HALLIBURTON LOGGING SERVICES, INC.

FINAL PRINT

DUAL INDUCTION SHORT GUARD LOG

5" = 100'

COMPANY ______________

WELL ________________

FIELD ________________

COUNTY __________ ST __

COMPANY ARCO OIL AND GAS COMPANY

WELL C.E.R. 41-16-64

FIELD MIST

COUNTY COLUMBIA

STATE OR

API NO.

LOCATION :
217.27 FEET SOUTH AND
796.34 FEET WEST FROM THE
NORTHEAST CORNER OF:
SEC. 16 TWP 6N RGE 4W

OTHER SERVICES
AVL/GR
SDL/DSN/GR

PERMANENT DATUM G.L. ELEV. 1616.5
LOG MEASURED FROM K.B. 11.5FT.ABOVE PERM.DATUM
DRILLING MEASURED FROM KELLY BUSHING

ELEV.:K.B. 1628.0
D.F. ------
G.L. 1616.5

DATE	09/10/89			
RUN NO.	ONE			
DEPTH-DRILLER	2107			
DEPTH- LOGGER	2104			
BTM. LOG INTER.	2101			
TOP LOG INTER.	1104			
CASING-DRILLER	7 IN.@1104	@	@	@
CASING- LOGGER	1104			
BIT SIZE	6 1/4			
TYPE FLUID IN HOLE	E-Z POLYMER			
DENS. : VISC	9.5 :43	:	:	:
PH : FLUID LOSS	10.0 :6.2	:	:	:
SOURCE OF SAMPLE	CIRCULATED			
RM @ MEAS. TEMP.	5.0 @72.	@	@	@
RMF @ MEAS. TEMP.	4.8 @78.	@	@	@
RMC @ MEAS. TEMP.	3.1 @78.	@	@	@
SOURCE RMF : RMC	MEAS.:MEAS.	:	:	:
RM @ BHT	3.59 @103.	@	@	@
TIME SINCE CIRC.	3.5 HOURS			
TIME ON BOTTOM	6:15 PM			
MAX. REC. TEMP.	103. @BHT	@	@	@
EQUIP. : LOCATION	2890 :WDLND	:	:	:
RECORDED BY	D.MCDANIEL			
WITNESSED BY	R.SPAETH	J.EASTES		

Fold Here

Service Ticket No.: 12268 API Serial No.: PGM Version: 1.31 PC

Change in Mud Type or Additional Samples

Date/Sample No.	09/10/89:ONE	/ / :
Depth-Driller		
Type Fluid in Hole		
Dens. : Visc.	:	:
pH. : Fluid Loss	:	:
Source of Sample		
Rm @ Meas.Temp.	@	@
Rmf @ Meas.Temp.	@	@
Rmc @ Meas.Temp.	@	@
Source: Rmf:Rmc	:	:
Rm @ BHT	3.59 @103.	@
Rmf @ BHT	3.71 @103.	@
Rmc @ BHT	2.39 @103.	@

RESISTIVITY SCALE CHANGES

Type Log	Depth	Scale Up Hole	Scale Down Hole

RESISTIVITY EQUIPMENT DATA

Run No	Tool Type & No	Pad Type	Tool Pos.	Other
ONE	DUAL #W109432	N/A	1.5"S.O.	M412
ONE	SGRD #W108932	N/A	1.5"S.O.	M416

EQUIPMENT DATA

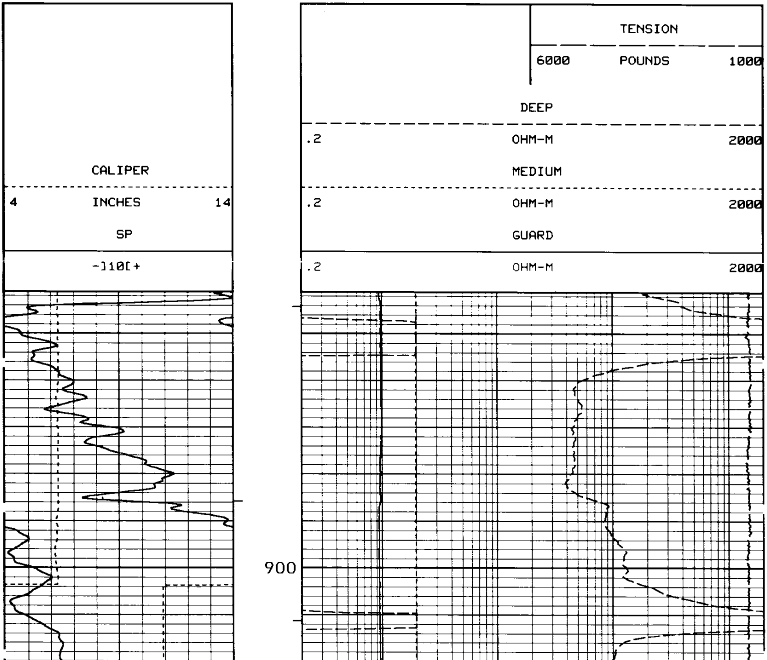
GAMMA		ACOUSTIC		DENSITY		NEUTRON	
Run No.	N/A	Run No.	N/A	Run No.	N/A	Run No.	N/A
Serial No.	W108594	Serial No.	W112458	Serial No.	W109742	Serial No.	W108750
Model No.	432	Model No.	305	Model No.	465	Model No.	434
Diameter	3 5/8	No.of Cent.	FOUR	Diameter	4 1/2	Diameter	3 5/8
Detector Model No.	N/A	Spacing	1 FOOT	Log Type	GAMMA	Log Type	NEUTRON
Type	SCINT.			Source Type	CS137	Source Type	AM241BE
Length	4 IN.	LSA	Y	Serial No.	118	Serial No.	66
Distance To Source	N/A	FWDA	N	Strength	1.5 CU.	Strength	19.5 CU

