

Application Note

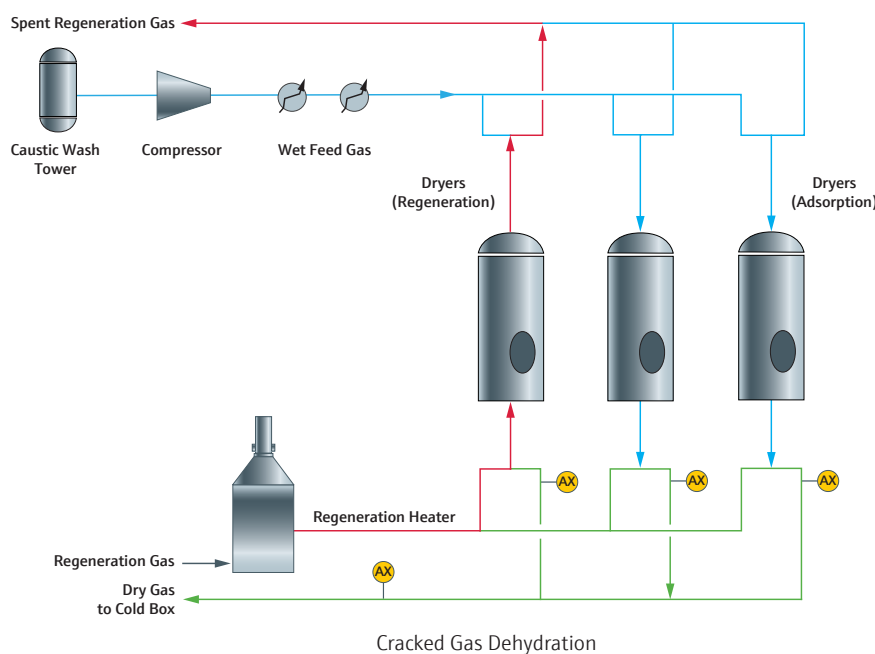
Water in cracked gas dryer vessel outlets

Industry:
Petrochemicals
Application Note 54801

Key Points

- Fast response to H₂O concentration changes
- Laser-based measurement is highly selective and accurate for H₂O in cracked gas
- Patented* Differential Spectroscopy technique measures H₂O at sub-ppm_v levels
- Integrated permeation tube supports automated validation checks

Cracked gas dehydration Cracked gas exiting a caustic wash tower is saturated with water vapor. Water must be removed before the gas undergoes cryogenic fractionation to avoid formation of hydrates and ice. Gas from the caustic wash tower is compressed and then cooled to remove as much entrained water as possible before it is sent to molecular sieve dryers. Molecular sieve dehydration dries the cracked gas down to < 1 ppm_v H₂O.



On-line monitoring of H₂O Multiple 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. Monitoring H₂O in cracked gas at the outlet of molecular sieve dryer vessels helps detect H₂O breakthrough and prevents gas with elevated levels of H₂O from entering downstream cryogenic separation equipment.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective for this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H₂O concentration, an important performance characteristic for detecting breakthrough in molecular sieve beds. SpectraSensors patented* differential spectroscopy technique enables detection and quantitation of sub-ppm_v levels of H₂O in cracked gas. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when H₂O is not present in the gas. 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.

