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Second edition
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Volatile organic liquids — Determination of boiling range of organic solvents used as raw materials

Liquides organiques volatils — Détermination de l'intervalle de distillation des solvants organiques utilisés comme matières premières

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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 document 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 35, *Paints and varnishes*.

This second edition results from the reinstatement of ISO 4626:1980, which was withdrawn in 2017.

The main changes are as follows:

- the normative references have been updated.

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.

Volatile organic liquids — Determination of boiling range of organic solvents used as raw materials

1 Scope

This document specifies a method for determining the boiling range of liquids that boil between 30 °C and 300 °C at normal pressure, and that are chemically stable and do not corrode the apparatus during the distillation.

The method is applicable to organic liquids such as hydrocarbons, esters, alcohols, ketones, ethers and similar products.

NOTE 1 The method differs from that described in ISO 918 with respect to the volume of the distillation flask, the type of cooler and the distillation receiver.

NOTE 2 The method differs from that specified in ISO 3405 with respect to the volume of the distillation flask and the diameter of the hole in the flask support.

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 3165, *Sampling of chemical products for industrial use — Safety in sampling*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Terms and definitions

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

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

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at https://www.electropedia.org/

3.1
initial boiling point
temperature noted (corrected if required) at the moment when the first drop of condensate falls from the tip of the condenser during a distillation carried out under standardized conditions

3.2
dry point
temperature noted (corrected if required) at the moment of vaporization of the last drop of liquid at the bottom of the flask during a distillation carried out under standardized conditions, disregarding any liquid on the side of the flask and on the thermometer

3.3
boiling range
temperature interval between the *initial boiling point* (3.1) and the *dry point* (3.2)

3.4
end point

final boiling point

maximum temperature noted (corrected, if required) during the final phase of a distillation carried out under standardized conditions

4 Principle

100 ml of a test portion are distilled under prescribed conditions which are equivalent to a simple batch distillation. Thermometer readings and volumes of condensate are observed systematically and the results from these data with correction to standard atmospheric pressure are calculated.

5 Apparatus

The apparatus, a suitable form of which is shown in Figure 1 to Figure 4, shall comprise the following items.

5.1 Distillation flask, of heat-resistant glass, of capacity 200 ml, conforming to the dimensions shown in Figure 1.

Superheating of liquid in a new flask may be prevented by depositing a small amount of carbon in the bottom of the flask. This may be accomplished by heating and decomposing a pinch of tartaric acid in the bottom of the flask. The flask is then prepared for use by washing with water, rinsing with acetone, and drying.

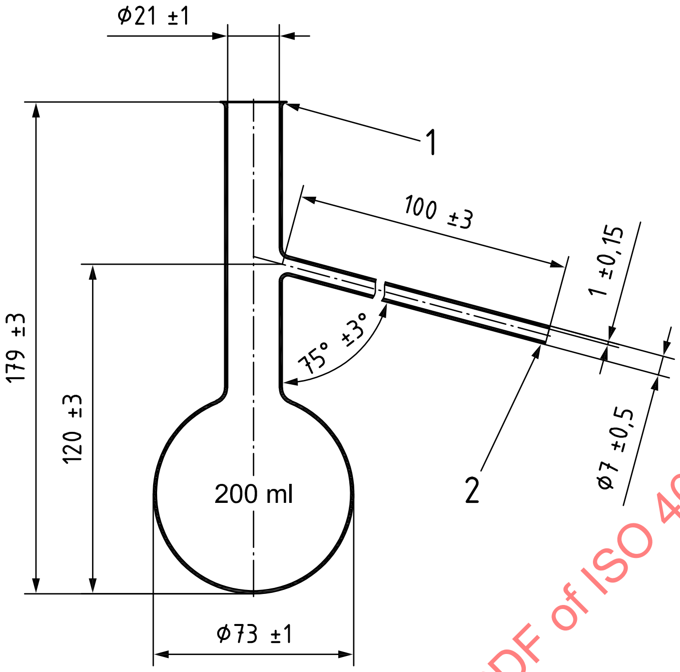
An exception is made for diacetone alcohol: in order to avoid an erratic value for the initial boiling point, the distillation flask should be clean and free of any residual carbon deposit.

5.2 Thermometers, mercury-in-glass type, nitrogen-filled, graduated on the stem, enamel-backed, and conforming to the requirements in Table 1.