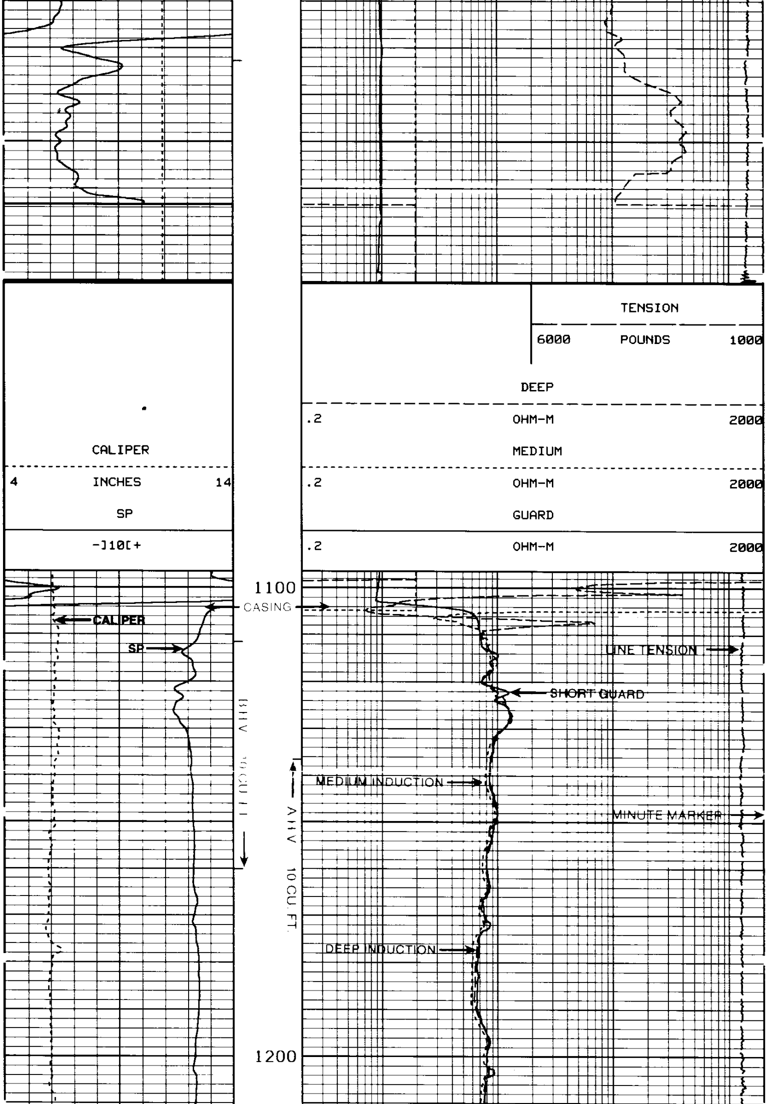
LOGGING DATA

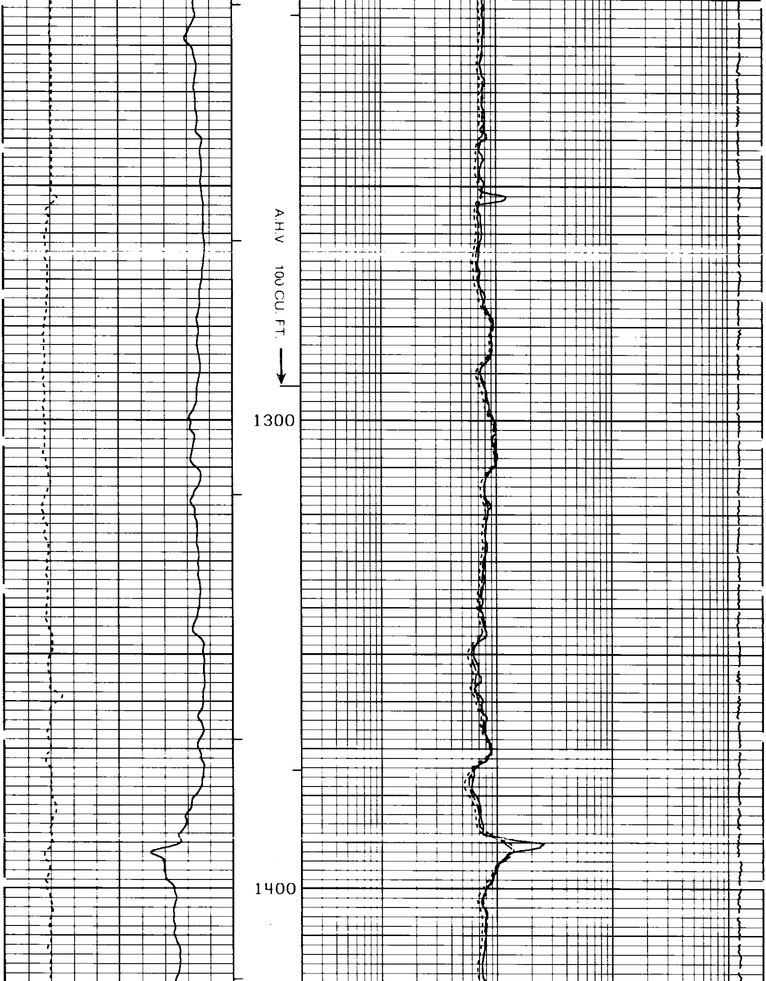
GENERAL				GAMMA		ACOUSTIC			DENSITY			NEUTRON		
Run	Depth		Speed	Scale		Scale			Scale			Scale		
No.	From	To	Ft/Min	L	R	L	R	Matrix	L	R	Matrix	L	R	Matrix
ONE	2101	1104	30.											

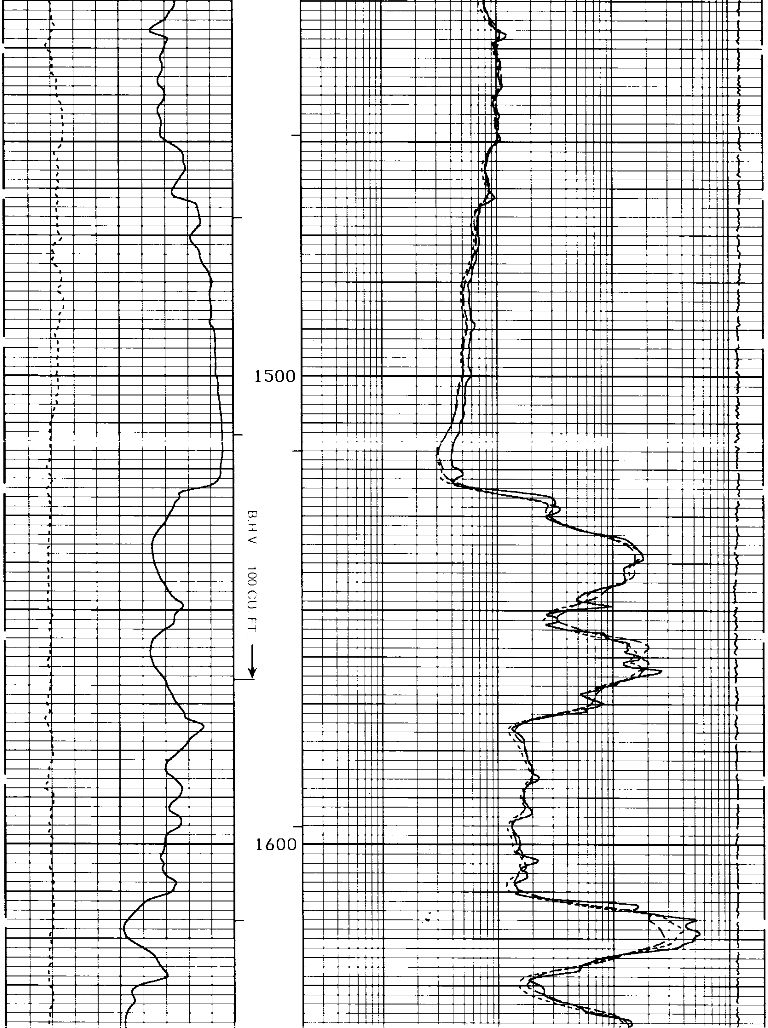
Remarks: ANNULAR HOLE VOLUME CALCULATED FOR 3 1/2 INCH PRODUCTION CASING.
SONIC MATRIX=55.6 US/FT, A=.81, AND M=2.0 FOR RWA CALCULATIONS.
EXTRA REPEAT SECTION RUN TO SHOW SONIC RESPONSE FROM 1600 TO 1700 FEET.
CASING STRIP RUN ON TOP OF LOG TO SHOW DELTA-T IN FREE PIPE AND CALIPER.
SQUARING OF DEEP INDUCTION BETWEEN 1650 AND 1700 DUE TO MAXIMUM READINGS.

