Weatherford®

CALIPER LOG

COMPANY	EAST CHEYENNE GAS STORAGE LLC
WELL	ECGS No 31-7 WPD005-1
FIELD	PEETZ WEST
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA/COLORADO
LOCATION	1065' FSL & 2185' FEL

SEC	TWP	RGE
31	12N	52W

Other Services
MAI CMI
MPD/MDN

API Number 05-075-09410
Permit Number

Permanent Datum GL, Elevation 4543 feet
Log Measured From KB
Drilling Measured From KB

Elevations:	feet
KB	4557.00
DF	4556.00
GL	4543.00

Date	16-OCT-2012			
Run Number	ONE			
Depth Driller	5260.00	feet		
Depth Logger	5254.00	feet		
First Reading	5198.00	feet		
Last Reading	1214.00	feet		
Casing Driller	1212.00	feet		
Casing Logger	1212.00	feet		
Bit Size	8.750	inches		
Hole Fluid Type	WBM			
Density / Viscosity	9.80 g/c3		48.00 CP	
PH / Fluid Loss	9.00		7.40 ml/30Min	
Sample Source	FLOWLINE			
Rm @ Measured Temp	6.46 @ 54.2	ohm-m		
Rmf @ Measured Temp	5.17 @ 54.2	ohm-m		
Rmc @ Measured Temp	7.75 @ 54.2	ohm-m		
Source Rmf / Rmc	CALC		CALC	
Rm @ BHT	2.42 @148.0	ohm-m		
Time Since Circulation	4 HOURS			
Max Recorded Temp	148.00	deg F		
Equipment Name	COMPACT			
Equipment / Base	13037		RK SPR	
Recorded By	B. ROSSER			
Witnessed By	J. ASHBY			

BOREHOLE RECORD

Last Edited: 16-OCT-2012 14:49

Bit Size (inches)	Depth From (feet)	Depth To (feet)
8.750	1212.00	5260.00

CASING RECORD

Type	Size (inches)	Depth From (feet)	Shoe Depth (feet)	Weight (pounds/ft)
SURFACE	9.625	0.00	1212.00	36.00

REMARKS

SOFTWARE VERSION 13.03.6600
TOOLS RUN: SHA, MCG, MDN, MPD, MIS-A, SKJ, MIS-E, SKJ, SHA, MIM, MIE, SKJ, MFE, MAI RUN IN COMBINATION.

HARDWARE: MPD: 8" PROFILE PLATE USED.
MAI: TWO 1 INCH STANDOFFS USED.
MDN: DUAL BOWSPRING USED.
MIM: ONE NONMETALIC CENTRALIZING BASKET USED.
MIE: ONE 1 INCH STANDOFF USED

2.65 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY FROM TD TO BOTTOM OF FORT HAYES FORMATION(5254FT TO 4790FT)

4700 FT).
2.71 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY IN FORT HAYES FORMATION (4700 FT TO 4200 FT).

TIGHT PULLS, BOREHOLE SIZE AND RUGOSITY WILL AFFECT REPEATABILITY AND DATA QUALITY.

ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.

LAT/ LONG: 40.966620 / -103.221030

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1026 CUBIC FEET
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING = 655 CUBIC FEET

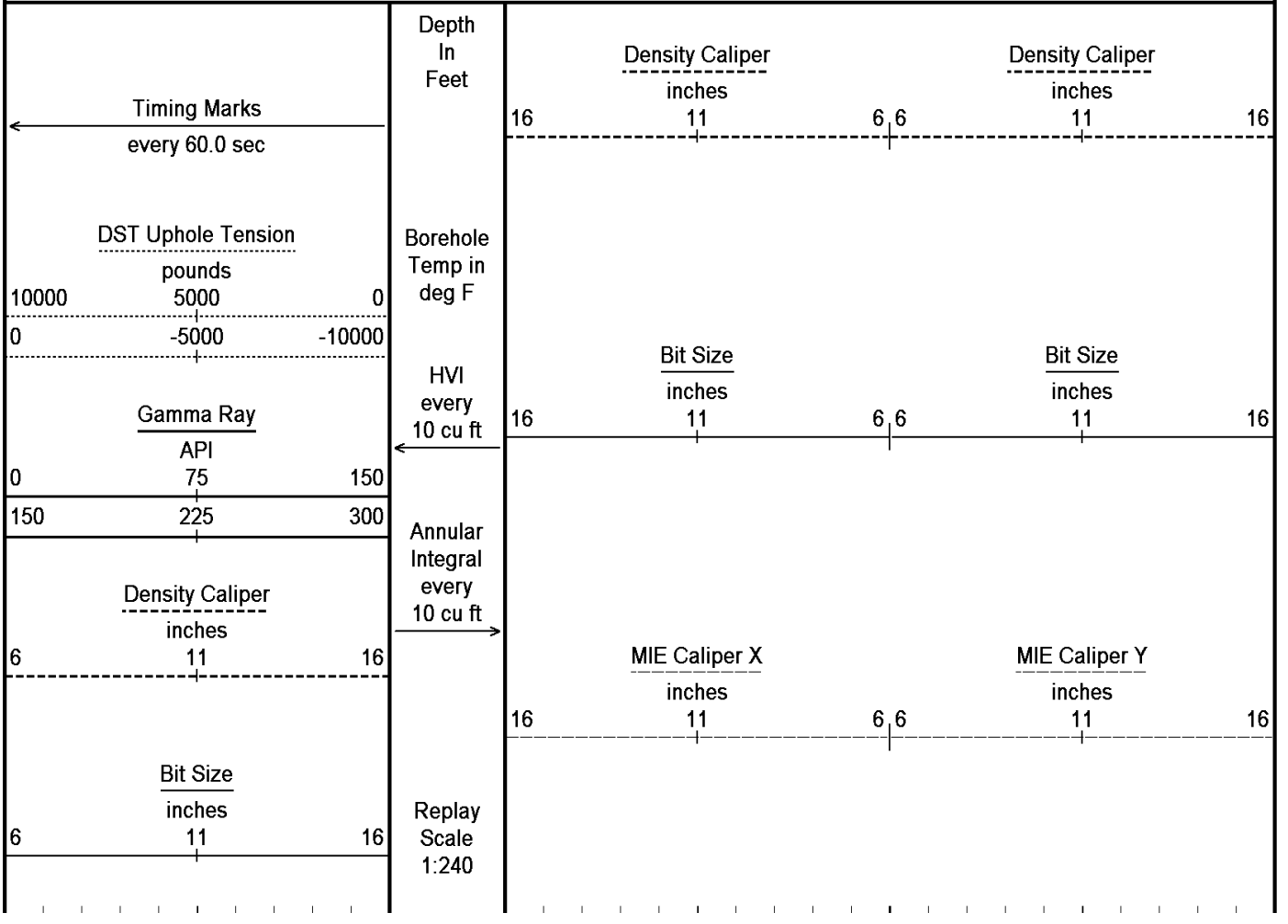
TOTAL VOLUME FROM TD TO 4200 FT = 410 CUBIC FEET
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 4200 FT = 140 CUBIC FEET