The thermometer should have been artificially aged by means of a suitable treatment before graduation, in order to ensure stability of the lowest point on the scale. This treatment should have been such that, after the procedure described below, the rise at a fiducial point is not greater than the maximum error specified, and the accuracy of the thermometer is within the limits specified.

Heat the thermometer to a temperature equal to its highest reading and keep it at this temperature for 5 min. Allow the thermometer to cool, either naturally in still air or slowly in the test bath (at a specified rate), to 20 °C above ambient temperature or to 50 °C, whichever is the lower, and then determine the lowest point on the scale. If rapid cooling is used, the lowest point on the scale shall be determined within 1 h. Heat the thermometer again to a temperature equal to its highest reading, keep it at this temperature for 24 h. Allow the thermometer to cool to 20 °C above ambient temperature or to 50 °C, at the same rate as at the start of the test, and re-determine the lowest point on the scale under the same conditions as before.

Dimensions in millimetres



Key

1 reinforcing bead

2 fire-polished

Figure 1 — Distillation flask

Table 1 — Solvent distillation thermometers

Designation[a]	38 C-75	39 C-75	40 C-75	41 C-62	42 C-62	102 C-65	103 C-65	104 C-75	105 C-65	106 C-75	107 C-75
Immersion mm	100	100	100	100	100	100	100	100	100	100	100
Range °C	24 to 78	48 to 102	72 to 126	98 to 152	95 to 255	123 to 177	148 to 202	173 to 227	198 to 252	223 to 277	248 to 302
Graduation °C	0,2	0,2	0,2	0,2	0,5	0,2	0,2	0,2	0,2	0,2	0,2
Longer lines at each °C	1	1	1	1	1	1	1	1	1	1	1
Figured at each °C	2	2	2	2	5	2	2	2	2	2	2
Scale error not to exceed °C	0,2	0,2	0,2	0,2	0,5	0,2 up to 150 0,3 over 150	0,4	0,4	0,4 up to 225 0,6 over 225	0,8	1,0
Overall length mm	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5	395 ± 5
Stem diameter mm	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 7,0	6,0 to 8,0	6,0 to 8,0
Bulb length mm	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20
Distance from bottom of bulb — to	24 °C 125 mm to 145 mm	48 °C 125 mm to 145 mm	72 °C 125 mm to 145 mm	98 °C 125 mm to 145 mm	95 °C 125 mm to 145 mm	123 °C 125 mm to 145 mm	148 °C 125 mm to 145 mm	173 °C 125 mm to 145 mm	198 °C 125 mm to 145 mm	23 °C 125 mm to 145 mm	248 °C 125 mm to 145 mm
— to	78 °C 335 mm to 360 mm	102 °C 335 mm to 360 mm	126 °C 335 mm to 360 mm	152 °C 335 mm to 360 mm	255 °C 335 mm to 360 mm	177 °C 335 mm to 360 mm	202 °C 335 mm to 360 mm	227 °C 335 mm to 360 mm	252 °C 335 mm to 360 mm	277 °C 335 mm to 360 mm	302 °C 335 mm to 360 mm
Expansion chamber to allow heating to °C	105	130	150	180	280	200	225	250	275	300	325

[a] These designations correspond to those in ASTM E1.

5.3 Draught screen

5.3.1 For use with a gas burner

The draught screen shall be rectangular in cross-section and open at the top and bottom. It shall have the dimensions shown in Figure 2 and be made of a sheet of metal, approximately 0,8 mm thick.

In each of the two narrower sides of the draught screen, there shall be two circular holes of diameter of 25 mm, the centres of which are situated 215 mm below the top of the shield, as shown in Figure 2.

In each of the four sides of the draught screen, there shall be three circular holes of diameter 12,5 mm, the centres of which are situated 25 mm above the base of the draught screen. These holes shall occupy the positions shown in Figure 2.

