Schlumberger

Company: Cascade Petroleum LLC

Well: State 16-11S-55W-02

Field: Wildcat

County: Lincoln State: Colorado

## Repeat Pass

County: Lincoln
Field: Wildcat
Location: SWSW Sec 16 T11S, R55W
Well: State 16-11S-55W-02
Company: Cascade Petroleum LLC

| | | | | |
|---|---|---|---|---|
| Location: | SWSW Sec 16 T11S, R55W<br>660 FSL X 660 FWL | Elev. | K.B.<br>G.L.<br>D.F. | 5331.00 ft<br>5314.00 ft<br>5330.00 ft |
| | Permanent Datum: | Ground Level | Elev.: | 5314.00 f |
| | Log Measured From: | Kelly Bushing | 17.00 ft | above Perm.Datum |
| | Drilling Measured From: | Kelly Bushing | | |

| API Serial No. | Section: | Township: | Range: |
|---|---|---|---|
| 05-073-06501-0000 | 16 | 11S | 55W |

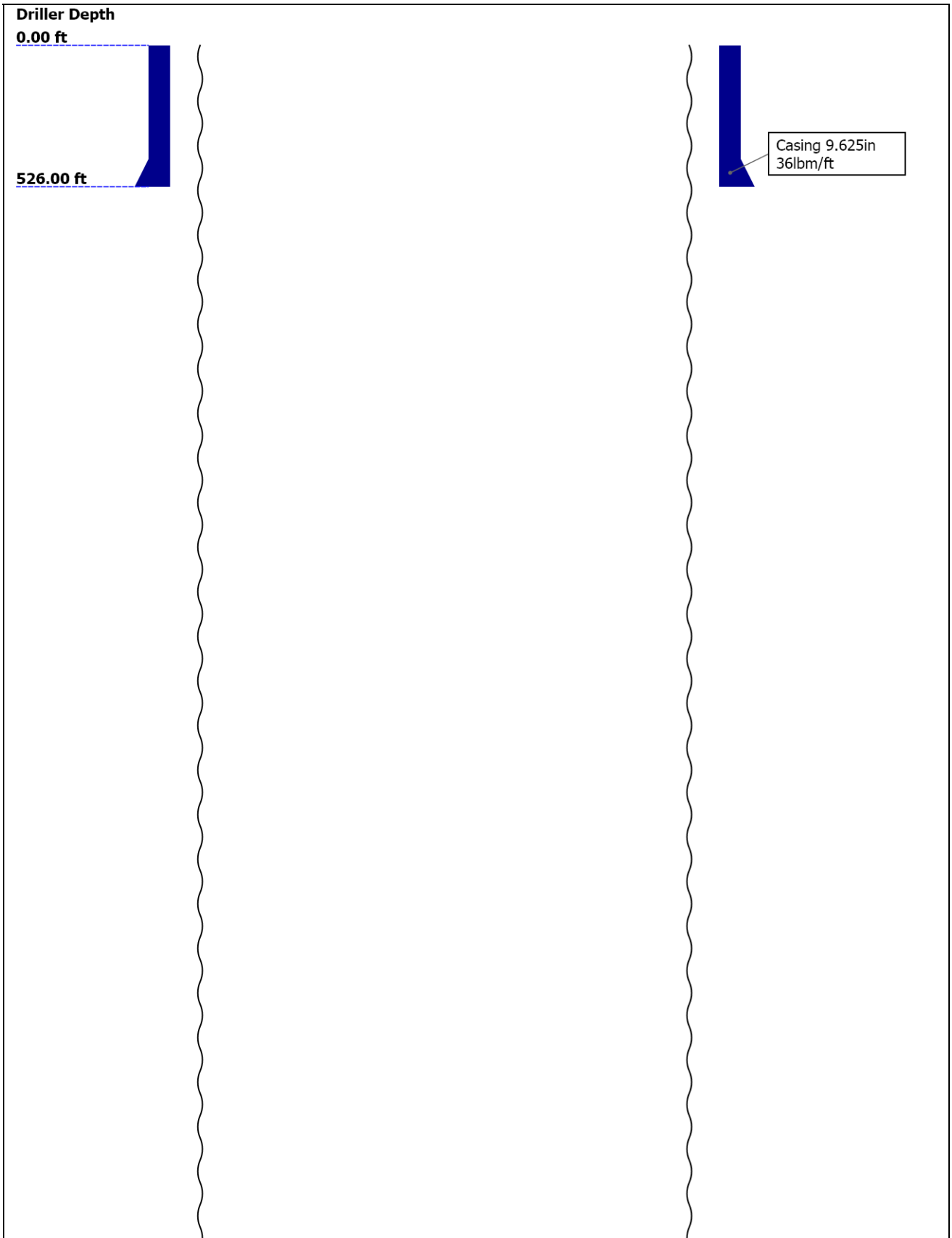
| | | | | | | |
|---|---|---|---|---|---|---|
| Logging Date | | | 07-Mar-2013 | | | |
| Run Number | | | One | | | |
| Depth Driller | | | 8173.00 ft | | | |
| Schlumberger Depth | | | 8173.00 ft | | | |
| Bottom Log Interval | | | 7590.00 ft | | | |
| Top Log Interval | | | 530.00 ft | | | |
| Casing Driller Size @ Depth | | | 9.625 in @ 526.00 ft | | | |
| Casing Schlumberger | | | 530 ft | | | |
| Bit Size | | | 7.875 in | | | |
| Type Fluid In Hole | | | DAP/Pac | | | |
| MUD | Density | Viscosity | 8.9 lbm/gal | 46 s | | |
| | Fluid Loss | PH | 12 cm3 | 7.4 | | |
| | Source of Sample | | Active Tank | | | |
| RM @ Meas Temp | | | 0.88 ohm.m @ 53 degF | | | |
| RMF @ Meas Temp | | | 0.72 ohm.m @ 60.6 degF | | | |
| RMC @ Meas Temp | | | 1.15 ohm.m @ 53 degF | | | |
| Source RMF | RMC | | Pressed | Calculated | | |
| RM @ BHT | RMF @ BHT | | 0.27 @ 190 | 0.25 @ 190 | | |
| Max Recorded Temperatures | | | 164 degF | | | |
| Circulation Stopped | Time | | 07-Mar-2013 | 02:30:00 | | |
| Logger on Bottom | Time | | 07-Mar-2013 | 19:47:00 | | |
| Unit Number | Location: | | 2135 | Ft Morgan | | |
| Recorded By | | | Avery Becker/ Daniil Kholin | | | |
| Witnessed By | | | Jake DeHamer | | | |

## Disclaimer



## Contents

## Well Sketch



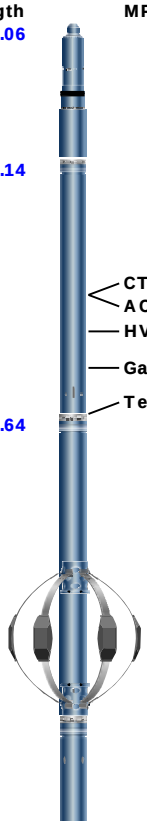

## Borehole Size/Casing/Tubing Record

| | | | | | | |
|---|---|---|---|---|---|---|
| Bit | | | | | | |
| Bit Size ( in ) | 7.875 | | | | | |
| Top Driller ( ft ) | 0 | | | | | |
| Top Logger ( ft ) | 0 | | | | | |
| Bottom Driller ( ft ) | 8173 | | | | | |
| Bottom Logger ( ft ) | 8173 | | | | | |
| Casing | | | | | | |
| Size ( in ) | 9.625 | | | | | |
| Weight ( lbm/ft ) | 36 | | | | | |
| Inner Diameter ( in ) | 8.914 | | | | | |
| Top Driller ( ft ) | 0 | | | | | |
| Top Logger ( ft ) | 0 | | | | | |
| Bottom Driller ( ft ) | 526 | | | | | |
| Bottom Logger ( ft ) | 530 | | | | | |

## Remarks and Equipment Summary

### One: Toolstring

| Equip name | Length | MP name | Offset |
|---|---|---|---|
| **LEH-QT** | **121.06** | | |
| LEH-QT | | | |
| **EDTC-B:8629** | **118.14** | | |
| EDTH-B:8652 | | | |
| EDTG-A | | | |
| EDTC-B:8629 | | | |
| | | **CTEM** | **114.64** |
| | | **ACCZ** | **0.00** |
| | | **HV** | **0.00** |
| | | **Gamma Ray** | **112.77** |
| | | **TelStatus** | **111.64** |
| **MAST-B:8053** | **111.64** | | |
| ECH-SF:8157 | | | |
| MAPC-BA:8159 | | | |
| MAMS-BA:8053 | | | |
| MASS-BA:8358 | | | |
| MAXS-BA:8183 | | | |



### One: Remarks

Toolstring ran as per tool sketch.

