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W/850306 ltr.

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March 6, 1985

Dr. Thomas E. Murley
Regional Administrator
U.S. Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

Subject: 1984 Steam Generator Tube Inservice Inspection Special Report

Dear Dr. Murley:

In accordance with Section 6.9.3.4 of the Ginna Station Technical Specifications and Appendix B step 5.7.2 of the Ginna Station Quality Assurance Manual, we are submitting the 1984 R.E. Ginna Nuclear Station Steam Generator Eddy Current Examination Summary Report.

This summary report includes:

1) The number and extent of tubes inspected.

2) Location and percent of wall-thickness penetration for each indication of an imperfection.

3) Identification of tubes plugged or sleeved.

4) Steam Generator tube inspection and corrective action history.

Sincerely,

Roger W. Kober

Roger W. Kober

xc: Director, Inspection and Enforcement

A047

Rochester Gas & Electric Corporation
General Maintenance Department
Materials Engineering Division

# EXAMINATION REPORT

## R.E. Ginna Nuclear Station
## 1984 Steam Generator Eddy Current
## Examination Summary Report

August 15, 1984

Prepared by: Materials Engineering Personnel

Reviewed by: Thomas A. Marlow
Supervisor, Technical Projects
Ginna Station

Date: 8-24-84

Approved by: Albert E. Curtis III
Manager, Materials Engineering

Date: 8-28-84

# 1984 Steam Generator Eddy Current Examination Summary Report

## Table of Contents

# 1984 STEAM GENERATOR EDDY CURRENT EXAMINATIONS SUMMARY REPORT

## A. Introduction

During the Spring 1984 Annual Refueling and Maintenance Outage at Ginna Station, a multifrequency eddy current examination was performed on tubes in both A and B steam generators. The purpose of these examinations was to access any corrosion or mechanical damage that may have occurred during the operating cycle since April 1983. Particular attention was given in detecting intergranular attack (IGA) in the tube sheet crevices; pitting, stress corrosion cracking (SCC) and wastage between the tube sheet and the first support plate, denting and fretting wear at the antivibration bar to tube intersections in the U-bend region.

The examination was performed by R.G.& E. personnel that have been trained and qualified in the eddy current method to at least a Level I Examiners Certification. Initial data analysis was performed by two personnel from Zetec, Inc. of Issaquah, Washington. Data analysis and review was also performed by R.G.& E. and Babcock & Wilcox personnel subsequent to the Zetec personnel analysis. The data analysis was performed by both teams utilizing Zetec DDA-4 Digital Data Analysis System.

Results of this examination highlights, once again, the major area of concern for future steam generator tube degradation being tube sheet crevice intergranular attack (IGA) and stress corrosion cracking (SCC). Attachment 1 gives the Steam Generator Tube Inspection and Corrective Action History from 1972 through the April 1984 Outage.

## B. Program

At each inspection of the steam generators an eddy current examination program is generated for each leg (inlet and outlet) of both A and B steam generators. The philosophy in generating this program is to examine every tube in the inlets to at least the first tube support plate, as well as doing at least three percent (3%) over the U-bends to the primary face of the outlet. Then as a random sample an examination of a select group of tubes up through the sixth tube support plate. The program for the outlets varies somewhat each year and includes the three percent (3%) sample up to the U-bend to complete the full length inspection of those tubes. Other tubes are also looked at up through the sixth tube support plate. An assesment of the sludge pile zone of the outlet is performed by examining tubes up through the first tube support plate.

The specific program for this year included 100% of all the tubes in the inlets of both steam generators examined to at least the first tube support plate. The following is a breakdown by steam generator of all tubes examined and to the extent tested.

B. Program (Continued)

A S/G Inlet

| Number of Tube Supports | Number of Tubes | Percentage |
|---|---|---|
| 1st | 2926 | 89.7% |
| 2nd | 44 | 1.0% |
| 3rd | 2 | < 1.0% |
| 4th | 0 | |
| 5th | 0 | |
| 6th | 165 | 5.0% |
| Tubes Permanently Plugged | 123 | 3.7% |

A S/G Outlet

| Number of Tube Supports | Number of Tubes | Percentage |
|---|---|---|
| 1st | 495 | 15.1% |
| 2nd | 3 | < 1.0% |
| 3rd | 0 | |
| 4th | 0 | |
| 5th | 0 | |
| 6th | 1 | < 1.0% |
| 7th | 209 | 6.4% |
| 8th | 5 | < 1.0% |
| Sleeved | 4 | 100.0% |

B S/G Inlet

| Number of Tube Supports | Number of Tubes | Percentage |
|---|---|---|
| 1st | 2818 | 86.4% |
| 2nd | 80 | 2.0% |
| 3rd | 3 | < 1.0% |
| 4th | 2 | < 1.0% |
| 5th | 12 | < 1.0% |
| 6th | 178 | 5.0% |
| Tubes Permanently Plugged | 167 | 5.1% |

B S/G Outlet

| Number of Tube Supports | Number of Tubes | Percentage |
|---|---|---|
| 1st | 665 | 20.3% |
| 2nd | 7 | < 1.0% |
| 3rd | 0 | |
| 4th | 0 | |
| 5th | 0 | |
| 6th | 2 | < 1.0% |
| 7th | 217 | 6.6% |
| 8th | 4 | < 1.0% |
| Tube Sheet to Tube Sheet | 1 | < 1.0% |
| Sleeved Tubes | 67 | 63.65% |

B. Program (Continued)

In addition to the scheduled eddy current examination a profilometry examination was performed on the nine new sleeves. This examination was performed by Babcock & Wilcox personnel.

Figures 1 through 4 are tube sheet maps which define the actual program that was followed for each leg of both steam generators.

C. Procedure

The procedure utilized for the examination of steam generator tubes was NDE-500-4 Rev.6, "Multifrequency Eddy Current Examination of Inconel 600 Steam Generator Tubing". For the sleeve examination NDE-500-5 Rev.3, "Eddy Current Examination of Sleeved Inconel 600 Steam Generator Tubing".

Procedure NDE-500-4 provides for the examination of steam generator tubing utilizing 400KHZ and 200KHZ differential method and 210KHZ and 100KHZ absolute method. These frequencies give the ability for direct comparison with all steam generator inspection data since 1972, as well as allow for a more sensitive examination for small volume defects and intergranular attack (IGA). The detection of IGA utilizing the absolute frequencies has been performed since the Spring 1980 examination. IGA is the most difficult type of degradation to detect with the eddy current method of examination because the total loss of conductivity is so minute as compared to complete wall loss.

Procedure NDE-500-5 provides for the examination of sleeved steam generator tubing addressing the sleeve which forms the new primary boundary and the original tube in the area of the expanded/braze region as well as the "free spand" region. Both of these procedures are available in the NDE Procedures Manual.

D. Results

The results of this examination are as follows: (Further information is given on the defect logs, Figures 7 and 8 of the report.)

| A Inlet | Number of Tubes |
|---|---|
| 0-20% OD | 263 |
| 21-30% OD | 48 |
| 31-40% OD | 5 |
| 41-50% OD | 1 |
| **Crevice IGA** | |
| 27% | 1 |
| **Dents** | 872 |
| **A Outlet** | |
| 0-20% | 5 |
| Dents | 225 |
| **B Inlet** | |
| 0-20% OD | 95 |
| 21-30% OD | 3 |
| 31-40% OD | 1 |
| 51-60% OD | 1 |
| 81-90% OD | 1 |
| 81-90% ID | 1 |
| 91-100% OD | 1 |
| **Crevice IGA** | |
| Not Sizable | 5 |
| 51-60% | 1 |
| 81-90% | 1 |
| 91-100% | 1 |
| **Dents** | 576 |
| **Bulges** | 2 |
| **B Outlet** | |
| 0-20% OD | 1 |
| 31-40% OD | 1 |
| 41-50% OD | 1 |
| **Dents** | 178 |

*Inside Diameter Defect

## STEAM GENERATOR
## IGA INDICATION HISTORY

| | Not Sizeable | 0-25% | 26-50% | 51-75% | 76-100% | A-S/G TOTAL | B-S/G TOTAL |
|---|---|---|---|---|---|---|---|
| March 1979 | 0 | 0 | 0 | 2 | 0 | (0) | 2 |
| December 1979 | 0 | 0 | 6 | 5 | 0 | (0) | 11 |
| April 1980 * | 19 | 1 | 2 | 7 | 2 | (0) | 31 |
| November 1980 | 2 | 0 | 0 | 1 | 0 | (0) | 3 |
| April 1981 | 0 | 5 | 4 | 5 | 0 | (0) | 14 |
| February 1982 | 1 | 0 | 1 | 6 | 5 | (0) | 13 |
| October 1982 | 27 | 4 | 5 | 7(1) | 16 | (1) | 59** |
| April 1983 | 38(3) | 3(1) | 15 | 7 | 15 | (4) | 51 |
| March 1984 | 5 | 0 | 0(1) | 1 | 2 | (1) | 8 |
| | 92(3) | 13(1) | 33(1) | 41(1) | 40 | (6) | 192 |

* Crevice flushing implemented

** (31) tubes plugged at this outage (28) remained inservice and were sleeved during April 1983 Outage with 50 other indications, (1) indication was removed by pulling.

( ) denotes A-S/G tube indications

These results are consistent with past examinations of the A steam generator. However, the B steam generator has shown a much lower number of IGA and possible IGA indications in comparison to the previous years examination.

The 8 IGA indications identified in the B steam generator breakdown into the following two categories:

1. Tubes above plugging criteria greater than 40% - 3 Tubes
   a. All 3 tubes were new indications

2. Tubes below plugging criteria less than 40% - 5 tubes
   a. All 5 tubes were new indications.
   b. All 5 tubes were identified as not sizeable.

Out of the 8 indications, all 8 were new indications. There were no recorded indications in these tubes during the Spring 1983 examination.

E. Observations

As was noted last year, the IGA continues to be developing deeper in the crevice. Along with the IGA being deeper in the crevice, most of the tubes requiring corrective action had stress corrosion crack (SCC) indications near the rolled transition zone. There were no indications of pitting, wastage or SCC above the top of the secondary face of the tube sheet. A comparison of the dent indications between this inspection and past inspections revealed that there were no noticable changes in number of tube intersections or size of dents. All sleeves continue to perform well with no indications of any degradation.

One tube had an 85% Inside Diameter (ID) defect in the rolled transition area of the tube. Comparison with the previous years data showed some change. In reviewing the data no other tubes with similar indication were found. Also one cold leg tube had an apparent wastage indication at the first tube support plate intersection that exceeded the plugging criteria. This tube was sized utilizing the differential mix which allowed for more accurate sizing than in the past. Several of these type of indications have been seen in the past in the periphery zone of the cold leg and are probably the result of old phosphate chemistry control resulting in wastage. These phenomenas will continue to be monitored in future inspections.

There were no indications of any problems associated with the antivibration bar to tube intersection points during this inspection. This is a very important area of the steam generator due to problems that have been found at other plants, especially those with Model 51 steam generators.

At the end of the outage a meeting was held to discuss the net positive reduction in number of IGA indications at this inspection as compared to last year's, (8 to 78). One of the most significant observations during the meeting was that last years inspection was after two outages in 1982 where there was an abnormal number of days with the B steam generator in dry lay-up. In dry lay-up the tube sheet crevices could be affected by both oxygen and carbon dioxide potentially raising the crevice environment's aggressiveness.

In order to allay this concern and continue to try improving our IGA attack rate, the following items have been addressed by the plant for the 84-85 operating cycle:

a) Continue excellent operating secondary water chemistry.

b) Crevice flushing.

c) Water lancing of sludge.

d) Minimize dry layup time.

e) Maintain excellent wet layup chemistry.

f) Consider $N_2$ or Argon blanket of steam generator secondary for sleeving or when not in wet layup.

g) Continued plant operation support.

F. Corrective Action

Corrective Action for the one tube in the A steam generator that had an area of IGA approximately 19.6 inches above the tube end required that the tube be plugged. A Combustion Engineering Mechanical Plug was used for removing the tube from service.

Corrective action for ten (10) tubes in the B steam generator included plugging one (1) tube and sleeving nine (9) tubes with tube sheet sleeves. These sleeved tubes are listed in the 1984 Corrective Action Summary (Figure 5), along with the tubes that were plugged in both steam generators.

Also included in this year's maintenance activity was the repair of three (3) leaking explosive plugs in the A steam generator. The following tubes were repaired by Gas Tungsten Arc Welding in bare hole plugs: R12 C70, R17 C60, and R27 C48.

In previous years leaking explosive plugs have been repaired in the B steam generator, the following are those tubes that were repaired in May 1983: R24 C44 and in October 1982 R39 C68, R39 C69 and R39 C70.

Figure 6 of this report "Steam Generator Tube Inspection and Corrective Action History" gives an overview of inspections, results, and actions taken for all inspections since 1977.

● = PERMANENT PLUG
X = SLEEVED TUBE

A S/G INLET

SPRING 1984 EXAMINATION PROGRAM

RG&E Steam Generator

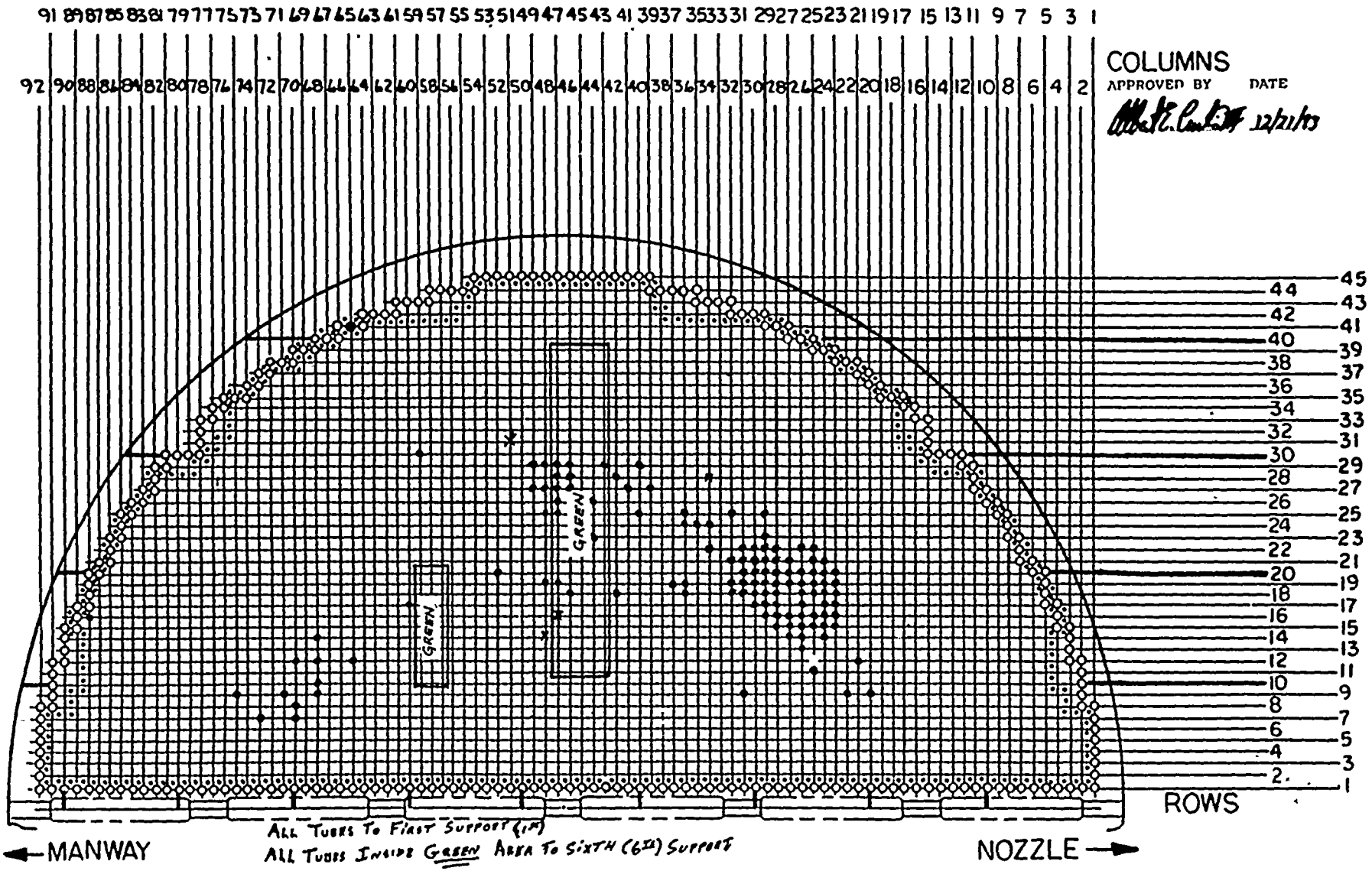


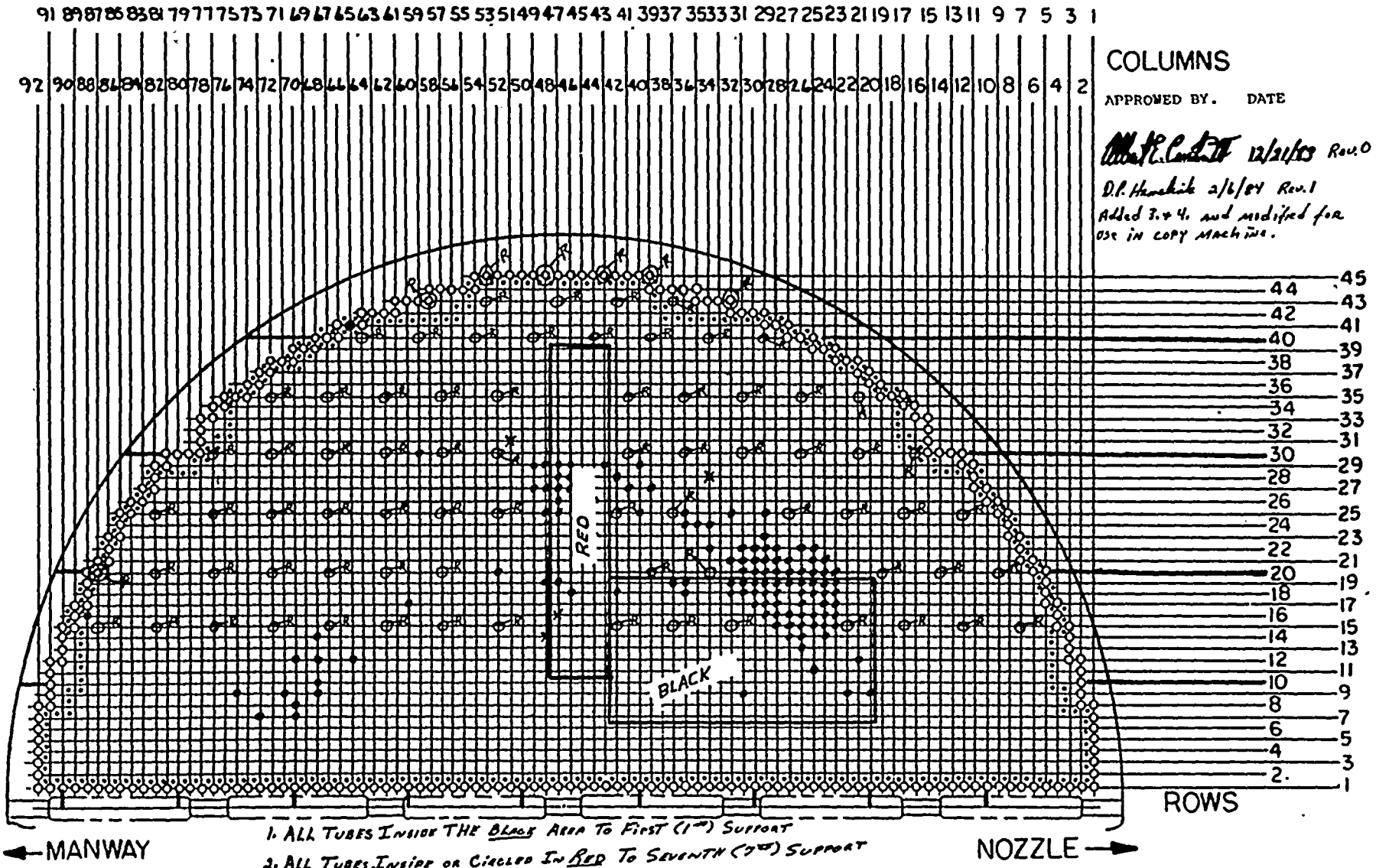

FIGURE 1

● = PERMANENT PLUG
X = SLEEVED TUBES ON HOT SIDE

A S/G OUTLET

SPRING 1984 EXAMINATION PROGRAM

RG&E Steam Generator




1. ALL TUBES INSIDE THE BLACK AREA TO FIRST (1ST) SUPPORT
2. ALL TUBES INSIDE OR CIRCLED IN RED TO SEVENTH (7TH) SUPPORT
3. ALL TUBES DESIGNATED BY ⊕R OR ◎R TO SEVENTH (7TH) SUPPORT
4. FIRST TWO, UNPLUGGED, TUBES @ EACH ROW/COLUMN AROUND THE PERIPHERY TO BE INSPECTED TO THE FIRST (1ST) SUPPORT PLATE.

