

# Dual Laterolog Service (DLL™)

Halliburton's proven Dual Laterolog service provides reliable means of measuring formation resistivity in conductive borehole fluids and/or where large contrasts exist between the formation and mud resistivities. The DLL service operates by focusing currents into the formation to produce a deep resistivity measurement (LLd) and a shallow resistivity measurement (LLs). The Micro-Spherically Focused Log (MSFL™) is usually run in combination to provide a third, shallow resistivity measurement. Together, these three measurements provide the resistivity profile around the borehole and permit the computation of  $R_t$  in presence of invasion.

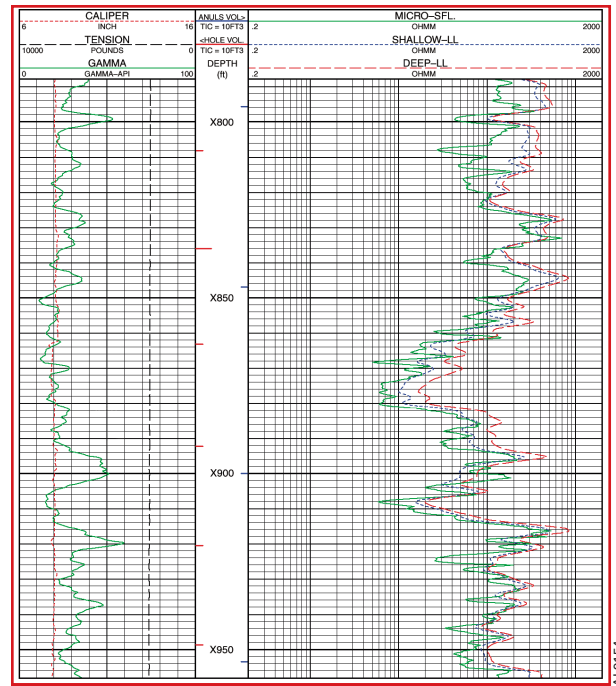
## DLL Service Features

The DLL service contains the following features:

- Acquires improved formation resistivity measurements in saline borehole fluids and in high  $R_t/R_m$  (>100) contrast logging conditions or when formation resistivity exceeds the limits of induction tools (> 2000 ohm·m)
- Uses LLd, LLs, and MSFL to determine  $R_t$  and diameter of invasion of the formation and depth of invasion
- Provides MSFL measurements to help delineate thin beds and provide estimates of  $R_{xo}$
- Offers qualitative indication of permeable zones and estimating invasion diameters (when run with MSFL)

## DLL Service Benefits

The DLL service gives operators a reliable way of measuring formation resistivity in conductive borehole fluids and/or where large contrasts exist between the formation and mud resistivities.



A DLL log example from a carbonate-evaporite sequence showing deep and medium laterolog curves presented along with the shallow MSFL log.

HALB154

Dual Laterolog Service (DLL™) Specifications									
Length		Diameter		Maximum Pressure		Maximum Temperature		Weight	
(ft)	(m)	(in)	(mm)	(psi)	(Mpa)	(°F)	(°C)	(lb)	(kg)
33.9	10.3	3.63	92.2	20,000	137.9	350	176.7	460	208.7

## Hostile Environment Dual Laterolog Tool

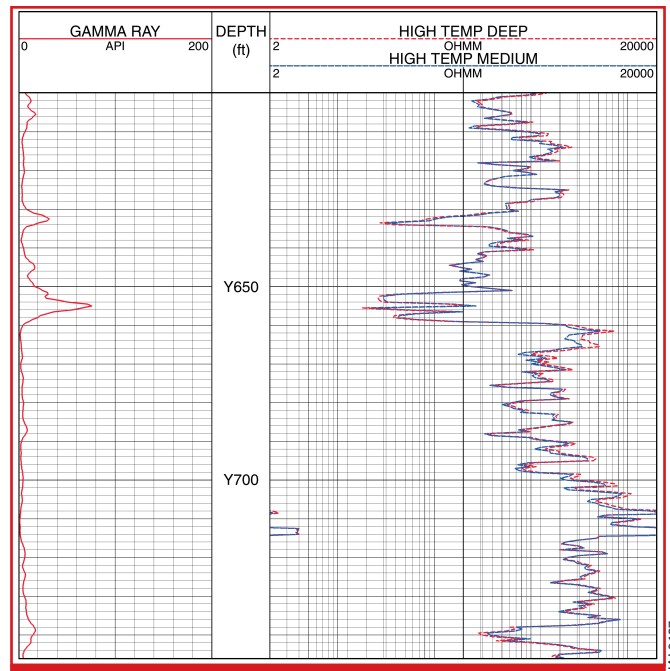
(HEDL™) The HEDL tool is a wirelined deployed formation resistivity device designed for extreme borehole temperatures and pressures. It is the tool of choice when those resistivities routinely exceed 100 ohm•m, especially in highly conductive muds. The HEDL tool is combinable with other hostile environment tools, e.g. the density and neutron tools to permit simultaneous resistivity/porosity measurements in the reservoirs. The tool is designed to be run with the Hostile Environment Telemetry Sub (HETS™) and must be located immediately below the HETS sub and a 2.75-in. diameter isolation sub. From top to bottom, the HEDL tool assembly consists of:

- A flaked electronic assembly
- An upper toroid sub
- An alpha sub
- A lower toroid sub

### HEDL Tool Features

The HEDL tool contains the following features:

- 2.75-in. diameter permits slim-hole and through-drill-pipe logging of high-temperature / high-pressure wells
- Performs two resistivity/porosity measurements: a deep laterolog (LLd) and a shallow laterolog (LLs) resistivity measurement
- Calibrated using three external resistor networks that simulate relatively low, medium, and high resistivities



Typical HEDL log recorded in highly resistive carbonate formations.

### HEDL Tool Benefits

Under conditions of high  $R_t$  and low  $R_m$  and at temperatures higher than 350°F, HEDL provides the basic formation resistivity data to aid formation evaluation.

### Hostile Environment Dual Laterolog (HEDL™) Tool Specifications

Length		Diameter		Maximum Pressure		Maximum Temperature		Weight	
(ft)	(m)	(in)	(mm)	(psi)	(Mpa)	(°F)	(°C)	(lb)	(kg)
21	6.4	2.75	69.9	25,000	172.4	450	232.2	300	136.1