Two centralizers ran for centralization.

Computed on limestone matrix 2.71 g/cc.

Toolstring bridged at 7605 and the log started from this depth.

MAMS 96.2

MAXS 70.36

PPC-B:8733 70.36
PPC-B:8733

PPC-B Calipers 69.21

AH-184[3]:909 63.84

**GPIT-F:770** 61.84
GPIH-B
GPIC-F:770
DHRU-F

GPIT-F Inclinometer 60.42

GPIT 0.00

**Adaptor_Head** 57.84

**AH-184[2]** 53.34

**HNGS-BA:152** 51.34
HEH-K:149
HNGS-BA:152

GR 48.35

**HNGC-B:87** 43.15
HNGH-A:250
HNGC-B:87

Tel Status 41.4

**AH-184[1]** 39.65

**HGNS-H:4865** 37.65
HGNH:4817
NSR-F:2554
NPV-N
HACCZ-H:6991
HGNS-H:4865
HMCA-H

Temperature 37.62

GR 36.91

CNL Porosity 30.57

HGNS 28.24

HMCA 28.24

Accelerometer 0.00

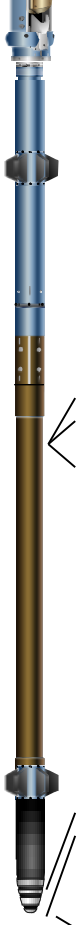
**HDRS-H:3863** 28.24
ECH-MEB:2898
HRCC-H:3828
HRMS-H:3863
Long Spacing:28620
Short Spacing
HRGD-H:3870
GSR-J:5471
GPV-Q
Backscatter

HRCC 24.24

MCFL 18.81

Caliper 18.33

TLD Density 17.94




Lengths are in ft
Maximum Outer Diameter = 5.000 in
Line: Sensor Location, Value: Gating Offset
All measurements are relative to TOOL_ZERO

## Depth Summary

| | | | |
|---|---|---|---|
| **Depth Control Parameters** | **One** | | |
| Conveyance Type | Wireline | | |
| Log Sequence | First run in hole. | | |
| Rig Type | Land | | |
| **Depth Remark Parameters** | **One** | | |
| Depth Remark 1 | All Schlumberger depth control procedures followed. | | |
| Depth Remark 2 | IDW used as primary depth control device. | | |
| Depth Remark 3 | Z-chart used as secondary depth control device. | | |
| **Depth Measuring Device** | **One** | | |
| Type | IDW-JA | | |
| Serial Number | 6515J | | |
| Calibration Date | 23-Oct-2012 | | |
| Calibrator Serial Number | 1 | | |
| Calibration Cable Type | 7-46P XS | | |
| Wheel Correction 1 | -7 | | |
| Wheel Correction 2 | -5 | | |
| **Tension Device** | **One** | | |
| Type | CMTD-B/A | | |
| Serial Number | 1919 | | |
| Calibration Date | 25-Feb-2013 | | |
| Calibrator Serial Number | 78135A | | |
| Calibration Points | 10 | | |
| Calibration RMS | 6 | | |

| | | | |
|---|---|---|---|
| Calibration RMS | 6 | | |
| Calibration Peak Error | 11 | | |
| **Logging Cable** | **One** | | |
| Type | 7-46P-XS | | |
| Serial Number | U711056 | | |
| Logging Cable Length ( ft ) | 24000.00 | | |

## Repeat Pass

## Integration Summary

| Output Channel(s) | Output Description | Input Parameter | Output Value | Unit |
|---|---|---|---|---|
| IHV | Integrated Hole Volume | GCSE_UP_PASS, GCSE_DOWN_PASS:One | 308.02 | ft3 |
| ICV | Integrated Cement Volume | GCSE_UP_PASS, GCSE_DOWN_PASS:One, FCD | 177.14 | ft3 |

## Composite Summary

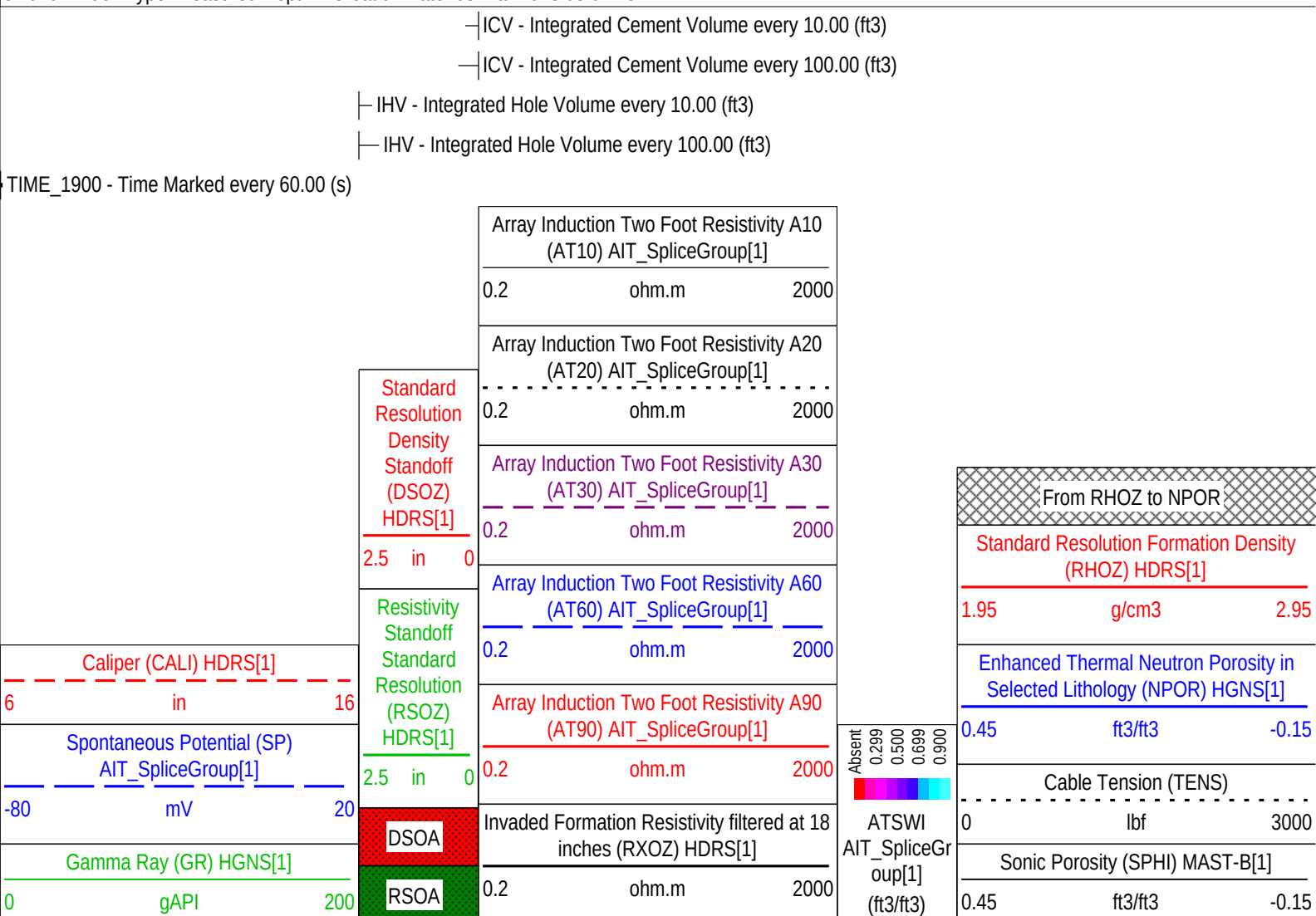
| Run Name | Pass Objective | Direction | Top | Bottom | Start | Stop | Depth Shift | Include Parallel Data |
|---|---|---|---|---|---|---|---|---|
| One | Log[4]:Up | Up | 6906.57 ft | 7476.06 ft | 07-Mar-2013 7:50:29 PM | 07-Mar-2013 8:17:20 PM | 4.50 ft | |
| One | Repeat[5]:Up | Up | 6665.46 ft | 7149.40 ft | 07-Mar-2013 8:27:08 PM | 07-Mar-2013 8:57:10 PM | 4.50 ft | |

