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Plastics — Determination of ignition temperature using a hot-air furnace

Plastiques — Détermination de la température d'allumage au moyen d'un four à air chaud

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 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 61, *Plastics*, Subcommittee SC 4, *Burning behaviour*.

This fourth edition cancels and replaces the third edition (ISO 871:2006), which has been technically revised.

The main changes compared to the previous edition are as follows.

— An option to use a modification of the equipment used for ISO 1182 to assess ignitability has been added.

— Mandatory information has been provided throughout the document.

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.

Plastics — Determination of ignition temperature using a hot-air furnace

1 Scope

1.1 This document specifies a laboratory method for determining the flash-ignition temperature and spontaneous-ignition temperature of plastics using a hot-air furnace. It is one of a number of methods in use for evaluating the reaction of plastics to the effects of ignition sources.

NOTE Information on additional ignition methods can be found in ISO 10093.

1.2 This method does not give a direct measure of the combustibility or rate of burning of a material or any definition of the safe upper limit of temperature for the plastics in use, and it is inappropriate to use it alone to describe or appraise the fire hazard or fire risk of materials, products or assemblies under actual fire conditions. However, results of this test are suitable for use as elements of a fire hazard or fire risk assessment which takes into account all of the factors pertinent to an assessment of the fire hazard of a particular end use.

1.3 Tests made under conditions of this method are potentially of considerable value in comparing the relative ignition characteristics of different materials. Values obtained represent the lowest ambient air temperature that has the potential to cause ignition of the material under the conditions of this test. Test values are expected to rank materials according to ignition susceptibility under actual use conditions.

1.4 The results of this test method are not intended for fire safety engineering calculations.

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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 1182, *Reaction to fire tests for products — Non-combustibility test*

ISO 13943, *Fire safety — Vocabulary*

IEC 60584-1, *Thermocouples Part 1 EMF Specifications And Tolerances*

IEC 60584-2:1982, *Thermocouples — Part 2: Tolerances*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and the following 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 https://www.electropedia.org/

3.1
flash-ignition temperature
FIT
minimum temperature at which, under specified test conditions, sufficient flammable gases are emitted to ignite momentarily on application of a pilot flame

3.2
spontaneous-ignition temperature
SIT
minimum temperature at which, under specified test conditions, ignition is obtained by heating in the absence of any additional ignition source

3.3
glowing combustion
combustion of a material in the solid phase without flame but with emission of light from the combustion zone

4 Principle

A specimen of the material is heated in a hot-air ignition furnace using various temperatures within the heated chamber, and the flash-ignition temperature is determined with a small pilot flame directed at the opening in the top of the furnace to ignite evolved gases.

