
**Plastics — Decorative solid surfacing
materials —**

**Part 2:
Determination of properties — Sheet
goods**

*Plastiques — Matériaux décoratifs massifs de revêtement de surface —
Partie 2: Détermination des propriétés — Produits en feuilles*



Reference number
ISO 19712-2:2007(E)

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 19712-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

ISO 19712 consists of the following parts, under the general title *Plastics — Decorative solid surfacing materials*:

- *Part 1: Classification and specifications*
- *Part 2: Determination of properties — Sheet goods*
- *Part 3: Determination of properties — Solid surface shapes*

Introduction

This part of ISO 19172 is intended for use by manufacturers, installers and specifiers of solid surfacing materials.

The test methods and minimum performance values presented have been related as closely as possible to end-use applications. The fabrication techniques employed may, however, have a bearing on product performance and service.

The performance requirements include impact resistance, structure, renewability, colourfastness, cleanability, stain resistance, water resistance, chemical resistance, bacterial and fungal resistance, and other significant properties.

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Plastics — Decorative solid surfacing materials —

Part 2: Determination of properties — Sheet goods

SAFETY STATEMENT — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory conditions.

1 Scope

This part of ISO 19712 specifies the methods of test for determination of the properties of solid surfacing materials, as defined in Clause 3, in the form of sheets. These methods are primarily intended for testing the materials specified in ISO 19712-1.

The tests may be carried out on finished sheets, but are generally carried out on test specimens of a size sufficient to meet the requirements of the test, and of the same material and finish as the finished sheet.

2 Normative references

The following referenced documents are indispensable for the application 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 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 105-B02, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test*

ISO 209:2007, *Aluminium and aluminium alloys — Chemical composition*

ISO 1770, *Solid-stem general purpose thermometers*

ISO 2039-1, *Plastics — Determination of hardness — Part 1: Ball indentation method*

ISO 2039-2, *Plastics — Determination of hardness — Part 2: Rockwell hardness*

ISO 3668, *Paints and varnishes — Visual comparison of the colour of paints*

ISO 4211:1979, *Furniture — Assessment of surface resistance to cold liquids*

ISO 4892:1981, *Plastics — Methods of exposure to laboratory light sources*¹⁾

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

1) Withdrawn, but still used in certain Asian countries.

ISO 19712-2:2007(E)

ISO 4892-2:2006, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 9370, *Plastics — Instrumental determination of radiant exposure in weathering tests — General guidance and basic test method*

ISO 19712-1, *Plastics — Decorative solid surfacing materials — Part 1: Classification and specifications*

CIE Publication No. 85:1989, *Solar spectral irradiance*

ASTM D 2244, *Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates*

ASTM D 2583, *Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor*

3 Terms and definitions

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

3.1 solid surfacing material
SSM
material, composed of polymeric materials together with pigments and fillers, intended to be cast into sheets or shaped products

NOTE 1 The material is of the same composition throughout the whole thickness of the sheet or product.

NOTE 2 Sheets and products made from SSMs are repairable and renewable to the original finish.

NOTE 3 SSMs can also be fabricated into continuous sheets with inconspicuous seams.

4 Cleaning the test specimen surface

4.1 General

The surface to be tested shall be prepared prior to testing using the procedure specified in 4.3.

4.2 Materials

4.2.1 **Cellulose sponge.**

4.2.2 **Non-abrasive cleanser**, containing a bleaching agent.

4.2.3 **Water.**

4.2.4 **Clean, absorbent, lint-free material.**

4.3 Procedure

Clean the surface using a damp sponge and non-abrasive cleanser containing a bleaching agent, scrubbing the surface with light hand pressure for up to 1,0 min/m². Rinse the prepared surface with water and dry with clean, absorbent, lint-free material.

5 Surface defects

5.1 Procedure

The entire finished surface of a suitable-size sheet shall be rubbed with a sponge and a 50 % solution of tap water and water-soluble black or blue-black ink after the surface has been washed and dried as described in 4.3. When inspecting coloured sheets, contrasting-coloured ink shall be used. The ink shall be wiped from the surface with a damp cloth and the surface dried before inspection.

5.2 Method of inspection of surface

After being inked in accordance with 5.1, the surface of the sheet shall be inspected with the unaided eye for defects and blemishes from a distance of between 305 mm and 610 mm, using a light source giving an illumination intensity of $(1\,615 \pm 540)$ lx near the surface to be inspected.

5.3 Performance requirements

The finished surfaces of sheets shall be free from cracks, chipped areas, pinholes and blisters.

Spots, dirt and similar surface blemishes are admissible provided the total area covered by such blemishes is not more than $1,0\text{ mm}^2/\text{m}^2$ of sheet surface. The blemishes may be concentrated in one place or scattered over the sheet.

5.4 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) whether the surface was free from cracks, chipped areas, etc.;
- d) whether the area covered by spots, dirt, etc., was more than $1,0\text{ mm}^2/\text{m}^2$ of sheet surface;
- e) any deviation from the method specified;
- f) the date of the test.

6 Consistency of colour

6.1 Test apparatus and materials

6.1.1 Tabletop, approximately 760 mm above the floor.

6.1.2 Overhead white fluorescent lights, with the bulbs positioned parallel to the line of sight and providing an illumination intensity of 800 lx to 1 100 lx at the tabletop.

6.1.3 Manufacturer's recommended seam adhesive.

6.1.4 Manufacturer's recommended abrasives and random orbital sander.

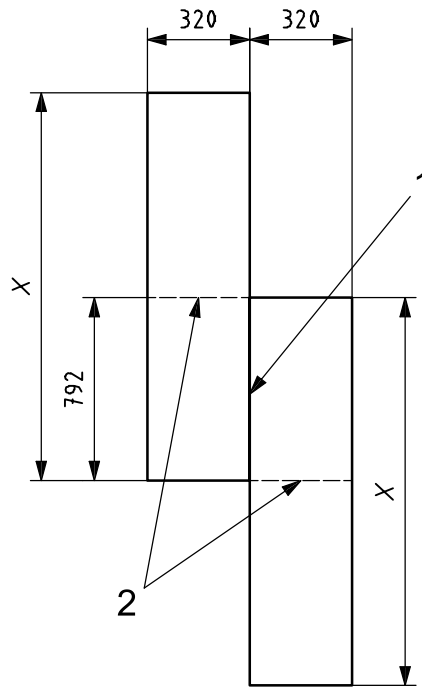
6.2 Test specimens

Two specimens shall be prepared, one from the beginning of the lot and the other from the end of the lot.

For each test specimen, cut two strips, each 320 mm wide, from the full width of the sheet and bond the strips together, offset by 792 mm, with the manufacturer's recommended adhesive as shown in Figure 1. The strips shall be bonded in the same direction as they were removed from the sheet. Cut off the two unbonded portions of the panel thus prepared to give a $(640 \pm 0,5) \text{ mm} \times (792 \pm 0,5) \text{ mm}$ specimen with a bond seam running down the centreline between the midpoints of the 640-mm-long sides as shown in Figure 2. Finish the seamed specimen by sanding with an orbital sander.

The seam shall be made and finished in strict accordance with the manufacturer's recommendations for the fabrication and finishing of seamed panels.

Dimensions in millimetres



Key

- 1 seam
- 2 cut lines

X = full width of sheet

Figure 1 — Fabrication of seamed panel from which specimen is cut

Dimensions in millimetres

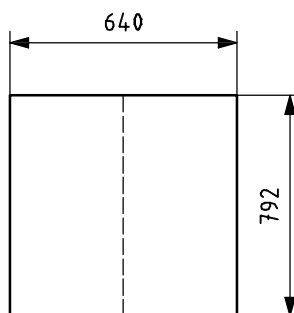


Figure 2 — Seamed specimen

6.3 Test procedure

Place a specimen on the table face up and view it under the illumination defined in 6.1.2 at an eye-to-specimen distance of 760 mm to 910 mm. View the specimen at angles of approximately 45° and 75°.

6.4 Performance requirement

There shall be no noticeable base colour change along the length of the seam.

6.5 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) whether there was any noticeable base colour change along the seam;
- d) any deviation from the method specified;
- e) the date of the test.

7 Load test

7.1 Clamping frame

The clamping frame for conducting the load test shall be constructed so as to provide an area measuring $(610 \pm 0,6)$ mm \times $(762 \pm 0,6)$ mm over which the test specimen is unsupported.

7.2 Test specimen

A seamed specimen shall be used for the test. The specimen shall be fabricated as specified in 6.2.

7.3 Test method

Mount the seamed specimen in the clamping frame so that it is held securely at the four corners of the specimen and so that the seam runs between the midpoints of the 762-mm-long sides of the unsupported area inside the clamping frame (see Figure 3).

Apply a load of 1 334 N to the midpoint of the specimen via a weight distribution disc 203 mm in diameter resting on a 13 mm thick layer of sponge rubber or other suitable soft material located between the disc and the specimen surface. Leave the load in place for $(2,5 \pm 0,5)$ min to allow for settlement of the clamping frame and any initial slip in the fasteners. Then remove it.

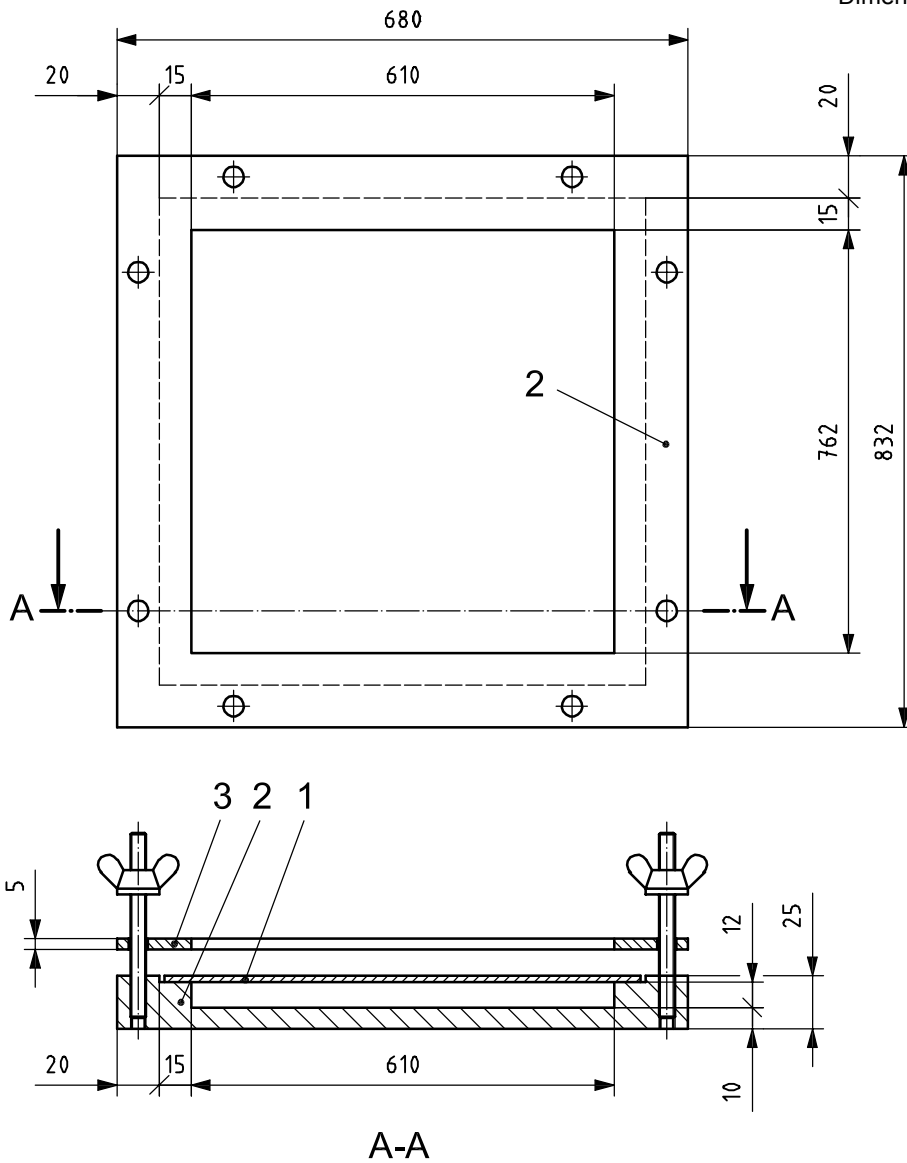
$(12,5 \pm 2,5)$ min after removal of the load, reapply the 1 334 N load for not less than 1,5 min or more than 2 min.

