Designation: D8251 – 23

Standard Practice for Determining Compressor Oil Carryover in Compressed Natural Gas Used as a Natural Gas Motor Vehicle Fuel[1]

This standard is issued under the fixed designation D8251; 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 standard practice is intended for gravimetric determination of compressor oil carryover as aerosols using either a coalescing filter method or sorbent tube method.

1.2 The method using coalescing filters is applicable to analysis of compressor or lube oil carryover as a liquid and is intended for long term monitoring of a compressed natural gas (CNG) dispenser system.

1.3 The method using a sorbent tube is applicable to analysis of compressor or lube oil carryover as a vapor and liquid in CNG dispenser systems present at 1 mg/kg to 500 mg/kg in a sample volume of 0.2 m^3 to 0.6 m^3. This method is applicable to a measurement intended to replicate the filling of a vehicle.

1.4 This standard shall be applicable to natural gas, biogas, or renewable natural gas (RNG) that is compressed for use as a fuel for internal combustion engines in motor vehicles.

1.5 This standard shall be applicable to natural gas, biogas, or renewable natural gas when they have been blended with hydrogen and have been compressed for use as a fuel for internal combustion engines in motor vehicles.

1.6 The user shall determine if the volumetric measuring elements of the dispensing system are adjusted for the composition of gaseous fuel blends being delivered and those volumetric measuring elements correctly calculate the volume of fuel delivered. The users shall apply appropriate correction factors if necessary.

1.7 *Units*—The values stated in SI units are to be regarded as standard.

1.8 Mention of trade names or organizations in this standard does not constitute endorsement or recommendation. Other manufacturers of equipment or equipment models can be used.

1.9 *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.*

1.10 *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]

D1070 Test Methods for Relative Density of Gaseous Fuels

D3588 Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels

D4150 Terminology Relating to Gaseous Fuels

E617 Specification for Laboratory Weights and Precision Mass Standards

2.2 *ISO Standard:*[3]

ISO 15970:2008 Natural gas—Measurement of properties—Volumetric properties: density, pressure, temperature, and compression factor

3. Terminology

3.1 For definitions of terms used D03 Gaseous Fuels standards, refer to Terminology D4150.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *natural gas vehicle (NGV), n*—vehicle designed to operate on compressed natural gas (CNG), liquefied natural gas (LNG), or renewable natural gas (RNG).

4. Summary of Practice

4.1 This practice describes construction of an apparatus for collecting compressor oil contained in CNG as well as a procedure for collecting and gravimetrically measuring compressor oil in CNG.

[1] This practice 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 International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

5. Significance and Use

5.1 Uncontrolled oil carryover from lubricated natural gas compressors can adversely affect natural gas vehicle (NGV) performance. In some instances, small amounts of oil will accumulate in vehicle pressure regulators and slow their response. It can also affect other components of the engine fueling system. Erratic engine performance, under fueling, or engine shutdown can occur. Such incidents have been reported by operators of NGV fueling stations and vehicles.

5.2 There is some vaporization of the lubrication (lube) oil that occurs due to compression of the gas. The oil vapor in CNG can be collected using a sorbent tube and quantified. Along with quantification of lube oil, this procedure can collect solids present in the gas.

5.3 These methods do not separate any solids including siloxane from the compressor oil carryover or vapor.

5.4 This practice can be applied to other gaseous samples requiring determination of compressor oil carryover provided the user's data quality objectives are satisfied.

6. Materials

6.1 *Filter Method:*

6.1.1 Filter test assembly (Fig. 1).

6.1.1.1 Coalescing filter elements 0.1 micron.

6.1.1.2 Coalescing filter housings without auto drain feature.

NOTE 1—The filter selected should not be affected by the solvent used to wash it. The filters used should be verified that any binder material is not soluble in the solvent.

6.1.2 Cleaned and pre-weighed glass jars for liquids.

6.1.3 Two glass jars (100 mL) for filter elements.

6.1.4 Solvent: Petroleum ether or Acetone; certified ACS grade.

6.1.5 O-rings for filter housings, compatible with selected solvent.

6.1.6 Gloves compatible with the solvent(s) used.

6.1.7 Safety glasses.

6.1.8 Oven capable of maintaining a temperature of 250 °C ± 1 °C.

6.1.9 Analytical balance with a minimum capacity of 200 g at a minimum resolution of 0.1 mg.

6.1.10 Tongs.

6.2 *Tube Method:*

6.2.1 Stainless steel tubing, 316.

6.2.2 Sampling apparatus as per Fig. 2.

6.2.3 Chromosorb® P NAW, 60/80 mesh or equivalent.

6.2.4 Glass wool.

6.2.5 Analytical balance with a minimum capacity of 200 g at a minimum resolution of 0.1 mg.

6.2.6 Oven capable of maintaining a temperature of 250 °C ± 1 °C.

6.2.7 Dessicator.

6.2.8 Dessicant.

6.2.9 Gloves compatible with the solvent used and/or tongs.

6.2.10 Acetone, Certified ACS Grade.

6.2.11 Plastic bags.

6.2.12 Stainless steel needle valve.

6.2.13 Particulate filter, 0.5 micron (as needed).

6.2.14 Drying tube (as needed).

6.2.15 Hydrocarbon filter (as needed).

6.2.16 Compressed nitrogen. Purity consisting of total hydrocarbons less than 0.5 ppm(v) and water less than 1 ppm(v).

7. Hazards

7.1 CNG is a highly flammable gas. Care should be taken to avoid hazards associated with gas leaks during sampling. Redundant safety measures such as gas leak monitors are recommended to ensure that potentially combustible gas mixtures do not come in contact with any ignition sources.

7.2 Improper handling of CNG can result in fire and/or explosion.

7.3 Rapid release CNG can result in asphyxiation.

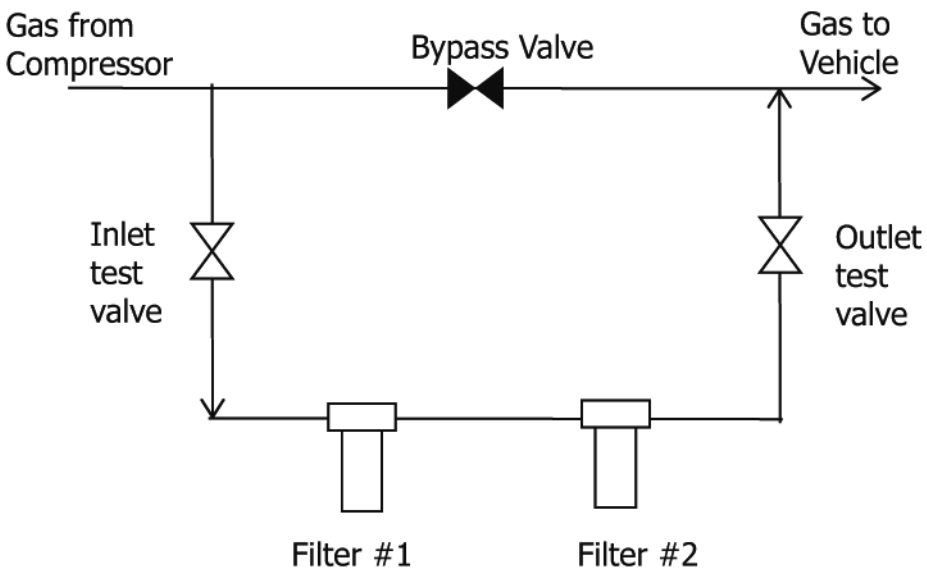

FIG. 1 Filter Test Assembly