



Designation: D 5454 – 93 (Reapproved 1999)

Standard Test Method for Water Vapor Content of Gaseous Fuels Using Electronic Moisture Analyzers¹

This standard is issued under the fixed designation D 5454; 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.

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:

- D 1142 Test Method for Water Vapor Content of Gaseous Fuels by Measurement of Dew-Point Temperature²
- D 1145 Test Method for Sampling Natural Gas³
- D 4178 Practice for Calibrating Moisture Analyzers⁴
- D 4888 Test Method for Water Vapor In Natural Gas Using Length-of-Stain Detector Tubes²

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 *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/m³ of water vapor. Analyzers must cover the range 0.1 to 50 lb/MMSCF.

3.1.4 *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 D 1142.

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.

5. Apparatus

5.1 The moisture analyzer and sampling system will have the following general specifications:

5.1.1 *Sampling System*—Most errors involved with moisture analysis can be eliminated with a proper sampling system.

5.1.1.1 A pipeline sample should be obtained with a probe per Method D 1145. The sample temperature must be maintained 2°C (3°F) above the dewpoint of the gas to prevent condensation in the sample line or analyzer. Use of insulation or heat tracing is recommended at cold ambient temperatures.

5.1.1.2 Analyzer sensors are very sensitive to contamination. Any contaminants injurious to the sensor must be removed from the sample stream before reaching the sensor. This must be done with minimum impact on accuracy or time of response. If the contaminant is an aerosol of oil, glycol, and so forth, a coalescing filter or semipermeable membrane separator must be used.

5.1.2 *Construction*—Sampling may be done at high or low pressure. All components subject to high pressure must be rated accordingly. To minimize diffusion and absorption, all materials in contact with the sample before the sensor must be

¹ This test method is under the jurisdiction of ASTM Committee D-3 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.05 on Determination of Special Constituents of Gaseous Fuels.

Current edition approved Sept. 15, 1993. Published November 1993.

² *Annual Book of ASTM Standards*, Vol 05.06.

³ Discontinued—See 1986 *Annual Book of ASTM Standards*, Vol 05.05.

⁴ *Annual Book of ASTM Standards*, Vol 05.02.