Current Production Logging Tools

All of Century's Tools digitize the sensor measurements downhole. This minimizes interference from varying wireline cable lengths, and other factors that can alter the data. All measurements from Century Tools are calibrated, and are recorded in engineering units.

Click on the Model Number for more information
Legend: S=Standard O=Optional

Sensors	Model Number																			
	9012	9238	9239	9144	9053	9057	9058	9072	9074	7201	9096	9320	9322	9411	9512	9622	9702	9711	9721	9751	9804
16" Normal				S		S															
64" Normal				S		S															
Acoustic Televiewer																					S
Gyro Deviation											S										
Magnetic Deviation				O		O	O				O			S		O	S				S
Caliper		S	S						S												
Casing Collar Locator					S				O			O	O								
Conductivity															S						
Dipmeter														S							
Compensated Density			S																		
High Resolution Density		S																			
Near Density			S																		
Far Density			S																		
Fluid Resistivity				S																	
Guard Resistivity		S	S					S													
Lateral Resistivity				S		S															
Micro Resistivity														S							
Flowmeter, Impeller																		S			
Flowmeter, Electro Magnetic																			S		
Fluid Sampler																				S	
Magnetic Susceptibility																S					
Natural Gamma	S	S	S	O	S	O	S	S	O	S	S	O	O	S	S	S	S	O			O
Neutron - Neutron						S	S	S													
Potassium Uranium Thorium										S											
Spontaneous Potential				S		S															

Single Point Resistance					S		S														
Temperature					S		S	S	S										S		
Sonic Full Wave												S	S								
X - Y Caliper														S							S
Sensors	9012	9238	9239	9144	90053	90057	90058	90072	90074	72011	90096	93200	93222	94111	95122	96222	97022	97111	97211	97511	98044
	Model Number																				

Legend: S=Standard O=Optional
Click on the Model Number for more information

Phone: 918-838-9811
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Century
WIRELINE SERVICES

WESTERN U.S. PRICE SCHEDULE
Prices Effective: JAN 1, 2010

SERVICE RATE: $ 750.00

FOOTAGE RATES:

1. **STANDARD COAL DENSITY LOG** $ 0.65/ft
   (Gamma Ray, Caliper, Resistivity, Density)

2. **E LOG SUITE** $ 0.65/ft
   (Gamma Ray, 16/64 Inch Normal, SP, SPR, Deviation, Optional Neutron)

3. **FULL WAVE FORM SONIC VELOCITY** $ 0.85/ft
   (Gamma Ray, Delta Time, N/F Time, Sonic Variable Density)

4. **3 ARM CALIPER LOG** $ 0.45/ft

5. **GYRO DEVIATION SURVEY** $ 1.25/ft
   (Through Rods Deviation)

6. **ACOUSTIC TELEVIEWER LOG** $ 1.50/ft
   (Travel Time and Amplitude for Fracture Identification)

500 Foot Minimum Footage Charge per Tool Used.

ADDITIONAL CHARGES

MILEAGE CHARGE (Each Way) $ 1.50/mile

STATE RADIATION FEE (For Density and Neutron logs) $ 200.00/day
(Maximum per customer charge of $ 800 per year)

WIRELINE CHARGE (Un-logged Footage Interval) $ 0.30/ft

STANDBY CHARGE (Two Hours Free Standby per Day) $ 100.00/hr
(Based on a 10 hour work day / 12 hour port to port)

EXTRA LOG PLOTS (Three Provided Free with Each Hole) $ 10.00/copy

PROCESSING TELEVIEWER IMAGE $ 150.00/hr

Dispatch Number: 254/760-9788

SERVICES PER CENTURY TERMS AND CONDITIONS

Hello Doug,

I am back from Texas today, so just catching up on some email traffic. We will use our Western Price Schedule for your logging costs. Some tools are not listed, as summarized below.

1. Dipmeter, $1.00/ft
2. Mag. Susc. $ .65/ft
3. Spectral Gamma, $ 1.00/ft
4. EM Flowmeter, 1.00/ft (this tool was being shipped from Australia last week, so hopefully it will arrive in time).

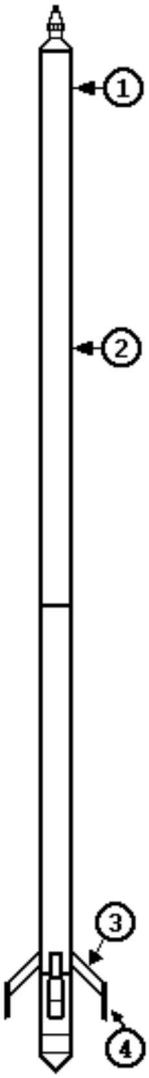
I think that will cover it.

Regards,
Brian P.

