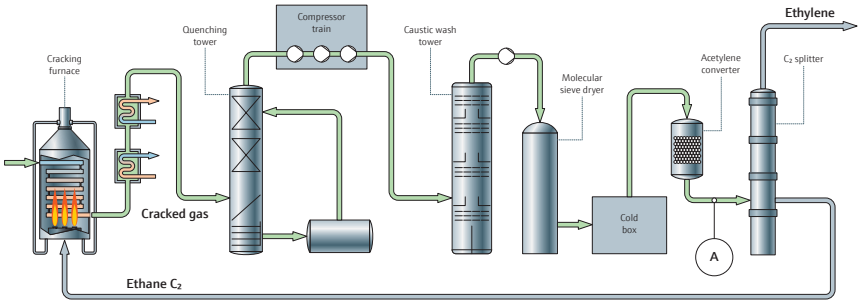
Petrochem: H_2O in cracked gas dryer vessel outlets

Benefits at a glance

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



Cracked gas dehydration

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 ppmv H_2O.

On-line monitoring of H_2O

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 H_2O in cracked gas at the outlet of molecular sieve dryer vessels helps detect H_2O breakthrough and prevents gas with elevated levels of H_2O from entering downstream cryogenic separation equipment.

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 patented differential spectroscopy technique enables detection and quantitation of sub-ppmv levels of H_2O 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 H_2O 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.

Endress+Hauser

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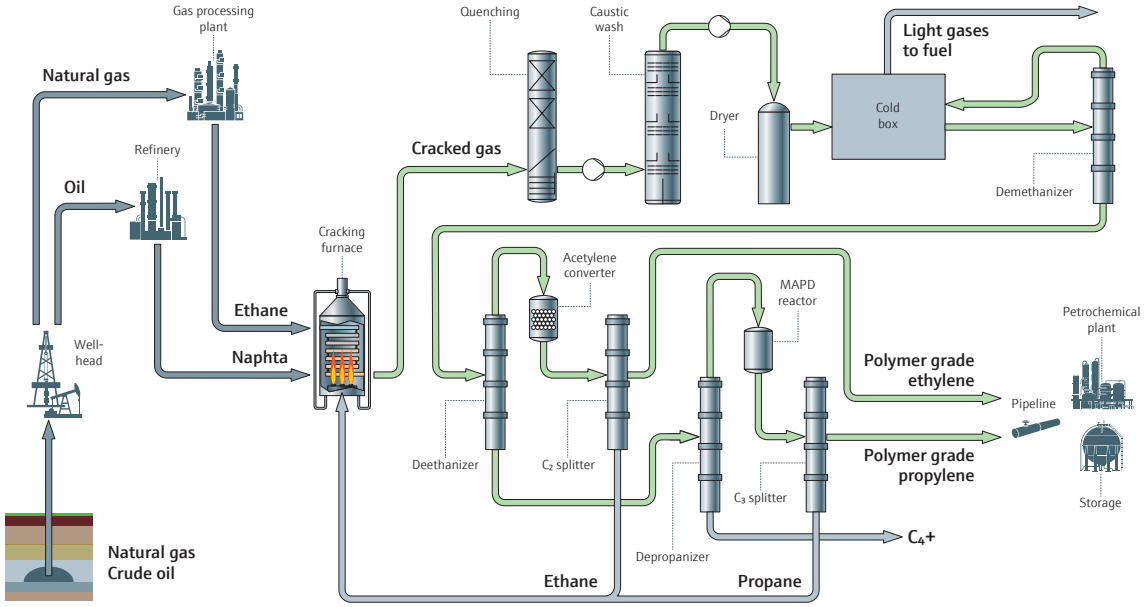
Application data	
Target component (Analyte)	Water in cracked gas dryer vessel outlet
Typical measurement range	0 – 10 ppmv*
Typical repeatability	±30ppb or 1% of reading (whichever greater)*
Measurement response time	1 to ~60 seconds*
Principle of measurement	Differential tunable diode laser absorption spectroscopy (TDLAS) (H_2O dryer included)
Validation	Integrated permeation system

*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.

Endress+Hauser 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 H_2O the measured component.



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