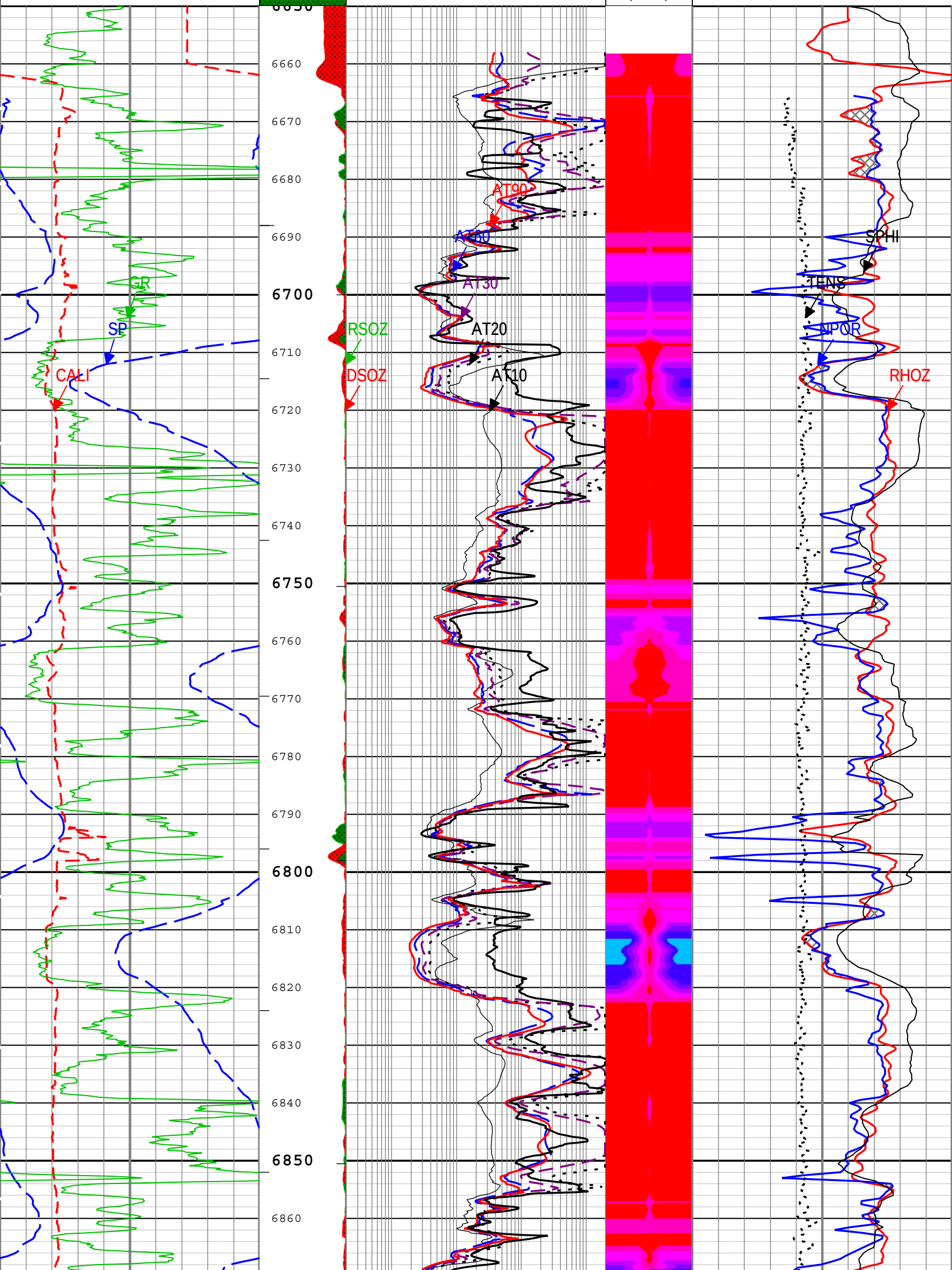
All depths are referenced to toolstring zero

## Log

Repeat Pass

Description: Triple Combo standard resolution template for Platform Express Format: Log ( PEX Triple Combo StdRes ) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 08-Mar-2013 03:02:23

