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Petroleum products — Gum content of fuels — Jet evaporation method

Produits pétroliers — Teneur en gommes des carburants — Méthode d'évaporation au jet

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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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 28, *Petroleum products and related products of synthetic or biological origin.*

This third edition cancels and replaces the second edition (ISO 6246:1995), which has been technically revised and aligned with ASTM D381[1].

It also incorporates the Technical Corrigendum ISO 6246:1995/Cor 1:1998.

The changes incorporate modern methods for temperature measurement and clarification of various measurement limits. Some process steps on the rounding of results are added. The precision in the former edition was based on very old data using samples that did not contain components found in modern gasoline, such as oxygenated compounds and deposit control additives. New precision estimates from a 1997 joint ASTM/EI study[3] are included. Unwashed and washed gum results for non-aviation fuels can now be expressed to the nearest 0,5 mg/100 ml. This study and additional work in ASTM[4] and CEN in 2014[5] have led to broadening of the scope to modern gasoline (blends).

Introduction

The true significance of this test method for determining gum in motor gasoline is not firmly established. It has been proven that high gum content can cause induction-system deposits and sticking of intake valves, and in most cases, it can be assumed that low gum content will ensure absence of induction-system difficulties. The user should, however, realize that the test is not of itself correlative to induction-system deposits.

The primary purpose of the test, as applied to motor gasoline, is the measurement of the oxidation products formed in the sample prior to or during the comparatively mild conditions of the test procedure. Since many kinds of motor gasoline are purposely blended with non-volatile oils or additives, the heptane extraction step is necessary to remove these from the evaporation residue so that the deleterious material, gum, can be determined. With respect to aviation turbine fuels, large quantities of gum are indicative of contamination of fuel by higher boiling oils or particulate matter and generally reflect poor handling practices in distribution downstream of the refinery.

Petroleum products — Gum content of fuels — Jet evaporation method

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel prior to application of the document, and fulfil statutory and regulatory requirements for this purpose.

1 Scope

This document specifies a method for determining the existent gum content of aviation fuels and the gum content of motor gasoline or other volatile distillates. It includes the determination of products containing ethanol (up to a volume fraction of 85 %) and ether-type oxygenates and deposit control additives.

For determination of gum content in automotive ethanol (E85) fuel, no precision data is available (see 14.1).

For non-aviation fuels, a procedure for the determination of the heptane-insoluble portion of the residue is also described.

CAUTION — This method is not intended for the testing of gasoline components, particularly those with a high percentage of low-boiling unsaturated compounds, as they can cause explosions during evaporation.

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*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

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

ISO 4788, *Laboratory glassware — Graduated measuring cylinders*

ASTM E2251-14, *Standard specification for liquid-in-glass ASTM thermometers with low-hazard precision liquids*

BS 2000, *IP standard thermometers*

3 Terms and definitions

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

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

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

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

3.1
existent gum
evaporation residue (3.2) of aviation fuels without any further treatment

3.2
evaporation residue
material that remains after controlled heating under a flow of air or steam

3.3
unwashed gum content
⟨non-aviation fuel⟩ *evaporation residue* (3.2) of the product under test without any further treatment

3.4
solvent-washed gum content
⟨non-aviation fuel⟩ residue remaining after the *evaporation residue* (3.2) has been washed with heptane and the washings discarded

4 Principle

A measured test portion of fuel is evaporated under controlled conditions of temperature and flow of air or steam. The resulting residue is weighed and may be subject to further treatment by solvent washing and further weighing.

5 Reagents

During the analysis, unless otherwise stated, use reagents of recognized analytical grade. Water, where specified, shall be of a quality equivalent to grade 3 of ISO 3696.

5.1 Heptane, $CH_3(CH_2)_5CH_3$, of minimum 99,7 % purity.

5.2 Toluene, $C_6H_5CH_3$.

5.3 Acetone, CH_3COCH_3.

5.4 Gum solvent, a mixture of equal volumes of toluene (5.2) and acetone (5.3).

5.5 Air supply, filtered, at a gauge pressure of not greater than 35 kPa.

5.6 Steam supply, free of oily residue and at a pressure of not less than 35 kPa.

5.7 Detergent cleaning solution.

The type of detergent and conditions for its use shall be established in each laboratory. The criterion for satisfactory cleaning shall be a matching of the quality of that obtained with chromic acid cleaning solution on used beakers (fresh chromic acid, 6 h soaking period, rinsing with water and drying).

6 Apparatus

6.1 Balance, capable of weighing to of the nearest 0,1 mg.

6.2 Beakers, capacity 100 ml, tall form, as illustrated in Figure 1, individually permanently marked.

It is expedient to arrange the beakers in sets, the number in each set being the number of beaker wells in the evaporating bath. The lowest-mass beaker in each set should be reserved for use as the tare.

6.3 Cooling vessel, tightly covered vessel such as a desiccator without desiccant for cooling the beakers before weighing.

NOTE The use of a desiccant can lead to erroneous results.

6.4 Evaporation bath, either a solid metal block bath or a liquid bath, electrically heated and constructed in accordance with the general principles shown in Figure 1, having wells and jets for two or more beakers.

The rate of air/steam flow at the temperature of test from each outlet jet when fitted with the conical adaptors with 500 µm to 600 µm copper or stainless steel screens shall be 1 000 ml/s ± 150 ml/s. A liquid bath, if used, shall be filled to within 25 mm of the top with a suitable liquid. Maintain the bath temperature either by means of thermostatic controls or by refluxing liquid of suitable composition.

WARNING — If a liquid-filled evaporation bath is used, care shall be taken to ensure that the flash point of the liquid used is at least 30 °C higher than the highest bath temperature expected.

6.5 Flow indicator, capable of indicating a total flow of air or steam equivalent to 1 000 ml/s for each outlet.

6.6 Sintered glass filter funnel, capacity 150 ml, with a maximum pore diameter between 150 µm and 250 µm.

6.7 Steam super heater, capable of delivering to the bath inlet the required amount of steam at 232 °C ± 3 °C.

6.8 Temperature sensors, liquid in glass thermometer conforming to the requirements in ASTM E2251-14 or IP 73C of BS 2000, or another temperature sensor or systems, or both, of at least equivalent accuracy and precision over a temperature range from –5 °C to 400 °C.

6.9 Graduated cylinders, capacity 50 ml or 100 ml and 2 l, conforming to the requirements of ISO 4788.

6.10 Forceps, stainless steel, spade-ended.

6.11 Oven, capable of being maintained at 150 °C ± 2 °C.

7 Assembly of air-jet apparatus

7.1 Assemble the air-jet apparatus as shown in Figure 1. With the apparatus at room temperature, adjust the flow of air to a rate of 600 ml/s at one of the outlets, with the remaining conical adaptors in position. Check the other outlets individually under the same conditions for uniform air flowrate within the range of 600 ml/s ± 90 ml/s.

NOTE A total reading on a flow indicator (calibrated under ambient conditions) corresponding to 600 ml/s ± 90 ml/s at each outlet will, in normal circumstances, ensure a flowrate of 1 000 ml/s ± 150 ml/s at a temperature of 155 °C ± 5 °C, provided that the back pressure across the flow indicator is not greater than 1 kPa.

7.2 In order to set the apparatus in operation, heat the bath until the temperature reaches 160 °C to 165 °C, and then introduce air into the apparatus until the reading established in accordance with 7.1