FIGURE 2

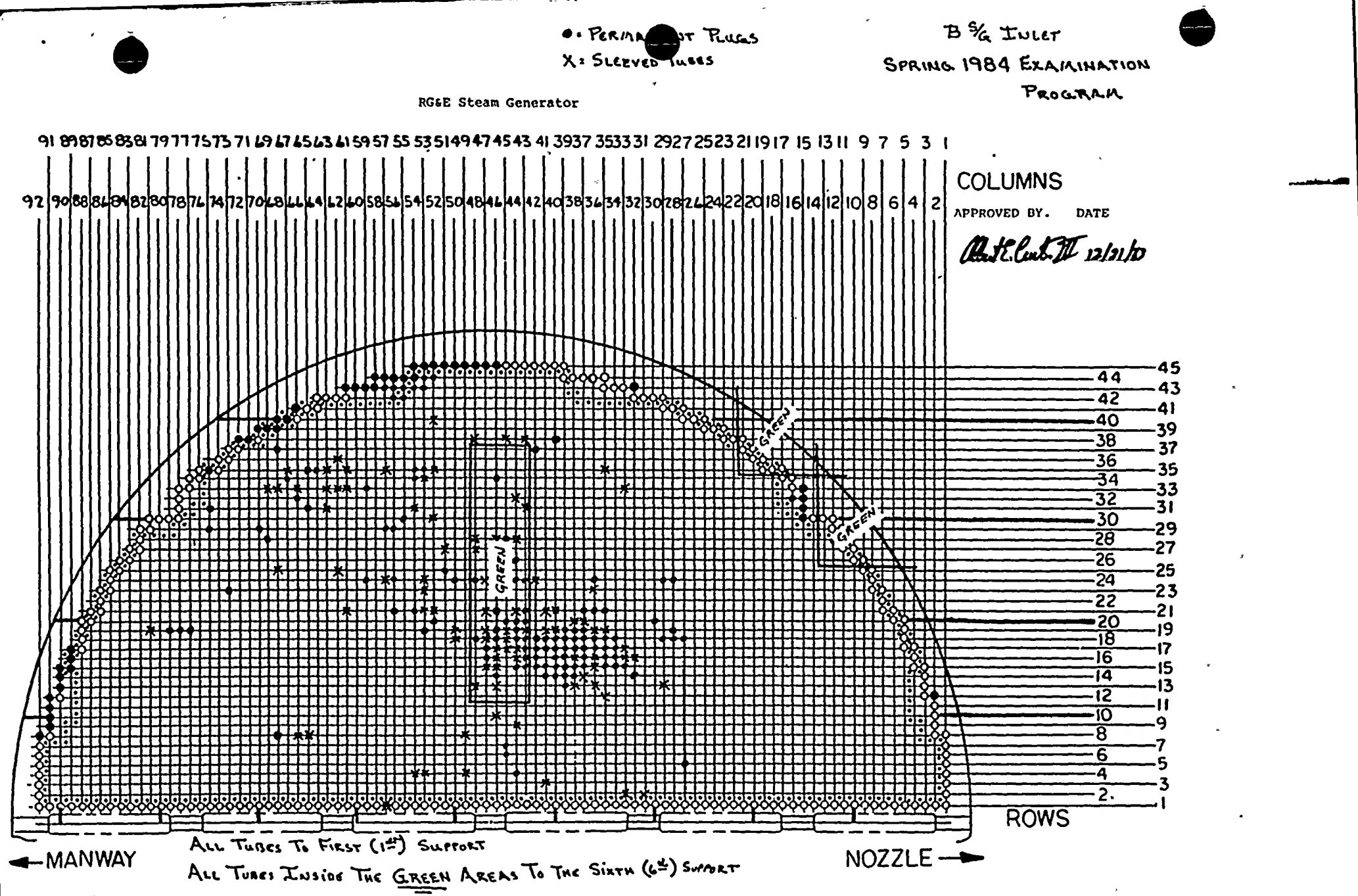

●: Permanent Plugs
X: Sleeved Tubes
B S/G Inlet
Spring 1984 Examination
Program
RG&E Steam Generator
91 89 87 85 83 81 79 77 75 73 71 69 67 65 63 61 59 57 55 53 51 49 47 45 43 41 39 37 35 33 31 29 27 25 23 21 19 17 15 13 11 9 7 5 3 1
92 90 88 86 84 82 80 78 76 74 72 70 68 66 64 62 60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
COLUMNS
APPROVED BY. DATE
12/31/80
GREEN
GREEN
GREEN
45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2. 1
ROWS
MANWAY
NOZZLE
All Tubes To First (1st) Support
All Tubes Inside The Green Areas To The Sixth (6th) Support

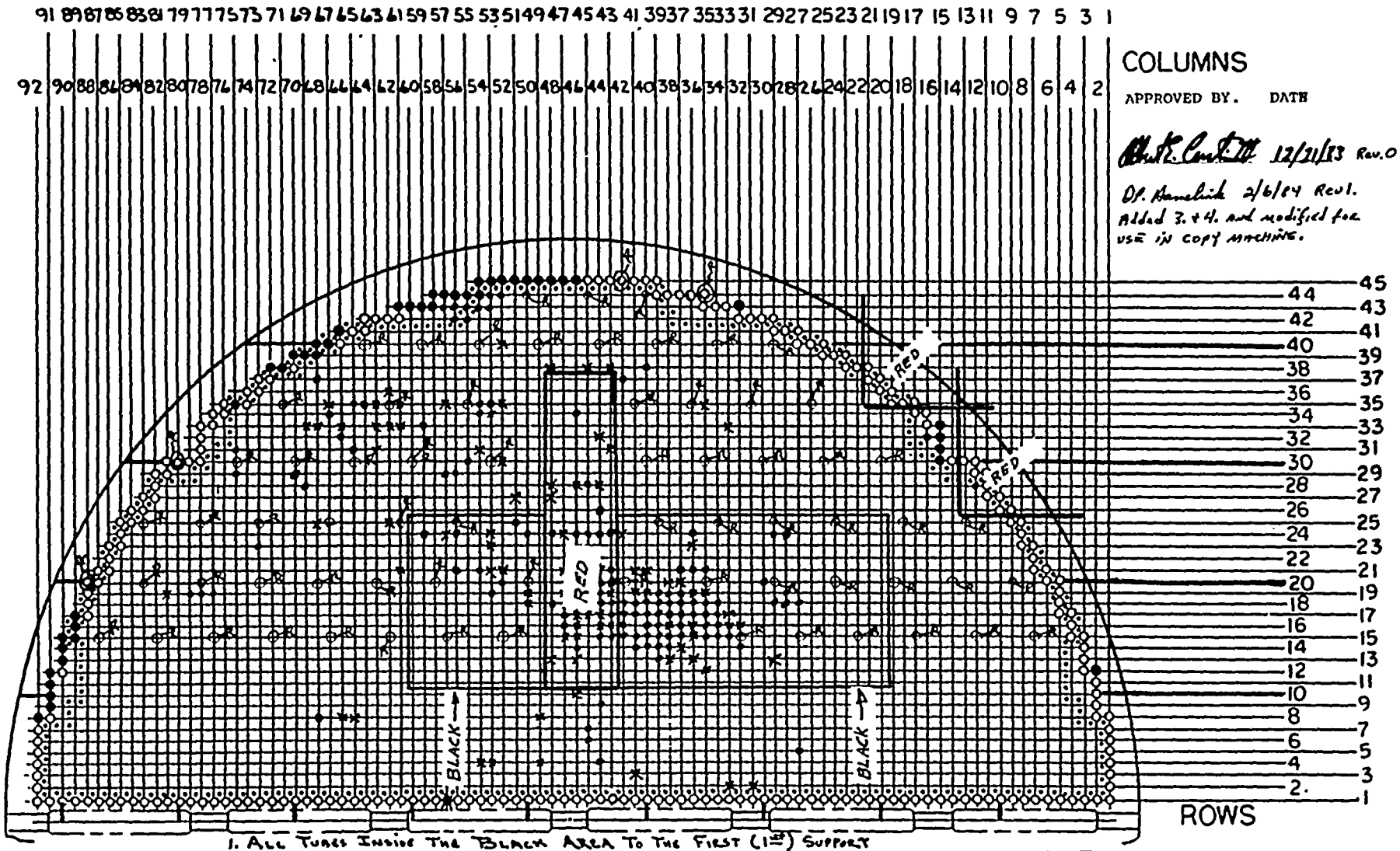
FIGURE 3

●: Permanent Plug
X: Sleeved Tube On Inlet Side

B & W Outlet

Spring 1984 Examination Program

RG&E Steam Generator




1. All Tubes Inside The Black Area To The First (1st) Support
2. All Tubes Inside or Circled in Red To Seventh (7th) Support
3. All Tubes Designated by $\oplus^{R}$ or $\odot^{R}$ – To Seventh (7th) Support D.P.H.
4. First Two, Unplugged, Tubes @ Each Row/Column Around the Periphery to be Inspected to the First (1st) Support Plate.

FIGURE 4

GINNA STATION

## 1984 CORRECTIVE ACTION SUMMARY

### A Steam Generator

| ROW | COLUMN | LEG | FLAW | LOCATION | SLEEVE SIZE |
|---|---|---|---|---|---|
| 17 | 47 | Hot | 27% OD IGA | 19.6" Above Tube End | Combustion Mech. Plug. |

### B Steam Generator

| | | | | | |
|---|---|---|---|---|---|
| 20 | 47 | Hot | Abs Indication IGA | 6-11" Above Tube End | 22" |
| 42 | 50 | Hot | 85% OD SCC | 4" Above Tube End | 22" |
| 32 | 53 | Hot | 54% OD SCC | 4" Above Tube End | 22" |
| 32 | 54 | Hot | Abs Indication IGA | 4-8" Above Tube End | 22" |
| 11 | 55 | Hot | Abs Indication IGA | 4-8" Above Tube End | 22" |
| 36 | 59 | Hot | Abs Indication IGA | 4-8" Above Tube End | 22" |
| 36 | 63 | Hot | Abs Indication IGA | 4-10" Above Tube End | 22" |
| 28 | 76 | Hot | 85% ID SCC | 3.2" Above Tube End | 22" |
| 26 | 79 | Hot | 95% OD SCC | 3" Above Tube End | 22" |
| 18 | 87 | Cold | 53% OD Wastage | #1 Tube Support Plate | B&W Explosive Plug |

FIGURE 5

# STEAM GENERATOR TUBE INSPECTION AND CORRECTIVE ACTION HISTORY

| DATE | No. Tubes Inspected A Hot | A Cold | B Hot | B Cold | Primary to Secondary Leakage, gpm | Total Defects A | B | Type of Deterioration A/B | No. Defects Requiring Repair A | B | No. Tubes Plugged A | B | No. Tubes Sleeved A | B | No. Tubes Pulled A | B | Comm A | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| In Factory | | | | | ---- | 1 | -- | ---- | 1 | -- | 1 | -- | -- | -- | -- | -- | -- | - |
| April 1972 | 1050 | | | | ---- | 0 | 0 | ---- | 0 | 0 | 0 | 0 | -- | -- | -- | -- | -- | - |
| March 1974 | 3259 | 516 | 1098 | 516 | ---- | 19 | 0 | Wastage | 19 | 0 | 19 | 0 | -- | -- | 2 | -- | -- | - |
| Nov. 1974 | 1701 | 430 | 672 | 39 | ---- | 2 | 0 | Wastage | 2 | 0 | 2 | 0 | -- | -- | -- | -- | -- | - |
| March 1975 | 2174 | 442 | 1931 | 442 | 0.0050 A S/G | 46 | 11 | Cracking/Wastage | 46 | 11 | 46 | 11 | -- | -- | 2 | -- | -- | - |
| Jan. 1976 | ---- | --- | 53 | --- | 0.091 B S/G | 0 | 2 | Wastage | 0 | 2 | 0 | 2 | -- | -- | -- | -- | -- | - |
| Feb. 1976 | 3192 | 3192 | 3247 | 3247 | ---- | 39 | 2 | Wastage | 39 | 2 | 39 | 2 | -- | -- | -- | -- | -- | - |
| April 1976 | 100 | --- | 1025 | 75 | 0.099 B S/G | 0 | 15 | Cracking | 0 | 15 | 0 | 15 | -- | -- | -- | -- | -- | - |
| April 1977 | 2003 | 268 | 1525 | 268 | ---- | 13 | 1 | Wastage | 13 | 1 | 13 | 1 | -- | -- | -- | -- | -- | - |
| July 1977 | ---- | --- | 300 | --- | 0.012 B S/G | -- | 5 | ID Cracking | -- | 5 | -- | 5 | -- | -- | -- | -- | -- | - |
| Jan. 1978 | ---- | --- | 350 | --- | 0.060 B S/G | -- | 8 | Cracking/Wastage | -- | 8 | -- | 8 | -- | -- | -- | -- | -- | - |
| April 1978 | 2049 | 325 | 1714 | 375 | ---- | 1 | 15 | ID Cracking | 1 | 15 | 1 | 15 | -- | -- | -- | 1 | -- | - |
| Feb. 1979 | 2049 | 325 | 1714 | 375 | ---- | -- | 6 | Cracking,Wastage,21GA | | 6 | -- | 6 | -- | -- | -- | -- | -- | - |
| Dec. 1979 | ---- | --- | 1200 | --- | 0.007 B S/G | -- | 13 | 111GA, 2 Wastage | -- | 13 | -- | 13 | -- | -- | -- | -- | -- | - |
| April 1980 | 3139 | 325 | 3182 | 375 | ---- | 1 | 31 | "A" Pitting/"B"IGA | 1 | 13 | 1 | 31 | -- | -- | -- | 3 | --(1 | |
| Nov. 1980 | 3138 | 325 | 3151 | 375 | ---- | -- | 3 | IGA | -- | 2 | -- | 0 | -- | 5 | -- | -- | --(2 | |
| May 1981 | 3138 | 325 | 3141 | 400 | ---- | -- | 15 | IGA, Wastage | -- | 6 | -- | 4 | -- | 16 | -- | 3 | --(3 | |
| Feb 1982 | 3137 | 526 | 3140 | 526 | 620/ B S/G | -- | 16 | IGA, Mech. Dam | -- | 16 | -- | 18 | -- | -- | -- | 1 | --(4 | |
| Sep. 1982 | 3138 | 382 | 3129 | 893 | ---- | 1 | 32 | IGA | 1 | 28 | 1 | 33 | -- | -- | -- | -- | -- | - |
| April 1983 | 3137 | 633 | 3096 | 832 | ---- | 4 | 78 | IGA, SCC | -- | 23 | -- | 3 | 4 | 74 | -- | 1 | --(5 | |
| March 1984 | 3137 | 717 | 3093 | 963 | ---- | 1 | 10 | IGA, SCC | -- | 5 | 1 | 1 | -- | 9 | -- | -- | | |
| | | | | | | 128 | 263 | | 123 | 171 | 124 | 168 | 4 | 104 | | | | |
| | | | | | | Or | Or | | Or | Or | Or | Or | Or | Or | | | | |
| | | | | | | 3.9% | 8.0% | | 3.7% | 5.2% | 3.8% | 5.1% | 0.1% | 3.1% | | | | |

FIGURE 6

8/13/84

Albert E. Curtis III

## Steam Generator Tube Inspection and Corrective Action History Comments

(1) Pulled R15 C55 and R17 C41 from hot leg and R17 C40 from the cold leg to determine IGA conditions in "B" steam generator. R17 C41 had ECT indications at all frequencies, R15 C44 had just 100k$H_2$ Absolute ECT indication and R17 C40 had not ECT indication. Both hot leg tubes had approximately 50% IGA, R17 C41 had a 60% SCC indication associated with the IGA.

(2) Manually sleeved five (5) tubes with Nickel plated - inconel 600 T.T. sleeves. Three tubes had IGA indications, two others were preventatively sleeved.

(3) Sleeved 16 tubes with co-extruded sleeves, 13 with defects and 3 preventatively. Pulled R21 C46 with a 100k$H_2$ ECT indication, R7 C45 and R28 C45 which were clean. All tubes pulled were from the hot leg.

(4) Recovery from the January 25, 1982 included removing 26 tube sections by EDM and ID Cutters along with one tube pulled from the secondary side.

(5) The four tubes identified with IGA in the A steam generator were sleeved with 22" tube sheet sleeves. The 78 tubes identified in the "B" steam generator with IGA and/or SCC in the crevice were repaired as follows:

41 tubes were sleeved with 36" brazed sleeves
9 tubes were sleeved with 28" brazed sleeves
24 tubes were sleeved with 22" tube sheet sleeves
1 tube and 2 sleeves were plugged
1 tube R34 C54 was pulled for metallurgical analysis

8/13/84

Albert E. Curtis III

FIGURE 6A

# A S/G DEFECT LOG 1984

March 1984 Inspection

## INLET

Dents:

| | |
|---|---|
| Below Tube Sheet | 8 |
| At Tube Sheet | 521 |
| Above Tube Sheet | 12 |
| #1 Tube Support | 304 |
| Above #1 Tube Support | 3 |
| #2 Tube Support | 7 |
| #3 Tube Support | 1 |
| #4 Tube Support | 2 |
| #5 Tube Support | 1 |
| #6 Tube Support | 13 |
| TOTAL | 872 |

Defects:

| | |
|---|---|
| 0-20% | 263 |
| 21-30% | 48 |
| 31-40% | 5 |
| 41-50% | 1 |
| 51-60% | 0 |
| 61-70% | 0 |
| 71-80% | 0 |
| 81-90% | 0 |
| 90-100% | 0 |
| TOTAL | 317 |

## OUTLET

Dents:

| | |
|---|---|
| Below Tube Sheet | 7 |
| At Tube Sheet | 101 |
| Above Tube Sheet | 8 |
| #1 Tube Support | 47 |
| Above #1 Tube Support | 1 |
| #2 Tube Support | 13 |
| #3 Tube Support | 5 |
| Above #3 Tube Support | 1 |
| #4 Tube Support | 12 |
| #5 Tube Support | 3 |
| #6 Tube Support | 11 |
| AVB | 3 |
| Bulge | 13 (10 Possible) |
| TOTAL | 225 |

Defects:

| | |
|---|---|
| 0-20% | 5 |
| 21-30% | 0 |
| 31-40% | 0 |
| 41-50% | 0 |
| 51-60% | 0 |
| 61-70% | 0 |
| 71-80% | 0 |
| 81-90% | 0 |
| 90-100% | 0 |
| TOTAL | 5 |

FIGURE 7

# B S/G DEFECT LOG

March 1984 Inspection

## INLET

Dents:

| | |
|---|---|
| Below Tube Sheet | 8 |
| At Tube Sheet | 483 |
| Above Tube Sheet | 6 |
| #1 Tube Support | 37 |
| Above #1 Tube Support | 3 |
| #2 Tube Support | 2 |
| Tube Supports 3-5 | 0 |
| #6 Tube Support | 33 |
| #4 AVB | 4 |
| TOTAL | 576 |

Defects:

| | |
|---|---|
| 0-20% | 95 |
| 21-30% | 3 |
| 31-40% | 1 |
| 41-50% | 0 |
| 51-60% | 1 |
| 61-70% | 0 |
| 71-80% | 0 |
| 81-90% | 1 |
| 91-100% | 1 |
| TOTAL | 102 |

## OUTLET

Dents:

| | |
|---|---|
| Below Tube Sheet | 8 |
| At Tube Sheet | 103 |
| Above Tube Sheet | 2 |
| #1 Tube Support | 17 |
| Above #1 Tube Support | 1 |
| #2 Tube Support | 3 |
| #3 Tube Support | 2 |
| Above #3 Tube Support | 1 |
| #4 Tube Support | 0 |
| #5 Tube Support | 2 |
| #6 Tube Support | 37 |
| Below #6 Tube Support | 2 |
| TOTAL | 178 |

Defects:

| | |
|---|---|
| 0-20% | 1 |
| 21-30% | 0 |
| 31-40% | 1 |
| 41-50% | 1 |
| 51-60% | 0 |
| 61-70% | 0 |
| 71-80% | 0 |
| 81-90% | 0 |
| 91-100% | 0 |
| TOTAL | 3 |

FIGURE 8

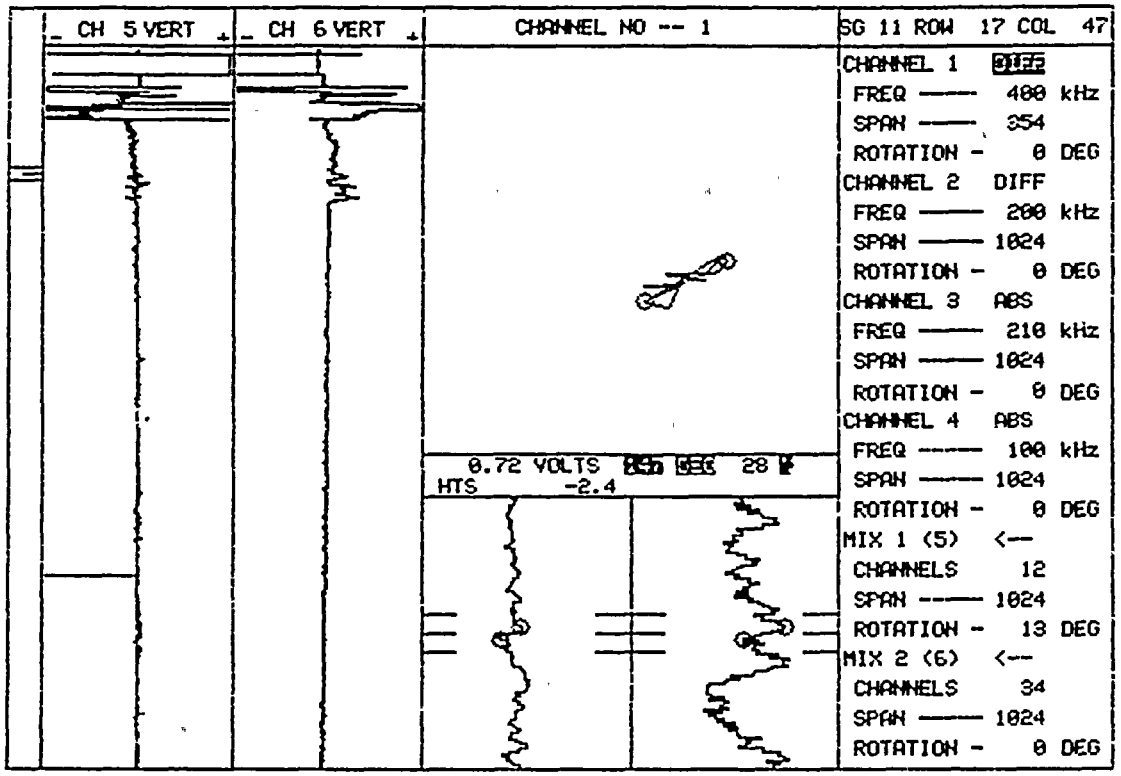
ATTACHMENT 1

STRIP CHART DATA REVIEW

NOTE: Steam Generator Identification as Follows:

