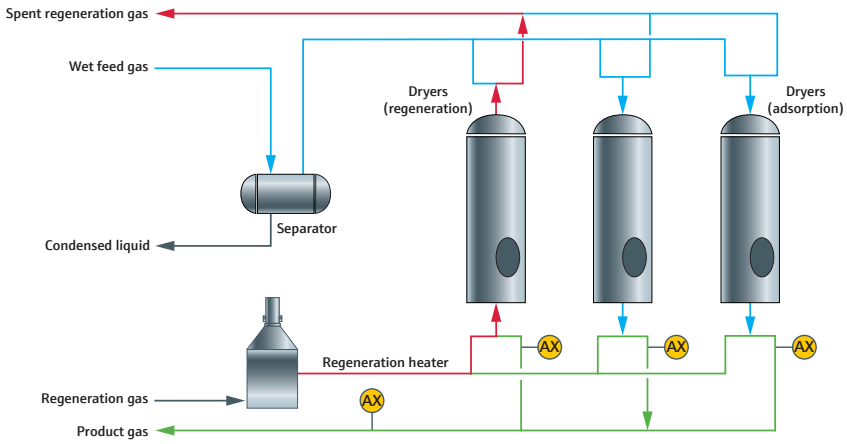
Natural gas processing: H_2O in molecular sieve dryer vessel outlet

Benefits at a glance

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



Molecular sieve dehydration system

Molecular sieve dehydration

Sweet natural gas exiting an amine treatment unit is saturated with water vapor. Some water can be removed from the gas by passing it through a knock-out drum, compression and cooling. Molecular sieve dehydration must be used to obtain the very low H_2O concentration (<0.1 ppmv) required in low temperature and cryogenic processes for NGL extraction and liquefied natural gas (LNG) production.

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 natural 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.

Endress+Hauser
People for Process Automation

Application data

Target components	H_2O in molecular sieve dryer vessel outlet
Typical measurement ranges	0-10 ppmv*
Typical accuracy	±50 ppb at 0.5 ppmv ±240 ppb 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 scrubber included)
Validation	Integrated permeation system

* Consult factory for alternate ranges

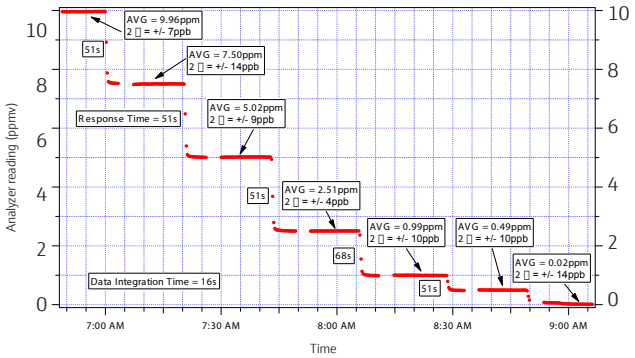
Typical background stream composition

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
Butanes +	0	4	5

Step test H_2O in natural 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).

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.



AI01219C/66/EN/01.21

Endress+Hauser
People for Process Automation