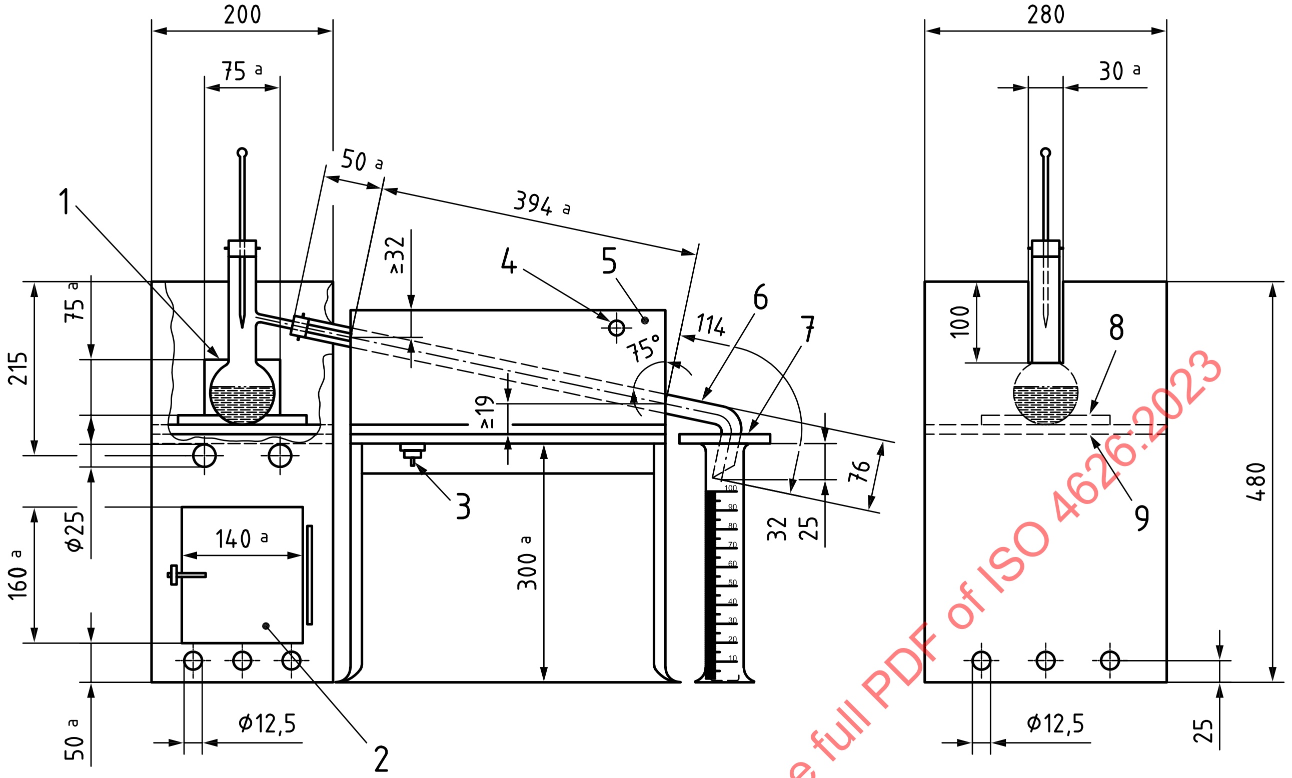
At the middle of each of the wider sides, a vertical slot for the condenser tube, dimensioned approximately as shown in Figure 2, shall be cut downwards from the top of the screen. A removable shutter of suitable dimensions shall be provided for closing whichever vertical slot is not in use. This arrangement enables the condenser (5.6) to be placed on either side of the draught screen.

A shelf of ceramic material, of thickness 3 mm to 6 mm and possessing a centrally cut circular hole of diameter 75 mm to 100 mm, shall be supported horizontally in the screen and shall fit closely to the sides of the screen, to ensure that hot gases from the source of heat (5.5) do not come in contact with the sides or neck of the flask (5.1). The supports for this shelf may conveniently consist of triangular pieces of metal sheet firmly fixed to the screen at its four corners.

A board as described in 5.4 shall rest on this shelf.

In one of the narrower sides of the screen, a door shall be provided, having the approximate dimensions shown in Figure 2 and overlapping the opening in the screen by approximately 5 mm all round.

