Continuous Monitoring of Bulk and Specialty Gas Purity in Industrial Gas Applications

Process Overview

Industrial gas production of bulk and specialty gases requires accurate gas concentration monitoring to meet the purity and blend requirements for a variety of end-use applications in many industries, including:

- Petroleum refining
- Electronic and semi-conductor industry
- Food and beverage
- Healthcare and medical
- Chemical industry, especially inert process blanketing/purging
- Production of metal processing and welding gases
- Production of calibration gases

Production of critical industrial bulk gases such as nitrogen (N_2), oxygen (O_2) and argon (Ar) is performed in air separation plants. Other gases that are used for commercial purposes but are not atmospheric gases include: hydrogen (H_2), helium (He), carbon dioxide (CO_2), carbon monoxide (CO), ammonia (NH_3), sulfur dioxide (SO_2) and other specialty gases. The production of larger quantities of these industrial gases is typically located close to the processing plant. For the production of smaller quantities and specialty gases, gas cylinders are filled in bottling plants where various gas products and blends are packaged for a variety of end-use applications.

Highly accurate analysis and monitoring of gas purity at both ends of the bulk gas supply network is critical. This includes maintaining gas purity for point-of-use at the high pressure cylinder filling manifolds, outlet lines of the air separation plant or gas manufacturing facility, as well as the custody transfer receipt at the bottling plants.

Gas Purity Monitoring Challenges

Monitoring the purity of bulk gas poses many challenges, including the presence of moisture, the use of highly corrosive gases and the need for readings in real time to control the process. Plant operators need a gas analyzer that can identify a range of impurities and their concentration, detect low levels of moisture, and the ability to handle reactive and caustic gases such as those used in semi-conductor manufacturing process.

Generating high-purity gases for point-of-use also requires continuous process monitoring of impurities to detect potential process upsets, such as compressor leak, purifier breakthrough, and to verify certain impurities at part-per-billion (ppb) levels.

Bundled Gas Cylinders

The Emerson Solution

Emerson provides a wide range of continuous gas analysis technologies to meet the monitoring needs of bulk gas and specialty gas production. Emerson's Rosemount Continuous Gas Analyzers can certify gas purity to ppb levels as well as trace impurities with real-time online gas analysis, ensuring process control and preventing potential gas stream contamination.

In addition to the impurity and purity measurements shown in Table 1, Rosemount Continuous Gas Analyzers can measure a wide range of gas components to identify the quality of mixed gas cylinders typically used in the medical industry, food and beverage industry, or for the production of welding gases.

Rosemount X-STREAM Enhanced Gas Analyzer shown in 19" rack-mount housing

Table 1 - Industrial Gas Measurement Applications Using Rosemount Continuous Gas Analyzers

Application	Measured Component	Technology	Lowest Range
Impurities	H_2O	Aluminum oxide (Al_2O_3) sensor	0-100 ppm (-100 to -10 °C d.p.)
	O_2	Trace O_2 sensor	0-10 ppm
	O_2	Paramagnetic Detection (PMD)	0-1 %
	CO	Non-Dispersive Infrared (NDIR)	0-10 ppm
	CO_2	Non-Dispersive Infrared (NDIR)	0- 5 ppm
	CH_4	Non-Dispersive Infrared (NDIR)	0-100 ppm
	SO_2	Non-Dispersive Ultra Violet (NDUV)	0-25 ppm
	NO_x	Chemiluminescence Detection (CLD)	0-5 ppm
	H_2	Thermal Conductivity Detection (TCD)	0-2000 ppm
	N_2	Thermal Conductivity Detection (TCD)	0-2000 ppm
Application	**Measured Component**	**Technology**	**Highest Suppressed Range**
Purities	CO_2	Non-Dispersive Infrared (NDIR)	90/95/98 to 100 %
	N_2O	Non-Dispersive Infrared (NDIR)	90/95/98 to 100 %
	CH_4	Non-Dispersive Infrared (NDIR)	90 to 100 %
	O_2	Paramagnetic Detection (PMD)	90/95/98 to 100 %
	H_2	Thermal Conductivity Detection (TCD)	90/95/98 to 100 %

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