Public Service
Electric and Gas
Company

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DEC 20 1993

NLR-N93190

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

NRC BULLETIN 88-09
THIMBLE TUBE THINNING IN WESTINGHOUSE REACTORS
SALEM GENERATING STATION
UNIT NOS. 1 AND 2
DOCKET NOS. 50-272 AND 50-311

By letter dated November 2, 1988 (ref: NLR-N88161), Public Service Electric & Gas Company (PSE&G) provided its response to NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors." During the Unit 1 seventh refueling outage, and the Unit 2 fourth refueling outage, PSE&G replaced the thimble tubes with an improved design. As a result of that modification, PSE&G discontinued its inspection program, but committed to provide a supplemental response with an evaluation of the new design at a later date. Attachment 1 contains PSE&G's supplemental response to Bulletin 88-09. Enclosure 1 contains a report entitled "Inspection Results of Flux Thimble Thermocouple Ultrasonic Profilometry and Eddy Current Encircling Coil Inspection of Stored Thimble Tubes" performed by ABB Combustion Engineering Nuclear Services Company. Based upon ABB's inspection results, PSE&G feels no periodic inspections are required.

PSE&G has completed all commitments required by Bulletin 88-09. Based on the results of the inspection on the improved flux thimble design, no further submittals are anticipated.

Should there be any questions with regard to this submittal, please do not hesitate to contact us.

Sincerely,

J. Hagan

IE18
1/1

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Licensing Project Manager

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ATTACHMENT 1

NRC BULLETIN 88-09 - SUPPLEMENTAL RESPONSE. THIMBLE THINNING - WESTINGHOUSE REACTORS. PSE&G THIMBLE TUBE ONE TIME INSPECTION.

PSE&G FTTC INSPECTION

PSE&G proposes to take exception to Part 1, of NRC Bulletin NO. 88-09. PSE&G performed a one time Flux Thimble ThermoCouple (FTTC) inspection.

During the Unit 1, 10th Refueling outage, 6 FTTCs were replaced in kind. The flux thimbles were replaced because they were inaccessible to the incore neutron detectors, no thimble wear issues were involved. These 6 thimbles were used as the representative sample providing information as to the status of all the FTTCs.

In July of 1993, PSE&G contracted ABB/CE to inspect the thimble tubes stored in the Unit 1 spent fuel pool. ABB/CE provided personnel and equipment to perform the examination using a combination UT profilometry and eddy current encircling coil technique. The examination fixture was mounted in an empty spent fuel pool cell. The examination fixture consisted of 8 focused UT transducers equally spaced around the circumference of the thimble tube. Each focused UT transducer measured an axial path approximately .010 inch wide without making physical contact with the thimble tube. Off-line analysis was used to obtain the axial and circumferential extent and profile of all OD indications on each thimble tube. The examination fixture also contained an encircling eddy current coil which locates tubing cracks and provides a secondary general sizing of any thimble tube wastage.

All examinations were conducted underwater for ALARA considerations. Each thimble end was placed in a special tool which mechanically restored the flattened cut end of the thimble tube to its original shape. Underwater Hydroproducts cameras were used to visually examine the outside surface of the thimble tubes after the UT/ET inspection is performed.

The results of the report: "No significant wear was detected on any of the FTTCs. No FTTC tested had greater than .002" wear detected by ultrasonics at any elevation. Cross sectional area wall loss is therefore less than 3% at any elevation."

Bulletin 88-09 entitled "Thimble Tube Thinning in Westinghouse Reactors,"

Bulletin 88-09 entitled "Thimble Tube Thinning in Westinghouse Reactors," required licensees to submit a written response that (a) confirms that an inspection program consistent with Part 1 of the bulletin has been established and (b) confirms that inspections of the thimble tubes have been performed and corrective actions have been taken.

ACTION REQUESTED

IAW Part 1, of NRC Bulletin NO. 88-09 each addressee is requested to establish an inspection program to monitor thimble tube performance. Part 1 states that this inspection program should include:

- the establishment, with technical justification, of appropriate thimble tube wear acceptance criterion (for example, percent throughwall loss). This acceptance criterion should include allowances for such items as inspection methodology and wear scar geometry uncertainties.

- the establishment, with technical justification, of an appropriate inspection frequency (for example, every refueling outage).

- the establishment of an inspection methodology that is capable of adequately detecting wear of the thimble tubes (such as eddy current testing).

ROOT CAUSE

In February 1982 , all Unit 1 flux thimbles were replaced. Three (3) leaking thimbles were sectioned and sent to the Westinghouse Nuclear Technology division hot cell facility for metallurgical investigation. ***The metallurgical exams concluded: the through wall defect on the samples is formed as a result of repeated mechanical wear on a localized region on the O.D. surface of the tubing.*** The profile of the fuel assembly lower nozzle block penetration was clearly worn into the incore thimble tube over ≈160° of the circumference. The decision is made to begin eddy current testing.

In 1987, PSE&G contracted the services of Combustion Engineering Nuclear Services (ABB CE) to conduct Salem specific tests to model the wear phenomenon and design wear resistant flux thimbles. These tests identified the specific root cause of the thimble leaks at Salem; flow induced thimble tube vibration. PSE&G installed Flux Thimble ThermoCouples (FTTCs), which are thimble tubes of improved design, on Salem Units 1 and 2 during their seventh and fourth refueling outages respectively. This improved design, implemented with modifications to the Salem units lower core plate, greatly reduce flow induced vibrations.

CORRECTIVE ACTION - IMPROVED THIMBLE DESIGN

FTTC assemblies consist of a seamless cold drawn outer pressure boundary tube and an inner tube to act as a dry guide path for the moveable incore neutron detectors. The outer sheath is designed to withstand 2500 psig and 650 °F, the inner sheath is also designed for these conditions. The tubes are fabricated from high strength Inconnel 600 as opposed to previously used stainless steel.

Type K (chromel-alumel) thermocouples and spacer cables are installed in the annulus between the two tubes. In addition the area of potential wear indication on these tubes is chrome plated. Also, wear inserts were installed in the lower core support plate reducing the forcing function and amplitude of flux thimble vibrational motion.

The addition of wear inserts decreases the wear rate by a factor of at least four by limiting the amplitude of the tube vibrations. The increase in wear area that the inserts afford decreases the wear rate by at least a factor of two. And finally, the chrome plating of the FTTC in the fuel bottom nozzle area reduces the wear rate by at least a factor of five. These reductions are multiplicative, and result in a possible reduction in the wear rate by a factor of forty. However to be conservative, ABB/CE concluded that the overall wear rate will be reduced by a factor of twenty.

Since the modified thimble tube design uses two concentric tubes with cable wound around the inner tube, eddy current testing conducted from within the inner tube would not yield meaningful results. As such PSE&G discontinued its program utilizing eddy current testing. No alternative in service inspection techniques existed at that time which would adequately detect wear from the ID of the thimble.

FTTC OPERATING PERFORMANCE

Prior to the installation of the FTTCs, assuming a constant wall loss vs. time, we had seen wear rates as high as 5% wall/month. Generally, wear appeared to progress at a rate of ≈2% wall/month.

- ***The results of the ABB/CE report: "No significant wear was detected on any of the FTTCs. No FTTC tested had greater than .002" wear detected by ultrasonics at any elevation. Cross sectional area wall loss is therefore less than 3% at any elevation."***

- ***Without the new FTTC design, these thimble could have shown 50 to 90% wall loss. In service time: Unit 1, Cycle 8, to the end of Cycle 10.***

- ***As of November, 1993, no FTTC wear induced failures have occurred on either Salem Unit.***

PSE&G's FTTC INSPECTION PHILOSOPHY

In response to Bulletin 88-09, PSE&G committed to reevaluate the need for future thimble inspections. This reevaluation would be based on advancements made in in service inspection techniques and the operating performance of the FTTC assemblies. Within four months after the start of the Unit 2 seventh refueling outage, PSE&G was to supplement the original Bulletin response. This supplemental response outlines PSE&G thimble inspection plans.

The inspection data shows the design of the FTTCs reduces the thimble wear rate below the threshold value of concern. Instead of continuing to inspect wearing thimble tubes, PSE&G has proactively replaced and modified the thimble tubes so that wear is greatly reduced. Using a conservative interpretation of the wear rate reduction of a factor of twenty, and the results of the ABB/CE inspection, it is PSE&G's position that no further inspections will be necessary.

Attachments

1. Table 1 - Salem flux thimble wear history.
2. Figure 1 - FTTC cross section.
3. Figure 2 - Wear insert.
4. Figure 3 - Core map showing inspected FTTC locations.
5. Report - ABB/CE final inspection report.

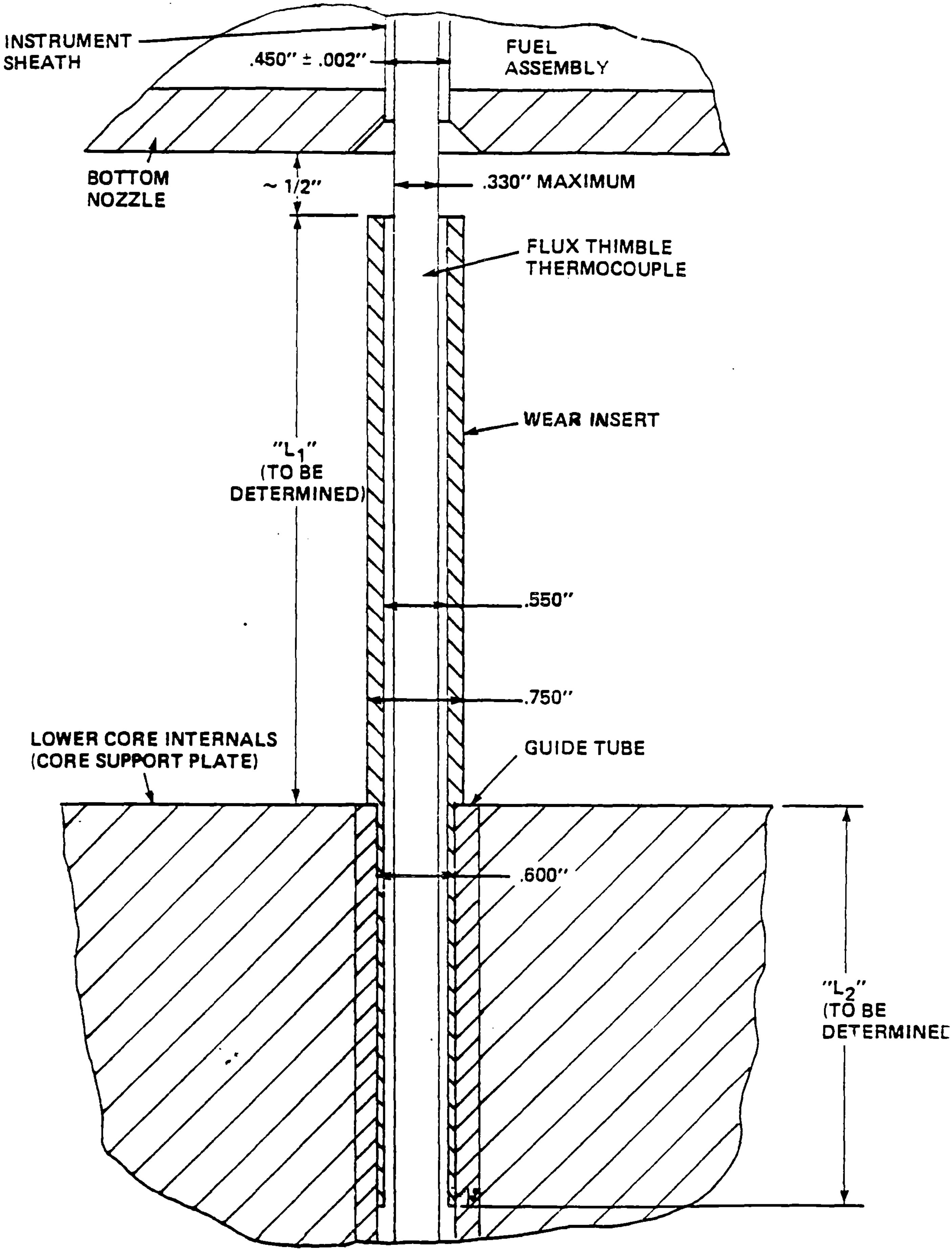
SALEM GENERATING STATION, UNIT 1 - EQUIPMENT HISTORY: INCORE FLUX THIMBLE WEAR

Date	Cycle #	Vendor	Thimble	Description
April 1981	3	N/A	H-11	Flux thimble leaking, cause unknown. ***Thimble isolated.***
July 1981	3	N/A	A-09	Flux thimble leaking, cause unknown. ***Thimble isolated.***
Nov. 1981	3	N/A	D-04	Flux thimble leaking, cause unknown. ***Thimble isolated.***
Feb. 1982	1R3	NUS	ALL	***All flux thimbles were replaced.*** The 3 leaking thimbles were sectioned and sent to the Westinghouse Nuclear Technology division hot cell facility for metallurgical investigation.
Aug. 1982	4	West.	H-11, A-09, D-04	***The metallurgical exams concluded: the through wall defect on the samples is formed as a result of repeated mechanical wear on a localized region on the O.D. surface of the tubing.*** The decision is made to begin eddy current testing.
Oct. 1982	1R4	Cramer & Lindell	57 insp 1 blocked	Cramer & Lindell concluded: The "new" thimble tubes are in good conditions and no damage was recorded. 10 tubes were inspected to the core plate.
July 1984	1R5	Cramer & Lindell	3 tubes >40%. 4 tubes 20 to 40%. 3 tubes < 20% wall loss	Jan. 28, 1985; Cramer & Lindell concluded: a total of 22 tubes recorded possible external damage or inconsistencies at the core plate. June 12, 1985; On the basis of a review of the results of the metallurgical exam, Cramer & Lindell establishes external vibrational/fretting wear as the cause of the thimble eddy current indications. ***Three (3) thimbles are isolated.***
April 1986	1R6	PSE&G Res. & Testing Lab	ALL	32 thimbles with > 20% wall loss. ***10 thimbles isolated.***
June 1986	7	N/A	N/A	***A major design change is planned.*** Requests for proposals are sent to West., GE, B&W and CE to design, fabricate and install new flux thimbles.
Mar. 1987	7	Comb. Eng.	N/A	***Combustion Engineering wear tests an improved thimble tube design. Flux Thimble ThermoCouples (FTTCs).***
Oct. - Dec. 1987	1R7	Comb. Eng.	ALL	***New FTTCs installed. Tube inside a tube, chrome plated in the wear region. The wear area is increased and cross flow vibration inhibited through the installation of wear inserts.*** Eddy current exams of the thimbles were discontinued since no company provided this service for tube within a tube designs.
Mar 1991	1R9	N/A	P-09	***FTTC P-09 kinked in two places during flux thimble re-insertion after core reload.*** Replacement planned during 1R10.

Attachment 1

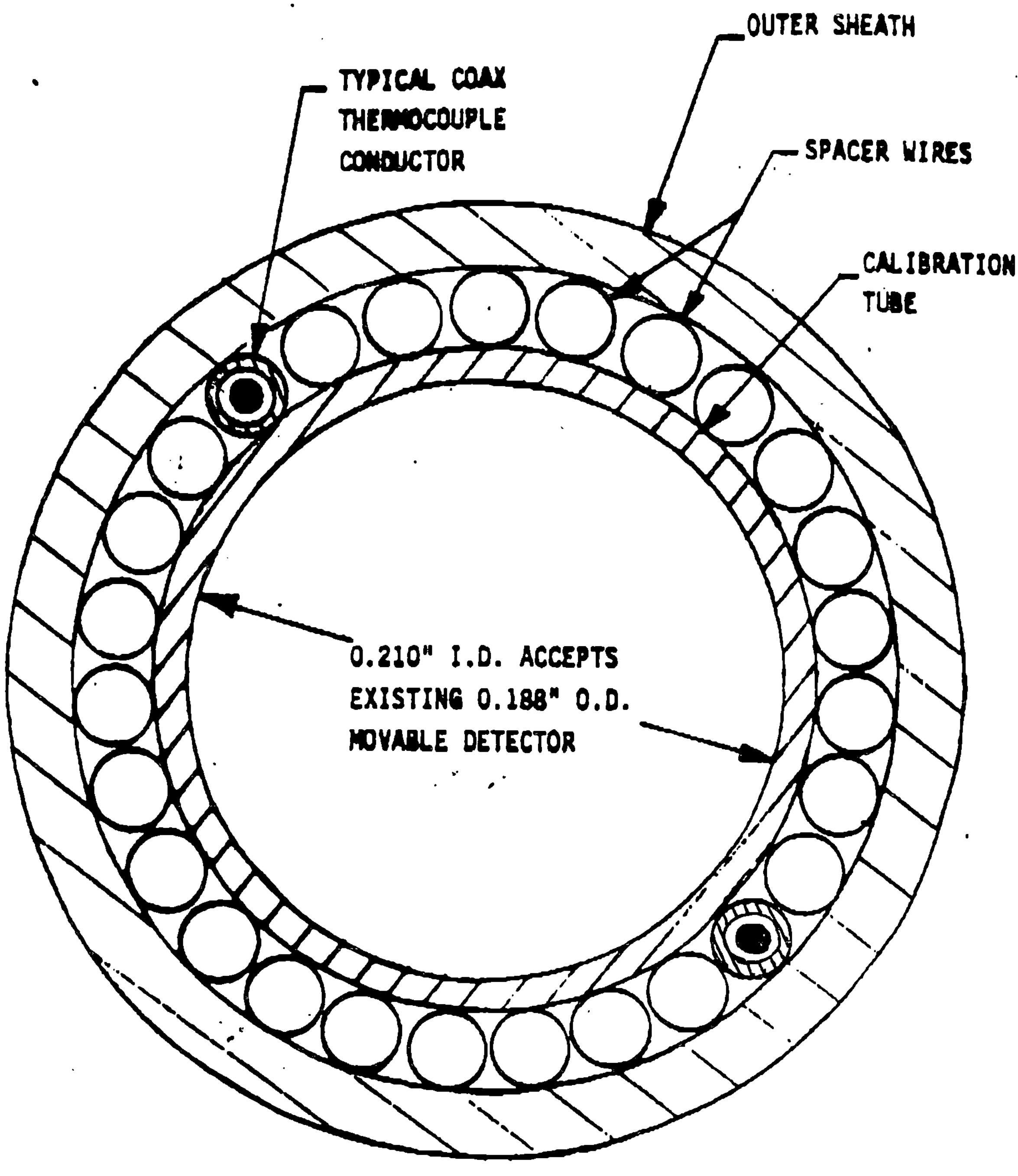
June 1992	1R10	West	P-09, H-06, F-01, F-07, B-03, & L-05.	***Flux thimbles were replaced with FTTCs purchased from Combustion Engineering.*** Six (6) FTTCs were replaced for 2 reasons: 1. All six (6) FTTCs were inaccessible to incore detectors. 2. 5-9 FTTCs was the minimum order from CE. ***No FTTC wear issues were involved.***
July 1993	11	ABB/CE	P-09, H-06, F-01, F-07, B-03, & L-05.	ABB/CE performed a combination ultrasonic profilimetry, eddy current encircling coil and visual inspection of the irradiated ends of the FTTCs. The irradiated ends of the six (6) thimbles, (13 pieces), were stored in the Unit 1, Spent Fuel Pool, the non-irradiated sections of the thimbles were disposed of. ***The inspection of the ≈30" chrome plated sections of the FTTCs was the primary goal.*** Note: This inspection was performed in the Salem Unit 1, Spent Fuel Storage Pool.
Oct 1993	11	ABB/CE	P-09, H-06, F-01, F-07, B-03, & L-05.	ABB/CE final inspection report is received. ***The results of the report: "No significant wear was detected on any of the FTTCs. No FTTC tested had greater than .002" wear detected by ultrasonics at any elevation. Cross sectional area wall loss is therefore less than 3% at any elevation."***

