



Standard Test Method for Determination of Fuel Dilution for In-Service Engine Oils by Gas Chromatography¹

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1. Scope*

1.1 This test method covers the determination of fuel dilution for in-service engine oil by gas chromatography.

1.2 Analysis can be performed directly by this test method without pretreatment or dilution of the sample.

1.3 There is no limitation for the determination of the dilution range, provided the amount of sample is within the linear range of the gas chromatograph detector. However, sample dilution can add potential error to the result and may affect the precision obtained as compared to the values presented in Section 14, which were obtained with no dilution.

1.4 This test method covers a quantitation range up to 10 % (m/m) for diesel and biodiesel, and up to 5 % (m/m) for gasoline.

1.5 The values stated in SI units are to be regarded as standard. Where non-SI units are provided, they are shown in parentheses.

1.6 *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:²

D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure

D3524 Test Method for Diesel Fuel Diluent in Used Diesel Engine Oils by Gas Chromatography

D3525 Test Method for Gasoline Diluent in Used Gasoline Engine Oils by Gas Chromatography

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.96.02 on Chemistry for the Evaluation of In-Service Lubricants.

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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.

E355 Practice for Gas Chromatography Terms and Relationships

E594 Practice for Testing Flame Ionization Detectors Used in Gas or Supercritical Fluid Chromatography

E1510 Practice for Installing Fused Silica Open Tubular Capillary Columns in Gas Chromatographs

3. Terminology

3.1 Definitions:

3.1.1 This test method makes reference to common gas chromatographic procedures, terms, and relationships. Detailed definitions of these can be found in Practices E355 and E594.

3.1.2 *fuel dilution, n*—the amount, expressed as a percentage, of engine fuel found in the in-service lubricating oil.

3.1.3 *fuel diluent, n*—in service oil analysis, is the unburned fuel components that enter the engine crankcase causing dilution of the oil.

3.1.4 *in-service oil, n*—lubricating oil that is present in a machine that has been at operating temperature for at least one hour.

3.1.5 *Marker Peak (MP), n*—a marker peak is a chromatographic peak used to differentiate sections of a chromatogram by retention time.

3.1.5.1 *Discussion*—For example, components that elute before this marker peak may be considered “fuel,” while components that elute after this marker peak would be considered “oil.” This marker peak retention time could also serve as the timing for physical changes in the chromatographic system, such as the time to initiate a valve change or a back-flush.

3.2 Abbreviations:

3.2.1 A common abbreviation of carbon compounds is to designate the number of carbon atoms in the compound. A prefix is used to designate the carbon chain form, while a subscripted suffix denotes the number of carbon atoms. For example, normal eicosane = $n\text{-C}_{20}$.

4. Summary of Test Method

4.1 A representative aliquot of in-service engine oil is introduced into a gas chromatograph through a programmable split injector. Carrier gas transports the vaporized aliquot through the dimethyl polysiloxane bonded phase capillary