Designation: ~~D4984 – 06 (Reapproved 2011)~~ D4984 – 06 (Reapproved 2015)

Standard Test Method for Carbon Dioxide in Natural Gas Using Length-of-Stain Detector Tubes[1]

This standard is issued under the fixed designation D4984; 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 a rapid and simple field determination of carbon dioxide in natural gas pipelines. Available detector tubes provide a total measuring range of 100 ppm (parts per million) up to 60 % by volume, although the majority of applications will be on the lower end of this range (that is, under 5 %). At least one manufacturer provides a special kit for measurements from 10 to 100 % CO_2, but the normal 100-cc hand pump is not used. See Note 1.

NOTE 1—High-range carbon dioxide detector tubes will have measuring ranges in percent (%) CO_2, and low-range tubes will be in parts per million (ppm). To convert percent to ppm, multiply by 10 000 (1 % = 10 000 ppm).

1.2 The values stated in SI units are regarded as standard. The inch-pound units 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *Gas Processors Association Standard:*
2337 Test for Hydrogen Sulfide and Carbon Dioxide in Natural Gas Using Length-of-Stain Tubes[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *detector tube pump*—a hand-operated pump of a piston or bellows type. It must be capable of drawing 100 mL per stroke of sample through the detector tube with a volume tolerance of ±5 mL.[3] It must be specifically designed for use with detector tubes.

3.1.1.1 *Discussion*—A detector tube and pump together form a unit and must be used as such. Each manufacturer calibrates detector tubes to match the flow characteristics of their specific pump. Crossing brands of pumps and tubes is not permitted, as considerable loss of system accuracy is likely to occur.[3]

3.1.2 *gas sampling chamber*—any container that provides for access of the detector tube into a uniform flow of sample gas at atmospheric pressure and isolates the sample from the surrounding atmosphere. A stainless steel needle valve (or pressure regulator) is placed between the source valve and the sampling chamber for the purpose of throttling the sample flow. Flow rate should approximate 1 to 2 volume changes per minute or, at minimum, provide exit gas flow throughout the detector tube-sampling period.

[1] This test method is issued under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.07 on Analysis of Chemical Composition of Gaseous Fuels.

Current edition approved ~~Nov. 1, 2011~~Nov. 1, 2015. Published ~~March 2012~~December 2015. Originally approved in 1989. Last previous edition approved in ~~2006~~2011 as D4984~~–06.~~ –06 (2011). DOI: ~~10.1520/D4984-06R11.~~10.1520/D4984-06R15.

[2] Available from Gas Processors Association, 6526 East 60th St., Tulsa, OK 74145.

[3] \, First ed., American Industrial Hygiene Association, Akron, OH 44311.

3.1.2.1 *Discussion*—

A suitable sampling chamber may be devised from a polyethylene wash bottle of nominal 500-mL (16-oz) or 1-L (32-oz) size. The wash bottle's internal delivery tube provides for delivery of sample gas to the bottom of the bottle. A 14.7-mm (½-in.) hole cut in the bottle's cap provides access for the detector tube and vent for the purge gas (see Fig. 1). (An alternate flow-through sampler

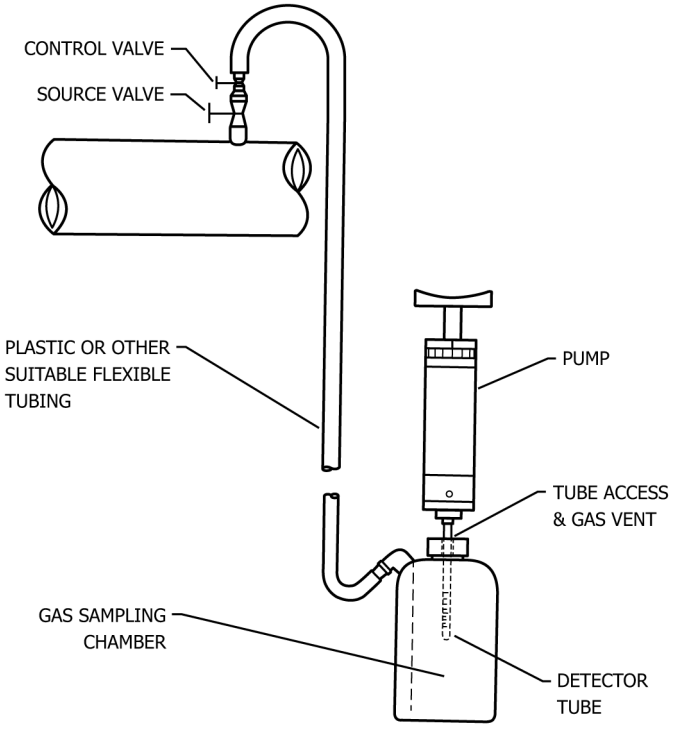

FIG. 1 Apparatus Schematic

may be fashioned using a 1-gal (3.8-L) "zipper"-type food storage bag. The flexible line enters one corner of the bag's open end and extends to the bottom of the bag. The opposite corner of the bag's top is sealed shut. The basic procedure for the sampler in Fig. 1 applies.)

3.1.2.2 *Discussion—*

An alternate sampling container is a collection bag made of a material suitable for the collection of natural gas (for example, polyester film). The sampling bag should have a minimum capacity of 2 L.

3.1.3 *length-of-stain detector tube*—a sealed glass tube with break-off tips sized to fit the tube holder of the pump. The reagent layer inside the tube, typically a silica gel substance coated with the active chemicals, must be specific for carbon dioxide and produce a distinct color change when exposed to a sample of gas containing carbon dioxide. Any substances known to interfere must be listed in the instructions accompanying the tubes. A calibration scale should be marked directly on the tube; however, other markings that provide for easy interpretation of carbon dioxide content from a separate calibration scale supplied with the tubes shall be acceptable. The calibration scale shall correlate carbon dioxide concentration to the length of the color stain. Shelf life of the detector tubes must be a minimum of two years from the date of manufacture when stored according to manufacturers' recommendations.

4. Summary of Test Method

4.1 The sample is passed through a detector tube filled with a specially prepared chemical. Any carbon dioxide present in the sample reacts with the chemical to produce a color change or stain. The length of the stain produced in the detector tube, when exposed to a measured volume of sample, is directly proportional to the amount of carbon dioxide present in the sample. A hand-operated piston or bellows-type pump is used to draw a measured volume of sample through the tube at a controlled rate of flow. The length of stain produced is converted to parts per million (ppm) or percent (%) carbon dioxide by comparison to a calibration scale supplied by the manufacturer for each box of detection tubes. The system is direct reading, easily portable, and completely suited to making rapid spot checks for carbon dioxide under field conditions. (See Note 1.)

5. Significance and Use

5.1 The measurement of carbon dioxide in natural gas is important, because of the gas quality specifications, the corrosive nature of carbon dioxide on pipeline materials, and the affects of carbon dioxide on utilization equipment.

5.2 This test method provides inexpensive field screening of carbon dioxide. The system design is such that it may be used by nontechnical personnel with a minimum of proper training.