Attachment 2



Attachment 3

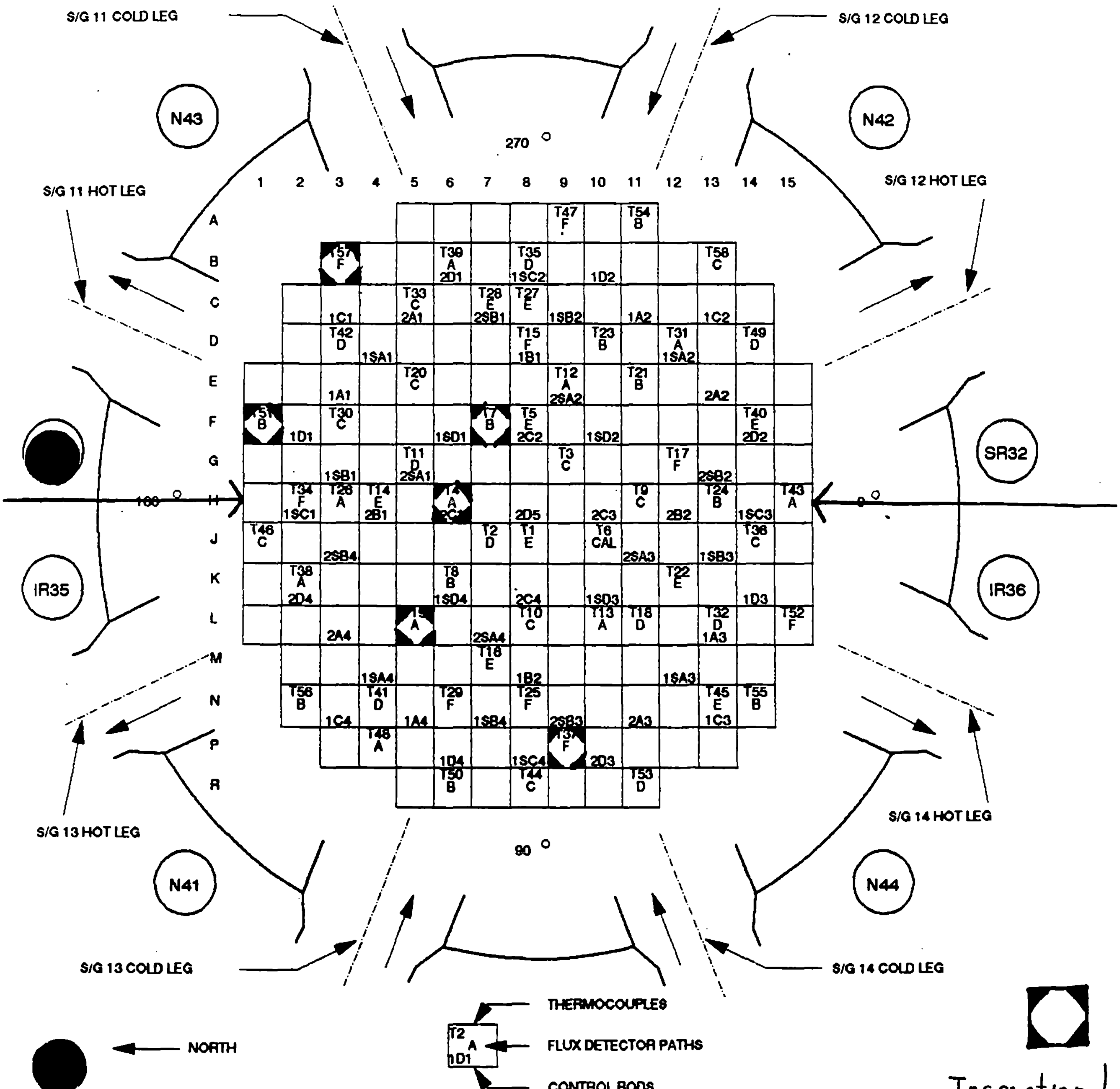
THIMBLE
CROSS SECTION



Attachment 4

S1.RE-RA.ZZ-0012(Q)

SALEM NUCLEAR GENERATING STATION
UNIT NO. 1
RCC INCORE DETECTOR THIMBLE AND THERMOCOUPLE LOCATIONS



Inspection Loc

PREPARED BY LISA FORD	DATE 6/15/92
TECHNICAL ENGR. [signature]	DATE 6/16/92

FIGURE 1

REV. 5

Attachment 5

ENCLOSURE 1

PUBLIC SERVICE ELECTRIC & GAS

SALEM NUCLEAR POWER STATION UNIT 1

Flux Thimble Thermocouple Ultrasonic Profilometry and Eddy Current Encircling Coil Inspection of Stored Thimble Tubes

FINAL REPORT PACKAGE

July - August 1993

ABB Combustion Engineering Nuclear Services

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ABB

Flux Thimble Thermocouple Ultrasonic Profilometry and Eddy Current Encircling Coil of Stored Thimble Tubes Inspection Results From SALEM UNIT 1 July/August, 1993

A Report To

Public Service Electric & Gas

From

ABB Combustion Engineering
Nuclear Power
Outage Services
Windsor, Connecticut

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ABB

October 15, 1993

To: Public Service Electric & Gas
Salem Power Station Unit 1

CERTIFICATE OF CONFORMANCE

ABB Combustion Engineering Nuclear Services hereby certifies that the activities associated with the Flux Thimble Thermocouple Ultrasonic Profilometry and Eddy Current Encircling Coil Inspection of Stored Thimble Tubes at the Salem Power Station Unit 1 site during July and August, 1993 are in conformance with the PSE&G Purchase Orders, Numbers P1-428978 and P1-428976 including addenda and attachments. Documentation attesting to this conformance is contained within this Final Report Package.

Victor Roy

Victor Roy
Supervisor, Core Component Services

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1.0 Introduction

Eleven stored thimble tubes were eddy current, ultrasonically and visually inspected at the Salem Unit 1 Nuclear Station in July, August 1993. A profilometry fixture utilized an ultrasonic technique to profile inspect thimble tube cladding for OD fretting wear and diameter changes. An eddy current encircling coil was run in parallel with the ultrasonics inspection to detect cladding cracks and provided relative sizing for wear.

The profile examination was performed in accordance with ABB Combustion Engineering Procedure Number Salem-400-019, Revision 0, Procedure for the Examination of Thimble Tubes.

2.0 Summary

The reported inspection data was analyzed to the requirements specified in the PSE&G Purchase Order number P1-428976. All thimble tube wear was analyzed using the UT profile data. The thimble tubes were examined for cracks by analyzing the eddy current encircling coil data and the results are reported in Section 5.0 and Table 2, "Encircling Coil Results".

No significant wear was detected on any of the thimble tubes. The largest indication detected was located on tube number 8 in the chrome plated portion of the thimble tube (less than 30.0"). This indication was determined and visually verified as an aborted tube cut scar, 0.021 inch deep. The attempted cut had displaced some cladding material outward and ovalized the tubing directly below the scar. This aborted thimble cut location exhibited the highest amplitude eddy current signal reported as wear on any thimble tube. Thimble tube number 7 also contained a partial tube cut, although not as deep as number 8. This was reported as the second largest wear by eddy current. Thimble tube numbers 3, 4 & 9 had indications exhibiting "dent" characteristics, (Figure 5), that were not discernable with ultrasonics because of their extremely small size. Chrome transition areas (where they existed) were easily discernable with eddy current (Figures 7 & 8) and could also be detected with ultrasonics (Figure 9). Chrome transition areas are listed in Table 2. No cladding bulging or ovality was detected in the thimble tubes tested. No thimble tubing tested had greater than 0.002 inch wear detected by ultrasonics at any elevation. Cross sectional area wall loss (CAWL) is therefore less than 3 percent at any elevation.

3.0 Measurement Method

There were two types of testing performed during the examination of stored thimble tubes at Salem 1 Nuclear Station in July/ August, 1993.

Encircling coil testing is performed for the detection of cladding cracks. Based on the signal response from the ECT results the corresponding UT data was reviewed to quantify and provide cladding profiles of all indications detected.

Profilometry testing is done using an array of 8 ultrasonic transducers evenly spaced around the circumference of the thimble (every 45 degrees). The UT transducers measure outside diameter changes and the changes in thimble cladding thickness. The UT transducers also determine the circumferential extent of any indications found.

Figure 1 shows the relative position of the 8 UT transducers and the eddy current encircling coil within the array housing.

3.1 Encircling Coil Test

A modified Zetec MIZ-18A eddy current tester was utilized for the encircling coil inspection. An ADIC Digital Data Recorder was used to record the encircling coil data.

Eleven thimble tubes were inspected. The thimble tube lengths were estimated to be between 36.0 inches and 180.0 inches. The actual length of thimble tubes inspected varied between 24.0 and 144.0 inches. The inspection fixture was capable of inspecting up to 144.0 inches at a time. Eddy current and ultrasonic inspections took place during the withdrawal of the thimble tube from the inspection station. The thimble tubes were manipulated and withdrawn by hand; by individuals using two poles, vice grip equipped. A steady rate of withdrawal was attempted, however most of the thimble tubes were bent (in several directions) and a constant rate of withdrawal was impossible. Therefore, length and location estimations are approximate. Indication analysis location calls are made from known locations, such as the cut end of the thimble tube or the chrome transition zones. Thimble tubes were turned around and retested (when required by the PSE&G representatives) to inspect the thimble tube material originally gripped by the vice grips, thus insuring the entire length of the thimble tube was inspected. Visual examinations were performed immediately after each NDE inspection.

The eddy current defect calibration standard used for set-up of the encircling coil test is composed of a representative sample of Inconel 600 tubing identical in size and composition to that of the flux thimble thermocouple cladding being tested. The calibration standard contains manufactured defects designed to represent destructive mechanisms which have been observed to effect thimble tube cladding (see Figure 3). These manufactured flaws are of a known measured size and shape and are described in detail on the calibration standard certification documentation included in this report.

Analysis is performed on the encircling coil data using a Zetec DDA4 (Digital Data Analysis System). The DDA4 is a computerized data analysis system which uses a Hewlett Packard 9836 computer. Specially designed software allows simultaneous display of operator selected testing parameters, strip chart recordings, CRT screen and numerical measurements (Figures 5 through 8). The computer will automatically calculate signal phase angle, peak to peak voltage, percent circumferential area loss, and axial positions relative to any operator selected landmark.

The axial positions of all encircling coil indications are measured using the lower end cut or bullet nose tip of the thimble sample as the "0" inch datum point. The encircling coil frequency of 500 Khz/differential is used for the data analysis primary frequency. An evaluation of OD wear indication signals is performed by comparing actual OD wear indication voltages to a cross-sectional area loss vs. amplitude plot, derived from testing pre-characterized OD wear flaws on the defect calibration standard. Cross-sectional area loss is analysed as well as depth of penetration to support plant accept/reject criteria.

The DDA4 requires three OD wear flaws (calibration points) from a calibration standard to generate an analysis curve. The three calibration points are selected from the calibration standard by the data analyst and the same flaws are consistently used for analyzing all data tapes. The following calibration point wear flaws were used from NSS-93-013 to generate the calibration curve.

o B dimension, 0.017 = 85% wear (Depth) = 22% (CAWL)
o C dimension, 0.008 = 40% wear 10%
o D dimension, 0.004 = 20% wear 5%

o Set the dent signal horizontal (the first indication) with the initial signal excursion to the right.

o The MIZ-18A default span voltage is used for testing.

* Corrected and revised November 8, 1993

- The Miz-18A spans during analysis were adjusted such that the dent produced a signal amplitude of 2.06 volts on all channels.

- Based on UT results; comparing the cross-sectional area wall loss to the related ECT signal amplitude, all ECT signals were selected for further analysis using the UT data.

- ABB-CENS personnel analyzed both ECT and UT results in Windsor and graphed recorded voltage vs. percent wall loss to assure all indications would be reported.

The encircling coil signal amplitude for all wear indications is used as a secondary method of determining the relative cladding wall loss. In general the larger the wear signal amplitude the greater the wall loss. Based on the geometry and scar fretting process the larger voltage might not reflect a greater wall loss. This will be further discussed in Section 4.0 "Measurement Error".

3.2 Profile Test

The N-16 Ultrasonic array system was utilized to profile inspect all eleven stored thimble tubes. As stated earlier UT data was recorded during the withdrawal of the thimble tube through the array housing.

The profile fixture array housing has eight (8) individual UT transducers spaced equally around the circumference of the rodlet, one transducer every 45 degrees.

Focused ultrasonic transducers are used to provide the most accurate profile measurement of the cylindrical thimble tube cladding surface. The eight UT transducers in each array housing profile a 0.010 inch wide axial path over the entire length of the thimble. A special array housing feature is the use of a constant distance reflector in front of each transducer. The reflector provides a method of continuously monitoring for possible changes in the speed of sound due to water temperature variations or equipment malfunctions. In effect a continual on-line calibration verification is performed using the fixed reflector.

The calibration standard, UT-Salem, with eight precision ground diameters from 0.3240 to 0.2917 inch is used to verify the actual speed of sound in the Spent Fuel Pool (SFP) water. The actual sound speed is utilized during analysis to determine defect size.

The N-16 Ultrasonic Profile System indirectly measures the size of defects. A sound energy pulse takes a specific amount of time to travel from the transducer to the rodlet surface and reflect back to the transducer. When the sound pulse encounters an indication the travel time is changed. This travel time difference is used to determine the defect size. The travel time difference in micro seconds is multiplied by the speed of sound (micro inches per second) in the SFP water, as determined with the calibration standard at the start of testing. The travel time difference is comprised of round-trip travel and thus the result of the above calculation must be divided by 2 to yield the half path distance which is the size of the defect in inches.

All data is permanently recorded on an 800 Mbyte optical disk. The data from a full length thimble piece (144 inches) fills approximately 0.5 MBytes of memory. This capacity is based upon storing the complete A-scan, B-scan, and C-scan presentations to allow in-depth analysis at any time in the future. The B-scans present a thimble tube profile trace and are pictured in Figures 9 through 12. The A-scan can be used to verify the B-scan results and to measure wall thickness of the thimble tube cladding if desired. All thimble tube data is stored as an ASCII file on the optical disk . A portion of which could be stored to another type of storage media.

4.0 Measurement Error

The N-16 UT profile system has an accuracy of ± 0.0005 inch based upon tests previously run at ABB CE. A calibration defect standard fabricated by Zetec Inc., Figure 13, was repeatedly inspected using the UT profile transducers. The net result of these measurements is given in Table 1A,B and shows the UT measurements are accurate to ± 0.0005 inch.

The encircling coil has an accuracy of ± 0.002 inch for OD wear depth estimates when the circumferential wear extent is known (an amplitude analysis is performed). The wear depth versus Amplitude Plots used to determine wear depth estimates was developed using the encircling coil data from the calibration standard wear defects.

A best fit curve was then drawn through the data points. The curve used to reduce the eddy current encircling coil data is conservative, i.e. it overestimates wear for wear scars accurately duplicated by the calibration standard.

The encircling coil analysis results have an additional conservatism due to the work hardening of the cladding which occurs as the thimble vibrates against the lower core plate transitions and guide paths . Work hardening changes the conductivity of the cladding material amplifying the eddy current signal from a guide induced wear scar relative to an equal size wear scar on the eddy current calibration standard. The calibration standard defects are not work hardened and thus the wear depth vs. amplitude plot, derived from the calibration standard defects does not produce accurate wear scar estimates for work hardened thimble tube cladding wear. The wear depth vs. Amplitude Plot yields conservative wear estimates for work hardened wear since the amplified signals yield larger wear depth estimates. The profile fingers on the coil are not affected by the work hardening and thus a decrease in the size estimate of the wall depths is expected when the profile results are compared to the encircling coil results.

5.0 Encircling Coil Results

The encircling coil analysis results are tabulated in Table 2 for all eleven thimble's. Typical DDA4 (Zetec analysis computer) screen displays are shown in Figures 5 through 8. All axial measurements are given from the cut tip or bullet nose of the sample.

Operating limitations inherent to the hand operating of the handling poles and the bent condition of thimble samples prevented the full length inspection of the thimble tubes during one pass. During the inspection process no significant ECT indications were observed. A detailed analysis of the data concluded that no existence of wear indications or bulging were detected. Uniform and repeatable ECT signal response, on all absolute channels, was achieved from the region with chrome coatings.

OD wear indications are reported as a percent wall loss, based upon an amplitude analysis (voltage size determines the percent wall loss). All guide wear is reported for each thimble.

Estimated thimble lengths and estimated inspection lengths are listed below:

Thimble No.	Actual length	Inspected length	Condition present	Chrome section
1	60"	24"	bent,two ways	(no)
2	180"	144"	bent,bottom 12"	(yes), 20"
3	168"	48"	bent,into a shepherd's hook	(no)
4	168"	132"	bent,into a shepherd's hook	(yes), full,30"
5	180"	144"	curved	(yes), no bullet nose

Thimble No.	Actual length	Inspected length	Condition present	Chrome section
6	168"	144"	curved, stuck	(no)
	134"		curved	(no) two sided
7	156"	144"	straight	(yes) 12" bullet nose
	144"		straight	see above
8	180"	144"	straight	(yes) 15" cut attempt in chrome, bullet nose
		134"	straight	see above
9	132"	120"	curved	(no) bullet nose
10	120"	108"	straight	(yes) 18" (part of no.8?)
11	180"	132"	straight	(yes) 10" bullet nose
12	24"	no NDE	straight	(no) VT only
13	n/a	n/a	bent	stuck in basket

The following is a brief explanation of the abbreviations used in Table 2:

CHROME - Transition area, from Inconel 600 to Inconel 600 with chrome

DENT - Deformation of the cladding without loss of material

WEAR - Sliding or fretting phenomena wear, elevation and wear method undetermined, samples without bullet noses or full chrome sections could not unequivocally be identified as to core location or positioning at lower core plate.

NDD - No Detectable Defect,

6.0 UT PROFILE RESULTS

The UT profile inspection evaluated wear data to determine the extent of wear on tube samples at Salem Unit 1. The UT profile displays for the inspection are presented in Figures 9 through 12. Typical examples of wear are attached. A UT display interpretation key is provided, (Figure 4 A, B, C).

A display of the largest guide fretting wears (including the attempted cut on thimble number 8) are presented in the UT profile results Figures 10, 11. Thimbles not shown had no cross-sectional area wall loss wear found on any thimble. The displays presented in Figures 9 through 12 are composed of multiple B-scan (profile) displays. The number of B scans presented is related to the circumferential extent of each individual indication. Only the attempted thimble cuts on thimble numbers 7 and 8 displayed wear on more than one circumferential channel. The circumferential extent is based upon which transducers detect the indication. The transducers with only the deepest indications are typically displayed on B scans.