Ex. S.G. 2.1 = B S/G = 2 Inlet = 1

S.G. 1.2 = A S/G = 1 Outlet = 2

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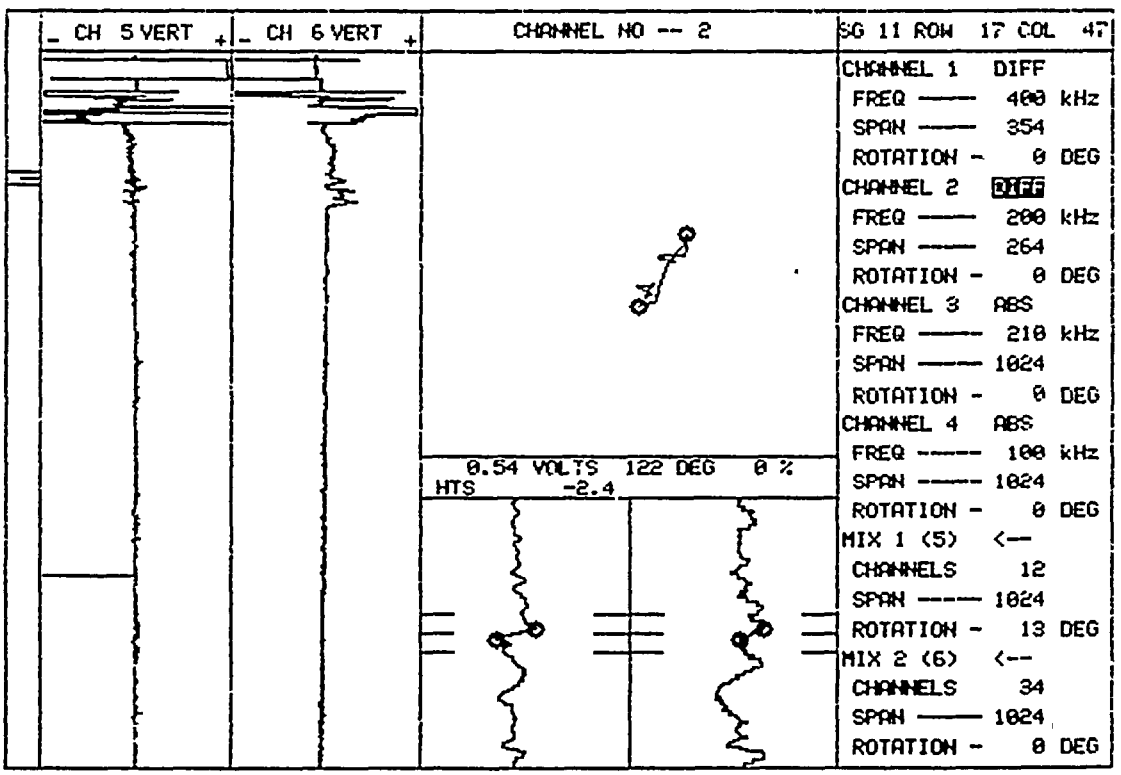
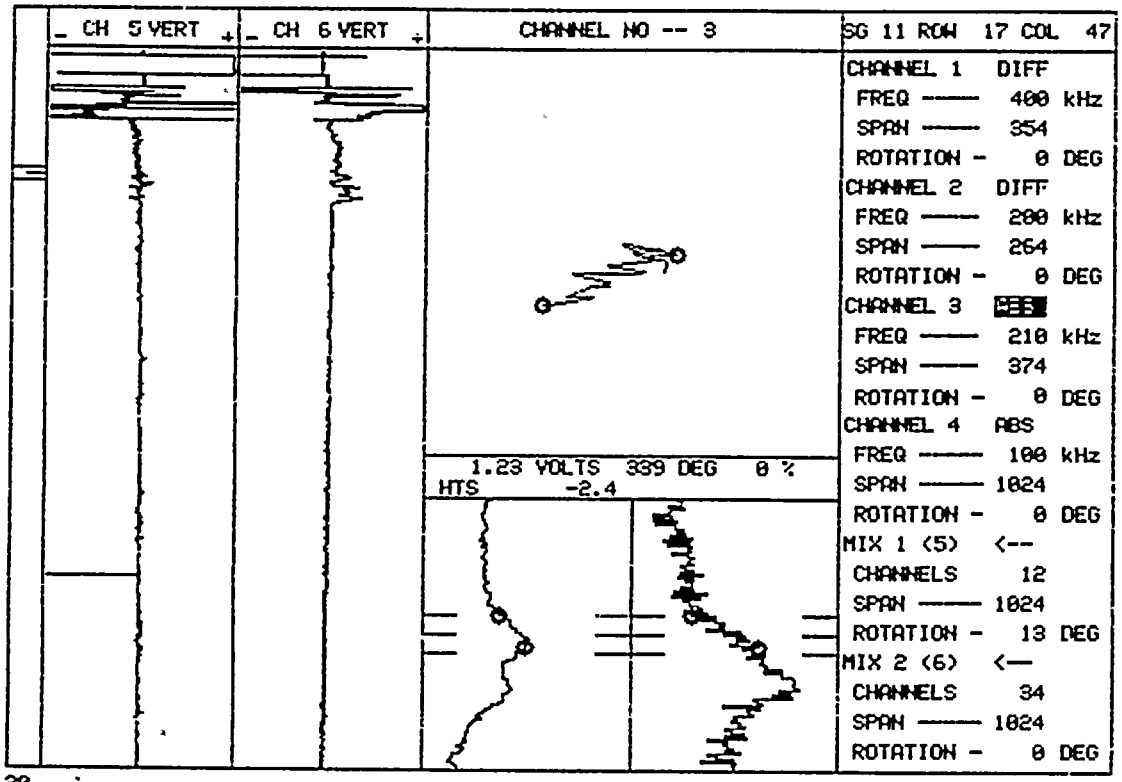



ZETEC Inc. - 1983
Edition 12.0 Rev 1


CH 5 VERT
CH 6 VERT
CHANNEL NO -- 3
SG 11 ROW 17 COL 47
CHANNEL 1 DIFF
FREQ 400 kHz
SPAN 354
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ 200 kHz
SPAN 264
ROTATION - 0 DEG
CHANNEL 3
FREQ 210 kHz
SPAN 374
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ 100 kHz
SPAN 1024
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN 1024
ROTATION - 13 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN 1024
ROTATION - 0 DEG
1.23 VOLTS 339 DEG 0 %
HTS -2.4
20
ZETEC Inc. - 1983
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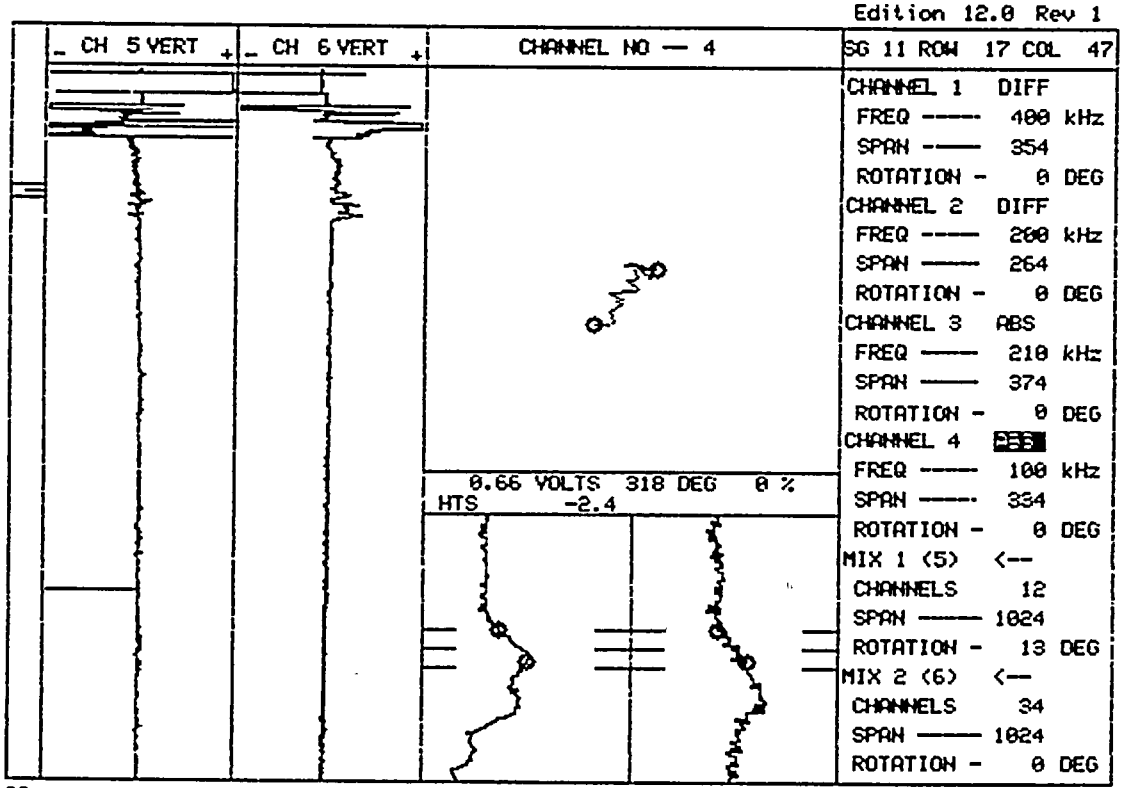
CH 5 VERT
CH 6 VERT
CHANNEL NO -- 4
SG 11 ROW 17 COL 47
CHANNEL 1 DIFF
FREQ 400 kHz
SPAN 354
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ 200 kHz
SPAN 264
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ 210 kHz
SPAN 374
ROTATION - 0 DEG
CHANNEL 4
FREQ 100 kHz
SPAN 334
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN 1024
ROTATION - 13 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN 1024
ROTATION - 0 DEG
0.66 VOLTS 318 DEG 0 %
HTS -2.4
20
ZETEC Inc. - 1983
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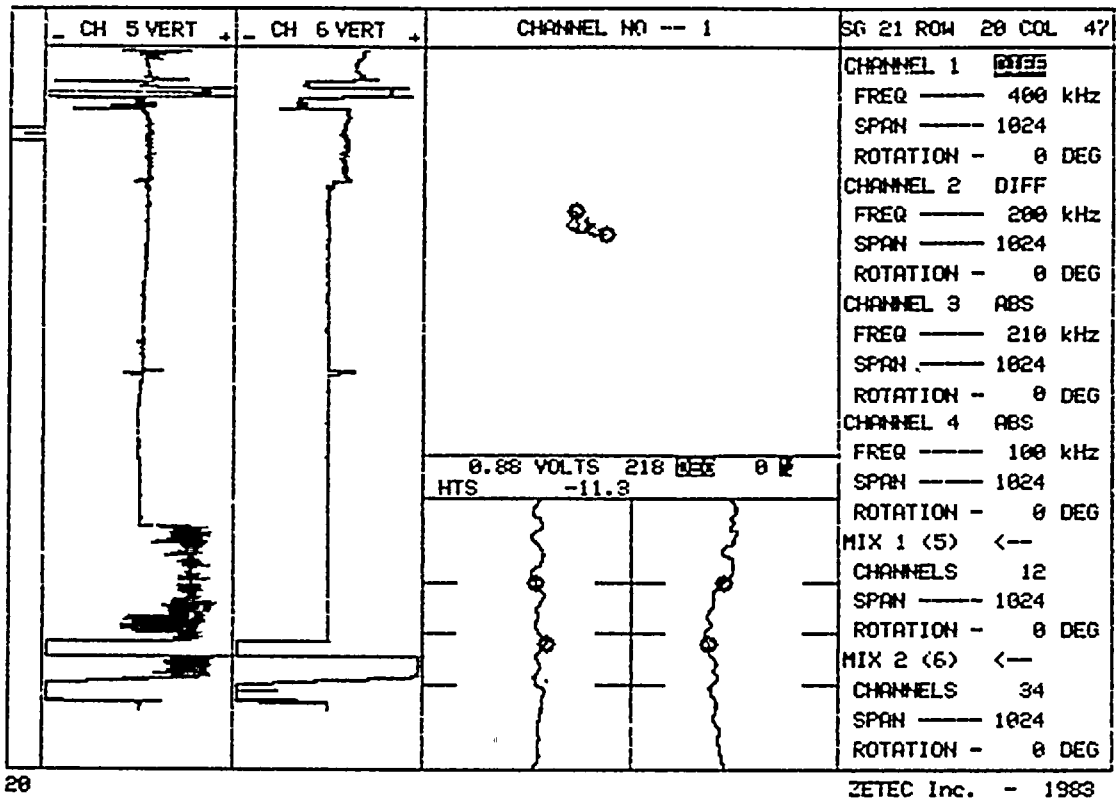


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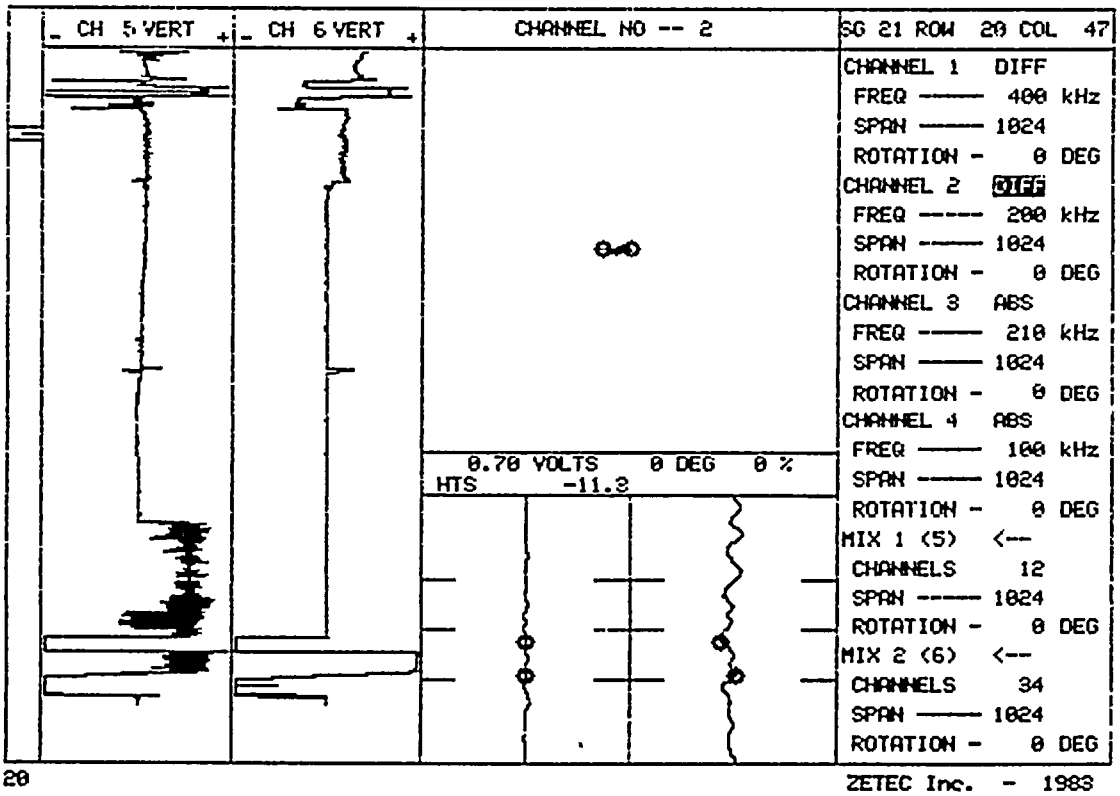


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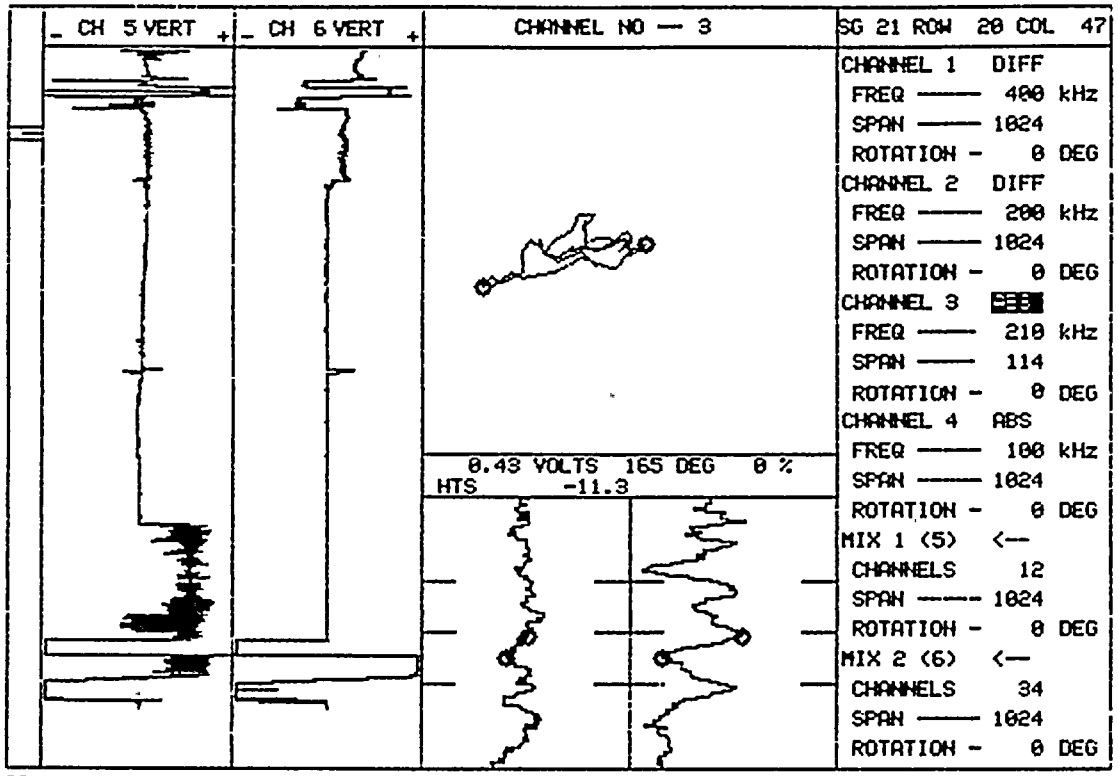
Edition 12.0 Rev 1


CH 5 VERT
CH 6 VERT
CHANNEL NO — 3
SG 21 ROW 20 COL 47
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 3
FREQ —— 210 kHz
SPAN —— 114
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ —— 100 kHz
SPAN —— 1024
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
0.43 VOLTS 165 DEG 0 %
HTS -11.3
20
ZETEC Inc. - 1983
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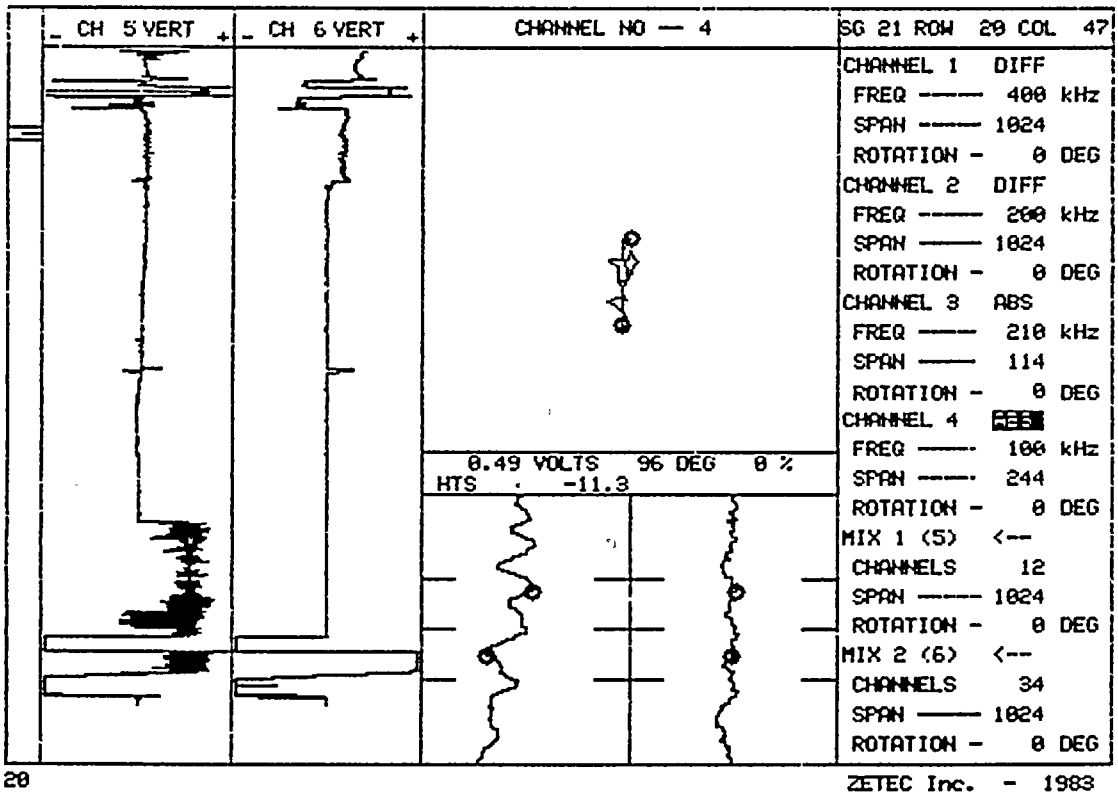
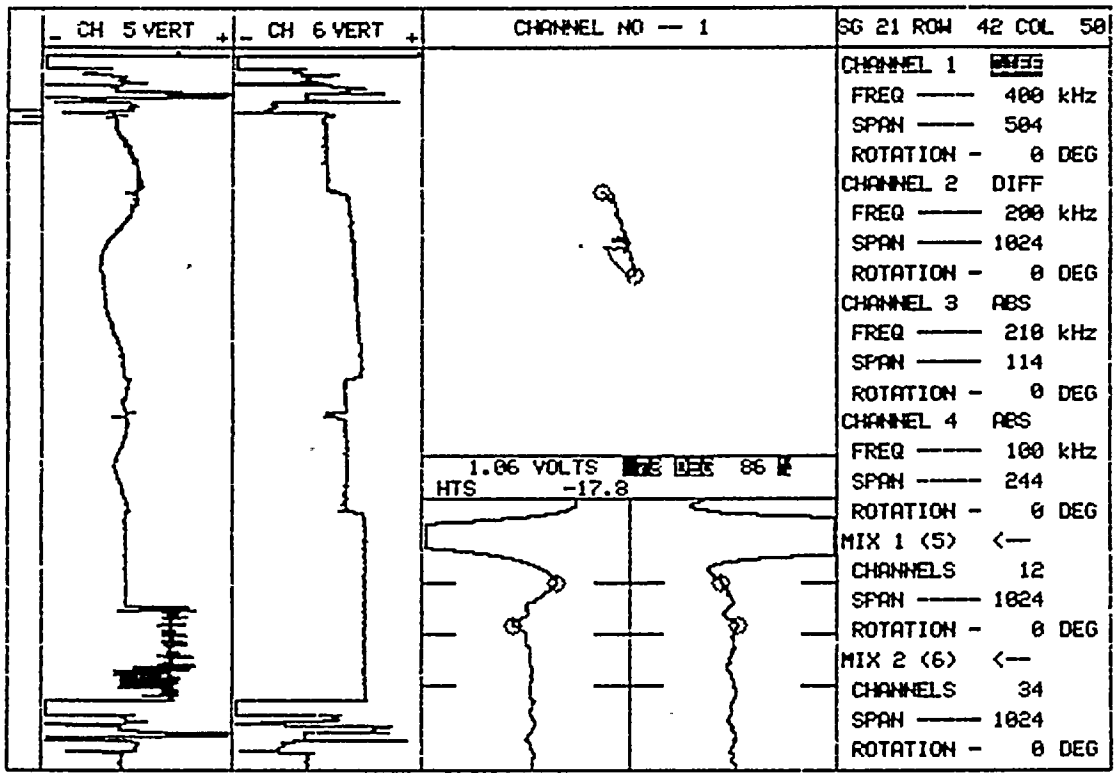
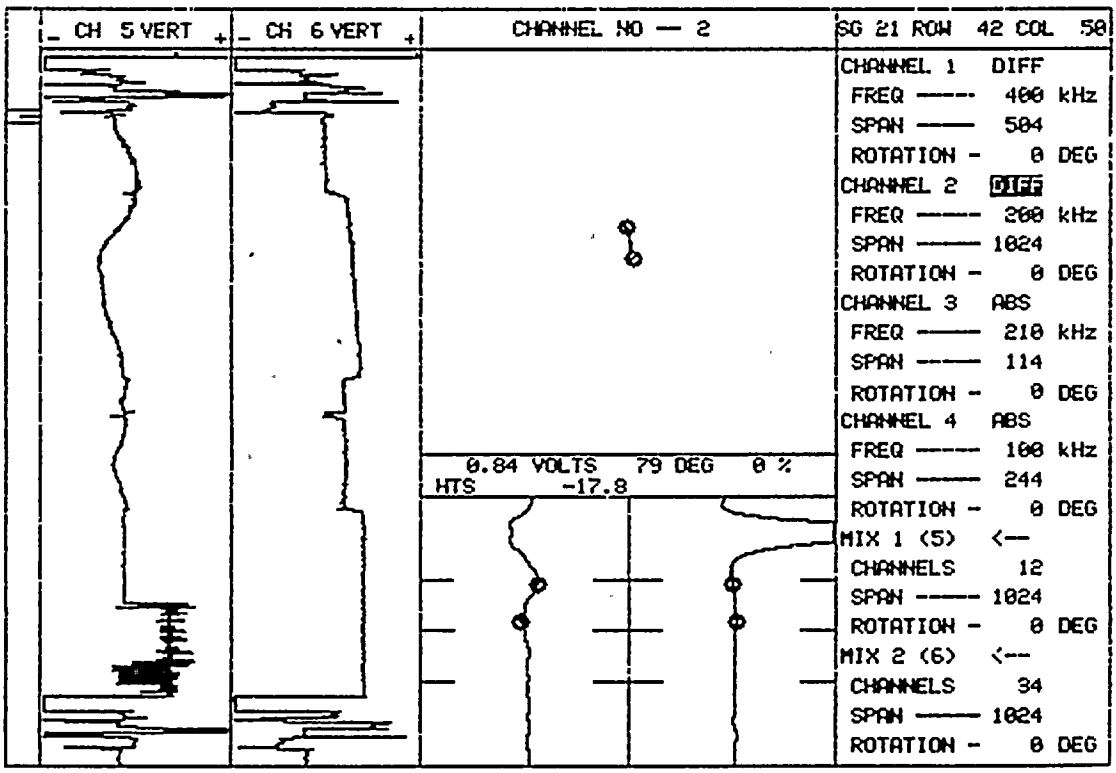