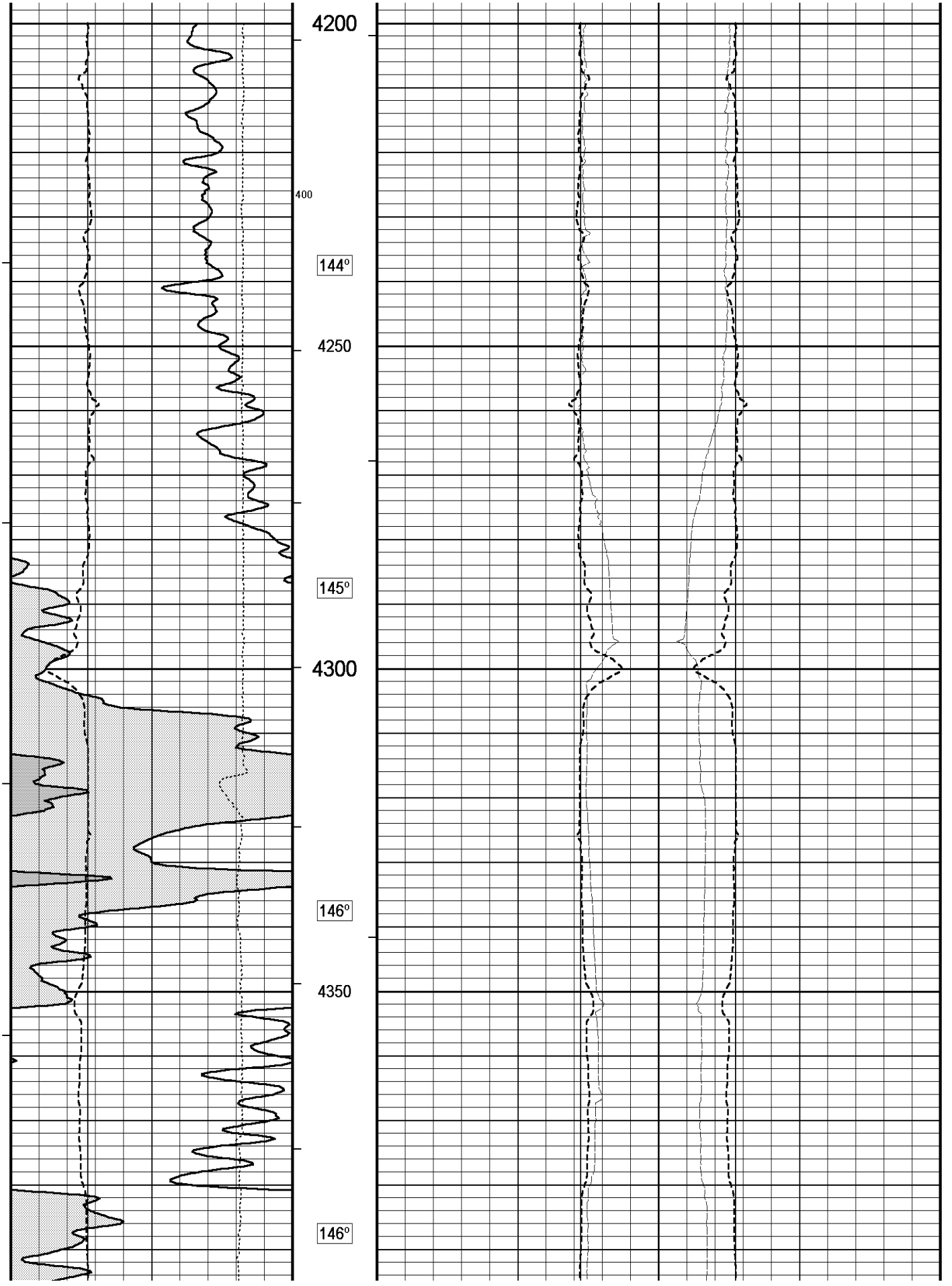
SERVICE ORDER: 3535300

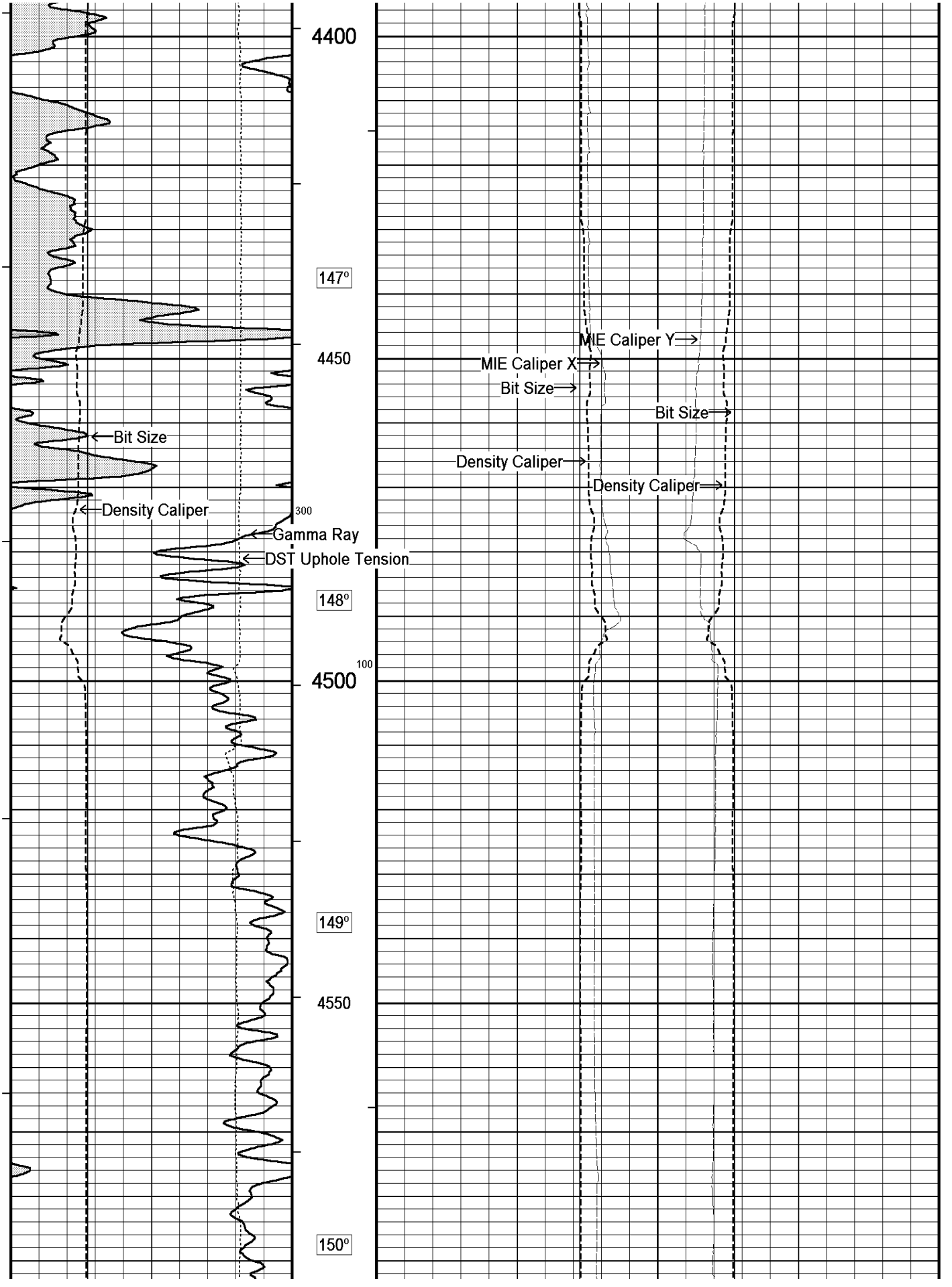
RIG: CADE 22

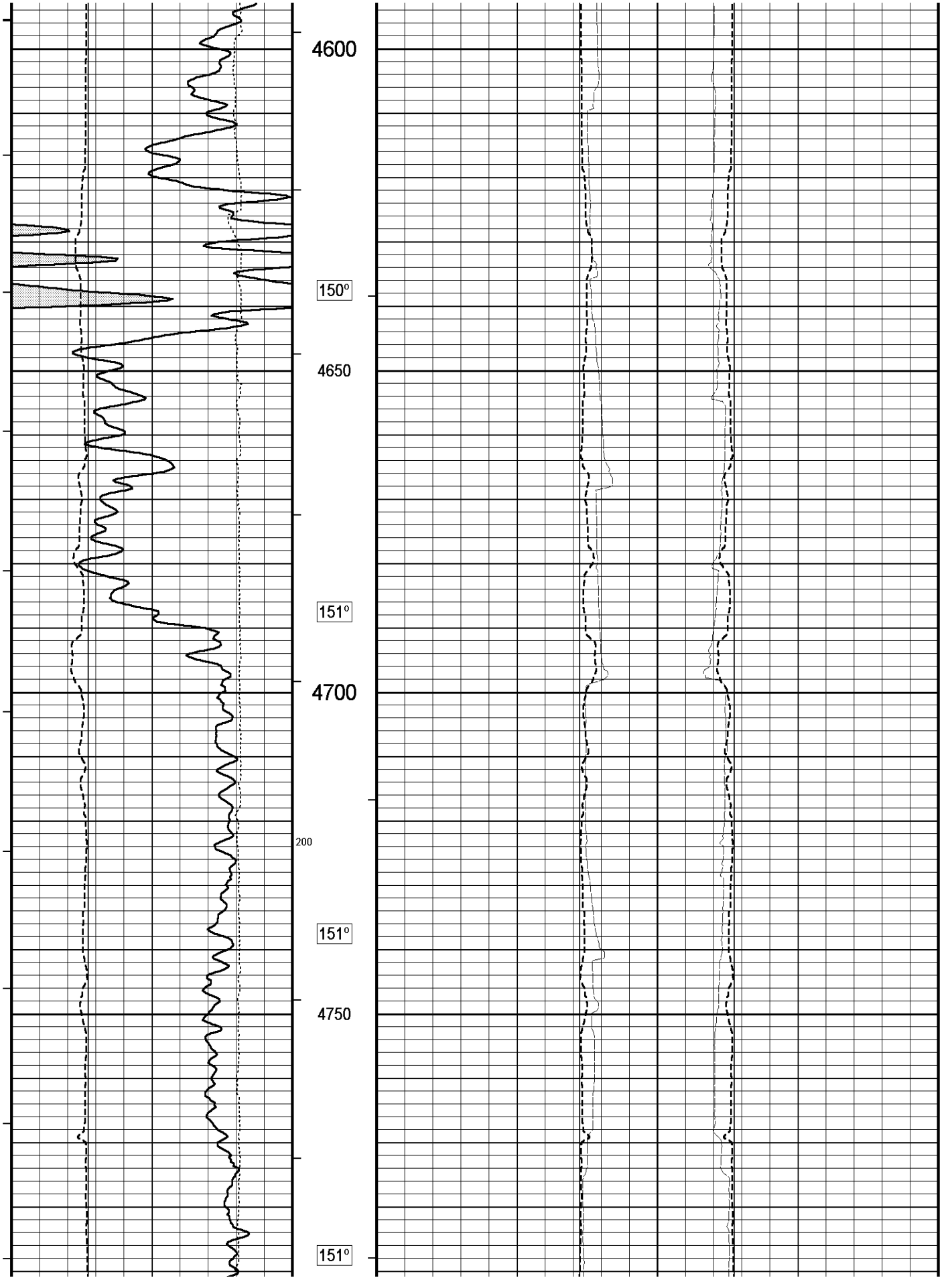
