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

*Produits pétroliers liquides — Détermination des groupes
d'hydrocarbures et des composés oxygénés de l'essence pour moteurs
automobiles et du carburant pour automobiles éthanol (E85) —
Méthode par chromatographie multidimensionnelle en phase gazeuse*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 28, *Petroleum products and related products of synthetic or biological origin*.

This third edition cancels and replaces the second edition (ISO 22854:2014), which contained a serious mistake in the scope regarding the levels of oxygen content.

Introduction

This International Standard is a small update of the second edition (ISO 22854:2014), which in turn was a revision to extend the scope of the first edition. Originally ISO 22854:2008 (and its predecessor EN 14517:2004) was used for determination of saturated, olefinic, aromatic and oxygenated hydrocarbons in automotive motor gasoline according to European fuel specifications. Recent round-robin work has shown that the scope of the method can be updated without alteration to include petrol with higher oxygen percentages than mentioned in the first edition and will now be applicable for automotive motor gasoline up to and including E10.

An interlaboratory study organized by CEN has shown that the method can also be used for high-ethanol gasoline [also called ethanol (E85) automotive fuel], provided that the sample is diluted with a component that will not interfere with any of the components or group of components that need to be analysed. Details of how to perform such analysis are given in 8.2.

The derived precision data for methanol do not comply with the precision calculation as presented in this International Standard. No precision calculation for methanol has been established as the need for such data has not been expressed. If methanol is present in the automotive motor gasoline sample, it is recommended that its contents is verified by the use of an appropriate test method, for instance as given in EN 228^[1].

The test method described in this International Standard is harmonized with ASTM D6839^[2].

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 International Standard specifies the gas chromatographic (GC) method for the determination of saturated, olefinic and aromatic hydrocarbons in automotive motor gasoline and ethanol (E85) automotive fuel. Additionally, the benzene content, oxygenate compounds and the total oxygen content can be determined.

NOTE 1 For the purposes of this document, the terms % (m/m) and % (V/V) are used to represent respectively the mass fraction, μ , and the volume fraction, φ .

This International Standard defines two procedures, A and B.

Procedure A is applicable to automotive motor gasoline with total aromatics of up to 50 % (V/V); total olefins from about 1,5 % (V/V) up to 30 % (V/V); oxygenates from 0,8 % (V/V) up to 15 % (V/V); total oxygen from about 1,5 % (m/m) to about 3,7 % (m/m); and benzene of up to 2 % (V/V). The system can be used for ethers with 5 or more C atoms up to 22 % (V/V) but the precision has not been established up to this level.

Although this test method can be used to determine higher-olefin contents of up to 50 % (V/V), the precision for olefins was tested only in the range from about 1,5 % (V/V) to about 30 % (V/V).

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.

NOTE 2 For Procedure A, precision data have been established for the oxygenate compounds in automotive motor gasoline samples containing ethyl-tert-butyl ether (ETBE), methyl-tert-butyl ether (MTBE), tert-amyl-methyl ether (TAME), *iso*-propanol, *iso*-butanol, *tert*-butanol, methanol and ethanol. The derived precision data for methanol do not comply with the precision calculation as presented in this International Standard. Applicability of this International Standard 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.

Procedure B describes the procedure for the analysis of oxygenated groups (ethanol, methanol, ethers, C3 – C5 alcohols) in ethanol (E85) automotive fuel containing ethanol between 50 % (V/V) and 85 % (V/V). The gasoline is diluted with an oxygenate-free component to lower the ethanol content to a value below 20 % (V/V) before the analysis by GC. If the ethanol content is unknown, it is advisable to use a dilution of 4:1 when analysing the sample.

The sample can be fully analysed including hydrocarbons. Precision data for the diluted sample are only available for the oxygenated groups.

NOTE 3 For Procedure B, the precision can be used for an ethanol fraction from about 50 % (V/V) up to 85 % (V/V). For the ether fraction, the precision as specified in Table 6 can be used for samples containing at least 11 % (V/V) of ethers. For the higher alcohol fraction, too few data were obtained to derive a full precision statement and the data presented in Table 6 are therefore only indicative.

NOTE 4 While developing this test method, the final boiling point was limited to 215 °C.

NOTE 5 An overlap between C9 and C10 aromatics can occur. However, the total is accurate. Isopropyl benzene is resolved from the C8 aromatics and is included with the other C9 aromatics.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

ISO 4259, *Petroleum products — Determination and application of precision data in relation to methods of test*

3 Terms and definitions

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

3.1

hydrocarbon group

family of hydrocarbons such as saturated hydrocarbons, olefinic hydrocarbons, etc

3.1.1

saturated hydrocarbon

saturate

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

EXAMPLE *n*-Paraffins, *iso*-paraffins, naphthenes and poly-naphthenes.

3.1.2

olefinic hydrocarbon

olefin

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.

3.1.3

aromatic hydrocarbon

aromatic

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 naphthalenes, with a carbon number of up to 12.

3.2

oxygenate

oxygenated compound

type of hydrocarbon that contains an oxygen group, the addition of which is allowed according to current petrol specifications

EXAMPLE Alcohols and ethers.

Note 1 to entry: See Clause 1, Note 2.

3.3

partial group

PG

one carbon number in an individual group, being either a single compound like toluene or an isomeric mixture

EXAMPLE *n*-Butane and *iso*-butane.