CH 5 VERT
CH 6 VERT
CHANNEL NO — 4
SG 21 ROW 20 COL 47
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ —— 210 kHz
SPAN —— 114
ROTATION - 0 DEG
CHANNEL 4
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
0.49 VOLTS 96 DEG 0 %
HTS -11.3
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1



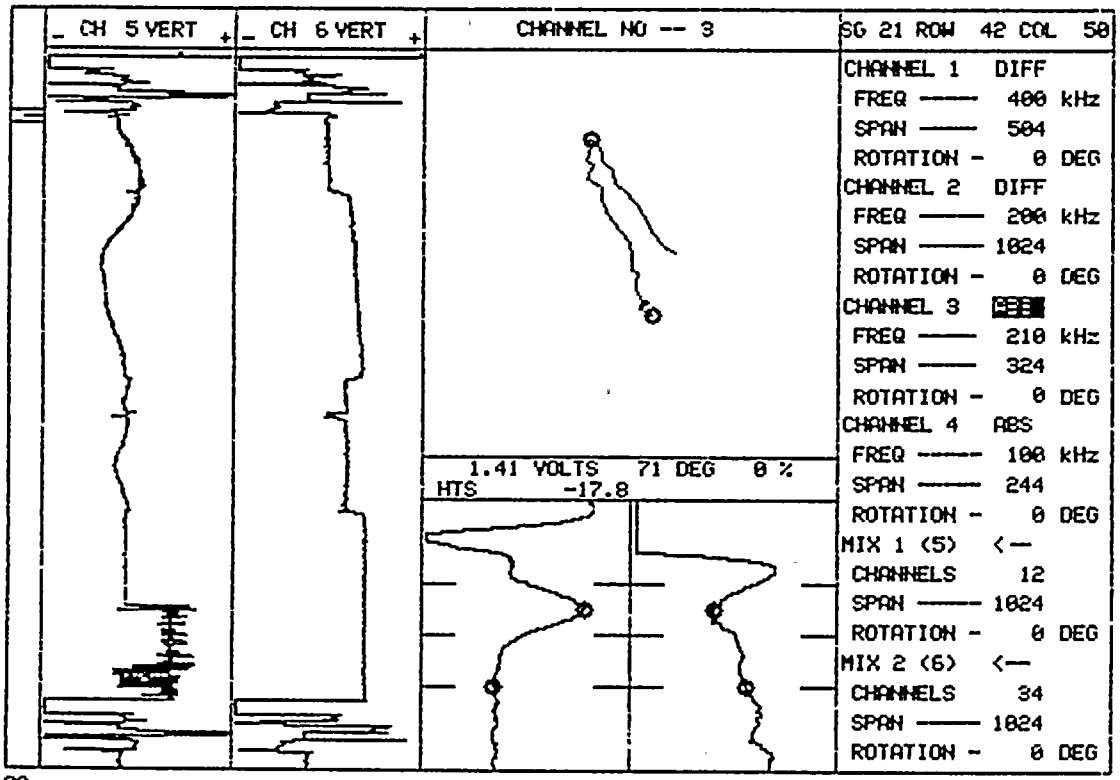

20

ZETEC Inc. - 1983
Edition 12.0 Rev 1

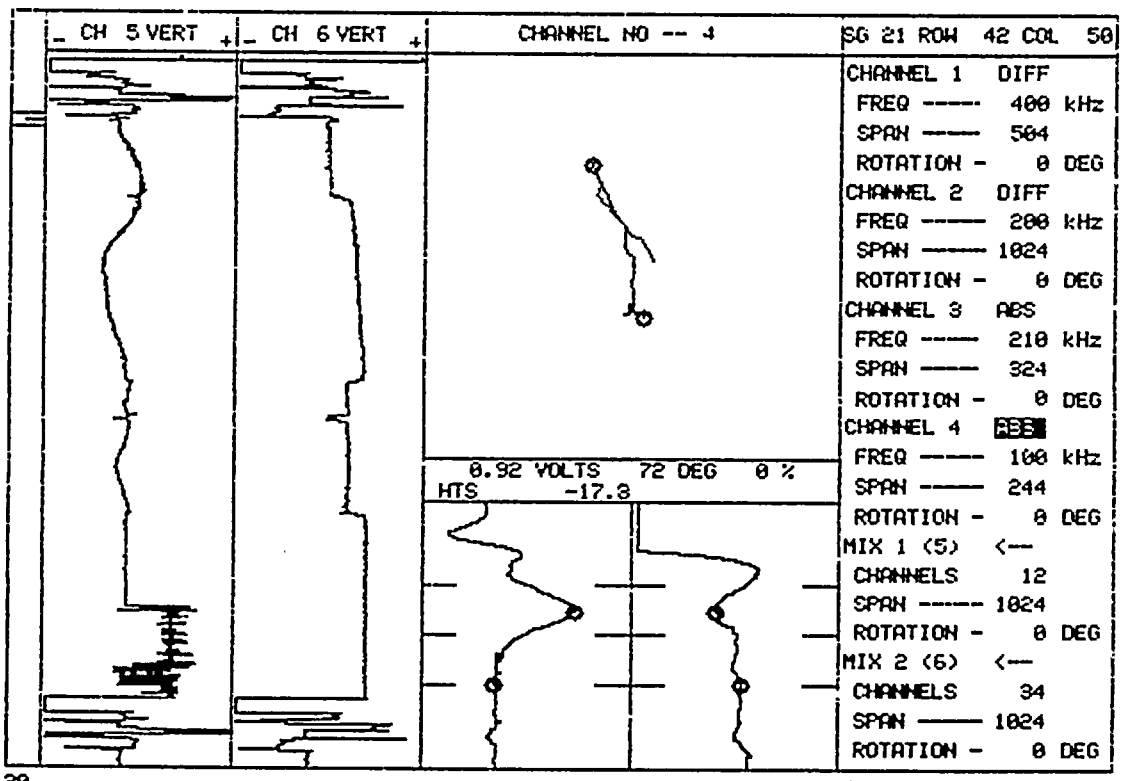



20

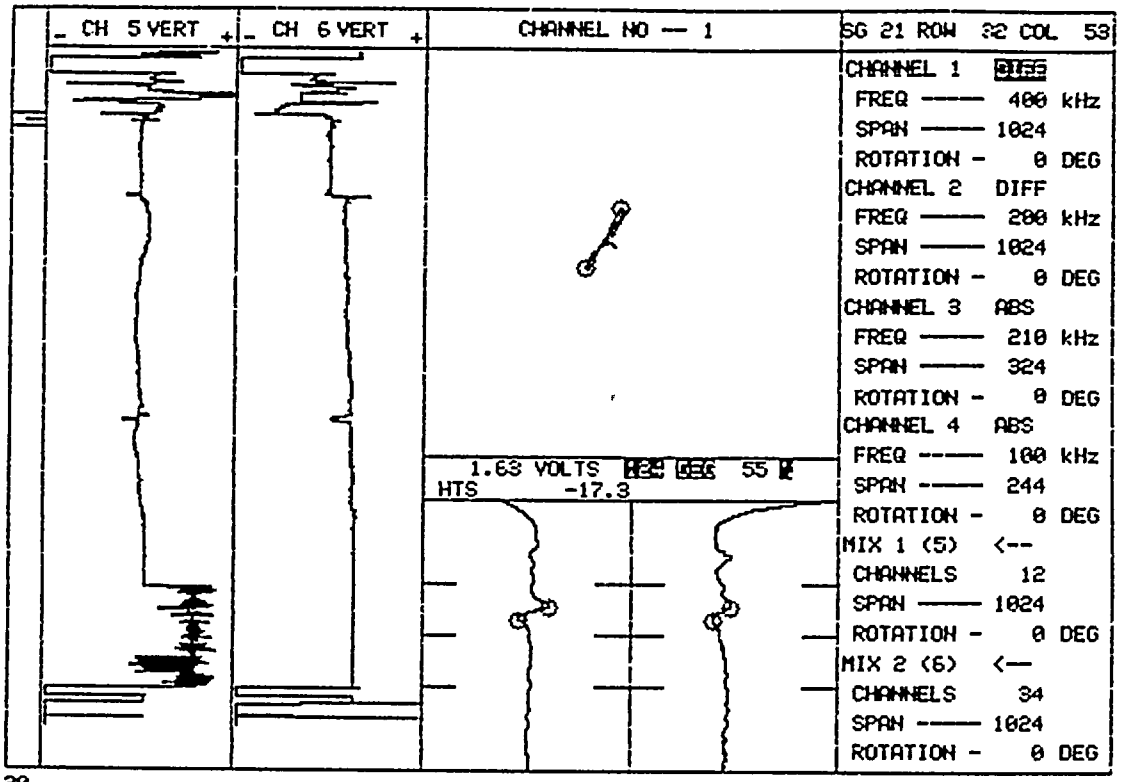
ZETEC Inc. - 1983
Edition 12.0 Rev 1

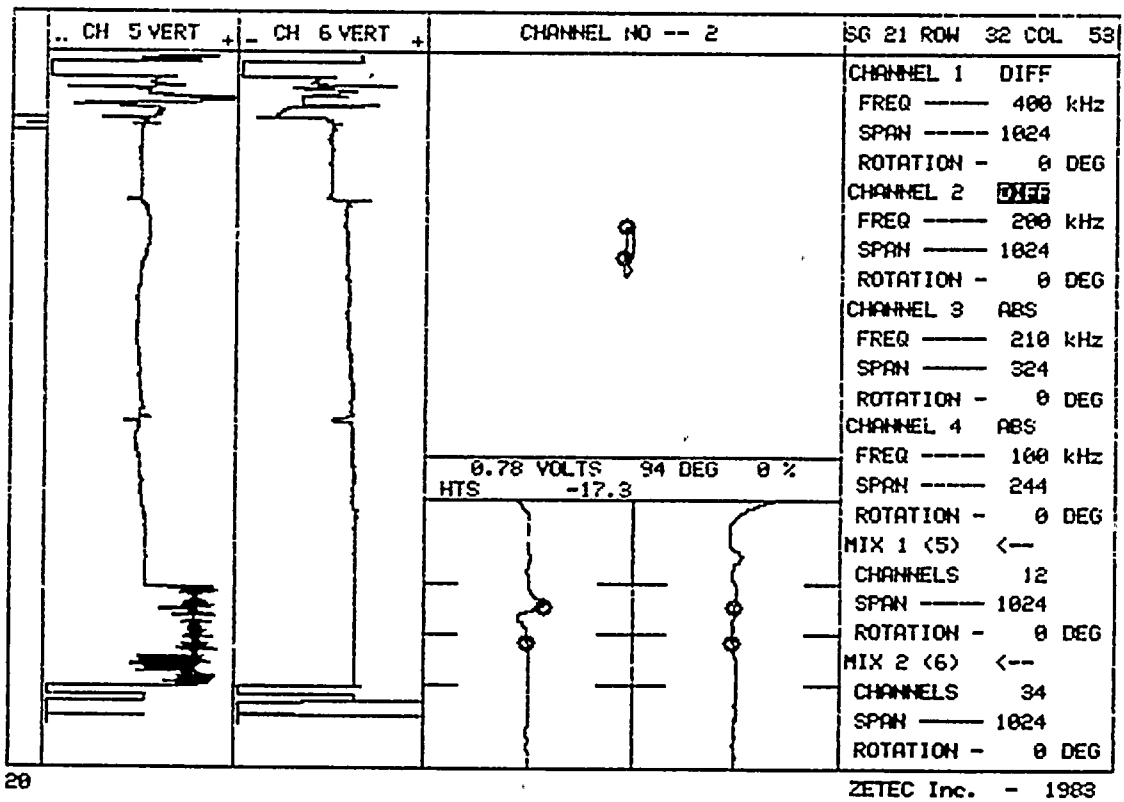


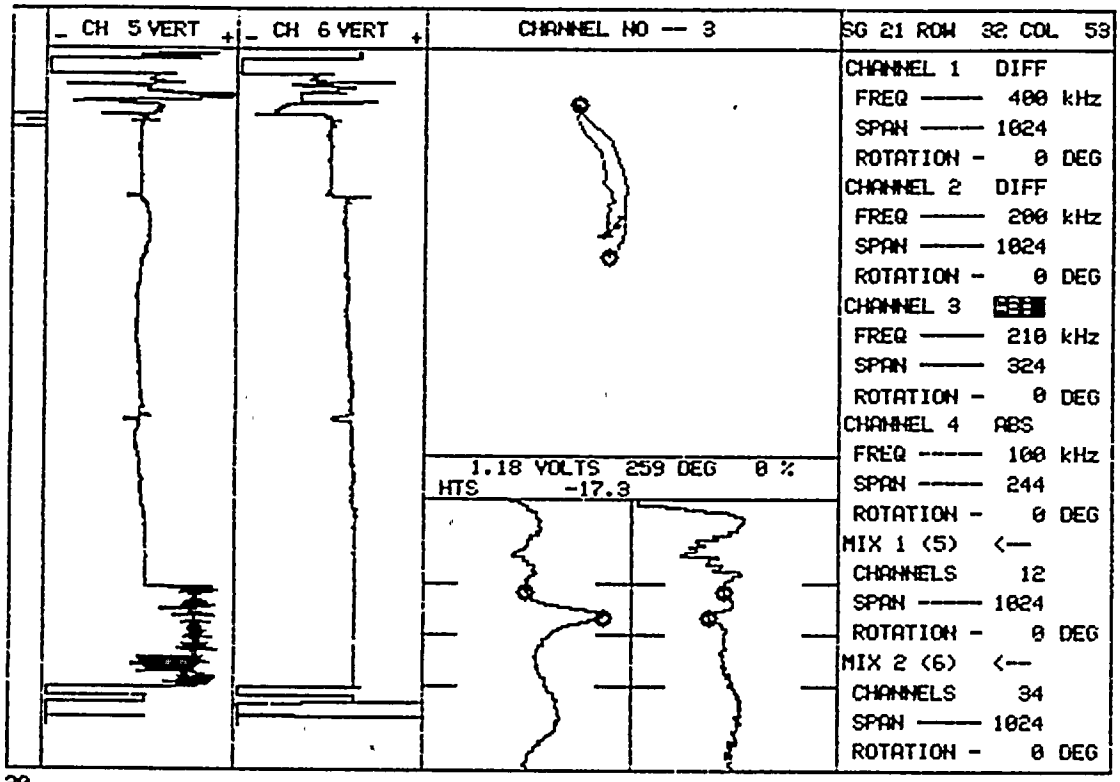

ZETEC Inc. - 1983
Edition 12.0 Rev 1

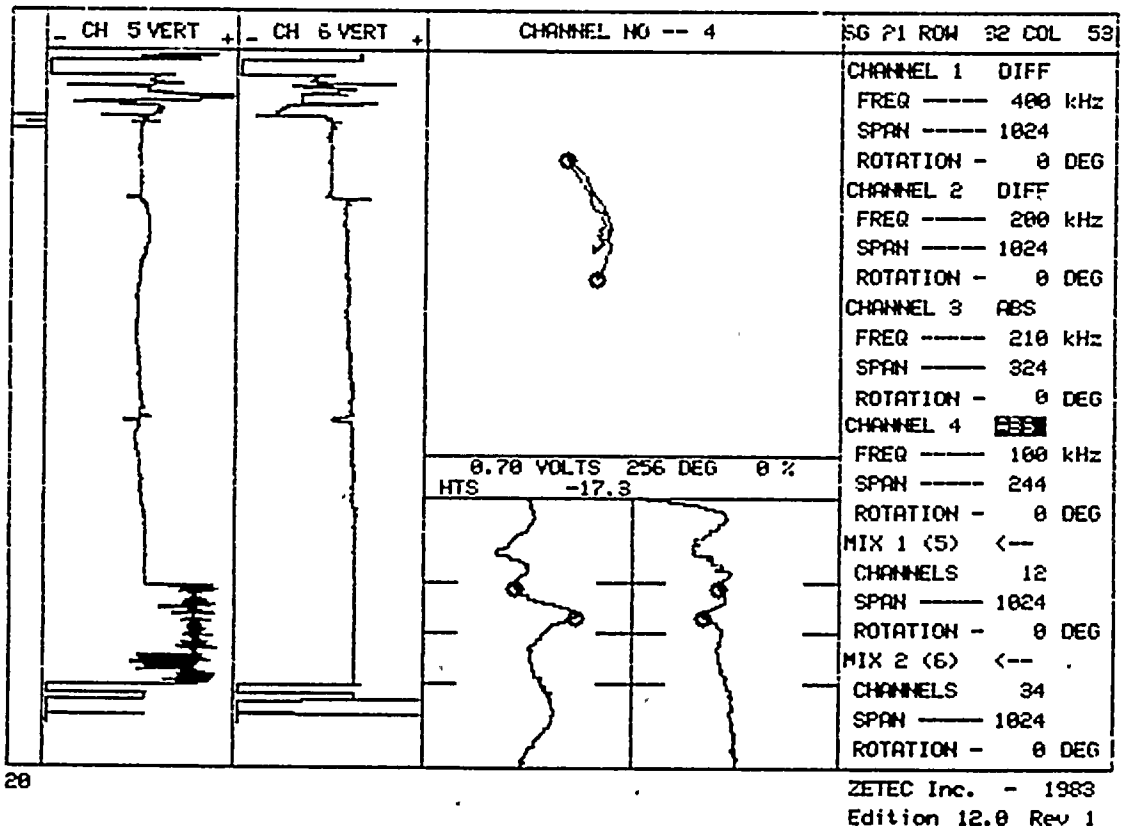


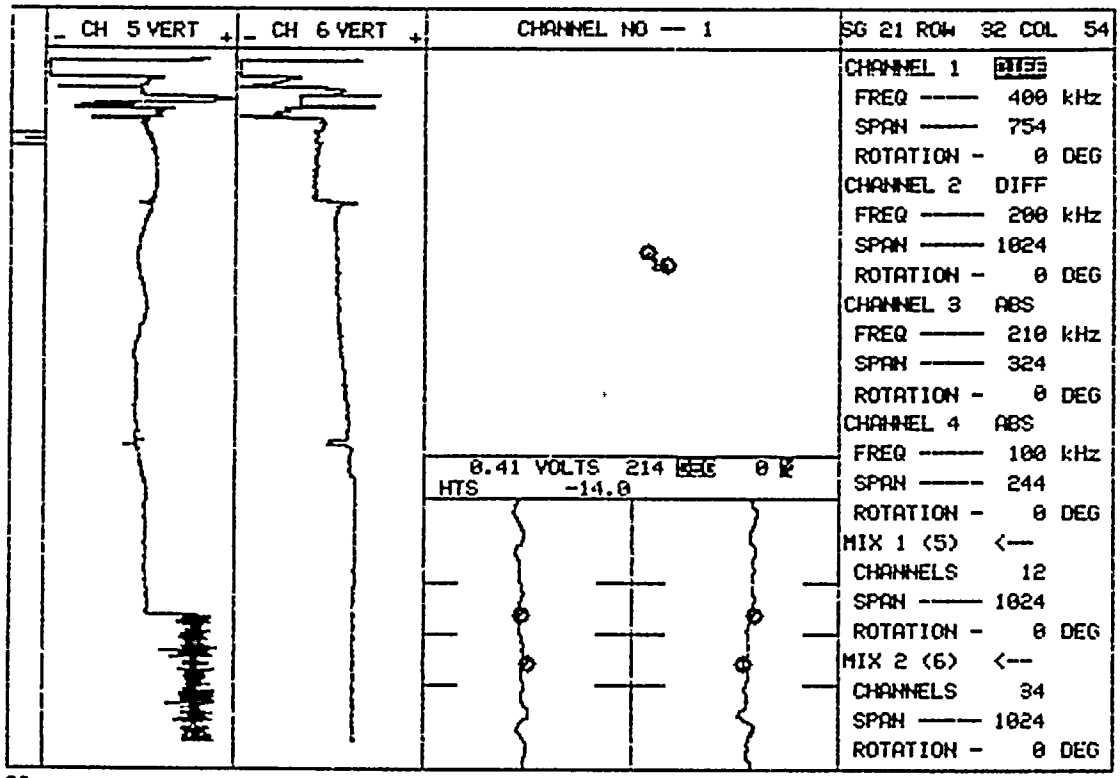

ZETEC Inc. - 1983
Edition 12.0 Rev 1


CH 5 VERT
CH 6 VERT
CHANNEL NO — 1
SG 21 ROW 32 COL 53
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ —— 210 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
1.63 VOLTS 55 DEG 55 %
HTS -17.3
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1