10 min after removal of the load, measure the residual deflection of the midpoint of the specimen with a deflectometer or other suitable device capable of measuring deflections of up to 0,25 mm.

7.4 Performance requirement

There shall be no cracks in the surface of the specimen when inspected after inking as described in 5.1 and 5.2. The maximum residual deflection shall not exceed 0,25 mm after removal of the load.

Dimensions in millimetres



Key

- 1 specimen
- 2 lower metal frame
- 3 upper metal frame, thickness 5 mm

Figure 3 — Clamping frame for load test (see 7.1)

7.5 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) whether cracks were formed in the surface of the specimen;
- d) whether the maximum residual deflection exceeded 0,25 mm;
- e) any deviation from the method specified;
- f) the date of the test.

8 Resistance to impact by large-diameter ball

8.1 Principle

A specimen taken from the sheet under test is covered with a sheet of carbon paper and subjected to the impact of a steel ball, which is allowed to fall from a known height. Impact resistance is expressed as the maximum drop height which can be achieved without incurring visible surface cracking or producing an imprint greater than a specified maximum diameter.

8.2 Apparatus

8.2.1 Free-fall test apparatus, of the type shown in Figure 4, or an equivalent which will produce the same results.

8.2.2 Polished steel ball, of mass $(324 \pm 5,0)$ g and diameter $(42,8 \pm 0,2)$ mm, having no damaged or flattened areas on its surface.

8.2.3 Specimen clamping frame, conforming to Figure 5.

8.3 Test specimens

Specimens shall measure $(230 \pm 0,5)$ mm \times $(230 \pm 0,5)$ mm \times the thickness of the sheet under test.

8.4 Procedure

The test shall be carried out in the laboratory atmosphere, and in cases of dispute it shall be carried out at (23 ± 2) °C.

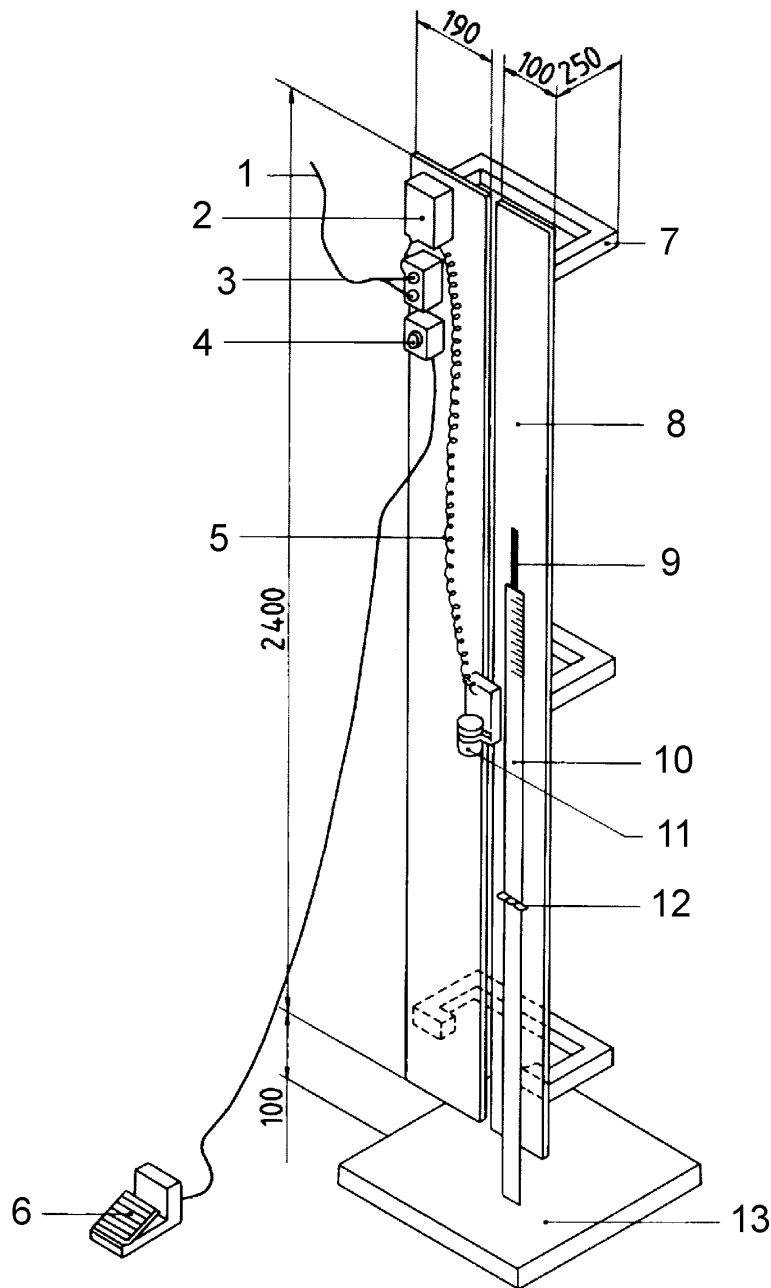
Clamp a specimen in the clamping frame (8.2.3) and place the assembly on the solid base of the free-fall test apparatus (8.2.1). Cover the specimen with a sheet of carbon paper with its coated face in contact with the decorative surface. Adjust the height scale so that its base is touching the face of the specimen.

Position the electromagnet at any arbitrary height (the specification limit for the material under test is a useful starting point).

Place the steel ball (8.2.2) on the energized electromagnet. Operate the release mechanism so that the ball falls on the specimen, catching the ball on the first rebound so that multiple impacts do not occur.

Examine the impact spot. If cracking is evident, or the carbon imprint is greater than the diameter specified in ISO 19712-1, lower the electromagnet and repeat the test. If no cracking is evident and the imprint is smaller than the specified diameter, raise the electromagnet and repeat the test. The distance between points of impact, and between points of impact and the edge of the specimen, shall be at least 50 mm. For referee purposes, only one impact per specimen shall be made, with the point of impact as near as possible to the centre of the specimen.

Repeat the above procedure, as necessary, to determine the impact resistance, which is defined as the maximum height for which no visible surface cracking, or imprint greater than the specified diameter, occurs in five successive strikes.

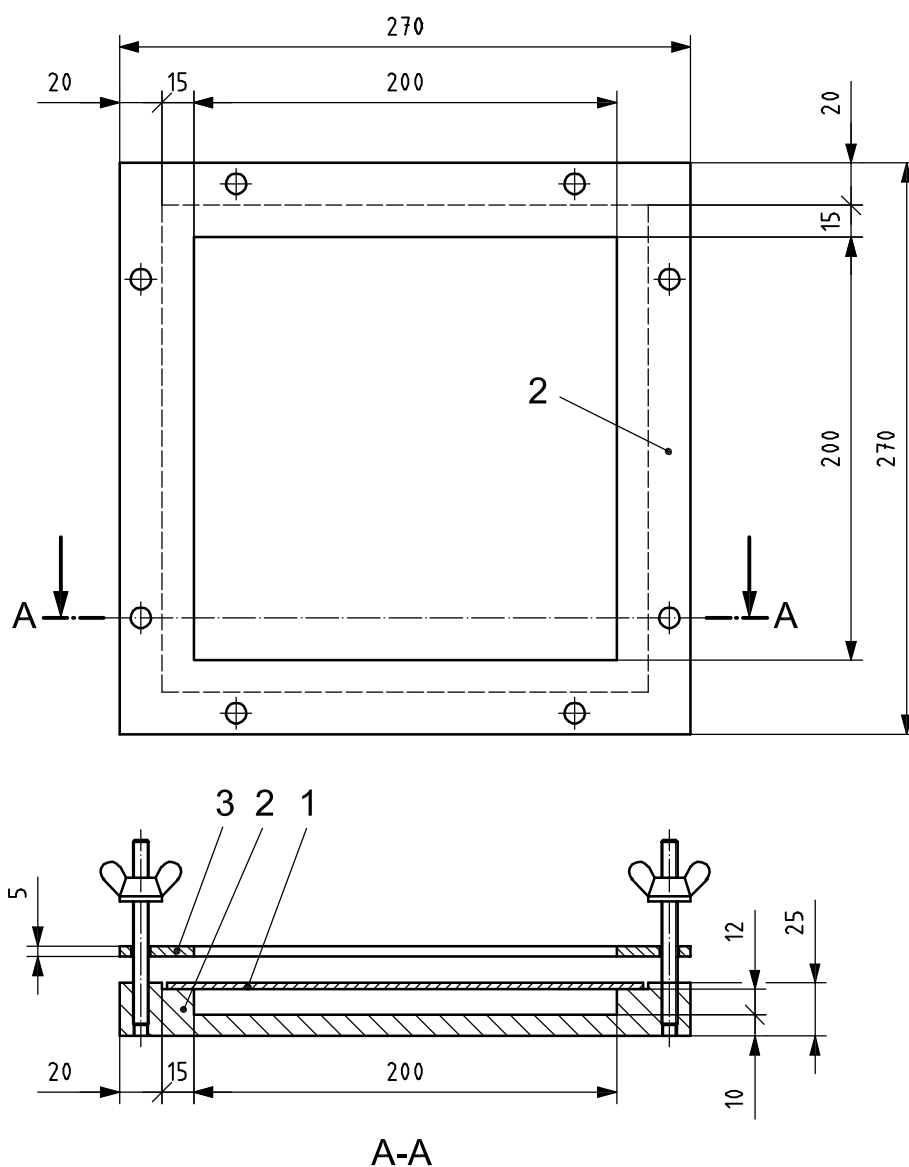


Key

- | | | | |
|---|--|----|---|
| 1 | electric power supply | 9 | 6-mm-wide slot |
| 2 | transformer and rectifier | 10 | slidabale machinist's steel scale |
| 3 | junction box with two-pin socket | 11 | electromagnet on sliding mount |
| 4 | junction box with indicator light | 12 | wing nut |
| 5 | coiled wire lead | 13 | 450 mm × 450 mm × 20 mm steel base plate, levelled and set firmly to floor, and projecting out far enough in front of the stand for the whole of the clamping frame holding the test specimen (see Figure 5) to be placed on it |
| 6 | foot treadle switch | | |
| 7 | angle iron brackets (attached firmly to wall or column, plumb and perpendicular to base plate) | | |
| 8 | mounting board for test apparatus (medium- or high-density chipboard) | | |

Figure 4 — Resistance to impact by large-diameter ball (see 8.2.1)

Dimensions in millimetres



Key

- 1 specimen
- 2 lower metal frame
- 3 upper metal frame, thickness 5 mm

Figure 5 — Clamping frame for resistance to impact by large-diameter ball (see 8.2.3)

8.5 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) the impact resistance, expressed in centimetres;
- d) the indentation diameter, expressed in millimetres;
- e) any deviation from the method specified;
- f) the date of the test.

9 Lightfastness

9.1 Method A

9.1.1 Principle

A specimen taken from the sheet under test is exposed to daylight simulated by the filtered light of one or more xenon-arc lamps. The effect on the colour of the specimen, at a specified radiant exposure, is assessed by the contrast between the exposed and unexposed portions of the test specimen. The radiant exposure is determined both instrumentally and by assessing the effect on blue wool references which are exposed simultaneously.

Daylight spectral distribution is specified since SSM sheets may, in certain applications, be exposed to direct daylight through open windows.