9411 Logging Tool

Dipmeter

Product Description



Background Information

The Dipmeter tool is a formation strike and dip directional probe primarily used in mining and environmental logging applications. Additionally, the tool also records natural gamma, X-Y calipers, and borehole deviation is computed from the slant angle and bearing measurements calculated from the inclinometer and magnetometer sensors. To ensure accurate strike and dip measurements in small-diameter holes, special care should be taken when calibrating the calipers to maximize their accuracy.

Features	
Properties Measured (see diagram)	**Tool Specifications**
1. Natural Gamma: 2.2 x 8.9 cm (0.875 x 3.5 in.) NaI (TI) Scintillation Offset: 14 cm (5.5 in.) **2. Slant Angle Bearing:** Offset: 67 cm (26.4 in.) **3. Independent X-Y Calipers:** Maximum 30 cm (12 in.) Hole Diameter Offset: 305 cm (120 in.) **4. 4-pad Micro Resistance:** Offset: 305 cm (120 in.)	**Length:** 323 cm (127 in.) **Temperature:** 85 C (185 F) **Diameter:** 57 mm (2.25 in.) **Pressure:** 352 kg/cm^2 (5000 PSI) **Weight:** 34.6 kg (76 lb.) **Logging Speed:** Maximum: 5.5 m/min. (18 ft./min.) Minimum: 2.7 m/min. (9 ft./min.) **Tool Voltage Required:** 115 VDC

Sensor Response Ranges		
Sensor	**Response Limits**	**Accuracy**
Natural Gamma (NG)	0 to 10,000 API units	+/-5%
X & Y Caliper (XCAL & YCAL)	6.4 to 30.5 cm (2.5 to 12 in.)	+/-0.5 cm (0.2 in.)
Micro Resistance (MR)	0 to 10,000 ua	+/-5%
X-Y Inclinometers (XYI)	0 to 90 degrees	+/-0.5 degrees
Azimuth (AZ)	0 to 360 degrees	+/-2 degrees

Tool Information		
Item	**Model #**	**Part #**
Tool with NG, XCAL, YCAL, 4-MR, XYI, AZ	9411	321300
Deviation Calibration Test Stand		317420

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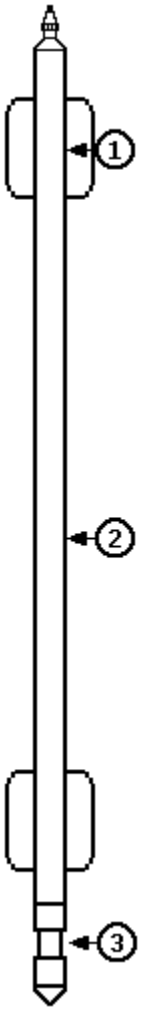
9804 Logging Tool

9804 Series Acoustic Televiewer — Product Description



Background Information

The Acoustic Televiewer takes an oriented "picture" of the borehole using high-resolution sound waves. This acoustic picture is displayed in both amplitude and travel time. This information is used to detect bedding planes, fractures, and other hole anomalies without the need to have clear fluid filling the boreholes. The televiewer digitizes 256 measurements around the borehole at each high-resolution sample interval (.005 meters/.02 feet). This data is oriented to North and displayed real-time while logging using the Visual Compu-Log software. Analysis includes color adjustment, fracture dip and strike determination, and classification of anomaly. It allows information to be displayed on the graphical screen, plot, and in report format. Optionally, the tool can be equipped with a natural gamma sensor.

Features	
Properties Measured (see diagram)	**Tool Specifications**
1. Natural Gamma: Offset: 30.48 cm (12 in.) **Scintillation (NG):** 0 to 10,00 API, Accuracy +/-5 percent **2. Deviometer:** **Offset: 175 cm (69 in.)** **X-Y Inclinometer (XYI):** **0 to 90 degrees, Accuracy +/-0.5 degrees** **Azimuth (AZ):** **3-axis magnetometer** **0 to 360 degrees, Accuracy +/- 2 degrees** **3. Acoustic Amplitude & Acousitic Travel Time:** **Offset: 175 cm (69 in.), Accuracy +/- 2.55 mm (0.1 in.)**	**Outside Diameter** 50.8 mm (2 in.) **Weight:** 14 kg (30 lbs.) **Length:** 193 cm (76.0 in.) **Pressure:** 105 kg/cm^2 (1500 psi) **Temperature:** 85 C (185 F) **Scan Rate:** 12 revolutions/second **Sample Rate:** 256 samples/revolutions **Borehole Size:** 74 to 230 mm (2.9 to 9 in.) **Logging Speed:** 2 m/min (6 ft/min.) **Tool Voltage Required:** 115 VDC