5 INCH MAIN LOG

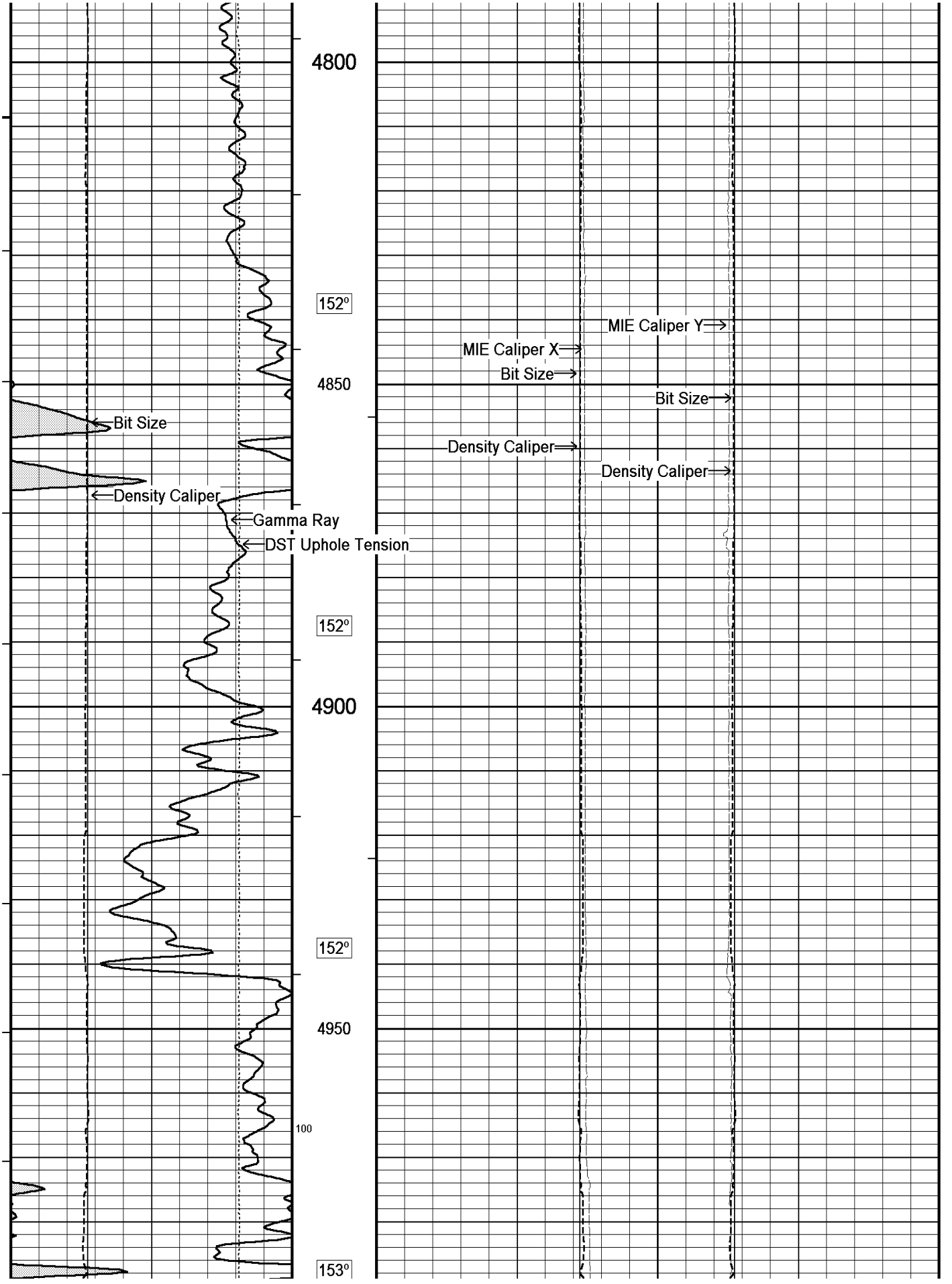
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 16-OCT-2012 16:23
Filename: C:\Minimus\Logs\ECGS\ECGS 31-7 WPD005-1\ECGS 31-7 WPD005-1 MainPass.dta — Recorded on 16-OCT-2012 13:54
System Versions: Logged with 13.02.6600 Plotted with 13.02.6600

