Hydrogen for Flame Ionization Detectors in Mud Logging

Market Application Publication

Background:

Mud logging refers to the monitoring of the physical characteristics and composition of rock cuttings that are obtained in the process of drilling an oil or gas well. This process is done to locate small pockets of oil or gas. One of the most critical parameters is the determination of the total organic content (TOC) of the rock, which is directly related to the economic value of the well. The TOC is determined by heating the sample to expel the hydrocarbons and monitoring their concentration by a Gas Chromatograph with a flame Ionization Detector (FID), which uses hydrogen as a fuel and an oxidant to convert the various organic compounds into ions. The presence of the ions is then detected by a pair of electrodes and a sensitive ammeter. The FID requires a supply of hydrogen at a flow rate of approximately 40 mL/min at a pressure of 50 psi. Some facilities provide the necessary gas from a high pressure gas cylinder; while this is a satisfactory approach, the use of a hydrogen generator offers a number of significant benefits. This is particularly important when the instrument is located on a mobile drilling platform where delivery of gas is expensive and unreliable. An in-house nitrogen generator is completely automatic and requires a minimum of maintenance.

Features and benefits:

- Generates pure hydrogen from water with minimum user interaction.
- Eliminates the use of dangerous and expensive hydrogen tanks.
- Safe, produces only the amount of hydrogen that the system needs on a 24h/7d basis, thus minimizing the possibility of asphyxiation.
- Remote control and remote monitoring via USB option.
- Extremely low cost of operation, no hidden costs (demurrage, maintaining inventory).
- Minimum environmental impact, while fractional distillation of air and transportation of tanks has a significant impact.
- Compact and reliable–requires only 1 ft^2 of bench space.

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Application:

Hydrogen gas can be readily generated by the electrolysis of water using a proton exchange membrane (PEM) such as Nafion® (a sulfonated tetrafluoroethylene polymer) or polybenzimidzole (PBI) that is designed to conduct protons while being impermeable to gases such as hydrogen and oxygen. PEM's are commonly used in fuel cells to create an electric current (and form water) from hydrogen gas and oxygen gas. When an appropriate potential is applied to a PEM in the presence of water, the reverse process occurs and the water is dissociated to form oxygen and hydrogen. A significant benefit of this approach for the generation of hydrogen is that DI water can be employed instead of the caustic 20% solution of Sodium Hydroxide typically used to promote the electrolysis. A palladium membrane is included to further purify the hydrogen by removing oxygen to less than 0.01 ppm and moisture down to <1.0 ppm. The Parker Model H2PEM-510 Hydrogen Gas Generator is capable of generating 99.9995% pure Hydrogen (non-carrier grade) at a flow rate of 510 mL/min at pressures up to 100 psi.

Case Study:

A GC-FID system for mud logging studies is typically located at the drilling site which is usually at a fairly remote location on a mobile drilling platform. The on-site hydrogen generator provides the necessary hydrogen on a 24/7 basis with a minimum of user interaction. Once the generator is installed, the user need only refill the water container on a periodic basis. Kris Andaur of Techquip reports that most users fill the water container every 2-3 days and the system requires minimal maintenance. In addition, it should be noted that the generator is directly interfaced to the GC-FID, reducing the possibility of introducing impurities into the system.

An on-site generator provides a considerably safer approach to supply Hydrogen. The generator provides the gas at a low pressure. In contrast, when tank gas is employed, the user must take significant precautions when handling a tank (which has pressure >2000 psi), as damage to the tank can cause significant damage to the facility.

The cost of generating hydrogen by an on-site generator is considerably lower than the use of tank gas; so many facilities provide fuel gas to the detector on a continual basis at a reduced level. This reduces the need to recalibrate the detector before analytical measurements can be taken. This can save a significant period of time and maximize laboratory efficiency.

Principal Specifications

Hydrogen Generators	Hydrogen Generators
Hydrogen Purity	99.9995%
Flow Rate	100 cc/min (H2PEM-100) 165 cc/min (H2PEM-165) 260 cc/min (H2PEM-260) 510cc/min (H2PEM-510)
Outlet Port	1/8" compression
Electrical	120 VAC/240 VAC
Delivery Pressure	5-100 psig ± 0.5 psig
Delivery Pressure	59 lb (27 kg (dry)
Dimensions	17"H x13.4"W x 18"D (43.2 cm x 34.1 cm x 45.8 cm)

Ordering Information

Description	Model Number
Hydrogen Generator	H2PEM-100 H2PEM-165 H2PEM-260 H2PEM-510
Desiccant Cartridge (1) 6 Month Service Kit 24Month Service Kit	MKH2PEM-D MKH2PEM-6M MKH2PEM-24M
Preventive Maintenance Plan	H2PEM-100-PM H2PEM-165-PM H2PEM-260-PM H2PEM-510-PM
Installation Service	H2PEM-100-INST H2PEM-165-INST H2PEM-260-INST H2PEM-510-INST
USB Remote Control Accessory	604970894

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