Captive hydrogen: CO_2 absorber recovery stream

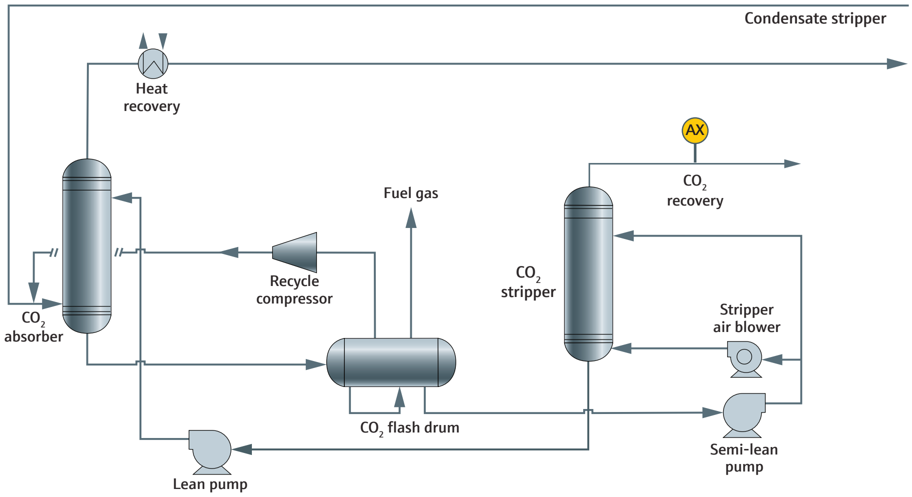

Figure 1: Typical recovered CO_2 measurement point after CO_2 stripper**

Benefits at a glance

- Unique spectroscopic capability to measure all syngas components, including H_2 and N_2
- Pipe-centric sampling and measurement at the sample tap requires no sample transport to the analyzer
- Sample can often be returned to the process – no sample flare
- Complete stream speciation
- No valves, columns, or carrier gas
- No routine calibration
- No interference from moisture

Introduction

An important gas treatment stage in the generation of hydrogen is the removal of CO_2 after the shift converter. This is the key step of carbon capture and storage (CCS) to reduce CO_2 emissions from the plant.* The captured CO_2 can be transported off-site for Enhanced Oil Recovery (EOR), or it can be sequestered for long-term storage in depleted underground gas fields or injected into the sea floor. Other options include using captured CO_2 as a feedstock for the synthesis of other useful chemicals, such as urea and methanol.

Measurement of recovered CO_2 from the CO_2 stripper

The Raman Rxn5 analyzer is a unique integrated sampling and measurement system for the CO_2 recovered from the CO_2 absorber unit. A typical Raman spectrum and stream composition for an CO_2 absorber outlet stream is shown in Figure 2. Note the simplicity and complete speciation of individual spectral peaks in the Raman spectrum. No other spectroscopic technique is capable of measuring N_2 in this stream. In addition, the measurement is based on a normalized analysis, which makes it very robust against pressure and temperature changes as well as any slow fouling that may occur.

Reliability issues with traditional methods for the recovered CO_2 measurement

In general, the CO_2 absorber outlet stream composition is measured with process gas chromatography (GC) or mass spectrometry (MS). Both technologies require transporting and conditioning the sample at both the sample tap and at the sample conditioning panel close to the analyzer. As the required sample pressure is relatively low, it is normally not possible to return the sample to process, so it must be disposed of via the low pressure flare header.

*See the Captive hydrogen: CO_2 absorber outlet - feed to PSA

**See the Captive hydrogen: production analytics overview

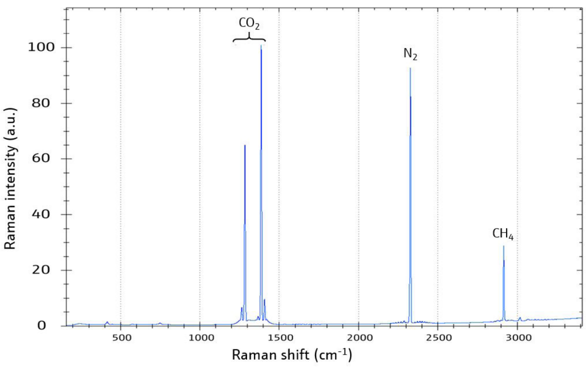

Figure 2: Raman spectrum of a typical CO_2 absorber recovery stream

Solution: Raman Rxn5 analyzer with the CO_2 absorber recovery stream method

In the case of a clean and dry stream like the CO_2 absorber outlet stream, the Raman Rxn5 analyzer with Rxn-30 probe allows for a wide range of sample pressure (70 to 800 psia) and a sample temperature (-40 to +150 °C). The Rxn-30 probe can be easily integrated into sample conditioning systems to measure process streams at higher temperatures and pressures. The ability to measure at higher pressures often allows the sample to be returned to the process, eliminating waste and costly flaring. The use of fiber optic cables allows the probe to be placed at the sample tap location, eliminating the need for long heated sample transfer lines and sample lag time.

The Raman Rxn5 analyzer for CO_2 absorber recovery stream contains the following per measurement point:

- Dedicated laser module
- Rxn-30 fiber optic probe
- Industrial hybrid electro-optical cable (up to 150 m long, customized to your plant requirements)
- Combined pressure and temperature sensor with cable (up to 150 m long, customized to your plant requirements)
- Dedicated CO_2 recovery stream method

Typical process conditions	P (barg)	T (°C)
At sample tap	5	70
At Rxn-30 probe	5	55

Typical stream composition

Component	Range (Mol%)	Normal (Mol%)	Precision (Mol%) k=2	Cal gas (Mol%)	Precision (Mol%) k=2
Nitrogen	35-75	55	0.11	55	0.11
Carbon dioxide	30-50	43	0.06	43	0.06
Methane	0-5	1.5	0.01	2	0.01

Table 1: Typical process conditions and stream composition

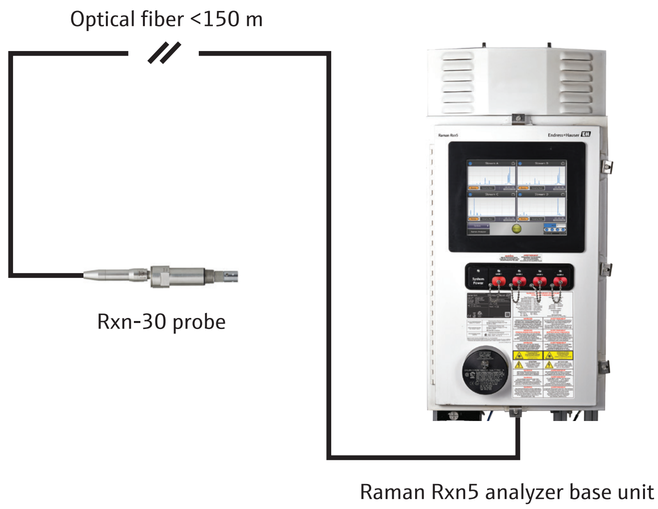

Figure 3: Recommended system configuration

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