



Designation: **D6273–14** **D6273 – 20**

Standard Test Methods ~~Method~~ for Natural Gas Odor Intensity¹

This standard is issued under the fixed designation D6273; 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 ~~These~~This test method covers the procedures for determining the threshold detection level, readily detectable level, and odor intensity of natural gas ~~through the use of using~~ instruments that dilute and mix the sampled natural gas with air. The mixed gas stream is then sniffed by the operator for the purpose of determining ~~the threshold detection level or the readily detection level, or both,~~ any of these parameters for odorant in the natural gas stream.

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

1.3 *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. Referenced Documents

2.1 ASTM Standards:²

D4150 Terminology Relating to Gaseous Fuels

D5287 Practice for Automatic Sampling of Gaseous Fuels

E253 Terminology Relating to Sensory Evaluation of Materials and Products

2.2 Other Standards:³

49 CFR Part 192.625 Odorization of gas

3. Terminology

3.1 Definitions:

3.1.1 *odorant, n*—sulfur-bearing compound that gives natural gas a distinctive odor. For the purpose of these test methods, natural gas odorants may be compounds that are present at the wellhead or commercial mixtures that are added to the gas stream, or both.

3.1.2 *olfactory fatigue, n*—desensitization of the sense of smell through either prolonged exposure or repeated exposure over a short period of time to an odor, a mixture of odors, or series of odors.

3.1.3 *sniff, vi*—smell or snuff with short, audible inhalations.

¹ ~~These~~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 For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

3.1 For definitions of general terms used in D03 Gaseous Fuels standards, refer to Terminology [D4150](#).

3.2 For definitions of common usage sensory evaluation of materials and products, refer to Terminology [E253](#).

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *high pressure, n*—for the purpose of ~~these~~this test ~~methods,~~method, high pressure refers to natural gas pressure greater than the maximum inlet pressure specified by the manufacturer of the gas dilution apparatus.

3.3.2 *intensity, n*—the magnitude of odor perceived by the operator.

3.3.3 *low pressure, n*—for the purpose of ~~these~~this test ~~methods,~~method, low pressure refers to natural gas pressure less than or equal to the maximum inlet pressure specified by the manufacturer of the gas dilution apparatus.

3.3.4 *olfactory fatigue, n*—desensitization of the sense of smell through either prolonged exposure or repeated exposure over a short period of time to an odor, a mixture of odors, or a series of odors.

3.3.5 *operator(s), n*—the person(s) performing the testing described in ~~these~~ test ~~methods.~~ Because of the nature of the testing described herein, the operator shall be qualified to perform this work (see this test ~~method.~~5.2).

3.3.6 *readily detectable level, n*—the concentration of natural gas and odorant mixture in air at which the operator is able to detect and identify natural gas odor.

3.3.7 *sniff, v*—smell or snuff with short, audible inhalations.

3.3.8 *threshold detection level, n*—the concentration of natural gas and odorant mixture in air at which the operator is barely able to detect an odor.

3.3 For definitions of terms related to natural gas that are used in these test methods, refer to Practice [D5287](#).

3.4 For definitions of terms related to olfactory testing that are used in these test methods, refer to Terminology [E253](#).

4. Significance and Use

4.1 Federal regulations (49 CFR Part 192.625) state: “A combustible gas in a distribution line must contain a natural odorant or be odorized so that at a concentration in air of one-fifth of the lower explosive limit, the gas is readily detectable by a person with a normal sense of smell.” These regulations state further that “To assure the proper concentration of odorant with this section, each operator must conduct periodic sampling of combustible gases using an instrument capable of determining the percentage of gas in air at which the odor becomes readily detectable.” Additionally, a number of states have enacted legislation that requires natural gas to be odorized so that it is detectable at concentrations less than one fifth of the lower explosive limit. See [Note 1](#). While regulations do not specify the exact method for determining compliance, it has been documented that compliance testing must be olfactory in nature.⁴

NOTE 1—For example, Massachusetts Section 192.625 MFS Standards requires that “... a concentration of fifteen hundredths of one percent gas in the air is readily perceptible to the normal or average olfactory senses of a person...”

4.2 ~~These~~This test ~~methods cover~~method covers procedures to measure the odor level of natural gas by way of olfactory determination. No direct correlation may be ascertained between ~~these~~this test ~~methods,~~method and those methods available or under development that quantitatively measure the concentration of sulfur compounds in natural gas.

4.3 ~~These~~This test ~~methods outline~~method outlines general procedures to measure the odor detection levels of natural gas. It is

⁴ American Gas Association Operating Section Technical Note CAS-2-1-95, “~~Natural~~“Natural Gas Odorization: Compliance with Federal Regulations.”

the responsibility of persons using ~~thesethis test methods~~method to develop and maintain equipment and specific operating procedures to ensure public safety and compliance with all appropriate regulations.

5. Interferences and Precautions

5.1 ~~The location to be tested should be sheltered from wind and isolated from~~Wind can dilute the apparatus exhaust; therefore, protect the testing equipment from wind when sniffing. If possible, avoid testing near sources of interfering ambient odors such as those from certain industrial plants and landfills—landfills, garbage bins, etc. The equipment and sampling lines used in testing shall be clean and free of odor.

5.2 Operators shall be trained to perform odor testing of natural gas and in the proper use and care of test instrumentation. It is preferred that operators should be nonsmokers, or, if smokers, they shall not smoke for at least 30 min before performing the test. Additionally, operators shall not chew tobacco or gum or eat food of pungent taste or odor for at least 30 min before performing the test. Operators should have no cold, allergies, or other physical conditions that would affect their sense of smell.