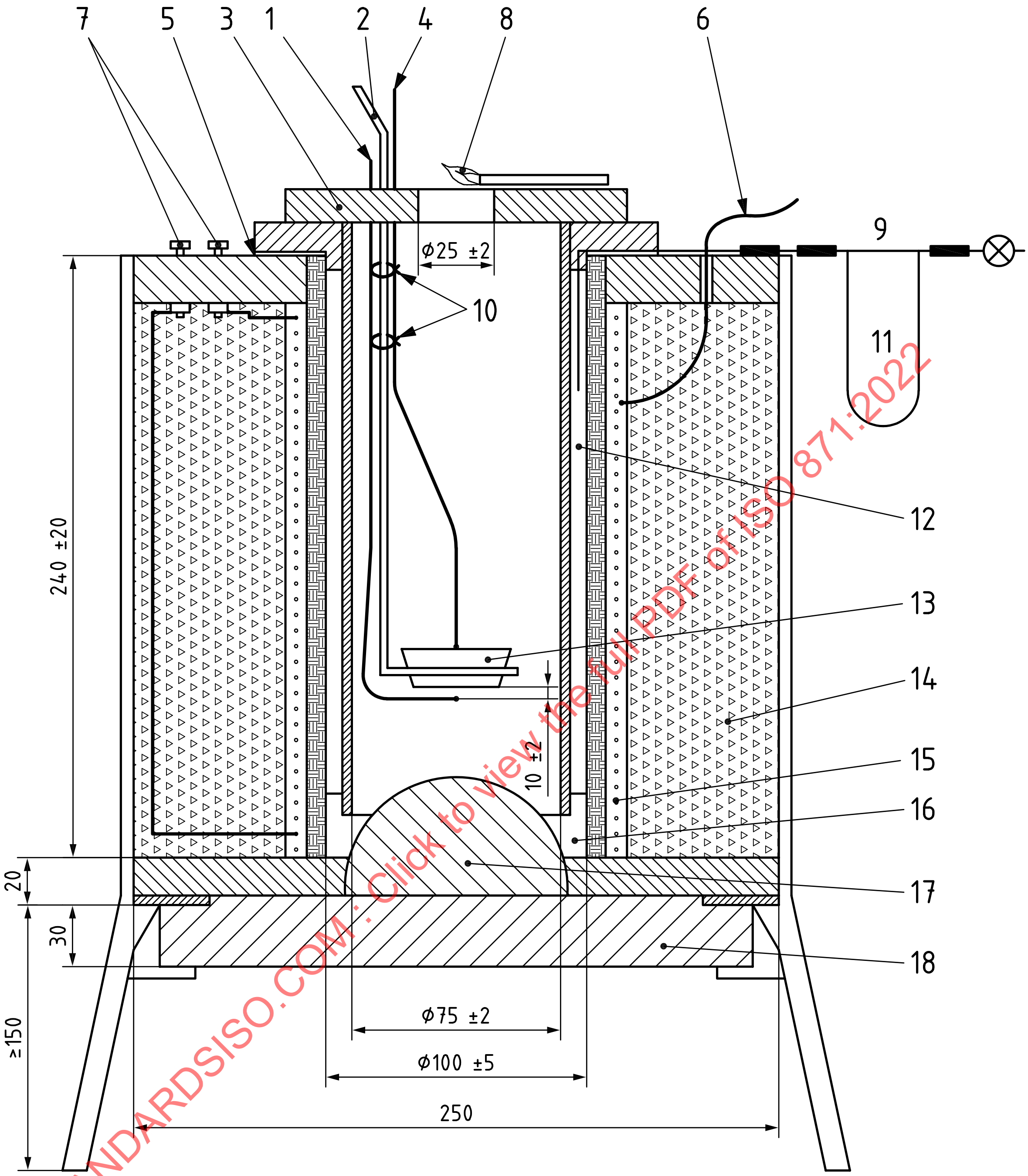
The spontaneous-ignition temperature is determined in the same manner as the flash-ignition temperature, but without the pilot flame.

NOTE The results from using Option 1 or Option 2 can potentially be different.

5 Apparatus

5.1 Option 1 — Setchkin furnace

5.1.1 Hot-air ignition furnace, similar to that shown in Figure 1, consisting primarily of an electrical heating unit and a specimen holder.



Key

1	thermocouple TC2	10	metal fasteners
2	support rod	11	air-flow meter (not part of furnace)
3	refractory disc cover	12	air flow tangential to cylinder
4	thermocouple TC_1	13	specimen pan
5	gasket	14	mineral fibre wool
6	thermocouple TC_3	15	50 turns of No. 16 nichrome wire in heat-resistant cement
7	heater terminals	16	three refractory blocks to space inner tube and support it
8	pilot flame	17	inspection plug (removable)
9	air supply	18	thermal insulation (removable)

Figure 1 — Cross section of hot-air ignition furnace

5.1.2 Furnace tube, with an inside diameter of 100 mm ± 5 mm and a length of 240 mm ± 20 mm, made of a ceramic that is suitable for use at a temperature of at least 750 °C. The tube shall be positioned vertically so that it stands on the furnace floor above a plug for the removal of accumulated residue.

5.1.3 Inner ceramic tube, capable of withstanding at least 750 °C, with an inside diameter of 75 mm ± 2 mm, a length of 240 mm ± 20 mm and a thickness of approximately 3 mm, placed centrally inside the furnace tube and positioned 20 mm ± 2 mm above the furnace floor on three small refractory spacer blocks. The top shall be covered by a disc of heat-resistant material with a 25 mm ± 2 mm diameter opening in the centre which is used for observations and allows the passage of smoke and gases. The pilot flame shall be located immediately above the opening.

5.1.4 Outside air source, to supply clean air near the top of the annular space between the ceramic tubes through a copper tube at a steady and controllable rate. The air shall be heated and circulated in the space between the two tubes and enter the inner ceramic tube at the bottom. The air flow shall be metered by a rotameter or other suitable device.