9.1.2 Apparatus

9.1.2.1 Test device, as specified in ISO 4892-1 and ISO 4892-2, equipped with:

- a) one or more xenon-arc lamps, filtered to provide a spectral energy distribution which closely approximates to that of solar irradiance as described in CIE Publication No. 85:1989, Table 4, and ISO 4892-2:2006, Table 1 (method A);
- b) stainless-steel specimen holders, in the form of an open frame, which provide the test specimens with a solid backing;
- c) a black-standard thermometer as specified in ISO 4892-1;
- d) a photoelectronic sensor (radiometer) of one of the types specified in ISO 9370 to measure the irradiance and the radiant exposure at the specimen surface in the wavelength range 300 nm to 400 nm, or at 340 nm.

9.1.2.2 Viewing enclosure, having a matt interior colour corresponding approximately to Munsell N5. It shall be equipped with an artificial light source, located at the top, simulating average north sky daylight (e.g. tungsten-halogen incandescent lamps) and generating a colour temperature of $(6\,500 \pm 200)$ K and at least 800 lx at the surface of the specimen. The viewing enclosure shall be placed in a position where the surrounding lighting conditions will not affect the visual assessment of the specimen.

9.1.3 Test specimen

One test specimen shall be prepared, of a size suitable for the specimen holder used and appropriate for the method of assessment after exposure.

9.1.4 Procedure

The test specimen and a set of blue wool references 5, 6 and 7 (as specified in ISO 105-B02) shall be exposed simultaneously. Blue wool references 5 and 7 are included to provide confirmation that wool reference 6 has degraded to the specified degree of contrast.

Using opaque stainless-steel covers, shield approximately one-half of both the test specimen and the set of blue wool references.

Carry out the test in accordance with ISO 4892-2 under the following operating conditions:

- a) irradiance at the test specimen surface in the wavelength range 300 nm to 400 nm: $(60 \pm 3) \text{ W/m}^2$; or at wavelength 340 nm: $(0,5 \pm 0,03) \text{ W/m}^2$;
- b) black-standard temperature: $(65 \pm 3) \text{ }^\circ\text{C}$;
- c) relative humidity: $(50 \pm 5) \%$.

Discontinue the exposure when the contrast between the exposed and unexposed portions of blue wool reference 6 is equal to grade 4 on the grey scale, as defined in ISO 105-A02 (see Note 1).

Measure and record the radiant exposure (over 300 nm to 400 nm, or at 340 nm).

Remove the test specimen from the apparatus, take off the cover, and leave the specimen for $(24 \pm 2) \text{ h}$ in dark conditions to prevent extraneous darkening and/or photochromism (see Note 2).

NOTE 1 Although the use of blue wool references is no longer the preferred method of measuring radiant exposure, the method is still in common use and is therefore permitted. Once sufficient data have been collected, the end-point of the test will be defined by the level of radiant exposure.

NOTE 2 Extraneous darkening and/or photochromism are due to the shock effect of accelerated exposure, and are not characteristics of natural exposure. Keeping the specimens in dark conditions for 24 h allows recovery from these effects.

9.1.5 Assessment of specimen and expression of results

Place the test specimen in the viewing enclosure (9.1.2.2).

Examine the surface of the test specimen with the naked eye, corrected if necessary, at a distance of approximately 500 mm for any change in colour, assessing the contrast between the exposed and unexposed portions of the test specimen in terms of a grade on the grey scale in accordance with ISO 105-A02.

The lightfastness of the test specimen is expressed in terms of the contrast being greater than, equal to or less than grade 4 on the grey scale.

9.1.6 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name, type and nominal thickness of the sheet;
- c) details of the apparatus used;
- d) the irradiance at the test specimen surface;
- e) the radiant exposure;
- f) the exposure time;

- g) the lightfastness of the specimen;
- h) any deviation from the method specified;
- i) the date of the test.

9.2 Method B

9.2.1 Principle

The test assesses the effect on the colour of a test specimen of exposure to a filtered xenon-arc light source having a frequency range simulating sunlight through window glass.

It is not intended to show the resistance to continuous exposure to outdoor weathering conditions.

9.2.2 Materials

9.2.2.1 White petroleum jelly.

9.2.3 Apparatus

9.2.3.1 Suitable xenon-arc test apparatus, as specified in ISO 4892-1 and ISO 4892-2, capable of providing radiant energy closely simulating sunlight, with a spectral passband of 280 nm to 800 nm and with appropriate filtering to simulate daylight through window glass. The apparatus shall incorporate a system for mounting specimen holders at an equal radial distance from the centre of the light source and revolving them around the light source so as to provide equal radiant exposure.

9.2.3.2 Specimen holders, suitable for the test apparatus, and incorporating a mask to cover half of the exposed face of the test specimen.

9.2.3.3 Overhead white fluorescent lights, with bulb(s) positioned parallel to the line of sight and providing an intensity of 800 lx to 1 100 lx at the specimen surface.

9.2.4 Standardization of apparatus

Calibration, maintenance and filter changes shall be strictly in accordance with the equipment manufacturer's recommendations.

The calibration wavelength for the xenon unit shall be 420 nm.

9.2.5 Test specimens

The test specimens shall be of the size specified for the test apparatus being used.

9.2.6 Procedure

Mount each test specimen in a specimen holder (9.2.3.2) so that approximately one-half of the specimen is exposed to the light source, the other half being covered by the mask. Fill all the specimen holders, utilizing blanks if necessary, and keep them filled during the whole of the test in order to maintain correct airflow conditions through the test chamber.

Carry out the test under the operating conditions specified in Table 1.

NOTE The setting of the wet-bulb temperature in relation to the dry-bulb temperature is designed to maintain a relative humidity of $(50 \pm 5) \%$.

All test parameters shall be maintained as close as possible to the required settings.

Table 1 — Operating conditions

Parameter	Setting	Tolerance
Total irradiance	279,0 kJ/m ²	± 2,0 kJ/m ²
Irradiance level	1,10 W/m ²	± 0,03 W/m ²
Black-panel temperature	70 °C	± 3 °C
Dry-bulb temperature	50 °C	± 3 °C
Wet-bulb temperature	39 °C	± 1 °C
Conditioning-water temperature	20 °C	± 3 °C
Duration of exposure	72 h	± 1 %
Power adjustment	Automatic	To maintain steady irradiance levels, allowing for ageing of xenon burners and solarization of filters

The black-panel thermometer shall be mounted at the same distance from the light source as the test specimen. The black coating shall be maintained in good condition in order to achieve as accurately as possible the black-body temperature of the panel.

At the conclusion of the specified exposure period, remove the test specimens from their holders and allow them to condition at room temperature for a period of 24 h.

After this conditioning period, examine each specimen within 4 h by placing the specimen on a horizontal surface under the inspection lights (9.2.3.3) and viewing it at an eye-to-specimen distance of 750 mm to 900 mm, and at an angle of 45° to 75° from the horizontal plane. Rotate the specimen on the horizontal surface and view it from all directions. Direct sunlight or other light sources which might accentuate or minimize the visual effect shall be avoided.

If a difference in appearance is evident between the exposed and unexposed areas of the test specimen, coat the surface of the specimen with a thin film of white petroleum jelly (9.2.2.1) and re-examine it. If the difference persists, report the difference as a colour change; if it disappears, report it as a change in surface finish.

9.2.7 Expression of results

Express the result of the examination in accordance with the following rating scale:

- Rating 5: No change in colour or surface finish
- Rating 4: A slight change in colour or surface finish visible only at certain viewing angles and directions
- Rating 3: A moderate change in colour or surface finish that is just visible at all viewing angles and directions
- Rating 2: A marked change in colour or surface finish that is very evident at all viewing angles and directions
- Rating 1: Surface blistering and/or cracking

9.2.8 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name, type and nominal thickness of the sheet;
- c) details of the apparatus used;
- d) the lightfastness of the specimen, expressed in accordance with 9.2.7;
- e) any deviation from the method specified;
- f) the date of the test.

9.3 Method C (resistance to colour change in light from an enclosed carbon-arc lamp)

9.3.1 Principle

Part of a test specimen taken from the sheet under test is exposed, together with standard blue wool specimens, to the light of an enclosed carbon-arc lamp. The light dosage is determined by the effect on the wool specimens, and the effect on the test specimen is assessed at a specified light dosage by the contrast between the exposed and unexposed portions of the specimen.

The test is fully described in ISO 4892:1981.

9.3.2 Apparatus

As specified in ISO 4892:1981, without control of humidity.

9.3.3 Test specimen

As specified in ISO 4892:1981.

9.3.4 Procedure

Carry out the test using the single-exposure method described in ISO 4892:1981, and discontinue the exposure when blue wool standard No. 5 shows a contrast between exposed and unexposed portions equal to grade 4 on the grey scale.

9.3.5 Evaluation and expression of results

Examine the contrast between the exposed and unexposed portions of the test specimen and record it in terms of grades on the grey scale.

Express the result in relation to the resistance to colour change of blue wool standard No. 5 as one of those given in Table 2.

Table 2 — Colour change evaluation

Specimen contrast (grey scale grade No.)	Resistance to colour change (blue wool standard No.)
> 4	> 5
4	5
< 4	< 5

9.3.6 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) the resistance of the specimen to colour change, expressed as greater than, equal to or less than that of blue wool standard No. 5;
- d) any deviation from the specified procedure;
- e) the date of the test.

10 Stain/chemical-resistance test

10.1 Method A

10.1.1 Principle

Test specimens are left in contact with a series of staining agents which are likely to be encountered in everyday use. The time and conditions of contact are specified for each staining agent. At the end of the specified contact period, the specimens are washed and examined for residual surface marks.

If the product under test meets specification requirements when tested with each of the six staining agents marked with an asterisk, then it is deemed to comply with the specification for stain resistance. The other staining agents are included for information only. In the case of a specific complaint, the staining agent in question (selected from group 1, 2 or 3) shall be used to verify the quality of the sheet.

10.1.2 Staining agents

Staining agents and test conditions are listed in Table 3.

Table 3 — Staining agents

Staining agent	Test conditions	Contact time
Group 1 Toothpaste Hand cream Urine Alcoholic beverages Natural fruit and vegetable juices Lemonade and fruit drinks Meats and sausages Animal and vegetable fats and oils Water Yeast suspension in water Salt (NaCl) solutions Mustard Lyes, soap solutions Cleaning solution 23 % dodecylbenzene sulfonate 10 % alkylaryl polyglycol ether 67 % water Phenol and chloramine-T disinfectants Citric acid (10 % solution)	10.1.5.1 Procedure A Apply staining agent at ambient temperature	16 h to 24 h
Group 2 *Coffee (120 g of coffee per litre of water) Black tea (9 g of tea per litre of water) Milk (all types)	10.1.5.1 Procedure A Apply staining agent at approximately 80 °C	16 h
----- Cola beverages Wine vinegar Alkaline-based cleaning agents diluted to 10 % concentration with water Hydrogen peroxide (3 % solution) Ammonia (10 % solution of commercial concentrate) Lipstick Water colours Laundry marking inks Ball point inks	10.1.5.1 Procedure A Apply staining agent at ambient temperature	16 h
Group 3^a *Sodium hydroxide (25 % solution) *Hydrogen peroxide (30 % solution) *Acetone Trichlorethane Other organic solvents Concentrated vinegar (30 % acetic acid) Bleaching agents and sanitary cleaners containing them Hydrochloric acid based cleaning agents (\leq 3 % HCl) Acid-based metal cleaners Mercurochrome (2,7-dibromo-4-hydroxymercurifluorescein, disodium salt) *Shoe polish Hair colouring and bleaching agents Tincture of iodine Boric acid Lacquers and adhesives (except fast-curing materials) Amidosulfonic acid descaling agents (< 10 % solution) Nail varnish Nail varnish remover Stain or paint remover based on organic solvents	10.1.5.1 Procedure A Apply staining agent at ambient temperature	10 min
Group 4 *Citric acid (10 % solution) Acetic acid (5 % solution)	10.1.5.2 Procedure B	20 min
^a Acids and alkalis, in concentrations stronger than those shown in group 3, which can be contained in commercial cleaning agents, can cause surface damage or marking, even with very short contact times. Any spillage of such materials shall be washed off immediately.		