5.3 Prolonged use of the sense of smell may result in olfactory fatigue. Sufficient time shall be allotted between tests to ensure that the tester's sense of smell is not adversely affected by the previous test.

6. Apparatus

6.1 *Gas Dilution Apparatus*—This apparatus shall consist of a gas inlet control valve, a gas/air mixing chamber, a sample port for sniffing the gas/air mixture, and a method to determine the relative concentration of the gas/air mixture. All components that come in contact with natural gas shall be inert to odorant compounds.

6.2 *Natural Gas Pressure Regulator(s)*—This item may be required to lower the gas pressure at the sampling location to a level that is safe for the gas dilution apparatus as specified by the manufacturer.~~This regulator may need to be a heated regulator if an extremely large pressure drop is required, for example, when compressed natural gas or gas at transmission line pressure is to be tested. More than one regulator may be required to perform this function satisfactorily.~~

6.2.1 The gas dilution apparatus shall never be subjected to natural gas pressures greater than that specified by the manufacturer. Excessive natural gas pressure may result in instrument failure and cause an excessive amount of gas to vent out of the instrument.

6.2.2 ~~The regulator shall be a heated regulator when~~Odorant compounds have a preference for liquid hydrocarbons when present. When compressed natural gas (CNG) is to be tested or when it is anticipated that liquid hydrocarbons may condense from the gas stream as a result of Joule-Thompson Expansion. Odorant compounds have a preference for liquid hydrocarbons when present.Expansion, the regulator shall either:

6.2.2.1 Be a heated regulator, or

6.2.2.2 Require multiple pressure reductions to maintain a gas phase.

6.3 *Sample Line*—The sample line shall be clean and consist of material that is inert to natural gas odorant compounds. Sample lines shall be tested periodically by performing a blank determination as specified in 9.1 and replaced as required. Rubber or copper tubing shall not be used. Appropriate material for sample lines include stainless steel, aluminum, urethane, PTFE, PVC, and sample line materials may include, but are not limited to, passivated stainless steel or aluminum, PTFE, PE, or PEK.

6.4 *Sample Probe*—A stainless steel sample probe shall be used where appropriate to prevent the possibility of pipeline contaminants from entering the sample stream. (See Section 6 of Practice [D5287](#) for specifics on sample probe construction and installation.)

7. Hazards

7.1 Because ~~thesethis test methods involve~~method involves the sampling of natural gas and the venting of a gas/air mixture, only qualified persons shall perform the testing described. **Warning**—This test method shall not be performed near open flames. Failure to follow manufacturer's instructions for the instrumentation used in this test method may result in a hazardous condition~~These test methods shall not be performed near open flames. Failure to follow manufacturer's instructions for the instrumentation used in these test methods may result in a hazardous condition.~~

~~7.2 These~~ **Warning**—~~This test method shall never be performed at locations that potentially contain sour gas. High concentrations of hydrogen sulfide can quickly poison the operator, resulting in death or permanent injury. test methods shall never be performed at locations that potentially contain sour gas. High concentrations of hydrogen sulfide can quickly poison the operator resulting in death or permanent injury.~~

7.3 Caution must be exercised in selecting appropriate instrumentation used in application of ~~these~~**this** test ~~methods.~~**method.** Odor intensity instrumentation should be operated and suited for the intended use, including suitability to area classification and measurement environment.

8. Sampling

8.1 Location:

8.1.1 The location shall be far enough downstream from an odorizing station to ensure that the odorant is well mixed within the gas stream.

8.1.2 In systems fed by more than one odorizer, test points shall be located to ensure that the odorant concentration supplied by each individual odorizer is evaluated.

8.1.3 In large systems, test points also shall be selected at or near the end of the system to ensure adequate odorant concentration.

8.2 Frequency:

8.2.1 Sampling frequency shall be established in accordance with applicable regulations and company policy.

8.3 Low-Pressure Sampling:

8.3.1 In low-pressure sampling, the gas dilution apparatus is connected directly to the gas source with the appropriate tubing as specified in **6.3**. Connections shall be made to the appropriate gas dilution apparatus port in accordance with the manufacturer's instructions.

8.4 High-Pressure Sampling:

8.4.1 In high-pressure sampling, a regulator is connected directly to the gas source with the appropriate tubing as specified in **6.3**.

8.4.1.1 In addition to other precautions, the gas pressure should be taken into consideration when selecting the tubing that connects the gas source with the inlet of the regulator. Stainless steel shall be the only material used for this purpose when the sampling source is ENG.CNG or another high-pressure gas.

8.4.2 If a heated regulator is used, then the temperature shall be set high enough to prevent hydrocarbon condensation.

NOTE 2—A regulator set temperature of 140°F (60°C)140 °F (60 °C) has been found to be adequate in most circumstances.

8.4.3 The tubing connection between the regulator outlet and the gas dilution apparatus shall be as specified in **8.3.1**.

9. Calibration and Maintenance

~~9.1 Blank Determination—This test should be performed every 30 days with each gas dilution apparatus. Gas dilution apparatus shall be calibrated following the manufacturer's instructions. Calibration intervals shall not exceed the manufacturer's recommendation. A Blank Determination should be performed before calibration.~~

~~9.1.1 The gas dilution apparatus shall not be connected to a natural gas source.~~

~~9.1.2 Power on the apparatus and allow air to flow.~~