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Petroleum and related products — Determination of wick flame persistence of fire-resistant fluids

Pétrole et produits connexes — Détermination de la persistance d'une flamme sur une mèche trempée dans un fluide difficilement inflammable

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

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 second edition cancels and replaces the first edition (ISO 14935:1998), which has been technically revised. The main changes compared to the previous edition are as follows:

— material data of the reservoir have been changed;

— some designations have been changed;

— drawings have been revised;

— tolerances in ignition and dropping times and nozzle dimensions have been tightened for better accuracy.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document was originally developed by CEN under a mandate from the European Commission.

The test methodology laid down in this document is commonly listed in fire-resistant hydraulic fluids' specifications, such as ISO 12922, in which it defines the minimum requirements for unused flame-retardant and less flammable hydraulic fluids for hydrostatic and hydro-dynamic systems in general industrial applications.

Petroleum and related products — Determination of wick flame persistence of fire-resistant fluids

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 the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This document specifies a method for the assessment of the persistence of a flame applied to the edge of a wick of non-flammable material immersed in fire-resistant fluid.

This test does not determine the behaviour of a spray of fire-resistant fluid.

NOTE Such test methods are specified in ISO 15029-1 and ISO 15029-2.

This document specifies one of four basic tests for determining flammability.

This document does not apply to certain liquids such as HFAE and HFAS liquids.

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 9162, *Petroleum products — Fuels (class F) — Liquefied petroleum gases — Specifications*

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:

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

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

3.1
flame mean persistence
persistence for each of the five different periods of application of the igniting flame calculated as the average of the six determinations

4 Principle

A length of non-flammable aluminosilicate plate is soaked in the fluid being tested and placed in a reservoir of the fluid with one edge exposed.

A small flame is applied to the exposed edge of the plate, and the persistence, in seconds, of the flame after removal of the igniting flame is measured. The tests are carried out with five different exposure times (2 s, 5 s, 10 s, 20 s and 30 s) and the after burning time is measured six times for each of the five

exposure times. As a result, the mean of the six recorded results shall be calculated from each of the five exposure times (see Clause 10). The highest mean value is the mean duration of the continued burning.

5 Reagents and materials

5.1 Propane, of commercial quality in accordance with ISO 9162.

5.2 Cleaning materials, for cleaning the reservoir, consisting of solvents appropriate to the material being tested.

6 Apparatus

6.1 Reservoir, made of brass, 200 mm in length, 25 mm in width and 20 mm in depth. It shall be fitted with clips or clamping devices to hold the plate (6.5) at either end, with a distance between the inner edges of these clips of 180 mm ± 2 mm. Each clip or clamp shall have a reference mark at 30 mm ± 0,5 mm above the inside bottom of the reservoir. Figure 1 illustrates a suitable reservoir.