Tool Information		
Item	**Model #**	**Part #**
Tool with Acoustic Televiewer, XYI, AZ	8804	332004B
Tool with Acoustic Televiewer, XYI, AZ, and Natural Gamma	9804	332004A
Deviation calibration test stand		317420

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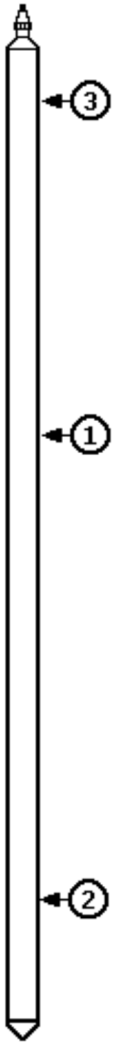
9622 Logging Tool

9622 Series Magnetic Susceptibility (Deviation Option) — Product Description



Background Information
The Magnetic Susceptibility tool is a slim hole mining tool primarily designed to measure the magnetic susceptibility of the formation. Additionally, optional natural gamma, inclinometer and magnetometer sensors.

Features

Properties Measured (see diagram)	Tool Specifications
1. Natural Gamma: (optional) 2.2 x 10.2 cm (0.875 x 4 in.) Scintillation Crystal Offset: 91.4 cm (36 in.) **2. Magnetic Susceptibility :** Dual-focused coils, 1.44 kHz operating frequency 10.2 cm (4 in.) resolution vertically and horizontally Offset: 186 cm (73.2 in.) **3. Slant Angle and Azimuth Measurements:** 3-axis magnetometer 2-axis inclinometer Offset: 34.3 cm (13.5 in.)	**Length:** 203 cm (80 in.) **Temperature:** 70 C (158 F) **Diameter:** 4.1 cm (1.63 in.) **Pressure:** 253 kg/cm^2 (3600 PSI) **Weight:** 18 kg (40 lb.) **Logging Speed:** 9 m/min. (30 ft./min.) **Tool Voltage Required:** 36 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Natural Gamma (NG)	0 to 10,000 api units 0 to 320,000 cps	+/-5%
Magnetic Susceptibility (MS)	0 to 90,000 cgs	+/-5%; 20 x 10-5 cgs temperature drift over range
X-Y Inclinometers (XYI)	0 to 90 degrees	+/-.5 degrees
Azimuth (AZ)	0 to 360 degrees	+/-2 degrees

Tool Information

Item	Model #	Part #
Tool with MS	7622	314500C
Tool with NG, MS	8622	314500B
Tool with MG, MS, XYI, AZ	9622	314500A
Deviation Calibration Test Stand		317420
Calibration Fixture for Mag. Susceptibility		318261

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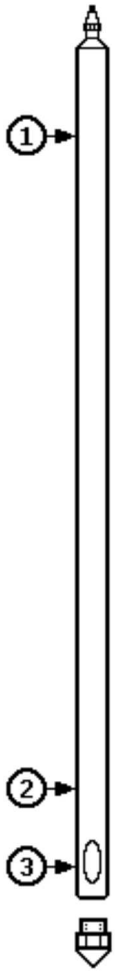
9058 Logging Tool

Natural Gamma, Neutron (Deviation Option) — Product Description



Background Information

The Natural Gamma, Neutron logging tool is designed for open and cased hole use. In open holes the neutron log may be converted to porosity units based on a limestone, sandstone or dolomite matrix. The tools small diameter makes it useful for logging Natural Gamma and Neutron through drill rods in cases where the hole is to unstable to be logged open hole. Natural Gamma, X-Y Inclinometers and Azimuth are optional.

Features

Properties Measured (see diagram)		Tool Specifications
1. Natural Gamma: 2.2 x 102 mm (0.875 x4.0 in.) NAI Scintillation Offset: 13.5 cm (5.3 in.) **2. Neutron-Neutron** He^3 Detector 25.4 mm x 152 mm (1in. x 6 in.) Offset: 217.5 cm (85.6 in.)	**3. Temperature** Offset: 220.4 cm (86.8 in.) **4. Slant Angle & Azimuth:** 3-axis magnetimeter and 2-axis inclinometer Offset: 213.3 cm (84 in.)	**Length:** 243 cm (96 in.) **Temperature:** 80 C (176 F) **Diameter:** 42 mm (1.625 in.) **Pressure:** 292 kg/cm^2 (4000 PSI) **Weight:** 12.0 kg (25 lb.) **Logging Speed:** 9 m/min. (30 ft./min.) **Tool Voltage Required:** 36 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Natural Gamma (NG)	0-400,000 API units	+/-5%
Temperature (TEMP)	0 C to 70 C (32 to 160 F)	+/-5%
Neutron, Neutron (NN)	0 - 2000 API	+/-5%
X - Y Inclination (XYI)	0 to 45 degrees	+/-0.5 degrees
Azimuth (AZ)	0 to 360 degrees	+/-2 degrees
CPS to API conversion = 1.0176		