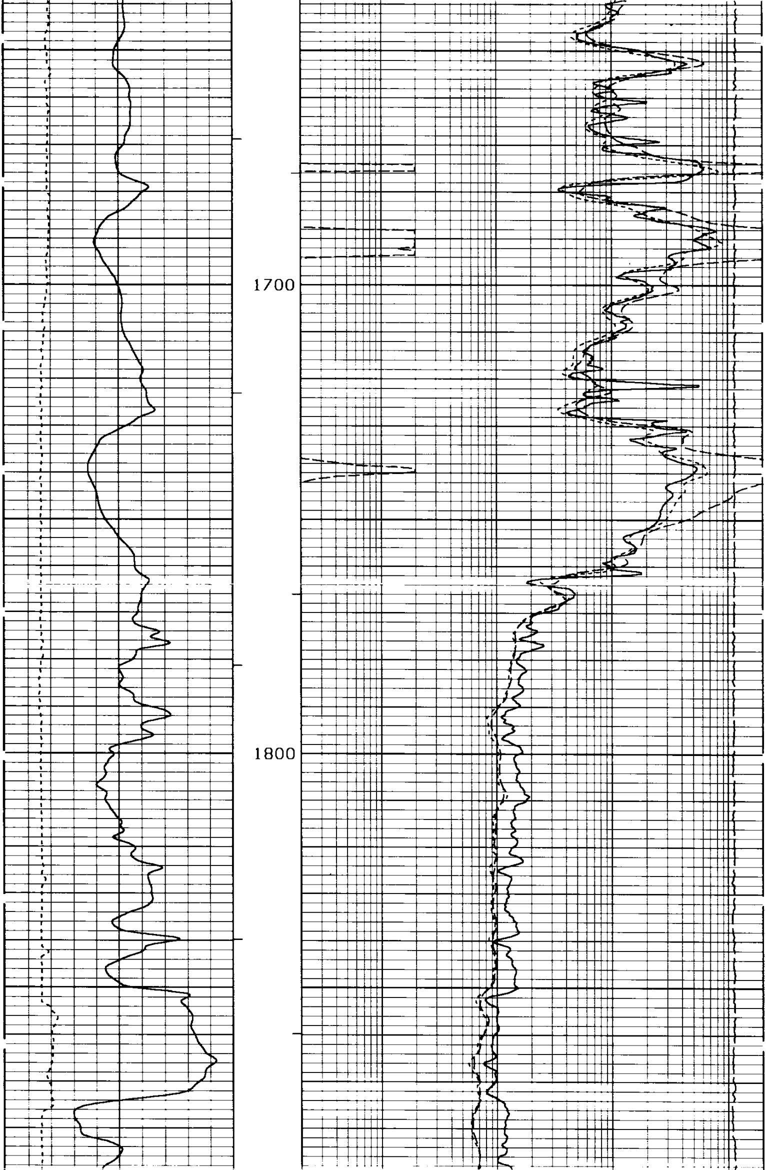
Halliburton Logging Services, Inc. does not guarantee the accuracy of any interpretation of log data, conversion of log data to physical rock parameters or recommendations which may be given by HLS personnel or which may appear on the log or in any other form. Any user of such data, interpretations, conversions or recommendations agrees that HLS is not responsible except where due to gross negligence or wilful misconduct, for any loss, damages, or expenses resulting from the use thereof.