Ultrasonic Measurement of the Tube Wall Thickness
Along the Wear Scar Standard

Location	(A) As built Measurement (inch)	(B) Ultrasonic Measurement (inch)	Measuring Deviation (B - A = inch)
Average Wall	.0250	.0250	0
Wearscar "A"	.0240	.0228	- .0012
Wearscar "B"	.0225	.0215	- .0010
Wearscar "C"	.0205	.0193	- .0012
Wearscar "D"	.0145	.0130	- .0015
Wearscar "E"	.0110	.0113	+ .0003
Wearscar "F"	.0090	.0085	- .0005

Maximum Deviation: + .0003 / - .0015 inch

Table 1A

Ultrasonic Measurement of the Outside Diameter Profile
Along the Wear Scar Standard

Radial Deviation from the Nominal Outside Diameter

Location	(A) As built Measurement (inch)	(B) Ultrasonic Measurement (inch)	Measuring Deviation (B - A = inch)
Wearscar "A"	.0010	.0011	+ .0001
Wearscar "B"	.0025	.0022	- .0003
Wearscar "C"	.0045	.0041	- .0004
Wearscar "D"	.0105	.0105	0
Wearscar "E"	.0140	.0140	0
Wearscar "F"	.0160	.0160	0

Maximum Deviation: + .0001
- .0004 inch

Table 1B

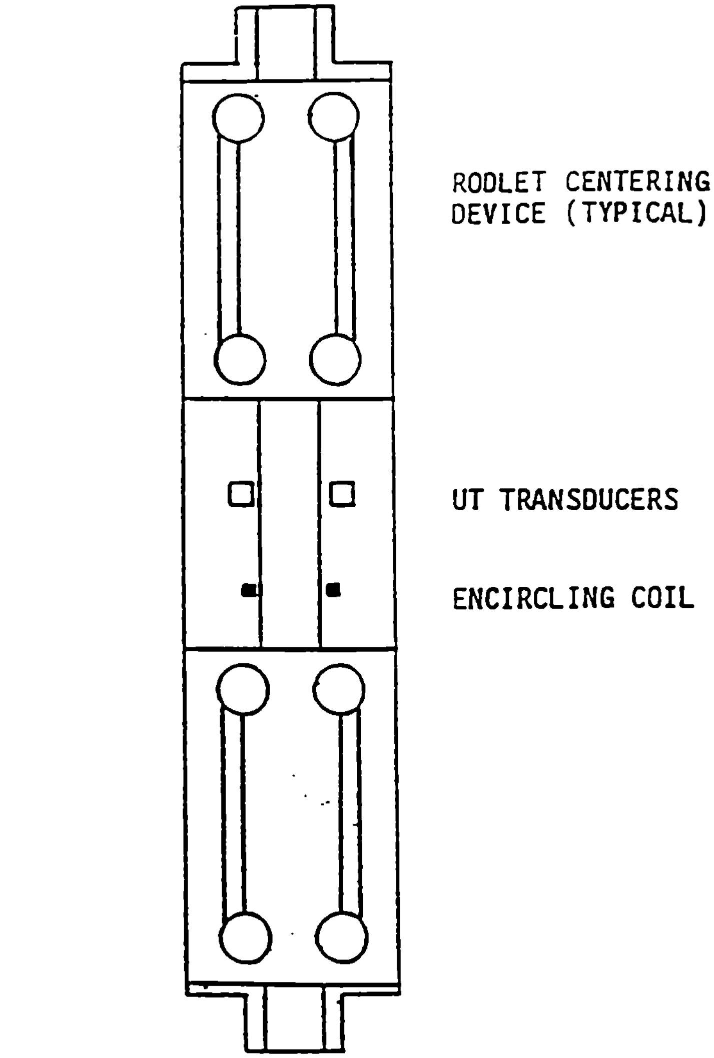
PLANT	UNIT	S/G	LE	REEL TO REEL	DATE
SALEM	I	THIM		01	08/03/93

SA	THM	UPS	VOLTS	DEG	%	CH#	LOCATION	EXTENT
0	1AN	N	2.32	27	25	1	END + 27.63	WEAR
0	2AU	N	2.27	28	25	1	END +130.75	WEAR
			15.61	217	73	1	END +106.19	CHROME
0	3AU	N	0.73	5	<20	1	END + 17.83	DENT
			0.35	5	<20	1	END + 27.82	DENT
			0.67	3	<20	1	END + 28.21	DENT
			0.55	11	<20	1	END + 57.58	DENT
			4.33	6	38	1	END + 62.98	DENT
0	4AU	999					0.00 TO + 30.00	CHROME
			1.07	23	<20	1	END + 42.86	WEAR
			0.70	36	<20	1	END + 49.92	WEAR
0	5AU	999	1.16	38	<20	1	END + 10.02	WEAR
			0.76	4	<20	1	END + 10.30	DENT
			11.84	221	65	1	END + 22.56	CHROME
0	6AU	0						NDD
0	6BU	0	0.70	27	<20	1	END + 22.39	WEAR
0	7AU	0	1.34	25	<20	1	END + 54.28	WEAR
			9.89	31	60	1	END + 94.72	CUT IN CHROME
0	7BU	0	1.69	27	21	1	END + 19.00	WEAR
			14.43	222	71	1	END + 79.28	CHROME
0	8AU	0	18.71	32	79	1	END + 91.55	CUT IN CHROME
0	8BU	0	8.80	42	56	1	END + 60.23	CHROME
0	9AU	0	0.66	7	<20	1	END + 10.87	DENT
			0.96	28	<20	1	END + 59.22	WEAR
0	10A	0	24.35	222	86	1	END + 46.24	CHROME
			2.83	22	29	1	END + 57.89	WEAR
0	11A	0	0.86	30	<20	1	END + 15.70	WEAR
			19.14	221	79	1	END + 69.84	CHROME

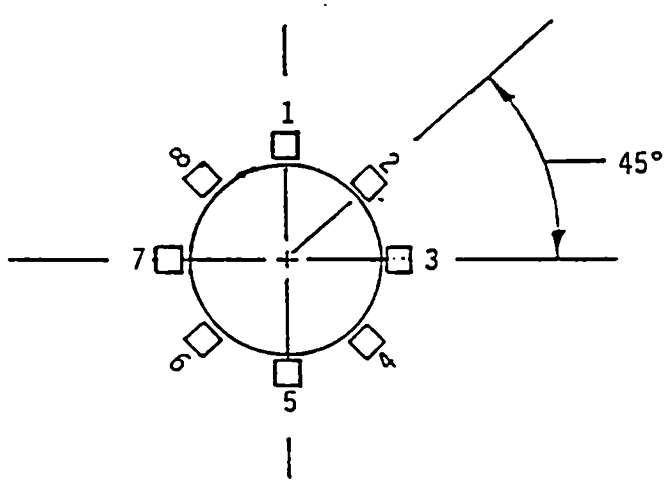
Table 2

PAGE 1 OF 1 EVALUATOR V. Roy LEVEL III

PROPRIETARY

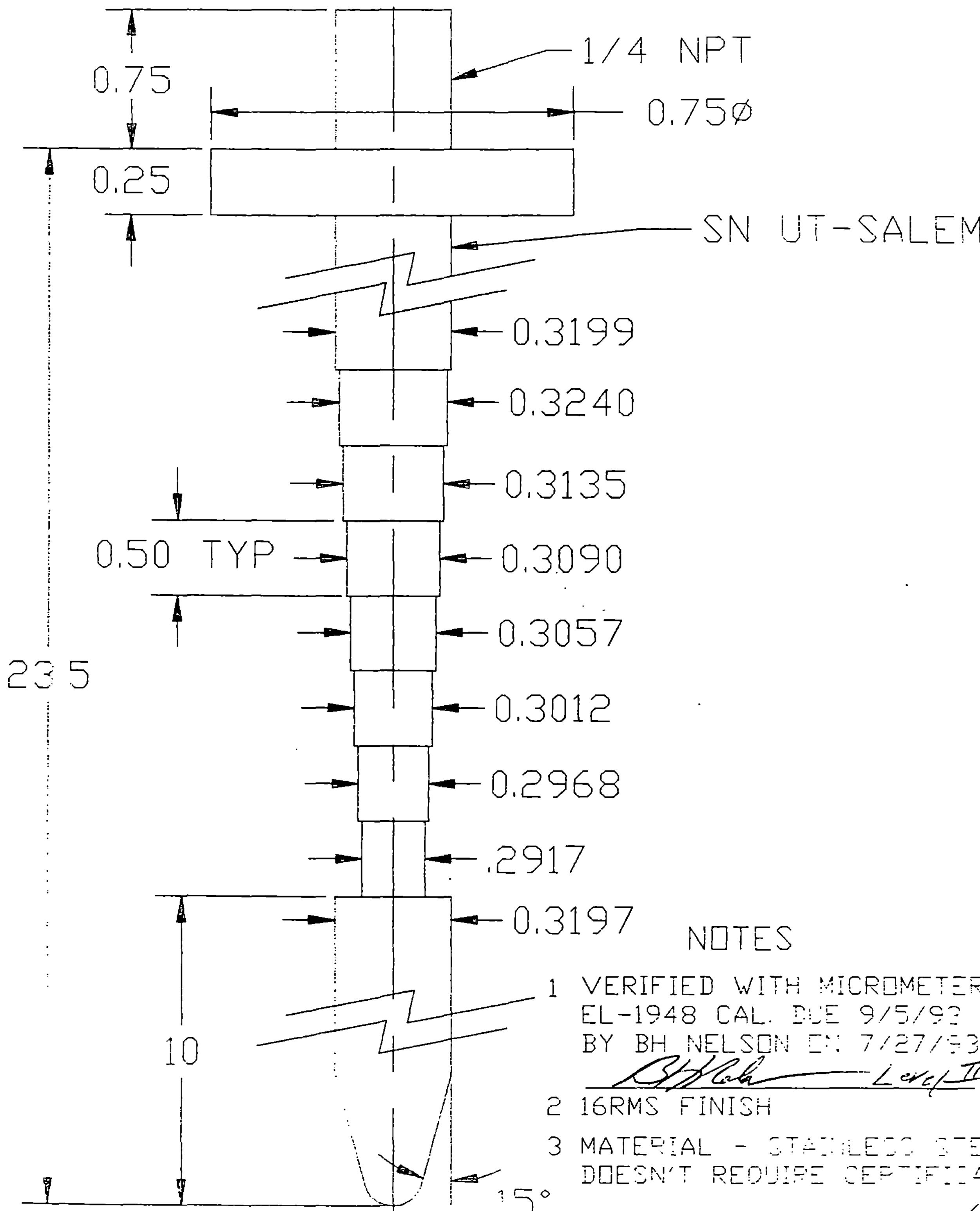


ARRAY HOUSING



UT TRANSDUCER IDENTIFICATION

Figure 1



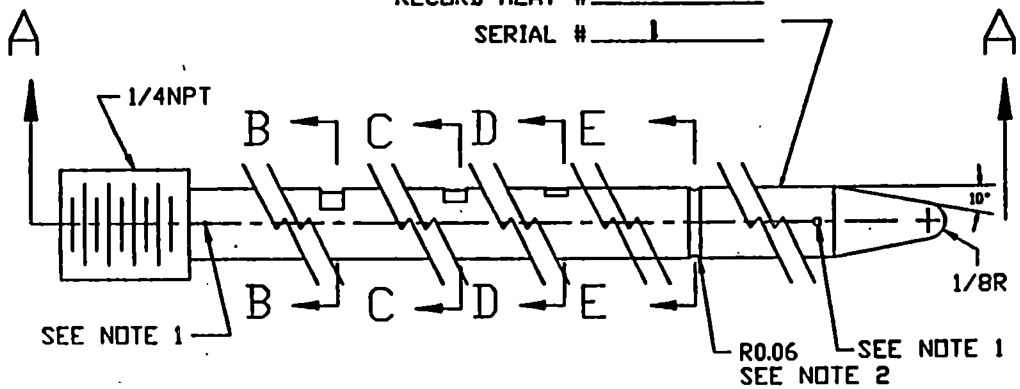
NOTES

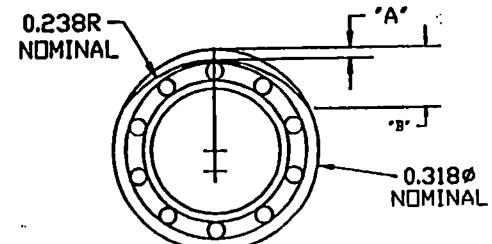
1. VERIFIED WITH MICROMETER EL-1948 CAL. DUE 9/5/93 BY BH NELSON ON 7/27/93
   (signature) Level II
2. 16RMS FINISH
3. MATERIAL - STAINLESS STEEL DOESN'T REQUIRE CERTIFICATION

UNLESS OTHERWISE SPECIFIED	**COMBUSTION ENGINEERING**	DRAWN BY GH WOODFORD — SIGNATURE (signed) — DATE 7/2?/93
BREAK CORNERS .015 APPROX. R OR CHAM - FILLETS .015 TO .030 R	NUCLEAR POWER — THIS DRAWING IS THE PROPERTY OF COMBUSTION ENGINEERING, INC., WINDSOR, CT. 06095 AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OR APPARATUS EXCEPT WHERE PROVIDED FOR BY AGREEMENT WITH SAID COMPANY	CHECKED BY K THOMPSON — SIGNATURE (signed) — DATE 7-28-93
DIMENSIONS APPLY AT 68°F(20°C)		REVIEWED BY MJ DASHUKEWICH — SIGNATURE (signed) — DATE 7-29-93
ALL DIMENSIONS ARE IN INCHES	CUSTOMER	APPROVED BY V ROY — SIGNATURE for B.A Cooper — DATE 7-28-93
TOLERANCES: ONE PLACE DECIMAL ± .1; TWO PLACE DECIMAL ± .02; THREE PLACE DECIMAL ± .001	SCALE / DATE	DWG TITLE SALEM FTTC DIAMETER STANDARD - AS BUILT
ANGLES ± 0° 30' CHAM ± 5°	JOB NO / FILE	DWG. NO. NCS-93-012 — SHEET 1 OF 1 — REV
DO NOT SCALE DRAWING		

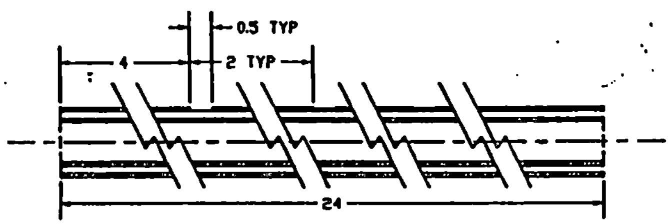
RECORD HEAT # *1565*

SERIAL # *1*





Charles L. McMenamin 7/28/93
Charles L. McMenamin QC. m



PARTIAL SECTION A-A
ROTATED 90°

SECTION	"A" DIM	"B" DIM
B - B	*.017*	*.044*
C - C	*.008*	*.022*
D - D	*.004*	*.012*
E - E	*.002 X 360°*	

Dimensions 'A' confirmed using micrometers EL-1595 and EL-1948
[signature] 7-30-93
Level II

NOTES

1) DRILL, PIN, PLUG WELD AND GRIND FLUSH
2) ROLLED DENT - NO MATERIAL REMOVED

REV.	DESCRIPTION
▽	

UNLESS OTHERWISE SPECIFIED
BREAK CORNERS .015 APPROX. R OR CHAM – FILLETS .015 TO .030 R
DIMENSIONS APPLY AT 68°F(20°C)
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ONE PLACE DECIMAL ± .1
TWO PLACE DECIMAL ± .02
THREE PLACE DECIMAL ± .001
ANGLES ± 0° 30' CHAM ± 5°
DO NOT SCALE DRAWING

COMBUSTION ENGINEERING
NUCLEAR POWER

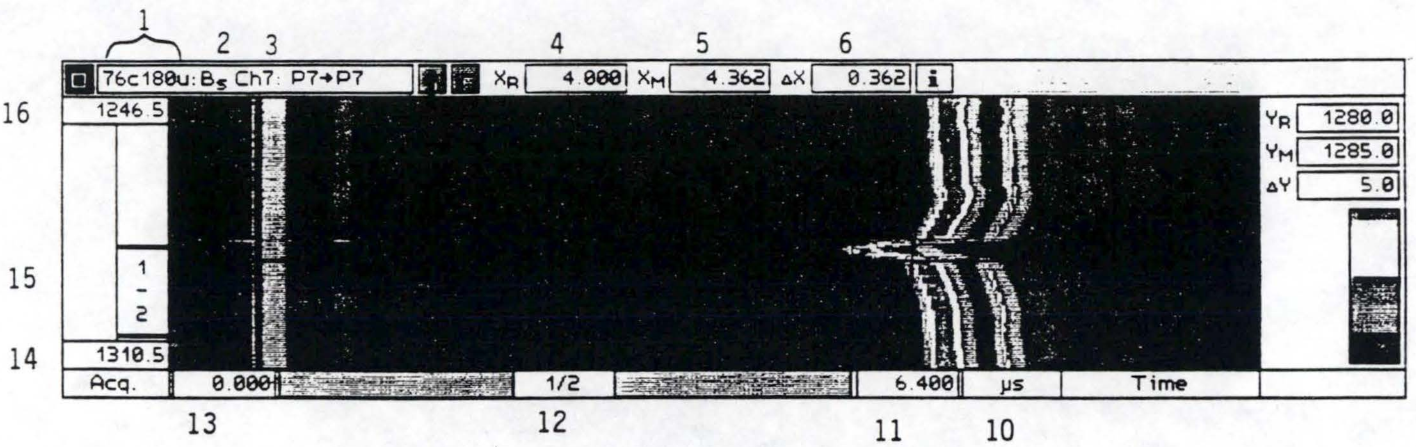
CUSTOMER
SCALE
DATE
JOB NO.
FILE

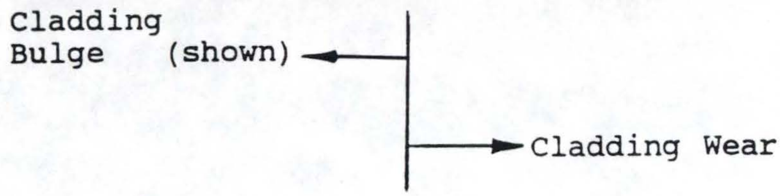
		Signature	Date
DRAWN BY	GH WOODFORD	*[signature]*	*7/26/93*
CHECKED BY	K THOMPSON	*K.W. Thompson*	*7-26-93*
REVIEWED BY	J RUSSELL		
APPROVED BY	V ROY		

DWG TITLE: SALEM FTTC WEAR STANDARD AS-BUILT

DWG. NO. NSS-93-013 SHEET 2 OF 2 REV. 4

UT SCREEN DISPLAY KEY





Top of thimble when data is collected while tube is moving up.

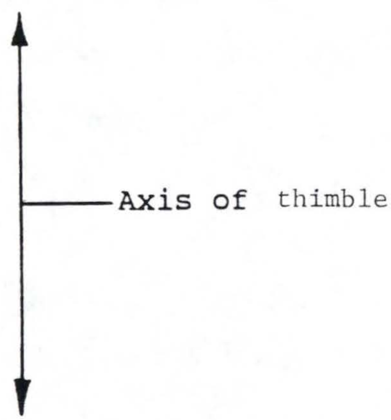


Figure 4 A

UT SCREEN DISPLAY KEY

1. 76C180U – "76" Represents the Thimble number
   "C" is the energized array set (see main text for an explanation)
   "180" is the tube orientation in the fixture
   "U" is the direction (u-up or d-down) the tube was moving as test data was collected.

2. B_S – States the type of UT scan pictured, in this case a B-scan.

3. CH7 – The transducer from which the image is produced.

4. X_R – The position of the first vertical cursor given in micro seconds measured along the radius of the rodlet (yellow line).

5. X_M – The position of the second vertical cursor, used in conjunction with vertical cursor X_R to measure defect size (blue line).

6. X – The difference between the two vertical cursors given in micro seconds which multiplied by 2.867×10^{4} inch/second yields the defect size in inches.

7. Y_R – The position of the first horizontal cursor given in data points measured along the axis of the rodlet (yellow line).

8. Y_M – The position of the second horizontal cursor used in conjunction with the horizontal cursor Y_R to measure the axial length of a defect (blue line).

9. Y – The difference between the two horizontal cursors given in data points but directly equal to 10^{-1} inches.

Figure 4 B

UT SCREEN DISPLAY KEY

10. µS - The unit of measurement used in the display of the X axis, micro seconds in this instance.

11. - The amount of radial thimble information displayed on the screen utilizing the units of measurement listed in number 10 above.

12. - The expansion or compression factor of the X-axis display normally a scale of 1/1 is displayed. A scale of 1/2 indicates each aquisition point is represented by two display units which enlarges the display. A scale of 2/1 indicates two aquisition points are represented by one display point which compresses the display.

13. - The point at which the radial thimble information displayed on the screen starts. The transducer surface is 0.0000 micro seconds.

14. - One boundry of the axial thimble information displayed on the screen given in data points.

15. - The expansion of compression factor of the Y-axis display. Normally a scale of 1/1 is displayed.

A scale of 1/2 indicates each aquisition point is represented by two display units which enlarges the display.

A scale of 2/1 indicates two aquisition points are represented by one display point which compresses the display.

16. - One boundry of the axial thimble information displayed on the screen given in data points.