CH 5 VERT
CH 6 VERT
CHANNEL NO -- 2
SG 21 ROW 32 COL 53
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ —— 210 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
0.78 VOLTS 94 DEG 0 %
HTS -17.3
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1

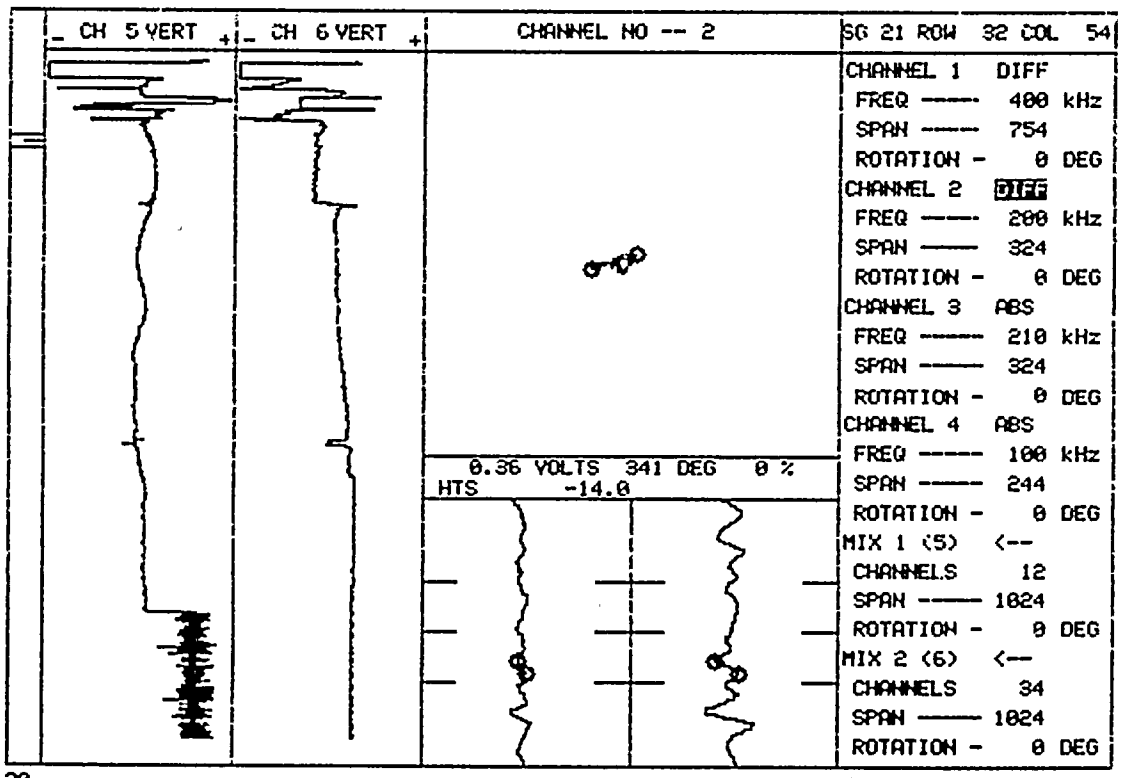

CH 5 VERT
CH 6 VERT
CHANNEL NO -- 3
SG 21 ROW 32 COL 53
1.18 VOLTS 259 DEG 0 %
HTS -17.3
CHANNEL 1 DIFF
FREQ 400 kHz
SPAN 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ 200 kHz
SPAN 1024
ROTATION - 0 DEG
CHANNEL 3
FREQ 210 kHz
SPAN 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ 100 kHz
SPAN 244
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN 1024
ROTATION - 0 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN 1024
ROTATION - 0 DEG
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1


CH 5 VERT
CH 6 VERT
CHANNEL NO -- 4
SG 21 ROW 32 COL 53
0.70 VOLTS 256 DEG 0 %
HTS -17.3
CHANNEL 1 DIFF
FREQ 400 kHz
SPAN 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ 200 kHz
SPAN 1024
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ 210 kHz
SPAN 324
ROTATION - 0 DEG
CHANNEL 4
FREQ 100 kHz
SPAN 244
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN 1024
ROTATION - 0 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN 1024
ROTATION - 0 DEG
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1




20



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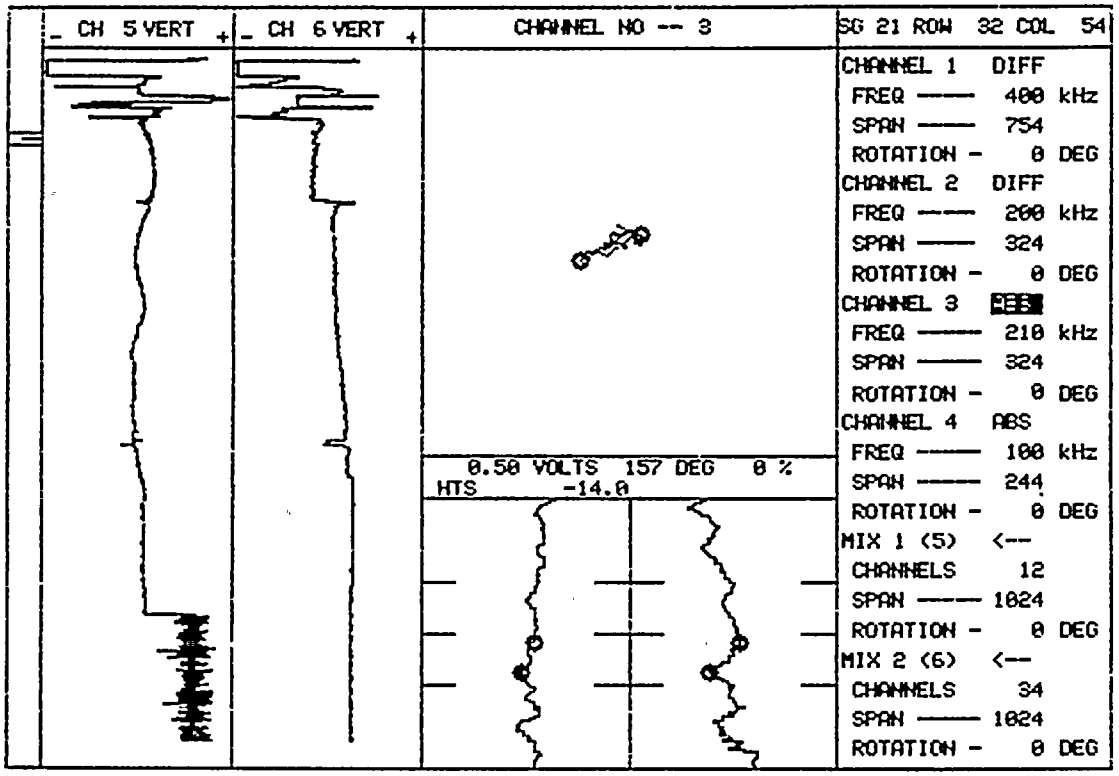
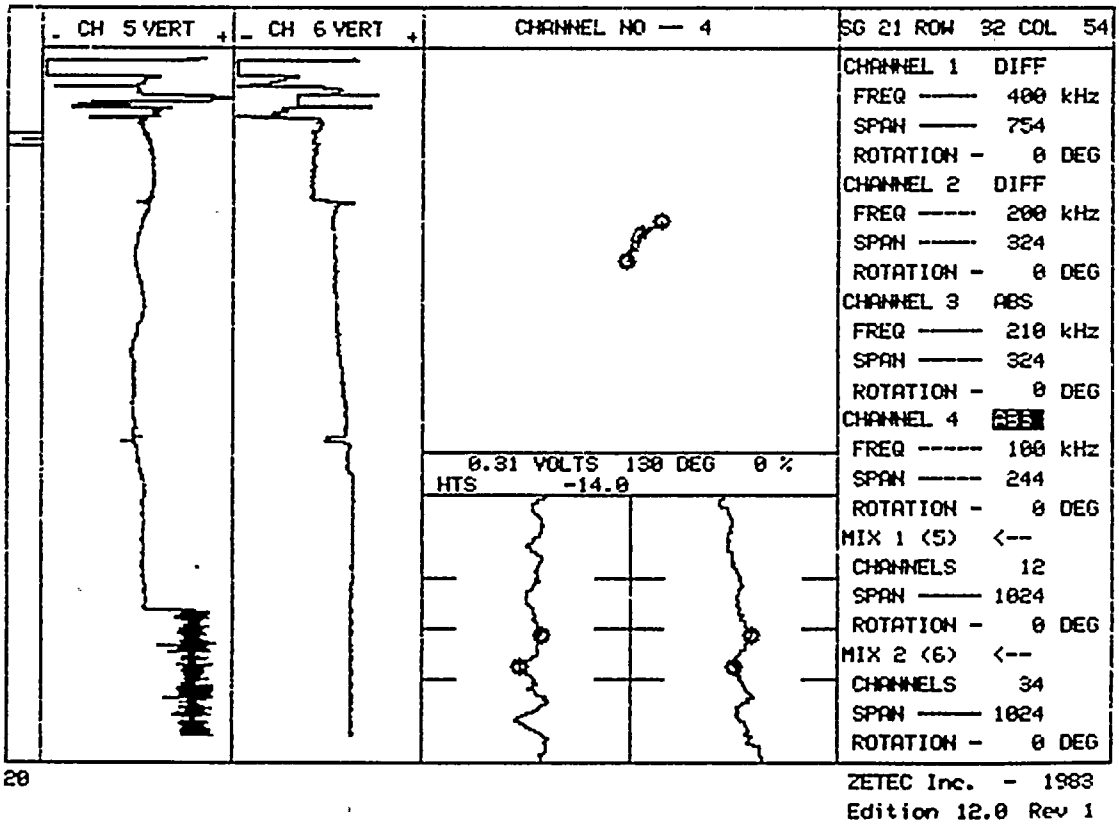
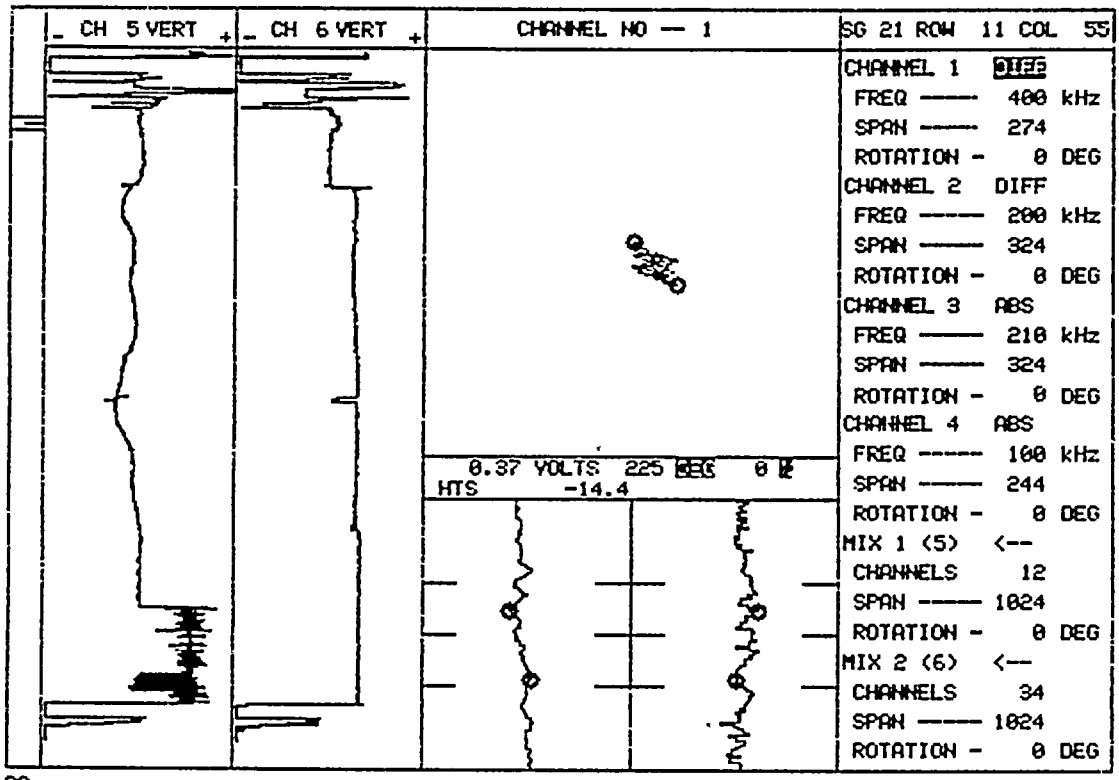
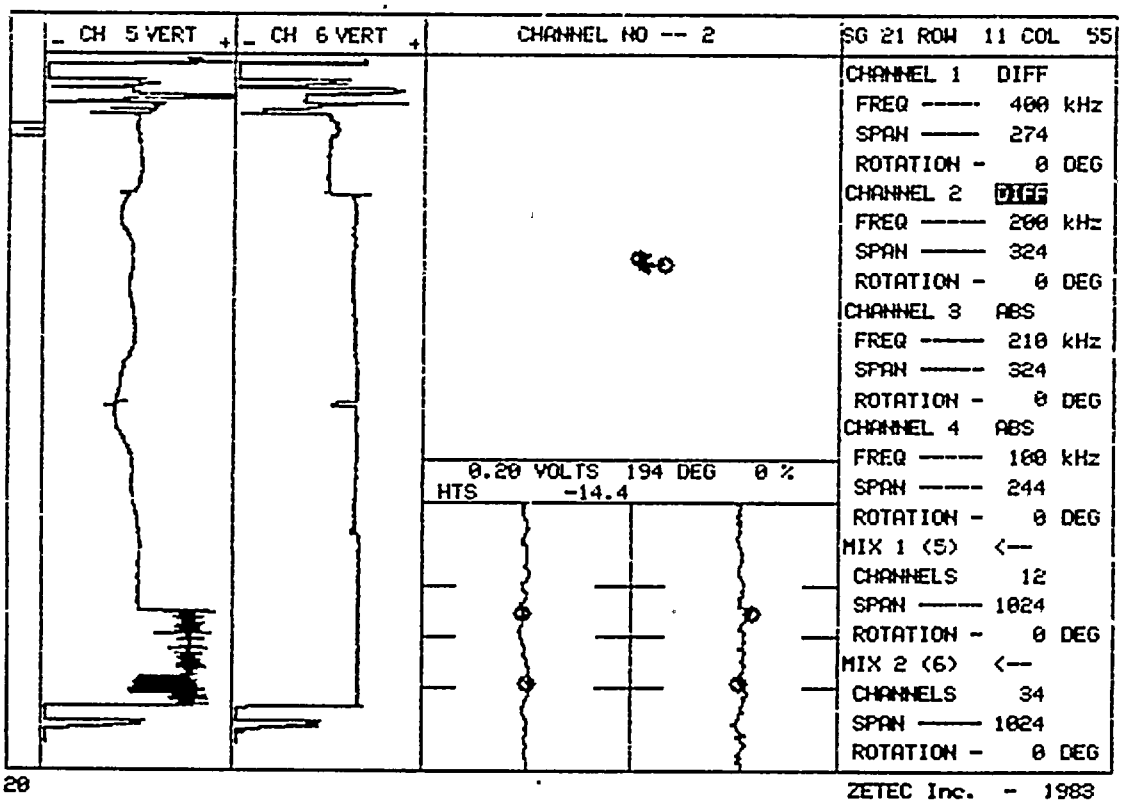
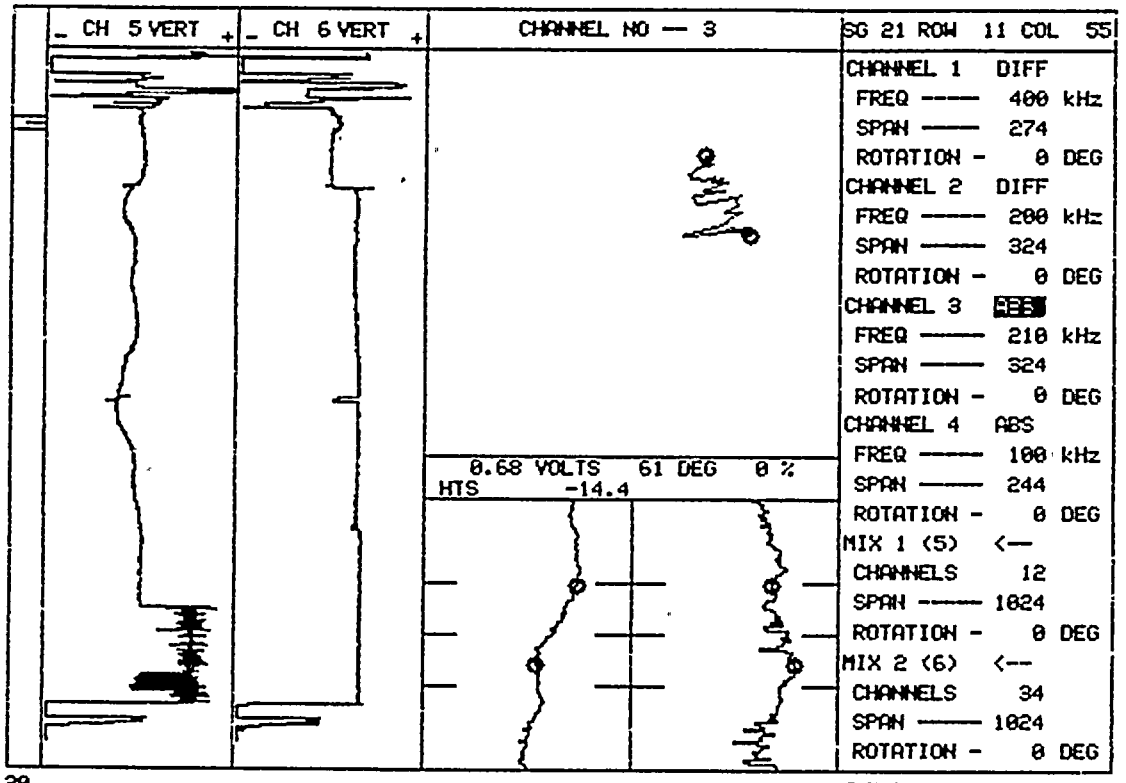

- CH 5 VERT +
- CH 6 VERT +
CHANNEL NO -- 3
SG 21 ROW 32 COL 54
CHANNEL 1 DIFF
FREQ ——— 400 kHz
SPAN ——— 754
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ ——— 200 kHz
SPAN ——— 324
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ ——— 210 kHz
SPAN ——— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ ——— 100 kHz
SPAN ——— 244
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN ——— 1024
ROTATION - 0 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN ——— 1024
ROTATION - 0 DEG
0.50 VOLTS 157 DEG 0 %
HTS -14.0
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1


- CH 5 VERT +
- CH 6 VERT +
CHANNEL NO — 4
SG 21 ROW 32 COL 54
CHANNEL 1 DIFF
FREQ ——— 400 kHz
SPAN ——— 754
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ ——— 200 kHz
SPAN ——— 324
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ ——— 210 kHz
SPAN ——— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ ——— 100 kHz
SPAN ——— 244
ROTATION - 0 DEG
MIX 1 (5) <--
CHANNELS 12
SPAN ——— 1024
ROTATION - 0 DEG
MIX 2 (6) <--
CHANNELS 34
SPAN ——— 1024
ROTATION - 0 DEG
0.31 VOLTS 130 DEG 0 %
HTS -14.0
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1