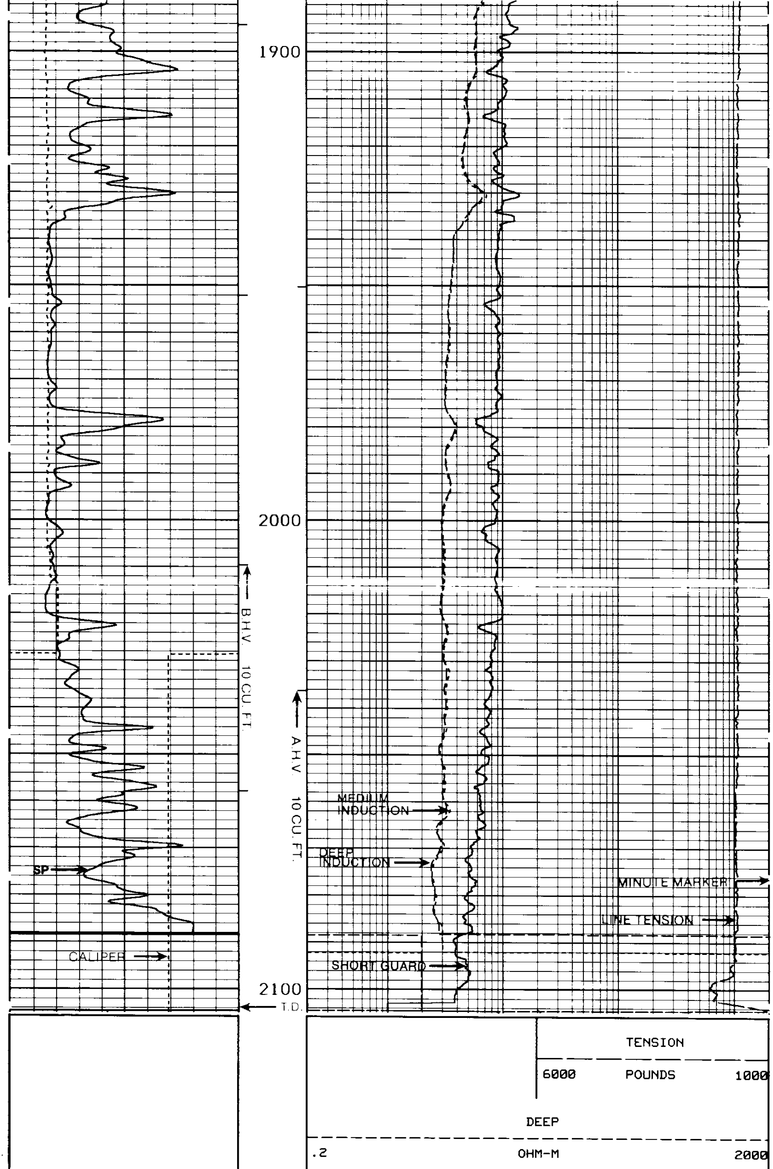


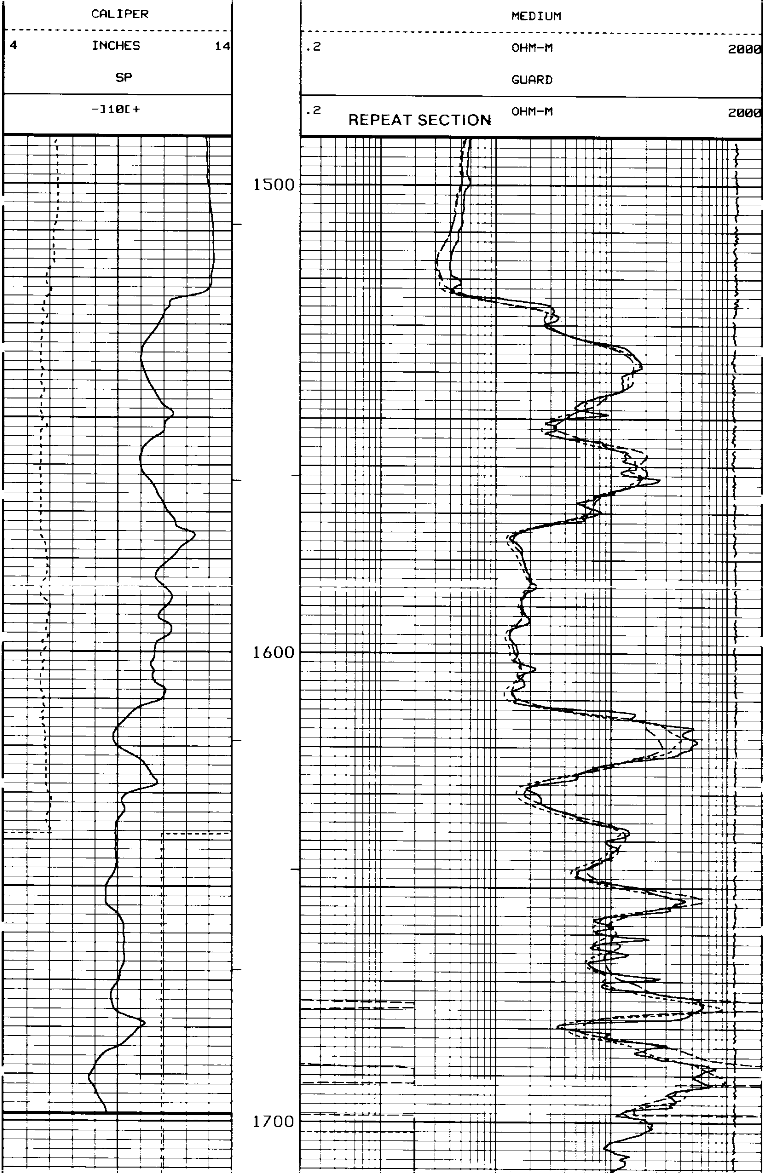











REPEAT SECTION

TENSION

6000 POUNDS 1000

DEEP

.2 OHM-M 2000

CALIPER

MEDIUM

4 INCHES 14

.2 OHM-M 2000

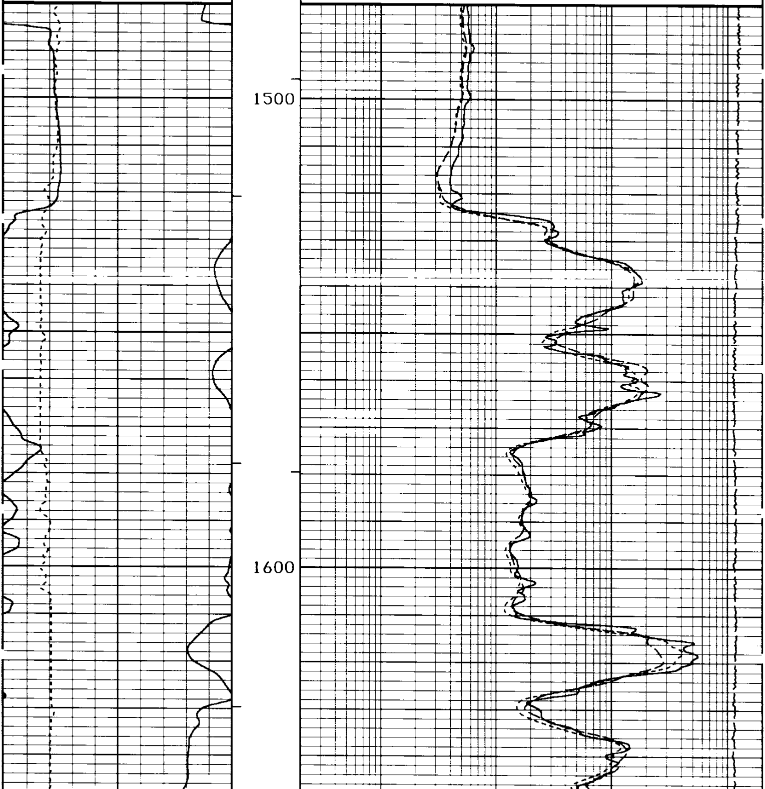
SP

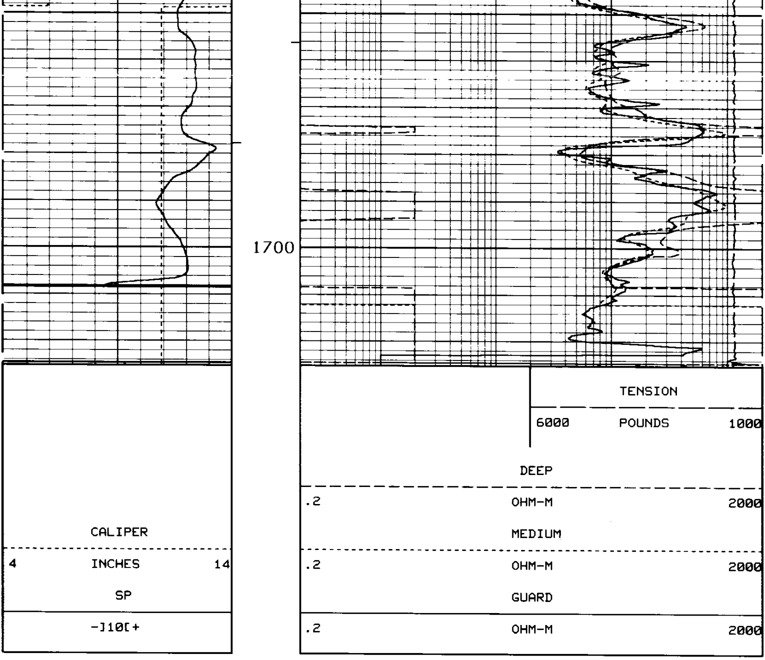
GUARD

-]10[+

.2 OHM-M 2000

REPEAT SECTION





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                  SHORT GUARD   SHOP CALIBRATION SUMMARY
PERFORMED:  10:57:24  08/31/89    LAST SHOP CALIBRATION:   14:26:45  08/10/89
SERIAL NUMBER: 108932             PROGRAM VERSION: 1.31 PC
MODEL: #405
PERFORMED BY: MCDANIEL
                          MEASURED        CALIBRATED         UNITS
                          --------        ----------         -----
EXT. CAL. POINT #1           1.996            2.000          OHM-M
EXT. CAL. POINT #2          20.018           20.000          OHM-M
EXT. CAL. POINT #3         192.589          200.000          OHM-M
INTERNAL REFERENCE          19.974           19.942          OHM-M

                  SHORT GUARD  BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED:  17:18:45  09/10/89    LAST SHOP CALIBRATION:   10:57:24  08/31/89

                             SHOP           FIELD            UNITS
                          --------       ---------          ------
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 INTERNAL REFERENCE          19.941          19.916          OHM-M


                      SHORT GUARD  AFTER SURVEY FIELD CHECK SUMMARY
 PERFORMED:  18:53:03  09/10/89    LAST SHOP CALIBRATION:    10:57:24  08/31/89