Dimensions in millimetres



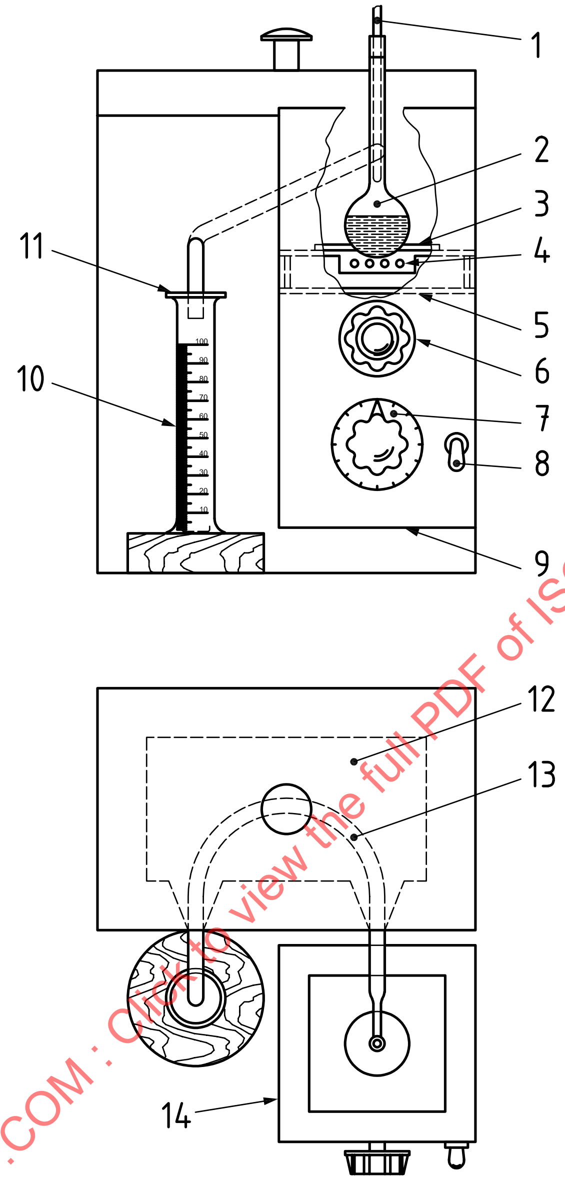
Key

1 window
2 door
3 tap
4 overflow tube
5 water bath, capacity not less than 5,5 l of cooling medium (approximately 380 mm long, 150 mm deep and 100 mm wide)
6 seamless brass tubing, external diameter 14 mm
7 blotting paper
8 asbestos or ceramic board
9 asbestos or ceramic shelf
[a] Approximate dimensions, given for guidance.

Figure 2 — Distillation apparatus using gas burner

5.3.2 For use with an electric heater

When an electric heater is employed, the portion of the draught screen above the shelf shall be as described in 5.3.1, but the lower portion (including the shelf) may be modified or omitted, provided that the change does not expose the distillation flask to draughts (see Figure 3). Provision shall be made to adjust the shelf to facilitate fitting of the flask.



Key

1	thermometer
2	flask
3	ceramic board
4	electric heating mantle
5	flask support platform
6	flask adjusting knob
7	heat adjusting dial
8	switch
9	open bottom shield
10	distillation receiver
11	blotting paper
12	condenser
13	condenser tube
14	shield

Figure 3 — Distillation apparatus using electric heater

5.4 Ceramic boards, of thickness 3 mm to 6 mm, with central holes of diameter 32 mm or 38 mm respectively, and overall dimensions not less than 150 mm^2. When a gas heater is employed, this board shall rest on the shelf described in 5.3.1. When an electric heater is employed, the same arrangement shall be adopted if the shelf is present. Alternatively, the board may be placed directly on the heater or it may form the top of the heater. Provision shall be made for adjusting the height of the heater.

Whichever type of heater is employed, direct heat shall only be applied to the flask through the central hole in the ceramic board.

5.5 Source of heat, comprising either a gas burner constructed so that sufficient heat can be obtained to distil the product at the uniform rate specified in 8.3.2 (a sensitive regulating valve or governor are desirable adjuncts) or an electric heater capable of complying with the same requirements. (A heater of low heat retention, adjustable from 0 kW to 1 kW, has been found satisfactory.) See also 9.6.