Tool Information

Item	Model #	Part #
Tool with NG, TEMP, NN	8058	338000
Add XYI, AZ	9058	338000
Source w/Shield Am 241 Be		109901
Source Handling Tool		101501
Deviation Calibration Test Stand		317420

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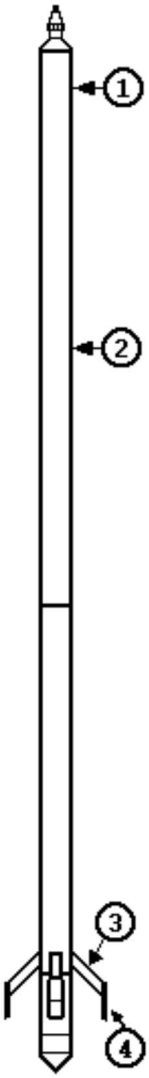
9411 Logging Tool

Dipmeter

Product Description



Background Information

The Dipmeter tool is a formation strike and dip directional probe primarily used in mining and environmental logging applications. Additionally, the tool also records natural gamma, X-Y calipers, and borehole deviation is computed from the slant angle and bearing measurements calculated from the inclinometer and magnetometer sensors. To ensure accurate strike and dip measurements in small-diameter holes, special care should be taken when calibrating the calipers to maximize their accuracy.

Features	
Properties Measured (see diagram)	**Tool Specifications**
1. Natural Gamma: 2.2 x 8.9 cm (0.875 x 3.5 in.) NaI (TI) Scintillation Offset: 14 cm (5.5 in.) **2. Slant Angle Bearing:** Offset: 67 cm (26.4 in.) **3. Independent X-Y Calipers:** Maximum 30 cm (12 in.) Hole Diameter Offset: 305 cm (120 in.) **4. 4-pad Micro Resistance:** Offset: 305 cm (120 in.)	**Length:** 323 cm (127 in.) **Temperature:** 85 C (185 F) **Diameter:** 57 mm (2.25 in.) **Pressure:** 352 kg/cm^2 (5000 PSI) **Weight:** 34.6 kg (76 lb.) **Logging Speed:** Maximum: 5.5 m/min. (18 ft./min.) Minimum: 2.7 m/min. (9 ft./min.) **Tool Voltage Required:** 115 VDC

Sensor Response Ranges		
Sensor	**Response Limits**	**Accuracy**
Natural Gamma (NG)	0 to 10,000 API units	+/-5%
X & Y Caliper (XCAL & YCAL)	6.4 to 30.5 cm (2.5 to 12 in.)	+/-0.5 cm (0.2 in.)
Micro Resistance (MR)	0 to 10,000 ua	+/-5%
X-Y Inclinometers (XYI)	0 to 90 degrees	+/-0.5 degrees
Azimuth (AZ)	0 to 360 degrees	+/-2 degrees

Tool Information		
Item	**Model #**	**Part #**
Tool with NG, XCAL, YCAL, 4-MR, XYI, AZ	9411	321300
Deviation Calibration Test Stand		317420

Phone: 918-838-9811
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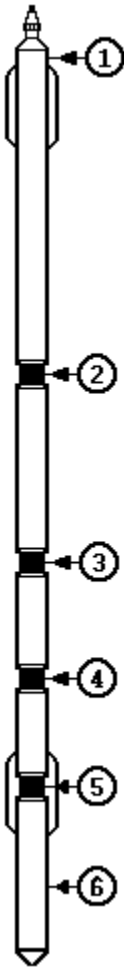
9320 Logging Tool

9320 Series Full Wave Sonic — Product Description



Background Information

The Full Wave Sonic tool contains a single transmitter and dual receiver to record formation travel times. The full wave form data is also recorded simultaneously, along with near and far travel times, borehole-compensated delta time, calculated sonic porosity, receiver gains, near/far amplitudes and natural gamma. The sonic or acoustic log uses the basic principle of sound waves traveling through a media. The Century sonic system uses a single transmitter and dual receiver system for recording the travel times of the formation. The receivers are spaced approximately 2 and 3 feet, from the transmitter. Therefore, a 0.3 m (1 ft.) calculation can be made to measure this interval transit time. Additionally, the 9320 can be upgraded for cement bond logging, by adding a casing collar locator (see below for link).

