Designation: D5454 – 04

Standard Test Method for Water Vapor Content of Gaseous Fuels Using Electronic Moisture Analyzers[1]

This standard is issued under the fixed designation D5454; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the water vapor content of gaseous fuels by the use of electronic moisture analyzers. Such analyzers commonly use sensing cells based on phosphorus pentoxide, P_2O_5, aluminum oxide, Al_2O_3, or silicon sensors piezoelectric-type cells and laser based technologies.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D1142 Test Method for Water Vapor Content of Gaseous Fuels by Measurement of Dew-Point Temperature

D1145 Test Method for Sampling Natural Gas [2]

D4178 Practice for Calibrating Moisture Analyzers

D4888 Test Method for Water Vapor in Natural Gas Using Length-of-Stain Detector Tubes

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *capacitance-type cell*—this cell uses aluminum coated with Al_2O_3 as part of a capacitor. The dielectric Al_2O_3 film changes the capacity of the capacitor in relation to the water vapor present. Unlike P_2O_5 cells, this type is nonlinear in its response. If silicon is used instead of aluminum, the silicon cell gives improved stability and very rapid response.

3.1.2 *electrolytic-type cell*—this cell is composed of two noble metal electrode wires coated with P_2O_5. A bias voltage is applied to the electrodes, and water vapor chemically reacts, generating a current between the electrodes proportional to the water vapor present.

3.1.3 *piezoelectric-type cell*— sensor consists of a pair of electrodes which support a quartz crystal (QCM) transducer. When voltage is applied to the sensor a very stable oscillation occurs. The faces of the sensor are coated with a hygroscopic polymer. As the amount of moisture absorbed onto the polymer varies, a proportional change in the oscillation frequency is produced.

3.1.4 *laser-type cell*— consists of a sample cell with an optical head mounted on one end and a mirror mounted on the other. The optical head contains a NIR laser, which emits light at a wavelength known to be absorbed by the water molecule. Mounted along side the laser is a detector sensitive to NIR wavelength light. Light from the laser passes through the the far end and returns to the detector in the optical head. A portion of the emitted light, proportional to the water molecules present, is absorbed as the light transits the sample cell and returns to the detector.

3.1.5 *water content*—water content is customarily expressed in terms of dewpoint, °F or °C, at atmospheric pressure, or the nonmetric term of pounds per million standard cubic feet, lb/MMSCF. The latter term will be used in this test method because it is the usual readout unit for electronic analyzers. One lb/MMSCF = 21.1 ppm by volume or 16.1 mgm/m^3 of water vapor. Analyzers must cover the range 0.1 to 50 lb/MMSCF.

3.1.6 *water dewpoint*—the temperature (at a specified pressure) at which liquid water will start to condense from the water vapor present. Charts of dewpoints versus pressure and water content are found in Test Method D1142.

4. Significance and Use

4.1 Water content in fuel gas is the major factor influencing internal corrosion. Hydrates, a semisolid combination of hydrocarbons and water, will form under the proper conditions causing serious operating problems. Fuel heating value is reduced by water concentration. Water concentration levels are therefore frequently measured in natural gas systems. A common pipeline specification is 4 to 7 lb/MMSCF. This test method describes measurement of water vapor content with direct readout electronic instrumentation.

[1] This test method is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.05 on Determination of Special Constituents of Gaseous Fuels.

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[2] Withdrawn.