Dewpoint Measurement in Natural Gas Processing & Transmission

APPLICATION NOTE

SHAW MOISTURE METERS

Natural gas dewpoint measurement is the process of tracking the temperature at which water vapour in a gas stream begins to condense, at a given pressure. Producers, processors, and pipeline operators all check to confirm that gas is dry enough to move through the pipeline without dropping out free water. Two points matter most: the outlet of a dehydration unit and the custody-transfer point where ownership of the gas changes hands.

Water is the single most consequential impurity a shipper has to control before gas enters the pipeline. Left unchecked, it corrodes steel in the presence of acid gases, freezes into methane hydrates that block valves and instrumentation and can trigger a tariff dispute at the point where custody of the gas changes hands.

Why Moisture is a Problem in Natural Gas Processing and Transmission

Each of the failure modes below starts the same way: water vapour condensing out of the gas stream somewhere it should not.

Corrosion from Acid Gases

Natural gas carries trace carbon dioxide and in sour service, hydrogen sulphide. When free water condenses in the presence of either, it forms corrosive compounds that attack carbon steel pipe and fittings from the inside. Over years of operation, that steady internal corrosion is what forces an operator into an unplanned pipeline inspection or repair.

Methane Hydrate Formation

Under line pressure and the temperature swings common in transmission systems, free water and hydrocarbon molecules lock together into solid, ice-like hydrates. They lodge in valves, orifice plates and instrumentation tapping points and a build-up can block flow at a compressor station or a metering skid entirely.

Reduced gas quality and heating value. Water vapour displaces hydrocarbon content in the gas stream and lowers its delivered heating value. A wet stream can fall short of the energy content a buyer is paying for, even when nothing downstream has visibly failed.



Custody-Transfer and Tariff Risk

Pipeline transportation contracts set a maximum water content limit, commonly in the range of 1 to 7 lb/MMSCF, at the point where custody of the gas changes hands. Gas that arrives wetter than the tariff allows may be rejected at the receipt point or trigger a commercial dispute between shipper and pipeline.

Instrumentation and Control Fouling

Condensed water in sample lines and control tubing biases pressure and flow readings. In colder climates it can freeze, giving false signals to the control system at exactly the moment operators need reliable data.

Where Water Dewpoint Is Measured in the Process

The diagram below traces gas from the wellhead to the point where custody changes hands and marks the two places water dewpoint is checked in a typical system. Everything upstream of the dehydration outlet is common to nearly every natural gas processing scheme; what varies most between sites is how extensive the drying needs to be.

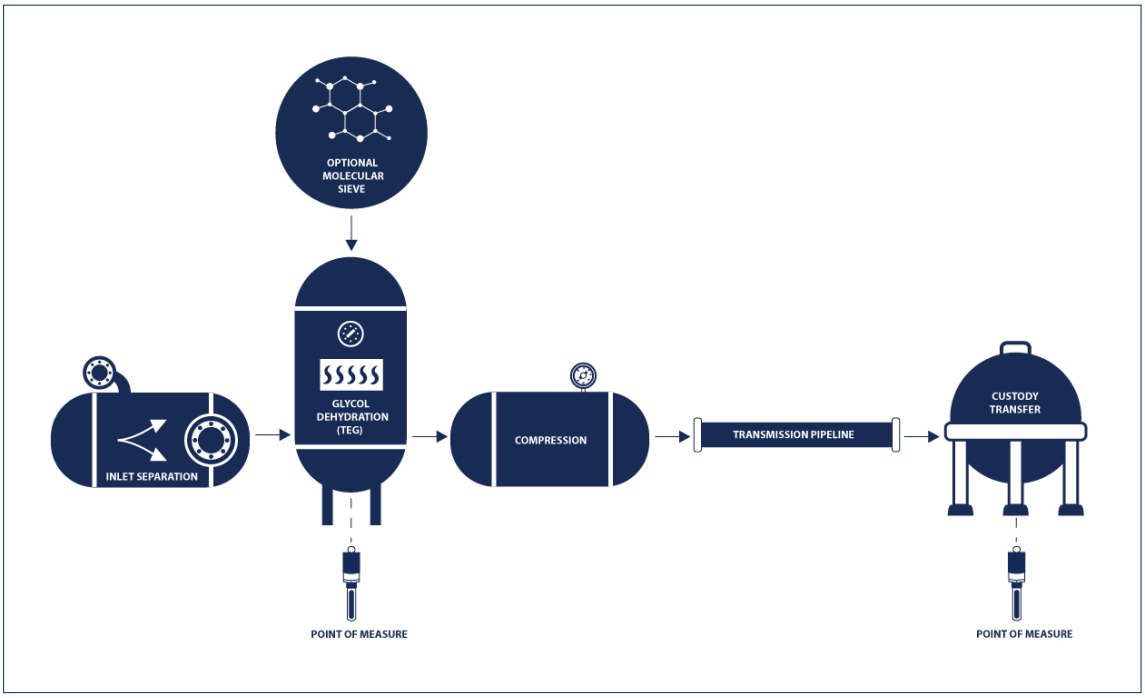


Figure 1. Water dewpoint measurement points in a natural gas processing and transmission system: the dehydration outlet and the custody-transfer point. The molecular sieve stage applies only where gas is dried further for cryogenic or NGL processing; the compression and pipeline stages shown are common to all cases.