                            BEFORE          AFTER            UNITS
                           --------       ---------          -----
 INTERNAL REFERENCE          19.916          19.919          OHM-M


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                     DUAL INDUCTION  SHOP CALIBRATION SUMMARY
 PERFORMED:  11:05:42  08/31/89    LAST SHOP CALIBRATION:    14:34:51  08/10/89
 SERIAL NUMBER: 109432             PROGRAM VERSION: 1.31 PC
 MODEL: #412
 PERFORMED BY: MCDANIEL

                             DEEP INDUCTION          MEDIUM INDUCTION
                          MEASURED   CALIBRATED    MEASURED   CALIBRATED     UNITS
                          --------------------     --------------------     -------
 TOOL ZERO                  -.883        .000        -.007        .000      MMHOS/M
 INTERNAL REFERENCE       494.528     496.539      499.505     502.422      MMHOS/M
 WHEEL                    496.819     500.000      497.376     500.000      MMHOS/M
 MANDREL BASE               4.517       3.727        5.650       5.896      MMHOS/M

                     DUAL INDUCTION BEFORE SURVEY FIELD CHECK SUMMARY
 PERFORMED:  17:24:24  09/10/89    LAST SHOP CALIBRATION:    11:05:42  08/31/89

                             DEEP INDUCTION          MEDIUM INDUCTION
                            SHOP      FIELD         SHOP       FIELD         UNITS
                          --------------------     --------------------     -------
 TOOL ZERO                   .000       2.467         .000       -.210      MMHOS/M
 INTERNAL REFERENCE       496.539     505.795      502.420     509.633      MMHOS/M