10.1.3 Apparatus and materials

10.1.3.1 Glass covers (for example watch-glasses), to restrict evaporation.

10.1.3.2 Thermometer, range 0 °C to 100 °C.

10.1.3.3 Cylindrical aluminium-alloy heating vessel, without a lid, the bottom of which has been machined flat. The vessel shall have an external diameter of $(100 \pm 1,5)$ mm and an overall height of $(70 \pm 1,5)$ mm, and have a safety rim round the top. The thickness of the wall and bottom shall be $(2,5 \pm 0,5)$ mm. An example of a suitable vessel is shown in Figure 6.

10.1.3.4 Hotplate, or other suitable heat source.

10.1.3.5 Horizontal inspection surface, illuminated by overhead and low-angle daylight or white fluorescent light of intensity 800 lx to 1 000 lx.

10.1.3.6 Wetting agent, for example domestic detergent.

10.1.3.7 Cleaning solvents, such as ethanol, acetone, methyl ethyl ketone.

10.1.3.8 Soft clean cloth.

10.1.3.9 Hard polyamide bristle brush (for example a nail brush).

10.1.4 Test specimens

Individual specimens of any suitable size may be used, cut from the sheet under test. Alternatively, a single piece, large enough to allow the staining agents to be applied side by side, can be used.

10.1.5 Procedures

10.1.5.1 Procedure A

The specimens shall initially be at ambient temperature.

Apply a small quantity (for example 2 or 3 drops) of staining agent to two specimens. The staining agent shall be at the temperature specified in Table 3. Cover the staining agent on one of the two specimens with a glass cover (10.1.3.1). Keep the specimens flat during the test.

After the specified contact time has elapsed, if necessary remove the staining agent with a suitable solvent as recommended by the manufacturer, then wash with water containing a suitable wetting agent (10.1.3.6), and finally with ethanol or another solvent (see 10.1.3.7), as required, to clean the surface. A suitable brush (10.1.3.9) may be used to remove staining agent from textured surfaces.

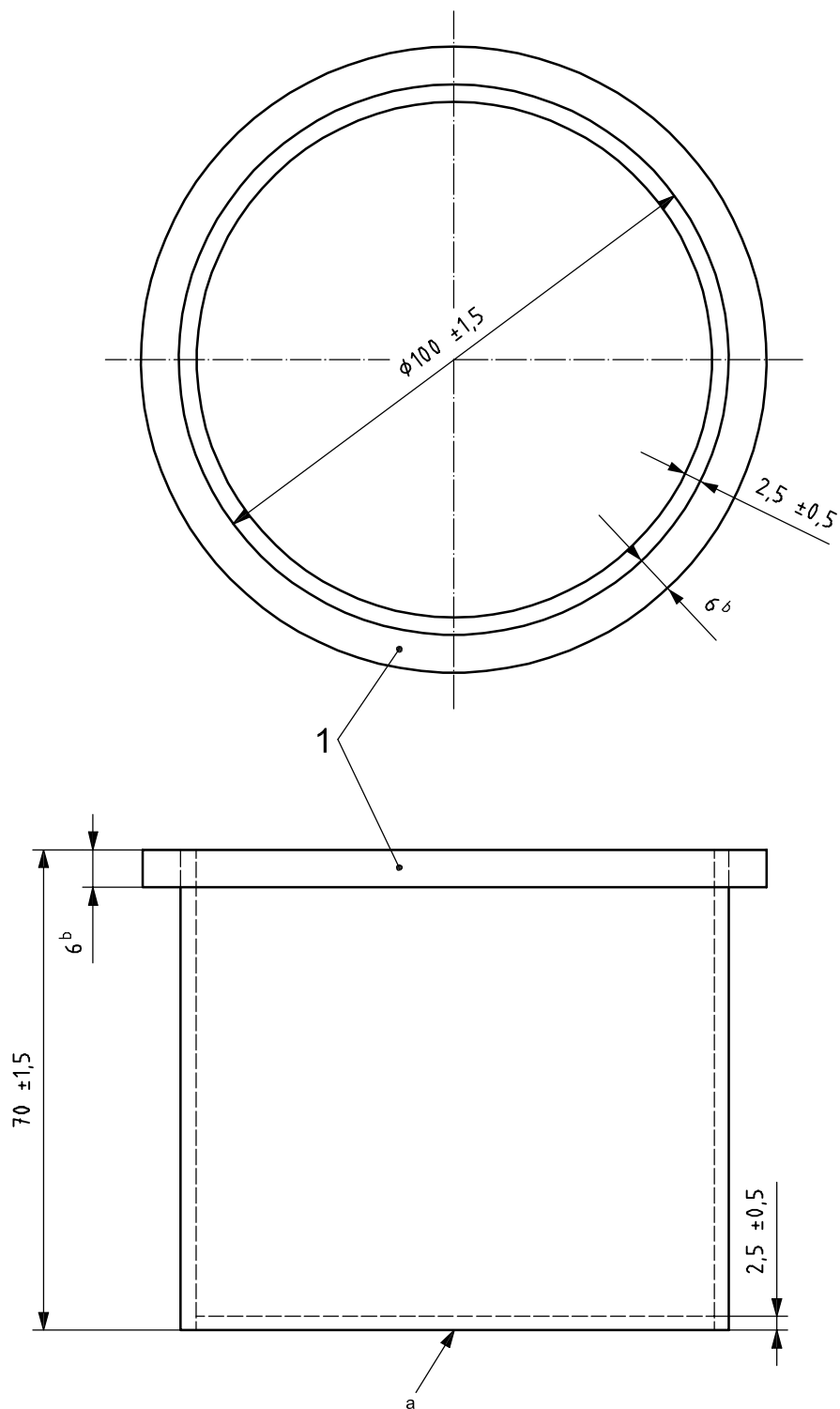
1 h after washing, place the specimens on the inspection surface (10.1.3.5) and view them from various angles at a distance of 400 mm.

10.1.5.2 Procedure B

Apply a small quantity (for example 2 or 3 drops) of the staining agent to a specimen. The staining agent shall be at ambient temperature.

Fill the heating vessel (10.1.3.3) with water (to within 15 mm of the top) and heat it until the water boils vigorously. Discontinue heating and immediately place the vessel containing the boiling water on the surface of the specimen directly over the pool of staining agent. Keep the specimen flat during the test.

Dimensions in millimetres



Key

- 1 aluminium-alloy safety rim
- a Bottom welded in place and machined flat. Vessel shall be completely watertight.
- b Nominal value.

Figure 6 — Example of heating vessel

After the specified contact time, remove the vessel and wash the specimen with water containing a suitable wetting agent (10.1.3.6), and then with ethanol or another solvent (see 10.1.3.7), as required, to clean the surface. A suitable brush (10.1.3.9) may be used to remove staining agent from textured surfaces.

1 h after washing, place the specimen on the inspection surface (10.1.3.5) and view it from various angles at a distance of 400 mm.

10.1.6 Expression of results

The effect on the surface of the specimen shall be expressed in accordance with the following rating scale for each of the six mandatory staining agents:

- Rating 5: No visible change
- Rating 4: Slight change in gloss and/or colour, only visible at certain viewing angles
- Rating 3: Moderate change in gloss and/or colour
- Rating 2: Marked change in gloss and/or colour
- Rating 1: Surface distortion and/or blistering

10.1.7 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) an assessment of stain resistance for each staining agent applied, expressed in accordance with the rating scale given in 10.1.6;
- d) any deviation from the specified procedure;
- e) the date of the test.

10.2 Method B

10.2.1 Principle

Test specimens are left in contact with a series of staining agents that are likely to be encountered in everyday household use. At the end of the prescribed contact period, the specimens are subjected to a specified cleaning programme and examined for any residual surface marks.

This method may also be used with staining agents other than those specified, to cover specific requirements agreed between supplier and purchaser.

10.2.2 Materials

- 10.2.2.1 **Commercially available non-abrasive cleaner**, containing approximately 4 % of butyl cellosolve.
- 10.2.2.2 **Commercially available bleach**, containing (5 ± 0,5) % of sodium hypochlorite.
- 10.2.2.3 **Baking soda**.
- 10.2.2.4 **Supply of clean, soft, white cloth**.

10.2.2.5 **Supply of cotton balls.**

10.2.2.6 **Acetone**, 100 % by volume, or **ethanol**, 95 % by volume.

10.2.2.7 **Distilled water.**

10.2.2.8 **Staining agents**, as listed in Table 4.

Table 4 — Staining agents and their method of application

Agent number	Description	Preparation notes	Application
1	Distilled water	—	Apply 2 drops (an approximately 6-mm-diameter spot) and cover with a watch-glass.
2	Ethyl alcohol	A mixture of 50 % ethyl alcohol and 50 % distilled water	
3	Household ammonia	Non-sudsing type	
4	10 % citric acid	A solution of 10 % citric acid in distilled water	
5	Vegetable oil	—	
6	Fresh coffee	One teaspoon of instant coffee per 180 ml of distilled water	
7	Fresh tea	Brew 1 tea bag per 120 ml of boiling distilled water for 2 min	
8	Tomato ketchup	—	
9	Yellow mustard	—	
10	Tincture of iodine	—	
11	Acetone	—	Apply a spot approximately 6 mm in diameter; do not cover.
12	Black permanent marker	—	
13	HB pencil	—	
14	Wax crayon	—	
15	Black paste shoe polish	—	

NOTE Staining agents shall be kept in closed containers to avoid any change in concentration. Perishable food items shall be kept refrigerated.

10.2.3 Apparatus

10.2.3.1 **Glass covers**, approximately 25 mm in diameter (for example watch-glasses), one for each test requiring a cover.

10.2.3.2 **Overhead white fluorescent lights**, with bulb(s) positioned parallel to the line of sight and providing an intensity of 800 lx to 1 100 lx at the specimen surface.

10.2.3.3 **Cellulose sponge**, measuring approximately 75 mm × 100 mm × 50 mm.

10.2.3.4 **Hard polyamide bristle brush**, for example a nail brush.

10.2.3.5 **Weight**, of mass 1 kg.

10.2.4 Test specimen

The test specimen shall have a surface area sufficient to permit all 15 test reagents to be placed on the surface in two lines with the individual stains about 50 mm apart. A 100 mm × 400 mm specimen is adequate.

10.2.5 Procedure

10.2.5.1 Staining procedure

Clean the surface of the test specimen using the cleaner (10.2.2.1) and water on a clean cloth (10.2.2.4). Rinse the specimen thoroughly and dry using another clean, soft cloth. Allow to dry completely at room temperature.

Position the test specimen on a flat, level, horizontal surface and fix it down (e.g. with tape or weights) to keep it in the horizontal plane.

Place a small quantity of each staining agent (to give a spot approximately 6 mm in diameter) on the surface of the test specimen. The staining agents shall be at room temperature.

If indicated in Table 4, cover each staining agent with a glass cover (10.2.3.1), concave side down, and move the glass cover gently while in contact with the surface of the test specimen until the entire circular rim of the glass cover is wetted by the staining agent and the staining agent covers an area both under and outside the glass cover.

Mark the test specimen suitably so that each staining agent is identified.

Leave the test specimen undisturbed for a period of 16 h to 24 h, then remove the glass covers and subject the test specimen to the cleaning procedures prescribed in 10.2.5.2.

10.2.5.2 Cleaning procedures and ratings

Stage 1: Flush the surface of the specimen with water and wipe gently with the sponge (10.2.3.3) moistened with water. Blot the specimen dry with a clean, soft cloth (10.2.2.4) and examine the surface in accordance with the inspection procedure described in 10.2.5.3. If a staining agent is completely removed by stage 1 cleaning (i.e. no visible marks remain), then give that agent a rating of 0. If any stains remain, proceed to stage 2.

