WIRELINE OPEN HOLE LOGGING TOOLS
Why not?

Why not develop oilfield tools and equipment that are superior in their functionality, differentiated from the competition, and cost-effective? Why not manufacture, train and operationally support the use of this high quality technology? Why not strategically use our technical expertise to support other energy group members.

PICO Technologies was conceived to answer that question as a subsidiary of PICO Energy Group since 2008 located in Houston, TX and the technology arm of the group, currently responsible for developing “fit-for-purpose”, high quality and cost efficient solutions that address the operating needs of the E & P industry: delivering patented designed proprietary Openhole wireline logging tools and Production optimization control systems for Progressive Cavity Pump systems, as well as Production development and management of other Projects Like PICO IV...

PICO Technologies provides a High Standard Technology with proven capabilities Delivering Cost Efficiency for a Changing Market inspired by the Gearhart Model – High Quality Technology in Massive Production leads to a meaningful Market share.

“I got it in my blood”

–Marvin Gearhart
PICO Group was founded in 1974. A modest beginning indeed, it has been an exciting 40 years. Today, PICO Group remains the Egyptian service leader, with a lead brand and operations in different diverse segments through independent entities in Real Estate, Agriculture, Food, Engineering Services & Trading, Private Equity Investments, Petroleum Services, and Exploration & Production for Oil & Gas.

PICO Group has grown in different market segments it operates in with offices in the Middle East, Europe, United States, and Mexico; the Group employs over 5,000 people.

PICO Energy Group is a leading Egyptian operator of mature oil & gas fields and a provider of fit-for-purpose petroleum services. The E&P Division is focused on the development of mature fields with an international network; a recognized specialization in redeveloping mature fields, and a strong portfolio of assets, the E&P division expects to increase to 65,000 BOEPD by 2016. Meanwhile, the Services Division, operating under PICO Petroleum Services (“PPS”), is expanding beyond the Middle East into the Gulf of Mexico. PPS is comprised of distinct, independent, integrated companies, including: PICO Petroleum Integrated Services, PICO Technologies, PICO Marine Services, PICO Logistics Services, and PICO Research & Analysis. With the support of a specialist technology research & development subsidiary PICO Technologies LLC "established in 2008" in Houston, Texas, PPS is capitalizing on its proven know-how in servicing mature oil and gas fields, providing clients with innovative ideas and fit-for-purpose solutions.

So much for our past and present... What about PICO ENERGY’s future?

The 21st Century is now upon us with a multitude of exciting possibilities and new challenges. PICO ENERGY is no stranger to challenges as it has always welcomed them as a prerequisite of progress. In the past, we had the burden of limited opportunities but the luxury of limited information. Today in a border-less world with the flow of information exceeding human capacity, we are faced with a different challenge: we have the burden of unlimited information but the luxury of unlimited opportunities. We are forced to filter, focus, select, and then prioritize more than any time before. Therefore, we believe that investing in human resources is fundamental for securing the flow of innovative ideas and the future potential of our organizations.

Our key corporate focus is now shifting from the traditional financial indicators towards building a sustainable intellectual base, adaptive to the rapid changing world around us. Our present drive for expansion and innovation is intended to propel us forward as a major regional player in the Energy sector.

Eng. Salah Diab

PICO Technologies is a research, development and manufacturing company focused on innovative oil field equipment and tools. Currently dedicated to designing open-hole wireline logging tools and Production Optimization Control Systems, as well as Production development and management of several other projects. Our proprietary open-hole wire line logging technology provides high quality, cost effective triple combo tools with slimmer, shorter designs to enhance your operations. Full support and training ensure a high performance solution to your logging requirements.

For more information on how you can improve your fundamental logging operation, please contact us at: 19407 Park Row, #130 Houston, TX 77084 956.688.8201 picotechllc.com

Compensated Spectral Density Logging Tool

Compensated Neutron Tool

Thin Bed Array Induction Tool

Telemetry Natural Gamma Tool

Telemetry Spectral Gamma Tool

Borehole Compensated Sonic Tool

Advanced Borehole Imager Tool

Pulsed Neutron Reservoir Saturation Tool

Further Tool Specifications
PICO’s Compensated Spectral Density Logging (CSDL) tool provides state-of-the-art bulk density measurements to understand formation porosity and identify lithology. The tool is rugged and versatile. It operates in wellbore extremes up to 350°F (175°C) and maximum pressure of 20,000 psi. The minimum casing/tubing ID is 5 in. (12.7 cm).