Features

Properties Measured (see diagram)		Tool Specifications
1. Natural Gamma: Mechanical Centralizer 2.5 x 10.2 cm (1.0 x 4.0 in.) NaI Scintillation Offset: 22.9 cm (9 in.) **2. Transmitter:** 24 khz. piezoelectric Offset: 170.2 cm (67 in.)	**3. Acoustic Isolator:** Thermoplastic polyester Offset: N/A **4. Near Receiver:** (2 ft.) spacing Offset: 231.1 cm (91 in.) **5. Far Receiver:** (3 ft.) spacing Offset: 266.7 cm (105 in.)	**Length:** 283.2 cm (111.5 in.) **Temperature:** 85 C (185 F) **Diameter:** 50.8 mm (2.0 in.) **Pressure:** 175 kg/cm^2 (2500 PSI) **Weight:** 22.7 kg (50 lb.) **Logging Speed:** 9 m/min.@0.06 SI (30 ft./min. @ 0.2 ft. SI) **Tool Voltage Required:** 85 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Near Receiver (NR)	40 to 4096 usec	+/-0.5 usec
Far Receiver (FR)	40 to 4096 usec	+/-0.5 usec
Delta Time	-400 - +400 mv	+/-5%
Sonic Porosity	-10 to 100	+/-2%
Amplitude (minimum)	+/- 10 mv @ 256 gain	+/-5%
Amplitude (maximum)	+/-1.5 volts @ 4 gain	+/-5%
Gains	4 to 256	+/-5%
Natural Gamma (NG)	0 to 10,000 api	+/-5%

Tool Information

Item	Model #	Part #
Full Wave Sonic without NG	8320	339000A
Full Wave Sonic with NG	9320	339000B
Full Wave Sonic with NG and CCL	9321	339500A

Phone: 918-838-9811
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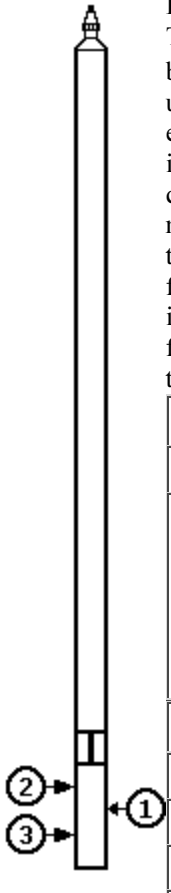
9721 Logging Tool

E-M Flowmeter

Product Description



Background Information

The E-M Flowmeter tool is used in the environmental and hydrology industries to measure fluid movement in a borehole. It incorporates Quantum Engineering's "EBF" electromagnetic sensor. The instrument measures flow rates using the principal of Faraday's Law of Induction. The downhole probe consists of an electromagnet and two electrodes located 180 degrees apart and 90 degrees to the magnetic field inside of a hollow cylinder. The voltage induced by a conductor moving at right angles through the magnetic field is directly proportional to the velocity of the conductor (water) through the field. The tool is capable of measuring low velocity flow rates down to less than 50 ml/min and increased flow rates to 40 liters/min, through the tool's 1 inch inside diameter sensor. When using the tool to measure low velocity flow rates a rubber skirt is attached to the outside of the sensor to block off the bore hole and force the fluid to pass through the 1 inch diameter opening inside the sensor coil. The Compu-View Software program is designed to allow the automatic collection of data at selected static stations in the borehole. When measuring faster flow rates the rubber skirt is typically removed and the tool is run in either the static station or dynamic mode. The tool has no moving parts.

Features

Properties Measured (see diagram)	Tool Specifications
1. Flowmeter: Electromechanical Offset: 139.7 cm (55.0 in.) **2. Fluid Resistivity:** Offset: 139.7 cm (55.0 in.) **3. Temperature & Delta Temperature :** Offset: 139.7 cm (55.0 in.)	**Length:** 142 cm (56.0 in.) **Temperature:** 60 C (140 F) **Diameter:** 41.3 mm (1.625 in.) **Sensor Housing:** 50.8 mm (2.0 in.) **Weight:** (13.5 lbs.) **Tool Voltage Required:** 64 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Flowmeter (EMF)	50 ml./min. to 40 liters./min.	+/-20 ml/min. (High Gain)
Temperature (TEMP)	0 C to 60 C (32 to 140 F)	+/-5%
Fluid Resistivity (FR)	0-100 ohm meters	+/-5%

Tool Informaiton

Item	Model #	Part #
Tool with EMF, TEMP, FR	9721	300000
(included) 6.5 in. Diameter Flow Diverter Skirt (modifiable for use in hole from 3.75 in. to 6.25 in. diameter)		
(included) Centralizer		
(included) Weighted Section		

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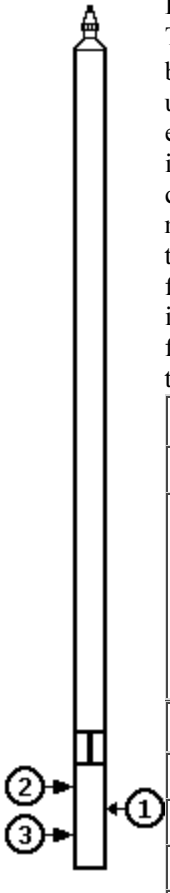
9721 Logging Tool