Figure 4 C

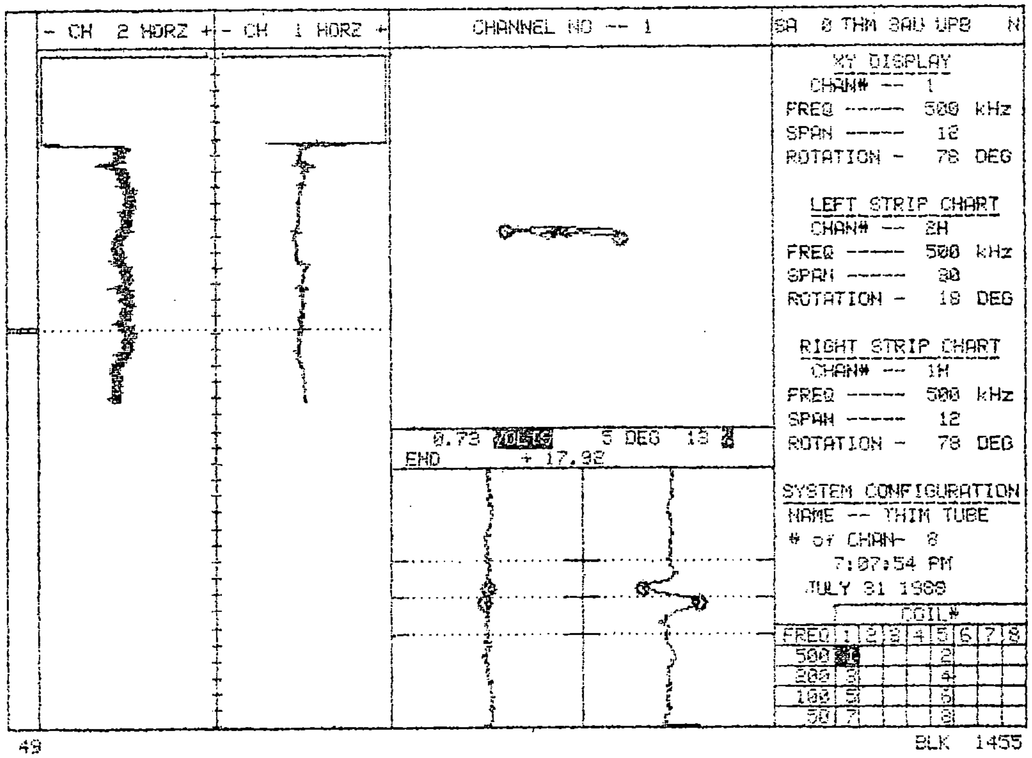


Figure 5
ECT Printout
Dent Signal

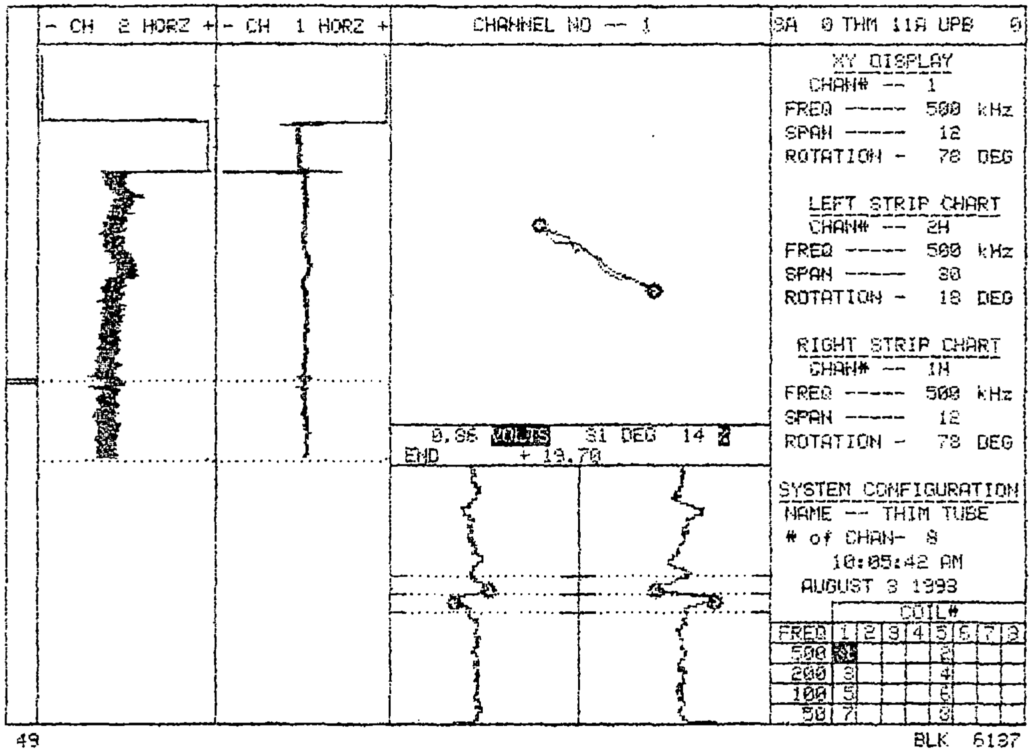


Figure 6
ECT Printout
Wear Signal

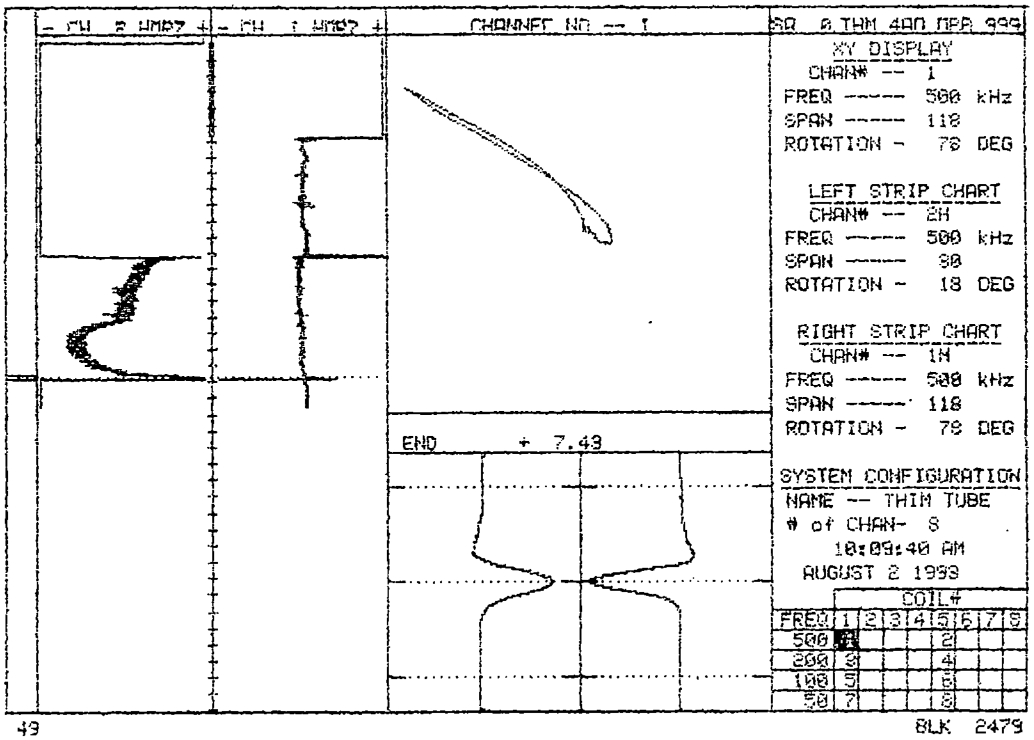


Figure 7
ECT Printout
Chrome Transition (Lower)

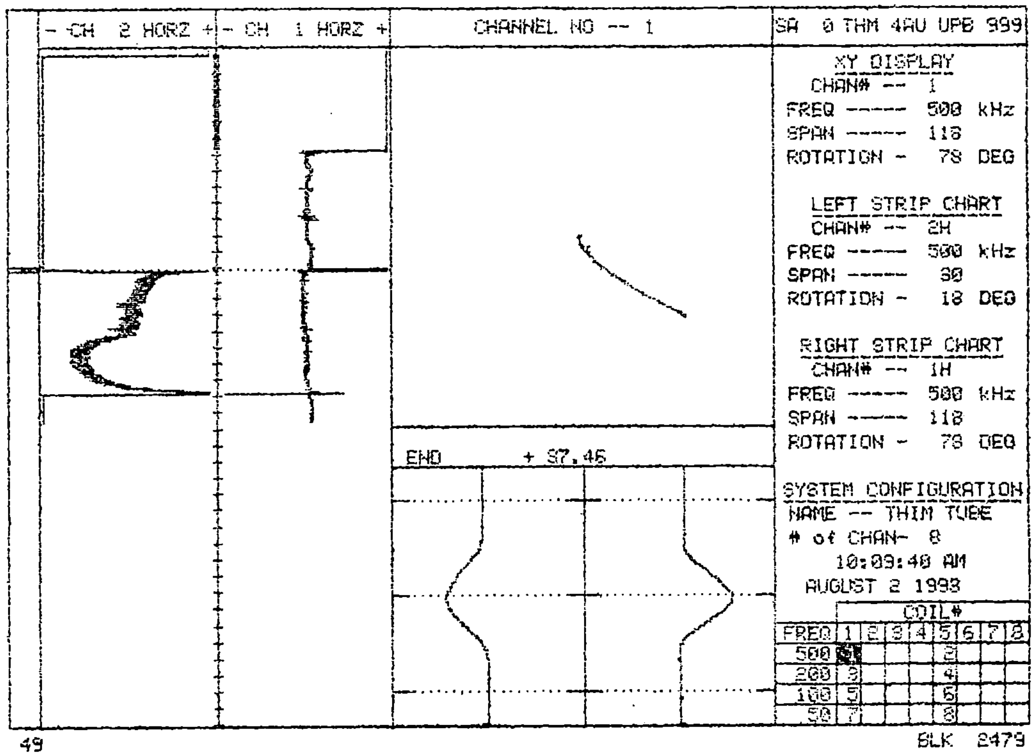


Figure 8
ECT Printout
Chrome Transition (Upper)

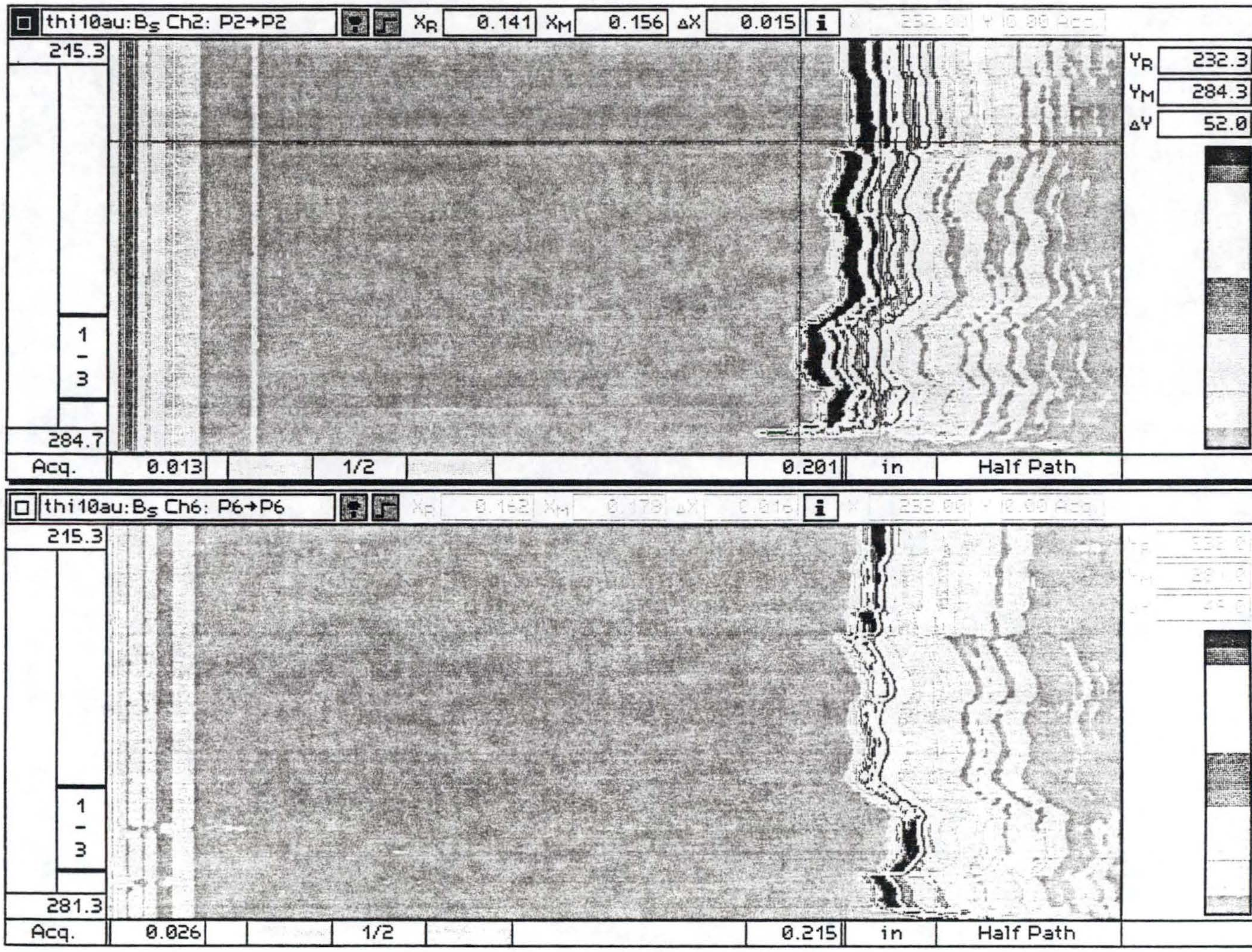


Figure 9
Thimble number 10
Chrome Transition
Opposite Channels

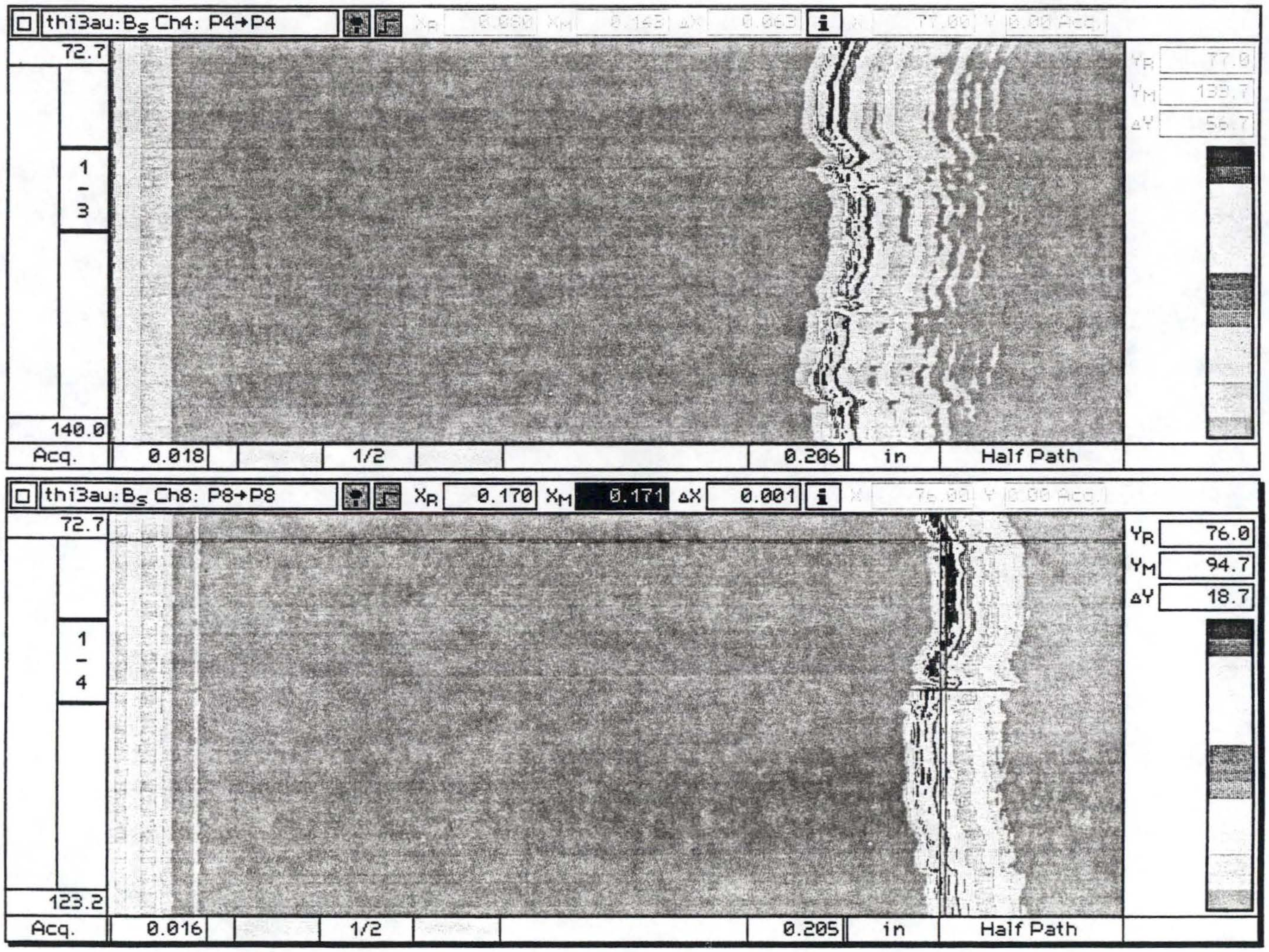


Figure 10
Thimble number 3
Wear, .001 inch (depth)