The tool is designed to match the maximum hole size of 22 in. (55.9 cm) and is equally effective in salt, freshwater, oil, and air environments. PICO’s new tool is suitable for use in wells where the wellbore is up to 350°F (175°C) and 20,000 psi, with a minimum casing/tubing ID of 5 in. (12.7 cm). It operates in wellbore extremes up to 350°F (175°C) and maximum pressure of 20,000 psi. The minimum casing/tubing ID is 5 in. (12.7 cm).

Applications include:
- Determination of formation bulk density and porosity
- Identification of formation lithology regardless of formation fluid type
- Delineation of thinly bedded formations
- Detection of formation gas

Features include:
- Highly accurate measurements of ±0.01 gm/cc, no standoff
- Logging in a full range of borehole fluids, including salt and freshwater, oil and air, at speeds as high as 60 ft/min.
- A decentralizer presses the source and detector pad against the wellbore wall to ensure high-quality formation data.
- Borehole environments up to 350°F and 20,000 psi

Specifications:
- Length: 15.21 ft (4.63m)
- Max OD: 4.5 in. (11.43 cm)
- Min Hole: 5 in. (12.7 cm)
- Max Temp: 350°F (175°C)
- Max Press: 20,000 psi
- Pad Length: 43 in.
- Pad Width: 3.28 in.
- Weight: 428 lb

Hardware characteristics:
- Source Type: 1.5 Ci Cesium-137
- Sensor Type: NaI Scintillation
- Sensor Spacing: Proprietary
- Sample Rate: 4 or 10 samples/ft
- No. Channels: 128
- Full Spectrum: Full
- Combinability: PTEL

Calibration:
- Primary: UT Test Pit
- Secondary: Water Tank
- Wellsite Verifier: Ice Block

Compensated Spectral Density Logging Tool

The PICO Compensated Neutron Tool (PCNT) provides state-of-the-art measurement of formation porosity. The data is used with resistivity logs and/or pulsed neutron logs to determine formation water saturation. Combined with density logs from Pico’s Spectral Density Logging Tool, the PCNT logs also indicate formation gas saturation and formation lithology.

Applications include:
- Determination of porosity
- Determination of lithology
- Detection of formation gas

Features include:
- Highly accurate measurements of ± 5% or 1 p.u. (whichever is greater)
- A bowspring decentralizer presses the tool against the wellbore wall to ensure acquisition of high-quality formation data
- Borehole environments up to 350°F and 20,000 psi

Specifications:
- Length: 7.04 ft (2.14m)
- Max OD: 3.625 in. (9.2 cm)
- Min Hole: 4 in. (10.16 cm)
- Max Temp: 350°F (175°C)
- Max Press: 20,000 psi
- Weight: 144 lb

Hardware characteristics:
- Source Type: 15 Curie AmBi 241
- Sensor Type: Helium3 Gas Detector
- Sensor Spacing: Proprietary
- Sample Rate: 4 or 10 samples/ft
- No. Windows: Aggregate Counts
- Full Spectrum: Aggregate Counts
- Combinability: PTEL below PSGT, above TBI

Calibration:
- Primary: UT Test Pit
- Secondary: Water Tank
- Wellsite Verifier: Ice Block

Compensated Neutron Tool
**Thin Bed Array Induction Tool**

The PICO Thin Bed Array Induction (PTBI) tool measures formation resistivity in fresh water environments using electromagnetic induction. In addition to standard horizontal measurements, vertical conductivity measurement (relative to the axis of the tool) enables examination of thinly bedded and dipping reservoir rock.

**Performance**

The innovative, high quality tool has a short overall length of just 19.6 ft (5.97 m) and a maximum outside diameter of only 3.625 in. (9.2 cm). Its short length and smaller diameter contributes to a triple combo assembly that improves logging runs in short radius wellbores, and reduces rethole length to provide data across the full formation while cutting drilling requirements.