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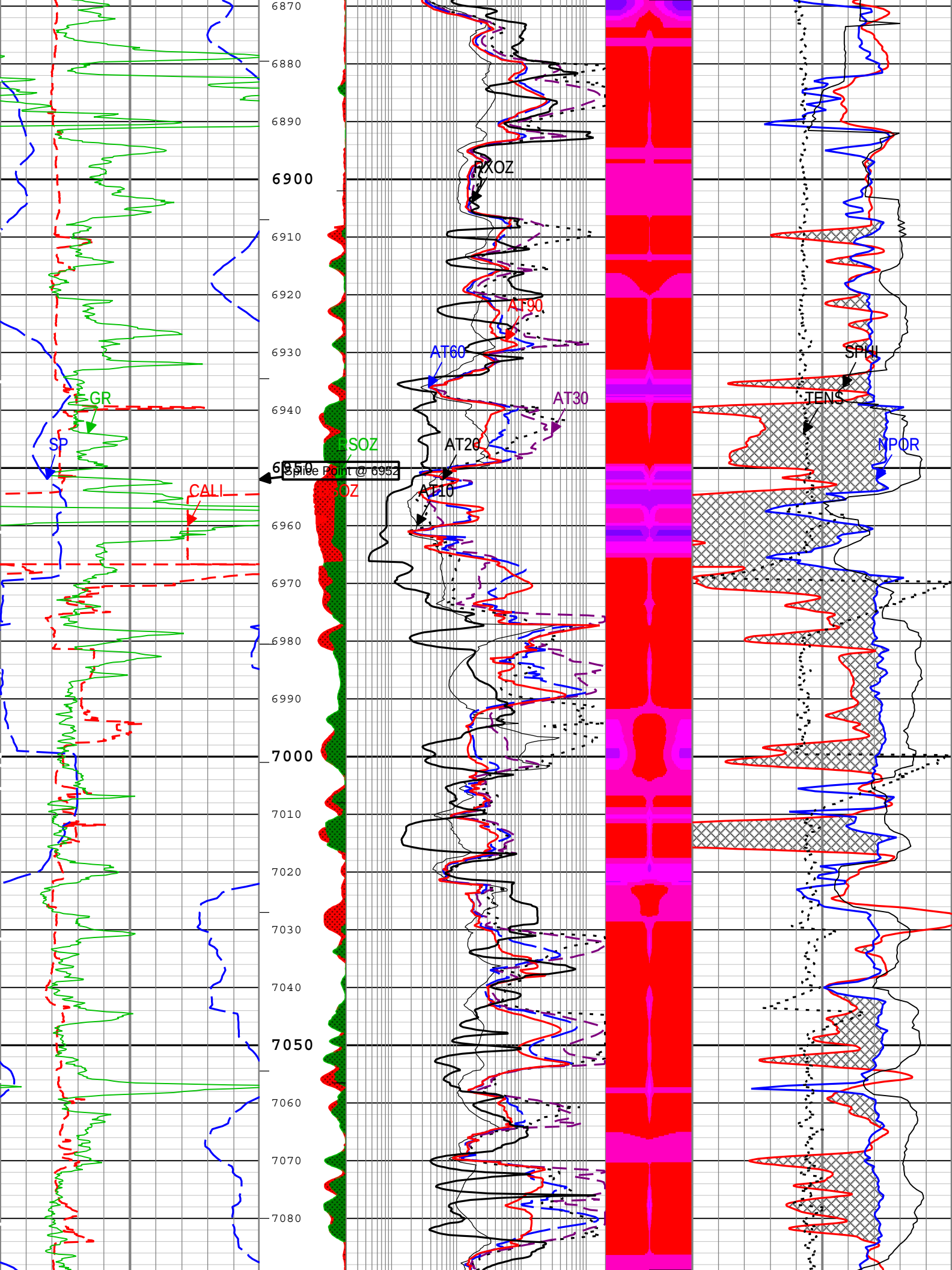
6830
6840
6850
6860
GR
SP
CALI
RSOZ
DSOZ
AT90
AT60
AT30
AT20
AT10
SPHI
TENS
NPOR
RHOZ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7010
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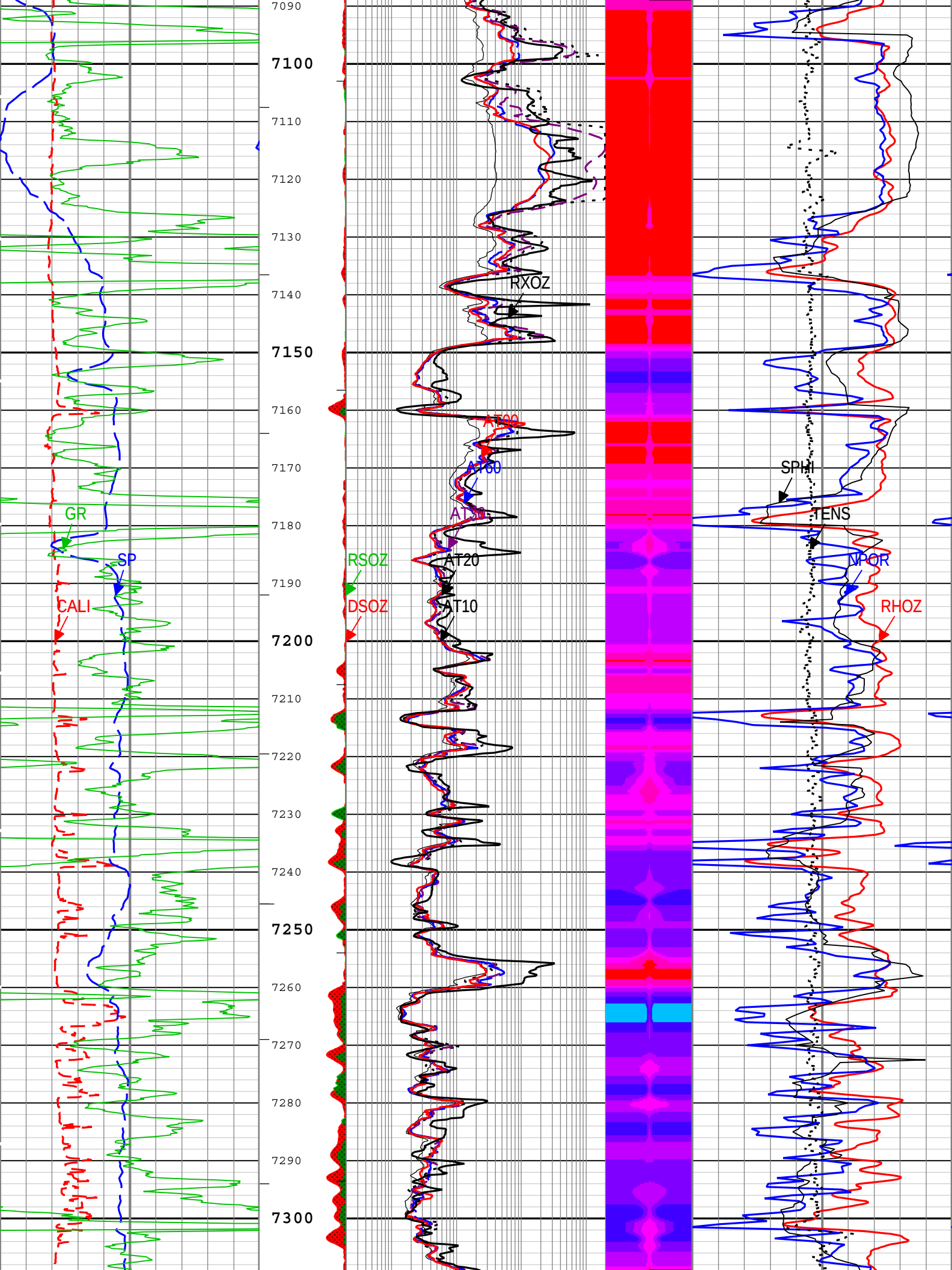
7030
7040
7050
7060
7070
7080
RXOZ
AT90
AT60
AT30
AT20
AT10
SPHI
TENS
NPOR
GR
SP
CALI
RSOZ
SOZ
Splice Point @ 6952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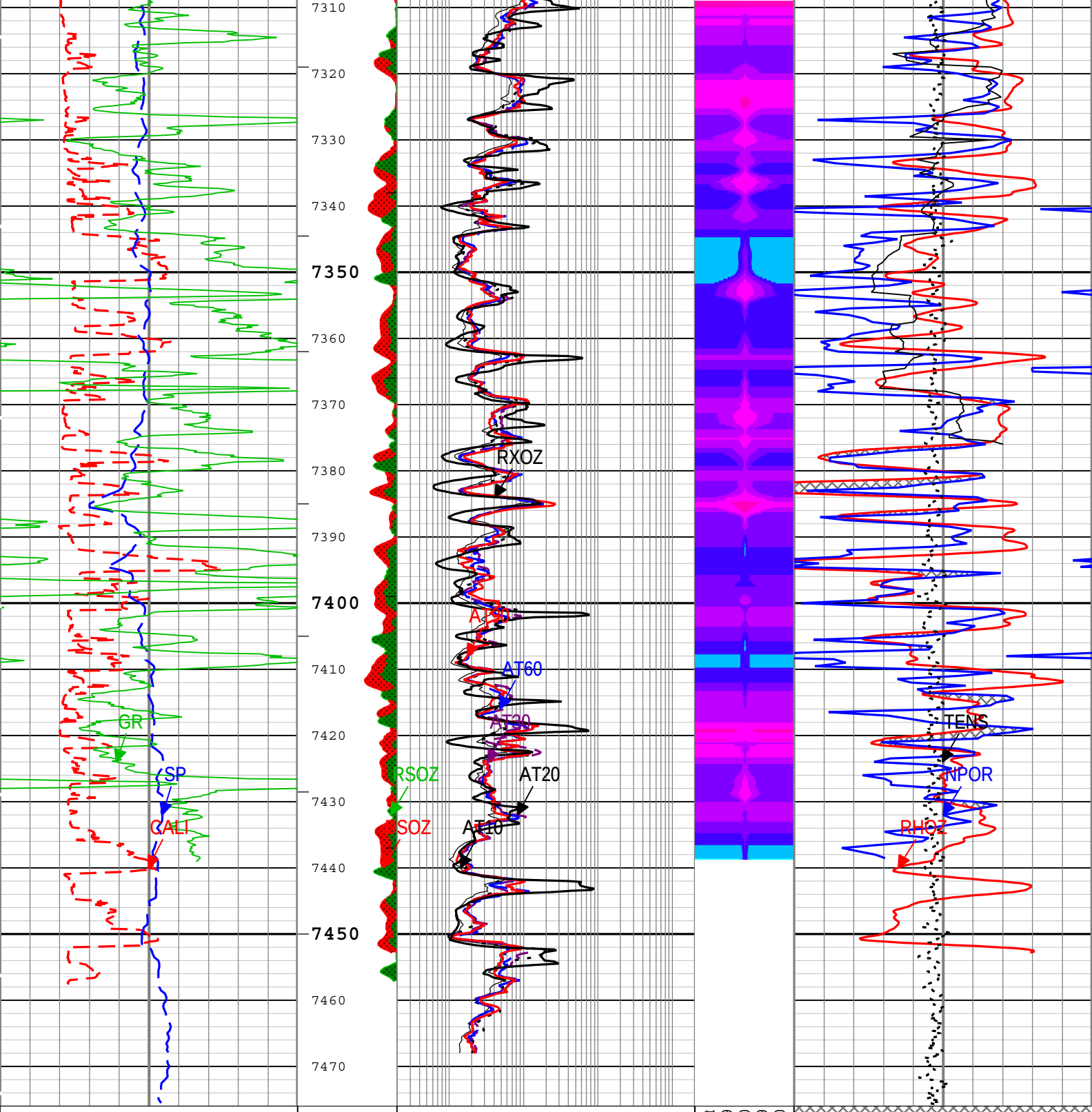
7250
7260
7270
7280
7290
7300
GR
SP
CALI
RSOZ
DSOZ
RXOZ
AT90
AT60
AT30
AT20
AT10
SPHI
TENS
NPOR
RHOZ