 MANDREL BASE               3.727       3.727        5.896       5.896      MMHOS/M

                     DUAL INDUCTION AFTER SURVEY FIELD CHECK SUMMARY
 PERFORMED:  19:01:31  09/10/89    LAST SHOP CALIBRATION:    11:05:42  08/31/89

                             DEEP INDUCTION          MEDIUM INDUCTION
                           BEFORE     AFTER        BEFORE       AFTER        UNITS
                          --------------------     --------------------     -------
 TOOL ZERO                  2.467       2.547        -.210       -.251      MMHOS/M
 INTERNAL REFERENCE       505.794     507.094      509.632     510.220      MMHOS/M
 MANDREL BASE               3.727       3.727        5.896       5.896      MMHOS/M


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                        GAMMA   SHOP CALIBRATION SUMMARY
 PERFORMED:  10:05:26  09/01/89    LAST SHOP CALIBRATION:    14:24:17  08/08/89
 SERIAL NUMBER: 108594             PROGRAM VERSION: 1.31 PC
 MODEL: #432          FIELD CALIBRATOR: #2141
 PERFORMED BY: MCDANIEL

                          MEASURED         CALIBRATED          UNITS
                          --------         ----------          -----
 BACKGROUND                  13                13              API-CPS
 BACKGROUND+CALIBRATOR      269               271              API-CPS
 CALIBRATOR                 256               258              API-CPS

                        GAMMA  BEFORE SURVEY FIELD CHECK SUMMARY
 PERFORMED:  17:16:47  09/10/89    LAST SHOP CALIBRATION:    10:05:26  09/01/89
 FIELD CALIBRATOR: #2141