The tool is rugged and versatile. It operates in wellbore extremes up to 350°F (175°C) and maximum pressure of 20,000 psi. The minimum casing/tubing ID is 4 in. (10.16 cm).

**Technology summary**

Kessivity of rock and fluids around the wellbore is proportional—when pores are partially filled with gas or oil, the formation resistance to an electric current is higher, when the pores are filled with water resistance is lower. The differences in the logged resistivity of the formation are used to calculate hydrocarbon saturation and determine the reservoir’s reserve potential.

**Applications include:**
- Detection of water migration
- Delineation of bed boundaries
- Correlation of log run depths in the same well
- Correlation of formations in different wells
- Estimation of shale volume
- Indication of hydrocarbon bearing zones
- Estimation of shale volume
- Correlation of formations in different wells
- Correlation of log run depths in the same well
- Delineation of bed boundaries
- Detection of water migration

**Specifications:**

- **Source Type:** 16, 24, 32 KHz Coil Arrays
- **Sensor Type:** Coil Array
- **Sample Rate:** 4 samples/ft
- **No. Channels:** 6
- **Combinability:** Bottom only
- **Calibration:**
  - Primary: Precision conductive loop
  - Secondary: Internal R and X Cal signals
  - Wellsite Verifier: Precision resistor, sondes error offset

**Hardware characteristics**

- **Length:** 19.6 ft (5.97 m)
- **Max OD:** 3.625 in. (9.2 cm)
- **Max Temp:** 350°F (175°C)
- **Max Press:** 20,000 psi
- **Max OD:** 3.625 in. (9.2 cm)
- **Min Hole:** 4 in. (10.16 cm)
- **Max Hole:** 24 in. (61 cm)
- **Weight:** 299 lb

**Recommended Maximum Logging Speed:** 60 ft/min

**Recommended Environment:** Salt, fresh, oil, and air

**Recommended Logging speed:** 100 ft/min

**Tool positioning:** Centralized and eccentralized

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**Telemetry Natural Gamma Tool**

The PICO Telemetry Natural Gamma (PTNG) tool measures naturally occurring radiation in the formation. The data is used to understand rock types to identify production potential, estimate shale volume, and correlate lithology.

The PICO Telemetry (PTEL) system integrated on top of the PTNG enables depth correction using a single tool by providing reliable, high bandwidth communication between down hole and surface systems.

**Performance**

The innovative, high quality tool has a short overall length of just 4.2 ft (1.28 m) and a maximum outside diameter of only 3.625 in. (9.2 cm). Its short length and smaller diameter contributes to a triple combo assembly that improves logging runs in short radius wellbores, and reduces rethole length to provide data across the full formation while cutting drilling requirements.

The tool is rugged and versatile. It operates in wellbore extremes up to 350°F (175°C) and maximum pressure of 20,000 psi. The minimum casing/tubing ID is 4 in. (10.16 cm).

**Technology summary**

Rock types including sandstone, limestone, anhydrite and halite have low radiation levels, while shales, claystones have higher radiation levels. As a result, low gamma measurements are used to identify potential hydrocarbon bearing rock while higher values indicate shale volume. Variations in measurements correspond to changes in lithology, which enables formation correlation in different wells and the correlation of multiple log runs in the same well. Gamma ray logs also measure emissions from radioactive materials in water or from water-related deposits, allowing detection of water migration through the formation.

**Applications include:**
- Estimation of hydrocarbon saturation
- Correlation of formations in different wells
- Correlation of log run depths in the same well
- Delineation of bed boundaries
- Detection of water migration

**Specifications:**

- **Source Type:** API gamma ray, Univ. of Houston
- **Sample Rate:** 4 or 10 samples/ft

**Recommended Maximum Logging Speed:** 60 ft/min

**Recommended Environment:** Salt, fresh, oil, and air

**Recommended Logging speed:** 100 ft/min

**Tool positioning:** Centralized and eccentralized

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**Hardware characteristics**