Caliper (CALI) HDRS[1]

6 in 16

Spontaneous Potential (SP) AIT_SpliceGroup[1]

-80 mV 20

Gamma Ray (GR) HGNS[1]

0 gAPI 200

Standard Resolution Density Standoff (DSOZ) HDRS[1]

2.5 in 0

Resistivity Standoff Standard Resolution (RSOZ) HDRS[1]

2.5 in 0

Array Induction Two Foot Resistivity A10 (AT10) AIT_SpliceGroup[1]

0.2 ohm.m 2000

Array Induction Two Foot Resistivity A20 (AT20) AIT_SpliceGroup[1]

0.2 ohm.m 2000

Array Induction Two Foot Resistivity A30 (AT30) AIT_SpliceGroup[1]

0.2 ohm.m 2000

Array Induction Two Foot Resistivity A60 (AT60) AIT_SpliceGroup[1]

Absent 0.299 0.500 0.699 0.900

ATSWI AIT_SpliceGroup[1] (ft3/ft3)

From RHOZ to NPOR

Standard Resolution Formation Density (RHOZ) HDRS[1]

1.95 g/cm3 2.95

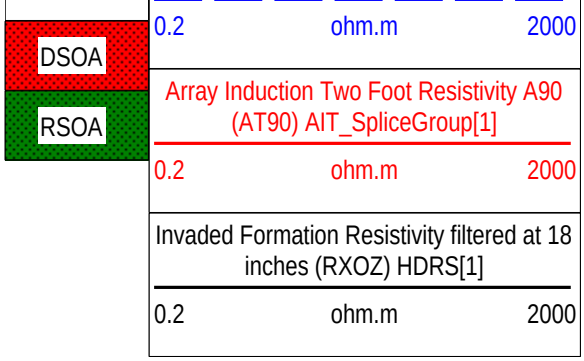
Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS[1]

0.45 ft3/ft3 -0.15

Cable Tension (TENS)

0 lbf 3000

Sonic Porosity (SPHI) MAST-B[1]




0.45 ft3/ft3 -0.15

TIME_1900 - Time Marked every 60.00 (s)

- IHV - Integrated Hole Volume every 100.00 (ft3)
- IHV - Integrated Hole Volume every 10.00 (ft3)
  - ICV - Integrated Cement Volume every 100.00 (ft3)
  - ICV - Integrated Cement Volume every 10.00 (ft3)

Description: Triple Combo standard resolution template for Platform Express Format: Log ( PEX Triple Combo StdRes ) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 08-Mar-2013 03:02:23

# Channel Processing Parameters

## One: Parameters

| Parameter | Description | Tool | Value | Unit |
|---|---|---|---|---|
| ABHM | Array Induction Borehole Correction Mode | AIT-H | Compute Mud Resistivity | |
| ABLM | Array Induction Basic Logs Mode | AIT-H | Normal | |
| ACDE | Array Induction Casing Detection Enable | AIT-H | Yes | |
| ASTA | Array Induction Tool Standoff | AIT-H | 0.6 | in |
| BARI | Barite Mud Presence Flag | Borehole | No | |
| BHS | Borehole Status (Open or Cased Hole) | Borehole | Open | |
| BS | Bit Size | WLSESSION | 7.875 | in |
| BSAL | Borehole Salinity | Borehole | 8734 | ppm |
| CALI_SHIFT | CALI Supplementary Offset | HDRS-H | 0 | in |
| CBLO | Casing Bottom (Logger) | WLSESSION | 530 | ft |
| CDEN | Cement Density | HGNS-H | 2 | g/cm3 |
| CDTS | Correction for Delta-T Shale, Empirical | Borehole | 100 | us/ft |
| DC_MODE | Depth Correction Mode | DepthCorrection | Real-time | |
| DFD | Drilling Fluid Density | Borehole | 8.9 | lbm/gal |
| DFT | Drilling Fluid Type | Borehole | Water | |
| DFT_WATER | Drilling Fluid Water Type | Borehole | DAP/Pac | |
| DHC | Density Hole Correction | HDRS-H | Bit Size | |
| DTF | Delta-T Fluid | Borehole | 189 | us/ft |
| DTM | Delta-T Matrix | Borehole | 56 | us/ft |
| DTMD | Borehole Fluid Slowness | Borehole | 206 | us/ft |
| FCD | Future Casing (Outer) Diameter | WLSESSION | 5.5 | in |
| FSAL | Formation Salinity | Borehole | 0 | ppm |
| GCSE_DOWN_PASS | Generalized Caliper Selection for WL Log Down Passes | Borehole | BS | |
| GCSE_UP_PASS | Generalized Caliper Selection for WL Log Up Passes | Borehole | CALI | |
| GRSE | Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity | Borehole | AMF | |
| GTSE | Generalized Temperature Selection, from Measured or Computed Temperature | Borehole | CTEM | |
| HSCO | Hole Size Correction Option | HGNS-H | Yes | |
| M | Exponent M of the Archie Formation Factor - Porosity Equation | Borehole | 2 | |
| MATR | Rock Matrix for Neutron Porosity Corrections | Borehole | LIMESTONE | |
| MFST | Mud Filtrate Sample Temperature | Borehole | 60.6 | degF |

| | | | | |
|---|---|---|---|---|
| MODALCTL_MFM | Modal Decomposition Processing Control Flag for Monopole Far Transmitter Mid Frequency Firing | MAST-B | On | |
| RMFS | Resistivity of Mud Filtrate Sample | Borehole | 0.72 | ohm.m |
| RW | Connate Water Resistivity | Borehole | 1 | ohm.m |
| SFTY | Slowness Formation Type (Fast, Intermediate, Slow, etc.) | Borehole | Intermediate | |
| SOCO | Standoff Correction Option | HGNS-H | Yes | |
| SPDR | SP Drift Per Foot | AIT-H | 0 | mV/ft |
| SPFS | Sonic Porosity Formula | Borehole | Raymer-Hunt | |
| SSCCTL_MFM | Sensor Sensitivity Correction Processing Control Flag for Monopole Far Transmitter Mid Frequency Firing | MAST-B | On | |