*www.spectrasensors.com/patents

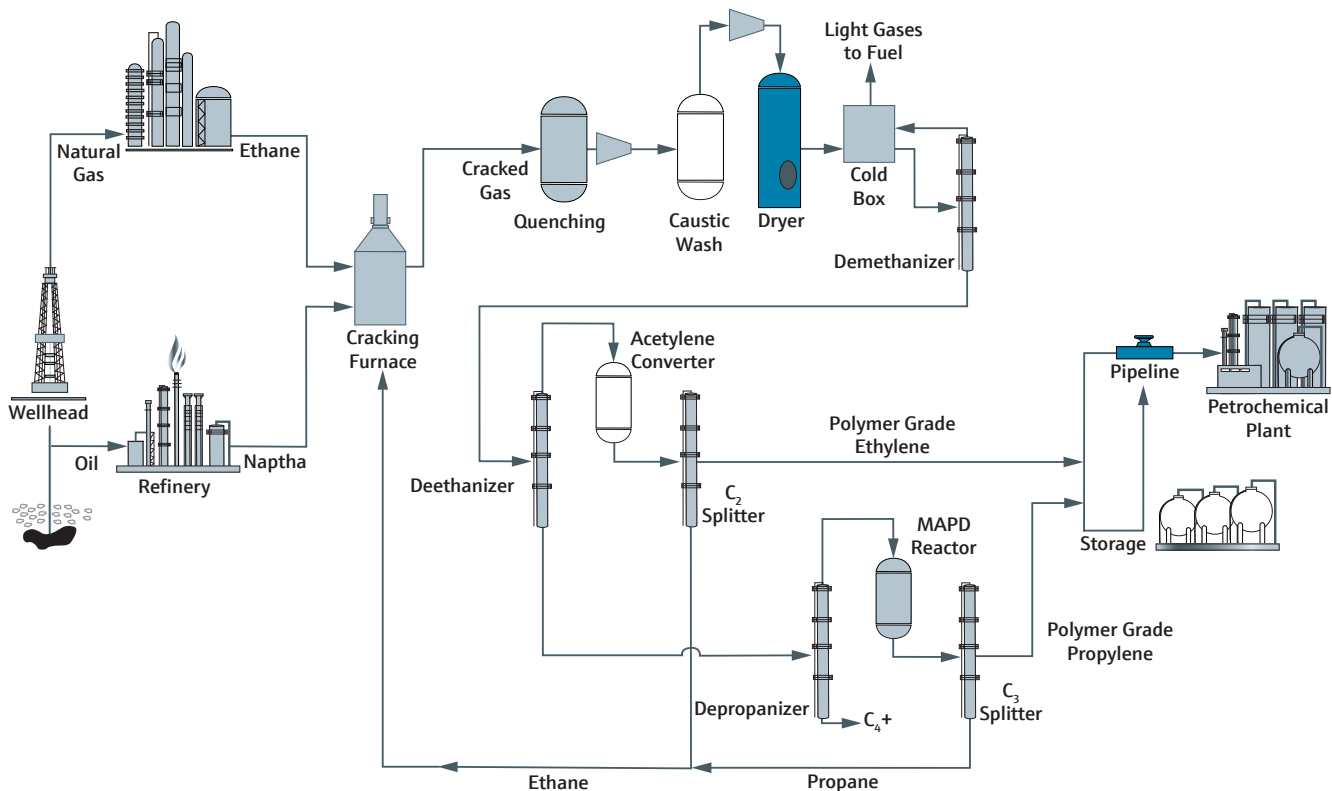
Application Data

Target Component (Analyte)	Water in Cracked Gas Dryer Vessel Outlet
Typical Measurement Range	0 – 10 ppm _v *
Typical Repeatability	± 0.5 ppm _v *
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H ₂ O dryer included)
Validation	Integrated Permeation System

*Application specific; consult factory.

Plant design and cracked gas stream composition The composition of a cracked gas stream in an ethylene plant is determined by the plant design and feedstock. Plants are characterized by the location of the demethanizer and acetylene converter. In front end plants the acetylene converter is located upstream of the demethanizer. In back end plants the acetylene converter is located downstream of the demethanizer. The diagram below depicts a back end plant. The location of the demethanizer determines the amount of light gases (methane, hydrogen, carbon monoxide) that will be present in the cracked gas stream entering the acetylene converter.

SpectraSensors calibrates each TDLAS analyzer we build using a calibration gas mixture blended to simulate the process gas stream. To do so we require the background stream composition of the cracked gas, with typical, minimum, and maximum expect values for each component, especially H₂O the measured component.



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