



Designation: D4178 – 82 (Reapproved 2017)

Standard Practice for Calibrating Moisture Analyzers¹

This standard is issued under the fixed designation D4178; 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 practice covers a calibration technique based on the preparation of standards of known water content. This technique is applicable to the production of standards between $20 \text{ cm}^3/\text{m}^3$ and $2000 \text{ cm}^3/\text{m}^3$ water.

1.2 The values stated in SI units are to be regarded as standard.

1.2.1 *Exception*—The values given in parentheses are for information only.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Summary of Practice²

2.1 The practice is based on the principle that ice has a vapor pressure of 0.611 kPa at 0 °C. Therefore, when a carrier gas at a constant gauge pressure of 207 kPa (30 psig) is passed through a molecular sieve saturated with water and held at 0 °C, the total pressure is equal to 207 kPa plus 98 kPa (one atmosphere) and the water concentration of the gas leaving the molecular sieve is $[0.611/(207 + 98)] \times 10^6$ ppm or 2000 ppm volume water, regardless of flow.

2.1.1 A carrier gas at a constant gauge pressure of 207 kPa is passed through a molecular sieve drier and then routed over a molecular sieve support saturated with water and equilibrated at 0 °C.

¹ This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.D0 on Hydrocarbons for Chemical and Special Uses.

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² For a more complete discussion of this procedure, see Mator, R. T., "Trace Moisture Analyzers and Their Calibration," *Proceedings of the 20th Annual ISA Analysis Instrumentation Symposium, May 12-15, 1974, Pittsburgh, PA, "Session: Sampling and Calibration Systems,"* 1974, p. 125.

2.1.2 By blending different volumes of the wet carrier gas with dried carrier gas, gas standards of known water concentration can be prepared.

2.2 The moisture analyzer to be calibrated is then connected to the source of the gas standard of known water concentration.

3. Significance and Use

3.1 This practice is intended to provide a method to calibrate moisture analyzers used on-stream or in the laboratory.

4. Apparatus

4.1 *Ice Bath Primary Standard Moisture Apparatus*—Fig. 1 illustrates a typical system.

4.2 *Wet Test Meter*, 1 L divisions.

4.3 *Bubble Meter*, graduated in cubic centimetres.

4.4 *Pressure Gauge*—A Bourdon-type spring gauge of test gauge quality, 100 mm to 250 mm in diameter, with a scale range from 0 kPa to 400 kPa (0 psi to 60 psi), maximum intermediate graduations of 1.5 kPa (0.25 psi).

4.5 *Wet Mole Sieve 5A*, 60/80 mesh (other mesh sizes may be used, except powder).

5. Preparation of Apparatus

5.1 Saturate mole sieve with water.

5.1.1 Cover in beaker enough mole sieve to fill the wet mole sieve container. Add water to cover mole sieve. Let stand overnight.

5.1.2 Drain the excess water by pouring the mole sieve slurry into a filtering funnel and letting all the free water drain out.

NOTE 1—The useful lifetime of the wet mole sieve is not known. It is recommended that the procedure described in 5.1.1 and 5.1.2 be followed prior to each calibration.

6. Procedure

6.1 Fill the ice bath bucket for the primary standard apparatus one third full of water; then add ice to bring the level to full.

6.2 Close the wet flow and the diluent flow needle valves.

6.3 Turn on the carrier gas supply (nitrogen or air) and adjust the regulator to 207 kPa (30 psig).