
**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*



Foreword

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

WARNING – The use of this International Standard may involve hazardous materials, operations and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard 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. The test relates to the bulk behaviour of a fluid, which may provide pertinent information for safe transportation and storage. This test does not ascertain the behaviour of a spray of fire-resistant fluid, for which ISO 15029 should be used. This International Standard establishes one of two basic measures of fire-resistance, and may be called up in regulations governing their use under the Luxembourg Report¹⁾. This International Standard does not apply to certain water-containing fluids or emulsions that do not adhere to the test board.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3170:1988, *Petroleum liquids – Manual sampling*.

ISO 9162:1989, *Petroleum products – Fuels (class F) – Liquefied petroleum gases – Specifications*.

ISO 15029:—²⁾, *Petroleum products and related products – Determination of spray ignition characteristics of fire-resistant fluids*.

1) Safety and Health Commission for the Mining and other Extractive Industries, Doc. No. 4746/10/91 EN (for English version, FR for French version), April 1994, *Requirements and tests applicable to fire-resistant hydraulic fluids used for power transmissions and control (hydrostatic and hydrokinetic)*, available from the Commission of the European Communities, Directorate-General V, Unit V.F.4 "Extractive, Iron and Steel Industries", Bâtiment Jean Monnet, C4/65, L-2920 Luxembourg.

2) To be published as a multi-part standard.

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 flame mean persistence: The largest average flame persistence time, in seconds, of five flame exposures carried out under the conditions specified in this International Standard, each flame exposure being the average of six determinations.

4 Principle

A length of non-flammable aluminosilicate board 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 board, and the persistence, in seconds, of the flame after removal of the igniting flame is measured. A total of six determinations is carried out for each of five different periods of flame application. The persistence of these five different periods of application of the igniting flame are calculated, and the result is the largest of these averages.

5 Reagents and materials

5.1 Propane, of commercial quality conforming to ISO 9162.

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

6 Apparatus

6.1 Reservoir, constructed of suitable metal, approximately 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 board (6.5) at either end, with a distance between the inner edges of these clips of $180\text{ mm} \pm 2\text{ mm}$. Each clip or clamp shall have a reference mark at $30\text{ mm} \pm 0,5\text{ mm}$ above the inside bottom of the reservoir. Figure 1 illustrates a suitable reservoir.