- **Length:** 4.2 ft (1.28 m)
- **Max OD:** 3.625 in. (9.2 cm)
- **Max Hole:** 4 in. (10.16 cm)
- **Max Hole:** 24 in. (60.96 cm)
- **Max Temp:** 350°F (175°C)
- **Max Press:** 20,000 psi
- **Weight:** 68 lb

**Measurement**

- **Principle:** Gamma ray aggregate
- **Range:** 3 API
- **Vertical Resolution (90%):** 18 – 36 in. (standard)
- **Depth of Investigation (50%):** 4 in. (90.11 cm)
- **Precision (99%):**
  - At 60 ft/min ±5% or ± 5 API (whichever is greater)
  - At 30 ft/min ±7% or ± 5 API (whichever is greater)
- **Secondary Curves:**
  - Primary Curves: GR
  - Secondary Curves: none

**Calibration**

- **Primary:** API gamma ray, Univ. of Houston
- **Secondary:** Thorium verifier
- **Wellsite Verifier:** Thorium verifier
**WIRELINE O.H. LOGGING TOOLS**

**Telemetry Spectral Gamma Tool**

The PICO Telemetry Natural Gamma (PTNG) tool measures naturally occurring radiation in the formation. The data is used to understand rock types to identify production potential, estimate shale volume, and correlate lithology.

The PICO Telemetry (PTEL) system integrated on top of the PTSG enables depth correction using a single tool by providing reliable, high bandwidth communication between downhole and surface systems.

**Performance**

- The innovative, high quality tool has a short overall length of just 5.08 ft (1.61m) and a maximum outside diameter of only 3.625 in. (9.2 cm). Its short length and smaller diameter contributes to a triple combo assembly that improves logging runs in short radius wellbores, and reduces rathole length to provide data across the full formation while cutting drilling requirements.

- The tool is rugged and versatile. It operates in wellbore extremes up to 350°F (175°C) and maximum pressure of 20,000 psi. The minimum casing/tubing ID is 4 in. (10.16 cm).

**Features include:**

- Estimation of relative formation permeability
- Detection of fractures
- Determining formation fluid content
- Investigating formation lithology

**Applications include:**

- Full range of borehole fluids, including salt and freshwater, oil and air, at speeds as high as 60 fps/min.
- Two receivers for multiple processing methods
- Dipole measurements

**Hardware characteristics**

- **Sensor Type:** NaI
- **Sample Rate:** 4 or 10 samples/ft
- **No. Channels:** 256
- **Full Spectrum:** 0 to 3 MeV

**Measurement**

- **Principle:** Gamma ray spectroscopy
- **Range:** 3 MeV
- **Vertical Resolution (POS):** 18 to 36 in. (standard), 18 in. (enhanced)
- **Depth of Investigation (OSI):** 4 in. (POS); 11 in. (enhanced)
- **Precision:** ±3% or ±5% API, whichever is greater
- **Accuracy:** ±5% API
- **Primary Curves:** NGR, Uranium, Thorium, and Potassium concentrations
- **Secondary Curves:** NGR Error, Stabilizer, Counts

**Calibration**

- **Primary:** API gamma ray pit, K, U, Th, Univ. of Houston
- **Secondary:** Thorium verifier
- **Wellsite Verifier:** Thorium verifier

**Specifications:**

- **Length:** 5.08 ft (1.61m)
- **Max OD:** 3.625 in. (9.2 cm)
- **Max Temp:** 350°F (175°C)
- **Max Press:** 20,000 psi
- **Min Csg/Tbg ID:** 4 in. (10.16 cm)
- **Max Csg/Tbg OD:** 20 in. (50 ft)
- **Weight:** 89 lb

**Telemetry Spectral Gamma Tool**

**Borehole Compensated Sonic Tool**

PICO’s Borehole Compensated Sonic Logging Tool measures formation shear wave velocity, and P, S and Stoneley wave amplitudes to support understanding of the lithological properties of the formation.

Formation data acquired with the state-of-the-art PFWS tool is used in many geological, geophysical, petrophysical and engineering applications, including reservoir evaluation, selecting well locations, and completion design.

