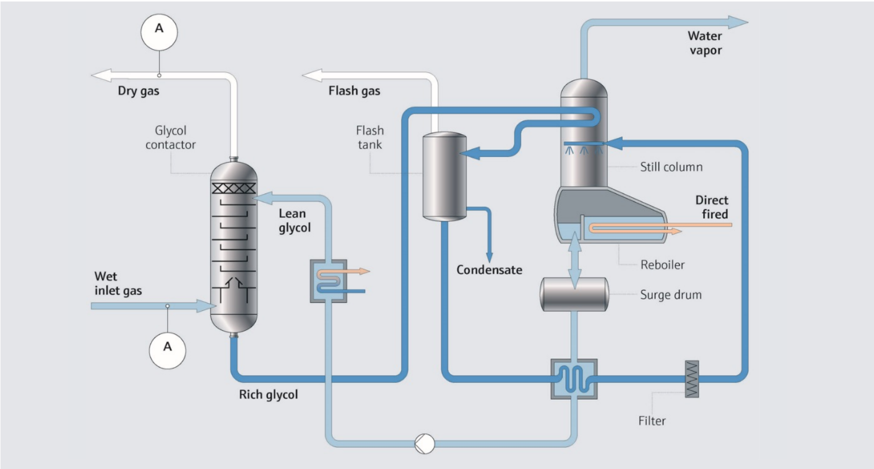
Carbon capture, utilization, and storage (CCUS) - CO_2 dehydration with glycol

Benefits at a glance

- Highly selective and accurate laser-based measurement for CO_2
- Measurement not affected by glycol or methanol
- Fast response to CO_2 concentration changes
- Low maintenance and OPEX costs - no carrier gases or consumable items



Glycol dehydration unit

Glycol dehydration for carbon capture applications

Gas-phase CO_2 that is removed by amine treatment or other methods frequently has high moisture content. Excess moisture creates multiple problems in downstream compression and liquefaction, including the following issues:

- **Corrosion -** Condensed water will react with CO_2 or residual H_2S to form acid compounds that lead to damage in downstream piping.
- **Hydrate formation -** Water is one component of solid hydrate formation that may occur in cooling stages after amine treatment. Hydrates are ice-like formations that are well known to cause blockages in gas pipelines.

Glycol dehydration is a common method to remove moisture down to trace levels suitable for dense phase gas compression in pipeline transport applications. The pipeline operator sets the maximum limit for moisture in CO_2, which can vary between <20 to <650 ppm H_2O depending on the use case. Moisture may be measured at both the wet gas inlet and the dry gas outlet of the glycol contactor. The measurement is important for gas quality and provides valuable data for the efficiency of glycol regeneration.

Moisture as a CO_2 quality measurement

Tunable diode laser absorption spectroscopy (TDLAS) has achieved broad acceptance for moisture measurement in dehydration applications. The non-contact, optical measurement is highly specific to water vapor, and thus unaffected by residual glycol or methanol that may be present in the CO_2 stream. Should a process upset occur, the fast response time of the TDLAS analyzer ensures that excess moisture is detected, and appropriate actions can be taken so non-compliant CO_2 does not reach the downstream compression and injection stages. TDLAS analyzers require no field calibration or consumable parts which minimizes overall OPEX costs.

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Application data

Target components	H_2O in CO_2 dehydration with glycol
Typical measurement range	0 to 100 up to 2000 ppmv*
Typical repeatability	± 1 ppmv or ± 1% of reading (whichever greater)
Measurement response time	1 to ~ 60 seconds*
Principle of measurement	Non-differential tunable diode laser absorption spectroscopy (TDLAS)
Validation	Certified blend of H_2O in nitrogen background

*Application specific, consult factory

Typical stream composition*

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Carbon dioxide (CO_2)	> 90	> 95	> 99
Water (H_2O)	< 1000 ppm	< 40 ppm	< 40 ppm
Hydrogen sulfide (H_2S)	< 200 ppm	< 5 ppm	< 5 ppm
Oxygen (O_2)	< 200 ppm	< 40 ppm	< 10 ppm
Nitrogen (N_2)	< 2	< 2	< 0.5
Methane (CH_4)	< 5	< 1	< 0.1
Amines	< 10 ppm	< 10 ppm	< 10 ppm
Ammonia (NH_3)	< 10 ppm	< 10 ppm	< 10 ppm

*Stream composition may vary depending on the gas being treated. Typical concentrations are representative of CO_2 for pipeline applications. Maximum concentrations are representative of CO_2 for liquefaction.

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