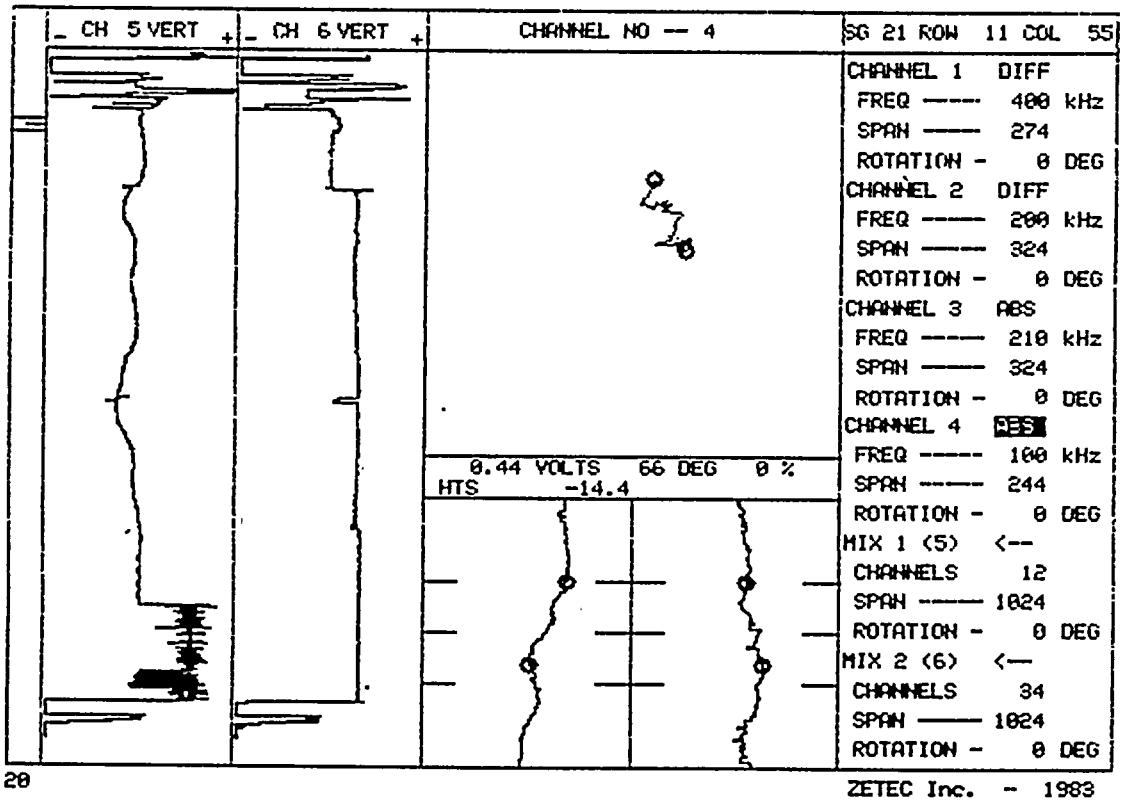





20

ZETEC Inc. - 1983
Edition 12.0 Rev 1

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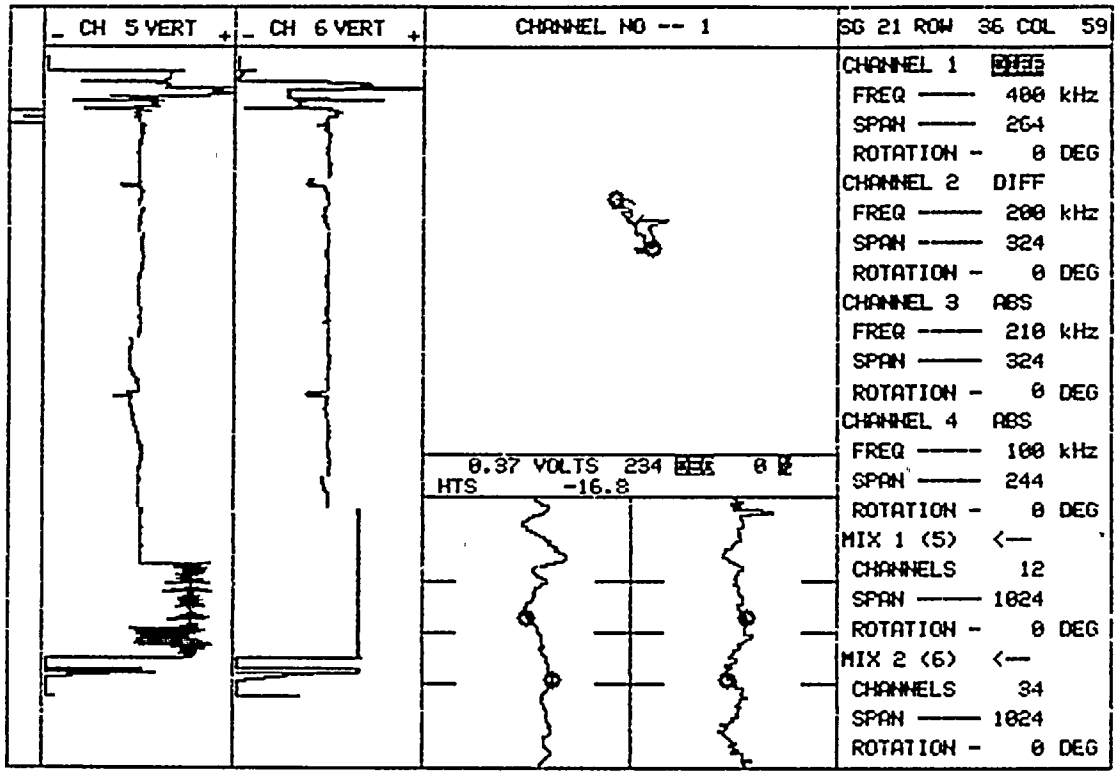
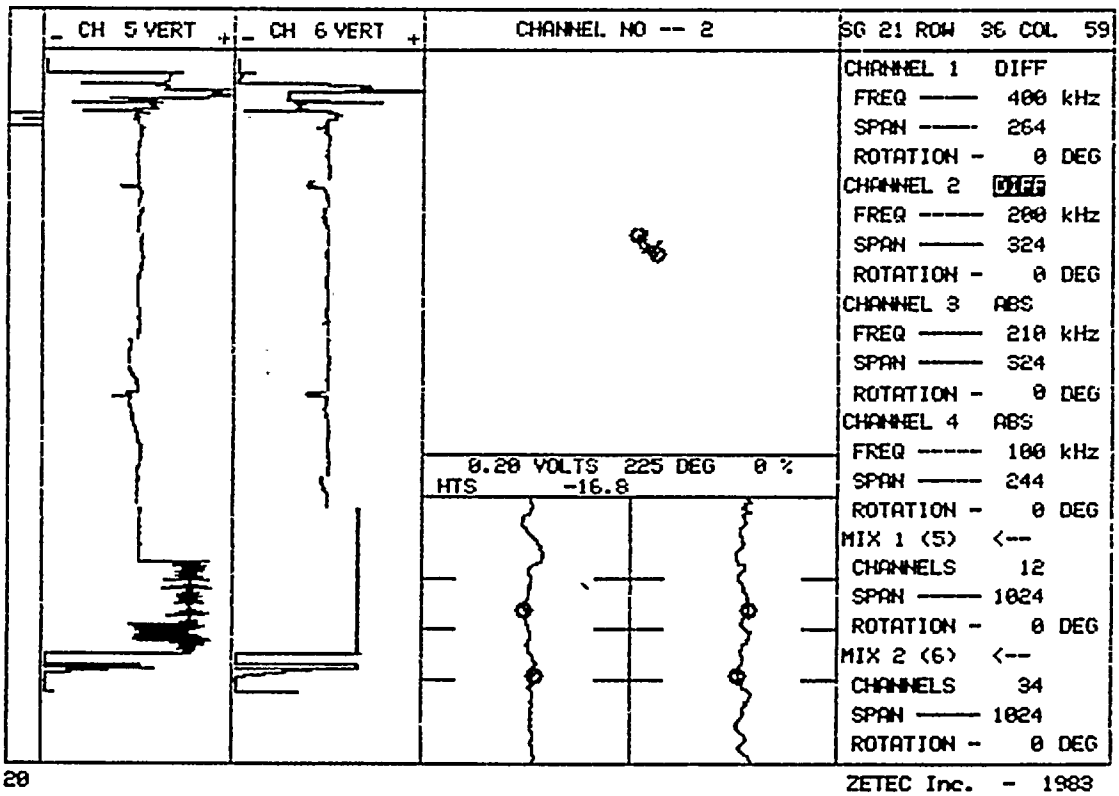
ZETEC Inc. - 1983
Edition 12.0 Rev 1



