Weatherford®

Surface Logging Systems

GC-TRACER™ Surface Gas Detector

Weatherford's *GC-TRACER* surface gas detector is used to extract and analyze formation gas samples from drilling fluid. Leveraging a patented membrane-based extraction technology, it delivers more precise results in less time than traditional methods, such as the gas agitator trap.

The speed and accuracy of the *GC-TRACER* detector enhance reservoir detection and evaluation capabilities. Once quantified, gas ratios can be used to improve well planning and completion; obtain an early indication of potential total reserves; make cost-effective decisions on wireline logging; geosteer a well's trajectory; evaluate fluid mobility within a reservoir; determine relative formation permeability; assess a horizon's potential for enhanced production; identify fracture and fault occurrence; and detect sweet spots in shale.

The *GC-TRACER* detector is highly versatile. Its compact size enables easy installation in even the most complex of surface flow systems. The unit can be used in tandem with dedicated onsite *GC-TRACER* analysts, who monitor the system and well 24 hours a day and provide data interpretation services. It is compatible with the majority of third-party mud-logging services; as such, it can be deployed as an enhancement to more conventional systems.

GC-TRACER Unit

Applications

- Extracting and analyzing formation gas directly from drilling fluid during conventional, underbalanced, and managed pressure drilling operations

Features, Advantages and Benefits

- A unique semi-permeable membrane exploits differences in partial pressure within the probe and within the drilling fluid to permit extraction of a wide range of hydrocarbon and non-hydrocarbon gases from the drilling fluid; the range enhances the quality and utility of the samples.

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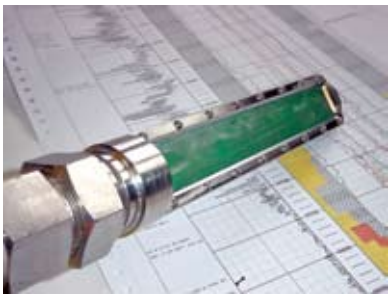
GC-TRACER™ Surface Gas Detector

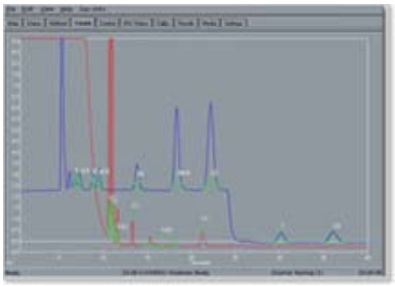
Features, Advantages and Benefits (continued)

- A slim probe housing the membrane offers several advantages:
  - It can be inserted directly into the flow line at the bell nipple, maximizing extraction efficiencies.
  - It can also be installed in the suction tank, thereby permitting real-time delta measurements.
  - It works in any drilling fluid or phase, including air and nitrogen.
  - The absence of moving parts inside the probe reduces its risk of damage or mechanical failure.
- The high-speed micro gas chromatograph enables quick analysis of gas samples. It is configured to analyze hydrocarbon gases ranging from methane (C1) to octane (C8) in less than 60 seconds and methane to decane (C10) in approximately 135 seconds; competing systems can take from one to five minutes just to sample methane to pentane (C5). The chromatograph's speed greatly reduces the risk of missing bypassed pay and weakly defined zones.
- The unit's gas chromatograph is also configured to analyze non-hydrocarbon gases, including nitrogen, carbon dioxide, and hydrogen sulfide, as well as aromatic hydrocarbons, with no additional equipment, enhancing the quality and utility of the samples without increasing costs or processing time.
- Sample lines from the point of extraction to the gas chromatograph are heated to ensure high resolution of heavier gas components.
- A temperature probe situated alongside the membrane probe enables real-time corrections to the gas readings to compensate for the effect of temperature on gas solubility.
- An explosion-proof enclosure housing the gas chromatograph and server is situated 10 ft (3 m) from the probe, providing for the shortest possible transit times of sample gases and thereby reducing lag time.
- The closed flow system eliminates dilution of gas samples with air (a major drawback of the gas trap system), improving the accuracy of sample analysis and allowing determination of nitrogen (N_2) and carbon dioxide (CO_2) concentrations.

Inside *GC-TRACER* Unit



GC-TRACER Probe



Evaluation Chart

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GC-TRACER™ Surface Gas Detector

Features, Advantages and Benefits (continued)

- Helium is used as an inert carrier gas to transport the samples from the probe to the gas chromatograph (as opposed to a more volatile gas such as hydrogen), removing safety concerns arising from locating the unit close to the well.
- The use of Wellsite Information Transfer Specification (WITS) protocols for the transmission of data facilitates the integration of the *GC-TRACER* surface gas detector with Weatherford and third-party mud-logging and logging-while-drilling data acquisition systems.

Specifications

Detector

Type	Micro-GC/thermal gas detector
Model	Varian CP4900
Column type	Custom backflush
Column oven temperature range (°F/*°C*)	86° to 356° isothermal *30° to 180° isothermal*
Sampling frequency	Continuous
Cycle time, C1 to C8	< 60 sec
Range	0 to 100%
Limit of detection (parts/million)	1
Limit of quantification (parts/million)	10
Resolution (parts/million)	< 1
Carrier gas	Helium

Unit

Dimensions (in./*cm*)	36 × 16 × 12 *91 × 41 × 31*
Weight (lb/*kg*)	79 *36*
Power frequency (V AC/*Hz*)	85 to 265 *40 to 70*
Power rate (Watts)	172 to 460
Air supply (SCF/min, *SCM/min*)	4.5 to 7.0 *0.127 to 0.199*
Communication protocol	WITS over TCP-IP or RS422
Probe length (in./*cm*)	10 *25.4*
Umbilical length (ft/*m*)	6.6 or 19.7 *2 or 6*
Safety classification	Class 1, Division 1, Zone 1
Ambient temperature range (°F/*°C*)	–4° to 122° *–20° to 50°*

Options

- The system can be configured to run in express mode, in which case the sampling range changes to C1 to C5 in less than 30 seconds. Used in conjunction with Weatherford's surface-logging service, express mode eliminates the need for onsite *GC-TRACER* personnel.

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