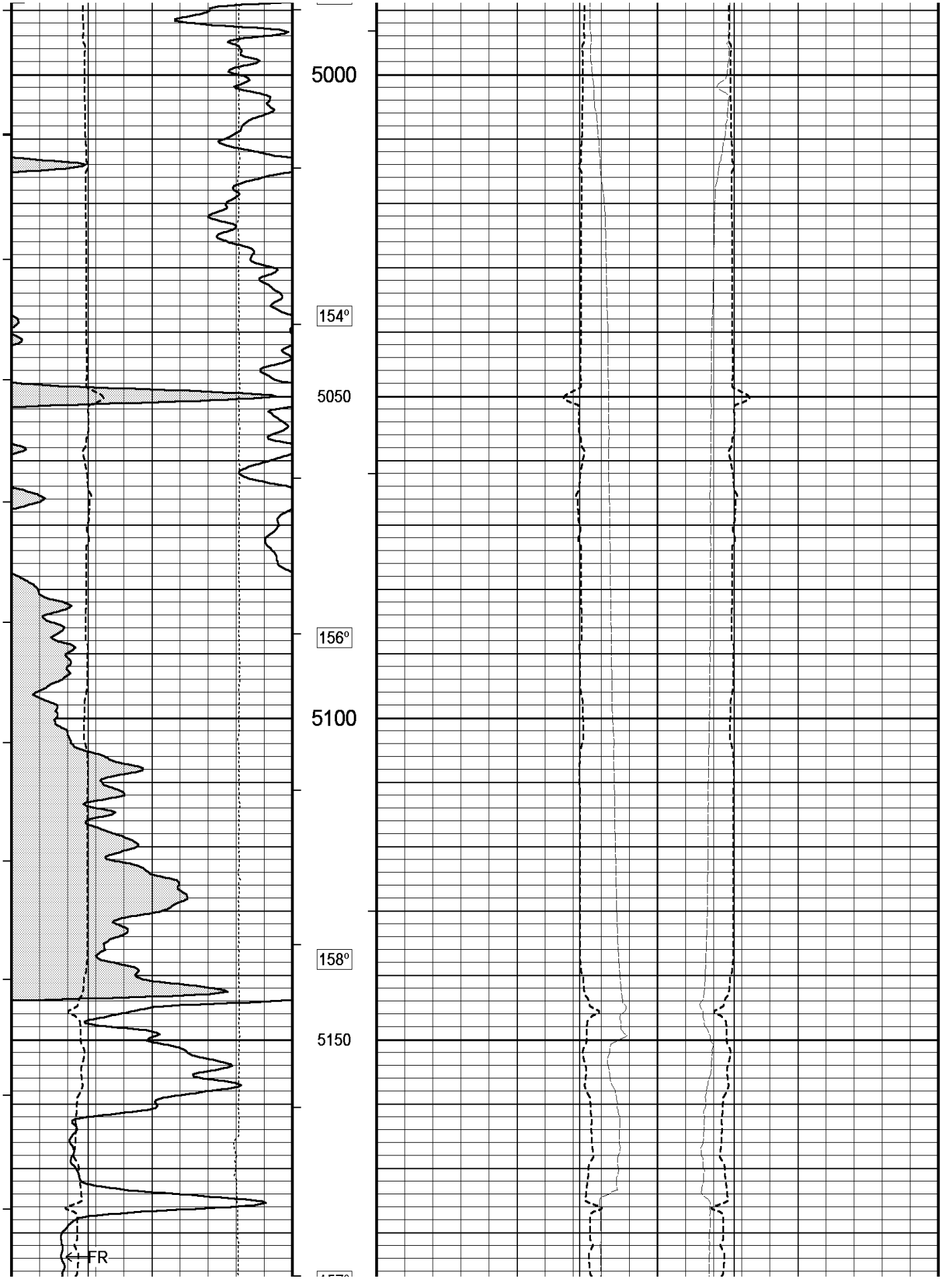


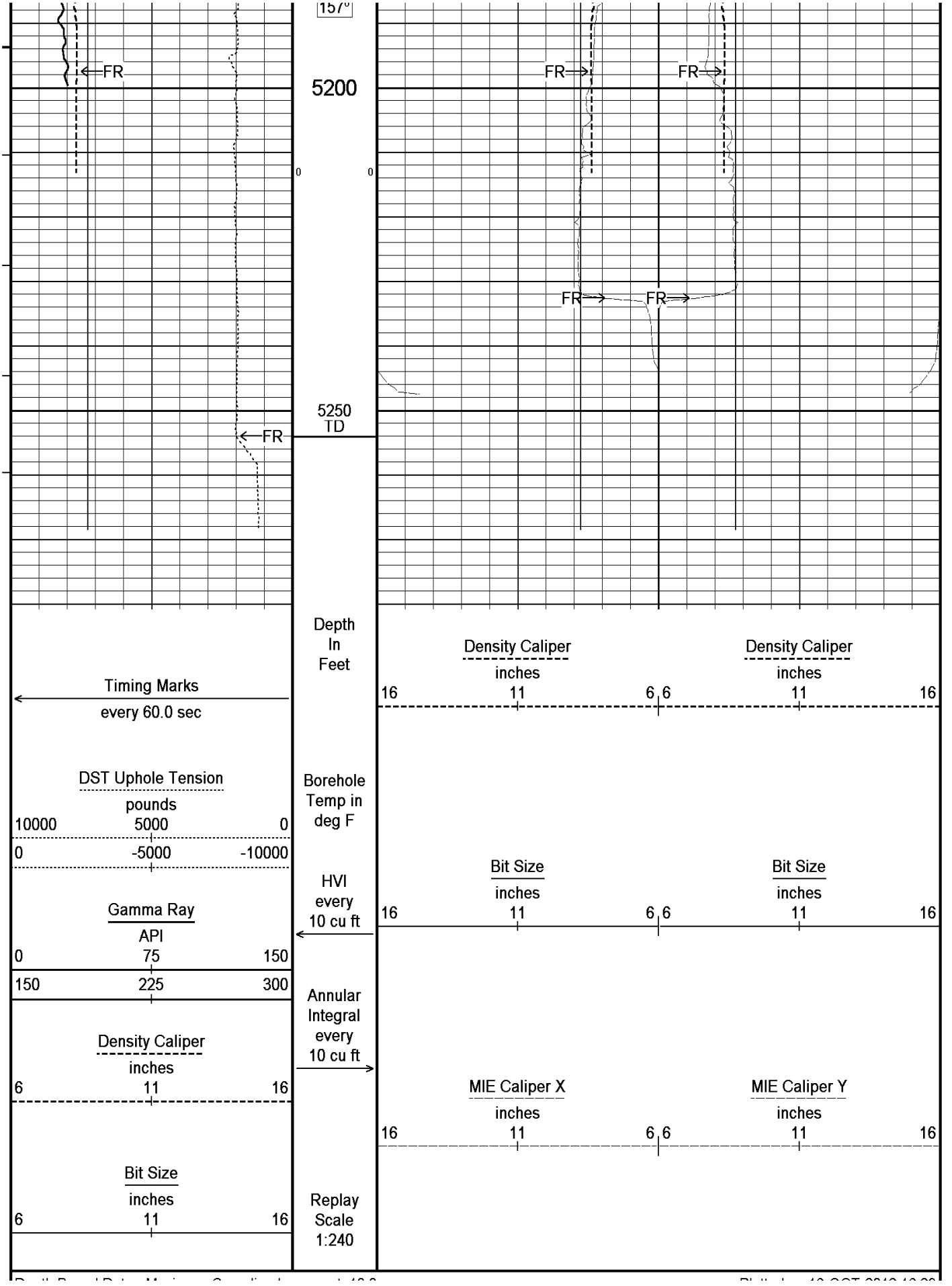

4200
400
144°
4250
145°
4300
146°
4350
146°


4400
147°
4450
Bit Size
Density Caliper
300
Gamma Ray
DST Uphole Tension
148°
4500
100
149°
4550
150°
MIE Caliper Y
MIE Caliper X
Bit Size
Bit Size
Density Caliper
Density Caliper