5.6 Condenser, of seamless brass tubing, of length 560 mm, outside diameter 14 mm and wall thickness 0,8 mm to 0,9 mm, surrounded by a metal cooling bath, preferably of copper or brass. The tube shall be set so that a length of approximately 390 mm is in contact with the cooling medium in the cooling bath, with about 50 mm outside the cooling bath at the upper end, and about 115 mm outside at the lower end. The length of the tube projecting at the upper end shall be straight and set at an angle of 75° to the vertical. The section of the tube inside the cooling bath may be either straight or bent in any suitable continuous smooth curve; the average gradient of this section shall be 0,26 mm per linear millimetre of the condenser tube (sine of angle of 15°), and no part of it shall have a gradient less than 0,24 mm nor more than 0,28 mm per linear millimetre of the tube. The projecting lower portion of the condenser tube shall be curved downward for a length of 76 mm and slightly backward, so as to ensure contact with the wall of the receiver (5.7) at a point 25 mm to 32 mm below the top of the receiver when it is in a position to receive the distillate. The lower end of the condenser tube shall be cut off at an acute angle so that the tip may be brought into contact with the wall of the receiver.

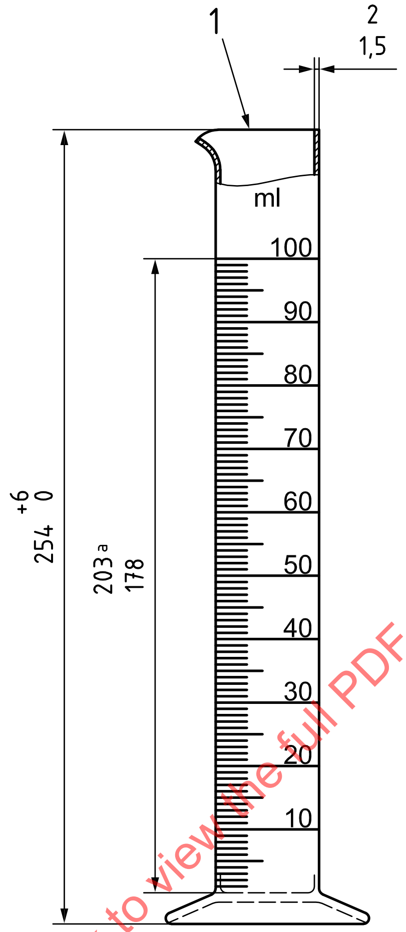
The capacity of the cooling bath shall be not less than 5,5 litres of cooling medium. The arrangement of the tube in the cooling bath shall be such that its centre line is not less than 32 mm below the plane of the top of the bath at its point of entrance, and not less than 19 mm above the floor of the bath at its exit. Clearances between the condenser tube and the walls of the bath shall be at least 13 mm, except for the section adjacent to the points of entrance and exit.

The cooling bath may be provided with a tap at the bottom for drainage or inlet, and with an overflow tube near the top.

The main dimensions of the tube and cooling bath are shown in Figure 2.

5.7 Receiver, of capacity 100 ml, complying with the details shown in Figure 4. None of the graduation lines shall be in error by more than 1 ml. The shape of the base is optional but it shall be such that the receiver does not topple when placed empty on a surface inclined at an angle of 15° to the horizontal.

Dimensions in millimetres



Key

1 fire polished

a Scale length.

Figure 4 — Distillation receiver

5.8 Barometer, accurate to the nearest 1 mbar1), 0,1 kPa or 1 mmHg.

6 Sampling

Representative samples, each having a volume of not less than 500 ml, should, wherever possible, be taken in triplicate from one or more original and previously unopened containers or from the bulk during packing, as may be agreed between the interested parties, and shall be packaged in clean, dry, airtight containers of dark glass or metal. The containers shall be of such a size that they are nearly filled by the sample. Each sample container so filled shall be sealed with a material unaffected by the contents and marked with the full details and date of sampling.

Sampling of chemical products for industrial use shall be as specified in ISO 3165.

Sampling of paints, varnishes and raw materials for paints and varnishes shall be as specified in ISO 15528.

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1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

7 Assembly and preparation of apparatus

7.1 Assembly

7.1.1 General

Assemble the apparatus as shown in Figure 2 or Figure 3, swabbing out the condenser with a piece of lint-free cloth attached to a wire cord or by any other suitable means, and paying attention to the following details in 7.1.2 to 7.1.4.

7.1.2 Position and choice of thermometer

Use the thermometer listed in the specification for the product under test, or the specification indicated in Table A.1. If no thermometer is specified, select one from Table 1, with the smallest graduations that covers the entire boiling range of the product.

