BS EN ISO 22854:2025

BSI Standards Publication

Liquid petroleum products — Determination of hydrocarbon types and oxygenates in automotive-motor gasoline and in ethanol (E85) automotive fuel — Multidimensional gas chromatography method

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National foreword

This British Standard is the UK implementation of EN ISO 22854:2025. It is identical to ISO 22854:2025. It supersedes BS EN ISO 22854:2021, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PTI/2, Liquid Fuels.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

Liquid petroleum products - Determination of hydrocarbon types and oxygenates in automotive-motor gasoline and in ethanol (E85) automotive fuel - Multidimensional gas chromatography method (ISO 22854:2025)

Produits pétroliers liquides - Détermination des groupes d'hydrocarbures et de la teneur en composés oxygénés de l'essence pour moteurs automobiles et du carburant éthanol pour automobiles E85 - Méthode par chromatographie multidimensionnelle en phase gazeuse (ISO 22854:2025)

Flüssige Mineralölerzeugnisse - Bestimmung von Kohlenwasserstoffgruppen und sauerstoffhaltigen Verbindungen in Ottokraftstoffen und in Ethanolkraftstoff (E85) - Multidimensionales gaschromatographisches Verfahren (ISO 22854:2025)

This European Standard was approved by CEN on 13 December 2024.

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European foreword

This document (EN ISO 22854:2025) has been prepared by Technical Committee ISO/TC 28 "Petroleum and related products, fuels and lubricants from natural or synthetic sources" in collaboration with Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin” the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2025, and conflicting national standards shall be withdrawn at the latest by July 2025.

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The text of ISO 22854:2025 has been approved by CEN as EN ISO 22854:2025 without any modification.

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 19, *Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fifth edition cancels and replaces the fourth edition (ISO 22854:2021), which has been technically revised.

The main changes are as follows:

— the Scope (Clause 1) and precision (Clause 11) have been clarified in terms of total oxygenates and corrected for previous mistakes in oxygen and ethanol contents, as well as corrected for rounding as required by the reporting requirements;

— a new procedure C has been implemented (and precision thereof determined by an interlaboratory study) to allow determination of very low aromaticity, benzene, toluene and hexane contents required for small engine petrol fuel for which CEN/TC 19 has developed a specification;

— the text has been further harmonized with ASTM D6839.

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Introduction

Originally, this document was used for the determination of saturated, olefinic, aromatic and oxygenated hydrocarbons in automotive motor gasoline according to European fuel specifications, such as EN 228.[3]

An interlaboratory study has shown that the method described in this document can be used for gasolines with a higher concentration of oxygenated compounds, including methanol. The interlaboratory study also provided data to calculate precision for toluene in gasoline. A further study focused on higher ether contents. Annex B includes example chromatograms of gasolines with a variety of oxygenates, which can be used to correctly identify these oxygenates.

Another interlaboratory study has shown that the method is applicable for gasolines with a very low content of aromatic compounds, such as those described in EN 17867.[13] The study delivered optimalization of a validation step (Procedure C).

This document lays down three procedures: A, B and C. The application ranges of each are given in Table 1. Procedure A is the normal procedure for motor gasoline, whereas Procedure B describes the procedure for the analysis of oxygenated groups (ethanol, methanol, ethers, C3 – C5 alcohols) in ethanol (E85) automotive fuel. Procedure C describes the analysis of small engine petrol fuel containing low contents of aromatics and olefins.

The test method described in this document is harmonized with ASTM D6839,[7] except for Procedure C which focuses on European products only.

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Liquid petroleum products — Determination of hydrocarbon types and oxygenates in automotive-motor gasoline and in ethanol (E85) automotive fuel — Multidimensional gas chromatography method

1 Scope

This document specifies the gas chromatographic (GC) method for the determination of saturated, olefinic and aromatic hydrocarbons in automotive motor gasoline, small engine petrol and ethanol (E85) automotive fuel. Additionally, the benzene and toluene content, oxygenated compounds and the total oxygen content can be determined.

Although specifically developed for the analysis of automotive motor gasoline that contains oxygenates, this test method can also be applied to other hydrocarbon streams having similar boiling ranges, such as naphthas and reformates.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3170, *Petroleum liquids — Manual sampling*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
hydrocarbon group
HG
family of hydrocarbons

EXAMPLE *Saturated hydrocarbons* (3.1.2) or *olefinic hydrocarbons* (3.1.3).