Stage 2: Wet the surface of the specimen with the non-abrasive cleaner (10.2.2.1). Moisten the sponge (10.2.3.3) with water and place it on the surface, then place the 1 kg weight (10.2.3.5) centrally on top of the sponge. Push the weighted sponge back and forth (without any additional downward pressure) over the area to be cleaned for 25 cycles (see the Note). Rinse the specimen with water and wipe dry using a clean, soft cloth (10.2.2.4), then examine the surface in accordance with the inspection procedure (see 10.2.5.3). If a staining agent is completely removed by stage 2 cleaning (i.e. no visible marks remain), then give that agent a rating of 1. If any stains remain, proceed to stage 3.

Stage 3: Wet the surface of the specimen with the non-abrasive cleaner (10.2.2.1) and add baking soda to achieve a pasty consistency. Using the stiff-bristle brush (10.2.3.4), scrub any areas where traces of the staining agents are still visible for 25 cycles (see the Note). Rinse the specimen with water and wipe dry using a clean, soft cloth (10.2.2.4), then examine the surface in accordance with the inspection procedure (see 10.2.5.3). If a staining agent is completely removed by stage 3 cleaning (i.e. no visible marks remain), then give that agent a rating of 2. If any stains remain, proceed to stage 4.

Stage 4: Using a cotton ball (10.2.2.5) saturated with acetone or ethanol (see 10.2.2.6), rub the stain gently for 2 min. Rinse the specimen with water and wipe dry using a clean, soft cloth (10.2.2.4), then examine the surface in accordance with the inspection procedure (see 10.2.5.3). If a staining agent is completely removed by stage 4 cleaning (i.e. no visible marks remain), then give that agent a rating of 3. If any stains remain, proceed to stage 5.

Stage 5: Place a cotton ball (10.2.2.5) saturated with hypochlorite bleach (10.2.2.2) on the stain, and allow it to remain in contact for a period of 2 min. Rinse the specimen with water and wipe dry using a clean, soft cloth (10.2.2.4), then examine the surface in accordance with the inspection procedure (see 10.2.5.3). If a staining agent is completely removed by stage 5 cleaning (i.e. no visible marks remain), then give that agent a rating of 4. Give any staining agent that remains visible after stage 5 a rating of 5.

NOTE In stages 2 and 3, one cycle is a movement forward across the area to be cleaned and back again to the starting position.

10.2.5.3 Inspection procedure

After each stage of cleaning, place the specimen on a horizontal surface under the inspection lights (10.2.3.2) and view it at an eye-to-specimen distance of 750 mm to 900 mm and at an angle of 45° to 75° to the horizontal plane. Rotate the specimen on the horizontal surface and view it from all directions. Direct sunlight or other light sources which might accentuate or minimize the visual effect shall be avoided.

10.2.6 Expression of results

10.2.6.1 Cleanability

Add up the ratings given to the 15 staining agents and report the cleanability of the test specimen as the sum of the ratings of the 15 agents.

A typical example, showing a specimen with a cleanability of 16, is shown in Table 5.

Table 5 — A typical example of cleanability

Agent number	Stain	Rating
1	Distilled water	0
2	Ethyl alcohol	0
3	Household ammonia	0
4	10 % citric acid	0
5	Vegetable oil	0
6	Fresh coffee	0
7	Fresh tea	0
8	Tomato ketchup	1
9	Yellow mustard	2
10	Tincture of iodine	2
11	Acetone	0
12	Black permanent marker	2
13	HB pencil	2
14	Wax crayon	3
15	Black paste shoe polish	4
Total:		16

10.2.6.2 Stain resistance

Assess the stain resistance after completion of the required stages of cleaning and report as one of the following:

- Rating 5: The staining agents have no effect. All marks from the staining agents removed, with no impairment to surface appearance other than a change in gloss due to cleaning.
- Rating 3: The staining agents have a moderate effect. One or more slight stains evident, with no other impairment to surface appearance other than a change in gloss due to cleaning.
- Rating 1: The staining agents have a severe effect. One or more heavy stains evident and/or disturbance of the surface other than a change in gloss due to cleaning.

Record any staining agents that produce a moderate or severe effect.

10.2.7 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712
- b) the name, type and nominal thickness of the sheet;
- c) the cleanability of the specimen, expressed in accordance with 10.2.6.1;
- d) the stain resistance of the specimen, expressed in accordance with 10.2.6.2, plus a note of any staining agents that produced a moderate or severe effect;
- e) any deviation from the method specified;
- f) the date of the test.

11 Resistance to cigarette burns

11.1 Method A

11.1.1 Principle

A specimen from the sheet under test is subjected to the heat from a burning cigarette placed on its surface. The test result is expressed in terms of any resultant damage.

11.1.2 Materials

11.1.2.1 Pale-tobacco cigarettes without filters, from each of three well-known brands, each with a mass of 1,0 g to 1,1 g for a length of 70 mm and with the tobacco evenly distributed over its length.

11.1.2.2 Acetone, 100 % by volume, or **ethanol**, 95 % by volume.

11.1.2.3 Soft cloth.

11.1.3 Test specimen

Prepare one test specimen, measuring (230 ± 5) mm \times (230 ± 5) mm \times the thickness of the sheet under test.

11.1.4 Procedure

Ignite one cigarette from one of the brands and let it burn to consume a length of approximately 10 mm.

Place the burning cigarette in full-length contact with the horizontal surface of the specimen in a draught-free area so that the glued seam of the cigarette is not in contact with the specimen. Allow the cigarette to continue burning until an additional 20 mm length is consumed. If the cigarette goes out before this occurs, repeat the test.

Follow the same procedure with the two cigarettes from the other two brands.

Remove any superficial combustion residues with a soft cloth (11.1.2.3) moistened with acetone or ethanol (see 11.1.2.2). Examine the surface with the naked eye, corrected if necessary, for any changes such as discolouration, cracks or blisters.

11.1.5 Expression of results

Express the result for each area of cigarette contact in accordance with the following rating scale:

- Rating 5: No visible change
- Rating 4: Slight change in gloss, only visible at certain viewing angles and/or slight brown stain
- Rating 3: Moderate change in gloss and/or moderate brown stain
- Rating 2: Severe brown mark, but no destruction of the surface
- Rating 1: Blistering and/or cracks

11.1.6 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) the brands of cigarette used;
- d) the cigarette burn resistance of the specimen, expressed as the arithmetic mean of the three individual ratings, rounded to the nearest integer;
- e) any deviation from the specified procedure;
- f) the date of the test.

11.2 Method B (simulated test using electric heater)

11.2.1 Principle

Specimens taken from the sheet under test are exposed to local radiant heat from an electric heater. The resistance of the material is assessed in terms of the duration of exposure needed to cause visible damage.

11.2.2 Apparatus

11.2.2.1 Heating-element support (see Figure 7), consisting of electrically non-conducting laminated sheet.

11.2.2.2 Heating element (see Figure 7), of iron-aluminium alloy, having the following characteristics:

- a) cross-section of flat wire: 1,6 mm × 0,25 mm;
- b) wire length: 480 mm;
- c) electrical resistance: $(1,8 \pm 0,1) \Omega$.

This heating element shall be in the form of a spiral (outside diameter approximately 15 mm, external ring not included).

11.2.2.3 Adjustable mounting, for the heating element (see Figure 7), consisting of an externally threaded brass sleeve located vertically by two knurled brass nuts.

11.2.2.4 Calibration block (see Figure 8), of electrically insulating laminate, on which are mounted:

- a) A disc support, made from homogeneous heat-insulating diatomaceous-earth sheet material of bulk density 512 kg/m^3 to 576 kg/m^3 , and of thermal conductivity $0,10 \text{ W/(m}\cdot\text{K)}$ to $0,12 \text{ W/(m}\cdot\text{K)}$ in the temperature range $0 \text{ }^\circ\text{C}$ to $300 \text{ }^\circ\text{C}$.
- b) A stainless steel disc, to the bottom of which is silver-soldered an iron-constantan thermocouple. The surface of the disc shall be highly polished and flat, and shall be in the same plane as the surface of the disc support. The disc shall be clamped firmly on its support.

11.2.2.5 Glass-windowed cover (see Figure 9), with the following nominal dimensions:

length: 240 mm;

width: 110 mm;

height: 80 mm.

11.2.2.6 Stopwatch.

11.2.2.7 Power source, producing a constant current for the heating element.

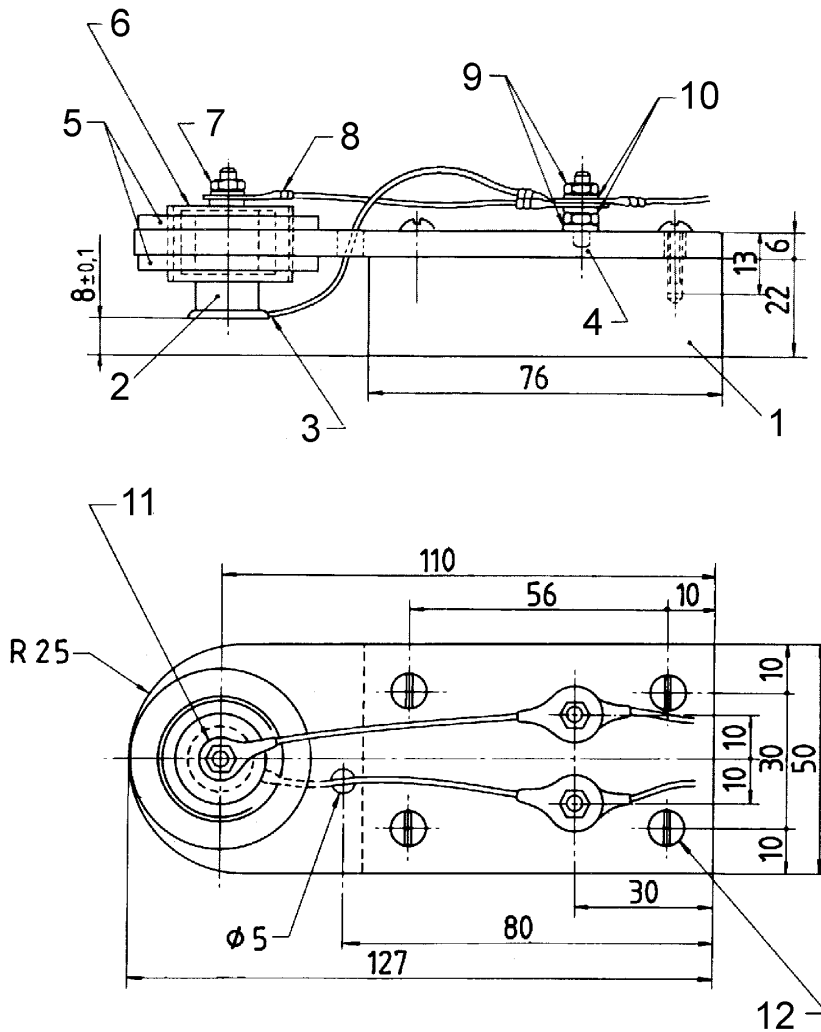
This source may be:

- a) either a series of well charged accumulators with elements in good condition, able to provide the heating element with a power greater than 20 W ;
- b) or an electrical unit powered from the mains supply.

11.2.2.8 Control circuit, to adjust and maintain the power consumption of the heating element with an accuracy of $\pm 0,1 \%$. Measurements are made by means of a voltmeter and an ammeter. A circuit for use with a 115 V supply is shown in Figure 10.