5.1.5 Electrical heating unit, made of 50 turns of 1,3 mm ± 0,1 mm nichrome wire or equivalent. The wires, contained within a mineral-fibre sleeve, shall be wound around the furnace tube and shall be embedded in heat-resistant cement.

5.1.6 Insulation, consisting of a layer of mineral-fibre wool approximately 60 mm thick, and covered by a sheet- iron jacket.

5.1.7 Pilot igniter, consisting of a copper tube of nominal inside diameter 1,8 ± 0,3 mm attached to a supply of 94 % minimum purity propane and placed horizontally 5 mm ± 1 mm above the top surface of the disc cover. The pilot flame shall be adjusted to 20 mm ± 2 mm in length and centred above the opening in the disc cover.

5.1.8 Specimen support and holder, consisting of a metal specimen pan made of 0,7 mm ± 0,3 mm thick stainless steel and measuring 40 mm ± 2 mm in diameter by 15 mm ± 2 mm in depth, having a rounded bottom and held in a ring of approximately 2 mm diameter stainless-steel welding rod. The ring shall be welded to a length of the same type of rod extending through the cover of the furnace, as shown in Figure 1. The bottom of the specimen pan shall be located 185 mm ± 2 mm down from the lower edge of the pilot igniter.

5.1.9 Thermocouples, 0,5 mm in diameter, chromel-alumel (type K) or iron-constantan (type J), for temperature measurement, connected to a calibrated recording instrument with a tolerance not exceeding ±2 °C. The thermocouple tolerance shall be in accordance with IEC 60584-2:1982, Table A.1; class 2 or better. They shall be installed as in Clause 6.

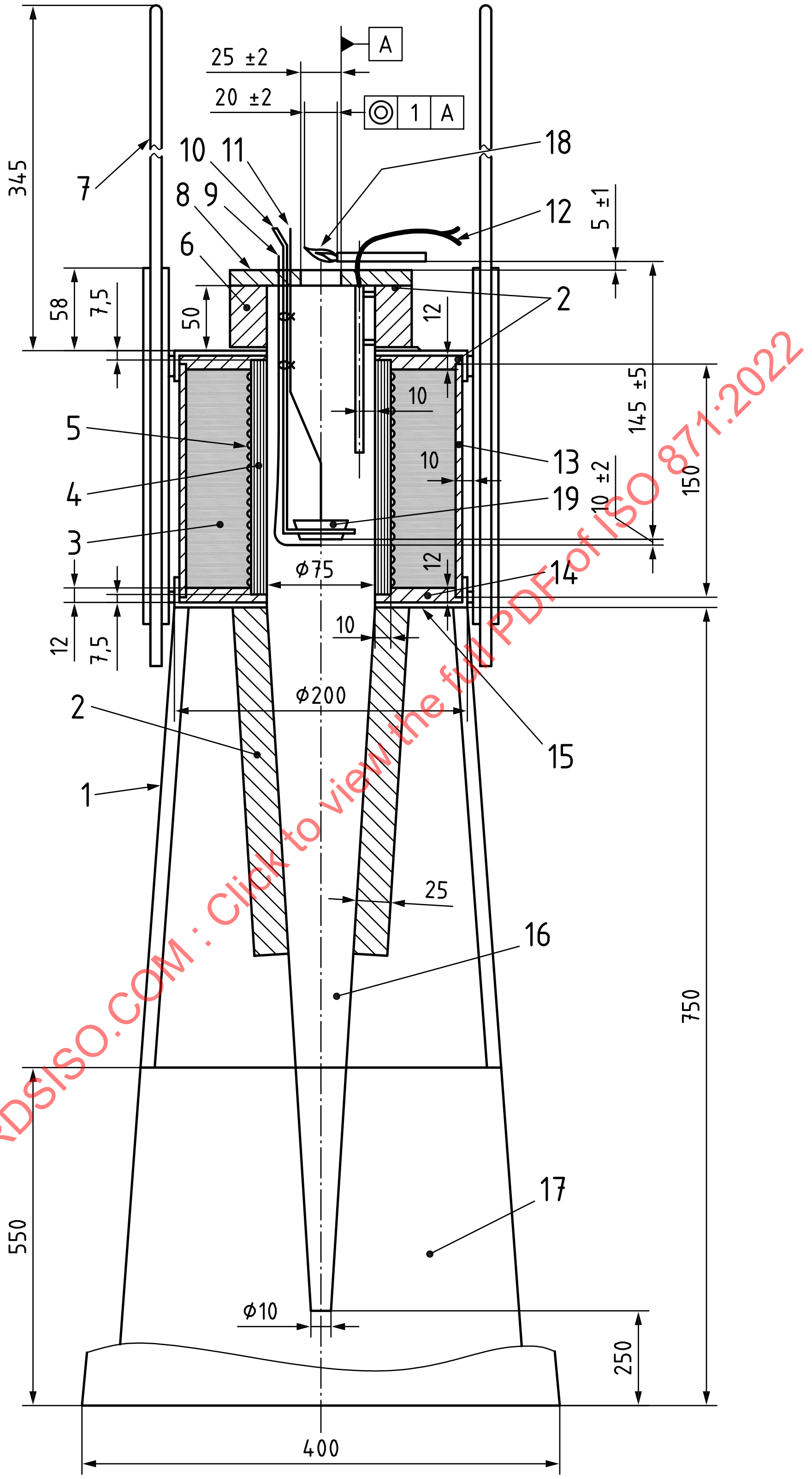
5.1.10 Heating control, consisting of a suitable variable transformer or an automatic controller connected in series with the heating coils.