# Tool Control Parameters

## One: Parameters

| Parameter | Description | Tool | Value | Unit |
|---|---|---|---|---|
| ACQ_DOMAIN | Custom Acquisition Domain Name | MAST-B | [UMMF, LMMF, FMMF, FMLF, XDCF, YDCF] | |
| CBOOTSTA_MAPC | MAMS Controller Boot Status | MAST-B | 1 | |
| CFWREV_MAPC | MAPC Firmware Revision of Controller Electronics | MAST-B | 1840 | |
| COMPCTL | Data Compression Control | MAST-B | [MZIPA, MZIPA, MZIPA, MZIPD, MZIPD, MZIPD] | |
| DHMODALCTL | Downhole/Surface Modal Computation Control | MAST-B | [HALF, OFF, OFF, HALF, HALF, HALF] | |
| DIGDEL | Waveform Digitizing Delay | MAST-B | [0, 0, 0, 0, 0, 0] | us |
| DIGDT | Sonic Waveform Digitizing Slowness | MAST-B | [0, 0, 0, 0, 0, 0] | us/ft |
| DIGTIME | Digitizing Time | MAST-B | [2550, 2550, 5110, 20440, 30480, 30480] | us |
| DIIN_WF_CHN | Dipole Inline Component Waveform Data Channel Name | MAST-B | [, , , , RSW90C_090, RSW00C_000] | |
| DIIN_WFN_CHN | Dipole Inline Component Waveform Normalization Data Channel Name | MAST-B | [, , , , RSW90CN_090, RSW00CN_000] | |
| DIOF_WF_CHN | Dipole Offline Component Waveform Data Channel Name | MAST-B | [, , , , RSW90C_000, RSW00C_090] | |
| DIOF_WFN_CHN | Dipole Offline Component Waveform Normalization Data Channel Name | MAST-B | [, , , , RSW90CN_000, RSW00CN_090] | |
| GNINT | Automatic Gain Selection Time Interval | MAST-B | [2550, 2550, 5110, 20440, 30480, 30480] | us |
| HMCA_BRD_TYPE | HMCA Board Type | HGNS-H | 1 | |
| HRGD_BRD_TYPE | HRGD Board Type | HDRS-H | WITH_HET | |
| MAX_LOG_SPEED | Toolstring Maximum Logging Speed | WLSESSION | Time Zoned | ft/h |
| MAX_TOOL_SPEED | Maximum service speed allowed for, or attained by, a logging tool. | MAST-B | Time Zoned | ft/h |
| MONO_WF_CHN | Monopole Component Waveform Data Channel Name | MAST-B | [RSWMUM_M, RSWMLM_M, RSWMFM_M, RSWMFL_M, RSW90C_M, RSW00C_M] | |
| MONO_WFN_CHN | Monopole Component Waveform Normalization Data Channel Name | MAST-B | [RSWMUMN_M, RSWMLMN_M, RSWMFMN_M, RSWMFLN_M, RSW90CN_M, RSW00CN_M] | |
| MSMT_LIST | Measurement List | MAST-B | [MUM, MLM, MFM, MFL, 90C, 00C] | |
| NUMMSMT | Number of active measurements | MAST-B | 6 | |
| PROD_CLASS | MAST Product Class Selection | MAST-B | STD | |
| R10FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #10 | MAST-B | 1057 | |
| R11FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #11 | MAST-B | 1057 | |
| R12FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #12 | MAST-B | 1057 | |
| R13FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #13 | MAST-B | 1057 | |
| R1FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #1 | MAST-B | 1057 | |
| R2FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #2 | MAST-B | 1057 | |
| R3FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #3 | MAST-B | 1057 | |
| R4FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #4 | MAST-B | 1057 | |
| R5FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #5 | MAST-B | 1057 | |
| R6FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #6 | MAST-B | 1057 | |
| R7FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #7 | MAST-B | 1057 | |

| | | | | |
|---|---|---|---|---|
| R8FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #8 | MAST-B | 1057 | |
| R9FWREV_MAPC | MAPC Firmware Revision of Sensor Electronics Station #9 | MAST-B | 1057 | |
| RBOOTSTA_MAPC | MAMS Receiver Boot Status | MAST-B | 1 | |
| RXSEL | Receiver Station Select | MAST-B | [[On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On], [On, On, On, On, On, On]] | |
| SAMINT | Sonic Waveform Sampling Interval | MAST-B | [10, 10, 10, 40, 40, 40] | |
| SERVICE_LIST | Service Selection List | MAST-B | [STSTC, NMSTC, XDSTC, YDSTC, FMSTC, ANISO, NMATD, FMATD, CRV, BHC, PBHC] | |
| SNSR_WF_CHN | Sensor Waveforms Data Channel Name | MAST-B | [RSWMUM, RSWMLM, RSWMFM, RSWMFL, RSW90C, RSW00C] | |
| SNSR_WFN_CHN | Sensor Waveforms Normalization Factor Channel Name | MAST-B | [SWMUMN, SWMLMN, SWMFMN, SWMFLN, SW90CN, SW00CN] | |
| SNSRSEL | Sensor Element Select | MAST-B | [[On, On, On, On, On, On], [Off, Off, Off, Off, On, On], [On, On, On, On, On, On], [Off, Off, Off, Off, On, On], [On, On, On, On, On, On], [Off, Off, Off, Off, On, On], [On, On, On, On, On, On], [Off, Off, Off, Off, On, On]] | |
| TX_AMP | Transmitter Amplitude Factor | MAST-B | [THREEQUARTER, THREEQUARTER, FULL, FULL, FULL, FULL] | |
| TXSEL | Transmitter Drive Selection | MAST-B | [UM, LM, FM, FM, D90, D00] | |
| WF_CR_CHN | Waveform Compression Rate Channel Name | MAST-B | [WCRMUM, WCRMLM, WCRMFM, WCRMFL, WCR90C, WCR00C] | |
| WF_DEPTH_CHN | Waveform Depth Channel Name | MAST-B | [WDMUM, WDMLM, WDMFM, WDMFL, WD90C, WD00C] | |
| WF_QI_CHN | Waveform Quality Indicator Channel Name | MAST-B | [WQMUM, WQMLM, WQMFM, WQMFL, WQ90C, WQ00C] | |
| WFSEL | Transmitter Drive Waveform Selection | MAST-B | [mp_mf_d, mp_mf_d, mp_mf_d, mp_lf_d, dp_cd_d, dp_cd_d] | |

## OneTime Zoned Parameters

## Pass Log[4]:Up

| Parameter | Value | Start Time | Stop Time | Start Depth ( ft ) | Stop Depth ( ft ) |
|---|---|---|---|---|---|
| MAX_LOG_SPEED | 1800 | 07-Mar-2013 19:50:29 | 07-Mar-2013 19:58:17 | 7475.91 | 7279 |
| MAX_LOG_SPEED | 1687 | 07-Mar-2013 19:58:17 | 07-Mar-2013 20:17:20 | 7279 | 6985.07 |
| MAX_TOOL_SPEED | 2028 | 07-Mar-2013 19:50:29 | 07-Mar-2013 19:51:07 | 7475.91 | 7473.61 |
| MAX_TOOL_SPEED | 1803 | 07-Mar-2013 19:51:07 | 07-Mar-2013 19:58:17 | 7473.61 | 7279 |
| MAX_TOOL_SPEED | 1687 | 07-Mar-2013 19:58:17 | 07-Mar-2013 20:17:20 | 7279 | 6985.07 |

## Pass Repeat[5]:Up

| | | | | | |
|---|---|---|---|---|---|
| MAX_LOG_SPEED | 1650 | 07-Mar-2013 20:35:47 | 07-Mar-2013 20:57:10 | 7004.87 | 6665.91 |
| MAX_TOOL_SPEED | 1650 | 07-Mar-2013 20:35:47 | 07-Mar-2013 20:57:10 | 7004.87 | 6665.91 |

All depth are at tool zero.