11.2.2.9 Potentiometer, for measuring the temperature of the stainless-steel disc.

11.2.2.10 Cotton wick, saturated with liquid paraffin.



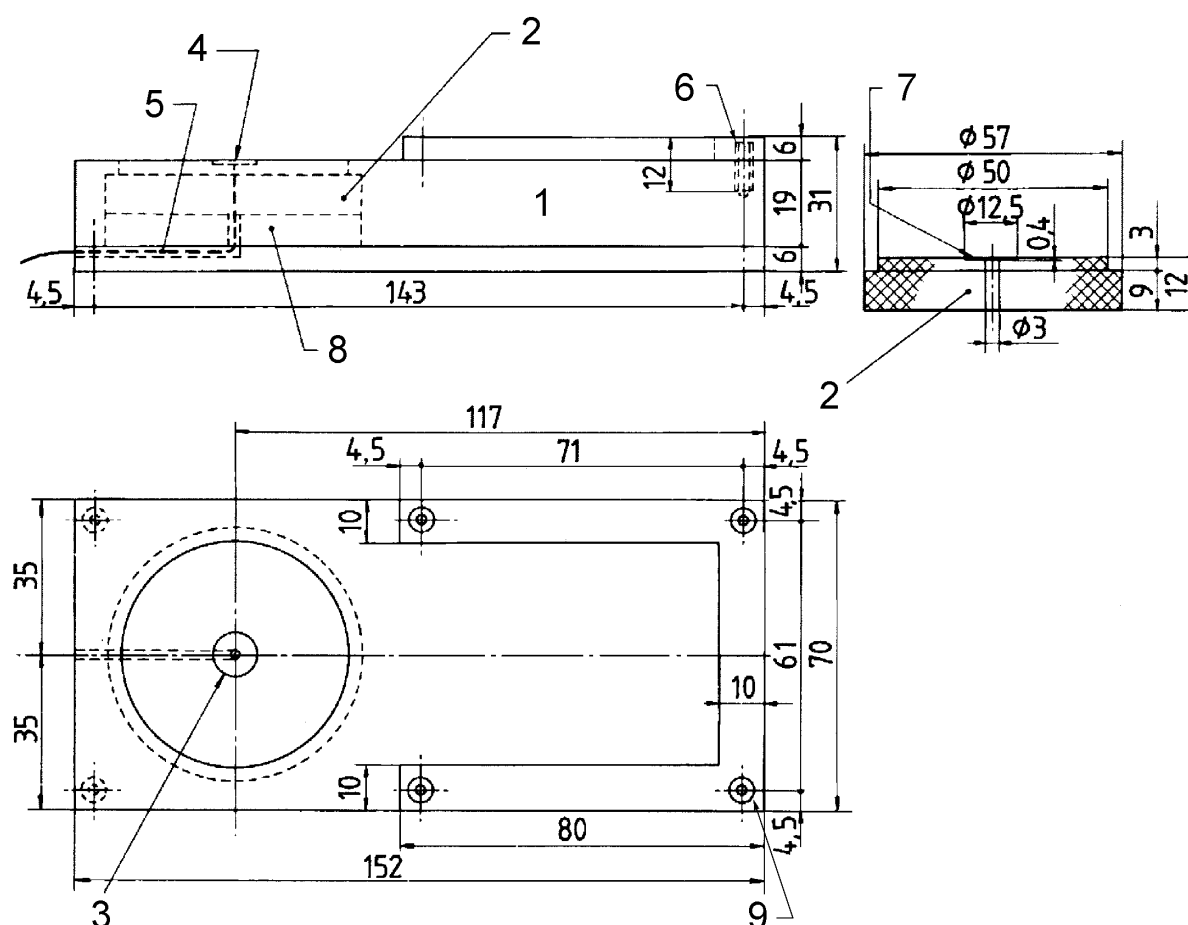
Key

- 1 heating-element support
- 2 heating element
- 3 silver-soldered connection
- 4 two screws F/90, Ø 4/18 mm
- 5 two knurled nuts, thickness 3 mm, fine threaded pitch 0,75 mm, Ø int. 27 mm, Ø ext. 39 mm
- 6 tube, Ø 20/27 mm, length 17 mm, externally threaded, fine threaded pitch 0,75 mm
- 7 nut HM4
- 8 earthing terminal
- 9 four nuts HM4
- 10 four washers M4
- 11 electrical resistance coil soldered to the threaded tube at three points on the circumference
- 12 four screws R 4/12

Materials: Electrically insulating laminate, screws and threaded tube.

Figure 7 — Electric heater for cigarette test (see 11.2.2.1, 11.2.2.2 and 11.2.2.3)

Dimensions in millimetres

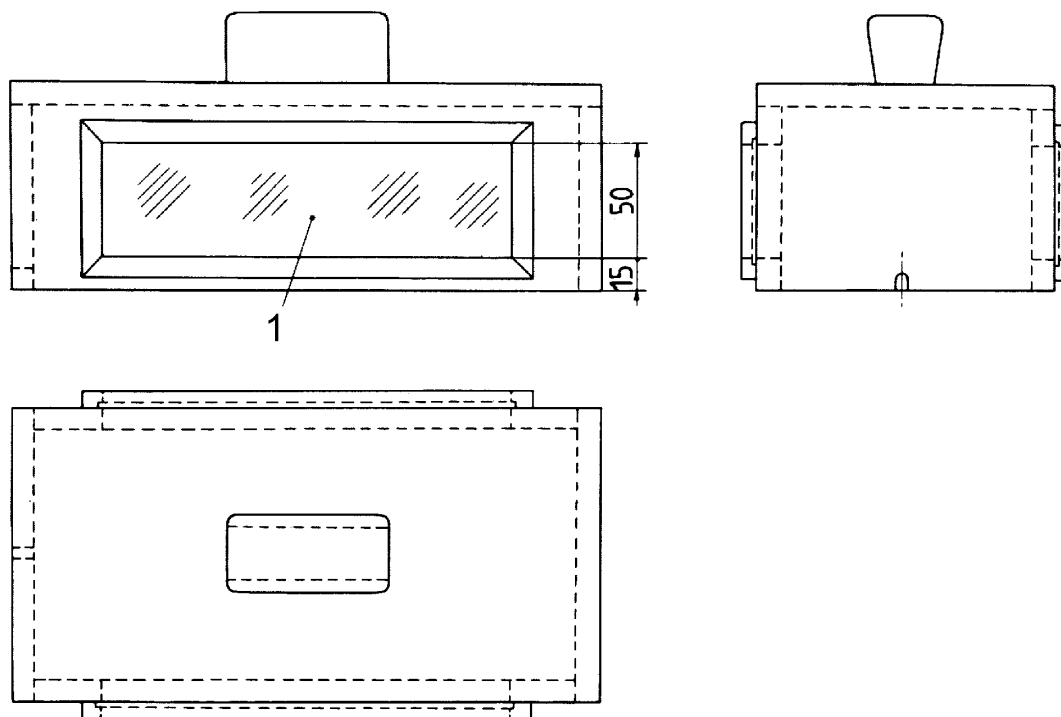
**Key**

- 1 calibration block
- 2 disc support (material: diatomaceous earth or similar insulating material)
- 3 stainless-steel disc, \varnothing 12,5 mm, thickness 0,4 mm, central hole \varnothing 1 mm
- 4 iron-constantan thermocouple silver-soldered in a hole (\varnothing 1 mm) in the stainless-steel disc
- 5 duct, \varnothing 3 mm
- 6 holes, \varnothing 3,5 mm
- 7 circular depression
- 8 electrically insulating laminate washer, \varnothing ext. 57 mm, \varnothing int. 3 mm, thickness 7 mm
- 9 eight screws F/90, \varnothing 3/10 mm

Material: Electrically insulating laminate.

Figure 8 — Calibration block for cigarette test (see 11.2.2.4)

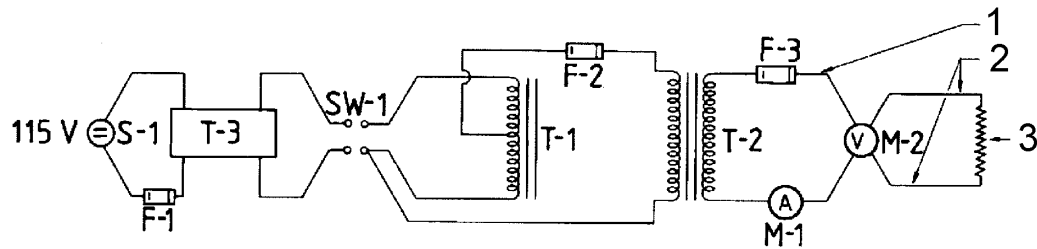
Dimensions in millimetres



Key

- 1 two glass-covered observation windows facing each other — size (nominal) 180 mm × 50 mm

Figure 9 — Apparatus cover for cigarette test (see 11.2.2.5)



Key

- 1 5 mm² wire
- 2 5 mm² heater cord
- 3 resistor heating element

List of items

Symbol	Function	Description
F-1	Line fuse Line fuse mounting	5 A
F-2	Control fuse Control fuse mounting	1 A Extractor post
F-3	Power fuse Power fuse mounting	10 A Extractor post
M-1	Ammeter	0 A to 10 A alternating current
M-2	Voltmeter	0 V to 6 V alternating current
S-1	Line connector	Male connector
SW-1	Line switch	DPST toggle switch
T-1	Autotransformer	Primary: 115 V; secondary: 0,130 V; 5 A
T-2	Power transformer	Primary: 115 V; secondary: 5,25 V; 22 A;
T-3	Voltage stabilizer	100 V·A: 115 V output ± 1 %

Figure 10 — Wiring diagram of control circuit for cigarette test (see 11.2.2.8)

11.2.3 Test specimens

Prepare three specimens, each measuring (230 ± 5) mm \times (230 ± 5) mm \times the thickness of the sheet under test.

11.2.4 Procedure

11.2.4.1 Calibration

The bottom of the heating element shall be flat.

Adjust the heating element so that the distance between its lower side and the disc is $(8 \pm 0,1)$ mm (without including the edging ring).

Stand the heating-element support (11.2.2.1) on its end and adjust the power input to approximately 20 W.

Allow to heat for 30 min.

Blacken the stainless-steel disc with the flame from the burning paraffin-saturated wick to produce a uniform coating of carbon. The insulating support shall be kept clean.

Place the heating-element support on the calibration block so that the heating element covers the disc.

Cover the assembly to exclude draughts.

Allow the heating element to warm the disc for 10 min in order to produce a final temperature of approximately 285 °C.

It is not necessary to record the intermediate temperatures. If the final temperature is not 285 °C, adjust the power input. Lift up the heating-element support without disconnecting the power supply and stand it in the vertical position.

Keep the calibration block under the cover until the disc cools to $(40 \pm 0,5)$ °C, then replace the heating-element support on the calibration block and cover immediately.

Start the stopwatch when the heating-element support and the calibration block touch. Measure and record the temperature at 1 min intervals for a period of 10 min.

The calibration curve shall be within the following limits:

Time (min)	Temperature (°C)
0	$40 \pm 0,5$
1	215 ± 3
2	251 ± 3
3	265 ± 3
4	274 ± 3
5	279 ± 3
6	282 ± 3
7	284 ± 3
8	285 ± 3
9	286 ± 3
10	287 ± 3

During the calibration, the current shall not fluctuate. If necessary, adjustment shall be made and further calibration carried out until the desired curve is obtained [each time allowing the calibration block to cool to $(40 \pm 0,5)$ °C].

When the calibration curve is obtained, proceed with the test.

11.2.4.2 Test

Position the heater on the specimen so that the resistance coil is at least 40 mm from the nearest edge, start the timer at the same time, and cover the assembly with the enclosure within 2 s.

Continue the test until the specimen fails or for 10 min. Failure is defined for this purpose as blistering, charring, permanent discolouration or crazing. If failure occurs in less than 10 min, record the time of failure.

The test shall be invalid if:

- a) the heating element is moved during the test or is not positioned $(8 \pm 0,1)$ mm above the surface of the specimen;
- b) the power input to the heating element does not remain constant at the level of the last calibration;
- c) the cover is removed at any time during the test.

Repeat the test on additional specimens to obtain three valid results.

The calibration of the heating element shall be checked at least once per hour, and at any time that irregular results or an unsteady power input are observed.

11.2.5 Expression of results

Report the result as the average of the three times to failure, in seconds.