5.1.11 Timing device, having an accuracy of 1 s or better.

5.2 Option 2 – ISO 1182 refractory tube furnace

5.2.1 The apparatus shall consist of a **refractory tube furnace** insulated and surrounded by a heating coil. The furnace specified in ISO 1182 shall be used. A cone-shaped airflow stabilizer shall be attached to the base of the furnace and a draft shield to its top. Details are shown in Figure 2.

Dimensions in millimetres



Key

1 stand

2 insulation

3 magnesium oxide powder

4 furnace tube

11 thermocouple TC_1

12 one of the two furnace thermocouples

13 external insulating wall

14 mineral fibre cement

5 heating coils
6 draft shield
7 heat resisting steel rod for insertion device
8 disc cover
9 thermocouple TC_2
10 support rod
15 seal
16 stabilizer cone
17 draft screen (metal sheet)
18 pilot flame
19 specimen pan

Figure 2 — Test apparatus for Option 2 (ISO 1182 refractory tube furnace)

5.2.1.1 Two furnace thermocouples shall be provided as specified in ISO 1182 and indicated in 6.3.2.

5.2.1.2 A thermal sensor shall be used to measure the furnace temperature along its central axis.

5.2.1.3 Unless stated otherwise, all dimensions shall have a 5 % tolerance.

5.2.2 Test furnace

5.2.2.1 The furnace tube shall be constructed of a refractory material, as specified in Table 1, of density 2 800 kg/m^3 ± 300 kg/m^3. The furnace tube shall be 150 mm ± 1 mm high with an internal diameter of 75 mm ± 1 mm and a wall thickness of 10 mm ± 1 mm.

Table 1 — Furnace tube refractory material for apparatus, Option 2 (ISO 1182 refractory tube furnace)

Material	**Composition** % (kg/kg mass)
Alumina (Al_2O_3)	>89
Silica and alumina (SiO_2, Al_2O_3)	>98
Ferric oxide (Fe_2O_3)	<0,45
Titanium dioxide (TiO_2)	<0,25
Manganese oxide (Mn_3O_4)	<0,1
Other trace oxides (sodium, potassium, calcium and magnesium oxides)	The balance

5.2.2.2 The top of the draught shield shall be covered by a disc of heat-resistant material with a 25 mm ± 2 mm diameter opening in the centre that is to be used for observation and passage of smoke and gases. The pilot flame shall be located immediately above the opening.

5.2.2.3 The furnace tube shall be surrounded by an annular space of the following dimensions: 150 mm high and of 10 mm wall thickness.

5.2.2.4 The annular space shall be fitted with top and bottom plates, recessed internally to locate the ends of the furnace tube.

5.2.2.5 The annular space shall be insulated with a 25 mm layer of an insulating material having a thermal conductivity of 0,04 W/(m·K) ± 0,01 W/(m·K) at a mean temperature of 20 °C. Magnesium oxide powder of a nominal bulk density of 170 kg/m^3 ± 30 kg/m^3 is a suitable material for this use.