Centre the thermometer into the neck of the flask through a tight-fitting silicone-rubber or cork stopper so that the upper end of the contraction chamber is level with the lower side of the vapour tube at its junction with the neck of the flask.

NOTE It is far more important that the greatest possible volume of mercury be immersed in the refluxing zone than that the immersion mark on the thermometer be placed at any specific point.

7.1.3 Support for flask

If a draught screen with ceramic shelf is used, place the appropriate ceramic board (see 5.4 and 8.3) on top of the shelf so that the two holes are concentric.

7.1.4 Connection of flask to condenser

Make a leak-proof connection of the flask (5.1) to the tube of the condenser (5.6) by means of a tight-fitting silicone rubber or cork stopper through which the vapour tube of the flask passes. Connect the flask to the condenser so that the flask is in a vertical position; the end of the vapour tube shall extend at least 25 mm and not more than 50 mm beyond the cork into the condenser tube and shall be co-axial with it.

Place the flask in such a position on the board that the base completely closes the hole in the board.

7.2 Filling of cooling bath

Fill the bath with water or with water and cracked ice in sufficient quantity to cover the condenser tube, so as to ensure that the temperature of the bath at the start of and during distillation is as shown in Table 2.

7.3 Adjustment of temperature of sample

Adjust the temperature of the sample to the appropriate value shown in Table 2, to prevent excessive evaporation of the product.

Table 2 — Temperatures

Initial boiling point °C	Condenser °C	Sample °C
Below 50	0 to 3	0 to 3
50 to 70	0 to 10	10 to 20
70 to 150	25 to 30	20 to 30
Above 150	35 to 50	20 to 30

8 Procedure

8.1 Test portion

Using the graduated receiver (5.7), measure (100 ± 0,5) ml of the sample at the temperature to which it has been adjusted, as specified in 7.3. Remove the flask (5.1) from the apparatus and transfer the test portion directly to the flask, allowing the receiver to drain for 15 s to 20 s. Do not allow any of the test portion to enter the vapour tube.

For viscous liquids, a longer drainage period can be necessary to complete the transfer of the test portion to the flask, but the drainage time should not exceed 5 min.

8.2 Apparatus assembly

Connect the flask to the condenser (5.6) and insert the thermometer (5.2) as described in 7.1.2 and position the flask as described in 7.1.4.

Place the receiver (5.7), without drying, at the outlet of the condenser tube in such a position that the condenser tube extends into the receiver at least 25 mm but does not extend below the 100 ml mark. If the initial boiling point of the sample is below 70 °C, immerse the receiver in a transparent bath and maintain it at the temperature as specified for the sample in Table 2 throughout the distillation.

Place a flat cover on the top of the receiver to prevent entry of condensed moisture.

8.3 Operating conditions

8.3.1 General

A certain amount of judgment is necessary for choosing the best operating conditions to obtain acceptable accuracy and reproducibility for materials having different distillation temperatures.

8.3.2 Materials with boiling point below 150 °C

For materials having an initial boiling point below 150 °C, the following conditions shall be established:

a) Flask support, with a hole diameter of 32 mm.

b) Heating rate where the time from the application of heat to the collection of the first drop of distillate is 5 min to 10 min. The time that it takes for the vapour column in the neck of the flask to the side arm to rise is 2,5 min to 3,5 min.

8.3.3 Materials with boiling point above 150 °C

For materials having an initial boiling point above 150 °C, the following conditions shall be established:

a) Flask support, with a hole diameter of 38 mm.

b) Heating rate, where the time from the application of heat to the collection of the first drop of distillate is 10 min to 15 min. The time that it takes for the vapour column in the neck of the flask to the side arm to rise is sufficiently rapid to permit collection of the first drop of distillate within 15 min of the start of heating.

8.4 Initial boiling point

Record the temperature at the instant the first drop of distillate falls from the tip of the condenser as the initial boiling point.

8.5 Distillation

Adjust the heat input so that the distillation proceeds at a rate of 4 ml/min to 5 ml/min (approximately 2 drops per second), and move the receiver so that the tip of the condenser tube touches one side of the cylinder after the first drop falls.

Record, if required, the readings of the distillation thermometer after collecting 5 ml, 10 ml, 20 ml, 30 ml, 40 ml, 50 ml, 60 ml, 70 ml, 80 ml, 90 ml and 95 ml of distillate.