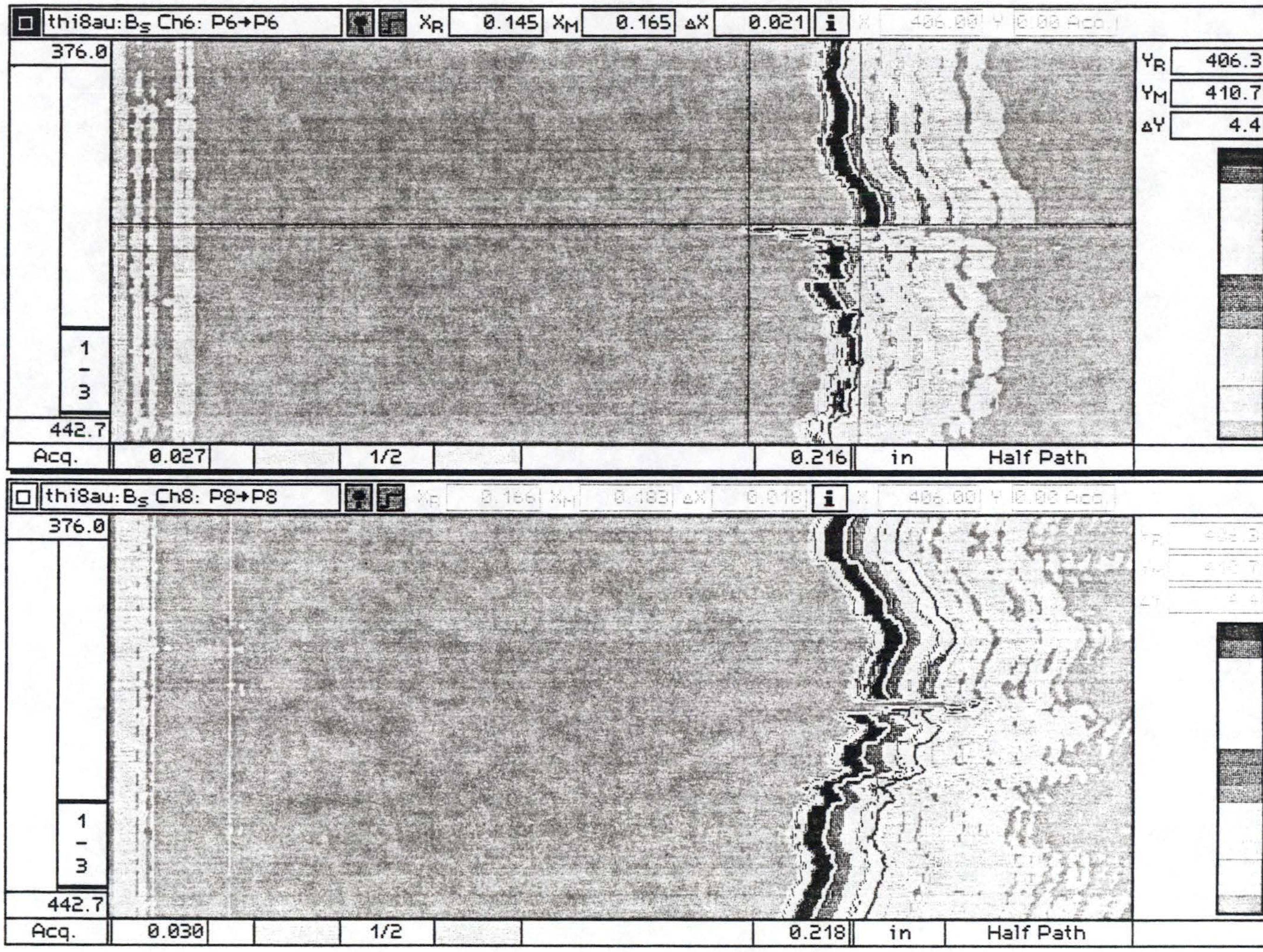


Figure 11
Thimble number 8
Partial aborted cut
Chrome section

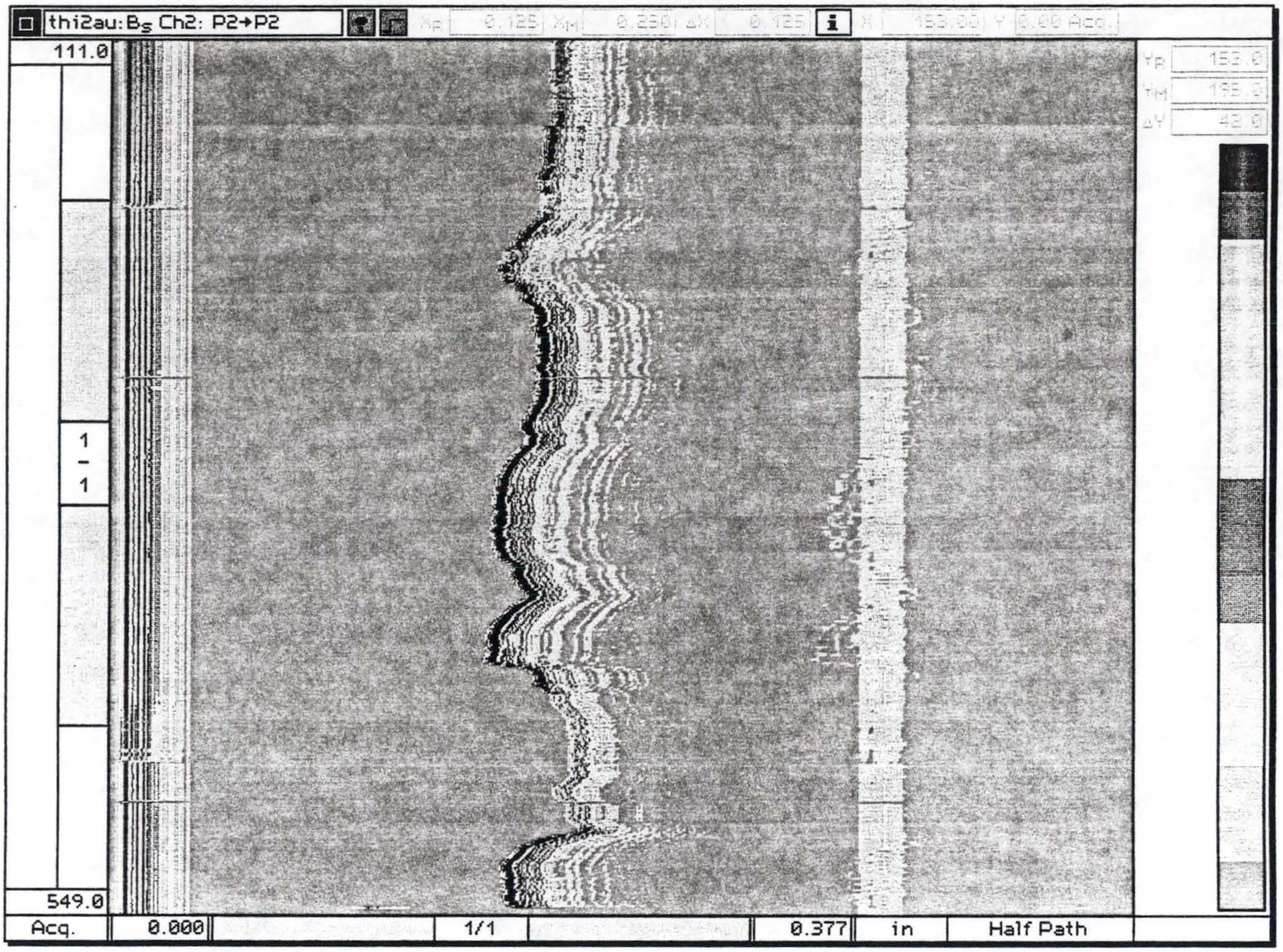


Figure 12 A
Thimble number 2
Full Lenght

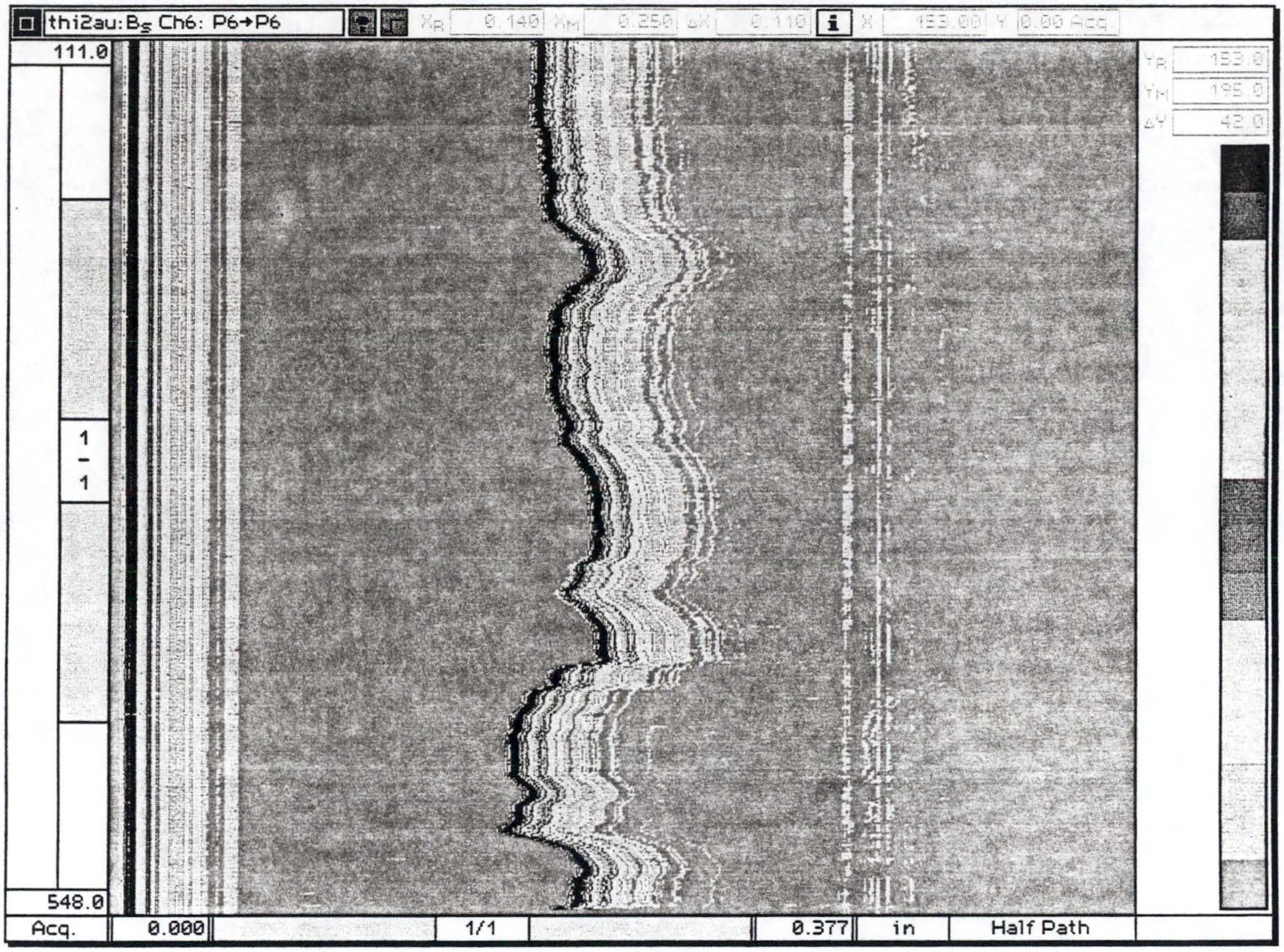
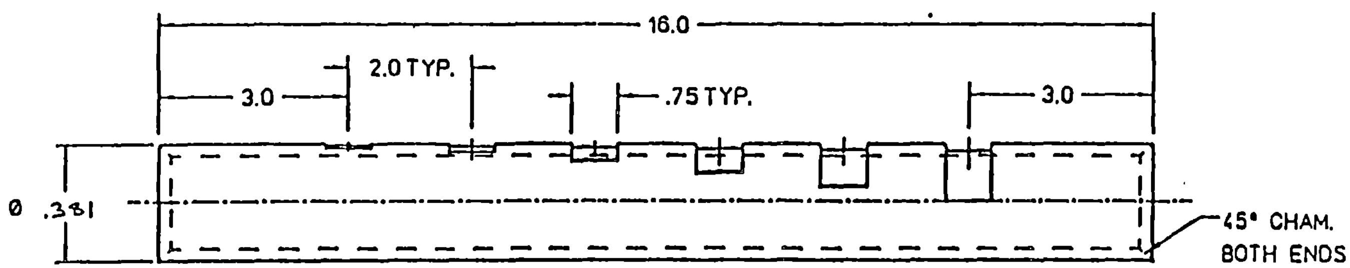


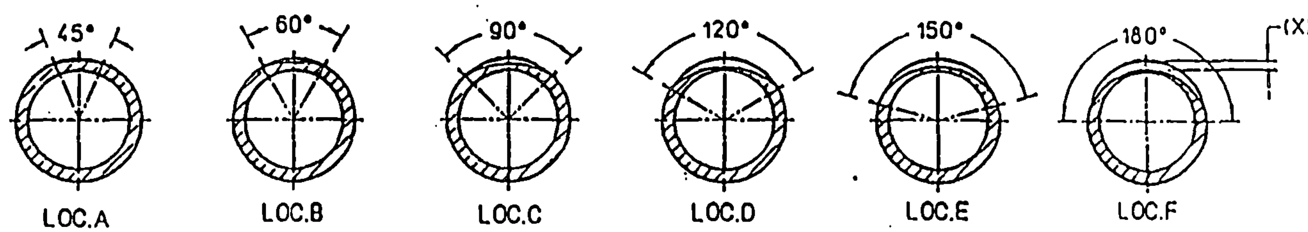
Figure 12 B
Thimble 2
Full Length

Figure 13

REVISIONS					
LTR	DATE	DESCRIPTION	APVD	CK	DF

LOCATION	A	B	C	D	E	F
ACTUAL MEAS. FLAW DEPTH (X)	.0010	.0025	.0115	.0105	.0140	.0160





MATERIAL UNSPECIFIED
AVERAGE MEAS. WALL THK. .025
NOMINAL WALL THK. .020
HEAT LOT NO. UNKNOWN-CUST. SUPL.
TEST FREQ. USED NA
SERIAL NO. Z-7290
P.O. NO. 9085065
REL. NO. NA
QUALITY REL. NO. NA
DATE MFG. 3-30-90
E.T. TECHNICIAN [signature]
CUSTOMER COMBUSTION ENGINEERING
RECORDED NA
PROBE USED NA
APVD. BY [signature]

NOTE:

ACTUAL MEASURED RADIAL WEAR IN DEGREES FOR FLAWS EXCEEDING ± 3° TOLERANCE:
C = 86° D = 133° F = 162°

CUSTOMER HAS ACCEPTED THESE DEVIATIONS, PER PHONE CONVERSATION W/EDRAN KULJIS 3/30/90.

UNL. OTHERWISE SPECIFIED DIM. ARE IN INCHES
TOLERANCES
DECIMAL FRACT. +/-
.XXX +/-.005
.XX +/-.010
.X +/-.030
ANGULAR +/- 3°
FINISH

DRAWN	DATE
K.ZEGKE	3/23/90
CHECK [initials]	3/27/90
DESIGN	
APVD. QA [initials]	3/28/90

ZETEC INC.

TITLE CUSTOM WEAR SCAR STD.
A# 1067 D# 1334-1-A

DWG NO 2-4436

SCALE NONE | REL. DATE 3/28/90 | SHT 1 OF 1

SALEM GENERATING STATION/TECHNICAL DEPARTMENT

VS1.RE-IS.RC-0001(Q) - REV. 0

ABB/CE FLUX THIMBLE THERMOCOUPLE EXAMINATION
FOR SALEM UNIT #1 (SALEM-400-019)

USE CATEGORY: I

REVISION SUMMARY

This is a vendor procedure written to perform Flux Thimble Thermocouple Ultrasonic, Eddy Current and Visual Inspection for flux thimbles removed and stored in the spent fuel pool during Unit 1, 10th Refueling outage.

IMPLEMENTATION REQUIREMENTS

None

APPROVED: R. W. Chr[illegible] for M. Morroni — TECHNICAL MANAGER   7/30/93 — DATE

PROCEDURE FOR

THE EXAMINATION OF

THIMBLE TUBES

PROCEDURE NO. SALEM-400-019

OUTAGE SERVICES DEPARTMENT

ABB COMBUSTION ENGINEERING NUCLEAR SERVICES

WINDSOR, CONNECTICUT

PREPARED BY: Brian Cooper / for DATE: 7-29-93
V.P. Roy

APPROVED BY: M.J. Dashukewich DATE: 7-29-93
M.J. Dashukewich
UT Level III

APPROVED BY: Henry Labieniec DATE: 7/29/93
H. Labieniec
ET Level III

APPROVED BY: John A. Colflesh DATE: 7/29/93
J.A. Colflesh
Manager, Component Services

APPROVED BY: ______ DATE: 7-29-93
for G.S. Bloomquist
Quality Operations

Rev. No. 0

Date: 7-29-93

TABLE OF CONTENTS

1.0 PURPOSE

1.1 INTENT

This procedure describes the method for ultrasonic (UT) and eddy current (ET) inspection of Thimble Tubes. This procedure describes the equipment setup, equipment calibration, and inspection procedure.

This procedure does not cover Thimble Tube handling, which is done with air operated, handheld, gripping tools. This procedure does not cover other activities such as requirements which would be part of a radiation work permit or part of a foreign material exclusion procedure.

1.2 APPLICABILITY

This procedure is applicable to Thimble Tube sections whose OD is accessible. Thimble tube sections which can not be straightened per section 8.6 will not be inspected.

2.0 REFERENCES

None

3.0 DEFINITIONS

3.1 Test Supervisor - The ABB Task Manager responsible for the inspection program. The duties of the Test Supervisor are to carry out the administrative and supervisory functions required to perform the examination program. The Test Supervisor may also operate equipment for which he is qualified.

3.2 Lead Inspector - The NDE inspector on a shift responsible for the setup, calibration and operation of the inspection equipment. The Lead Inspector shall be qualified as a Level II or higher in either UT or ET.

3.3 NDE Operator - The NDE qualified individual who performs setup, calibration, and data collection in accordance with this procedure. The NDE Operator shall be qualified as a Level I or higher in the discipline for which work is performed.

4.0 PERSONNEL REQUIREMENTS

4.1 The Test Supervisor, Lead Inspectors and NDE Operators shall be certified in accordance with QAP 2.4.

5.0 EXAMINATION REQUIREMENTS

Note: Examination requirements are contained within the body of the inspection procedure. This section is a summary of the requirements.

5.1 EQUIPMENT

Note: Equipment uses 110 VAC. Nominal power requirements are two 20-AMP circuits.

5.1.1 N16 Ultrasonic Array System (Digital Multi-Channel Inspection Unit)

5.1.2 Zetec Digital Multifrequency ET System (MIZ-18A, HP 9836 computer, DCR)

5.1.3 Thimble Tube Inspection Fixture.

5.1.4 Array Housing Units (UT transducers and ET coil)

5.1.5 Array Selector Box (optional).

5.1.6 Diameter standard (UT)

5.1.7 Defect Standard (ET)

5.1.8 Underwater TV camera system

5.2 INSPECTION PARAMETERS

5.2.1 UT examination frequency is 10 MHz.

5.2.2 UT examination angle is 0 degree longitudinal wave.

5.2.3 UT couplant is the pool water.

5.2.4 ET technique is encircling coil using frequencies of 500 KHz, 200 KHz, 100 KHz, and 50 KHz in both absolute and differential modes.

5.3 CALIBRATION

5.3.1 UT system calibration is performed with a multiple diameter rod standard (DIAMETER STANDARD). This rod was machined to provide various diameters which were then measured and certified.

5.3.2 ET system calibration is performed with a defect standard (DEFECT STANDARD). This standard was fabricated from a piece of tubing of the same material and nominal dimensions as the Thimble Tubes to be inspected. The tubing was machined to produce various defects which were then measured and certified.

5.4 INSPECTION RECORDS

5.4.1 The permanent UT inspection data is recorded on optical disk(s).

5.4.2 The permanent ET inspection data is recorded on magnetic tape (data cartridges).

5.4.3 The following data as a minimum shall be recorded on the UT/ET data disk/tape:

Owner	Calibration standard S/N
Plant and Unit	Procedure and revision no.
Date	Test item identification
Operator name	Operator NDE level

5.4.4 The completed data sheets contained within this procedure is the record of the Thimble Tubes inspected, times, test sequences, etc.

5.4.5 This inspection is a diagnostic examination of discharged and sectioned thimble tubes. No acceptance or rejection criteria applies.

6.0 EQUIPMENT SET-UP

Note: The major steps are listed in this section. Detail setup steps are listed in the appendices. Steps may be done in parallel where applicable.

6.1 Layout the UT and ET equipment and interconnect the equipment.

6.2 Layout the Thimble Tube INSPECTION FIXTURE (TEST FIXTURE) in the work area and install the ARRAY HOUSING UNIT(s) (TEST ARRAY) in the TEST FIXTURE.

6.3 Connect the TEST ARRAY cables to the UT and ET equipment.

NOTE: Step 6.4 must be performed by an NDE Operator qualified Level II or higher (either UT or ET).

6.4 Verify proper setup of all equipment and proper connection of all cables. (e.g. the TEST ARRAY in the TEST FIXTURE is connected to the Array A inputs 1 thru 8 on the selector box). Cables shall be labeled so that if the cables are disconnected and reconnected this setup can be re-verified without removing the TEST FIXTURE from the pool.

6.5 Perform an ET/UT operational checkout / calibration checkout of the equipment to check proper operation of all TEST ARRAY(s).

Note: Installation of the fixture into the pool may require use of a crane. The operation of the crane, rigging requirements, slings, etc. shall be done in accordance with plant procedures as required. The fixture is installed in a location as specified by the plant.

6.6 Install the TEST FIXTURE in the pool, typically next to an operator accessible pool wall.

6.7 Notify Station Quality Assurance (SQA) before starting the actual inspection of the thimbles. Record information below.

Art Siebert — Name of SQA Person Contacted

7-31-93 / 1230 -WNE — Date and Time Contacted

7.0 EQUIPMENT CALIBRATION

Note 1: Equipment calibration shall be checked by a Level II NDE Operator.

Note 2: The DEFECT STANDARD and DIAMETER STANDARD may physically be mated together as one piece.

7.1 Using the DIAMETER STANDARD calibrate the UT system for each TEST ARRAY as follows:

7.1.1 Fully insert the DIAMETER STANDARD into the TEST ARRAY.

7.1.2 Turn on the UT electronics and name the file as a calibration run, up.

7.1.3 The calibration file name will be specific to the TEST ARRAY used (if there is more than one).

7.1.4 Withdraw the DIAMETER STANDARD recording the data on the optical disk.

7.1.5 When the DIAMETER STANDARD is out of the TEST ARRAY stop recording.

7.1.6 Calibrate any remaining TEST ARRAY in the fixture in the same manner.

7.2 Using the DEFECT STANDARD calibrate the ET system for each TEST ARRAY as follows:

7.2.1 Fully insert the DEFECT STANDARD into the TEST ARRAY.

7.2.2 Name the ET data file as a calibration run.

7.2.3 Withdraw the DEFECT STANDARD, recording the data on the data cartridge recorder.

7.2.4 When the DEFECT STANDARD is out of the TEST ARRAY stop recording.

7.2.5 Calibrate any remaining TEST ARRAY in the fixture in the same manner.

7.3 Re-calibration is required only if there is a change in test equipment, TEST ARRAY, or ET coils. Periodic calibration checks are done to check equipment performance and provide calibration signals for use by the data analyst. Calibration checks shall be done as follows:

7.3.1 At the start of the inspection program.

7.3.2 At the beginning and end of a DCR tape. (ECT only)

7.3.3 At the beginning and end of a work shift (at minimum every 12 hours).

7.3.4 At the end of the inspection program.

8.0 INSPECTION PROCEDURE

8.1 If required, verify the Thimble Tube location in the pool using an underwater TV camera.

8.2 If not already done, calibrate the ET and UT systems per Appendix A and B.

8.3 Perform a calibration check by withdrawing the calibration standards thru each TEST ARRAY and recording the applicable UT and ET signals. If these checks do not appear to be consistent with the calibration standard, inform the Lead Inspector.

8.4 If available use an overhead crane to pull the Thimble Tubes through the TEST FIXTURE. If the overhead crane is used, determine the speed of Thimble Tube lift. (This step may be done in conjunction with the first Thimble Tube to be inspected.)

8.5 Mark the visegrip handling tool (graphite pole) using colored tape at the elevation determined by HP to ensure that the top of the thimble is not raised sufficiently near the top of the pool surface so as to create a radiation exposure hazard to personnel.

8.6 Inspect each Thimble Tube as follows:

CAUTION

EXTREME CARE SHALL BE EXERCISED IN THE HANDLING OF THE THIMBLE TUBE SECTIONS. DO NOT RAISE THE HANDLING TOOL OUT OF THE POOL ANY HIGHER THAN THE TAPE MARK (STEP 8.5).

8.6.1 Determine the Thimble Tube to be inspected and insert the crimped end of the Thimble Tube into the crimp removal tool until the tool stop is reached.

NOTE: The pressure gage on the hydraulic pump is used to determine the hydraulic line is pressurized and does not need to be calibrated.

8.6.2 Pressurize the crimp removal tool using a hydraulic pump, the pump has reached an adequate hydraulic pressure when the pump handle becomes hard to move.

8.6.3 Fully insert the THIMBLE TUBE into the TEST FIXTURE.

8.6.4 Select the appropriate ARRAY SET. Start the UT and ET data collection. Signal to the Thimble Tube handling operator to withdraw the Thimble Tube. Stop data collection once the Thimble Tube is fully withdrawn.

8.6.5 Record the Thimble Tube sequence number, inspection start time and inspection completion time in the Inspection Log.

8.6.6 Repeat test for other Thimble Tubes. Perform re-calibration and/or calibration checks (standard runs) as specified in step 7.3.

8.7 If required, verify that the Thimble Tube's are in their correct orientation and location in the pool using an underwater TV camera and the site supervisory direction.

9.0 EQUIPMENT TAKEDOWN

9.1 De-energize the UT and ET equipment and remove the interconnecting cables. Pack the equipment in the shipping boxes.

Note: Removal of the fixture may require use of a crane. The operation of the crane, rigging requirements, slings, etc. shall be done in accordance with plant procedures as required. HP requirements for rinsing, decontamination, etc. shall be done as specified in the plant's radiation work permit.