5.2.2.6 The furnace tube shall be provided with a single winding of 80/20 nickel/chromium electrical resistance tape, 3 mm ± 0,1 mm wide and 0,2 mm ± 0,01 mm thick.

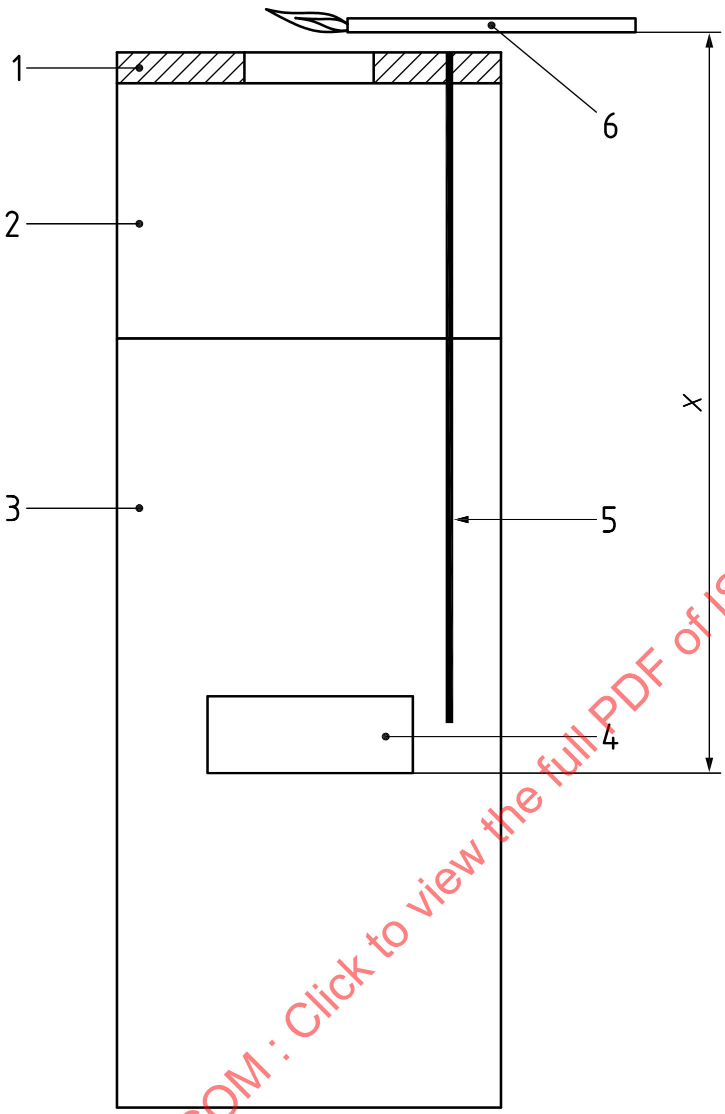
5.2.2.7 An open-ended cone-shaped air-flow stabilizer shall be attached to the underside of the furnace. The air-flow stabilizer shall be 500 mm long and shall be reduced uniformly from an internal diameter of 75 mm ± 1 mm at the top to an internal diameter of 10,0 mm ± 0,5 mm at the bottom. The air flow stabilizer shall be manufactured from 1 mm thick sheet steel, with a smooth finish on the inside. The joint between the air flow stabilizer and the furnace shall have an airtight fit, with an internal smooth finish. The upper half of the air flow stabilizer shall be insulated with a 25 mm layer of an insulating material having a thermal conductivity of 0,04 W/(m·K) ± 0,01 W/(m·K) at a mean temperature of 20 °C (68 °F). Mineral fibre insulating material with a nominal thermal conductivity of 0,04 W/(m·K) ± 0,01 W/(m·K) at a mean temperature of 20 °C is a suitable material for this use.

5.2.2.8 A draft shield, constructed of the same material as the air flow stabilizer, shall be provided at the top of the furnace. It shall be 50 mm high and have an internal diameter of 75 mm ± 1 mm. The draft shield and its joint with the top of the furnace shall have smooth internal finish. The exterior shall be insulated with a 25 mm layer of an insulating material having a thermal conductivity of 0,04 W/(m·K) ± 0,01 W/(m·K) at a mean temperature of 20 °C. Mineral fibre insulating material with a nominal thermal conductivity of 0,04 W/(m·K) ± 0,01 W/(m·K) at a mean temperature of 20 °C is a suitable material for this use.