E-M Flowmeter

Product Description



Background Information

The E-M Flowmeter tool is used in the environmental and hydrology industries to measure fluid movement in a borehole. It incorporates Quantum Engineering's "EBF" electromagnetic sensor. The instrument measures flow rates using the principal of Faraday's Law of Induction. The downhole probe consists of an electromagnet and two electrodes located 180 degrees apart and 90 degrees to the magnetic field inside of a hollow cylinder. The voltage induced by a conductor moving at right angles through the magnetic field is directly proportional to the velocity of the conductor (water) through the field. The tool is capable of measuring low velocity flow rates down to less than 50 ml/min and increased flow rates to 40 liters/min, through the tool's 1 inch inside diameter sensor. When using the tool to measure low velocity flow rates a rubber skirt is attached to the outside of the sensor to block off the bore hole and force the fluid to pass through the 1 inch diameter opening inside the sensor coil. The Compu-View Software program is designed to allow the automatic collection of data at selected static stations in the borehole. When measuring faster flow rates the rubber skirt is typically removed and the tool is run in either the static station or dynamic mode. The tool has no moving parts.

Features

Properties Measured (see diagram)	Tool Specifications
1. Flowmeter: Electromechanical Offset: 139.7 cm (55.0 in.) **2. Fluid Resistivity:** Offset: 139.7 cm (55.0 in.) **3. Temperature & Delta Temperature :** Offset: 139.7 cm (55.0 in.)	**Length:** 142 cm (56.0 in.) **Temperature:** 60 C (140 F) **Diameter:** 41.3 mm (1.625 in.) **Sensor Housing:** 50.8 mm (2.0 in.) **Weight:** (13.5 lbs.) **Tool Voltage Required:** 64 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Flowmeter (EMF)	50 ml./min. to 40 liters./min.	+/-20 ml/min. (High Gain)
Temperature (TEMP)	0 C to 60 C (32 to 140 F)	+/-5%
Fluid Resistivity (FR)	0-100 ohm meters	+/-5%

Tool Informaiton

Item	Model #	Part #
Tool with EMF, TEMP, FR	9721	300000
(included) 6.5 in. Diameter Flow Diverter Skirt (modifiable for use in hole from 3.75 in. to 6.25 in. diameter)		
(included) Centralizer		
(included) Weighted Section		

Phone: 918-838-9811
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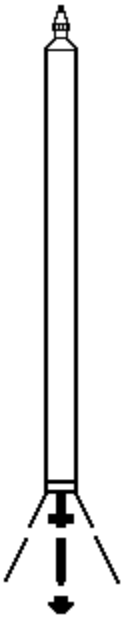
9074 Logging Tool

9074 Series Three Arm Caliper — Product Description



Background Information
The 9074, 8074, 7074 and 6074 Three Arm Caliper logging tools, are a three-arm caliper configuration used to measure the diameter of the borehole. They can be used in both open and cased holes. Natural Gamma and the casing collar locator are optionally available. However, when configured with both the natural gamma and casing collar locator the tool is slightly longer.

Features

Properties Measured (see diagram)	Tool Specifications
1a. Natural Gamma: (optional) 2.2 x 10.16 cm (0.875 x 4.0 in.) NaI Scintillation Offset: 14.6 cm (5.76 in.) **1b. Casing Collar Locator: (optional)** Dual magnet and coil assembly Offset: 14.6 cm (5.76 in.) **2. Three Arm Caliper:** Short- or Long- arm configuration, motor operated Sensor Offset: Short-arm: 220.4 cm (86.8 in.) Long-arm: 241.0 cm (94.9 in.)	**Tool Length:** With Short-arms: 226 cm (89 in.) With Long-arms: 264 cm (104 in.) **Temperature:** 85 C (185 F) **Diameter:** 50.8 mm (2.0 in.) **Pressure:** 281 kg/cm^2 (4000 PSI) **Weight:** Short-arm: 18.5 kg (48 lbs.) Long-arm 20.8 kg (54 lbs.) **Logging Speed:** 9 m/min. (30 ft./min.) **Tool Voltage Required:** 56 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Natural Gamma (NG)	0-400,000 API units	+/-5%
Casing Collar Locator (CCL)	+/- 50,000 CPS	NA
Short-Arm Caliper	5.1 to 76.2 cm (2 to 30 in)	+/-0.38 cm (0.15 in)
Long-Arm Caliper	5.1 to 113 cm (2 to 44.5 in)	+/-0.64 cm (0.25 in)