8.6 Dry point

Without changing the heater setting, continue distillation beyond the 95 % point until the dry point is observed. Record the temperature at this moment as the dry point. If a dry point is not obtained (that is, if active decomposition occurs before the dry point is reached, as shown by a rapid evolution of vapour or heavy fumes, or if there is liquid remaining on the bottom of the flask when the maximum temperature is observed on the distillation thermometer), record this fact.

8.7 End point

When a dry point cannot be obtained, report as the end point the maximum temperature observed on the distillation thermometer. When active decomposition is encountered, the rapid evolution of vapour and heavy fumes is usually followed by a gradual decrease in the distillation temperature. If the expected drop in temperature does not occur, record the maximum temperature observed on the distillation thermometer 5 min after the 95 % point has been reached, and report as “end point, 5 min”. This notation shows that a true end point cannot be reached within the given time limit. In any event, the end point shall not exceed 5 min after the 95 % point.

8.8 Atmospheric pressure

Read and record the barometric pressure to the nearest 1 mbar[2)], 0,1 kPa or 1 mmHg.

8.9 Recovery

After the condenser tube has drained, read the total volume of distillate and record it as recovery.

The quantity of distillate from non-viscous liquids having a distillation range of 10 °C or less shall be not less than 97 %. For viscous liquids and materials having a wider distillation range than 10 °C, a quantity of 95 % shall be satisfactory. If yields are not obtainable within these limits, the test shall be repeated.

8.10 Distillation loss

If any residue is present, cool the flask to room temperature and pour the residue into a small cylinder graduated in 0,1 ml subdivisions. Measure the volume and record it as residue. Record the difference between 100 and the sum of the residue plus recovery as distillation loss.

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2) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

9 Notes on procedure

9.1 Factors causing superheating

In general, any condition whereby the temperature surrounding the vapour exceeds the temperature of the vapour in equilibrium with the liquid, superheating can occur. Specific factors conducive to superheating are given in 9.2 to 9.6 and shall be avoided. See also 5.1.

9.2 Flame in contact with the flask

The applied gas flame shall be prevented from contacting more than the specified portion of the flask by the following procedures.

Maintain the correct overall dimensions and specified hole diameter of the board. The hole shall be perfectly circular, with no irregularities.

Use a board that is free of cracks and checks.

Set the flask snugly in the hole in the upper insulating board.

9.3 Application of heat

Attention shall be given to burner placement, position, and character of flame, as follows:

Apply the source of heat directly beneath the flask. Any variation can result in heating a larger portion of surrounding air to a higher temperature than that of the flask.

The flame shall not have a larger cross-section than is necessary, and shall be non-luminous.

Place the burner at a level such that the complete combustion area of a non-luminous flame is approximately 20 mm below the board.

9.4 Extraneous heat source

An extraneous source of heat such as sunlight falling directly on the flask causes superheating.

9.5 Condition of equipment

Caution shall be observed in employing the apparatus for immediate re-use. For low-boiling materials, cool the heating unit to room temperature before starting the test.

9.6 Use of electric heaters

In general, electric heaters cause superheating and shall be used only after they have been proven to give results comparable with those obtained when using gas heat. The superheating effect obtained from electric heaters can be minimized, but not completely eliminated, by selecting a heater which, by its design, concentrates the heating elements to a minimum area, and which contains a minimum amount of ceramic material in its overall construction. The fulfilment of these requirements will reduce, but not completely eliminate, the amount of extraneous heat radiating around the perimeter of the board on which the distillation flask is placed.

9.7 Safety precautions

9.7.1 Peroxide formation

Certain solvents and chemical intermediates, particularly but not only ethers and unsaturated compounds, can form peroxides during storage. These peroxides can present an explosion hazard when the product is distilled, especially as the dry point is approached.

When peroxide formation is likely, either because of the chemical nature of the product, the type of the product or its length of storage, the material should be analysed for peroxides and, if they are present, appropriate precautions should be taken, such as destruction of the peroxides before distillation, or protection of the operator.

A test for peroxides is described in Annex B.

9.7.2 Flammability

Most organic solvents and chemical intermediates are flammable. A fire hazard exists when a distillation is carried out and safety precautions should be taken.