5.2.2.9 The assembly, consisting of the furnace, air flow stabilizer cone and draft shield, shall be mounted on a firm horizontal stand, with a base and draft screen attached to the stand, to reduce drafts around the bottom of the stabilizer cone. The draft screen shall be 550 mm high, and the bottom of the air flow stabilizer cone shall be located 250 mm above the base plate.

5.2.3 Specimen support and holder. The specimen pan shall consist of a metal specimen pan of 0,7 mm ± 0,3 mm thick stainless steel, measuring 40 mm ± 2 mm in diameter by 15 mm ± 2 mm in depth, having a rounded bottom. The specimen pan is held in a ring of approximately 2,0 mm diameter stainless steel welding rod. The ring shall be welded to a length of the same type of rod extending through the cover of the furnace. The bottom of the specimen pan shall be located 145 mm ± 5 mm down from the lower edge of the pilot igniter.

5.2.3.1 The location of the test specimen in the Option 2 (ISO 1182 refractory tube furnace) shall be as indicated in Figure 3.



Key

1 refractory disc cover
2 draught shield
3 furnace tube
4 specimen pan
5 furnace thermocouple
6 copper tube
7 pilot flame
X distance from copper tube to bottom of specimen pan: 145 ± 5 mm

Figure 3 — Test specimen location

5.2.4 Thermocouples, 0,5-mm diameter, Chromel-Alumel (Type K) or Iron-Constantan (Type J), for temperature measurement connected to a calibrated recording instrument with a tolerance not exceeding ±2 °C. The thermocouple tolerance shall be in accordance with IEC 60584-2:1982, Table 1, Class 2 or better.

5.2.5 Heating control. A suitable variable transformer or an automatic controller connected in series with the heating coils.

5.2.6 Timing device, having an accuracy of at least 1 s.

5.2.7 Pilot igniter, consisting of a nominal 1,8 mm ± 0,3 mm inside diameter (ID) copper tubing attached to a gas supply of 94 % minimum purity propane and placed horizontally 5 mm ± 1 mm above the top surface of the disc cover. The pilot flame shall be adjusted to 20 mm ± 2 mm in length and centred above the opening in the disc cover.

6 Location of thermocouples

6.1 Thermocouple TC_1 (see Figure 1, for option 1) measures the temperature T_1 of the specimen. It is located as close as possible to the centre of the upper surface of the specimen when the specimen is in place within the furnace. The thermocouple wire is attached to the specimen support rod.

6.2 Thermocouple TC_2 gives some indication of the temperature T_2 of the air travelling past the specimen. It is located 10 mm ± 2 mm below the centre of the specimen pan. The thermocouple wire is conveniently attached to the specimen support rod.

6.2.1 It is acceptable to install thermocouple TC_2 through a hole drilled adjacent to the inspection plug below the specimen pan, instead of introducing it from the top, as shown in Figure 1, for option 1.

6.3 Furnace thermocouples

6.3.1 Furnace thermocouple for Option 1 (Setchkin furnace). Thermocouple TC_3 measures the temperature T_3 of the heating coil. It is located adjacent to the furnace heating coil and is used as a reference for temperature adjustment purposes. A metallic sheathed thermocouple with a diameter not greater than 1,7 mm is permitted to be used for thermocouple TC_3. The limit on thermocouple thickness does not apply to thermocouple TC_3.

6.3.2 Furnace thermocouples for Option 2 (ISO 1182 refractory tube furnace). Two thermocouples shall be used, with a wire diameter of 0,3 mm and an outer diameter of 1,5 mm. The hot junction shall be insulated and not earthed. The thermocouples shall be of either type K or type N. They shall be of tolerance class 1 in accordance with IEC 60584-1. The sheathing material shall be either stainless steel or a nickel-based alloy. All new thermocouples shall be artificially aged before use to reduce reflectivity.

NOTE 1 A suitable method of ageing is to run a test without any test specimen inserted for 1 h.

The two furnace thermocouples, $TC_{3.1}$ and $TC_{3.2}$, shall be located with each of their hot junctions (10 ± 0,5) mm from the tube wall and at a height corresponding to the geometric centre of the furnace tube.

NOTE 2 Further information can be found in ISO 1182.