Measuring Water Dewpoint in Natural Gas Pipeline Systems

Water Dewpoint vs Hydrocarbon Dewpoint

Water dewpoint and hydrocarbon dewpoint are not the same measurement and the difference matters when reading an instrument's output. Water dewpoint is the temperature at which water vapour condenses. Hydrocarbon dewpoint is the temperature at which the heavier hydrocarbon components condense out through retrograde behaviour, a separate phenomenon that shows up on a different part of the gas composition. In a rich gas stream the two dewpoints can sit close together but a water dewpoint transmitter is scoped to water vapour and should not be read as a stand in for hydrocarbon liquid dropout. Confusing the two is one of the fastest ways to misdiagnose a reading in the field.

Measure water dewpoint in the vapour phase, at or downstream of a heated pressure reduction. Never sample straight off an unconditioned high pressure line.

That rule exists because stepping gas down from line pressure to sensor pressure cools it. Unless the pressure reduction stage is heated, the sample can fall through its own water or hydrocarbon dewpoint before it ever reaches the sensor. The reading then shows condensation that was never present in the pipeline and a dry gas stream can look wet on the display. A sample system with a heated regulator, filtration and a controlled flow rate exists specifically to prevent that failure mode.



Typical Locations for Natural Gas Dehydration Monitoring and Custody-Transfer Checks

Dehydration Unit Outlet

Continuous monitoring here confirms the glycol contactor or the molecular sieve bed where one is installed, is holding its target dewpoint. Comparing this reading against the unit's design target is the fastest way to catch a slipping contactor or a spent sieve bed.

Custody-Transfer and Receipt Points

A continuous transmitter or a periodic spot check where a permanent transmitter is not installed, confirms the gas still meets the pipeline tariff after transport. Operators on both sides of the interconnect often rely on this figure to settle who is responsible for an off-spec delivery.

Remote and Unmanned Stations

A portable hygrometer lets a technician verify dewpoint during commissioning or troubleshooting without installing a permanent transmitter at every tap along the line. It also gives a new site a documented baseline dewpoint before a permanent transmitter is commissioned.

Shaw Moisture Meters high capacitance aluminium oxide sensors suit this duty due to their accuracy, repeatability and robustness and the same technology works well in both the SDT-Ex continuous dewpoint transmitter and the SDHmini-Ex portable dewpoint meters for spot checks. The sensors can be checked using AutoCal, span verification, between calibrations and recalibrated annually against a traceable humidity standard.

Accurate water dewpoint measurement is what keeps a natural gas processing and transmission system free of the corrosion, hydrate blockages and tariff disputes that unmonitored moisture eventually causes. Measuring it in the right place, in the vapour phase, with a properly conditioned sample, is what makes that protection dependable rather than accidental. Get the sampling right and the reading can be trusted at every one of those points.

References to Applicable Standards

ASTM D5454-11(2020)

Water Vapour Content of Gaseous Fuels Using Electronic Moisture Analysers. Covers high capacitance aluminium oxide and other electronic sensing cells directly, the category a dewpoint transmitter or portable hygrometer falls into.

ASTM D1142-95(2021)

Water Vapour Content of Gaseous Fuels by Measurement of Dew-Point Temperature. The chilled mirror reference method and the source of the water content correlation charts still used across the industry.

ISO 18453:2004

Natural gas, correlation between water content and water dew point. The GERG developed method used to convert between the two figures when only one has been measured.



Suitable Products



SDT-Ex Dewpoint Transmitters

Intrinsically safe, continuous online monitoring for dehydration outlet and custody-transfer points inside a classified hazardous area, wired into a control system on a 4-20 mA loop.



Portable Dewpoint Hygrometers

Handheld spot-check meters for commissioning, troubleshooting and periodic verification at remote or unmanned stations, using the same aluminium oxide sensing and AutoCal function as the fixed instruments.



Natural Gas Sample Systems

Sample conditioning built for line pressure natural gas, with a heated pressure reduction stage, filtration and hazardous area certification, matched to the transmitter or hygrometer in use.

Talk to our applications team

We design and manufacture dewpoint instruments for many different applications. Tell us about your application and we will help you choose the right product for your pressure, your hazardous area rating and your dewpoint range.

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