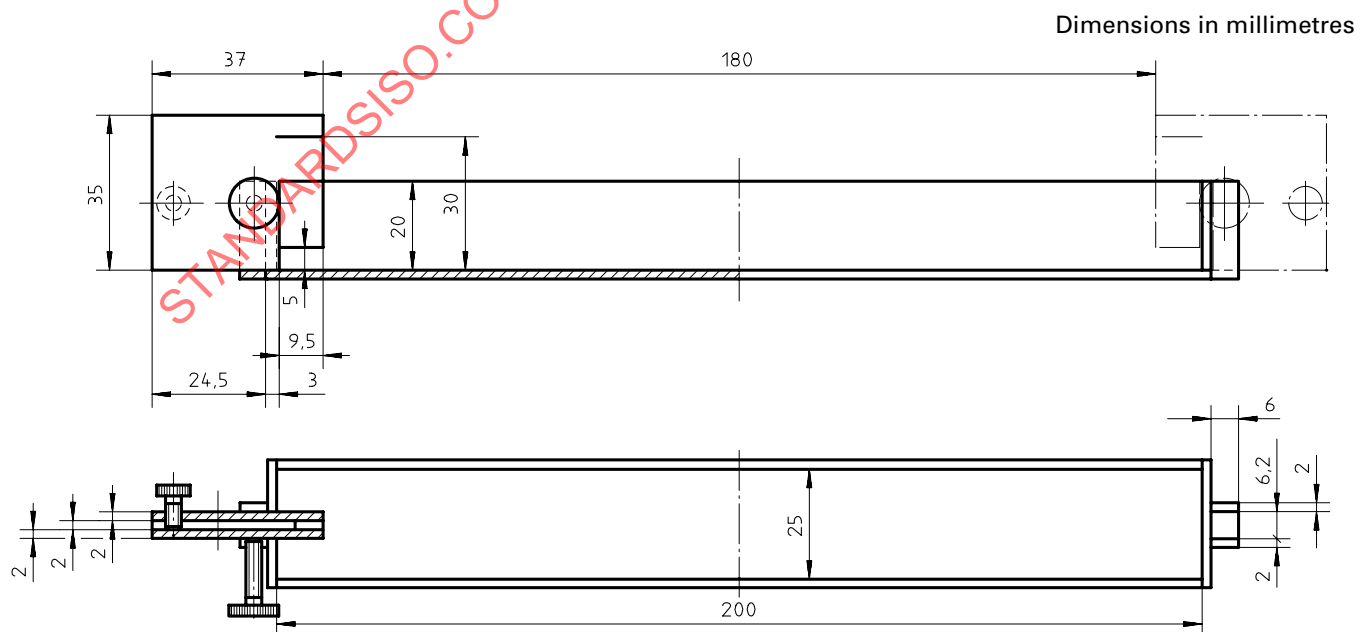


Figure 1 – Reservoir

6.2 Burner, fitted with a nozzle of 0,6 mm diameter as illustrated in figure 2.

NOTES

1 A 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 International Standard and does not constitute an endorsement by ISO of this product.

2 The burner may be fabricated from a length of tube, one end of which is threaded to accommodate the nozzle, and the other end of which is threaded to take the connector on the propane supply tube (6.3).

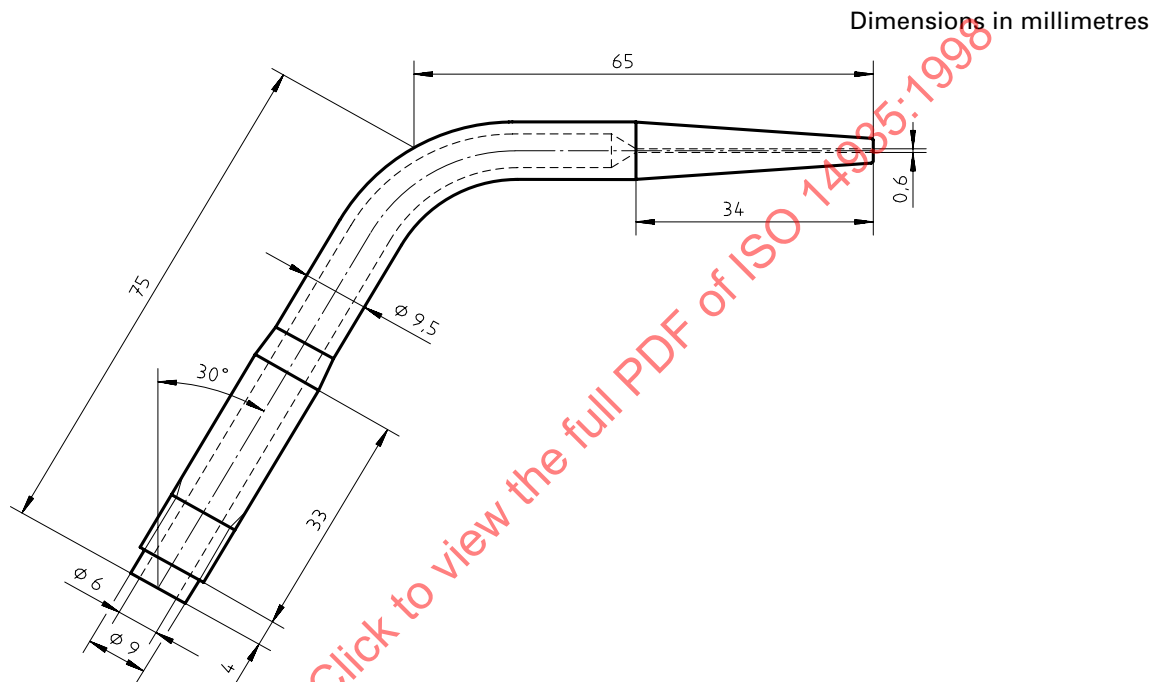


Figure 2 – Burner

6.3 Propane supply tube, made of rigid or flexible gas-tight material, fitted with a swivel connector at the end receiving the burner and a regulating valve connected to the propane supply.