9.2 Remove the TEST FIXTURE from the pool and place it in a laydown area for disassembly and packup.

9.3 Remove the calibration standards from the pool.

INSPECTION LOG DATA SHEET

1993

THIMBLE TUBE	DATE/TIME IN PROF.	DATE/TIME OUT OF PROF.	INITIAL	REMARKS
#1	7-31, 1440	7-31, 1449	RBM LII	
2	7-31, 1530	7-31, 1545	RBM LII	
3	7-31, 1900	7-31, 1920	RBM LII	
4	8-2, 0955	8-2, 1612	RBM LII	
5	8-2, 1631	8-2, 1040	RBM LII	
6	8-2, 1310	8-2, 1341	RBM LII	Tested from both ends
7	8-2, 1400	8-2, 1830	RBM LII	Tested from both ends
8	8-3, 0852	8-3, 0920	RBM LII	Tested from both ends
9	8-3, 0930	8-3, 0936	RBM LII	
10	8-3, 0945	8-3, 0947	RBM LII	
11	8-3, 1001	8-3, 1006	RBM LII	
Completed	8-3-93		VT LII, ET LII, UT LII	Robert B M[illegible]
		N/A		

The NDE Operator shall initial for each thimble inspected. When complete the NDE Operator shall sign, date and note his(her) NDE level on the next line in the log.

ET Standard S/N #1 NSS-93-013 UT Standard S/N UT-Salem NSS-93-012 rev1

If more Inspection Log Data Sheets are needed attach additional copies of this page to the completed procedure.

Record number of additional Data Sheets 0 attached.

APPENDIX A

ENCIRCLING COIL TEST

The following interconnections should be made.

1. Connect the GPIO interface card on the HP 9836 to the Data Cartridge Recorder with a 50-pin GPIO cable.

2. Connect the HPIB Interface on the HP 9836 to the HPIB/MIZ-18A interface with a GPIB cable.

3. Connect the HPIB/MIZ-18A Interface to the MIZ-18A Remote Unit with the desired length (10' to 100' typical) of MIZ-18A Remote Cables. The IEEE-488 connector at the lower right corner of the MIZ-18A Remote Unit should be used.

4. The appropriate MIZ-18A Probe Adaptor Splitter Cable connected to a PROBE connector on the MIZ-18A Remote Unit is used for standard test probe configurations.

   A) One reference coil MUST be connected to the REFERENCE connector of the probe adaptor splitter cable and reference standard inserted into the reference coil. Absolute data is now available for each test coil and frequency.

The following equipment precautions and notes should be followed:

1) When a MIZ-18A operator change occurs, identify the operators name and level in the message section.

2) Do not enter Review Mode when testing. Entering this mode could cause a loss of data entries on tape. After END TAPE and in safe position use Review Mode to check for complete data.

3) When using the coil, periodic cycling through the channels during data collection is recommended to ensure proper operation of the coil.

4) When the data cartridge is complete, a hard copy of Summary Information including updated test parameters should be included with the data cartridge package.

5) Make sure the backup disk is initialized and not write protected.

6) Make sure the cartridge is not in save mode or not write protected but <u>after</u> completion is put into the save mode.

7) Be sure that the index backup is <u>enabled</u> to avoid loss of data.

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

SEQUENCE FOR MIZ-18A START UP AND OPERATION

1. Load the MIZ-18A System Software (floppy disk into right disk drive) and a blank formatted diskette into left disk drive.
2. Turn on power.
3. The system will automatically boot into set clock and date mode.
4. Set clock and date.
5. Depress "TEST" (K9)
6. Depress "SHIFT" and "CONFIGURE" key (k3)
7. The encircling coil will be configured to test at 500 KHz, 200 KHz, 100 KHz, and 50 KHz differential and absolute modes with the sampling rate set at 400 samples per second.
8. Depress "CONFIGURE" key (k8) to achieve Test Mode.
9. Depress "SHIFT" key and the "TEST" and "REVIEW" key (k9) Twice simultaneously to achieve Utility Mode.
10. Depress Disk Utility (k2) on function keyboard.
11. Depress "SHIFT" and "INITIAL DISK" keys (k5) simultaneously to initialize unit.
12. Depress "UTILITY" key (k9)
13. Depress "SHIFT" and "UTILITY" key (k9) to achieve Test Mode.
14. Depress "TAPE RCDR" (k5).
15. Depress "BACKUP ON/OFF" key (k4) to ENABLE backup disk.
16. Depress "TEST" key (k9) to achieve Test Mode.

17. Load data cartridge -- wait approximately 90 seconds for completion of cycle.

18. Depress "SUMMARY" key (K2).

19. Depress "TYPE DATA" (K0).

20. Type in the information requested and include the serial numbers of all the equipment used.

    NOTE: If there is an operator change during testing, the new operator will enter their name in a "MESSAGE".

21. Depress "DONE" (k0) typed information will be transferred to data cartridge.

22. Depress "SHIFT" key and the "TEST" and "REVIEW" key (k9) simultaneous to achieve utility mode.

23. Depress "SET UP" key (k1). This function will set the system up to change the identification header.

24. Depress "KEY (k7)" until you have "KEYBOARD INPUT (KBD INP)". This will allow I.D. header to be updated using the keyboard prior to the start of each coil scan.

25. Depress "KEYS (k1), (k2) and (k3)" one at a time until they have no headers showing.

26. Depress "SHIFT" key and (k1) key simultaneously. This will enable you to type in the proper header. Do this for the following keys (k2) and (k3).

27. Depress "UTILITY" key (k9).

28. Depress "SHIFT" key and "UTILITY" key (k9). This will bring you back into the "TEST" mode.

29. Perform an "in air" and "in water" calibration standard run. The "in air" test is run to verify the coil is working prior to putting the fixture in the pool.

31. Depress "MIZ-18A OFF" (K4).

32. Place defect standard in the test coil.

33. With the coil at a no defect portion of the standard, depress "CONTINUE KEY" to balance the eddy current system.

34. Depress the "RUN" key and slowly withdraw the standard fully from the coil (the calibration standard is run during withdrawal).

35. When the defect standard exits the fixture depress the "PAUSE" key (this stops the testing).

36. Set span and rotation by setting the dent on the calibration standard horizontal with an initial excursion to the right.

37. Depress "SPAN/ROT" key (k7).

38. Depress "SET SPAN" key (k1) or "SET ROT" key (k6) to achieve desired spans and rotations. Do this for all test channels.

39. Depress "TEST" key (k4) to achieve test mode.

40. Depress "SUMMARY" key (k2).

41. Depress "UPDATE" key (k6). This will update all spans and rotations.

42. Depress "TYPE DATA" key (k0) followed by "DONE" key (k0).

43. Depress "MIZ-18A ON" (k4).

44. Fill in the Thimble Tube number. (Use Function Keys.)

45. Lower Thimble Tube into the fixture.

46. Depress "CONTINUE KEY" to balance. (Balance must be done with the Thimble Tube in the coil).

47. Start Data Recorder (Run Key).

48. Test the Thimble Tube.

49. Stop Data Recorder (Pause Key).

50. Test all remaining Thimble Tubes in the same manner.

APPENDIX B

UT EQUIPMENT TEST

1. Connect the N16 Ultrasonic Array Inspection System by following the instructions listed in the Ultrasonic Inspection System User Manual (Manual) and insert an optical disk into the N16.

2. Prior to mounting a TEST ARRAY in the TEST FIXTURE check that each of TEST ARRAY'S cable ends is identified as being a particular transducer out of the 8 possible transducers.

3. If the cable ends are not identified, physically trace each cable from the individual UT transducer back to its cable connector. Arbitrarily select any UT transducer as number 1 and label the remaining transducers as numbers 2 thru 8 starting with the first transducer in a clockwise direction from transducer number 1.

4. If the selector box is used connect the TEST ARRAY cables to Array A, inputs 1 thru 8.

5. If a backup TEST ARRAY is available and the selector box is used connect the TEST ARRAY cables to Array B, inputs 1 thru 8.

6. If the selector box is not used connect the TEST ARRAY cables to the pulser/receiver connectors labeled R1 thru R2 respectively.

7. Turn on the power to the N16, a special sequence of events occur when the equipment is turned on which are automatic and are described in the Manual.

8. Dependent on reject criteria (supplied by the plant owner/client) adjust signal response and gating to maximize signal sensitivity. Each individual channel set-up shall be verified with the DIAMETER STANDARD.

9. The system may be calibrated utilizing one gate in the A scan. The width of the gate will be determined by site supplied wear rejection criteria. No gate is necessary if no rejection criteria is supplied.

10. Gate #1 ("wear gate" colored yellow) is set to reflect an acceptable wear range. Diameter wear signals will move right from nominal. Movement of the signal out of this gate will reflect unacceptable wear indications.

11. A) Insert the DIAMETER STANDARD into the TEST FIXTURE insuring the nominal Thimble Tube diameter is reflected.

B) By adjusting the gate width and the delay, adjust the signal (Channel 1) so that the first reflector is enclosed in the new wear gate leaving 10% of gate open from the left extreme edge. This allows for slight diameter changes or movement of the standard/rodlet within the array.

C) Set the signal gain between 80-100% full screen height.

D) Withdraw the DIAMETER STANDARD until the site specified unacceptable reduced diameter range is reflected by the transducer array. Verify that this signal is outside (right) of the "wear" gate.

E) Repeat steps 11, B, C, D for all transducer channels.

12. The colored multi-channel C-scan readout reflects changes in diameter both in and out of the acceptable diameter ranges. Each color change will correlate to an actual measured reduced diameter depth. Coloration will be pre-set to reflect site rejection criteria.

13. The right indicator line of all channels correlate to the "wear" gate or diameter loss.

14. If the standard or rodlet signal remains in the set gated area the (right) indicator line of all channels will remain at the nominal dark blue color. As the signal moves towards the wear indicator side, the coloration will change (dependent on wear depth) to light blue, green, yellow, orange to red and black. Black will normally be set to indicate a rejectable indication.

15. Using the DIAMETER STANDARD calibrate the UT system TEST ARRAY as follows:

15.1 Fully insert the DIAMETER STANDARD into the TEST ARRAY.

15.2 Turn on the UT electronics and name the file as a calibration run.

15.3 The calibration file name will be specific to the TEST ARRAY used as shown below:

(CAL)[1] (1)[2] (A)[3] (2)[4] (U)[5]

1. Record "CAL" indicating the file contains DIAMETER STANDARD data.

2. Specific TEST ARRAY identification, TEST ARRAY 1 in this case, a spare TEST ARRAY would be ARRAY 2.

3. The specific array set, A or B, if the selector box is used. Nothing is recorded here if the selector box is not used.

4. The sequence number for the TEST ARRAY calibration, the example indicates this is the second calibration run.

5. U- UP, testing during withdrawal

   D- DOWN, testing during insertion

16. Withdraw the DIAMETER STANDARD recording the data on the optical disk.

17. When the DIAMETER STANDARD is out of the TEST ARRAY turn off the electronics.

18. Load Recording Dialogue Window prior to testing the Thimble Tube:

    A) "Recording Name", up to eight digits. This will be the Thimble Tube number with suffixes as shown:

$$(24)^1(a)^2(d)^3$$

1. Thimble Tube number.

2. Specific array set (optional).

3. U- Up, testing of the Thimble Tube during withdrawal.

   D- Down, testing of the Thimble Tube during insertion.

NUCLEAR DEPARTMENT WORK ACTIVITY PLANNED MAINTENANCE	ACT TYPE FW	TASK PL

W/O: 930615152 ACT: 01

SECTION 1 -- TASK DESCRIPTION — REPRINT 01

UNIT	PRI	RESP D/G	W/O SUMMARY
S1	3	SMD M	PROVIDE SUPPORT FOR FTTC UT INSPECTION

FEG/COMP ID: 1RCE1 MUC: C LOC: 06130003 SYSTEM: RC
1 REACT COOL REACTOR VESSEL
SERIAL NBR:
ACT SUMMARY: PROVIDE SUPPORT FOR FTTC UT INSPECTION
ACT DESC-1: PROVIDE SUPPORT FOR COMBUSTION ENGINEERING FLUX THIMBLE THERMOCOUPLE INSPECTION, EDDY CURRENT INSPECTION. THIS INSPECTION WILL BE PERORMED IN MID JULY. PROVIDE SUPPORT BY OPERATING THE CASK HANDLING CRANE & FUEL HANDLING CRANE AS REQUESTED BY RX. ENGINEERING. CONTACT SYSTEM ENGINEER

** DESCRIPTIONS CONTINUED ON NEXT PAGE. **

SECTION 2 -- PLANNING INFORMATION

PLANNER / SUPERVISOR	SAFETY RLTD	SAFETY CLASS	SEISMIC	EQ
PLANNER: FIGUEROA 2767 /SWD SUPERVISOR: BROWN $	SR	1	1	N

DR# - - DCR# - 00000 - PKG 00000
- - - -
- - - -
WORK STANDARDS: ____ ____ ____
____ (HP W/STD): ____
TEMPORARY MODIFICATION # 00 0000
CODE JOB PKG

RC#: 0063
AUTH NO:
ACCT NO: E530010
PRG PLN: I00013
LOC: 1614
PLN JOB#: 584818

SECTION 3 -- SCHEDULING INFORMATION

SCHED START DATE: 07/26/93 OVERDUE DATE:
SYSTEM OUTAGE: LCO NO: - -
SCHEDULER: ____
SCHEDULER COMMENTS: ____

ESTIMATED MANPOWER

MAN COD	NBR	DUR	EST	EST RCA
SMM	002	40.0	80.0	70.
	000	0.0	0.0	0.
	000	0.0	0.0	0.
	000	0.0	0.0	0.

TOTAL HRS: 40.0

SECTION 4 -- PERMISSION TO BEGIN

S/S PERMISSION
TO BEGIN WORK: [signature] DATE: JUL 24 [illegible] TIME: ____
TAGGING REQUIRED: N TAG NO:

SECTION 5 -- CLOSE OUT

PERSON COMPLETING WORK	BADGE	DATE	ACTUAL MANHOURS
____	__ - __	__/__/__	MANPOWER: ____ ____ ____ ____
WORK SUPERVISOR	BADGE	DATE	MEN REQ : ____ ____ ____ ____
____ REPEAT WORK { } (Y/N)	__ - __	__/__/__	DURATION: __.__ __.__ __.__ __.__

S/S SIGNOFF: ____ DATE: __/__/__

CHEMICAL ITEM CLASSIFICATION PERMIT

CICP No: 800-0011 **Folio No:**

Application Category: Hydraulic Fluid

Product Name: Ucon Hydraulic Fluid WS-34

Supplier/Mfg: Union Carbide

Chemical Family: Polyalkylene Glycol

Primary Function(s): Hydraulic Fluid

Use Class: 3 - May NOT be used in direct contact with plant systems, and may NOT be drained or flushed to plant waste processing systems.

Allowed Use: Thimble Tube UT/Eddy Current Inspection Equipment. 2 Quarts total. Unit 1 Spent Fuel Pool.

OSHA Hazard Communication Category:

Physical Hazard(s): Combustible Vapors

Health Hazard(s): Carcinogen. Mutagenic. Toxic. Eye, Lung & Skin Irritant

NFPA HAZARD CLASS:

Health (BLUE) -1- On exposure would cause irritation but only minor residual injury even if no treatment is given.

Flammability (RED) -1- Must be preheated before ignition can occur.

Reactivity (YELLOW) -0- Normally stable, even under fire exposure conditions and not reactive with water.

Storage Guidelines: General storage

Shelf Life: None

Handling Restrictions: Wear gloves and goggles. Use in well ventilated areas.

Control Room Habitabilty Concern: NO

NJ Right to Know: 1 - Requires a NJRTK label.

Disposal Guidelines:

USED (OPENED): E- HAZARDOUS: DISPOSE OF AS HAZARDOUS WASTE THRU SITE SERVICES

UNUSED (UNOPENED): E- HAZARDOUS: DISPOSE OF AS HAZARDOUS WASTE THRU SITE SERVICES

Approved [X] ; Disapproved [ ]

Chemistry Services Engineer: R.J. Dolan Date: 07/30/93

EXHIBIT 1

TRANSIENT COMBUSTIBLE WORKSHEET

HC ROOM(S) / SALEM AREA(S) 1FA-FH-100 [130' Fuel Hand Bldg]

START DATE: 7/29/93 DURATION: 10 days W/O#: 930615152

ALL PLANNERS AND SUPERVISORS SHALL STRIVE TO MINIMIZE THE AMOUNT OF TRANSIENT COMBUSTIBLES INTRODUCED INTO ALL AREAS

JOB PLANNER: G. Figueroa EXT. 2767 DATE: 7/27/93

JOB SUPERVISOR: Warren Evans EXT. 2082 DATE: 7/27/93

EVALUATE THE TRANSIENT COMBUSTIBLES WHICH YOU ANTICIPATE BEING USED DURING THE WORK ACTIVITY.

COMBUSTIBLE MATERIALS	ESTIMATED HEAT CONTENT	TOTAL BTU'S
FLAMMABLE LIQUIDS	90,000 BTU/GAL.	
COMBUSTIBLE LIQUIDS 55 gal.	160,000 BTU/GAL.	8,800,000
GREASE	150,000 BTU/GAL.	
CHARCOAL	13,000 BTU/LB.	
CLOTH 5 lbs	16,000 BTU/LB.	80,000
FIBERGLASS LADDER (6')	32,000 BTU/EA.	
RUBBER 5 lbs	10,000 BTU/LB.	50,000
CABLE INSULATION 50 lbs	12,000 BTU/LB.	600,000
CARDBOARD 2 lbs	6,000 BTU/LB.	12,000
PAPER 10 lbs	8,000 BTU/LB. (453,000 BTU/CU. FT.)	80,000
PC'S 2 lbs	16,000 BTU/LB. (1 PC = 1/2 LB.)	32,000
PLASTIC 50 lbs	20,000 BTU/LB.	1,000,000
WOOD 2.5	9,000 BTU/LB. (414,000 BTU/CU. FT.)	22,500
DRY ION RESINS	12,000 BTU/LB.	
TITANIUM	8,500 BTU/LB.	

TEMP COMB PERMIT #: 93-1FAFH100-8 TOTAL BTU'S: 10,676,500

MAKE SURE THE TRANSIENT COMBUSTIBLES ARE REMOVED UPON JOB COMPLETION

PERSONNEL CERTIFICATIONS

E. McGuffey	-	ET II, Eye Exam
R. McGuire	-	ET I, UT II, VT 1-4, Eye Exam
C. Provencher	-	ET I, Eye Exam
V. Roy	-	ET III, Eye Exam

Signature Log

ABB
ASEA BROWN BOVERI

CERTIFICATION RECORD

METHOD: EDDY CURRENT

NAME: Edward L. McGuffey

LEVEL: I I

SOC. SEC. NO.: [redacted]

CERTIFICATION DATE: 1/30/92

EXPIRATION DATE: 12/20/94

EDUCATION:
Connecticut State High School – GED

TRAINING:
ABB Combustion Engineering, Windsor, CT – February 1979 – 32 Hours ET L I
– March 1983 – 4 Hours ET L I
– August 1984 – 40 Hours ET L II
– January 1989 – 40 Hours ET L II

EXPERIENCE:
Certified and experienced at ABB CE as a Level I from January 1980 to May 1989 and as a Level II from May 1989 to January 1992.

EXAMINATION:

General/Basic: 70.0
Specific/Method: 100.0
Practical/Specific: 90.0
Total: 260.0 / 3 = 86.7 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 Power procedure QAP 2.4 revision 1.

CERTIFIED BY: [signature]
POSITION: Eddy Current Level III

NDECERTA.frp

ASEA BROWN BOVERI INC.
1000 Prospect Hill Road
Post Office Box 500
Windsor, Connecticut 06095-0500

CERTIFICATION FOR FIELD SERVICES ACTIVITIES

NAME Edward McGuffey SOCIAL SECURITY NO. [redacted] DATE 1/5/93 (of Examination)

EYE EXAMINATION

	NATURAL			CORRECTED		
NEAR VISION - JAEGER	R#	L#	B#	R# 1	L# 1	B# 1
FAR VISION - SNELLEN	R 20	L 20	B 20	R 20/15	L 20/13-2	B 20/10-2

COLOR VISION

[X] ISHIHARA Normal

[ ] WOOL (Holmgren)

EYE EXAMINATION ADMINISTERED BY: [illegible]

Eye Examination Results Reviewed & Accepted By: [illegible]
NDE Department

*Required to be completed for NDE certification only. Not required for qualification to wear respiratory protection devices.

