZEGKE	DATE 08/18/95	ZETEC INC. POST OFFICE BOX 140 ISSAQUAH WASHINGTON 98027-0140 USA TELEPHONE (206) 392-5316
CHECK C.B.	8/22/95	TITLE MISC. DEFECT STANDARD D#3538-1-A P#2956
DESIGN		SIMILAR / DWG NO 2-421-1007
APVD QA G.A.	8/22/95	SCALE NTS / USED ON / SHT 1 OF 2

ABB
ASEA BROWN BOVERI

May 6, 1997

Mr. Chip Bach
Carolina Power & Light Company
Shearon Harris Steam Electric Plant
5413 Shearon Harris Rd.
New Hill, NC 27562

SUBJECT: STEAM GENERATOR EDDY CURRENT TESTING PRELIMINARY REPORT AND DATA CARTRIDGES

Dear Mr Bach:

ABB/Combustion Engineering is transmitting the following items to you.

- Preliminary Report
- Data Disk H97A01-H97A06, H97B01-H97B06, H97C01-H97C07

Please acknowledge receipt of these items by signing a copy of this letter and forwarding it to me.

Receipt Acknowledged

5/6/97
Date

Sincerely,

ABB/COMBUSTION ENGINEERING

Thomas U. Bipes
Eddy Current Level III

cc: S. Shock
R. Polek

ABB Combustion Engineering Nuclear Services

Combustion Engineering, Inc. 1201 Riverfront Parkway Chattanooga, Tennessee 37402 Telephone (423) 752-2300 Toll Free 1-800-872-8836 Fax (423) 752-2449