NOTES

1 An alternative to the swivel connector is a pivot bar and clamp at the bottom of the burner tube (see figure 3).

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, board 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 board 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 board to a safe position.

NOTE — A suitable test rig is illustrated in figure 3.

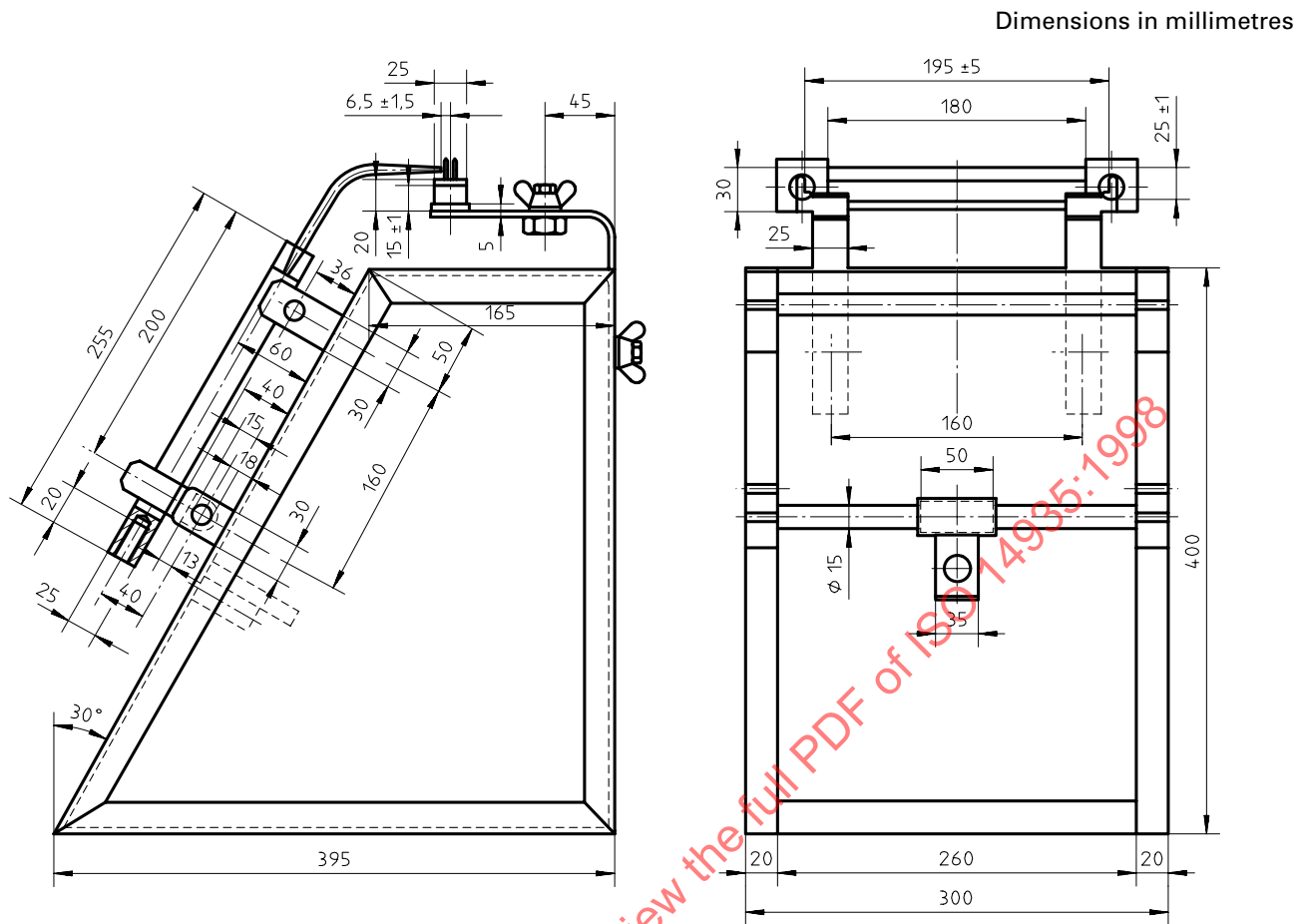


Figure 3 - Typical test rig

6.5 Test board, made of non-flammable aluminosilicate material of width $25 \text{ mm} \pm 1 \text{ mm}$ and of thickness $2 \text{ mm} \pm 0,2 \text{ mm}$. It shall be cut into lengths of $195 \text{ mm} \pm 5 \text{ mm}$.