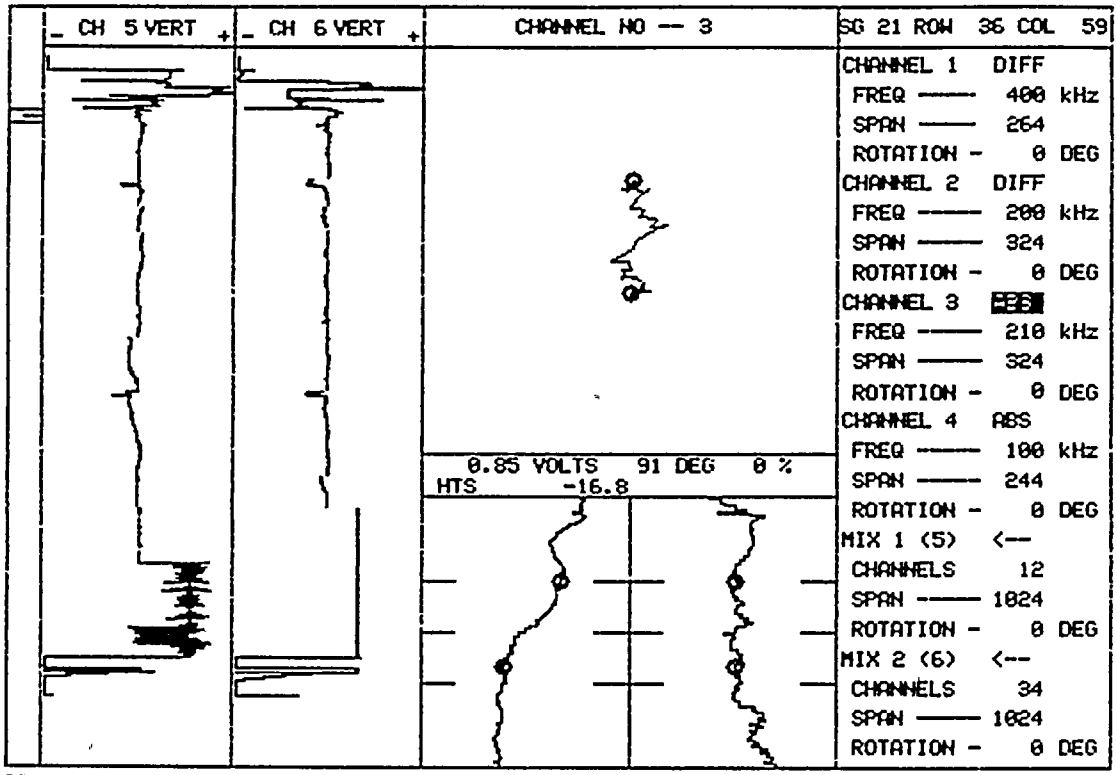

20

ZETEC Inc. - 1983
Edition 12.0 Rev 1



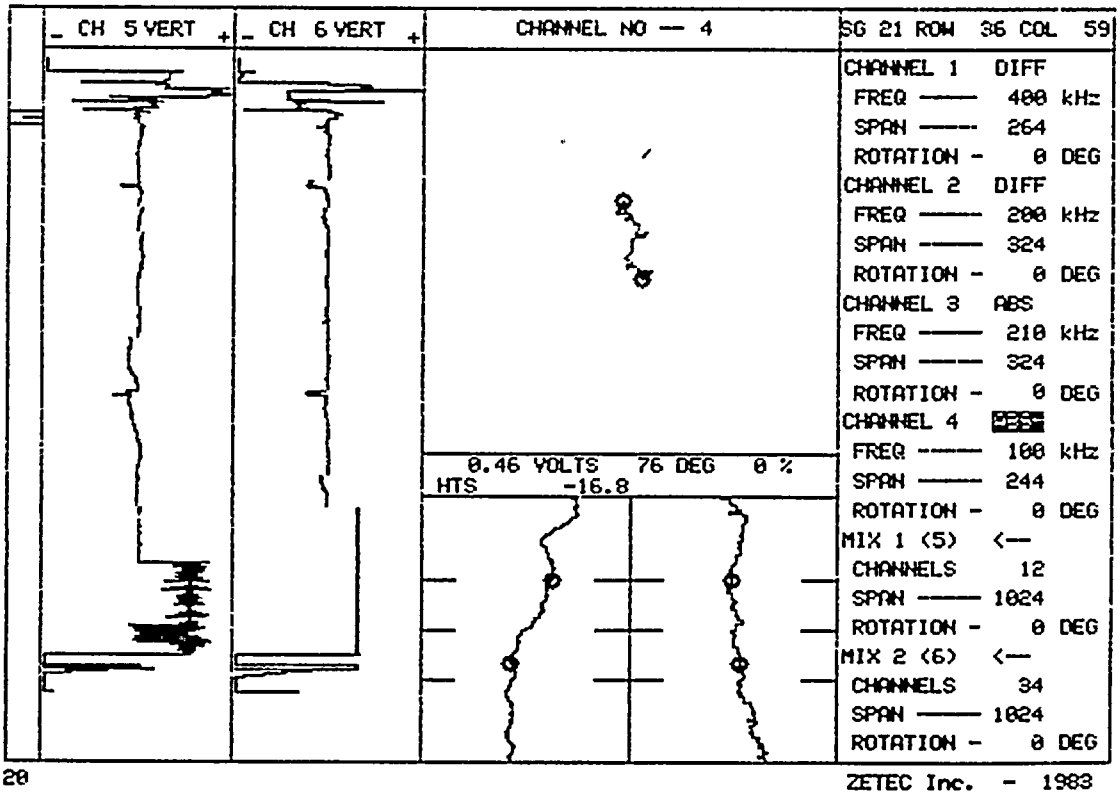

20

ZETEC Inc. - 1983
Edition 12.0 Rev 1

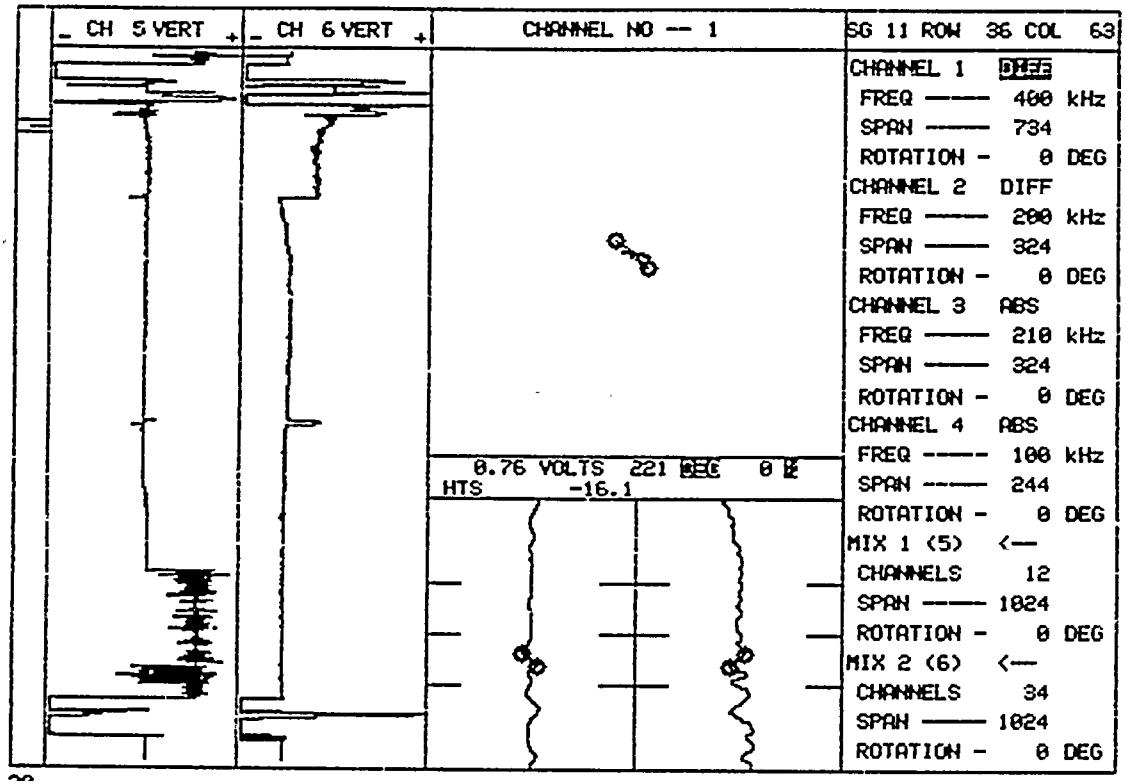



20

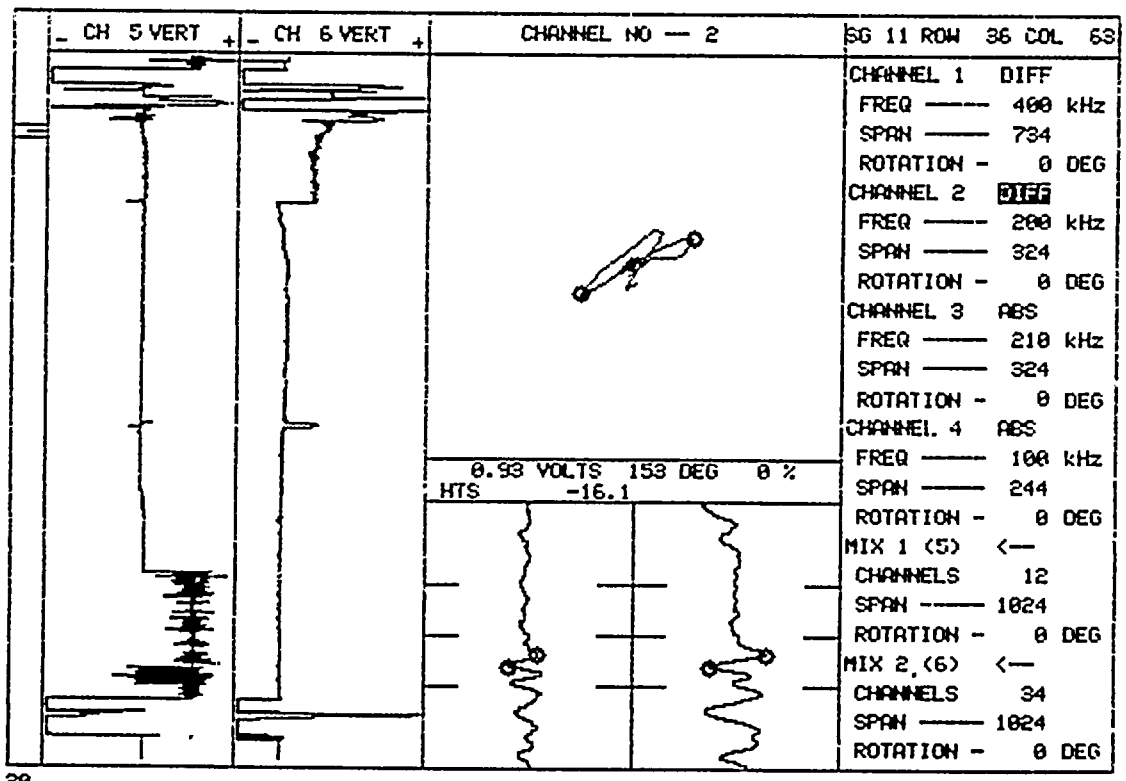




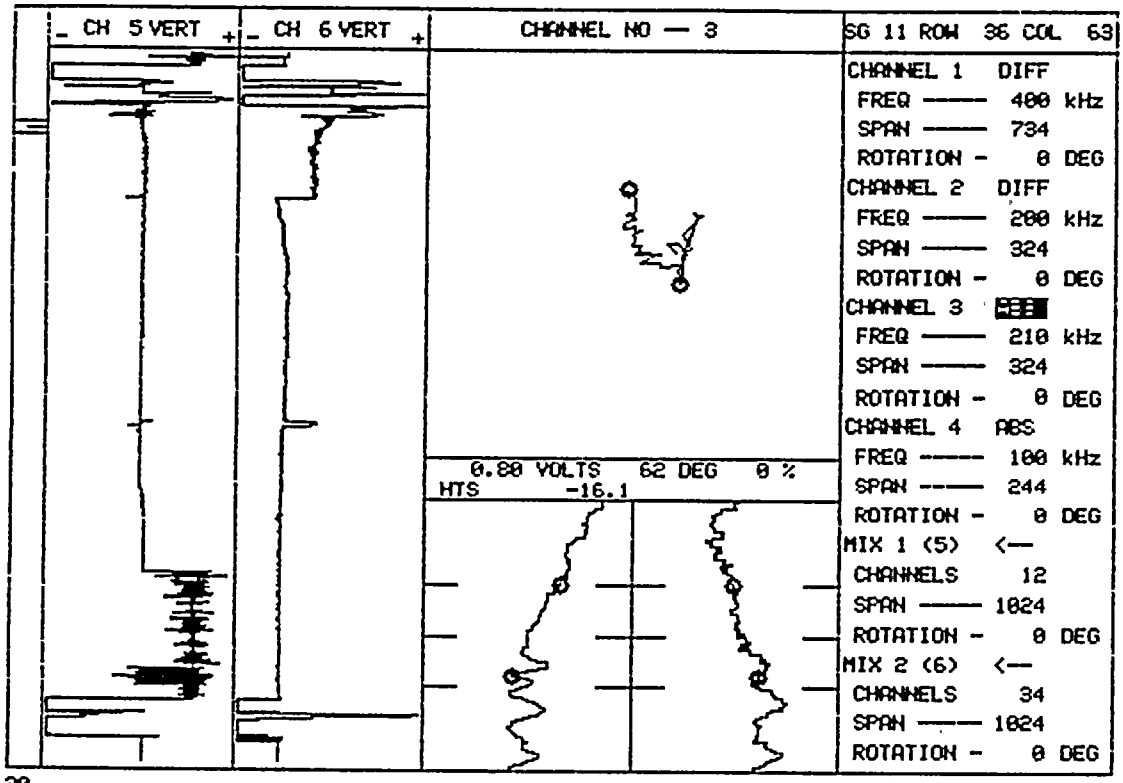

20

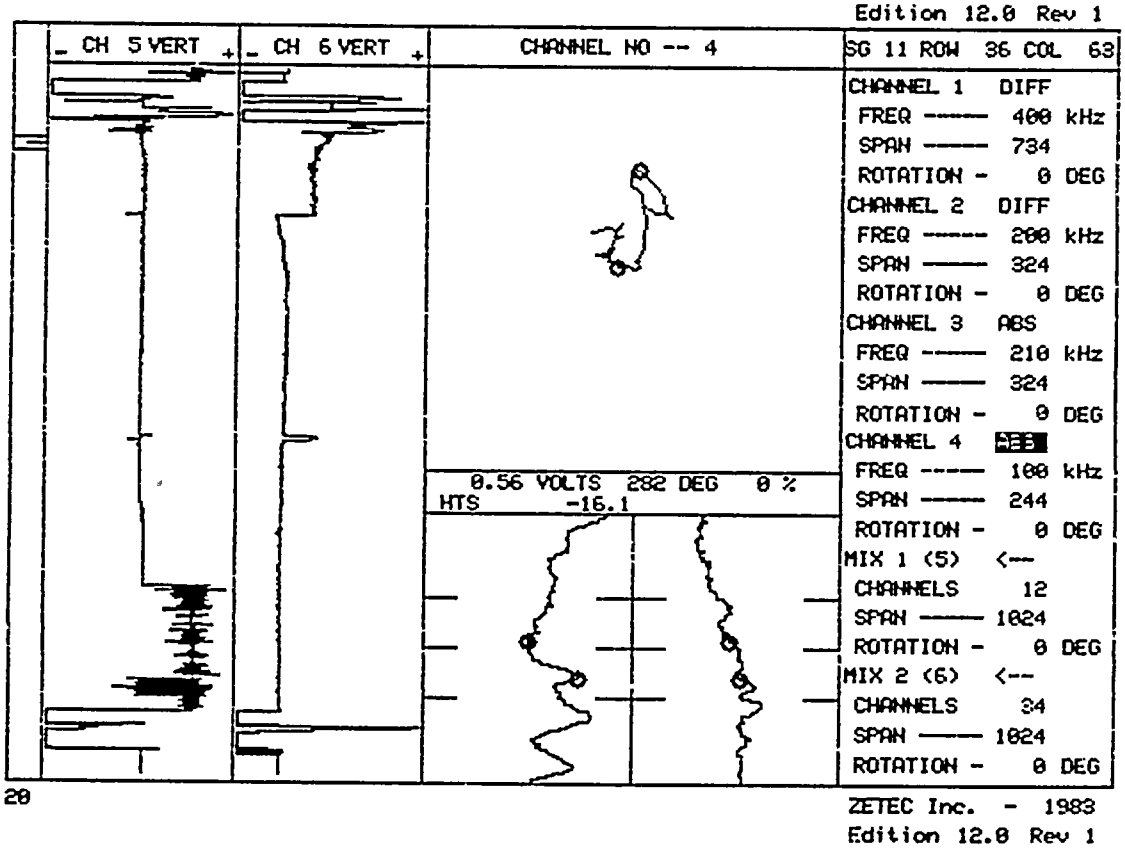


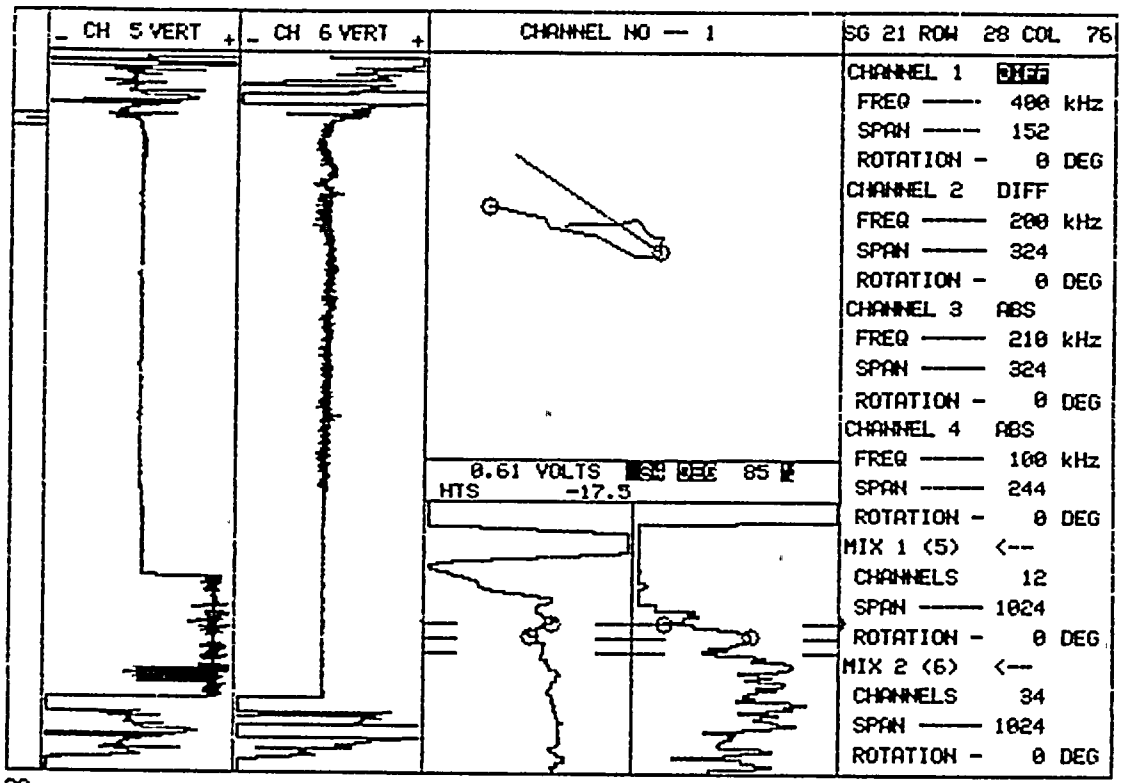

ZETEC Inc. - 1983
Edition 12.0 Rev 1



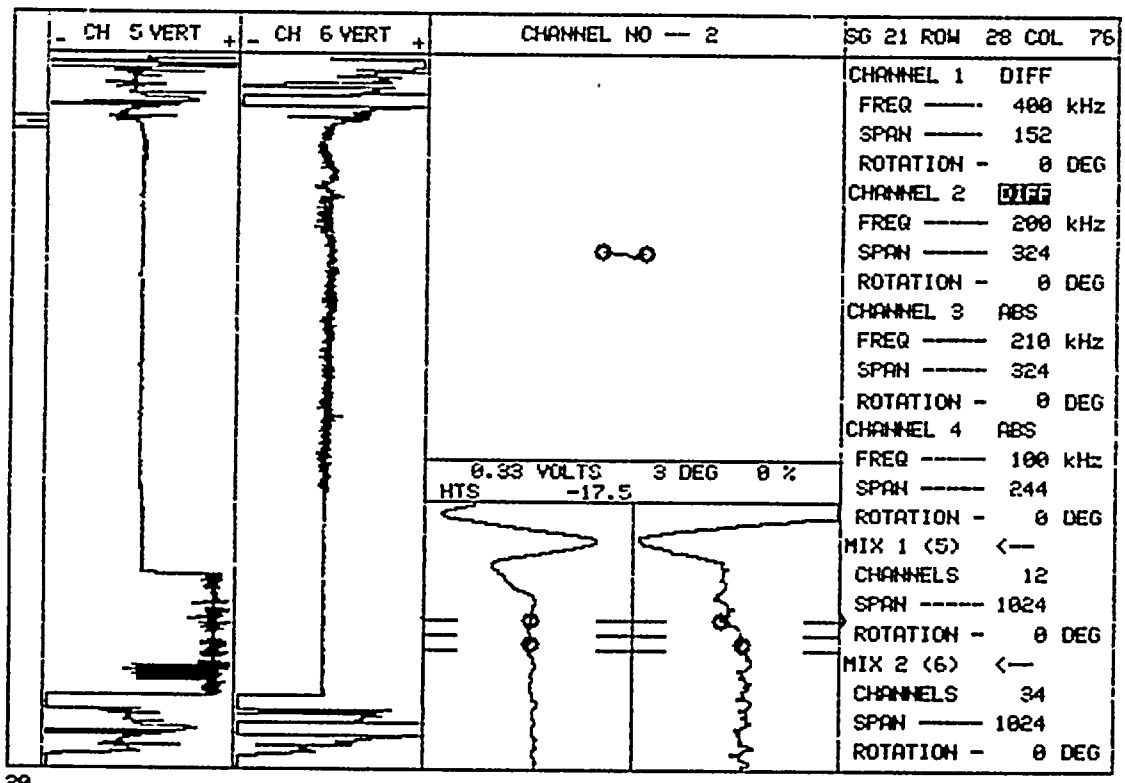

ZETEC Inc. - 1983
Edition 12.0 Rev 1

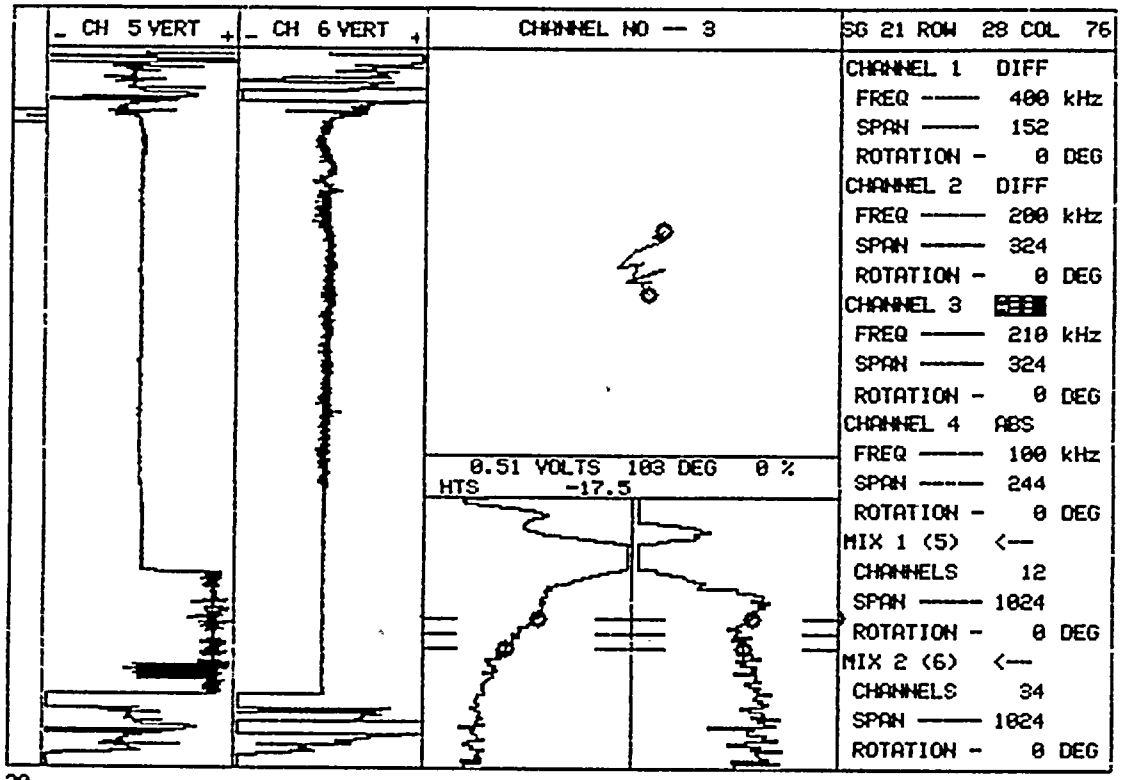

- CH 5 VERT +
- CH 6 VERT +
CHANNEL NO — 3
SG 11 ROW 36 COL 63
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 734
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 3
FREQ —— 210 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
0.80 VOLTS 62 DEG 0 %
HTS -16.1
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1


- CH 5 VERT +
- CH 6 VERT +
CHANNEL NO -- 4
SG 11 ROW 36 COL 63
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 734
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ —— 210 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 4
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
0.56 VOLTS 282 DEG 0 %
HTS -16.1
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1





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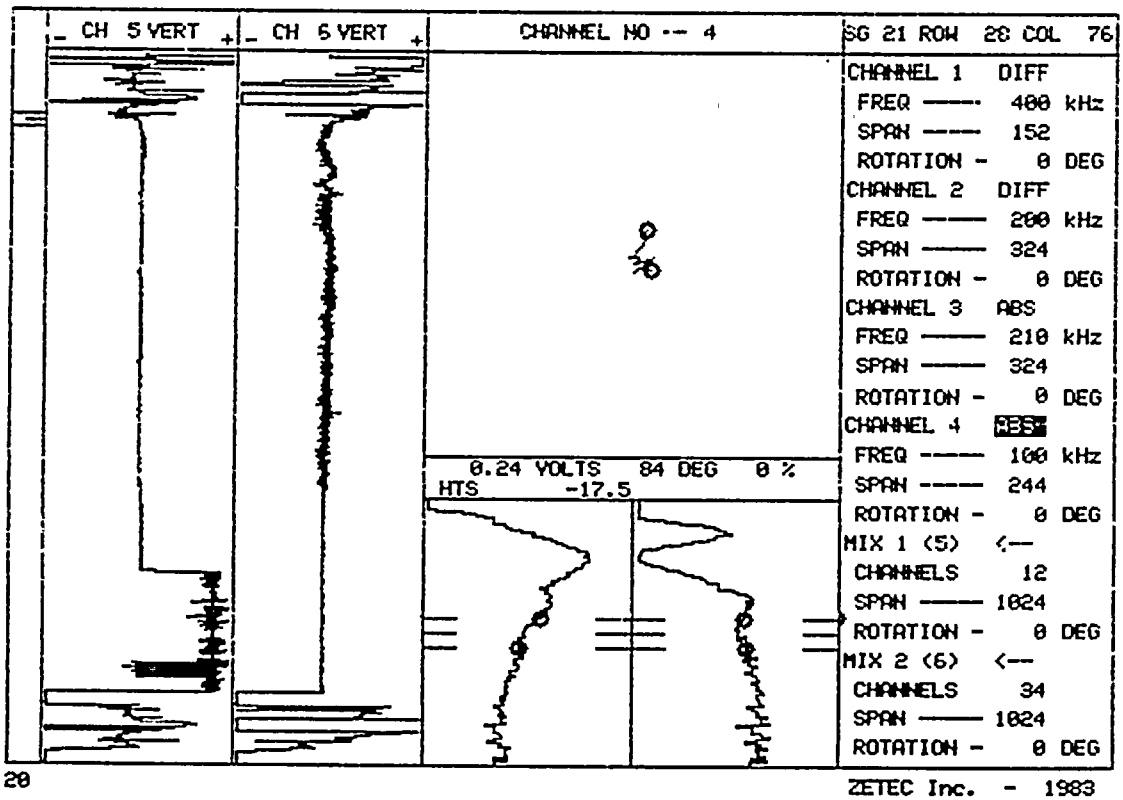


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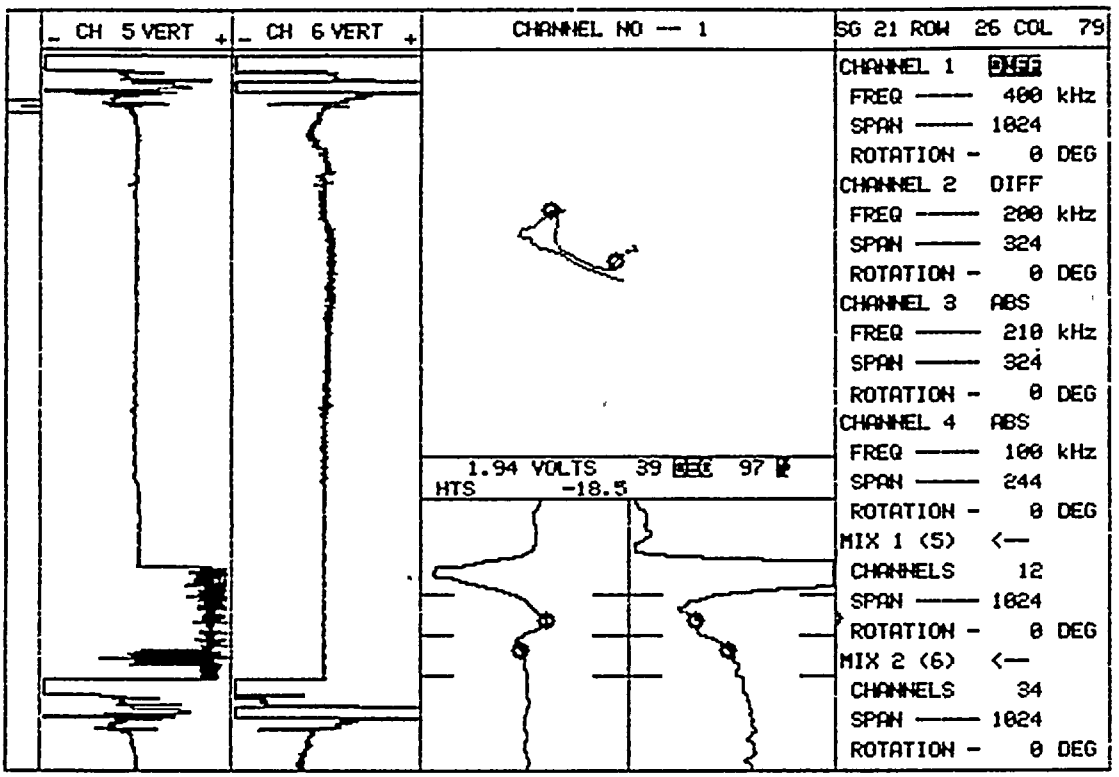


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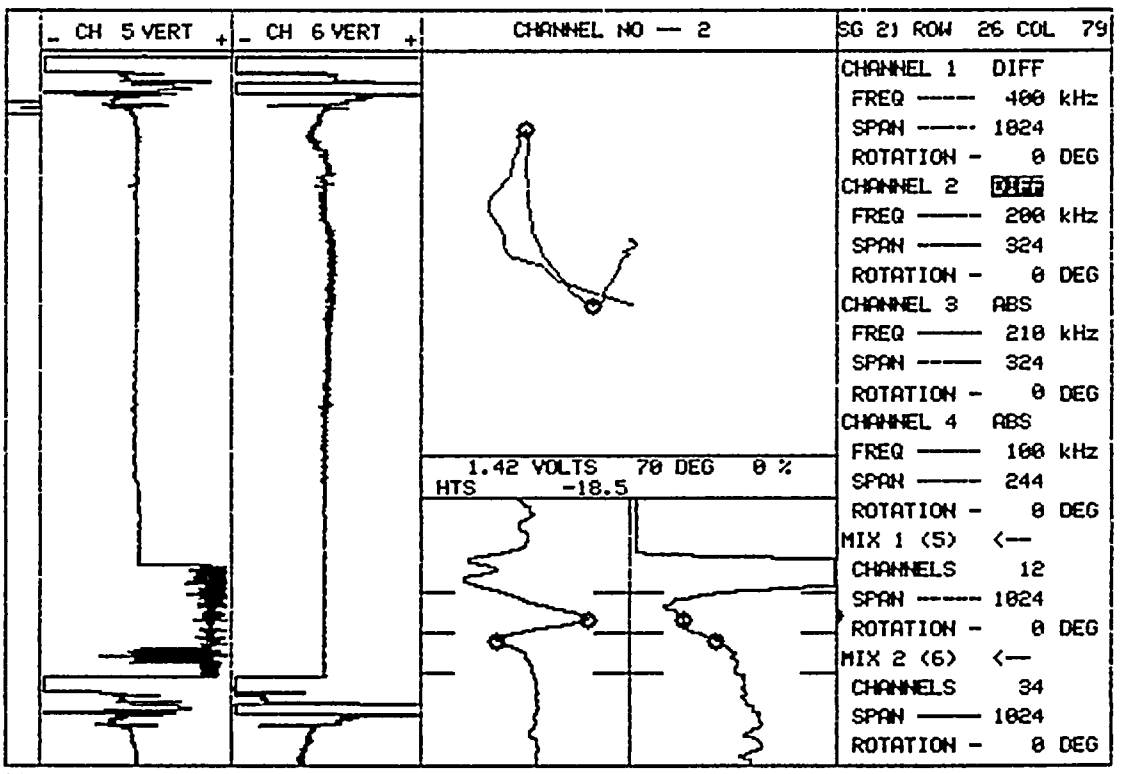


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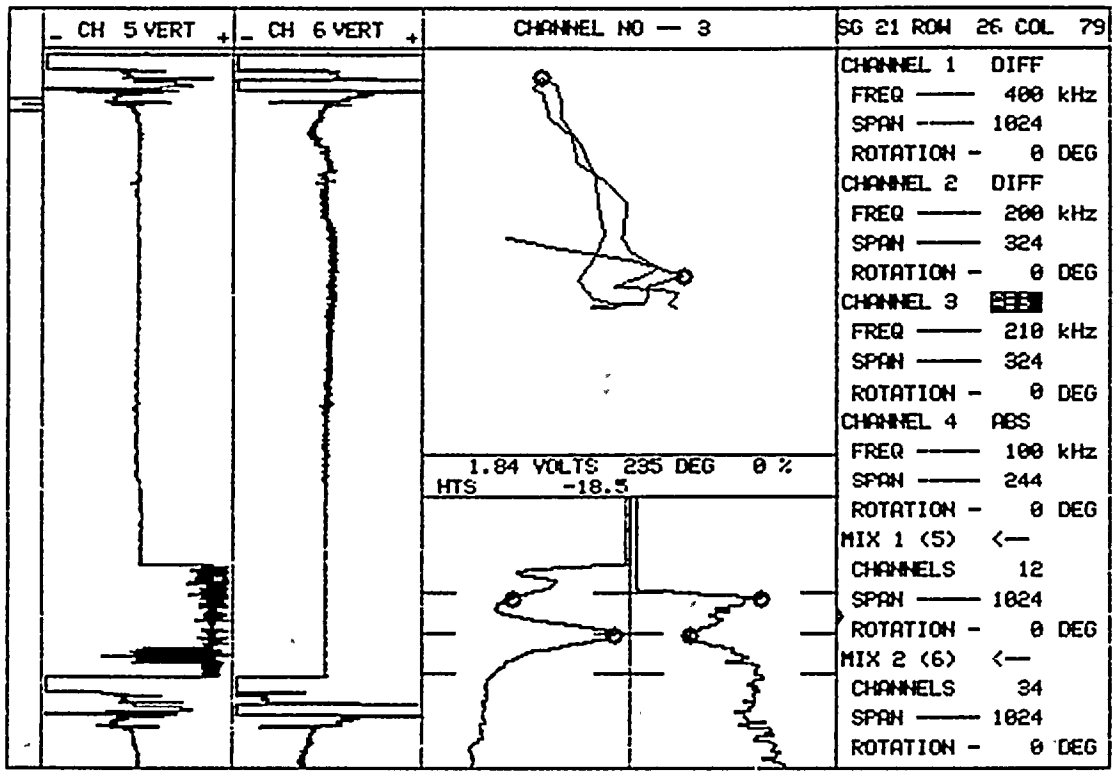






