Zero Air Generation for Process GC-FID to Monitor Stack Gas

Market Application Publication

Background:

Gas Chromatography with flame ionization detection (GC-FID) is commonly used to monitor stack gases at power plants mining facilities, refineries and other industrial sites. Monitoring is performed to determine the level of hydrocarbons and other organic compounds to ensure compliance with safety considerations and to ensure that government mandated emission control standards are met so that pollutants are not expelled into the atmosphere. In many cases, the process GC-FID system used to perform the monitoring is installed in a harsh environment and must meet stringent safety considerations. In addition the system must be designed to operate on a continuous basis without the need of operator attention. When a GC-FID system is used, air is required as a fuel for the detector to combust the organic compounds that are eluted to H_2O and CO_2 when are then detected. Atmospheric air cannot be used in the FID as it contains traces of hydrocarbons and will increase the signal to noise ratio and significantly reduce the sensitivity of the detector.

Zero air, which is air that contains <0.1 ppm hydrocarbon (measured as methane), is normally used for GC-FID systems. This air can be obtained by passing compressed air over a heated catalyst that converts the organic compounds into H_2O and CO_2. While many facilities provide zero air to the GC-FID using compressed gas tanks, an on-site Zero gas generator can provide the required gas in a safer, more convenient and more economical manner.

The specially designed zero gas generator in housed in an explosion proof enclosure and is designed to operate in a Class 1, Division 1, Groups B, C, D environment. In addition, the use of an in-house Zero gas generator is less energy intensive as the gas heavy tanks need not be transported from the filling station to the end use facility. An in-house Zero air generator is completely automatic and requires a minimum of maintenance.

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Features and benefits:

- Produces a continuous supply of Zero Air with minimum user interaction
- Safe, even in explosive environments. Certified by CSA (CSA NRTL/C)
- Eliminates acquisition transport and installation of bulky and hazardous gas tanks.
- Extremely low hydrocarbon level provides stable baselines and high sensitivity.
- Only requires a standard compressed air supply
- Designed to operate in Class 1, Division 1, groups B,C, D environments
- Prevents running out of gas during data collection
- Lower cost than Zero gas tanks, eliminates costs such as demurrage and maintaining inventory.
- Minimum environmental impact, transportation of tanks has a significant impact
- Operates on a 24/h/day, 7 day/week basis with minimum maintenance

Application:

Stack Gas from industrial applications such as refineries, power plants and other facilities frequently emit a broad range of aromatic hydrocarbons and other organic molecules into the atmosphere. As an example, the incomplete combustion of fuel oil provides a range of compounds that can contribute to air pollution such as methane and trace levels of complex aromatic hydrocarbons, many of which are carcinogenic are hazardous to health. It is necessary for the facility to monitor the output from the stack to ensure that the plant meets public health standards and governmental regulations. Many facilities employ gas chromatography with flame ionization detection to monitor the stack gas as essentially all organic compounds can be readily detected. To optimize the sensitivity of the measurement, zero gas (which contains less than 0.1 ppm of hydrocarbons, measured as CH_4) is used to combust the organic compounds eluted from the GC column.

While the zero air used for GC-FID analysis could be obtained via a high pressure gas tanks from commercial gas suppliers, many users have converted to the in-house generation of zero gas using the explosion proof system as it provides significant advantages, relative to compressed gas tanks including:

Safety - When an in house generator is employed, only a small amount of the gas is present at a low pressure at a given time and the gas is ported directly to the GC. The zero gas system generates a maximum of 1 L/min of air at a maximum pressure of 120 psig. In contrast, a number of serious hazards exist when gas is supplied to the GC via a tank. There is a significant hazard and the possibility of injury or damage during the transportation and installation of a gas tank. A standard tank is quite heavy and can become a guided missile if the valve on a full tank is compromised during transport (in many facilities, specially trained technicians are used to replace gas tanks).

Convenience - When an in-house generator is employed, the gas is supplied on a continuous basis and can be provided on a 24 hour/7 day a week basis without any user interaction other than a minimum of routine annual maintenance. In contrast, when tank gas is employed, the user must pay close attention to the level of gas in the tank and replace the tank on a periodic basis. In many facilities, spare gas tanks are stored outside in a remote area for safety reasons and it is time consuming to get a replacement cylinder.

Cost - An extremely important benefit of an in-house generator is the economic benefit compared to the use of gas tanks. The running cost of operation of the generator is extremely low; as the raw materials to prepare the required gas are air and electricity. The running costs and maintenance for an in-house gas generator is a few hundred dollars a year. In contrast, the cost for using gas from tanks includes the actual cost of obtaining the gas tank as well as the time involved in changing tanks, ordering new tanks, maintaining inventory, and related activities.

Environmental - The generator eliminates the need to transport filled gas cylinders from the point of filling to the user's site and return of the empty cylinders for refilling. Gas cylinders are bulky and heavy, requiring a considerable expenditure of energy to transport them.

Principal Specifications:

Explosion Proof Zero Air Generators	Specifications
Explosion Proof Certification (CSA NRTL/C)	Class 1, Division 1, Groups B,C,D
Maximum Flow Rate	1000 cc/min
Total Hydrocarbon Concentration	< 0.1 ppm (measured as methane)
Min./Max. Inlet Pressure	40 psig/125 psig
Maximum Inlet Hydrocarbon Content	100 ppm
Maximum Inlet Air Dewpoint	10°F (5°C) above ambient
Pressure Drop at Max. Flow Rate	<8 psid
Outlet Air Temperature	Ambient + 20°F (+11°C)
Start Up Time	45 min.
Electrical Requirements	120 VAC/60Hz, 0.5 Amps
Shipping Weight	28 lb (13 kg)
Dimensions	11"W x 7"H x 6"D (28 cm x 18 cm x 15 cm)

Ordering Information:

Description	Model Number
Zero Air Generator	75-82S
Replacement Catalyst Module	75398
Final Filter Cartridge	75820
Optional Prefilter Assemblies	2002N-1B1-DX, 2002N-1B1-BX
Installation Kit	INK76803
Preventative Maintenance Plan	75-82S-PM
Extended Support with 24 Month Warranty	75-82S-DN2

Note: Part Numbers are for North America; see product catalog for electrical and plug configurations for other locations.

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