**Performance**

- High quality data is acquired with two 20 KHz piezoelectric transmitters at a bandwidth of 7KHz to 32KHz. Tool length of just 15.9 ft (4.85m) and a maximum outside diameter only 3.375 in. (8.6cm) enhance logging runs in short radius wellbores and reduces rathole length.

**Features include:**

- Dipole measurements
- Two-receivers for multiple processing methods
- Measurements in saltwater, freshwater, and oil

**Applications include:**

- Investigation formation lithology
- Identifying gas intervals
- Determination formation fluid content
- Detection of fractures
- Estimation of relative formation permeability

**Hardware characteristics**

- **Sensor Type:** Two 20 KHz Piezoelectric Transmitter
- **Sensor Spacings:** 3, 5 feet
- **Firing Rate:** 3 per sec
- **Sample rate:** 10 per sec
- **Meas. Bandwidth:** 7KHz to 32KHz
- **Sample Rate:** 4 or 10 samples/ft

**Measurement**

- **Principle:** Full Waveform Sonic Travel Time
- **Range:** 40 to 1000us/ft
- **Vertical Resolution:** 1.97%
- **Depth of Investigation:** 0.98 to 1.48ft
- **Accuracy:** ±1us/ft
- **Primary Curves:** Waveform, Delta T
- **Secondary Curves:** Delta T for shear wave, Poison’s Ratio, quality curves

**Specifications:**

- **Length:** 15.9 ft (4.85m)
- **Max OD:** 3.375 in. (8.6cm)
- **Min Csg/Tbg ID:** 3.75 in. (9.52 cm)
- **Max Csg/Tbg OD:** 11.80 in.
- **Max Temp:** 350°F (175°C)
- **Max Press:** 15,000psi
- **Weight:** 180 lb

**Telemetry Spectral Gamma Tool**

**Borehole Compensated Sonic Tool**

**Specifications:**

- **Weight:** 180 lb
- **Max Press:** 15,000psi
- **Max Temp:** 350°F (175°C)
- **Min Csg/Tbg ID:** 3.75 in. (9.52 cm)
- **Max OD:** 3.375 in. (8.6cm)
- **Length:** 15.9 ft (4.85m)

**Telemetry Spectral Gamma Tool**

**Borehole Compensated Sonic Tool**

**Technology summary**

**Gamma ray spectral logging detects the three primary gamma ray contributors—potassium, thorium, and uranium and differentiates between them based on their different energy levels. This data improves log analysis in many ways. For example, the presence of thorium is a shale indicator. Because sandstones generally have low potassium and thorium concentrations compared to shale, spectral gamma logs help distinguish potential reservoir rocks. Fractured or highly permeable reservoirs can be indicated when high uranium concentrations appear with low potassium and thorium concentrations. The thorium-potassium ratio and other combined curves help identify minerals identification and support clay typing. By subtracting the uranium count from the total count, a uranium-concentrated gamma ray curve can be produced to make it easier to correlate data between wells.**

**Applications include:**

- Environment: salt, fresh, oil, and air
- Recommended logging speed: 60 fps/min
- Tool positioning: Centralized and eccentricized

**Features include:**

- Estimation of relative formation permeability
- Detection of fractures
- Determining formation fluid content
- Investigating formation lithology

**Technology summary**

- **Borehole Compensated Sonic Tool**
- **Applications include:**
  - Sonde Simulator
  - Internal CLK
- **Features include:**
  - Primary Curves: Waveform, Delta T
  - Secondary Curves: Delta T for shear wave, Poison’s Ratio, quality curves
- **Specifications:**
  - **Weight:** 180 lb
  - **Max Press:** 15,000psi
  - **Min Csg/Tbg ID:** 3.75 in. (9.52 cm)
  - **Max OD:** 3.375 in. (8.6cm)
  - **Length:** 15.9 ft (4.85m)

**Telemetry Spectral Gamma Tool**

**Borehole Compensated Sonic Tool**

**Technology summary**

- **Borehole Compensated Sonic Tool**
- **Applications include:**
  - Sonde Simulator
  - Internal CLK
- **Features include:**
  - Primary Curves: Waveform, Delta T
  - Secondary Curves: Delta T for shear wave, Poison’s Ratio, quality curves
- **Specifications:**
  - **Weight:** 180 lb
  - **Max Press:** 15,000psi
  - **Min Csg/Tbg ID:** 3.75 in. (9.52 cm)
  - **Max OD:** 3.375 in. (8.6cm)
  - **Length:** 15.9 ft (4.85m)
PICO’s Advanced Borehole Imager Tool provides state-of-the-art formation borehole imaging in water-based environments.