4600
150°
4650
151°
4700
200
151°
4750
151°


4800
152°
MIE Caliper Y
MIE Caliper X
Bit Size
4850
Bit Size
Bit Size
Density Caliper
Density Caliper
Density Caliper
Gamma Ray
DST Uphole Tension
152°
4900
152°
4950
100
153°


5000
154°
5050
156°
5100
158°
5150
FR


157°
5200
FR
FR
FR
FR
FR
0
0
5250
TD
Depth
In
Feet
Timing Marks
every 60.0 sec
DST Uphole Tension
pounds
10000
5000
0
0
-5000
-10000
Gamma Ray
API
0
75
150
150
225
300
Density Caliper
inches
6
11
16
Bit Size
inches
6
11
16
Borehole
Temp in
deg F
HVI
every
10 cu ft
Annular
Integral
every
10 cu ft
Replay
Scale
1:240
Density Caliper
inches
16
11
6
Density Caliper
inches
6
11
16
Bit Size
inches
16
11
6
Bit Size
inches
6
11
16
MIE Caliper X
inches
16
11
6
MIE Caliper Y
inches
6
11
16

5 INCH MAIN LOG

BEFORE SURVEY CALIBRATION

C:\Minimus\Logs\ECGS\ECGS 31-7 WPD005-1\ECGS 31-7 WPD005-1 Repeat.dta

Down-hole Tension Calibration All 000

Field Calibration on 24-OCT-2010 03:34

Reading No	Measured	0
1	15659.85	0.00
2	15734.68	370.00

General Constants All 000

Last Edited on 16-OCT-2012,09:44

General Parameters		
Mud Resistivity	6.420	ohm-metres
Mud Resistivity Temperature	54.200	degrees F
Water Level	0.000	feet
Density/Neutron Processing	Wet Hole	
Hole/Annular Volume and Differential Caliper Parameters		
HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	7.000	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Deep Induction	
RWA Constant A	0.610	
RWA Constant M	2.150	

Down-hole Tension Calibration SMS 0

Field Calibration on 16-OCT-2012 12:47

Reading No	Measured	Calibrated (lbs)
1	15175.17	0.00
2	16394.83	500.00

High Resolution Temperature Calibration MCG-D.K 483

Field Calibration on 06-JUL-2012 14:06

	Measured	Calibrated(Deg F)
Lower	0.00	0.00
Upper	0.00	0.00

High Resolution Temperature Constants MCG-D.K 483

Last Edited on

Pre-filter Length	11

SP Calibration MCG-D.K 483

Field Calibration on 06-JUL-2012 14:06

	Measured	Calibrated (mV)
Reference 1	100.6	100.1
Reference 2	-98.9	-100.1

Gamma Calibration MCG-D.K 483

Field Calibration on 15-OCT-2012 14:49

	Measured	Calibrated (API)
Background	60	40
Calibrator (Gross)	788	520
Calibrator (Net)	728	480

Gamma Constants MCG-D.K 483

Last Edited on 16-OCT-2012,09:37

Gamma Calibrator Number	GRCC-112	
Mud Density	1.00	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl	0.00	kppm

Neutron Calibration MDN-B.A 227

Base Calibration on 15-OCT-2012 15:48
Field Check on 15-OCT-2012 15:57

Base Calibration

	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	2896	90	3714	110
Ratio	32.069		33.764	

Field Calibrator at Base

	Calibrated (cps)	
	1658	2365
Ratio	0.701	

Field Check

	Calibrated (cps)	
	1664	2383
Ratio	0.698	

Neutron Constants MDN-B.A 227

Last Edited on 16-OCT-2012,13:17

Neutron Source Id	P44382B	
Neutron Jig Number	NEC43	
Epithermal Neutron	No	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	7.00	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	N/A	kpsi
Temperature Source	None	
Temperature	N/A	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	None	
Formation Fluid Salinity	N/A	kppm
Barite Mud Correction	Not Applied	

Caliper Calibration MIE-A.J 244

Base Calibration on 15-OCT-2012 14:34
Field Calibration on 15-OCT-2012 14:37

Base Calibration

Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)
1	26843	27657	5.96
2	37134	38542	7.99
3	46830	48303	9.86
4	58657	60137	11.93
5	0	0	0.00

Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	25364	25860	23860	25685	5.96
2	34515	34810	32509	34263	7.99
3	42698	43019	40815	42625	9.86
4	52715	53061	50670	52203	11.93
5	0	0	0	0	0.00

Field Calibration

	Measured Pads 1-5 Caliper(in)	Measured Pads 3-7 Caliper(in)	Actual Caliper(in)

	7.99	8.00	7.99		
	Measured Pad 2 Caliper(in)	Measured Pad 4 Caliper(in)	Measured Pad 6 Caliper(in)	Measured Pad 8 Caliper(in)	Actual Caliper(in)
	4.00	4.00	4.00	4.00	7.99

Caliper Constants MIE-A.J 244

Last Edited on 15-OCT-2012,14:26

Caliper Difference for BRKT	0.120	inches	

Accelerometer Parameters MIE-A.J 244

Date Of Last Accelerometer Calibration: 8-FEB-2012,10:33

	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.101858	-1.105662	-1.102074
Offset	-0.006691	0.007176	-0.004341

Accelerometer Constants MIE-A.J 244

Last Edited on 15-OCT-2012,14:38

Accelerometer Calibrator Number: 000

Accelerometer Temperature Characterisation

X Accelerometer

Serial Number	1016			
Calibration Date	12-Apr-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	1.93698e-005	-7.60293e-010	6.54727e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.59257e-004	6.13375e-007	-3.90888e-010