If one or two tests are discontinued without failure, their results shall be taken as 600 s for the purpose of calculating the average. If all three tests are discontinued without failure, the result shall be recorded as “no failure in 600 s”.

11.2.6 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) the average time to failure, or a statement that failure did not occur in 600 s;
- d) the type of failure, for example blistering, crazing;
- e) any deviation from the specified procedure;
- f) the date of the test.

12 Resistance to dry heat

12.1 Method A

12.1.1 Principle

A specimen taken from the sheet under test is subjected to dry heat by contact with a vessel of defined heat capacity, initially at 180 °C but cooling during the 20 min of contact. Resistance to the test conditions is assessed by visual examination.

The test is intended to determine the suitability of sheets for use in applications where contact with moderately hot utensils is to be expected.

12.1.2 Materials

12.1.2.1 Glycerol tristearate, or any other material of similar specific heat which will produce the same result. To minimize health and safety risks, metal blocks can be used if it can be shown that similar results will be obtained. The same glycerol tristearate or other material can normally be used for at least twenty tests, but if it has been heated to a temperature above 200 °C, or in cases of dispute, fresh material shall be used.

12.1.3 Apparatus

12.1.3.1 Cylindrical aluminium-alloy heating vessel, without a lid, the bottom of which has been machined flat. The vessel shall have an external diameter of $(100 \pm 1,5)$ mm and an overall height of $(70 \pm 1,5)$ mm, and have a safety rim round the top. The thickness of the wall and bottom shall be $(2,5 \pm 0,5)$ mm. An example of a suitable vessel is shown in Figure 6.

12.1.3.2 Heat source, for heating the vessel (12.1.3.1) uniformly.

12.1.3.3 Heat-insulating board, made of suitable inorganic material, measuring approximately 150 mm × 150 mm and approximately 2,5 mm thick.

12.1.3.4 Thermometer, range – 5 °C to + 250 °C.

12.1.3.5 Fixed frame, to hold the specimen flat.

12.1.3.6 Stirrer.

12.1.4 Test specimen

Prepare one specimen, measuring (230 ± 5) mm × (230 ± 5) mm × the thickness of the sheet under test.

12.1.5 Procedure

Fill the heating vessel (12.1.3.1) with sufficient glycerol tristearate (12.1.2.1) so that at 180 °C the level is about 15 mm from the top. Fix the thermometer (12.1.3.4) centrally in the vessel with its bulb about 6 mm from the bottom. Raise the temperature of the glycerol tristearate to approximately 185 °C, stirring from time to time. Transfer the vessel to the heat-insulating board (12.1.3.3) and allow the temperature to fall to (180 ± 1) °C, stirring continuously.

Immediately place the vessel on the surface of the specimen and allow to stand for 20 min without further stirring.

At the end of this period, remove the vessel and allow the specimen to cool for a period of 45 min. Examine the specimen for surface disturbance, for example blistering, crazing, discolouration or loss in gloss visible to the naked eye, corrected if necessary, allowing the light to fall on the specimen at various angles of incidence.

12.1.6 Expression of results

Express the result of the examination in accordance with the following rating scale:

- Rating 5: No visible change
- Rating 4: Slight change in gloss and/or colour, only visible at certain viewing angles
- Rating 3: Moderate change in gloss and/or colour
- Rating 2: Marked change in gloss and/or colour
- Rating 1: Surface damage and/or blistering

12.1.7 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) the effect on the surface of the specimen, expressed in accordance with 12.1.6;
- d) any deviation from the method specified;
- e) the date of the test.

12.2 Method B

12.2.1 Principle

A standard aluminium-alloy block at a temperature of 180 °C is placed on the surface of the test specimen. After 20 min the block is removed. The test area is wiped dry and the specimen allowed to stand for at least 16 h. It is then examined under specified lighting conditions for signs of damage (discolouration, change in gloss, blistering or other defects). The damage is assessed by reference to a numerical rating scale.

12.2.2 Materials

12.2.2.1 Soft, absorbent cloths.

12.2.3 Apparatus

12.2.3.1 Thermometer, as specified in ISO 1770, capable of insertion to the bottom of the centre bore in the heating block (12.2.3.2), or other suitable means of measuring the temperature of the heating block to an accuracy of 1 °C.

12.2.3.2 Aluminium-alloy heating block, as shown in Figure 11, made of alloy 6060 (previously designated Al MgSi) as specified in ISO 209:2007. The bottom of the block shall be machined flat.

12.2.3.3 Oven, or other suitable means of heating the heating block (12.2.3.2) to a temperature at least 10 °C higher than 180°C.

12.2.3.4 Heat-insulating board, made of suitable inorganic material, measuring approximately 150 mm × 150 mm (or larger) and approximately 2,5 mm thick.

12.2.3.5 Diffuse light source, providing evenly diffuse light in the test area. This may be either diffuse natural daylight sufficiently bright to give an illumination of at least 2 000 lx or diffuse artificial daylight in a colour-matching booth in accordance with ISO 3668.

12.2.3.6 Viewing cabinet (see Figure 12), with a 60 W frosted bulb so screened that light reaches the test area only from the bulb and that the bulb is not in the direct view of the tester. The angle between the horizontal and a line between the bulb and the area under examination shall be 30° to 60°.

12.2.4 Test specimen

The specimen shall be flat and of a size sufficient to accommodate the heating block (12.2.3.2).

If necessary, the surface of the test specimen shall be cleaned by wiping with a soft, absorbent cloth (12.2.2.1) moistened with a mild cleansing solution (as specified in ISO 4211:1979, 3.10). The surface shall then be wiped with a clean, soft, absorbent cloth (12.2.2.1) moistened with distilled or deionized water.

12.2.5 Procedure

Place the thermometer or other means of measuring temperature (see 12.2.3.1) in the central bore of the heating block (12.2.3.2).

Using the oven or other heating means (see 12.2.3.3), raise the temperature of the heating block to a temperature at least 10 °C higher than 180 °C.

Wipe the test area with a soft, absorbent cloth (12.2.2.1).

When the heating block is at a temperature at least 10 °C higher than 180 °C, transfer it to the heat-insulating board (12.2.3.4).

When the temperature of the heating block has dropped to 180 °C, immediately place it on the test area.

After 20 min in this position, remove the block and wipe the test area with a soft absorbent cloth.

Allow the specimen to stand at ambient temperature for at least 16 h.

Wipe the test area again with a soft absorbent cloth and examine the specimen using the diffuse light source (see 12.2.3.5) and also in the viewing cabinet (12.2.3.6).

Dimensions in millimetres
General tolerance limits $\pm 0,1$ mm

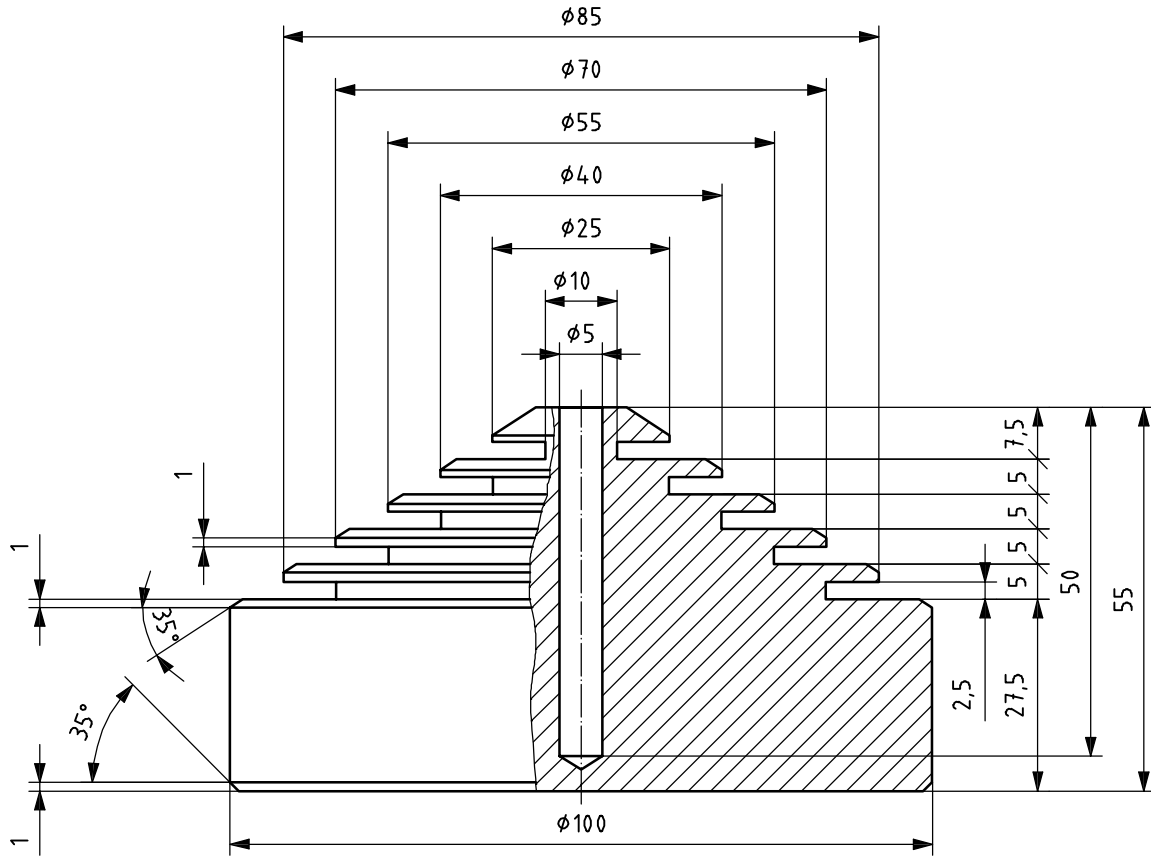
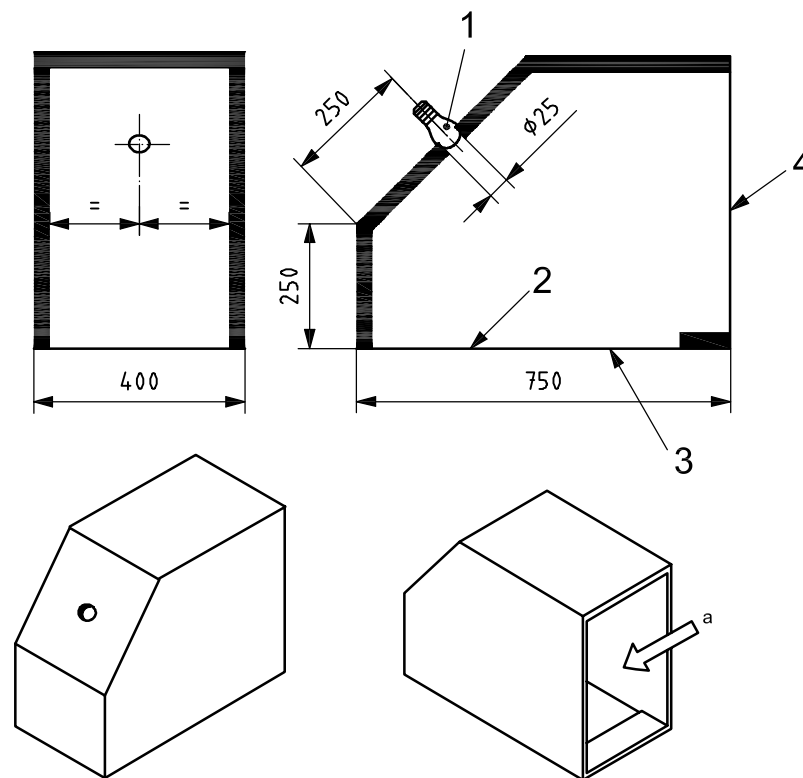


Figure 11 — Aluminium-alloy block used as heat source

Dimensions in millimetres

**Key**

- 1 60 W frosted bulb
- 2 observation area
- 3 open bottom
- 4 open end
- a Viewing direction.