The ABIT is a state-of-the-art wireline logging tool with proprietary spacing of source and sensor button electrodes to ensure high-resolution imaging. Its short length and smaller diameter contributes to a triple combo assembly that improves logging runs in short radius wellbores, and reduces rathole length to provide data across the full formation while cutting drilling requirements.

The ABIT technology introduces current to the formation and measures it using button electrodes. The tool reveals changes in micro resistivity resulting from the presence of conductive lithology and pore geometry.

**Specifications:**
- **Max Temp:** 350°F (177°C)
- **Max OD:** 5 in. (12.7 cm)
- **Length:** 24 ft (7.315 m)
- **Max Press:** 20,000 psi
- **Max Hole:** 21 in. (53.34 cm)
- **Weight:** 496 lb (225 kg)

**Applications include:**
- Fracture identification
- Net pay identification in thin beds
- Dip azimuth determination
- Defining borehole features and irregularities
- Correlating core depth

**Features include:**
- Borehole imaging in water-based fluid environments
- High-resolution, high-speed logging
- Logging performance in short radius wellbores

**Borehole conditions**
- Borehole Fluids: Salt, Fresh
- Recommended Logging Speed: 30 ft/minute
- Tool Positioning: Centralized

**Hardware characteristics**
- **Source Type:** Button Electrodes
- **Sensor Type:** Button Electrodes
- **Sensor Spacing:** Proprietary
- **Sample rate:** 120 samples/ft
- **Vertical Sampling:** 0.1 in

**Measurement**
- **Principle:** Laterolog
- **Vertical Resolution:** 0.2 in
- **Depth of Investigation:** 30 in
- **Max Resistivity Range:** 0.01 ohm–10 ohm
- **Coverage:** 57% in 8.5 inch borehole

**Calibration**
- **Primary:** Precision conductive loop
- **Secondary:** Internal R and X-Cal signals
- **Wellsite Verifier:** Precision resistor, sonda error offset

**Under Development**

PICO’s Pulsed Neutron Reservoir Saturation provides formation evaluation data in open hole/cased hole to distinguish between water and hydrocarbons to help determine porosity and bulk water in the formation.

The PNRST is a full 14 MeV pulsed neutron generator featuring three high Z fast decay detectors with 256 channels each for fast, high data acquisition. Its short length and smaller diameter contributes to a triple combo assembly that improves logging runs in short radius wellbores, and reduces rathole length to provide data across the full formation while cutting drilling requirements.

The pulsed neutron tool introduces bursts of neutrons into the formation. Energy resulting primarily from collisions with hydrogen atoms in water and hydrocarbons in pores spaces results in a thermalized state in which the neutron is captured by chlorine in the water to indicate water saturation.

**Specifications:**
- **Max Temp:** 325°F (167°C)
- **Max OD:** 2.125 in. (5.4 cm)
- **Length:** 8 ft (7.315 m)
- **Max Press:** 15,000 psi
- **Max Hole:** 3 in. (7.6 cm)
- **Max Hole:** 16 in. (40.6 cm)
- **Weight:** 75 lb (34 kg)

**Applications include:**
- Determining oil saturation
- Well integrity
- Zonal isolation
- Evaluate gravel packs
- Evaluating aging well
- Monitoring reservoir performance

**Features include:**
- Highly accurate measurements in cased hole
- Fast 15 ft/min logging rate
- Logging performance in short radius wellbores

**Borehole conditions**
- Borehole Fluids: Salt, Fresh, Oil, Air
- Recommended Logging Speed: 15 ft/minute
- Tool Positioning: Eccentralized