7 Test specimens

7.1 It is acceptable to use, as test specimens, materials, or products, supplied in any form, with some examples being pellets, powders and films. It is also acceptable to use composites as test specimens. The test report shall include full details of the form in which the test specimens have been tested.

NOTE 1 Specimens containing high levels of inorganic fillers can be difficult to evaluate.

NOTE 2 In some cases, different results can be obtained if the same material is tested in different forms.

7.2 For materials having a density greater than 100 kg/m^3, a specimen mass of 3,0 g ± 0,2 g shall be used.

7.3 For information on testing particular types of materials, see 7.3.1 to 7.3.3.

7.3.1 For sheet materials, cut the sheet into squares of maximum size (20 mm ± 2 mm) × (20 mm ± 2 mm) and stack these to a height which gives the required specimen mass.

7.3.2 For film materials, roll up a strip 20 mm ± 2 mm wide and of length sufficient to give the required specimen mass.

7.3.3 For cellular materials having a density less than 100 kg/m^3, remove any outer skin and cut specimens in the form of a block measuring (20 mm ± 2 mm) × (20 mm ± 2 mm) × (50 mm ± 5 mm). Binding the specimen with a thin wire is acceptable if the specimen is bulky and light and is so easily affected by the furnace air flow that it is feasible that the specimen will potentially fall out of the tray.

7.4 Sufficient material is required for at least two determinations.

7.5 Condition the test specimens at 23 °C ± 2 °C and (50 ± 5) % relative humidity for not less than 40 h prior to test, in accordance with ISO 291.

8 Procedure

8.1 Flash-ignition temperature (FIT)

8.1.1 In case the option 1 (Setchkin) furnace is used, set the air velocity to 25 mm/s by adjusting the actual air-flow rate (q_V) through the full section of the inner tube (5.1.3) at the furnace temperature to a value calculated in litres per minute from Formula (1):

$$q_V = 6{,}62 \times \frac{293}{T} \qquad (1)$$

where T is the temperature, expressed in K.

Ensure that the air-flow rate is maintained at ±10 % of the calculated value. In case the option 2 furnace is used, the air flow through the furnace shall be left as natural convection air flow coming through the stabilizer cone.

8.1.2 Adjust the electric current supplied to the heating coil (5.1.5) by means of the variable transformer or automatic controller (5.1.10), by reference to temperature T_3, until the air temperature T_2 remains constant for at least 10 minutes at the desired initial test temperature, within ±5 K of the desired initial test temperature.

8.1.3 Use as the default initial test temperature, a temperature of 400 °C when no prior knowledge of the probable ignition temperature of the material or product to be tested is available.

8.1.4 If information is available regarding the approximate ignition temperature of the material or product to be tested is known, set the initial test temperature to 50 °C below the expected ignition temperature.

8.1.5 Follow the steps from 8.1.5.1 to 8.1.5.5 to assess the flash ignition temperature. Continuous burning of the specimen is likely to follow the ignition step.

8.1.5.1 Raise the specimen pan to the cover opening and place the specimen on the pan.

8.1.5.2 Ensure that thermocouples TC_1 and TC_2 are in their correct position, in accordance with Clause 6.

8.1.5.3 Lower the pan into the furnace.

8.1.5.4 Start the timer and ignite the pilot flame.

8.1.5.5 Watch for the occurrence of the following events, the first of which shall be used to represent evidence of ignition with this test method:

a) flaming combustion of the specimen;

b) glowing combustion of the specimen;

c) flash;

d) explosion;

e) rapid rise in temperature T_1 above that of T_2.

8.1.6 At the end of 10 min, lower or raise the temperature T_2 by 50 °C, depending on whether ignition has or has not occurred, and repeat the test with a fresh specimen.

8.1.7 When the range within which the flash-ignition temperature lies has been determined, begin tests 10 °C below the highest temperature within this range and continue by dropping the temperature in 10 °C steps until the temperature is reached at which there is no ignition during a 10 min period.

8.1.8 Record as the flash-ignition temperature the lowest air temperature T_2 at which a flash ignition (in accordance with 8.1.5) is observed during the 10 min period.

8.2 Spontaneous-ignition temperature (SIT)

8.2.1 Follow the same procedure as in 8.1 but with two exceptions, as shown in 8.2.1.1 and 8.2.1.2.

8.2.1.1 Do not use the pilot flame.

8.2.1.2 Use the criteria shown in 8.2.2 instead of the criteria shown in 8.1.5.5 to determine when ignition has occurred.