PHYSICAL EXAMINATION

HEIGHT 71" WEIGHT 227 BLOOD PRESSURE 110/76 P 64

SKIN Benign EARS Benign NECK Benign EYES Benign

HEAD Normocephalic HEART [illegible] CHEST Benign LUNGS Clear

PULMONARY FUNCTION TEST: NORMAL ✓ ABNORMAL

This is to certify that this individual has been examined and no evidence has been found of any physical condition which might be aggravated by, or attributed to, occupational exposure to ionizing radiation. This individual has no history or evidence of previous radiation injury and has no history of exceeding the limits of 10 CFR 20.103 and is found to be physically qualified to perform duties involving occupational exposures to ionizing radiation.

This examination has also revealed no indications of aberrant behavior.

This individual has been examined in accordance with NUREG-0041 Section 7.4 and no evidence has been found of any physical or mental conditions in which the use of respiratory protection devices are considered contraindicated.

THE ABOVE INDIVIDUAL IS / ~~IS NOT~~ QUALIFIED FOR WORK INVOLVING RESPIRATORY PROTECTION DEVICES:

LIMITATIONS:

CORRECTIVE LENSES + DENTURES ✓ OTHER o

RESPIRATOR GLASSES yes

[illegible]
Signature of Medical Examiner

Joseph A. Amato, M.D.
Medical Examiner (Print)

ABB Medical Department
Dept. 5420-1902
1000 Prospect Hill Road
Windsor, CT 06095-0500
(203) 285-3339
Clinic Location

Form #0020S08 (7/90)

ABB
ASEA BROWN BOVERI

CERTIFICATION RECORD

METHOD: EDDY CURRENT

NAME: Robert B. McGuire

LEVEL: I

SOC. SEC. NO.: [redacted]

CERTIFICATION DATE: 1/8/92

EXPIRATION DATE: 12/18/94

EDUCATION:
Bristol Eastern High School, Bristol, CT – Grad 1978

TRAINING:
ABB Combustion Engineering, Windsor, CT – June 1985 – 40 Hours ET Level I
– September 1986 – 18 hours ET Level I
Zetec, Inc, Issaquah, WA – January 1989 – 40 Hours ET Level II

EXPERIENCE:
Certified and experienced at ABB CE as a Level I–Trainee from June 1985 to September 1986 and as a Level I from September 1986 to January 1992.

EXAMINATION:

General/Basic: 88.0
Specific/Method: 75.0
Practical/Specific: 94.0
Total: 257.0 / 3 = 85.7 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 Power procedure QAP 2.4 revision 1.

CERTIFIED BY: [signature]

POSITION: Eddy Current Level III

NDECERIA.frp

ASEA BROWN BOVERI

CERTIFICATION RECORD

METHOD: ULTRASONIC

NAME: Robert B. McGuire

LEVEL: II

SOC. SEC. NO.: [redacted]

CERTIFICATION DATE: 5/20/93

EXPIRATION DATE: 5/20/96

EDUCATION:

Bristol Eastern High School, Bristol, CT - Grad 1978

TRAINING:

ABB Combustion Engineering, Windsor, CT - November 1984 - 40 Hours UT LI
- June 1990 - 40 Hours UT LII

EXPERIENCE:

Certified and experienced at ABB CE as a Level I-Trainee from November 1984 to June 1986, as a Level I from June 1986 to June 1990 and as a Level II from June 1990 to June 1993.

EXAMINATION:

General/Basic: 82.0

Specific/Method: 86.6

Practical/Specific: 95.0

Total: 263.6 / 3 87.9 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 1 .

CERTIFIED BY: [signature]

POSITION: Ultrasonic Level III

FM02-0401 FRP 6/ .2

ABB
ASEA BROWN BOVERI

CERTIFICATION RECORD

METHOD: VISUAL VT-1,2,3&4

NAME: Robert B. McGuire

LEVEL: II

SOC. SEC. NO.: [redacted]

CERTIFICATION DATE: 5/29/91

EXPIRATION DATE: 5/28/94

EDUCATION:

Bristol Eastern High School, Bristol, CT – Grad 1978

TRAINING:

ABB Combustion Engineering, Windsor, CT – September 1986 – 16 Hours VT 1&3
– May 1988 – 32 Hours AWS CWI Prep.
– October 1988 – 8 Hours VT 1,2,3,4
– May 1991 – 4 Hours VT 1,2,3,4

EXPERIENCE:

Certified and experienced at ABB CE as a Level II VT 1&3 from September 1986 to October 1988 and as a Level II 1,2,3,4 from October 1988 to May 1991 with additional experience obtained while performing ISI activities (UT and ET) from November 1984 to October 1988.

EXAMINATION:

General/Basic: 75.7

Specific/Method: 83.0

Practical/Specific: 87.5

Total: 246.2 / 3 = 82.1 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 Power procedure QAP 2.2/2.4 revision 1/1 .

CERTIFIED BY: [signature]

POSITION: VT Level III

ASEA BROWN BOVERI INC.
000 Prospect Hill Road
st Office Box 500
Windsor, Connecticut 06095-0500

CERTIFICATION FOR FIELD SERVICES ACTIVITIES

NAME Robert McGuire SOCIAL SECURITY NO. [redacted] DATE 5/25/93 (of Examination)

EYE EXAMINATION

	NATURAL			CORRECTED		
NEAR VISION - JAEGER	R#	L#	B#	R# 1	L# 1	B# 1
FAR VISION - SNELLEN	R 20	L 20	B 20	R 20/30	L 20/15	B 20/13

COLOR VISION

[X] ISHIHARA normal

[ ] WOOL (Holmgren)

EYE EXAMINATION ADMINISTERED BY: Nancy A. Russo R.N.

Eye Examination Results Reviewed & Accepted By: Victor Roy Level III
NDE Department

*Required to be completed for NDE certification only. Not required for qualification to wear respiratory protection devices.

PHYSICAL EXAMINATION

HEIGHT 73¼" WEIGHT 175¼" BLOOD PRESSURE 110/78 (60)

SKIN Benign EARS NL NECK NL EYES 20

HEAD NL HEART RSR no m CHEST Symmetric LUNGS Clear

PULMONARY FUNCTION TEST: NORMAL ✓ ABNORMAL

This is to certify that this individual has been examined and no evidence has been found of any physical condition which might be aggravated by, or attributed to, occupational exposure to ionizing radiation. This individual has no history or evidence of previous radiation injury and has no history of exceeding the limits of 10 CFR 20.103 and is found to be physically qualified to perform duties involving occupational exposures to ionizing radiation.

This examination has also revealed no indications of aberrant behavior.

This individual has been examined in accordance with NUREG-0041 Section 7.4 and no evidence has been found of any physical or mental conditions in which the use of respiratory protection devices are considered contraindicated.

THE ABOVE INDIVIDUAL IS / IS NOT QUALIFIED FOR WORK INVOLVING RESPIRATORY PROTECTION DEVICES:

LIMITATIONS:

CORRECTIVE LENSES yes DENTURES no OTHER

RESPIRATOR GLASSES yes

Signature of Medical Examiner

Joseph A. Amato, M.D.
Medical Examiner (Print)

ABB Medical Department
Dept. 5420-1902
1000 Prospect Hill Road
Windsor, CT 06095-0500
(203) 285-3339

Clinic Location

Form #0020808 (7/90)

ABB
ASEA BROWN BOVERI

CERTIFICATION RECORD

METHOD: EDDY CURRENT

NAME: Calvin C. Provencher

LEVEL: I

SOC. SEC. NO.: [redacted]

CERTIFICATION DATE: 8/6/92

EXPIRATION DATE: 8/3/95

EDUCATION:

Waterford High School, Waterford, CT - Grad 1988

TRAINING:

ABB Combustion Engineering, Chattanooga, TN - August 1992 - 80 Hours ET LI

EXPERIENCE:

Experienced at ABB CE performing activities comparable to a Level I from October 1989 to August 1992.

EXAMINATION

General/Basic:	88.0
Specific/Method:	85.0
Practical/Specific:	86.0

Total: 259.0 / 3 = 86.3 COMPOSITE

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 1 .

CERTIFIED BY:

POSITION: Eddy Current Level III

SEA BROWN BOVERI INC.
00 Prospect Hill Road
ost Office Box 500
Windsor, Connecticut 06095-0500

CERTIFICATION FOR FIELD SERVICES ACTIVITIES

NAME Colin C. Provencher SOCIAL SECURITY NO. [redacted] DATE 1/29/93 (of Examination)

EYE EXAMINATION

	NATURAL			CORRECTED		
NEAR VISION - JAEGER	R# 1	L# 1	B# 1	R#	L#	B#
FAR VISION - SNELLEN	R 20/15-2	L 20/13-1	B 20/13	R 20	L 20	B 20

COLOR VISION

[ ] ISHIHARA

[X] WOOL (Holmgren) Normal

EYE EXAMINATION ADMINISTERED BY: [signature]

Eye Examination Results Reviewed & Accepted By: [signature]
NDE Department

*Required to be completed for NDE certification only. Not required for qualification to wear respiratory protection devices.

PHYSICAL EXAMINATION

HEIGHT 71'4" WEIGHT 202 BLOOD PRESSURE 132/70 P-76

SKIN [handwritten] EARS 0 NECK 0 EYES clear

HEAD [handwritten] HEART RSR no [handwritten] CHEST [handwritten] LUNGS clear

PULMONARY FUNCTION TEST: NORMAL ✓ ABNORMAL

This is to certify that this individual has been examined and no evidence has been found of any physical condition which might be aggravated by, or attributed to, occupational exposure to ionizing radiation. This individual has no history or evidence of previous radiation injury and has no history of exceeding the limits of 10 CFR 20.103 and is found to be physically qualified to perform duties involving occupational exposures to ionizing radiation.

This examination has also revealed no indications of aberrant behavior.

This individual has been examined in accordance with NUREG-0041 Section 7.4 and no evidence has been found of any physical or mental conditions in which the use of respiratory protection devices are considered contraindicated.

THE ABOVE INDIVIDUAL IS / IS NOT QUALIFIED FOR WORK INVOLVING RESPIRATORY PROTECTION DEVICES: (IS circled)

LIMITATIONS:

CORRECTIVE LENSES 0 DENTURES 0 OTHER 0

RESPIRATOR GLASSES 0

[signature]
Signature of Medical Examiner

Joseph A. Amato, M.D.
Medical Examiner (Print)

ABB Medical Department
Dept. 5420-1902
1000 Prospect Hill Road
Windsor, CT 06095-0500
(203) 285-3339

Clinic Location

Form #0020S08 (7/90)

ABB
ASEA BROWN BOVERI

CERTIFICATION RECORD

METHOD: EDDY CURRENT

NAME: Victor P. Roy

LEVEL: III

SOC. SEC. NO.: [redacted]

CERTIFICATION DATE: 1/31/91

EXPIRATION DATE: 1/31/94

EDUCATION:

Norwood High School, Norwood, MA - Grad 1970
Northeastern University, Boston, MA - BSME

TRAINING

ABB Combustion Engineering, Windsor, CT - July 1980 - 24 Hours ET LI
- August 1980 - 8 Hours ET LII
- March 1981 - 34 Hours ET LII
- August 1984 - 52 Hours ET IIA(Fuel Analysis)

EXPERIENCE:

Certified and experienced at ABB CE as Level I-Trainee from April 1981 to June 1981, as a Level I from June 1981 to April 1982, as a Level II from April 1982 to October 1984, as a Level II-A Limited to Data Analysis for Fuel from October 1984 to January 1985 and as a Level III from January 1985 to January 1991.

EXAMINATION RESULTS:

General/Basic: 84.3
Specific/Method: 83.0
Practical/Specific: 82.1
Total: 249.4 / 3 = 83.1 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 Power procedure QAP 2.4 revision 1 .

CERTIFIED BY: H D Goddard

POSITION: Manager, Core Component Services

EA BROWN BOVERI INC.
Prospect Hill Road
Post Office Box 500
Windsor, Connecticut 06095-0500

CERTIFICATION FOR FIELD SERVICES ACTIVITIES

NAME Victor Roy SOCIAL SECURITY NO. [redacted] DATE 7/9/93 (of Examination)

EYE EXAMINATION

	NATURAL			CORRECTED		
NEAR VISION - JAEGER	R# 1	L# 1	B# 1	R#	L#	B#
FAR VISION - SNELLEN	R 20	L 20	B 20	R 20/15	L 20/13	B 20/10-1

COLOR VISION

[X] ISHIHARA normal

[ ] WOOL (Holmgren)

EYE EXAMINATION ADMINISTERED BY: Nancy A. Grasso C.N.
Eye Examination Results Reviewed & Accepted By: B Wals
NDE Department

*Required to be completed for NDE certification only. Not required for qualification to wear respiratory protection devices.

PHYSICAL EXAMINATION

HEIGHT 69" WEIGHT 168 lbs. BLOOD PRESSURE 128/84 (60)
SKIN benign EARS benign NECK benign EYES benign
HEAD benign HEART RSR - CHEST sml. LUNGS Clear
PULMONARY FUNCTION TEST: NORMAL ✓ ABNORMAL

This is to certify that this individual has been examined and no evidence has been found of any physical condition which might be aggravated by, or attributed to, occupational exposure to ionizing radiation. This individual has no history or evidence of previous radiation injury and has no history of exceeding the limits of 10 CFR 20.103 and is found to be physically qualified to perform duties involving occupational exposures to ionizing radiation.

This examination has also revealed no indications of aberrant behavior.

This individual has been examined in accordance with NUREG-0041 Section 7.4 and no evidence has been found of any physical or mental conditions in which the use of respiratory protection devices are considered contraindicated.

THE ABOVE INDIVIDUAL (IS) / IS NOT QUALIFIED FOR WORK INVOLVING RESPIRATORY PROTECTION DEVICES:

LIMITATIONS:

CORRECTIVE LENSES + DENTURES 0 OTHER

RESPIRATOR GLASSES +

Joseph Amato
Signature of Medical Examiner

Joseph A. Amato, M.D.
Medical Examiner (Print)

ABB Medical Department
Dept. 5420-1902
1000 Prospect Hill Road
Windsor, CT 06095-0500
(203) 285-3339

Clinic Location

Form #0020808 (7/90)

OUTAGE SERVICES

SIGNATURE LOG

COMBUSTION ENGINEERING

Jobsite: PSE+G Salem Unit 1

Work Activity: Flux Thimble Tube Insp

Approximate Dates of Work Activity: 7-25 - 8-3-93

The following individuals are associated with the subject work activity and may sign-off on data sheets and other quality documentation.

NAME (Type or Print)	SIGNATURE	INITIALS
Robert B. McGuire	[signature]	RBM
Colin C Provencher	[signature]	CCP
EDWARD L. McGUFFEY	[signature]	EM
VICTOR P. ROY	[signature]	VPR
	N/A	

Power Systems
Combustion Engineering, Inc.
1000 Prospect Hill Road
Post Office Box 500
Windsor, Connecticut 06095-0500
(203) 688-1911
Telex: 99297

EQUIPMENT CERTIFICATIONS

1) ICI Thimble Defect Standard (Package, 6 pages)

2) ICI Thimble Diameter Standard (Package, 2 pages)

3) Miz 18A S/N 043 Certification (Package, 6 pages)

ABB

Certification of ICI Thimble Defect Calibration Standard

NSS-93-013
Serial #1

ICI Thimble Calibration Standard (NSS-93-013 Serial #1) was manufactured from tubing of the same nominal size (diameter and wall thickness) and material (INCONEL 600) as the tubing to be examined. The pertinent as-built dimensions and material certifications are attached.

Richard S. Mau[illegible]
ECT Level III

7-30-93
Date

[illegible signature]
Field Quality Operations

7-30-93
Date

ABB Combustion Engineering Nuclear Services

Combustion Engineering Inc
P.O. Box [illegible]
1000 Prospect Hill Road
Windsor CT 06095-0500
Telephone [illegible]
Fax [illegible] 285-[illegible]

ABB PO 9307888

IST IMAGING & SENSING TECHNOLOGY

465 Dobbie Drive
Cambridge, Ontario, Canada
N1R 5X9
Tel.: (519) 523-4880
Fax: (519) 623-4686

22 July 1993

93/07/B

CERTIFICATE OF CONFORMANCE

IT IS HEREBY CERTIFIED THAT THE 24" PIECE OF SWAGED ICI THIMBLE MATERIAL SUPPLIED ON ABB-COMBUSTION ENGINEERING PURCHASE ORDER NUMBER 9307888 WAS CUT FROM THE ICI THIMBLES ORDERED ON PURCHASE ORDER 768533-01.

I. Wilson
Quality Manager

NOTE: IST JOB NO: NS-7F
MATERIAL CERTIFICATION FOR OUTER SHEATH TUBE ATTACHED.

PLYMOUTH TUBE CO — TEST REPORT

2000 Industrial Parkway
Salisbury, MD 21801

CERTIFICATION APPROVAL
CERT. No. T-391 JOB EL-116
BY Q.C. [signature] DATE 16 Jn 1987
SPEC. SPI-SB-163
FORM 1 # 9790/9791

SOLD TO: Reuter-Stokes Can. LTD.
465 Dobbie Drive
Cambridge, Ontario, Canada, N1R 5x9

DATE: May 28, 1987
CUST. ORD. # 20637

SPECIFICATION(S): .292 I.D. X .0205 Wall Alloy 600S
ASME SB-163 REUTER STOKES # SPI-163-1 Rev.4

MILL ORD. # 57-0111

HEAT #	O.D.	WALL	YIELD P.S.I.	ULTIMATE P.S.I.	ELONG %	HARD-NESS	* μIN. f
NX1561	.3315	.021	58,750 ✓	107,000 ✓	36 ✓	62-30T ✓	2 10-12
	I.D.+.289						
NX1565	.3315	.021	61,250	111,000 ✓	36 ✓	64-30T ✓	2 8-12
	I.D.+.289						

ANALYSIS

		C	Mn	P	S	Si	Cr	Mo	Ni	Cu	Co	Fe
NX1561	L	.03	.27	.009	.001	.18	15.02	--	74.93	.29	.05	9.28
NX1561	C	.03	.28	.010	.007	.19	15.02	--	74.89	.28	.05	9.48
NX1565	L	.03	.29	.008	.001	.27	15.30	--	74.76	.34	.07	9.01
NX1565	C	.03	.29	.009	.003	.26	14.76	--	75.63	.33	.07	8.92
	L											
	C											
	L	THIS MATERIAL PRODUCED IN ACCORDANCE WITH OUR QUALITY										
	C	ASSURANCE MANUAL REV. 04. ALL U.T. SETUPS AND TESTS										
	L	EVALUATED BY A LEVEL III INSPECTOR. 10CFR 21 APPLIES.										
	C											

TESTS

- FLARE ..... OK ✓
- FLATTEN ....
- FLANGE ....
- REV. FLAT ....
- REV. BEND ....
- EDDY CURRENT ...
- ....
- ULTRASONIC .. OK
- P-03 REV.1
- SB-513RZ ... ✓
- GRAIN SIZE #7 ✓
- CORROSION TEST.
- ....
- HYDRO TEST .... OK ✓
- 1000 PSI @ 5 SEC.
- PASSIVATION .....
- INT. CLEAN .. OK ✓
- T.C.C. .... YES ✓
- CAP . SLEEVE .....
- VISUAL-OK

⊠ PRODUCT BRIGHT ANNEALED @ 1900°F MINIMUM AND RAPIDLY COOLED.

BLOW .286" DIA. X .875L BULLET THRU EACH TUBE

ADDITIONAL REQUIREMENTS * I.D. MICROINCH FINISH ON TOP-O.D. ON BOTTOM

TOLERANCES: I.D. + .000"/-.003"/AIM FOR+.000/-.002"
WALL+/-.0015"/AIM FOR +/-.001"

NSS-93-013
Serial #1

THE INFORMATION PRESENTED ABOVE CONFORMS TO THE PURCHASE ORDER.

[signature]

Stan Bembenek
Plymouth Tube Company
2000 Industrial Parkway
Salisbury, MD 21801

Report Number	31422
Report Date	4-JUN-87
Client Number	666200
Client Order	PR 11404

RECEIVED 2 Pieces Tubing .332"Dia.
IDENT AS follows
MATL/COND Inco 600 / Annealed
TEST TO ASME SB163 Alloy N06600 and P/O Instructions

PHONE 301-749-1666

QUANTITATIVE ANALYSIS BY XRF, ~~COMB & ICP~~

Samples:	HN NX1561	HN NX1565
%		
Fe	9.28	9.01
Al	.22	.26
Si	.15	.23
Cu	.29	.33
Mn	.28	.30
Ni	73.85	73.44
Cr	15.15	15.48
Co	.04	.07
Pb	<.01	<.01
Mg	<.01	<.01
S	.001	.001
C	.03	.04
B	.003	.004
Disp:	In Spec	In Spec

CERTIFICATION APPROVAL
CERT. No. T-391 JOB EL-11C
BY Q.C [signature] DATE 16 Jul 87
SPEC. SPI-SB-163
FORM 1 # 9790/9791

RECEIVED
JUN 8 1987
SALISBURY, MD.

