

Measurement of Moisture in Natural Gas CEIRS™ Technology vs. TDLAS

KEY CONCEPTS

- Water Dewpoint is a better measurement for moisture in natural gas
- Water Dewpoint is a first-principle measurement and thus more accurate
- Water dewpoint can be measured at high operational pressure
- ZEGA7 CEIRS™ is the only technology that can unambiguously measure water dewpoint in natural gas
- ZEGA7 CEIRS™ Technology is immune to contaminants and corrosives in natural gas.
- ZEGA7 CEIRS™ Technology does not need calibration as it is a *first-principle* measurement.

EXECUTIVE SUMMARY

This technical note addresses the measurement of moisture in natural gas. Specifically, the difference between measuring of water dewpoint using CEIRS™ (Chilled-Mirror Evanescent Infra-Red Spectroscopy) technology vs. measuring water content using TDLAS (Tunable Diode Laser Absorption Spectroscopy).

INTRODUCTION

Measurement of water (moisture) content in natural gas is one of the essential measurements performed in the natural gas industry. There are several reasons that moisture content has to be measured. The four main reasons are:

- A- Corrosion effects. Moisture when combined with other components of natural gas such as H₂S and CO₂ will speed the corrosion process in steel pipes.
- B- Water dropout. Moisture in natural gas will condense into liquid water under certain conditions; i.e. below its dewpoint temperature. Creation of liquid water in the pipeline will cause operational issues.
- C- Hydrate Formation. Creation of natural gas hydrates is much more likely in the presence of free standing liquid water.
- D- Value Calculation. Since moisture does not have any monetary value, the amount of moisture needs to be subtracted from the total flow.

It is generally agreed that given the water content (amount of water vapor in natural gas), one can calculate the water dewpoint at a desired pressure. It is also possible to calculate the water content, given the dewpoint and the pressure.

So in principle, either measurement can be used as a proxy for the other. *This does not mean that both measurements are equivalent or prone to the same issues.* In order to decide which method to use, one has to consider several factors which will be discussed further.

Chilled-mirrors are the only way one can measure a dewpoint. ZEGA7 Instruments' CEIRS™ technology makes this measurement unambiguously.

	CEIRS™	TDLAS
Direct First Principle Measurement	✓	✗
NIST Traceable	✓	✗
Works at Line Pressure	✓	✗
No Calibrations	✓	Occasional with Drift
Measurement Time	A few minutes	A few seconds

Water DewPoint vs. Water Content

In the natural gas measurement context, “water content” measurement refers to measuring the amount of water in the vapor phase. There are many different methods that have been tried over the years, each with its own advantages and disadvantages. In general, most water measurement devices operate at near-atmospheric pressures. **This requires the reduction of the pressure from pipeline pressure (typically between 500-1500 psig or 35-100 barg) to close to 10 psig. This pressure reduction can and does introduce significant changes to the moisture content if not performed in multi-stages with excess amounts of heat input to the pressure-regulation system.** On the other hand, one can directly measure “water dewpoint”. Water dewpoint refers to the temperature at which water condenses out of natural gas at a given pressure. One can use the water dewpoint and calculate water content. However, as a measurement, there is only one way to measure water dewpoint (or any dewpoint for that matter) and that is to use a chilled-mirror instrument.

Misinformation in the Industry

Unfortunately, many companies that manufacture water content measurement equipment mislabel their products as dewpoint transmitters, or dewpoint measurement instruments. All of the following methods:

- Aluminum Oxide (aka Ceramic Oxide, or impedance hygrometers)
- Tunable Diode Lasers (TDL)
- Quartz-Crystal Microbalance (QCM)

measure water content and NOT the water dewpoint. Calling them a dewpoint transmitter is misleading. The only way to measure water dewpoint is to use a chilled-mirror. All other measurements such as above are inferred measurements.

Water Dewpoint Measurement

In the past, water dewpoint measurement was not feasible. However, ZEGAZ Instruments’ ground-breaking CEIRS™ technology allows first-principle measurement of water dewpoint, with no assumptions or calculations involved. Using ZEGAZ Instruments, natural gas producers, pipeline owners and distributors can actually measure the water dewpoint.

From an operational point of view, water dewpoint is really a much more important parameter than water content. All of the reasons to control water in natural gas can be better addressed by knowing the water dewpoint. That is why originally, most of the tariffs were written based on water dewpoint. To a large extent, most of the tariffs remain based on water dewpoint.

Conclusion

Measurement of water dewpoint is a more rational choice in controlling water in natural gas. Moisture dew point can be measured at line pressure, thus avoiding errors due to pressure regulation. Dew point measurement is also a direct, first-principle measurement and thus more accurate. The users should make sure that they understand the difference between the two measurements and choose the right option for their needs.