8.2.2 The occurrence of the first one of the following events shall be considered evidence of spontaneous ignition:

a) flaming combustion of the specimen;

b) glowing combustion of the specimen;

c) rapid rise in temperature of T_1 above that of T_2.

NOTE It is difficult, with some materials, to detect visually the evidence of spontaneous ignition when burning occurs by glowing combustion rather than by flaming combustion. When that is the case, the most reliable means of assessing spontaneous ignition is via a rapid rise in temperature, T_1 above T_2.

8.2.3 Record as the spontaneous-ignition temperature the lowest air temperature T_2 at which flaming or glowing combustion of the specimen is observed within the 10 min period.

Determination of ignition temperatures is a process which is very sensitive to outer conditions. It is therefore necessary to keep strictly to the test conditions and procedures specified in this document.

9 Precision

Precision data based on interlaboratory trials are given in Annex A.

10 Test report

The test report shall include the following:

a) a reference to this document, i.e. ISO 871:2022, with a description of the option chosen, since the results are potentially different between both options;

b) the designation of the material, including name of manufacturer and composition;

c) the mass of the test specimen, in grams;

d) the form of the material (granules, sheet, etc.);

e) the density of cellular materials, in kilograms per cubic metre;

f) the flash-ignition temperature (FIT), in degrees Celsius (°C)

g) the spontaneous-ignition temperature (SIT), in degrees Celsius (°C);

h) whether the combustion observed was flaming or glowing;

i) observations about the behaviour of the specimen during the test (how ignition occurred, formation of soot or smoke, excessive foaming, melting, bubbling, smoking, etc.);

j) the following pair of statements:

"These test results relate only to the behaviour of test specimens under the particular conditions of the test. They are not intended to be used, and shall not be used alone, to assess the potential fire hazards of a material in use."

"The ignition temperatures are a function of the test method (and option) used and are not an intrinsic property of the material or product tested."

Annex A
(informative)

Results obtained by interlaboratory trials using Option 1 (Setchkin furnace)

A.1 These precision data were determined from interlaboratory tests, involving seven laboratories, on five polymeric materials, with three replicates of each material. The resulting data were analysed in accordance with ISO 5725-2 and are summarized in Tables A.1 and A.2. Whilst the repeatability of the method for all materials tested was good, the reproducibility of the method for some materials was poor. For example, phenol-formaldehyde resin was an outlier in the tests and the data have been omitted from the analysis. It is possible to attribute the observations with phenol- formaldehyde resin to the subjective nature of the ignition characteristics of this material (see 8.2.2). The laboratories used Option 1 (Setchkin furnace).

Table A.1 — Flash-ignition temperature (FIT)

Values in degrees Celsius

	Physical form	Average FIT	Repeatability limit	Reproducibility limit
High-impact polystyrene	granulated	382	11	13
High-impact FR polystyrene	granulated	370	13	52
Polyamide 6	granulated	412	4	42
Poly(vinyl chloride) film	thickness 0,15 mm	325	11	45
Polyurethane foam, flexible	thickness 25 mm	346	12	66

Table A.2 — Spontaneous-ignition temperature (SIT)

Values in degrees Celsius

	Physical form	Average SIT	Repeatability limit	Reproducibility limit
High-impact polystyrene	granulated	458	12	59
High-impact FR polystyrene	granulated	422	14	47
Polyamide 6	granulated	439	6	59
Poly(vinyl chloride) film	thickness 0,15 mm	437	13	64
Polyurethane foam, flexible	thickness 25 mm	374	4	58

A.2 Repeatability limit — the value less than or equal to which the absolute difference between two test results obtained under repeatability conditions is expected to be with a probability of 95 %. The repeatability limits for this test method does not normally exceed those shown in Tables A.1 and A.2.

A.3 Reproducibility limit — the value less than or equal to which the absolute difference between two test results obtained under reproducibility conditions is expected to be with a probability of 95 %. The reproducibility limits for this test method does not normally exceed those shown in Tables A.1 and A.2.

A.4 Two averages (each determined from three specimens) are to be considered suspect and not equivalent if they differ by more than the repeatability or reproducibility limits shown in Tables A.1 or A.2.