3.1.2
saturate
saturated hydrocarbon
type of hydrocarbon that contains no double bonds with a carbon number of 3 to 12

EXAMPLE *n*-paraffins, *iso*-paraffins, cyclo-alkanes and poly-cyclic alkanes.

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3.1.3
olefin
olefinic hydrocarbon
type of hydrocarbon that contains double or triple bonds with a carbon number of 3 to 10

EXAMPLE *n*-Olefins, *iso*-olefins and cyclic olefins.

3.1.4
aromatic
aromatic hydrocarbon
type of cyclic hydrocarbon with alternating double and single bonds between carbon atoms forming the rings

EXAMPLE Benzene, toluene and higher homologous series with a carbon number of 6 to 10 and polycyclic aromatic hydrocarbons, with a carbon number of up to 12.

3.1.5
oxygenate
oxygenated compound
type of hydrocarbon that contains one or more oxygen atoms, the addition of which is allowed according to fuel specifications

EXAMPLE Alcohols and ethers.

3.2 Symbols and abbreviated terms

For the purposes of this document, the following symbols and abbreviations apply.

A_{HG}	total, corrected signal area for the hydrocarbon group
BOB	before oxygenate blending
DIPE	di-isopropyl ether
E85	ethanol automotive fuel
ETBE	ethyl-tert-butyl ether
FID	flame ionization detector
$F_{RR,HG}$	theoretical relative response factor of a particular carbon number for a hydrocarbon type group
φ_{HG}	volume fraction in per cent for a hydrocarbon group
GC	gas chromatography
H_2	helium
HG	hydrocarbon group
ID	Internal diameter
M_C	molar mass of carbon
M_H	molar mass of hydrogen
M_i	molar mass of the oxygenated compound
M_O	molar mass of oxygen
MTBE	methyl-tert-butyl ether

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n_C	number of carbon atoms in the group
n_H	number of hydrogen atoms in the group
n_O	number of oxygen atoms in the molecule
PTFE	polytetrafluoroethylene
QC	quality control
ρ_{HG}	density of the hydrocarbon group
r	repeatability
R	reproducibility
TAEE	tertiary amyl-ethyl ether
TAME	tertiary amyl-methyl ether
w_{HG}	mass fraction in per cent for a hydrocarbon group
w_i	mass percentage of the compound in the mixture
X	the mean of the two results being compared

4 Principle

4.1 The application ranges for each procedure are given in Table 1. All procedures specified use the same separation technique and analysis procedure.

Table 1 — Application ranges for each procedure[a]

Component or group	Procedure A	Procedure B	Procedure C
Saturates, % (volume fraction)	26,9 – 79,3		
Total aromatics, % (volume fraction)	19,3 – 46,3		0,4 – 2,7
Total olefins, % (volume fraction)	0,4 – 26,9		0,1 – 2,4
Benzene, % (volume fraction)	0,38 – 1,98	0,1 – 0,5	0,04 – 0,11
Toluene, % (volume fraction)	5,85 – 31,65		
n-Hexane, % (volume fraction)			0,1 - 2,1
Total napthenes (C6-C8), % (volume fraction)			0,2 - 3,8
Oxygenates[b], % (volume fraction)	0,61 – 27,42		0,08 – 0,86
Total oxygen content, % (mass fraction)	0,50 – 12,32		0,02 – 0,16
Methanol, % (volume fraction)	1,05 – 16,96		
Ethanol, % (volume fraction)	0,50 – 17,86	> 50,0 and < 85,0	0,06 - 0,39
C3 – C5 alcohols, % (volume fraction)		> 1,4 and < 6,0	
Ethers, % (volume fraction)		> 0,5 and < 11,0	
MTBE, % (volume fraction)	1,0 – 15,7		0,01 – 0,70
ETBE, % (volume fraction)	1,0 – 15,5		0,09 – 0,73
TAME, % (volume fraction)	1,0 – 5,9		
TAEE, % (volume fraction)	1,0 – 15,6		

[a] Empty cells indicate that the application range has not been determined.

[b] Oxygenated compounds (as individual component or as total oxygenates).

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