NOTE Interior surfaces are painted black. All dimensions are approximate.

Figure 12 — Viewing cabinet

12.2.6 Expression of results

Express the result of the examination in accordance with the following rating scale:

- Rating 5: No visible change (no damage)
- Rating 4: Slight change in gloss visible only when the light source is mirrored in the test area and the light is reflected towards the observer's eye, or a few isolated imperfections just visible
- Rating 3: Slight mark(s) visible when viewed from several directions, for example an almost complete disc
- Rating 2: Distinct mark(s) or region(s) of slight discolouration or region(s) of slight disturbance of the surface visible
- Rating 1: Distinct mark(s) or region(s) of distinct discolouration or region(s) of distinct disturbance of the surface visible

It is recommended that the test area be rated by more than one observer experienced in this type of assessment. In this case, report that rating which is given (or exceeded) by the majority of observers.

If the results obtained with the two light sources differ, report the lower of the two ratings.

12.2.7 Test report

The test report shall include at least the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product tested, plus any other relevant data (whenever possible, the substrate and the finishing system shall be identified);
- c) the effect on the surface of the specimen, expressed in accordance with 12.2.6;
- d) the result of the test in terms of the stated requirements, if any;
- e) any deviation from the method specified;
- f) the name and address of the test facility;
- g) the date of the test.

12.3 Method C

12.3.1 Test specimen

Prepare one specimen measuring (230 ± 5) mm \times (230 ± 5) mm \times the thickness of the sheet under test.

12.3.2 Procedure

Heat an aluminium-alloy heating block (12.2.3.2) for $(15 \pm 0,5)$ min in the oven (see 12.2.3.3) maintained at (185 ± 5) °C. Place the heating block on the test specimen, allow it to remain there for $(10 \pm 0,5)$ min and then remove it.

Allow the specimen to stand at ambient temperature for 4 h and then examine it for surface defects such as cracking, crazing or discolouration.

In cases of dispute, examination of the specimen shall be carried out in accordance with ASTM D 2244.

12.3.3 Performance requirements

There shall be no cracking, crazing or blistering.

Any discolouration shall be removable, using abrasives and polishing compound, to give a surface with approximately the same finish and serviceability as the original surface.

12.3.4 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product;
- c) the effect on the surface of the specimen, i.e. whether there was any cracking, crazing or blistering;
- d) whether any discolouration was removable;
- e) any deviation from the method specified;
- f) the date of the test.

13 Resistance to wet heat

13.1 Method A

13.1.1 Principle

A specimen taken from the sheet under test is subjected to wet heat by contact for a specified period with a vessel containing hot water placed in a pool of boiling water which has been poured onto the surface of the specimen. Resistance to the test conditions is assessed by visual examination.

13.1.2 Materials

13.1.2.1 Distilled or deionized water.

13.1.2.2 Supply of clean, soft, white cloth.

13.1.3 Apparatus

13.1.3.1 Cylindrical aluminium-alloy heating vessel, without a lid, the bottom of which has been machined flat. The vessel shall have an external diameter of $(100 \pm 1,5)$ mm and an overall height of $(70 \pm 1,5)$ mm, and have a safety rim round the top. The thickness of the wall and bottom shall be $(2,5 \pm 0,5)$ mm. An example of a suitable vessel is shown in Figure 6.

13.1.3.2 Heat source, for heating the vessel (13.1.3.1) uniformly (e.g. a hotplate).

13.1.4 Test specimen

Prepare one specimen measuring (230 ± 5) mm \times (230 ± 5) mm \times the thickness of the sheet under test.

13.1.5 Procedure

Fill the vessel (13.1.3.1) to 12 mm from the rim with distilled or deionized water and heat it using the heat source (see 13.1.3.2) until the water boils vigorously.

As water boils and evaporates, dissolved minerals are left behind and will adhere to the vessel walls, forming scale which is an effective insulator. Any such scale shall be removed periodically or the accuracy of the test may be compromised. The use of distilled or deionized water will minimize this problem.

Using tongs, or other suitable means, carefully remove the vessel from the heat source, pour approximately 10 ml of boiling water onto the horizontal surface of the test specimen and immediately place the vessel containing the remainder of the boiling water in the pool of water on the surface of the specimen.

Allow the vessel to remain in place for 20 min.

At the end of this period, remove the vessel and wipe the surface of the specimen dry using a clean, soft cloth (13.1.2.2) to remove any residual contaminants. Allow the specimen to stand for a period of 45 min.

Examine the specimen surface for disturbance (for example blistering, crazing, discolouration or loss in gloss) visible to the naked eye, corrected if necessary, allowing the light to fall on the specimen at various angles of incidence.

13.1.6 Expression of results

Express the result of the examination in accordance with the following rating scale:

- Rating 5: No visible change
- Rating 4: Slight change in gloss and/or colour, only visible at certain viewing angles
- Rating 3: Moderate change in gloss and/or colour
- Rating 2: Marked change in gloss and/or colour
- Rating 1: Surface damage and/or blistering

13.1.7 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 19712;
- b) the name, type and nominal thickness of the sheet;
- c) the effect on the specimen, expressed in accordance with 13.1.6;
- d) any deviation from the method specified;
- e) the date of the test.

13.2 Method B

13.2.1 Principle

A standard aluminium-alloy block at a temperature of 100 °C is placed on a damp cloth in contact with the surface of a test specimen. After a specified period of time the block and damp cloth are removed. The test area is wiped dry and the specimen allowed to stand for at least 16 h. It is then examined under specified lighting conditions for signs of damage (discolouration, change in gloss, blistering or other defects). The damage is assessed by reference to a numerical rating scale.

13.2.2 Materials

13.2.2.1 Soft, absorbent cloths.

13.2.2.2 120 mm × 120 mm squares of white polyamide-fibre cloth, approximately 3 mm thick, of plain weave, having approximately 40 threads/cm in both the warp direction and the weft direction and weighing approximately 60 g/m².

13.2.2.3 Distilled or deionized water, at (23 ± 2) °C.

13.2.3 Apparatus

13.2.3.1 Thermometer, as specified in ISO 1770, capable of insertion to the bottom of the centre bore in the heating block (13.2.3.2), or other suitable means of measuring the temperature of the heating block to an accuracy of 1 °C.

13.2.3.2 Aluminium-alloy heating block, as shown in Figure 11, made of alloy 6060 (previously designated Al MgSi) as specified in ISO 209:2007. The bottom of the block shall be machined flat.

13.2.3.3 Oven, or other suitable means of heating the heating block (13.2.3.2) to a temperature at least 10 °C higher than 100°C.

13.2.3.4 Heat-insulating board, made of suitable inorganic material, measuring approximately 150 mm × 150 mm (or larger) and approximately 2,5 mm thick.

13.2.3.5 Diffuse light source, providing evenly diffuse light in the test area. This may be either diffuse natural daylight sufficiently bright to give an illumination of at least 2 000 lx or diffuse artificial daylight in a colour-matching booth in accordance with ISO 3668.

13.2.3.6 Viewing cabinet (see Figure 12), with a 60 W frosted bulb so screened that light reaches the test area only from the bulb and that the bulb is not in the direct view of the tester. The angle between the horizontal and a line between the bulb and the area under examination shall be 30° to 60°.

13.2.4 Test specimen

The specimen shall be flat and of a size sufficient to accommodate the heating block (13.2.3.2).

If necessary, the surface of the test specimen shall be cleaned by wiping with a soft, absorbent cloth (13.2.2.1) moistened with a mild cleansing solution (as specified in ISO 4211:1979, 3.10). The surface shall then be wiped with a clean, soft, absorbent cloth (13.2.2.1) moistened with distilled or deionized water (13.2.2.3).

13.2.5 Procedure

Place the thermometer or other means of measuring temperature (see 13.2.3.1) in the central bore of the heating block (13.2.3.2).

Using the oven or other heating means (see 13.2.3.3), raise the temperature of the heating block to a temperature at least 10 °C higher than 100 °C.

Wipe the test area with a soft absorbent cloth (13.2.2.1).

When the heating block is at a temperature at least 10 °C higher than 100 °C, transfer it to the heat-insulating board (13.2.3.4).

Place the polyamide-fibre cloth (13.2.2.2) centrally over the test area. Spread 2 ml of distilled or deionized water (13.2.2.3) uniformly over the whole of the polyamide fibre cloth.

NOTE A graduated dropper is suitable for dispensing the distilled or deionized water.

When the temperature of the heating block has dropped to 100 °C, immediately place it on the polyamide cloth.

After 20 min in this position, remove the block and polyamide cloth and wipe the test area with a soft absorbent cloth.

Allow the specimen to stand at ambient temperature for at least 16 h.

Wipe the test area again with a soft absorbent cloth and examine it using the diffuse light source (see 13.2.3.5) and also in the viewing cabinet (13.2.3.6).

13.2.6 Expression of results

Express the result of the examination in accordance with the following rating scale:

- Rating 5: No visible change (no damage)
- Rating 4: Slight change in gloss visible only when the light source is mirrored in the test area and the light is reflected towards the observer's eye, or a few isolated imperfections just visible
- Rating 3: Slight mark(s) visible when viewed from several directions, for example an almost complete disc
- Rating 2: Distinct mark(s) or region(s) of slight discolouration or region(s) of slight disturbance of the surface visible
- Rating 1: Distinct mark(s) or region(s) of distinct discolouration or region(s) of distinct disturbance of the surface visible

It is recommended that the test area be rated by more than one observer experienced in this type of assessment. In this case, report that rating which is given (or exceeded) by the majority of observers.

If the results obtained with the two light sources differ, report the lower of the two ratings.

13.2.7 Test report

The test report shall include at least the following information:

- a) a reference to this part of ISO 19712;
- b) the name and type of product tested, plus any other relevant data (whenever possible, the substrate and the finishing system shall be identified);
- c) the effect on the surface of the specimen, expressed in accordance with 13.2.6;
- d) the result of the test in terms of the stated requirements, if any;
- e) any deviation from the method specified;
- f) the name and address of the test facility;
- g) the date of the test.

14 Hot/cold-cycle water-resistance test

14.1 Test specimen

Prepare a specimen measuring (230 ± 5) mm \times (230 ± 5) mm \times the thickness of the sheet under test.

14.2 Procedure

Clamp the specimen at an angle of $(8 \pm 2)^\circ$ to the horizontal.

Direct a jet of hot water at $(90 \pm 2)^\circ\text{C}$, at a flow rate of $(0,063 \pm 0,013)$ l/s, for 90 s vertically down at a point on the specimen surface that is at least 40 mm from the edge of the specimen. Follow this immediately (within 90 s) by a jet of cold water at $(20 \pm 2)^\circ\text{C}$, flowing at the same rate and directed at the same point (to within 25 mm). Continue the test for 250 consecutive cycles without a pause between cycles.

On completion of the 250 cycles, examine the specimen for cracking, crazing and other defects, using an ink solution as described in 5.1 and 5.2.

14.3 Performance requirement

There shall be no cracking, crazing, blistering, peeling or delamination from the substrate, if used.

15 Hardness

The Barcol hardness shall be determined in accordance with ASTM D 2583.

The ball indentation hardness shall be determined in accordance with ISO 2039-1.

The Rockwell hardness shall be determined in accordance with ISO 2039-2.

16 Ability to be renewed

Under normal conditions of use, solid surface materials may sometimes need to be renewed by sanding or polishing in cases when scratches, gouges, chips or stains have marred the surface.

In every case where any of the tests in this part of ISO 19712 results in the need for the test specimen to be sanded or polished in order to return it to its original finish, the procedure recommended by the manufacturer shall be followed. Include the result of the renewal treatment in the appropriate test report.

Bibliography

- [1] ANSI/IAPMO Z 124.6, *Plastic Sinks*
- [2] EN 13310, *Kitchen sinks — Functional requirements and test methods*
- [3] ANSI/NEMA LD 3, *High-Pressure Decorative Laminates*

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