Y Accelerometer

Serial Number	973			
Calibration Date	19-Jan-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	1.95276e-005	-1.88058e-008	2.74122e-010
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.75268e-004	3.53140e-007	7.52116e-010

Z Accelerometer

Serial Number	1032			
Calibration Date	18-Apr-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-1.14960e-005	3.94288e-009	8.97135e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.88058e-004	2.44833e-007	8.38007e-010

Magnetometer Parameters MIE-A.J 244

Date Of Last Magnetometer Calibration: 16-FEB-2012,10:58

	X Magnetometer	Y Magnetometer	Z Magnetometer
Slope	-1.000000	-1.002948	-0.976095
Offset	-0.005483	-0.018155	-0.000073

Magnetometer Constants MIE-A.J 244

Last Edited on 15-OCT-2012,14:39

Magnetometer Calibrator Number: 000

Navigation Constants MIE-A.J 244

Last Edited on 15-OCT-2012,14:39

Magnetic Declination	0.00	degrees	East

Imager Pad Check MIE-A.J 244

Field Check on

Pad 1	Pad Not Tested	Pad 5	Pad Not Tested
Pad 2	Pad Not Tested	Pad 6	Pad Not Tested
Pad 3	Pad Not Tested	Pad 7	Pad Not Tested
Pad 4	Pad Not Tested	Pad 8	Pad Not Tested

Pad 4 Pad Not Tested Pad 8 Pad Not Tested

Compact Micro Imager Constants MIE-A.J 244

Last Edited on 15-OCT-2012,14:39

Sonde Configuration	Imager Mode	degrees
Arm-Pad Kit	Normal Pads (12.25 in)	
Centre Pad 1 Rotational Offset	0.00	
Image/Borehole Ovality Reference	Azimuth of Pad 1	degrees
Non Active Buttons	Omit	feet
Search Angle	0.00	feet
Correlation Interval	3.28	mAmp
Correlation Step	1.64	mAmp
Current Offset	0.0000	
Squasher Start	N/A	
Image Processing	Enabled	

FE Calibration MFE-A.A 66

Base Calibration on 15-OCT-2012 13:42
Field Check on 15-OCT-2012 13:46

Base Calibration

	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	997.0	126.8
Base Check		272.6
Field Check		272.7

FE Constants MFE-A.A 66

Last Edited on 16-OCT-2012,09:34

Running Mode	No Sleeve	
MFE K Factor	0.1268	
Caliper Source for FE correction	Density Caliper	
Caliper Value for FE correction	N/A	inches
Rm Source for FE correction	Temperature Corr	
Temp. for Rm Corr.	MCG External Temperature	
Stand-off	1.0	inches

FE Calibration MAI-A.A 165

Base Calibration on 12-FEB-2009 10:30
Field Check on 04-APR-2009 14:52

Base Calibration

	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	976.9	126.8
Base Check		277.9
Field Check		278.3

FE Constants MAI-A.A 165

Last Edited on 04-APR-2009,15:12

Running Mode	0	
MFE K Factor	0.0000	
Caliper Source for FE correction	Density Caliper	
Caliper Value for FE correction	N/A	inches
Rm Source for FE correction	Temperature Corr	
Temp. for Rm Corr.	MCG External Temperature	
Stand-off	1.0	inches

High Resolution Temperature Calibration MAI-A.A 165

Field Calibration on 10-OCT-2011,15:43

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

High Resolution Temperature Constants MAI-A.A 165

Last Edited on 15-OCT-2012,13:33

Pre-filter Length	11

Induction Calibration MAI-A.A 165

Base Calibration on 15-OCT-2012,13:08
Field Check on 15-OCT-2012 13:32

Base Calibration

Test Loop Calibration	Measured		Calibrated (mmho/m)	
Channel	Low	High	Low	High
1	17.2	469.6	9.3	966.2
2	6.7	392.8	7.6	821.4
3	4.2	262.3	5.2	566.0
4	1.6	136.6	2.6	279.2
Array Temperature		75.0	Deg F	

Channel	Base Check (mmho/m)		Field Check (mmho/m)		
	Low	High	Low	High	
1	12.9	3869.0	13.0	3868.3	
2	28.4	3433.8	28.4	3433.0	
3	26.7	3021.4	26.7	3021.3	
4	19.7	2016.0	19.7	2016.1	
Deep	17.3	2011.3	17.3	2011.8	
Medium	37.6	3970.8	37.6	3970.3	
Shallow	41.2	5011.9	41.3	5010.0	
Array Temperature		69.2		70.6	Deg F

Induction Constants MAI-A.A 165

Last Edited on 16-OCT-2012,09:33

Induction Model	RtAP-WBM	
Caliper for Borehole Corr.	Density Caliper	
Hole Size for Borehole Correction	N/A	inches
Tool Centred	No	
Stand-off Type	Fins	
Stand-off	1.00	inches
Number of Fins on Stand-off	6.0000	
Stand-off Fin Angle	60.00	degrees
Stand-off Fin Width	0.0500	inches
Borehole Corr. Rm Source	Temperature Corr	
Temp. for Rm Corr.	MCG External Temperature	
Squasher Start	0.0020	mhos/metre
Squasher Offset	N/A	mhos/metre

Borehole Normalisation

DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000

Calibration Site Corrections

Channel 1	0.00	mmhos/metre
Channel 2	0.00	mmhos/metre
Channel 3	0.00	mmhos/metre
Channel 4	0.00	mmhos/metre

Apparent Porosity and Water Saturation Constants

Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	100.00	percent
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

Caliper Calibration MPD-C.A 195

Base Calibration on 15-OCT-2012 13:53
Field Calibration on 15-OCT-2012 13:54

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	15007	4.00
2	23645	5.96
3	32400	7.99
4	40464	9.86
5	49760	11.93
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.95	7.99

Photo Density Calibration MPD-C.A 195

Base Calibration on 15-OCT-2012 14:12
Field Check on 15-OCT-2012 14:18

Density Calibration

Base Calibration	Measured		Calibrated (sdu)	
	Near	Far	Near	Far
Reference 1	38135	13267	52994	19128
Reference 2	18092	1824	25188	2558

