

Oxygen measurement in pipeline natural gas

Summary

Oxygen is a contaminant in natural gas processing and pipeline transportation with the potential to create serious issues for production and storage facilities, gas plants and the associated transportation pipelines. Natural gas and methane (CH_4) are terms often used interchangeably however natural gas is typically comprised of 70%–90% methane with the remainder comprising mostly of ethane (C_2H_6), propane (C_3H_8), carbon dioxide (CO_2), nitrogen (N_2) and oxygen (O_2). The oxygen concentration in the gas stream is continuously measured to ensure that the oxygen concentration and resultant harmful effects are minimized.

Application

Natural gas is extracted from wells where it passes to treatment plants for multi-stage separation. The treated natural gas is then pumped using compressors through transportation pipelines to storage facilities or end users. The presence of oxygen in the natural gas can cause a number of issues for the end product and transportation infrastructure. Combining oxygen (O_2) with hydrogen sulfide (H_2S) and moisture (H_2O) produces highly corrosive sulfuric acid (H_2SO_4), detrimental to pipeline infrastructure. Pipelines are typically under pressure and, leakage due to the corrosion of components can have serious consequences.

Furthermore, the presence of oxygen can reduce the efficacy of carbon dioxide (CO_2) and hydrogen sulfide (H_2S) removal. It also adds no specific heating value to the end product and is therefore undesirable to the end user. Oxygen can enter the gas stream through inadequate vapor recovery units or leaks in compressor seals or pipeline fittings.

Oxygen is measured at several points along the natural gas value chain. Regional requirements may dictate limits. Typically these measurements will be conducted at custody transfer points or metering skids. For treated pipeline natural gas in Europe, EASEE-gas stipulates that the oxygen concentration maximum limit is 0.01% or 100ppmv. The North American region is more fragmented with limits ranging from 1% oxygen down to 50ppm.

Benefits:

- Turnkey packaged solution
- Stainless steel IP66 enclosure
- Background gas unaffected
- Class 1 Div 1/Zone 0 option



Challenge

The challenge with this measurement is having a sensor technology that can measure oxygen in low ppm ranges, which is unaffected by background gases in the stream and can work with low levels of hydrogen sulfide (H_2S). The sample system supporting the measurement must protect the oxygen transmitter from high pressure, particulates, and condensates.

Analyzer shelters frequently are space restricted. The sample system is tasked with providing a proper measurement, with a small footprint, while meeting hazardous area requirements.

Solution

The O2.IQ is an oxygen analyzer package specifically designed for this application. The oxy.IQ oxygen transmitter can be configured to low ppm and percent oxygen ranges and is unaffected by the background gas stream. The standard measurement cell can tolerate up to 5 ppm H_2S .

The O2.IQ includes the oxy.IQ transmitter in a sample handling system designed to provide an accurate and reliable measurement in a very space-conscious package. Sample handling features include filtration and pressure reduction along with flow control and calibration gas inlets. The stainless-steel enclosure also ensures the integrity of the system.

Sample take off configurations can also be added in cases where the O2.IQ is not installed as part of a metering skid.

Operating parameters

- Sample gas pressure: 0 – 400psig (0 – 27.5 Bar)
- Sample gas temperature: 32 to 113°F (0 to 45°C)
- Power requirements: 24 to 28 VDC at 50 mA