Dimensions in millimetres

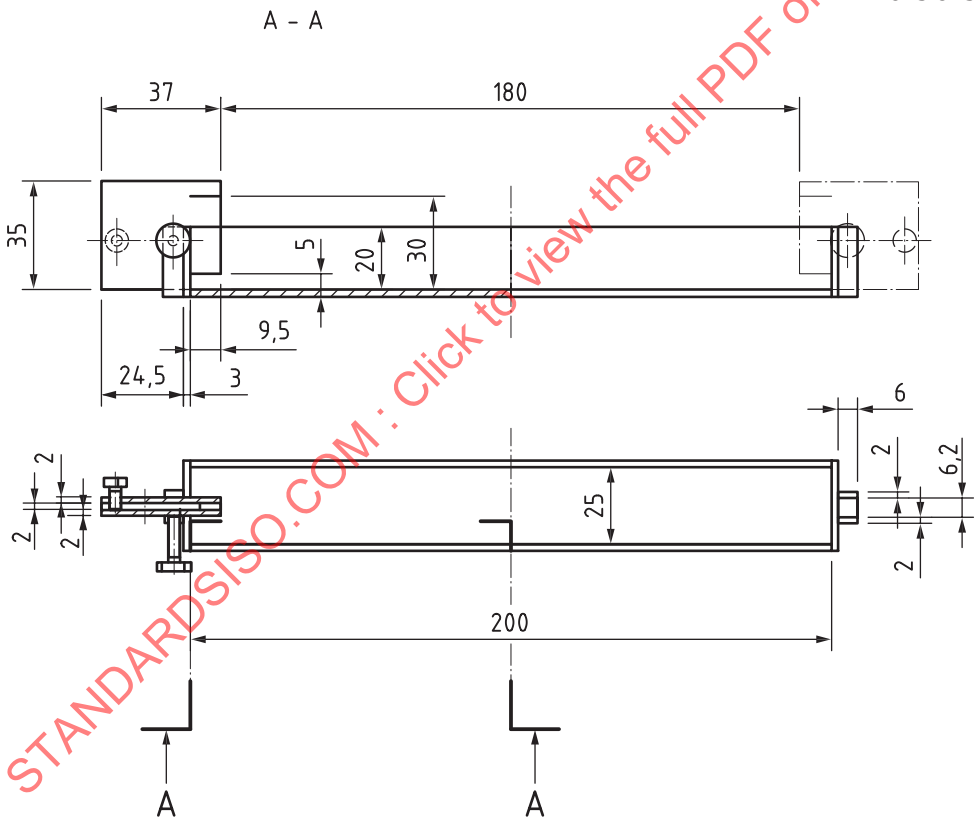


Figure 1 — Reservoir

6.2 Burner, fitted with a nozzle[1)] of 0,6 mm diameter as illustrated in Figure 2.

The burner may be made from a tube with an internal diameter of 6,0 mm, one end of which has a thread to receive the nozzle (see Figure 2) and the other end has a thread to receive the connection to the propane supply tube (swivel connector).

1) The British Oxygen Company No. 1 welding nozzle is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

Dimensions in millimetres

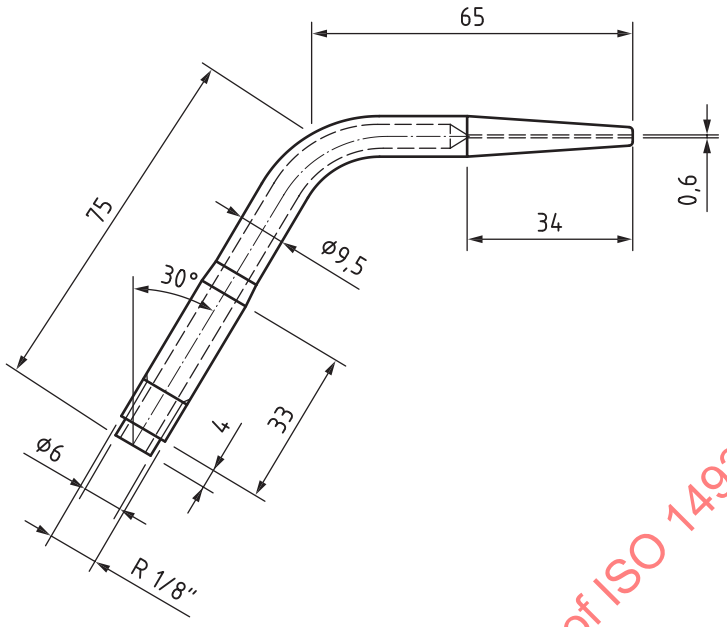


Figure 2 — Burner

6.3 Propane gas connection, by means of a flexible gas hose, the swivel connector on which the burner is installed is connected to the propane gas supply.

NOTE 1 The threaded connection to the swivel connector is shown in Figure 3.