Field Check at Base

670.1	775.1

Field Check

667.4	773.4

PE Calibration

Base Calibration	Measured			Calibrated
	WS	WH	Ratio	Ratio
Background	122	602		
Reference 1	13157	38045	0.348	0.309
Reference 2	5216	18018	0.292	0.274

Field Check at Base

122.4	602.2

Field Check

122.5	598.0

Density Constants MPD-C.A 195

Last Edited on 16-OCT-2012,13:16

Density Source Id	2859GW	
Nylon Calibrator Number	535	
Aluminium Calibrator Number	535	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.17	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	1.00	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	

Matrix Density (gm/cc)	Depth (ft)
2.68	
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	

0.00	0.00
0.00	0.00
0.00	0.00

DOWNHOLE EQUIPMENT

C:\Minimus\Logs\ECGS\ECGS 31-7 WPD005-1\ECGS 31-7 WPD005-1 Repeat.dta

CBH-C, Cablehead, 11 pin
CBH-C 102 LG: 2.40 ft WT: 24.3 lb OD: 2.24 in

SHA-H Compact Swivel Head Adaptor
SHA-H 142 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma
MCG-D.K 483 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Neutron
MDN-B.A 227 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper
MPD-C.A 195 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

MIS-D.B Compact Inline Bowspring sub
MIS-D.B 658 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

SKJ-E.B Compact Knuckle Joint
SKJ-E.B 536 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

MIS-E.A Compact Inline Standoff sub
MIS-E.A 199 LG: 2.14 ft WT: 15.4 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint
SKJ-D.A 66 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

SHA-J.B Compact Swivel Head Adaptor
SHA-J.B 511 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

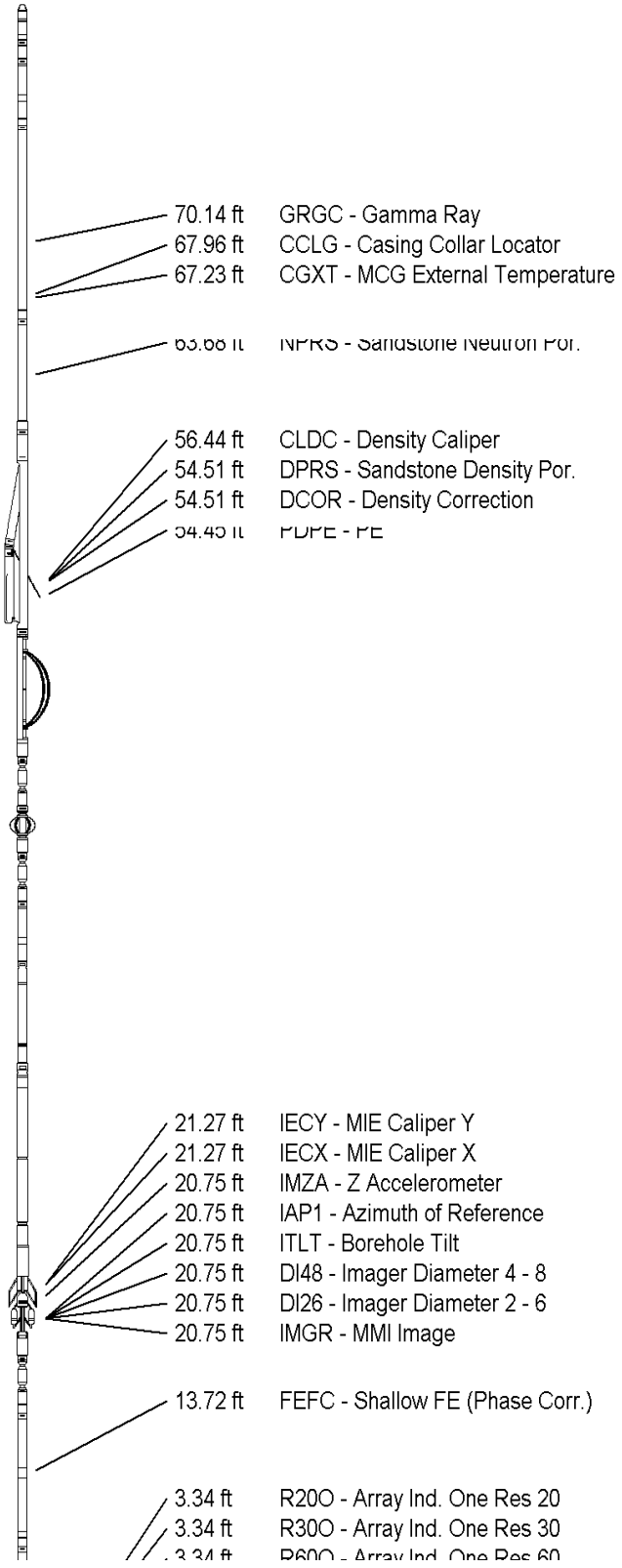
Compact MMI Memory Section
MIM-A.J 244 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

Compact MMI Electrode Section
MIE-A.J 244 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

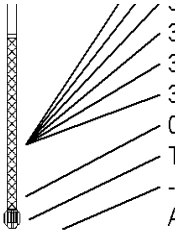
SKJ-E.B Compact Knuckle Joint
SKJ-E.B 589 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact Focussed Electric
MFE-A.A 66 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-A.A 165 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in



Total Length: 80.12 ft Weight: 617.3 lb



3.34 ft	R40O - Array Ind. One Res 40
3.34 ft	R85O - Array Ind. One Res 85
3.34 ft	RTAO - Array Ind. One Res Rt
0.23 ft	SPCG - Spontaneous Potential
Tool Zero	(0.13ft from bottom)
-0.13 ft	SMTU - DST Uphole Tension

All measurements relative to tool zero.

COMPANY	EAST CHEYENNE GAS STORAGE LLC
WELL	ECGS No 31-7 WPD005-1
FIELD	PEETZ WEST
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA/COLORADO

Elevation Kelly Bushing	4557.00	feet	First Reading	5198.00	feet
Elevation Drill Floor	4556.00	feet	Depth Driller	5260.00	feet
Elevation Ground Level	4543.00	feet	Depth Logger	5254.00	feet

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