# Calibration Report

## AIT-H (Array Induction Tool - H) Calibration - Run One

Primary Equipment :

| | | |
|---|---|---|
| Array Induction Sonde - H | AHIS | 216 |

Auxiliary Equipment :

| | |
|---|---|
| AITH Rm/SP Bottom Nose | AHRM |

## AIT Sonde Calibration - Test Loop Gain

## AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 14:05:49 10-Dec-2012

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Test Loop Gain - 0 | | Master | 1.000 | 0.950 | 1.012 | 1.050 |
| Test Loop Phase - 0 | deg | Master | 0 | -3.000 | 0.555 | 3.000 |
| Test Loop Gain - 1 | | Master | 1.000 | 0.950 | 1.009 | 1.050 |
| Test Loop Phase - 1 | deg | Master | 0 | -3.000 | 0.353 | 3.000 |
| Test Loop Gain - 2 | | Master | 1.000 | 0.950 | 1.011 | 1.050 |
| Test Loop Phase - 2 | deg | Master | 0 | -3.000 | -0.040 | 3.000 |
| Test Loop Gain - 3 | | Master | 1.000 | 0.950 | 1.010 | 1.050 |
| Test Loop Phase - 3 | deg | Master | 0 | -3.000 | 0.091 | 3.000 |
| Test Loop Gain - 4 | | Master | 1.000 | 0.950 | 0.993 | 1.050 |
| Test Loop Phase - 4 | deg | Master | 0 | -3.000 | -0.048 | 3.000 |
| Test Loop Gain - 5 | | Master | 1.000 | 0.950 | 0.986 | 1.050 |
| Test Loop Phase - 5 | deg | Master | 0 | -3.000 | -0.240 | 3.000 |
| Test Loop Gain - 6 | | Master | 1.000 | 0.950 | 0.988 | 1.050 |
| Test Loop Phase - 6 | deg | Master | 0 | -3.000 | 1.333 | 3.000 |
| Test Loop Gain - 7 | | Master | 1.000 | 0.950 | 0.999 | 1.050 |
| Test Loop Phase - 7 | deg | Master | 0 | -3.000 | -0.235 | 3.000 |

## AIT Sonde Calibration - Sonde Error Correction

Master (EEPROM): 14:05:49 10-Dec-2012

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Sonde Error Correction Real - 0 | mS/m | Master | ----- | -231.000 | -92.597 | 119.000 |
| Sonde Error Correction Quad - 0 | | Master | ----- | -2250.000 | -167.839 | 2250.000 |
| Sonde Error Correction Real - 1 | mS/m | Master | ----- | 114.000 | 165.455 | 204.000 |
| Sonde Error Correction Quad - 1 | | Master | ----- | -625.000 | 0.770 | 625.000 |
| Sonde Error Correction Real - 2 | mS/m | Master | ----- | 66.000 | 114.233 | 156.000 |
| Sonde Error Correction Quad - 2 | | Master | ----- | -350.000 | -176.552 | 350.000 |
| Sonde Error Correction Real - 3 | mS/m | Master | ----- | 39.000 | 59.629 | 89.000 |
| Sonde Error Correction Quad - 3 | | Master | ----- | -250.000 | -64.057 | 250.000 |
| Sonde Error Correction Real - 4 | mS/m | Master | ----- | 15.000 | 26.319 | 35.000 |
| Sonde Error Correction Quad - 4 | | Master | ----- | -63.000 | -12.336 | 63.000 |
| Sonde Error Correction Real - 5 | mS/m | Master | ----- | 4.000 | 14.027 | 24.000 |
| Sonde Error Correction Quad - 5 | | Master | ----- | -50.000 | -14.788 | 50.000 |
| Sonde Error Correction Real - 6 | mS/m | Master | ----- | 5.000 | 10.456 | 15.000 |
| Sonde Error Correction Quad - 6 | | Master | ----- | -30.000 | -4.003 | 30.000 |
| Sonde Error Correction Real - 7 | mS/m | Master | ----- | -5.000 | -0.491 | 5.000 |
| Sonde Error Correction Quad - 7 | | Master | ----- | -30.000 | 1.926 | 30.000 |

## AIT Mud Calibration - Mud Calibration Gain

Master (EEPROM): 14:05:49 10-Dec-2012

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Coarse Gain | | Master | 1.000 | 0.800 | 0.850 | 1.200 |
| Fine Gain | | Master | 1.000 | 0.800 | 0.849 | 1.200 |

## AIT Electronics Check - Thru Calibration Check

Master (EEPROM): 14:05:49 10-Dec-2012 Before (Measured): 08:09:48 07-Mar-2013 After:

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Thru Cal Mag - 0 | V | Master | ----- | 0.363 | 0.628 | 0.847 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Thru Cal Phase - 0 | deg | Master | ----- | 11.000 | 51.537 | 131.000 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Thru Cal Mag - 1 | V | Master | ----- | 0.762 | 1.288 | 1.778 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Thru Cal Phase - 1 | deg | Master | ----- | 10.000 | 50.510 | 130.000 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Mag - 2 | V | Master | ----- | 0.374 | 0.639 | 0.872 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Phase - 2 | deg | Master | ----- | 6.000 | 46.742 | 126.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Mag - 3 | V | Master | ----- | 0.422 | 0.721 | 0.986 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Phase - 3 | deg | Master | ----- | 5.000 | 45.953 | 125.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Mag - 4 | V | Master | ----- | 0.802 | 1.357 | 1.872 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Phase - 4 | deg | Master | ----- | -1.000 | 39.574 | 119.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Mag - 5 | V | Master | ----- | 1.173 | 1.970 | 2.737 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Phase - 5 | deg | Master | ----- | -3.000 | 37.668 | 117.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Mag - 6 | V | Master | ----- | 1.173 | 1.969 | 2.737 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Phase - 6 | deg | Master | ----- | -3.000 | 37.662 | 117.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Mag - 7 | V | Master | ----- | 0.849 | 1.408 | 1.981 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| Thru Cal Phase - 7 | deg | Master | ----- | -7.000 | 33.836 | 113.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| SPA Zero - 0 | mV | Master | | -50.000 | -0.041 | 50.000 | |
| | | Before | ----- | ----- | ----- | ----- | |
| | | After | ----- | ----- | ----- | ----- | |
| | | Before-Master | ----- | ----- | ----- | ----- | |
| | | After-Before | ----- | ----- | ----- | ----- | |
| SPA Plus - 0 | mV | Master | | 941.000 | 993.255 | 1040.000 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Temperature Zero - 0 | V | Master | | -0.050 | 0.000 | 0.050 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Temperature Plus - 0 | V | Master | | 0.870 | 0.921 | 0.960 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |

## HDRS-H (HILT Density and Rxo Sonde, 150 degC) Calibration - Run One

**Primary Equipment :**

| | | |
|---|---|---|
| HILT High-Resolution Control Cartridge, 150 degC | HRCC-H | 3828 |
| HILT Resistivity Gamma-Ray Density Device, 150 degC | HRGD-H | 3870 |

**Auxiliary Equipment :**

| | | |
|---|---|---|
| HRDD Backscatter Detector | Backscatter | |
| HRDD Long Spacing Detector | Long Spacing | 28620 |
| HRDD Short Spacing Detector | Short Spacing | |
| Cesium 137 Gamma-Ray Logging Source | GSR-J | 5471 |
| HILT High-Resolution Control Cartridge, 150 degC | HRCC-H | 3828 |
| HILT High-Resolution Mechanical Sonde, 150 degC | HRMS-H | 3863 |

**Calibration Parameter :**

| | |
|---|---|
| Small Ring Size (Caliper Calibration Small Ring) | 8.00 |
| Large Ring Size (Caliper Calibration Large Ring) | 12.00 |

## HDRS Caliper Calibration - Caliper Accumulations

Before (Measured): 10:09:12 06-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Small Ring | in | Before | 8.00 | 6.00 | 7.85 | 10.00 |
| Large Ring | in | Before | 12.00 | 9.00 | 12.17 | 15.00 |

## HDRS Density Calibration - Inversion Results

Master (EEPROM): 15:58:08 05-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Rho Aluminum | g/cm3 | Master | 2.596 | 2.586 | 2.599 | 2.606 |
| Rho Magnesium | g/cm3 | Master | 1.686 | 1.676 | 1.685 | 1.696 |
| Pe Aluminum | | Master | 2.570 | 2.470 | 2.540 | 2.670 |
| Pe Magnesium | | Master | 2.650 | 2.550 | 2.637 | 2.750 |