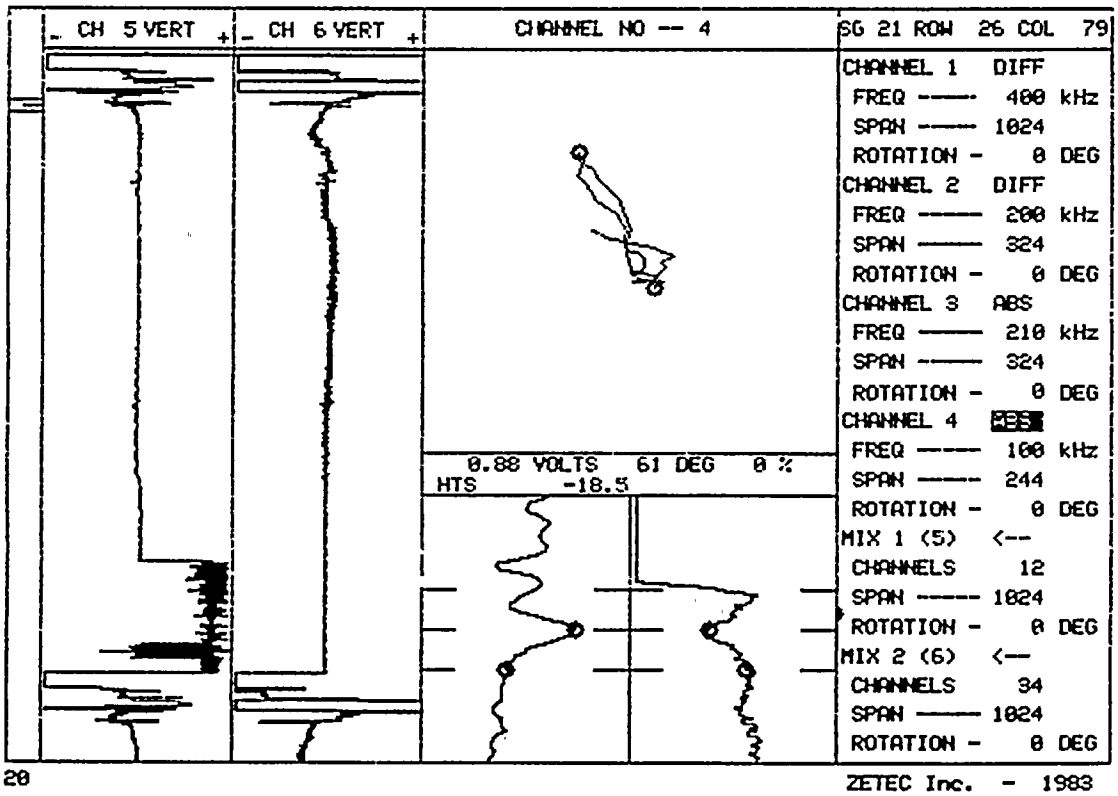

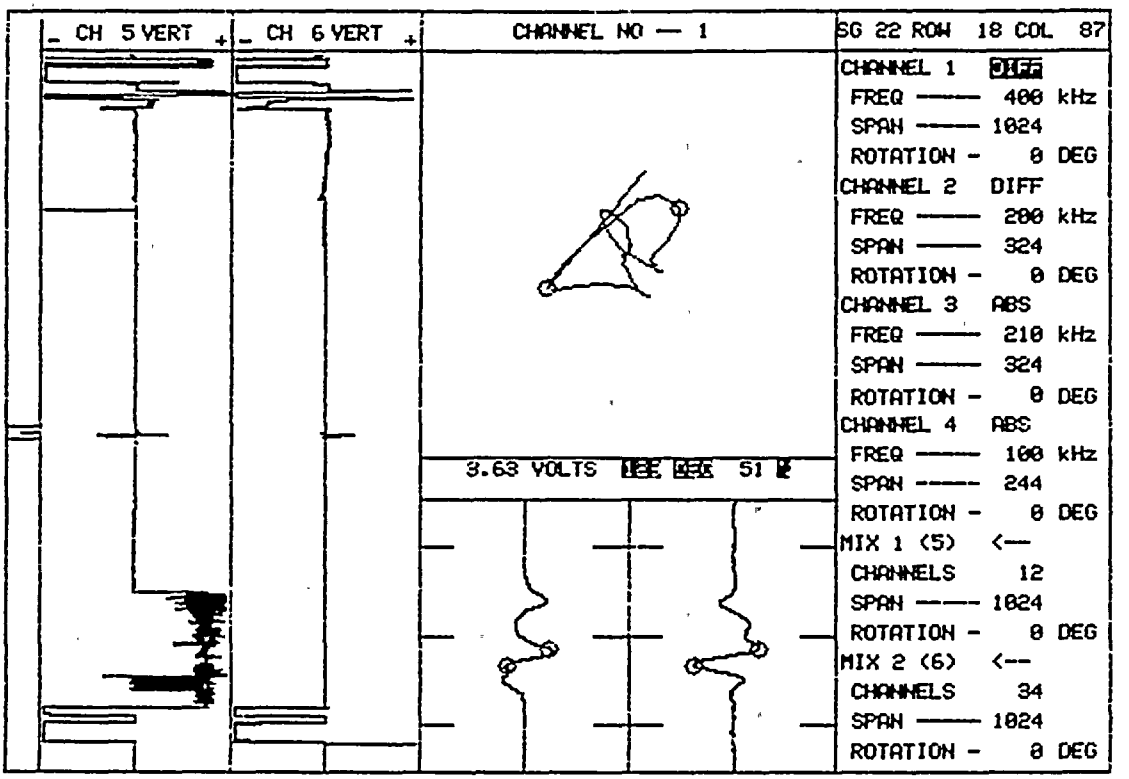
CH 5 VERT
CH 6 VERT
CHANNEL NO — 1
SG 22 ROW 18 COL 87
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ —— 210 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
3.63 VOLTS 51 %
20
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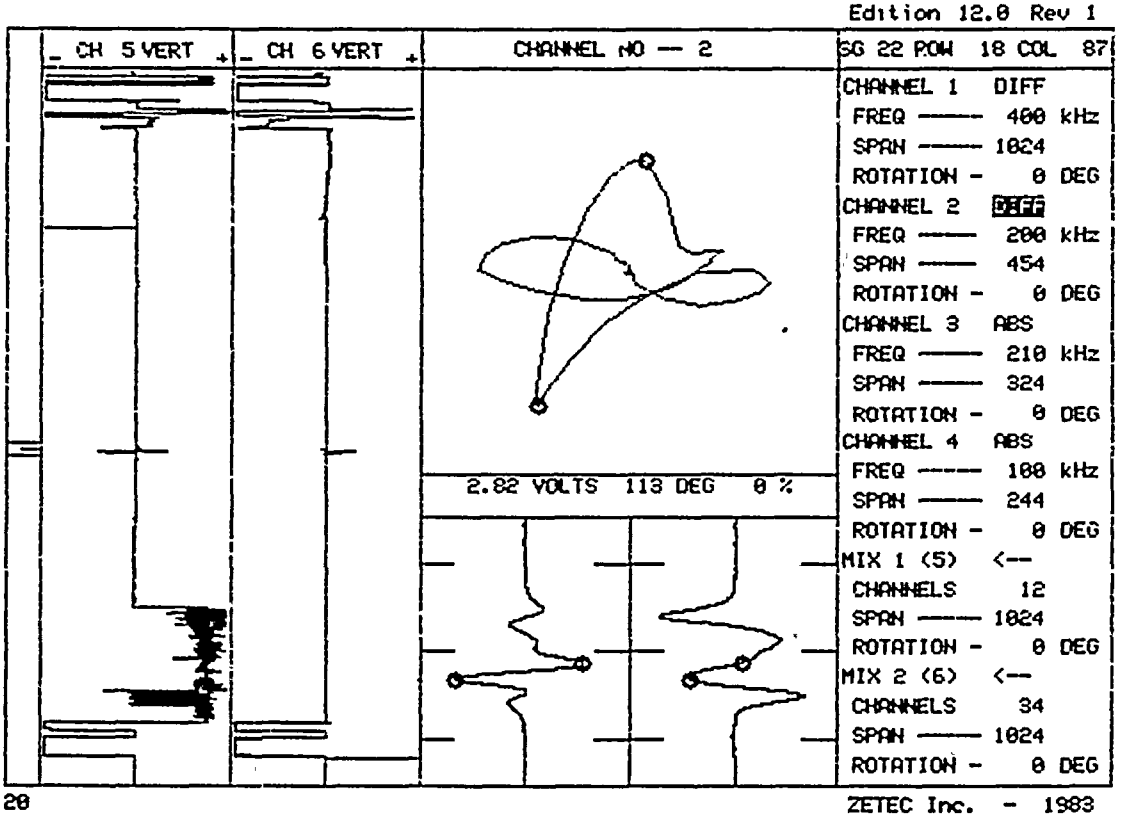
CH 5 VERT
CH 6 VERT
CHANNEL NO — 2
SG 22 ROW 18 COL 87
CHANNEL 1 DIFF
FREQ —— 400 kHz
SPAN —— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ —— 200 kHz
SPAN —— 454
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ —— 210 kHz
SPAN —— 324
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ —— 100 kHz
SPAN —— 244
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN —— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN —— 1024
ROTATION - 0 DEG
2.82 VOLTS 113 DEG 0 %
20
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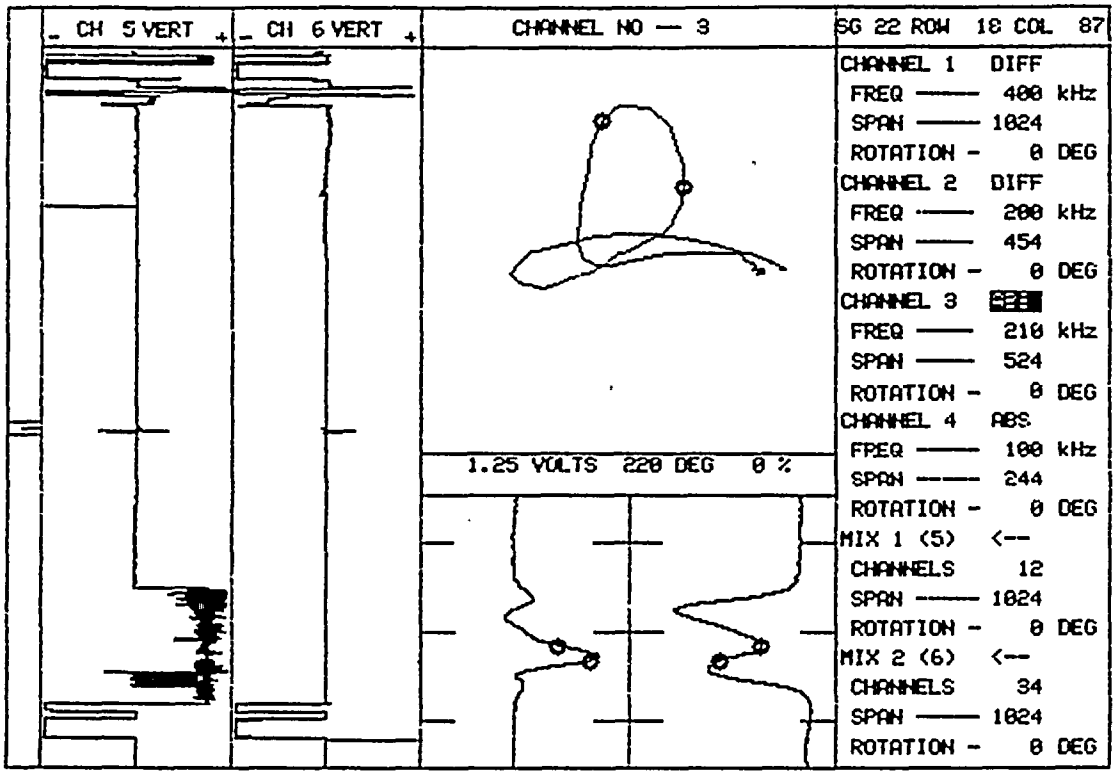






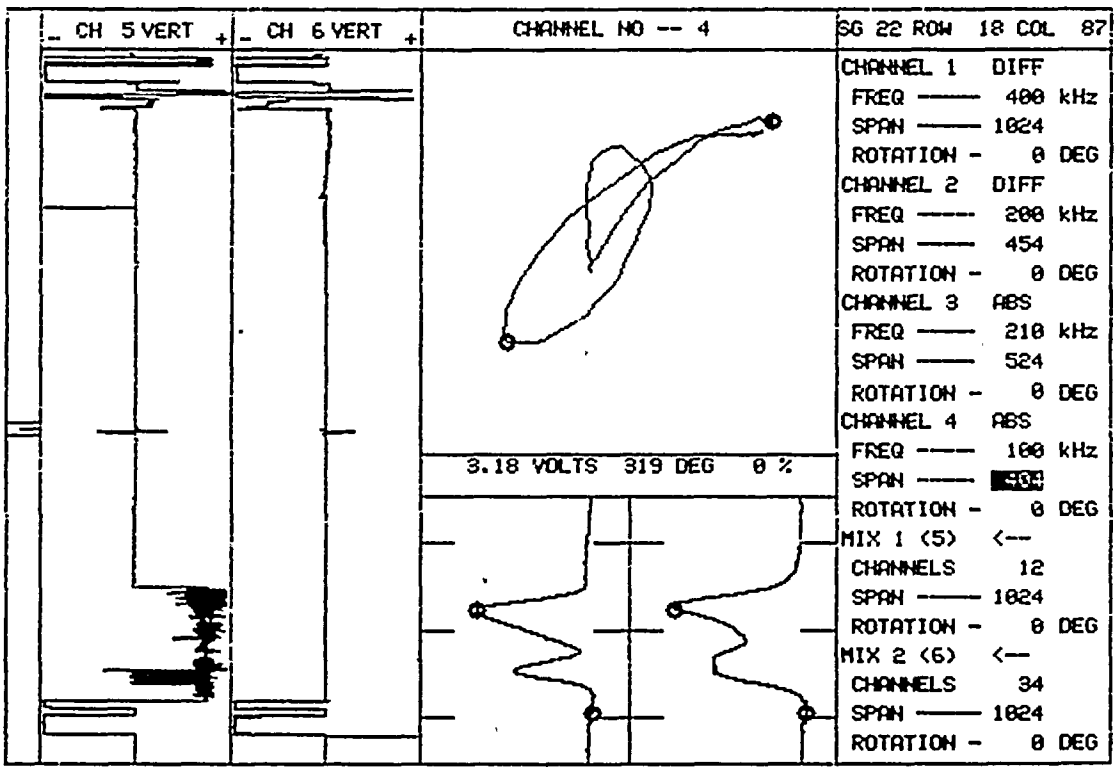

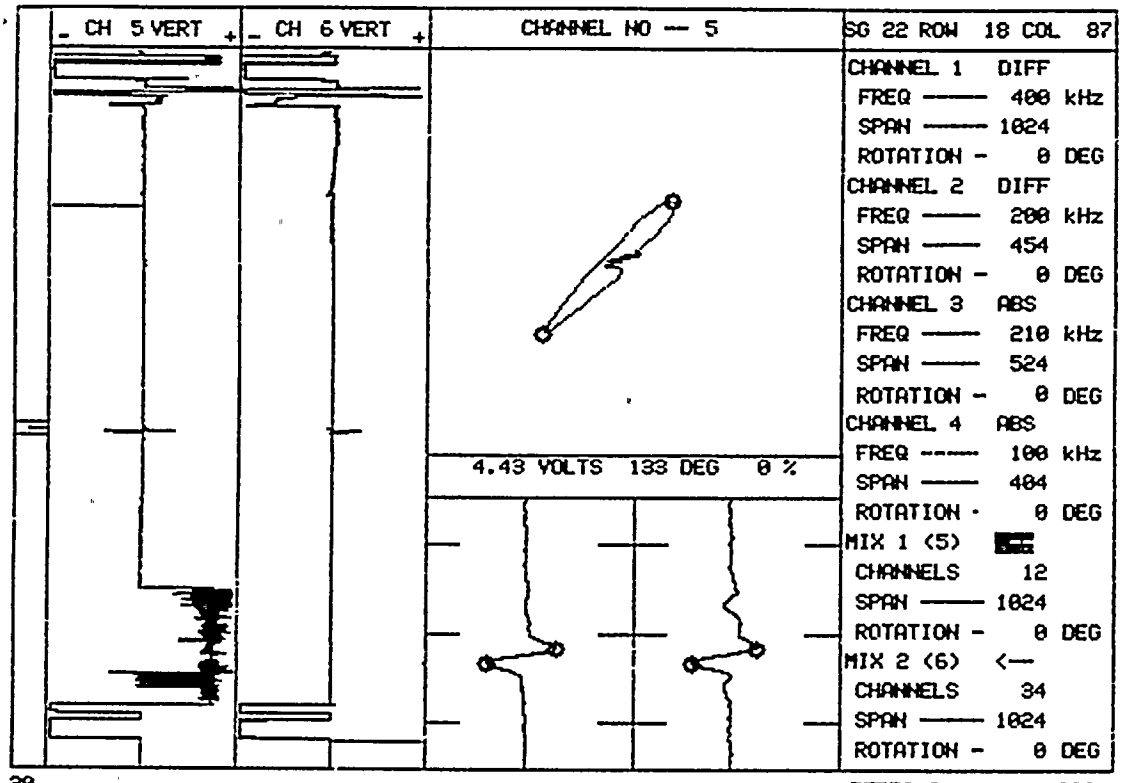
- CH 5 VERT +
- CH 6 VERT +
CHANNEL NO -- 5
SG 22 ROW 18 COL 87
CHANNEL 1 DIFF
FREQ ——— 400 kHz
SPAN ——— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ ——— 200 kHz
SPAN ——— 454
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ ——— 210 kHz
SPAN ——— 524
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ ——— 100 kHz
SPAN ——— 404
ROTATION - 0 DEG
MIX 1 (5)
CHANNELS 12
SPAN ——— 1024
ROTATION - 0 DEG
MIX 2 (6) <—
CHANNELS 34
SPAN ——— 1024
ROTATION - 0 DEG
4.43 VOLTS 133 DEG 0 %
20
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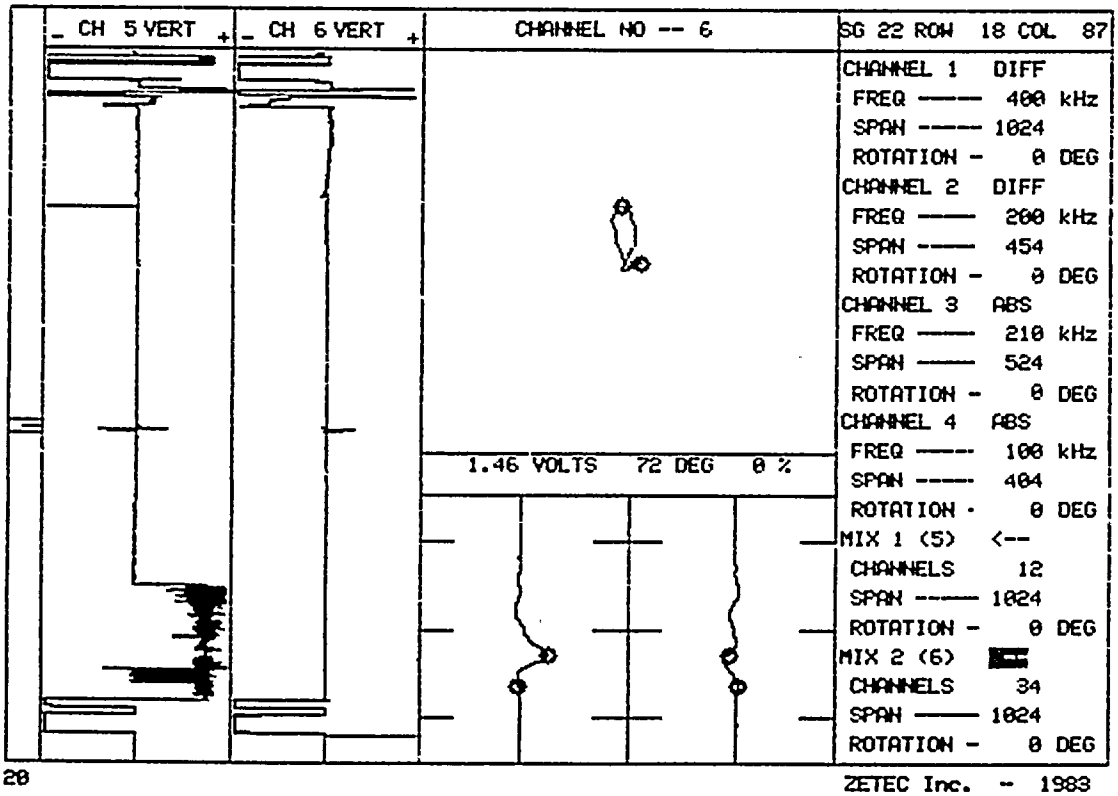
- CH 5 VERT +
- CH 6 VERT +
CHANNEL NO -- 6
SG 22 ROW 18 COL 87
CHANNEL 1 DIFF
FREQ ——— 400 kHz
SPAN ——— 1024
ROTATION - 0 DEG
CHANNEL 2 DIFF
FREQ ——— 200 kHz
SPAN ——— 454
ROTATION - 0 DEG
CHANNEL 3 ABS
FREQ ——— 210 kHz
SPAN ——— 524
ROTATION - 0 DEG
CHANNEL 4 ABS
FREQ ——— 100 kHz
SPAN ——— 404
ROTATION - 0 DEG
MIX 1 (5) <—
CHANNELS 12
SPAN ——— 1024
ROTATION - 0 DEG
MIX 2 (6)
CHANNELS 34
SPAN ——— 1024
ROTATION - 0 DEG
1.46 VOLTS 72 DEG 0 %
20
ZETEC Inc. - 1983
Edition 12.0 Rev 1