

Natural Gas Sampling for the Moisture Chek 2000

Introduction

A well-designed sample handling system is essential to the accuracy and reliability of moisture instrumentation. Approximately 70% of the problems encountered with moisture analyzers are associated with the sample handling system. To ensure that a representative sample reaches the Moisture Chek 2000, the effects of sample composition, pipeline pressure, ambient temperature, and contaminants must be considered.

The sample handling system must extract a representative sample from a flowing pipeline, transport the sample to the analyzer, condition the sample to be compatible with the analyzer, and resist corrosion by the sample.

The sampling system can best be described as a collection of components that:

- extracts the sample from the pipeline
- delivers the sample to the analyzer
- reduces the sample pressure
- filters the sample
- heats the sample

Sample Probe

The sample probe should be located in a flowing pipeline where there is little turbulence and where the composition is representative. The sample probe collects a representative sample near the center one-third of the pipeline where changes in stream composition can be quickly detected. In this way, the sample is extracted without the contaminants that creep along the inside wall of the pipe.

Sample probes can be purchased with various lengths and pressure connections. Two types of sample probes exist: a simple sample probe, and a combination probe and pressure regulator. The simple probe consists of a length of tubing that extends into the pipeline and a threaded NPT connection for the pipeline.

The combination probe performs the same function except that the sample pressure is reduced within the probe at pipeline temperature. Since the gas in the pipeline provides its own heat, the use of the combination probe reduces the possibility of sample condensation due to the Joule-Thomson effect.

The following rules apply to the use of sample probes.

- The tip of the sample probe must be positioned in the center one-third of the pipeline away from the pipeline wall where large particles accumulate. The probe must not be positioned in a "dead-end" zone where positive flow does not exist.
- The probe should be a minimum of five pipe diameters downstream from any device that could produce aerosols or significant pressure drop.
- The sample probe should not be located within a defined meter tube region.
- The sample probe should be mounted vertically from the top of the horizontal pipelines. The sample probe should not be located on vertical pipelines.

If an external pressure reduction is required as with the sample probe, the amount of pressure reduction required must be considered. The sample gas must be in the *vapor* phase before entering the Moisture Chek 2000. This includes prevention of condensation (water, hydrocarbons, contaminants) in the pressure regulator and transport tubing leading to the analyzer.

The general rule is:

There is a 1°F decrease in sample temperature for every 10 PSIG reduction in pressure.

Pressure Regulator

The pressure regulator is used to reduce the sample pressure to the inlet pressure requirements of the analyzer. In many cases, the outlet pressure is less than 50 PSIG (344.75 kPa). An additional pressure regulator is not required if a combination probe/regulator is being used. The pressure regulator must accept the pipeline pressures and reduce the sample pressure without condensing the sample.

To meet this requirement, many regulators reduce the pressure in two steps, known as two-step regulators. The regulator body may require heating to prevent condensation in cases where the ambient temperature is similar to the water or hydrocarbon dew point of the sample at line pressure. The regulator body and internal diaphragm should be manufactured from 316 stainless steel to resist corrosion by the sample.

Coalescing and Membrane Filters

Coalescing and/or membrane filters should be installed immediately downstream of the combination probe. These types of filters will remove liquids that could damage the analyzer. A coalescing (Balston-type) filter installed upstream of the membrane (Genie-type) filter is required in all cases where the probability of a liquid sample or "slug" is high. The membrane filter contains a membrane that is permeable to gas but will not allow liquids to pass.

Coalescing Filters

Coalescers are used to force liquid aerosol to combine into larger liquid droplets so they can be separated by gravity. The liquid is removed through the bottom drain and filtered gaseous sample exits the outlet downstream of the filter cartridge. The flow rates out of the top and bottom are critical for proper operation.

Membrane Filters

Membranes are used to force liquid aerosols to combine into larger liquid droplets so they can be swept away by the bypass flow. The liquid is removed through the bypass vent and filtered gaseous sample exits the outlet downstream of the membrane. The flow rates out the sample vent and the bypass vent are critical for proper operation.

In addition, an internal membrane filter is installed in the Moisture Chek to protect the sensor from pipeline contamination.

Transport Tubing

The sample transport tubing is used to deliver the sample to the analyzer. The choice of sample tubing must be based on chemical compatibility with the sample. In most cases, the tubing should be 316 stainless steel with a diameter of 1/8" (6mm) or smaller to minimize the total volume of the sample.

The sample tubing may require heating depending on the ambient temperature and the composition and pressure of the sample. Heat-traced tubing is used to prevent condensation of water or hydrocarbons due to ambient temperatures below the sample dew point.

Equilibrium Dew Point Temperatures

If the pressure must be reduced external to the pipeline, the ambient temperature must be at least 50°F above the dew point to prevent condensation of the sample. The pressure regulator and transport tubing should be heat-traced and insulated when appropriate.

One of a family of innovative process analyzer solutions from AMETEK Process Instruments. Specifications subject to change without notice.

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