Before starting the test, the flask should be examined for flaws and care should be taken that good seals are obtained where the side arm connects with the condenser and where the thermometer fits into the neck. Some solvents are liable to autoignition if distilled. Distillation of these products should be avoided. During the distillation, a suitable catch-pan and shield should be used to contain spilled liquid in the event of accidental breakage of the distillation flask.

Adequate ventilation should be provided to maintain the solvent vapour concentration below the explosive limit in the immediate vicinity of the distillation apparatus, and below the threshold limit value in the general work area.

10 Calculations

10.1 Thermometer bore correction

Apply the correction for any variation in the bore of the thermometer as given by the calibration certificate.

10.2 Thermometer bulb shrinkage correction

Apply the correction for shrinkage of the mercury bulb of the thermometer as determined by any change in its ice or steam point, where applicable. Other means can be employed, such as the use of a platinum-resistance thermometer or a recognized standard thermometer.

10.3 Barometer correction

After applying the corrections for thermometer error, correct each reading for deviation of the barometric pressure from normal by adding algebraically the correction, calculated using Formulae (1) to (3):

$$K\,(760 - p_0) \tag{1}$$

$$\text{or } K'\,(1\,013 - p_1) \tag{2}$$

$$\text{or } K'\,(1\,013 - 10\,p_2) \tag{3}$$

where

K is the rate of change of boiling point with pressure, in degrees Celsius per millimetre of mercury (°C/mmHg). K shall be as given in Annex A (see also text below);

K' is the rate of change of boiling point with pressure, in degrees Celsius per millibar or per 0,1 kPa (°C/mbar or °C/0,1 kPa). K' shall be as given in Annex A;

p_0 is the barometric pressure, in millimetres of mercury (mmHg), during the test;

p_1 is the barometric pressure, in millibars, during the test;

p_2 is the barometric pressure, in kilopascals during the test.

For other pure compounds not listed in Annex A, the value of K should be obtained from the literature. For narrow-boiling hydrocarbon materials, the value of K can be assumed as 0,000 12 times the normal boiling point on the absolute temperature scale.

10.4 Combined corrections

If the overall boiling range of the test portion does not exceed 2 °C, combined thermometer (bore irregularities and bulb shrinkage) and barometric corrections may be made on the basis of the difference between the observed 50 % boiling point and the true boiling point at 101,3 kPa, as given in Annex A.

10.5 Precision

10.5.1 General

The precision of the method obtained by statistical examination of interlaboratory results is related to the purity and the boiling point of the material.

In general, precision increases with increasing purity and decreasing boiling point, while it is poorest for mixtures that have a wide boiling range at elevated temperatures.

10.5.2 Repeatability, *r*

The value below which the absolute difference between two test results is obtained by one operator in one laboratory on identical material, using the same equipment within a short interval of time and using the standardized test method, can be expected to lie with a 95 % probability, is as shown in Table 3.

10.5.3 Reproducibility, *R*

The value below which the absolute difference between two test results is obtained by operators in different laboratories on identical material, using the standardized test method, can be expected to lie with a 95 % probability, is as shown in Table 3.

Table 3 — Precision data

Materials tested			**Precision** °C							
	Boiling range °C	**50 % point** °C	**Initial boiling point**		**50 % point**		**Dry point**		**Boiling range**	
			r	*R*	*r*	*R*	*r*	*R*	*r*	*R*
Single compounds										
Acetone	0,5	56	0,1	0,45	0,15	0,35	0,25	0,5	0,3	0,7
Ethoxyethyl acetate	4,7	218	0,9	1,5	0,6	1,2	0,6	1,4	1,1	2,1
Mixtures										
Glycols	12	193	0,5	1,9	0,4	1,6	0,8	3,4	0,9	3,9
Aromatic hydrocarbons	28	146	0,4	2,4	0,8	1,8	1,2	2,7	1,3	3,6
Mineral spirits	37	175	2,1	2,2	0,5	1,2	0,8	3,5	2,3	4,1

11 Test report

The test report shall contain at least the following information:

a) the type and identification of the product tested;

b) a reference to this document (i.e. ISO 4626:2023) or to a corresponding national standard;

c) the results of the test as described in the product specification. If no requirements for reporting the results are specified, report the corrected temperatures at each observed volume, and report the volume percentages of residue, recovery, and distillation loss;

d) any deviation, by agreement or otherwise, from the procedure specified;

e) any unusual features observed;

f) the date of the test.