Formation Sidewall Density Sonde

This combinable sonde is suitable for quantitative formation density measurements in uncased holes. It uses a bottom loading gamma ray source (Typically 100 mCi activity) and a set of two or optionally three detectors at different spacing to detect the gamma rays scattered by the formation. The amount of scattered gamma rays is a function of the electron density of the formation material and hence, a function of its bulk density. This relationship is used to calibrate the density sonde and then use it to log the bulk density of the formations crossed by the borehole. In order to optimise performance, the sonde is designed with three main features:

1. A side-walling calliper to ensure that the detector measures only the radiation scattered by the formation.
2. A detector mandrel diameter that is large enough to minimise the sonde and borehole curvature mismatch and improve sonde to formation contact to minimise the effect of the borehole fluid.
3. An efficient detector shield to prevent gamma rays from travelling up, inside the sonde body.

Specifications:

Length	Diam.	Weight	Detector	Source	Density	Calliper	Temp.	Press.
2.06 m	54 mm	26 kg	x2, NaI crystals Spaced at 47 and 25 cm (Opt. additional at 14 cm)	^{137}Cs *or* ^{60}Co	Range: 1-3 or 1- 4.5 g/cc	Range: 60 to 350 mm	Max. 80ºC	Max. 20 MPa

Compensated Neutron Sonde

This combinable sonde provides quantitative formation porosity measurements in uncased holes, based on Hydrogen Index. The sonde uses a bottom loading neutron source and a set of two detectors at different spacing to detect the neutrons that are slowed down by hydrogen in the formation. As the sonde is sensitive to hydrogen, it is used to distinguish between fluid bearing formations and solid matrix rock.

In order to optimise performance, the sonde is designed with three main features:

1. A side-walling bow spring to ensure that the detector measures only the neutrons slowed by the formation.
2. A detector mandrel diameter that is large enough to minimise the sonde and borehole curvature mismatch and improve sonde to formation contact to minimise the effect of the borehole fluid.
3. An efficient detector shield to prevent neutrons from travelling up, inside the sonde body.

Specifications:

Length	Diam.	Weight	Detector	Source	Temp.	Press.
1.67 m	60 mm	23 kg	x2 ^{3}He Proportional counters	^{241}Am-Be Typically 2.5 Ci	Max. 80ºC	Max. 20 MPa

Reduced Diameter Neutron and Density Tools

A reduced diameter version of the neutron and density sondes (bottom loading) is also available. These sondes offer the advantage of a 38 mm diameter, making them suitable for reduced diameter boreholes. They also require smaller sources. However, they are only suitable for qualitative porosity or density measurements because they do not lend themselves to easy or effective calibration.

- A 46mm side loading slim density sonde version is also available that allows tools to be connected below this tool.

Specifications:

	Length	Diam.	Weight.	Detector	Source	Max. Temp.	Max. Press.
Density *(bottom loading)*	1.65 m	38 mm	5.0 kg	x3 NaI crystals (GR, LS & SS density)	^{137}Cs 10mCi	80ºC	20 MPa
Density *(side loading)*	1.44 m	46 mm	6.0 kg	x2 NaI crystals (LS & SS density)	^{137}Cs 10mCi	80ºC	20 MPa
Neutron	1.44 m	38 mm	5.0 kg	^{3}He prop. Counter	^{241}Am-Be 1Ci	80ºC	20 MPa

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