NOTES

- 1 Isoplan 1100³⁾ is a suitable material.
- 2 Test boards with split edges should be discarded as splits may 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, suitable for the preparation of the test boards. A bath of suitable material of length approximately 200 mm, of width approximately 30 mm and of depth approximately 40 mm is required.

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

3) Isoplan 1100 is available from

- a) Frenzeit-Werke GmbH, Post Box, D-8582 Bad Berneck, Germany.
- b) Evco-S.A., Les Petites Roches, Trept, F-38460 Crémieu, France.

This information is given for the convenience of users of this International Standard 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.

7 Samples and sampling

7.1 Unless otherwise specified, samples shall be taken in accordance with the procedures specified in ISO 3170.

7.2 Laboratory samples 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 board 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 board is burned free of combustible material. The board shall be allowed to cool for at least 1 h before use.

NOTE — It is recommended that batches of boards are prepared at the same time, and prepared boards are stored in a covered vessel.

8.2 The test rig shall be adjusted such that the reservoir is level, the plane of the board is vertical, and the top of the board is horizontal, when the board is positioned with the top of the board in line with the reference marks on the clips or clamps.

8.3 The burner in the igniting position shall be mounted such that the axis of the nozzle is horizontal and level with the top of the board $\pm 1,5$ mm. The horizontal distance between the tip of the nozzle and the top of the board shall be $6,5 \text{ mm} \pm 1,5 \text{ mm}$ along the whole length of the board. The igniting and removal positions of the burner nozzle shall be in a safe position.

8.4 The igniting flame shall be adjusted to a height of $25 \text{ mm} \pm 1 \text{ mm}$, and shall be checked between each determination and adjusted as necessary.

9 Procedure

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

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

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

NOTE — At least five boards are required for each test, but up to 15 may be required in certain circumstances.

9.3 Fill the reservoir (6.1) with fresh fluid to a level of $15 \text{ mm} \pm 1 \text{ mm}$ from the bottom, and ensure that this level is maintained throughout the test.

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

9.5 Allow the board to drain for 1 min to 5 min and then apply the igniting flame to the mid-point of the board for $2 \text{ s} \pm 0,2 \text{ s}$.

9.6 Remove the igniting flame, and time the persistence of the flame on the test board to the nearest 0,1 s. Record as T_1 . If the flame on the board reaches the clips, mention this fact in the test report, and do not carry out any further tests on that edge of the board. If the flame on the board does not extend more than 20 mm from the point of ignition, carry out up to two further tests on the board edge at points 50 mm from the mid-point. If any residual flame traverses a previously burned section of the board, discard the result. Complete six determinations.

9.7 Repeat procedures 9.5 and 9.6 with igniting flame applications $\pm 0,1$ s of 5 s (MP_5), 10 s (MP_{10}), 20 s (MP_{20}) and 30 s (MP_{30}). All applications shall be made with the board within a draining time of 1 min to 5 min.

NOTE — The board 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 mean persistence time, MP, expressed in seconds, for each of the five periods of application of the igniting flame (MP_2 , MP_5 , MP_{10} , MP_{20} and MP_{30}) using the following equation:

$$MP = \frac{T_1 + T_2 + T_3 + T_4 + T_5 + T_6}{6}$$

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 mean persistence of flame.

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

No precision has been established for this procedure, since it is used on a go/no-go test with an absolute maximum value of 60 s being decreed as a threshold definition of fire-resistance.

13 Test report

The test report shall contain at least the following information:

- a) a reference to this International Standard;
- b) the type and complete identification of the product tested;
- c) the result of the test (see clause 11);
- d) any deviation, by agreement or otherwise, from the procedure specified;
- e) the date of the test.