NSS-93-013
Serial #1
Page 4 of 5

WE CERTIFY THIS IS A TRUE COPY OF OUR RECORDS
Signed for J. Dirats and Co. by Eric Dirats, Clerk
NOTE: The recording of false, fictitious or fraudulent statements or entries on this

J. DIRATS AND CO., INC. 41 AIRPORT ROAD P.O. BOX 39 WESTFIELD, MA 01086 413-568-1571 TLX 95-543

Pine Meadow Machine Co., Inc.

5 WEBB STREET
WINDSOR LOCKS, CONN. 06096

TEL. 203-623-4494 FAX 203-623-7853

CERTIFICATE OF CONFORMANCE

TO: ABB COMBUSTION ENGINEERING, INC.

ORDER NO. 9308107

PART NO. NSS-93-013 REV. 4

QUANTITY 1 EDDY CURRENT STANDARD S/N #1

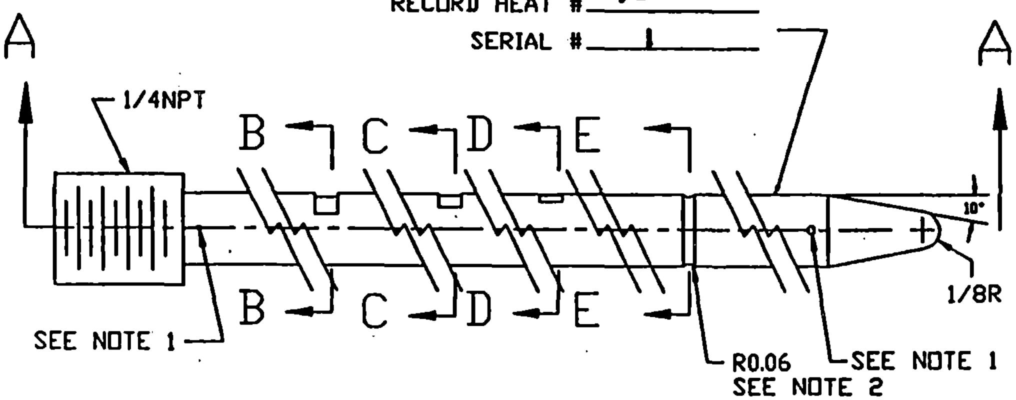
THESE SUPPLIES CONTAIN NO MERCURY COMPOUNDS OR METALLIC MERCURY AND REASONABLE STEPS WERE TAKEN TO ENSURE THESE SUPPLIES WERE NOT CONTAMINATED WITH METALLIC MERCURY OR MERCURY COMPOUNDS. PINE MEADOW FURTHER CERTIFIES THE ABOVE REFERENCED SUPPLIES WERE FABRICATED, TESTED AND INSPECTED IN ACCORDANCE WITH PURCHASE ORDER/MANUFACTURING ORDER REQUIREMENTS, TOGETHER WITH REFERENCE CODES, SPECIFICATIONS AND IS ACCEPTABLE FOR SHIPMENT.

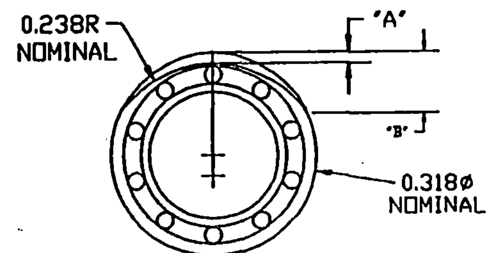
BY: Charles L. McMenamin 7/30/93
Authorized Agent

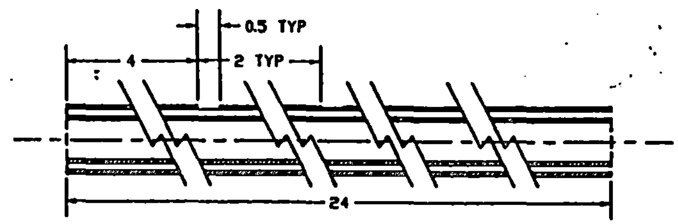
ITEM NO.	QTY.	PART NO.	REV.	PART NAME

RECORD HEAT # 1565

SERIAL # 1







PARTIAL SECTION A-A
ROTATED 90°

Charles L. McMenamin 7/28/93
Charles L. McMenamin QC.

SECTION	"A" DIM	"B" DIM
B - B	.017	.044
C - C	.008	.022
D - D	.004	.012
E - E	.002 X 360°	

Dimensions 'A' confirmed using micrometers EL-1595 and EL-1948
7-30-93
Level II

NOTES

1) DRILL, PIN, PLUG WELD AND GRIND FLUSH
2) ROLLED DENT - NO MATERIAL REMOVED

REV.	DESCRIPTION

UNLESS OTHERWISE SPECIFIED
BREAK CORNERS .015 APPROX. R OR CHAM - FILLETS .015 TO .030 R
DIMENSIONS APPLY AT 68°F(20°C)
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
ONE PLACE DECIMAL ± .1
TWO PLACE DECIMAL ± .02
THREE PLACE DECIMAL ± .001
ANGLES ± 0° 30' CHAM ± 3°
DO NOT SCALE DRAWING

COMBUSTION ENGINEERING
NUCLEAR POWER
CUSTOMER
SCALE DATE
JOB NO. FILE

		SIGNATURE	DATE
DRAWN BY	GH WOODFORD	[signature]	7/26/93
CHECKED BY	K THOMPSON	K.W. Thompson	7-26-93
REVIEWED BY	J RUSSELL		
APPROVED BY	V ROY		

DWG. TITLE: SALEM FTTC WEAR STANDARD AS-BUILT

DWG. NO. NSS-93-013 | SHEET 2 OF 2 | REV. 4

Certification of ICI Thimble

Diameter Calibration Standard

UT - SALEM

ICI Thimble Diameter Calibration Standard, UT-SALEM, was manufactured from stainless steel rod, to specific diameters. The pertinent as-built dimensions are attached. (Ref. Sketch NSS-93-012 Rev. 1)

[signature] 7-29-93

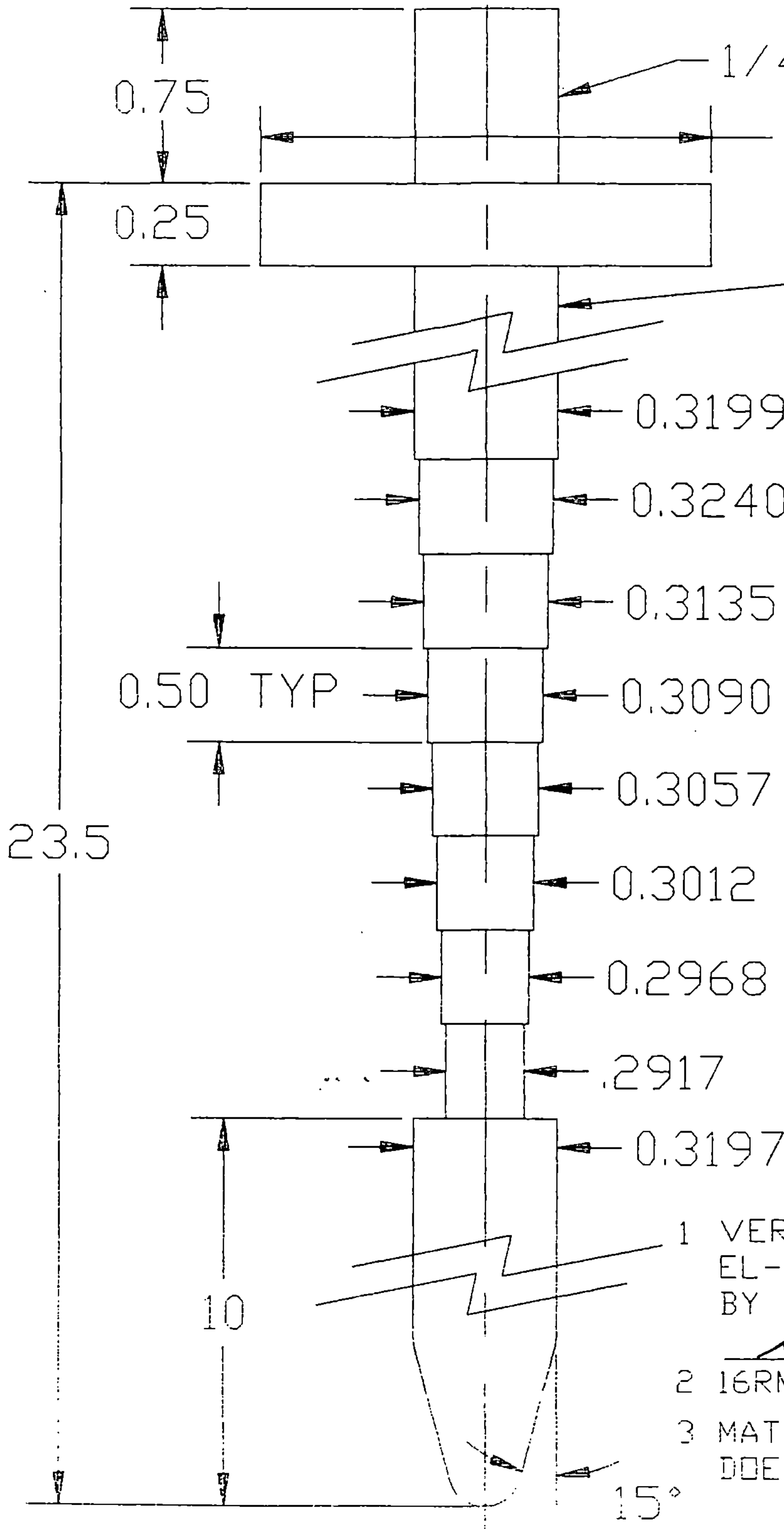
UT - Level III — Date

[signature] 7-29-93

Field Quality Operations — Date

ABB Combustion Engineering Nuclear Services

Combustion Engineering Inc. P.O. Box 500 1000 Prospect Hill Road Windsor CT 06095-0500 Telephone (203) 688-1911 Fax (203) 285-9530



NOTES

1. VERIFIED WITH MICROMETER EL-1948 CAL. DUE 9/5/93 BY BH NELSON ON 7/27/93
   (signature) Level II
2. 16RMS FINISH
3. MATERIAL - STAINLESS STEEL DOESN'T REQUIRE CERTIFICATION

UNLESS OTHERWISE SPECIFIED	COMBUSTION ENGINEERING	DRAWN BY GH WOODFORD	SIGNATURE (signature) DATE 7/23/93
BREAK CORNERS .015 APPROX. R OR CHAM - FILLETS .015 TO .030 R		CHECKED BY K THOMPSON	SIGNATURE K. Thompson DATE 7-28-93
DIMENSIONS APPLY AT 68°F(20°C)	NUCLEAR POWER / THIS DRAWING IS THE PROPERTY OF COMBUSTION ENGINEERING, INC. WINDSOR, CT 06095 AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OR APPARATUS EXCEPT WHERE PROVIDED FOR BY AGREEMENT WITH SAID COMPANY	REVIEWED BY MJ DACHUKEWICH	SIGNATURE (signature) DATE 7-29-93
ALL DIMENSIONS ARE IN INCHES	CUSTOMER	APPROVED BY V PEY	SIGNATURE for B.A. Cooper DATE 7-28-93
TOLERANCES ONE PLACE DECIMAL ± .1 TWO PLACE DECIMAL ± .02 THREE PLACE DECIMAL ± .001		DWG TITLE SALEM ETTC DIAMETER STANDARD - AS BUILT	
ANGLES ± 0° 30' CHAM ± 5°	SCALE / DATE	DWG NO [illegible]-93-012	SHEET 1 OF 1 REV. [illegible]
DO NOT SCALE DRAWING	JOB NO. / FILE		

ELECTRIC TRANSMISSION
AND DISTRIBUTION DIVISION

Category 14.1
Reviewed [signature]

ELECTRIC LABORATORY & TELECOMMUNICATIONS

TEST PROCEDURE

TEST DATE 11-25-92 ASSIGNMENT RS(NDE)

LTP- ECT REV. 3

EFFECTIVE DATE As Approved

LABORATORY TEST PROCEDURE FOR:

The calibration of Zetec Eddy Current Test System components.

CONTROLLED DOCUMENT

REVIEWED BY G. Bricks
DATE 9/3/92

Note:
This procedure contains
(3) Calibrations
MIZ-18 SN. 088
MIZ-18 SN. 043
MIZ-18 SN. 037

APPROVED FOR USE

Gerald V. Bricks
SUPERVISOR, ELECTRIC TEST LABORATORY

1/16/92
DATE

[signature]
SUPERINTENDENT, ELECTRIC LABORATORY AND TELECOMMUNICATIONS

1/17/92
DATE

This procedure contains 8 11 pages.

1.0 SUBJECT:

1.1 This procedure is used for calibrating various components of the Zetec Eddy Current Testing System to factory standards applicable unless otherwise noted.

2.0 REFERENCES:

2.1 Zetec Eddy Current technical procedures, as applicable, for particular components.

3.0 PROCEDURE:

3.1 Notify surveillance personnel of this activity.

3.2 Verify that personnel performing this activity are qualified per QT&D-1103.

3.3 Remove certification sticker from instrument, if any.

3.4 Verify that standards used are certified per QT&D-1201 to an accuracy of, at least, four times better than the stated tolerances in the manufactures references, or the best available standards noting all exceptions of tolerance, if any.

3.5 Enter the heading information on the attached Data Sheet and perform the certification tests as indicated in the referenced Zetec procedure(s), recording the "AS FOUND" data, on the Data Sheet.

NOTE: Equivalent test instruments and methods may be substituted.

3.7 Compare the "AS FOUND" data with the given tolerances in the Zetec procedures, and initial the applicable line, N/A the remaining line.

Data in tolerance: transfer results to the "AS LEFT" column or make adjustments for better accuracy and enter the final in-tolerance values in the "AS LEFT" column. ______

Data out of tolerance: instrument can be re-calibrated and/or repaired and record final "AS LEFT" results. Record notes of repairs, notes of problems found and work done (enter this information as comments on this procedure). N/A ______

NOTE: Calibrations are performed as a service to RSNDE who is responsible for non-conformance follow-up.

3.9 If "AS LEFT" data is in tolerance, complete a new certificate; mark it "QA approved" and indicate a due date of 1 year or N/A this step. ______

COMMENTS: (Indicate any maintenance performed)

4.0 RECORDS:

4.1 Attach copy of applicable completed Data Sheets to each instrument being returned to RSNDE. ______

4.2 Give this completed procedure to a record reviewer, who will submit a copy to Ginna Central Records, after review. ______

Record Reviewer: ______

Date Sent to GCR: 12/22/92

MIZ-18 CALIBRATION SPECIFICATIONS

S/N	43
ROT	0
SPAN	100
FIRST CHANNEL	1
LAST CHANNEL	16

MIN-MAX HOR. TO VERT. GAIN DEVIATION OF ALL CHANNELS OF ALL FREQUENCIES IN SCAN FREQUENCY TABLE (S.F.T)

CHN#	FREQ	H-VDEV	SPEC
15	25000	+0.00%	+/- 1%
6	90000	+0.99%	+/- 1%

MIN-MAX QUADRATURE DEVIATION OF ALL CHANNELS OF ALL FREQUENCIES IN S.F.T.

CHN#	FREQ	QDEV	SPEC
12	10000	0.00 DEG	3.00 DEG
3	120000	1.49 DEG	3.00 DEG

DEVIATION FROM 1 HZ INJECTION AT 400KHZ

CHN#	FREQ	H-HDEV	V-VDEV	FREQ	H-HDEV	V-VDEV	SPEC
1	401000	- 2.9%	- 2.9%	400100	+ 0.0%	+ 0.0%	-15%
2	401000	- 3.1%	- 2.8%	400100	+ 0.1%	+ 0.0%	-15%
3	401000	- 3.0%	- 2.9%	400100	+ 0.0%	+ 0.0%	-15%
4	401000	- 3.0%	- 2.7%	400100	+ 0.0%	+ 0.1%	-15%
5	401000	- 3.9%	- 3.8%	400100	+ 0.0%	+ 0.1%	-15%
6	401000	- 4.1%	- 3.8%	400100	+ 0.0%	- 0.2%	-15%
7	401000	- 3.9%	- 3.8%	400100	+ 0.0%	+ 0.0%	-15%
8	401000	- 4.0%	- 3.7%	400100	+ 0.0%	- 0.1%	-15%
9	401000	- 4.1%	- 3.8%	400100	- 0.2%	- 0.1%	-15%
10	401000	- 4.0%	- 3.8%	400100	- 0.1%	+ 0.0%	-15%
11	401000	- 4.0%	- 3.6%	400100	+ 0.0%	+ 0.0%	-15%
12	401000	- 4.0%	- 3.5%	400100	- 0.1%	+ 0.0%	-15%
13	401000	- 4.1%	- 3.8%	400100	- 0.2%	- 0.1%	-15%
14	401000	- 3.8%	- 3.9%	400100	+ 0.0%	- 0.1%	-15%
15	401000	- 3.9%	- 3.6%	400100	- 0.2%	- 0.1%	-15%
16	401000	- 4.1%	- 3.7%	400100	- 0.2%	+ 0.0%	-15%

C/C DEV : MAXIMUM GAIN DEVIATION OF ALL CHANNELS WITHIN A SPECIFIC FREQUENCY IN S.F.T

CHN#	FREQ	H	V	C/CDEV	SPEC
14	25000		1401		
3	25000	1457		+3.9%	10%

F/F DEV : MAXIMUM GAIN DEVIATION OF ALL CHANNELS OF ALL FREQUENCIES IN S.F.T.

CHN#	FREQ	H	V	F/FDEV	SPEC
2	340000		1375		
2	1000000		1527	+11.0%	30%

TECHNICIAN J.MANLEY

RG&E

Electric Laboratory

TEST REPORT

70-58 2/91 pl

APPARATUS TESTED: Zetec MIZ-18 RDAU

OWNED BY: RG&E

STANDARDS USED: See Previous Sheet

No.: 843

Location: Std. Lab

Room Temp: 23°C

Tested By: Maury-Sisson

Date: 11-25-92

Checked By: [signature]

Sheet No: 7 of 11

Test No.:

	Zetec Step No.		As Found		As Left				
8.0	FUNCTIONAL TEST								
	8.1		OK		OK				
	8.2		OK		OK				
	8.3		OK		OK				
	8.4		OK		OK				
	8.5		OK		OK				
	8.6		OK		OK				
	8.7		OK		OK				
	8.8		OK		OK				
	8.9		OK		OK				

⊗ CSP-KWU-10/10KT
Rev. 0

RG&E

Electric Laboratory

TEST REPORT

70-56 2/91 pl

APPARATUS TESTED: Zetec M/Z-18 RDAU
OWNED BY: RG&E
STANDARDS USED: HP. Function Gen. SN. 1748A15907
HP Counter SN. 2332A09922
HP DMM SN. 1716A-01398

No.: 043
Location: Std. Lab.
Room Temp: 23°C
Tested By: Maurey - Sisson
Date: 11-25-92
Checked By: [signature]
Sheet No: 6 of 11
Test No.:

	Zetec Step No.		As Found		As Left		Zetec Tolerance		
4.0	Power	Supply							
	4.1		ok		ok				
	4.2		ok		ok				
	4.3		ok		ok				
	4.4		ok		ok				
	4.5		ok		ok				
	4.6		+4.99	Volt	+4.99	Volt	+5V ± .125V		
			+14.96	Volt	+14.96	Volt	+15V ± .375V		
			-14.97	Volt	-14.97	Volt	-15V ± .375V		
			-5.120	Volt	-5.120	Volt	-5V ± .125V		
	4.7		ok		ok				
	4.8		-1.00	Volt	-1.00	Volt	-1V ± .01V		
	5.0	Frequency	Check						
		10KHZ	9.765	KHZ	9.765	KHZ	±488	HZ	
		25KHZ	24.999	KHZ	24.999	KHZ	±1250	HZ	
		27KHZ	27.044	KHZ	27.044	KHZ	±1352	HZ	
		100KHZ	99.998	KHZ	99.998	KHZ	±5000	HZ	
		110KHZ	110.087	KHZ	110.087	KHZ	±5504	HZ	
		120KHZ	119.854	KHZ	119.854	KHZ	±5992	HZ	
		340KHZ	340.409	KHZ	340.409	KHZ	±17020	HZ	
		360KHZ	359.369	KHZ	359.369	KHZ	±17969	HZ	
		400KHZ	400.400	KHZ	400.400	KHZ	±20020	HZ	
		900KHZ	898.456	KHZ	898.456	KHZ	±44922	HZ	
		990KHZ	992.863	KHZ	992.863	KHZ	±49642	HZ	
		1000KHZ	999.986	KHZ	999.986	KHZ	±50000	HZ	