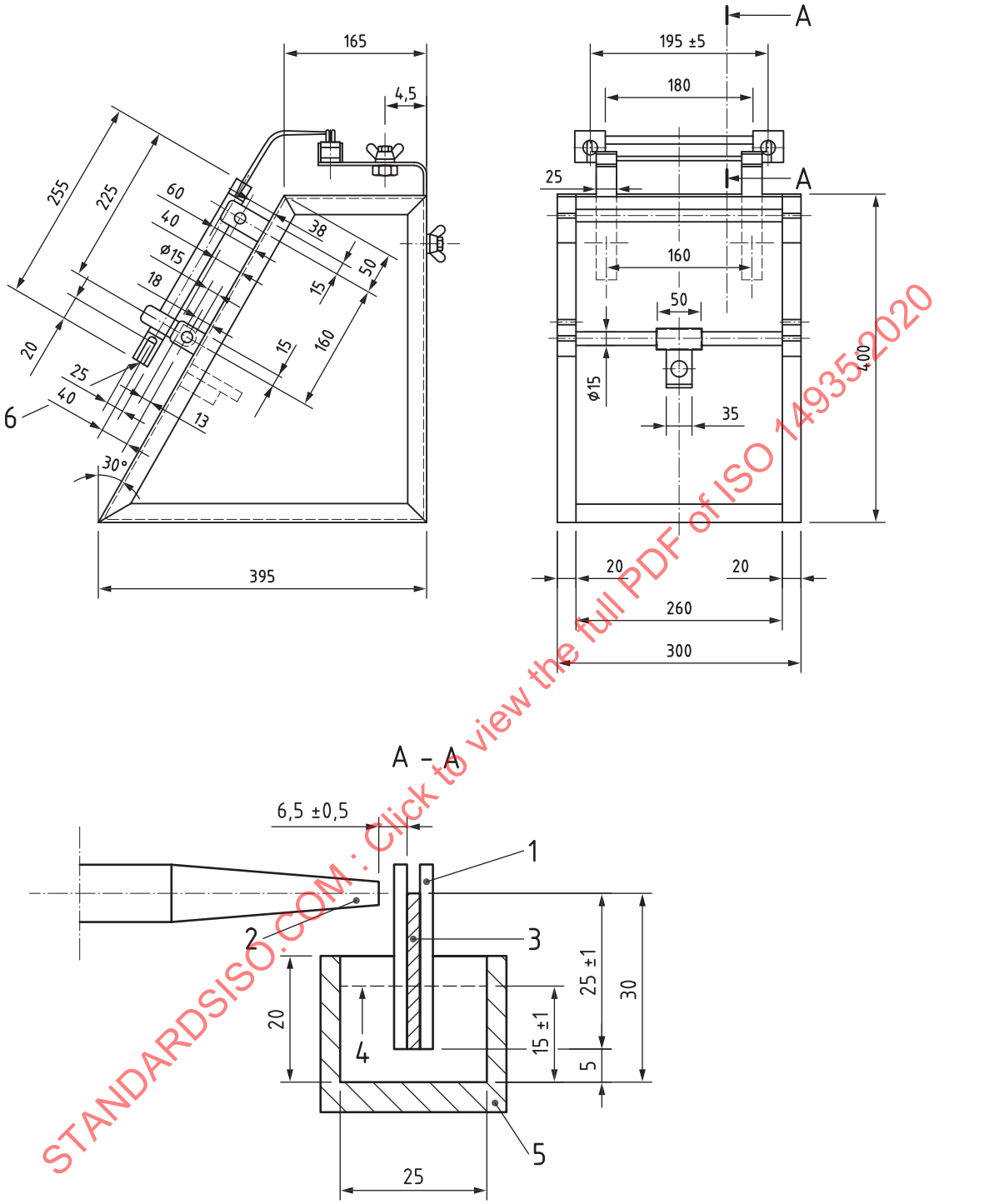
NOTE 2 When propane is supplied from cylinders, the regulating valve will normally consist separately of a pressure regulator and a needle valve to control the flow. Controlled-pressure reticulated supplies only require the needle valve.

6.4 Test rig, suitable for mounting the reservoir, test plate (6.5) and burner in the correct relative positions. A stop shall be provided such that the burner is positively located in the correct setting position for the height of the flame.

A means of moving the burner along the length of the plate shall be provided. The burner, by means of the swivel connector or pivot bar, shall be able to be moved such that the flame is displaced from the surface of the plate to a safe position.

NOTE Suitable test rig, see Figure 3.

Dimensions in millimetres



Key

1 clamping device
2 burner nozzle
3 test plate
4 liquid level
5 Reservoir
6 propane gas connection on swivel connector

Figure 3 — Typical test rig

6.5 Test plate, made of non-flammable aluminosilicate material[2)] of width 25 mm ± 1 mm and of thickness 2 mm ± 0,2 mm. It shall be cut into lengths of 195 mm ± 5 mm.

Test plates with split edges should be discarded as splits might affect results. Suitable methods of producing cleanly cut test boards are to use a sharp guillotine or a sharp knife in conjunction with a metal ruler.

6.6 Soaking bath, a container made of brass of a length approximately 200 mm, of width approximately 30 mm and of depth approximately 40 mm.

6.7 Timing device, electronic or mechanical, reading to 0,1 s with an accuracy of ±0,1 % over 10 min.

7 Samples and sampling

7.1 Samples, unless otherwise specified, which shall be taken in accordance with the procedures specified in ISO 3170.

7.2 Laboratory samples, which shall be examined for homogeneity and clarity before taking the test portion. Sediment and/or water shall be removed by filtration or decantation, and the presence noted on the test report.