**Hardware characteristics**
- **Source Type:** 14 MeV Pulsed Neutron Generator
- **Sensor Type:** 3 detectors, High Z fast decay
- **Sensor Spacing:** Proprietary
- **Sample rate:** 4 samples/foot
- **No. Windows:** 135 channels per detector
- **Full Spectrum:** 3 – 256 ch per detector
- **Combinability:** below PTel, optional above TBI, below PCNT, PDST

**Measurement**
- **Principle:** Neutron decay and capture
- **Range:** 0 to 100 p.u.
- **Vertical Resolution:** 90%/1 ft
- **Depth of Investigation:** 4–7 in
- **Accuracy:** ±5% SGR/NRM, or ±1 capture unit whichever is greater
- **Primary Curves:** SigmaNear, SigmaFar, SigmaXFar
- **Secondary Curves:** Density, Porosity, Ratios, Quality Curves
- **Computed Curves:** Density, Porosity, Water Saturation, Oil Saturation, Gas Saturation, SigmaIntrinsic

*In cased holes, Min. Csg/Tbg ID 2.375 in., Max Csg/Tbg ID is 16 in.*

*Under Development*
### Further Specifications

#### Compensated Spectral Density Logging Tool

**Measurement**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pe (High-Res)</td>
<td>0 to 5 ±0.15</td>
</tr>
<tr>
<td>Pe (High-Res)</td>
<td>4 ±0.07</td>
</tr>
</tbody>
</table>

**Bulk Density**

<table>
<thead>
<tr>
<th>Value</th>
<th>1.0 to 3.1 gm/cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>33 in.</td>
</tr>
<tr>
<td>Enhanced</td>
<td>5.5 in.</td>
</tr>
</tbody>
</table>

**Gamma Attenuation**

<table>
<thead>
<tr>
<th>Value</th>
<th>±0.01 gm/cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Standoff</td>
<td>±5% or ±1 p.u., whichever is greater</td>
</tr>
</tbody>
</table>

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

**Hardware**

- **Tool Joints**
  - Tension: 130,000 lb (59,000 Kg)
  - Compression: 130,000 lb (59,000 Kg)
- **Other**
  - Torque: 600 ft-lbs (850 nm)

#### Telemetry Natural Gamma Tool

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

**Measurement**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutron-Thermal Neutron</td>
<td>-2 to 100 p.u.</td>
</tr>
</tbody>
</table>

**Neutron Porosity, Near-to-Far Detector Count Rate Ratio**

<table>
<thead>
<tr>
<th>Value</th>
<th>Near-to-Far Detector Count Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Porosity (3 p.u.)</td>
<td>±5% or ±1 p.u., whichever is greater</td>
</tr>
<tr>
<td>Medium Porosity (30 p.u.)</td>
<td>±5% or ±1 p.u., whichever is greater</td>
</tr>
<tr>
<td>High Porosity (60 p.u.)</td>
<td>±5% or ±1 p.u., whichever is greater</td>
</tr>
</tbody>
</table>

#### Compensated Neutron Tool

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

**Measurement**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutron-Thermal Neutron</td>
<td>-2 to 100 p.u.</td>
</tr>
</tbody>
</table>

#### Telemetry Spectral Gamma Tool

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

**Measurement**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutron-Thermal Neutron</td>
<td>-2 to 100 p.u.</td>
</tr>
</tbody>
</table>

#### Thin Bed Array Induction Tool

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

#### Borehole Compensated Sonic Tool

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

**Measurement**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonic Wave</td>
<td>150,000 ft (52,000 m)</td>
</tr>
</tbody>
</table>

#### *Advanced Borehole Imager Tool*

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

#### Pulsed Neutron Reservoir Saturation Tool

**Physical Strengths**

* Strengths apply to new tools at 70°F (21°C) and 0 psi.

* Under Development
Our commitment to Research & Development of World Class Patent Technology requires us to maintain an ongoing Field Testing Program. Thorough testing proves the quality and reliability of our technology and tools. This process pushes us to strive for new innovations that will allow us to reach even higher standards for our clients.
19407 Park Row, #130
Houston, TX 77084

phone: 956.688.8201
email: Tarek.AbdelAziz@pico.com.eg
     Gerald.Miles@pico.com.eg
web: picotechllc.com