



Designation: D6839 – 21a

Standard Test Method for Hydrocarbon Types, Oxygenated Compounds, Benzene, and Toluene in Spark Ignition Engine Fuels by Multidimensional Gas Chromatography¹

This standard is issued under the fixed designation D6839; 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 the quantitative determination of saturates, olefins, aromatics, and oxygenates in spark-ignition engine fuels by multidimensional gas chromatography. Each hydrocarbon type can be reported either by carbon number (see [Note 1](#)) or as a total.

NOTE 1—There can be an overlap between the C₉ and C₁₀ aromatics; however, the total is accurate. Isopropyl benzene is resolved from the C₈ aromatics and is included with the other C₉ aromatics.

1.2 This test method is not intended to determine individual hydrocarbon components except benzene and toluene.

1.3 This test method is divided into two parts, Part A and Part B.

1.3.1 Part A is applicable to the concentration ranges for which precision (Table 10 and Table 11) has been obtained:

Property	Units	Applicable range
Total aromatics	Volume %	19.32 to 46.29
Total saturates	Volume %	26.85 to 79.31
Total olefins	Volume %	0.40 to 26.85
Oxygenates	Volume %	0.61 to 9.85
Oxygen Content	Mass %	2.01 to 12.32
Benzene	Volume %	0.38 to 1.98
Toluene	Volume %	5.85 to 31.65
Methanol	Volume %	1.05 to 16.96
Ethanol	Volume %	0.50 to 17.86
MTBE	Volume %	0.99 to 15.70
ETBE	Volume %	0.99 to 15.49
TAME	Volume %	0.99 to 5.92
TAE	Volume %	0.98 to 15.59

1.3.1.1 This test method is specifically developed for the analysis of automotive motor gasoline that contains oxygenates, but it also applies to other hydrocarbon streams having similar boiling ranges, such as naphthas and reformates.

1.3.2 Part B describes the procedure for the analysis of oxygenated groups (ethanol, methanol, ethers, C₃ to C₅ alcohols) in ethanol fuels containing an ethanol volume fraction between 50 % and 85 % (17 % to 29 % oxygen). The gasoline

is diluted with an oxygenate-free component to lower the ethanol content to a value below 20 % before the analysis by GC. The diluting solvent should not be considered in the integration, this makes it possible to report the results of the undiluted sample after normalization to 100 %.

1.4 Oxygenates as specified in Test Method [D4815](#) have been verified not to interfere with hydrocarbons. Within the round robin sample set, the following oxygenates have been tested: MTBE, ethanol, ETBE, TAME, *iso*-propanol, isobutanol, *tert*-butanol and methanol. Applicability of this test method has also been verified for the determination of *n*-propanol, acetone, and *di*-isopropyl ether (DIPE). However, no precision data have been determined for these compounds.

1.4.1 Other oxygenates can be determined and quantified using Test Method [D4815](#) or [D5599](#).

1.5 The method is harmonized with ISO 22854.

1.6 This test method includes a relative bias section for U.S. EPA spark-ignition engine fuel regulations for total olefins reporting based on Practice [D6708](#) accuracy assessment between Test Method D6839 and Test Method [D1319](#) as a possible Test Method D6839 alternative to Test Method [D1319](#). The Practice [D6708](#) derived correlation equation is only applicable for fuels in the total olefins concentration range from 0.2 % to 18.2 % by volume as measured by Test Method D6839. The applicable Test Method [D1319](#) range for total olefins is from 0.6 % to 20.6 % by volume as reported by Test Method [D1319](#).

1.7 This test method includes a relative bias section for reporting benzene based on Practice [D6708](#) accuracy assessment between Test Method D6839 and Test Method [D3606](#) (Procedure B) as a possible Test Method D6839 alternative to Test Method [D3606](#) (Procedure B). The Practice [D6708](#) derived correlation equation is only applicable for fuels in the benzene concentration range from 0.52 % to 1.67 % by volume as measured by Test Method D6839.

1.8 This test method includes a relative bias section for reporting benzene based on Practice [D6708](#) accuracy assessment between Test Method D6839 and Test Method [D5580](#) as a possible Test Method D6839 alternative to Test Method

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 [D02.04.01](#) on Gas Chromatography Methods.

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*A Summary of Changes section appears at the end of this standard