8 Preparation of apparatus

8.1 Each plate shall be suspended vertically in still air and shall be ignited by applying a small flame to the lower edge. The flame shall be allowed to spread vertically so that the whole of the test plate (6.5) is burned free of combustible material. The test plate shall be allowed to cool for at least 1 h before use.

It is recommended to prepare several plate batches at the same time; the flamed still dry plates are stored in a covered container.

8.2 To facilitate adjustment of the test device, a dry test plate is attached between the clamps in the container. The plate shall be straight aligned. The top edge of the plate shall be in line with the reference mark on the clamps. The plate surface shall be vertical. The container shall be arranged horizontally.

8.3 The test apparatus shall be so adjusted that the axis of the burner nozzle is horizontal ±1 mm in one plane with the upper edge of the plate. The horizontal distance between the tip of the nozzle and the top of the plate shall be 6,5 mm ± 0,5 mm along the whole length of the plate. The nozzle axis is vertical when the burner is in its starting position.

8.4 The ignition flame shall be adjusted to a height of (25 ± 1mm). The burner shall be in the starting position during adjustment. The flame height shall be checked between the individual tests and corrected if necessary.

9 Procedure

9.1 Carry out the tests at ambient laboratory temperature (18 °C to 22 °C) in still air.

A fume cupboard with ventilation switched off or a shield of sufficient height covering three sides of the test rig is recommended.

2) Isoplan 1100 is an example of a suitable material available commercially from Frenzeit-Werke GmbH, Germany, and Evco-S.A., Les Petites Roches, France. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

9.2 Fill the soaking bath (6.6) to a depth of approximately 30 mm with the fluid and immerse a batch of plates (6.5) for at least 10 min. The liquid is disposed of after use.

NOTE At least five plates are required for each test, but up to 15 might be required in certain circumstances.

9.3 Fill the reservoir (6.1) with fresh fluid to a level of 15 mm ± 1 mm from the bottom and ensure that this level is maintained throughout the test.

9.4 Using forceps, remove a soaked plate from the soaking bath and mount it in the clips or clamps in the reservoir. Handle the plate carefully within 20 mm of each end.

9.5 In this position the plate shall be 300 ± 10 s drip off, then the ignition flame is directed to the mid-point of the plate and left their for 2 ± 0,5 s.

9.6 Remove the igniting flame, and time the persistence of the flame on the test plate to the nearest 0,1 s. Record as T_1.

If the flame on the plate reaches the clips, mention this fact in the test report, and do not carry out any further tests on that edge of the plate. If the flame on the plate does not extend more than 20 mm from the point of ignition, carry out up to two further tests on the plate edge at points 50 mm from the mid-point.

If a flame continues to burn over a previously burnt part of the plate or if it reaches one of the retaining clips, this result is not taken into account. A total of six determinations are carried out, T_1, T_2, T_3, T_4, T_5 and T_6 are recorded.

9.7 Repeat procedures 9.5 and 9.6 with igniting flame applications ±0,5 s of 5 s ($T_{MP\,5}$), 10 s ($T_{MP\,10}$), 20 s ($T_{MP\,20}$) and 30 s ($T_{MP\,30}$).

For all exposure times the drip-off time of the test plate shall be 300 ± 10 s.

The plate may be inverted after one, two or three flame applications.

9.8 Complete all five flame application times within 2 h of test commencement.

10 Calculation

Calculate the flame mean persistence time, T_{mean}, expressed in seconds, for each of the five periods of application of the igniting flame ($T_{MP\,2}$, $T_{MP\,5}$, $T_{MP\,10}$, $T_{MP\,20}$ and $T_{MP\,30}$) using Formula (1):

$$MP = \frac{T_1 + T_2 + T_3 + T_4 + T_5 + T_6}{6} \quad (1)$$

where T_1, T_2, T_3, T_4, T_5 and T_6 are the six determinations described in 9.6.

11 Expression of results

Report the largest of the five averages in Clause 10, to the nearest 0,1 s, as the flame mean persistence.

Report the presence of sediment and/or water in the sample, if observed in 7.2.

Report the traverse of flame to the clips or clamps, if observed in 9.6.

12 Precision

For this test method, no information was given on accuracy. The test is passed if the average burning time is less than 60 s This definition of flame retardancy shall be considered as yes/no testing.