## HDRS Density Calibration - Deviation Summary

Master (EEPROM): 15:58:08 05-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS Average Deviation | % | Master | 0 | -0.6000 | 0.5000 | 0.6000 |
| BS Max Deviation | % | Master | 0 | -1.6000 | 0.9313 | 1.6000 |
| SS Average Deviation | % | Master | 0 | -1.0000 | 0.2753 | 1.0000 |
| SS Max Deviation | % | Master | 0 | -2.5000 | 0.7110 | 2.5000 |
| LS Average Deviation | % | Master | 0 | -1.5000 | 0.6418 | 1.5000 |
| LS Max Deviation | % | Master | 0 | -3.5000 | 1.8756 | 3.5000 |

## HDRS Density Calibration - Background Summary

Master (EEPROM): 15:58:08 05-Mar-2013 Before (Measured): 09:59:49 06-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS Window Ratio | | Master | 1.0000 | | 0.7399 | |
| | | Before | 0.7399 | 0.7029 | 0.7397 | 0.7769 |
| | | Before-Master | ----- | ----- | -0.0002 | ----- |
| BS Window Sum | 1/s | Master | 1 | | 24418 | |
| | | Before | 24418 | 23197 | 24505 | 25639 |
| | | Before-Master | ----- | ----- | 87 | ----- |

| | | | | | | |
|---|---|---|---|---|---|---|
| SS Window Ratio | | Master | 1.0000 | | 0.4908 | |
| | | Before | 0.4908 | 0.4663 | 0.4918 | 0.5154 |
| | | Before-Master | ----- | ----- | 0.0010 | ----- |
| SS Window Sum | 1/s | Master | 1 | | 13996 | |
| | | Before | 13996 | 13297 | 13993 | 14696 |
| | | Before-Master | ----- | ----- | -3 | ----- |
| LS Window Ratio | | Master | 1.0000 | | 0.3015 | |
| | | Before | 0.3015 | 0.2864 | 0.3019 | 0.3166 |
| | | Before-Master | ----- | ----- | 0.0004 | ----- |
| LS Window Sum | 1/s | Master | 1 | | 1257 | |
| | | Before | 1257 | 1194 | 1246 | 1320 |
| | | Before-Master | ----- | ----- | -11 | ----- |

## HDRS Density Calibration - Photo-multiplier High Voltages

Master (EEPROM): 15:58:08 05-Mar-2013 Before (Measured): 09:59:49 06-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS PM High Voltage | V | Master | | 1000 | 1617 | 2400 |
| | | Before | | 1000 | 1632 | 2400 |
| | | Before-Master | ----- | -100 | 15 | 100 |
| SS PM High Voltage | V | Master | | 1000 | 1685 | 2400 |
| | | Before | | 1000 | 1697 | 2400 |
| | | Before-Master | ----- | -100 | 12 | 100 |
| LS PM High Voltage | V | Master | | 1000 | 1324 | 2400 |
| | | Before | | 1000 | 1328 | 2400 |
| | | Before-Master | ----- | -100 | 4 | 100 |

## HDRS Density Calibration - Crystal Quality Resolutions

Master (EEPROM): 15:58:08 05-Mar-2013 Before (Measured): 09:59:49 06-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| BS Crystal Resolution | % | Master | | 5.00 | 11.41 | 25.00 |
| | | Before | | 5.00 | 11.45 | 25.00 |
| | | Before-Master | ----- | -1.00 | 0.04 | 1.00 |
| SS Crystal Resolution | % | Master | | 5.00 | 10.24 | 20.00 |
| | | Before | | 5.00 | 10.30 | 20.00 |
| | | Before-Master | ----- | -1.00 | 0.06 | 1.00 |
| LS Crystal Resolution | % | Master | | 5.00 | 8.30 | 20.00 |
| | | Before | | 5.00 | 8.27 | 20.00 |
| | | Before-Master | ----- | -1.00 | -0.03 | 1.00 |

## HDRS MCFL Calibration - MCFL Accumulations

Before (Measured): 10:02:18 06-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Main Resistivity | ohm.m | Before | 3875 | 3565 | 3913 | 4185 |
| Deep Resistivity | ohm.m | Before | 3830 | 3524 | 3857 | 4136 |
| Shallow Resistivity | ohm.m | Before | 3830 | 3524 | 3871 | 4136 |

## HGNS-H (HILT Gamma-Ray and Neutron Sonde, 150 degC) Calibration - Run One

**Primary Equipment :**

| | | |
|---|---|---|
| HILT Gamma-Ray and Neutron Sonde, 150 degC | HGNS-H | 4865 |

**Auxiliary Equipment :**

| | | |
|---|---|---|
| HGNS Accelerometer, 150 degC | HACCZ-H | 6991 |
| AmBe Neutron Logging Source | NSR-F | 2554 |

**Calibration Parameter :**

| | |
|---|---|
| Water Temperature | |
| Housing Size | |
| JIG-BKG (Jig minus background reference) | 165 |

## HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured): 08:09:11 07-Mar-2013

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| AZ Vertical Measurement | ft/s2 | Before | 32.2 | 31.5 | 32.1 | 32.8 |

## HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM): 00:00:00 15-May-2007

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Accelerometer Manufacturer | | Master | | | QAT_160 | |
| Accelerometer Reference Temperature | degF | Master | | 30.2 | 77.0 | 122.0 |
| Accelerometer Coefficients - 0 | | Master | ----- | ----- | -4298.000 | ----- |
| Accelerometer Coefficients - 1 | | Master | ----- | ----- | 50.180 | ----- |
| Accelerometer Coefficients - 2 | | Master | ----- | ----- | -0.002 | ----- |
| Accelerometer Coefficients - 3 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 4 | | Master | ----- | ----- | 2.754 | ----- |
| Accelerometer Coefficients - 5 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 6 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 7 | | Master | ----- | ----- | 0.000 | ----- |
| Accelerometer Coefficients - 8 | | Master | ----- | ----- | 300.500 | ----- |
| Accelerometer Coefficients - 9 | | Master | ----- | ----- | 0.994 | ----- |

## HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM): 22:07:24 05-Feb-2013 Before (Measured): 09:57:19 06-Mar-2013 After:

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| Near Zero Measurement | 1/s | Master | 0 | 5.0 | 28.3 | 40.0 |
| | | Before | 0 | 5.0 | 28.1 | 40.0 |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | -4.2 | -0.2 | 4.2 |
| | | After-Before | ----- | ----- | ----- | ----- |
| Far Zero Measurement | 1/s | Master | 0 | 5.0 | 28.1 | 40.0 |
| | | Before | 0 | 5.0 | 27.0 | 40.0 |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | -4.2 | -1.1 | 4.2 |
| | | After-Before | ----- | ----- | ----- | ----- |
| Near Plus Measurement - 0 | 1/s | Master | 6031.0 | 4700.0 | 5629.0 | 6900.0 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Far Plus Measurement - 0 | 1/s | Master | 2793.0 | 1900.0 | 2309.0 | 2900.0 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Near Corrected Plus Measurement - 0 | 1/s | Master | | 4700.0 | 5734.0 | 6900.0 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| Far Corrected Plus Measurement - 0 | 1/s | Master | | 1900.0 | 2366.0 | 2900.0 |
| | | Before | ----- | ----- | ----- | ----- |
| | | After | ----- | ----- | ----- | ----- |
| | | Before-Master | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |

## HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured): 10:09:49 06-Mar-2013 After:

| Measurement | Unit | Phase | Nominal | Low Limit | Actual | High Limit |
|---|---|---|---|---|---|---|
| RGR Zero Measurement | gAPI | Before | 30.0 | 0 | 94.9 | 120.0 |
| | | After | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |
| RGR Plus Measurement | gAPI | Before | 185.4 | 157.1 | 169.5 | 206.3 |
| | | After | | | NOT DONE | |
| | | After-Before | ----- | ----- | ----- | ----- |
| GR Calibration Gain | | Before | 0.89 | 0.80 | 0.97 | 1.05 |
| | | After | ----- | ----- | ----- | ----- |
| | | After-Before | ----- | ----- | ----- | ----- |

| | |
|---|---|
| Well: | State 16-11S-55W-02 |
| Field: | Wildcat |
| County: | Lincoln |
| State: | Colorado |

# Repeat Pass