

## Spectra Flow™ Logging Service (SpFI)

The Spectra Flow™ logging service directly detects and evaluates water movement behind and inside the casing of both production and injection wells. The service is capable of measuring water-flow direction up and down, linear flow velocity, and volume flow rate of water moving vertically.

Water velocity measurements using spectral data are provided with continuous logs and stationary impulse step-down tests. Water-flow greater than 3 ft/min can be detected and, depending on the flow volume and location, quantitative velocities as low as 5 ft/min can be measured. For velocities over 50 ft/min, improved accuracy is obtained by using the more distant natural gamma ray detector. A modular tool design allows the Spectra Flow service to be run in combination with production logging tools. Multiple configuration options allow the service to be tailored to the types of flows encountered downhole.

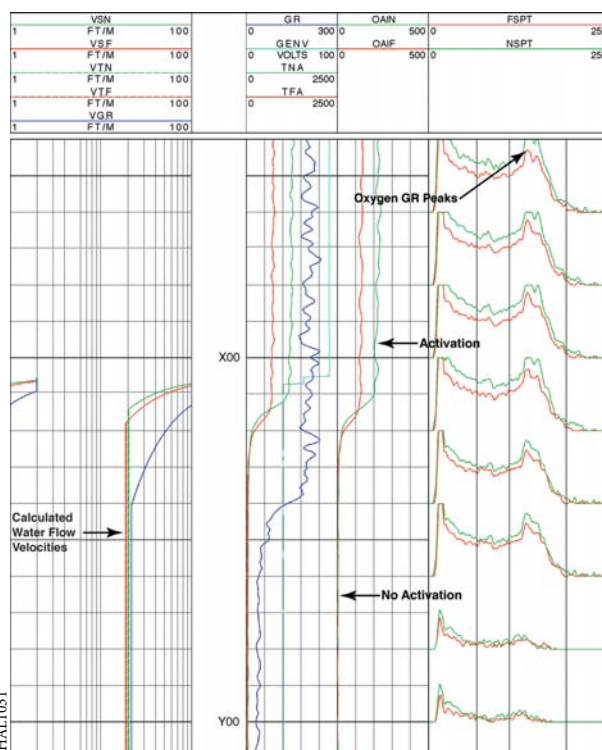
The Spectra Flow tool is a uniquely reconfigured pulse-neutron capture/spectral through-tubing device with a source to detect spacing to make quantitative water-flow measurements. The tool has two logging methods—continuous logging and stationary impulse testing.

This combination of high-resolution water detection plus unique pulsed-neutron timing allows the use of the continuous logging method. In this method, the linear velocity of water-flow is determined from the ratio of oxygen activation measured with the near and far detectors.

The stationary impulse method is a travel time measurement that automatically switches the neutron generator on/off and measures the fluid velocity with respect to time. Independent velocities are measured for each detector. Since calibration of the detectors is not required for measurement accuracy, this method has better results than any other system.

Other logging techniques used to discover fluid movement behind the casing involve measuring acoustical noise, temperature, and radioactive tracers. Running one or a combination of these services can be done successfully, but the interpretation of the data is frequently not easy.

Spectra Flow logs eliminate the need to inject tracer materials, have sufficient resolution, a deeper depth of investigation, and appear to be more practical for detecting low flow rates than traditional methods.



The above Spectra Flow™ impulse velocity test calculates accurate velocity by measuring the time of activated water compared to nonactivated water passing by Spectra Flow detectors. Velocities are calculated for the two spectral measurements, the total activation measurement, and the natural gamma ray detector. Both simultaneous up and down flow can be measured. Track 3 displays the spectral measurements of activated oxygen. Track 2 contains the gamma ray, near and far oxygen activation (OAIN and OAIF), generator voltage, and near and far total activation measurement (TNA and TFA) curves. Track 1 shows the water-flow velocity curves from each of the measurements in Track 2 (VSN for OAIN, VSF for OAIF, VTN for TNA, VTF for TFA, and VGR for GR).

**Applications**

- The detection and quantification of water flowing in cement channels (in producing or injection wells)
- Identification of water-flow between tubing and casing
- Detecting water entries
- Detecting thief zones
- Discovering cross flow between zones
- Detecting leaking plugs and packers
- CO<sub>2</sub> flow measurements

**Features**

- Specially designed for quantitative water-flow measurements
- Modified detector section for the pulsed neutron capture tool includes source-to-detector spacing to eliminate effects of stationary water in the borehole and/or the formation
- Fully combinable with a complete string of production log sensors

- Modular design allows tool to be configured for detecting water sources from above or below; can also be configured to measure both up and down water sources simultaneously
- Pure spectral measurement isolates only gamma rays produced for oxygen recording
- Gamma rays produced as a result of oxygen activation are recorded spectrally, allowing elimination of all other sources of gamma rays
- Because it measures spectrally, it can determine Compton downscattering, allowing qualitative determination of whether flow is inside or outside the pipe

**Associated Answer Products**

- QW (Calculates water-flow rate and velocity)

**Spectra Flow™ Logging Service (SpFI) Specifications**

Length ft (m)	Diameter in. (mm)	Maximum Pressure psi (Mpa)	Maximum Temperature °F (°C)	Weight lb (kg)
18 (5.5)	1.6875 (42.8625)	15,000 (103.4)	325 (162.8)	70 (31.8)