Tool Information

Item	Model #	Part #
Three Arm Caliper, with NG & Short Arms, without CCL	9074	298000A
Three Arm Caliper, with Short Arms, without NG and CCL	8074	298000B
Three Arm Caliper with CCL & Short Arms, without NG	7074	297000A
Three Arm Caliper with CCL & Short Arms, with NG	6074	298200A
Extensions to Long Arms	All	298009 (3 Req.)
Long Arm Center Shaft Extension	All	298010
Caliper Tip Balls	All	799959
Calibrator, Rings, 2	All	298001

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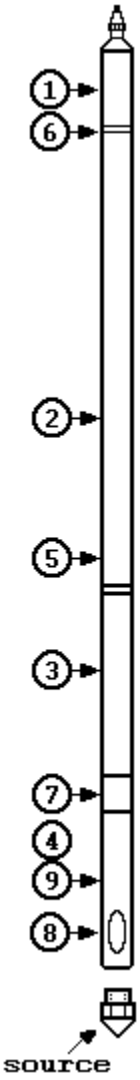
9057 Logging Tool

Multi-Parameter E-Log, Neutron (Deviation Option) — Product Description



Background Information

The Multi-Parameter E-Log, Neutron logging tool was developed to replace the 9055 which was historically Century's most popular tool. The tool duplicates all parameters on the 9055 while adding the 16 inch normal, 64 inch normal, and lateral resistivities. The 9057 natural gamma circuit features a low dead time and the ability to measure very high count rates making it a favorite for uranium logging. The tool records ten different parameters simultaneously in one pass of the borehole. The ten parameters are the following: natural gamma, spontaneous potential, single point resistance, 16 in. normal resistivity, 64 in. normal resistivity, 48 in. lateral resistivity, neutron-neutron, temperature, delta temperature, slant angle (tilt) and azimuth (bearing). Slant angle, azimuth, and natural gamma are optional.

Features

Properties Measured (see diagram)		Tool Specifications
1. Natural Gamma: 2.2 x 10.16 cm (0.875 x 4.0 in.) NaI Scintillation Offset: 14.7 cm (5.8 in.) **2. 64 in. Normal Resistivity:** Offset: 109.2 cm (43 in.) **3. 16 in. Normal Resistivity:** Offset: 170.2 cm (67 in.) **4. Neutron-Neutron:** He ^{3} Detector 2.54 cm x 15.2 cm (1 in. x 6 in.) Offset: 200.7 cm (79 in.)	**5. Lateral Resistivity 48 in.** Offset: 139.7 cm (55 in.) **6. Spontaneous Potential:** +/- 0.1 mv resolution Offset: 27.7 cm (10.9 in.) **7. Single Point Resistance:** +/- 0.1 ohm resolution Offset: 190.5 cm (75 in.) **8. Temperature & Delta Temperature:** 0.004 C (0.007 F) resolution Offset: 220.5 cm (86.8 in.) **9. Slant Angle & Azimuth:** 3-axis magnetometer and 2-axis inclinometer Offset: 200.7 cm (79 in.)	**Length:** 237 cm (93.6 in.) **Temperature:** 80 C (176 F) **Diameter:** 53 mm (2.1 in.) **Pressure:** 281 kg/cm^2 (4000 PSI) **Weight:** 15 kg (33 lb.) **Logging Speed:** 9 m/min. (30 ft./min.) **Tool Voltage Required:** 36 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Natural Gamma (NG)	0-400,000 API units	+/-5%
16 in. (16N) & 64 in. Normal (64N) & Lateral Resistivity (LR)	0-2,000 ohm/meters	+/-5%
Spontaneous Potential (SP)	-400 - +400 mv	+/-5%
Temperature (TEMP)	0 C- 70 C (32 - 160 F)	+/-5%
Single Point Resistance (SPR)	0-2,000 ohms	+/-5%
Neutron-Neutron (NN)	0-20,000 API	+/-5%
X - Y Inclination (XYI)	0-45 degrees	+/-0.5 degrees
Azimuth (AZ)	0-360 degrees	+/-2 degrees

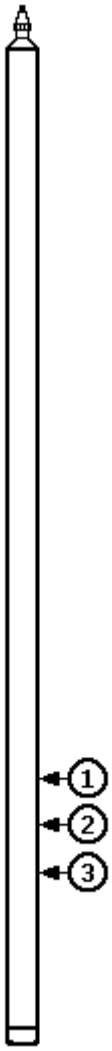
Tool Information

Item	Model #	Part #
Tool with 16N, 64N, LR, SP, SPR, NN, TEMP (No Natural Gamma)	7057	336600C
Tool with NG, 16N, 64N, LR, SP, SPR, NN, TEMP	8057	336600A
Magnetic Deviation Option and Same Parameters as 8057	9057	336600B
Source w/Shield Am 241 Be		109901
Source Handling Tool		101501

7201 Logging Tool

Spectral Gamma

Product Description



Background Information

The Spectral Gamma tool is a three-channel analysis of the gross gamma ray spectrum as it relates to potassium, uranium, and thorium content. An internal energy source of less than 1 micro-curries of Cs137 is used to excite the crystal and to stabilize the electronics prior to logging. The spectral window is recorded via a 256 channel spectrum board so that the different energy levels from the formation can be analyzed.

