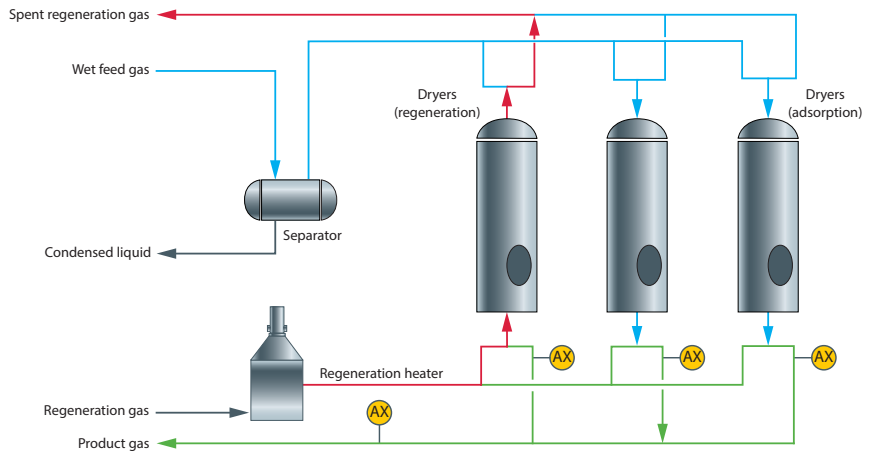
LNG: H_2O in dry LNG feed gas



Molecular sieve dehydration system

Benefits at a glance

- Fast response to H_2O concentration changes
- Patented differential spectroscopy technique measures H_2O at sub-ppmv levels in LNG feed gas
- Integrated permeation tube supports automated validation checks
- Laser-based measurement is highly selective and accurate for H_2O in LNG feed gas

Molecular sieve dehydration

Molecular sieve dehydration is used to meet the stringent specifications (< 0.1 ppmv) for H_2O concentration in LNG feed gas. Performance of the molecular sieve dehydration system is an important factor in the efficient, uninterrupted operation of an LNG plant. On-line monitoring of the H_2O concentration in the outlet gas of a dryer vessel provides real-time indication of adsorbent bed breakthrough to prevent gas containing an elevated level of H_2O from reaching the cryogenic liquefaction train.

Process control and optimization

Three or four molecular sieve dryer vessels are typically operated in parallel with a piping system that allows a saturated adsorbent bed to be taken off-line for regeneration with heated gas. Measuring the moisture level in the outlet gas from each dryer vessel enables the operator to rapidly detect moisture breakthrough in the adsorbent bed and switch gas flow to a vessel with a freshly regenerated adsorbent bed.

Endress+Hauser's solution

Tunable diode laser absorption spectroscopy (TDLAS) is a SpectraSensors technology that has proven highly effective for this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H_2O concentration, an important performance characteristic for detecting breakthrough in molecular sieve beds. Endress+Hauser's patented differential spectroscopy technique enables detection and quantitation of sub-ppmv levels of H_2O in LNG feed gas. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when H_2O is not present in the outlet gas from a molecular sieve vessel. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corrosion and ensuring stable long-term operation and accurate measurements in the field.

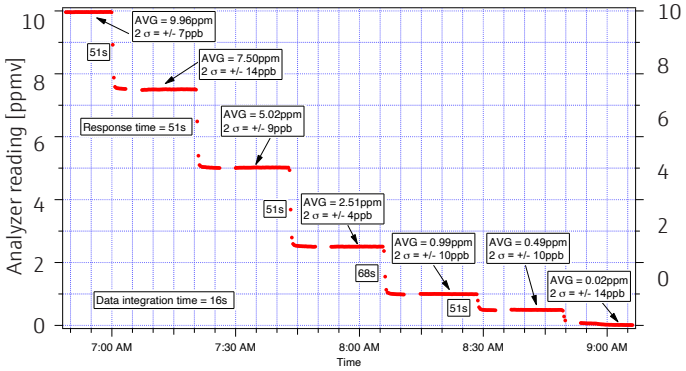
Application data	
Target component (Analyte)	H_2O in dry LNG feed gas
Typical measurement ranges	0-10 ppmv*
Typical accuracy	±50 ppbv at 0.5 ppmv ±240 ppbv at 10 ppmv
Typical repeatability	±0.03 ppmv*
Measurement response time	1 to ~60 seconds*
Principle of measurement	Differential tunable diode laser absorption spectroscopy (TDLAS) (H_2O dryer included)
Validation	Integrated permeation system

*Consult factory for alternate ranges.

Typical background stream composition			
Component	**Minimum (Mol%)**	**Typical (Mol.%)**	**Maximum (Mol%)**
Water (H_2O)	0	< 1 ppmv	10 ppmv
Nitrogen (N_2)	0	0.1	3
Oxygen (O_2)	0	0	1
Methane (C1)	60	75	100
Carbon dioxide (CO_2)	0	0	3
Ethane (C2)	0	15	20
Propane (C3)	0	6	13
Butane (C4)	0	4	5

The background stream composition must be specified for proper calibration and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component, especially water, the measured component. Other stream compositions may be allowable with approval from Endress+Hauser.

Step test H_2O in LNG feed gas The accompanying graph shows results of a Step test in which the concentration of H_2O was decreased from 10 ppmv down to 0 ppmv. Measurement repeatability at all concentrations is well within specifications (± 30 ppbv).



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