

Methods of test for petroleum and its products —

**Part 138: Determination of oxidation
stability of aviation fuel
Potential residue method
(Identical with IP 138:2002)**

ICS 75.160.20

Confirmed February 2012

National foreword

This British Standard reproduces verbatim IP 138:2002 and implements it as the UK national standard. It supersedes BS 2000-138:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PTI/13, Petroleum testing and terminology, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Energy Institute, under the brand of IP publishes and sells all parts of BS 2000, and all BS EN petroleum test methods that would be part of BS 2000, both in its annual publication “Standard methods for analysis and testing of petroleum and related products and British Standard 2000 parts” and individually.

Further information is available from:

**Energy Institute, 61 New Cavendish Street, London W1G 7AR.
Tel: 020 7467 7110. Fax: 020 7255 1472.**

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages 1 to 10, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 18 November 2005

© BSI 18 November 2005

ISBN 0 580 46180 7

Amendments issued since publication

Amd. No.	Date	Comments

Determination of oxidation stability of aviation fuel

Potential residue method

This standard does not purport to address all of the safety problems 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.

1 Scope

This standard specifies a method for the determination of the stability of aviation fuels in their finished form only for reciprocating, turbine, and jet engines, under accelerated oxidation conditions.

This method is not intended for the determination of the stability of aviation gasoline components individually, particularly those with a high percentage of low-boiling unsaturated compounds, as they may cause explosive conditions within the apparatus. However, because of the unknown nature of certain samples, the specified pressure vessel assembly includes a safety burst-disc in order to safeguard the operator.

The results may be used as an indication of the tendency of these fuels to form gum and deposits in storage. It should be recognized, however, that this correlation may vary markedly under different storage conditions and with different aviation fuels.

NOTE 1 Precision for this standard has only been determined for an aging period of 16 h.

NOTE 2 For the measurement of the oxidation stability (induction period) of motor gasoline, IP 40 should be used.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on

this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

ISO 3170, *Manual sampling*.

IP 131, *Petroleum products — Gum content of light and middle distillate fuels — Jet evaporation method* (≡ EN ISO 6246).

3 Definitions

For the purposes of this standard, the following definitions, all expressed in terms of milligrams per 100 ml of sample, after a specified ageing period at 100 °C, apply.

3.1 precipitate

sediment and suspended material in the aged fuel, obtained by filtering the aged fuel and washings from the test portion container

3.2 insoluble gum

deposit adhering to the test portion container after removal of the aged fuel, precipitate, and soluble gum

NOTE 3 Insoluble gum is obtained by measuring the increase in mass of the test portion container.

3.3 soluble gum

deterioration products present at the end of a specific ageing period. These deterioration products exist in solution in the aged fuel and as the toluene-acetone soluble portion of the deposit

on the test portion container. The soluble gum is obtained as a non-volatile residue by evaporating the aged fuel along with the washings from the test portion container

3.4

potential gum

sum of the soluble and insoluble gum

3.5

total potential residue

sum of the potential gum and the precipitate

4 Principle

The sample is oxidized under specified conditions in a pressure vessel filled with oxygen. The amounts of soluble gum, insoluble gum and precipitate formed are weighed and the total potential residue calculated.

WARNING - To provide protection against the possible explosive rupture of the pressure vessel, the pressure vessel should be operated behind an appropriate safety shield.

5 Reagents and materials

5.1 Toluene, $C_6H_5CH_3$, 99 % minimum purity.

5.2 Acetone, CH_3COCH_3 , 99 % minimum purity.

5.3 Gum solvent, mixture of equal volumes of toluene (5.1) and acetone (5.2).

5.4 Oxygen, commercially available extra-dry, of not less than 99 % purity.

WARNING - Use only with equipment conditioned for oxygen service by careful cleaning to remove oil, grease and other combustibles. Do not use oils or grease on regulators, gauges or control equipment. If a leak in the oxygen supply pipework is suspected, turn off immediately and seek qualified assistance. Depressurize the pipework prior to investigating a leak. The oxygen supply should be checked regularly.

5.5 Cleaning solution, able to clean used test portion containers and covers to match the quality with regard to visual appearance and mass loss on heating under test conditions obtained by immersing similar used test portion containers and

covers in fresh chromic acid cleaning solution for 6 h followed by rinsing with water as specified in 8.1.

NOTE 4 The type of cleaning solution and condition of use need to be established in each laboratory on the basis of cleaning used test portion containers and covers.

WARNING - Chromic acid is potentially hazardous in contact with organic materials and is toxic and highly corrosive. If used, wear full face-shield and full-length protective clothing including gloves.

6 Apparatus

6.1 Pressure vessel, of corrosion-resistant steel, with inside dimensions of the portion that encloses the reacting fuel-oxygen mixture conforming to those given in figure 1.

CAUTION - Pressure vessel assembly components obtained from different suppliers/manufacturers may not be compatible.

The interior surfaces of the pressure vessel and lid shall be highly polished to facilitate cleaning and to prevent corrosion.

Other structural details, such as method of closure (polygonal or knurled), gasket material, and outside dimensions, are optional provided the limitations given in 6.1.1 and 6.1.2 are observed.

6.1.1 The pressure vessel shall be constructed to withstand a working pressure of 1240 kPa at 100 °C, with an ultimate strength at least equal to that of a pressure vessel constructed of 18 % mass fraction chromium, and 8 % mass fraction nickel-alloy steel. A suitable material is an alloy steel conforming to the specification in annex A.

6.1.2 The closure shall be capable of making a seal that will not leak when the pressure vessel is filled with oxygen to 690 kPa at 15 °C to 25 °C and placed in a bath at 100 °C. It is preferable that the closure ring be constructed from an alloy different from that of the body if the mating threads of the two parts are to move with respect to each other when the tightening load is applied.