Features	
Properties Measured (see diagram)	**Tool Specifications**
1. Potassium (K) Percent 40 Offset: 135.63 cm (53.4in.) **2. Uranium (U):** Parts Per Million Offset: 135.63 cm (53.4in.) **3. Thorium (T)** Offset: 135.63 cm (53.4in.)	**Length:** 167 cm (65.75in.) **Temperature:** 65 C (150 F) **Diameter:** 60.96 mm (2.40 in.) **Pressure:** 232 kg/cm^2 (3000 PSI) **Weight:** 16.82 kg (37 lb.) **Logging Speed:** 1.5 m/min. (5 ft./min.) **Tool Voltage Required:** 60 VDC

Sensor Response Ranges	
Sensor	**Accuracy**
K, percent 40	+/-2%
U, PPM	+/-10 PPM
T, PPM	+/-10 PPM

Tool Information		
Item	**Part #**	**Part #**
Spectral Gamma Logging Tool	7201	272000

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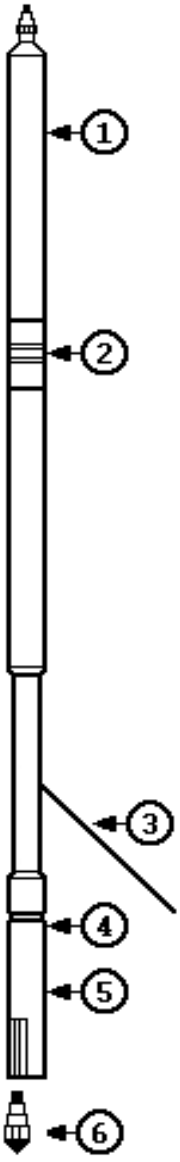
9239 Logging Tool

9239 Series Compensated Density — Product Description



Background Information

The Series 9239, Compensated Density logging tool uses the two focused density detectors to compute borehole compensated density real time while logging. No post processing required to produce CDL bulk density. Additionally, the tool also records natural gamma, caliper , and focused guard resistivity.

Features

Properties Measured (see diagram)		Tool Specifications
1. Natural Gamma: 2.2 x 10.16 cm (0.875 x4.0 in.) NAI Scintillation Offset: 21 cm (8.25 in.) **2. 3-Element Guard Resistivity:** 127.6 mm (50.25 in.) guard electrode Offset: 63.5 cm (25 in.) **3. Caliper:** Motorized, uphole actuated 35.6 cm (14 in.) or 20.3 cm (8 in.) Offset: 210.8 cm (83 in.)	**4. Far Density:** 2.2 x 10.16 cm (0.875 x4.0 in.) 35.8 cm (14.1 in.) spacing Offset: 243.3 cm (95.8 in.) **5, Near Density:** 2.2 x 3.2 cm (0.875 x1.25 in.) 20 cm (7.9 in.) spacing Offset: 259.3 cm (102.1 in.) **6. Radioactive source:** 200-300 mCi Cesium 137 in bullplug Offset: 274.3 cm (108.0 in.)	**Length:**280.3 cm (110.35 in.) **Temperature:** 85 C (185 F) **Diameter:** 56 mm (2.2 in.) **Pressure:** 175 kg/cm^2 (2500 PSI) **Weight:** 32.7 kg (72 lb.) **Logging Speed:** 9 m/min. (30 ft./min.) **Tool Voltage Required:** 56 VDC

Sensor Response Ranges

Sensor	Response Limits	Accuracy
Natural Gamma (NG)	0-10,000 API units	+/-5%
Short or Long Arm Caliper (CAL)	0 to 35.6 cm (14 in.)	+/-0.635 cm (0.25 in.)
Near Density (ND)	0.5 to 3.5 g/cc (0.02 to 0.13 lbs/ci)	+/-0.05 g/cc (0.001 lbs/ci)
Far Density (FD)	0.5 to 3.5 g/cc (0.02 to 0.13 lbs/ci)	+/-0.05 g/cc (0.001 lbs/ci)
Guard Resistivity (MG)	0 to 40,000 ohm meters	+/-5%

Tool Information

Item	Model #	Part #
Tool with NG, CAL, ND, FD, MG	9239	320599
200-300 mCi Source w/Shield Cesium		please inquire
Source Handling Tool		101501
Calibration Gauge		212471
Guard Resistivity Calibration Box		335227

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