                            SHOP              FIELD            UNITS
                          --------         ----------          -----
 BACKGROUND                  13                29              API-CPS
 BACKGROUND+CALIBRATOR      271               289              API-CPS
 CALIBRATOR                 258               260              API-CPS

                        GAMMA  AFTER SURVEY FIELD CHECK SUMMARY
 PERFORMED:  19:14:03  09/10/89    LAST SHOP CALIBRATION:    10:05:26  09/01/89
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                                BEFORE          AFTER          UNITS
                               --------       ----------       -----
 BACKGROUND                       29             23          API-CPS
 BACKGROUND+CALIBRATOR           289            286          API-CPS
 CALIBRATOR                      260            263          API-CPS


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                      CALIPER   SHOP CALIBRATION SUMMARY
PERFORMED:  14:00:58  08/07/89    LAST SHOP CALIBRATION:   10:24:30  05/29/89
SERIAL NUMBER: TAN                PROGRAM VERSION: 1.31 PC
MODEL: #202
PERFORMED BY: JOHNSON

                              MEASURED        CALIBRATED        UNITS
                              --------        ----------        -----
VALUE 1                          8.038           8.000          INCHES
VALUE 2                         16.000          16.000          INCHES

                      CALIPER  BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED:  17:10:33  09/10/89    LAST SHOP CALIBRATION:   14:00:58  08/07/89

                                SHOP            FIELD           UNITS
                              --------        ---------         -----
VALUE 1                          8.000           8.334          INCHES

                      CALIPER  AFTER SURVEY FIELD CHECK SUMMARY
PERFORMED:  19:07:15  09/10/89    LAST SHOP CALIBRATION:   14:00:58  08/07/89

                               BEFORE           AFTER           UNITS
                              --------        ---------         -----
VALUE 1                          8.334           8.393          INCHES

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                      TENSION   SHOP CALIBRATION SUMMARY
PERFORMED:  17:08:21  09/10/89    LAST SHOP CALIBRATION:   23:16:08  09/06/89
SERIAL NUMBER: TOP                PROGRAM VERSION: 1.31 PC


                          H L S CALIBRATION SUMMARY TABLE
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  SERVICE or SIGNAL          SHOP       BEFORE      AFTER      CHANGE    TOLERANCE
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GUARD                        19.941     19.916     19.919     -.002     +/-.80
DEEP INDUCTION              496.539    505.794    507.094    -1.300     +/- 20
MEDIUM INDUCTION            502.420    509.632    510.220     -.587     +/- 20
GAMMA                       258        260        263        -3         +/- 9.0
CALIPER VALUE 1               8.000      8.334      8.393     -.059     +/- 0.50
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EVENTS

```
  1 16: 6:45 00000 >DATE OF LOG: MMDD                  910
  2 16:13: 8 00000 >PLS SOFTWARE REVISION             1.31
  3 16:13: 8 00000 >CURRENT REVISION UPDATE NUMBER PC
  4 16:43:26 00000 >CASING SIZE O.D. (INCHES)          5.500+0
  5 16:43:27 00000 >BIT SIZE? (INCHES)                 7.875+0
  6 16:43:29 00000 >DT-MATRIX(40=DOL<DT<70=SHALY)      5.700+1
  7 16:43:29 00000 >DT-SHALE (100=MIN<DT<160=MAX)     1.000+2
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```
 8 16:43:29 00000 >FOR FORMATION FACTOR(.5<A<2.5)  1.000+0
 9 16:43:30 00000 >FOR FORMATION FACTOR(1.2<M<2.5) 2.000+0
10 16:43:41 00000 >CASING SIZE O.D. (INCHES)       3.500+0
11 16:43:52 00000 >BIT SIZE? (INCHES)              6.250+0
12 16:44: 8 00000 >FOR FORMATION FACTOR(.5<A<2.5)  8.100-1
13 16:44:20 00000 >>LOG PARAMETERS UPDATED HERE
14 17:39:35 01182 >DT-MATRIX(40=DOL<DT<70=SHALY)   5.560+1
15 17:39:51 01174 >>LOG PARAMETERS UPDATED HERE
16 17:50:41 01725 >LOGGING SECTION NO.                 2
17 17:58:45 01479 >"HALTING" END OF SECTION
18 18: 1:21 01715 >LOGGING SECTION NO.                 3
19 18: 8:45 01489 >"HALTING" END OF SECTION
20 18: 8:46 01489 >"HALTING" END OF SECTION
21 18:16:18 02105 >LOGGING SECTION NO.                 4
22 18:49: 2 01096 >"HALTING" END OF SECTION
23 18:54:16 00980 >LOGGING SECTION NO.                 5
24 18:58:53 00841 >"HALTING" END OF SECTION
25 18:58:53 00840 >"HALTING" END OF SECTION
```