INTERNATIONAL STANDARD

ISO 9958-2

First edition
1992-11-01

Draughting media for technical drawings — Draughting film with polyester base —

Part 2: Determination of properties

Supports de traçage pour dessins techniques — Films à dessin à base de polyester —
Partie 2: Détermination des propriétés

Reference number
ISO 9958-2:1992(E)

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.

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.

International Standard ISO 9958-2 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*, Sub-Committee SC 9, *Media and equipment for drawing and related documentation*.

ISO 9958 consists of the following parts, under the general title *Draughting media for technical drawings — Draughting film with polyester base*:

— *Part 1: Requirements and marking*

— *Part 2: Determination of properties*

Annex A of this part of ISO 9958 is for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Draughting media for technical drawings — Draughting film with polyester base —

Part 2:
Determination of properties

1 Scope

This part of ISO 9958 specifies test methods for determining the properties of draughting film with a biaxially oriented polyethylene terephthalate base (commonly known as a polyester base), to be used as a medium for drawn and written information which it is possible to duplicate, revise and store.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9958. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9958 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5-2:1991, *Photography — Density measurements — Part 2: Geometric conditions for transmission density*.

ISO 5-3:1984, *Photography — Density measurements — Part 3: Spectral conditions*.

ISO 6221:1991, *Photography — Films and papers — Determination of dimensional change*.

ISO 9175-1:1988, *Tubular tips for hand-held technical pens using India ink on tracing paper — Part 1: Definitions, dimensions, designation and marking*.

ISO 9177-1:1989, *Mechanical pencils — Part 1: Classification, dimensions, performance requirements and testing*.

ISO 9177-2:1989, *Mechanical pencils — Part 2: Black leads — Classification and dimensions*.

ISO 9957-1:1992, *Fluid draughting media — Part 1: Water-based India ink for tracing paper — Requirements and test conditions*.

ISO 9958-1:1992, *Draughting media for technical drawings — Draughting film with polyester base — Part 1: Requirements and marking*.

IEC 93:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*.

3 Definitions

For the purposes of this part of ISO 9958, the definitions given in ISO 9958-1 apply.

4 Testing — General

The atmosphere for conditioning and testing shall be (23 ± 2) °C and (50 ± 5) % relative humidity. (Such an atmosphere is in conformity with ISO 554[1], normal tolerances.)

Film packages free from defects shall be used.

5 Testing of dimensional stability

Any method complying with ISO 6221 and giving sufficient accuracy may be used for determining the thermal and hygroscopic coefficients of expansion.

Precautions to be considered when determining dimensional changes are described in ISO 6221.

The measurements shall be made in the machine direction and in the cross direction.

6 Testing of permanent dimensional change

6.1 Principle

Measurement of the dimensions of the test specimens at 23 °C and 50 % relative humidity. Storage of the test specimens at low temperature, and then at high temperature and high relative humidity, and measurement of the dimensions.

6.2 Test specimens

For draughting film sheets of size A4, select two sheets as the test specimens.

For draughting film sheets of size larger than A4, select two sheets of the film and cut from the centre of each sheet a test specimen of size A4 with the long side in the machine direction.

6.3 Procedure

6.3.1 Condition the test specimens of the draughting film at (23 ± 2) °C and (50 + 5) % relative humidity for at least 16 h.

Measure the dimensions in the machine direction and in the cross direction using a method giving sufficient accuracy. Repeat the measurements at least once so that each result is the mean of at least two separate measurements.

6.3.2 Store the film for 24 h at each of the following conditions:

(− 10 ± 2) °C (air of 23/50 cooled to − 10 °C);

(+ 23 ± 2) °C and (50 ± 5) % relative humidity;

(+ 60 ± 2) °C and (80 ± 5) % relative humidity;

(+ 23 ± 2) °C and (50 ± 5) % relative humidity.

6.3.3 Measure the dimensions as described in 6.3.1.

6.3.4 Calculate the mean dimensional change in the two directions separately.

7 Testing of stability of form

7.1 Curling

7.1.1 Principle

Measurement of the curl, in accordance with ISO 9958-1:1992, figure 2, of a draughting film of size A4 placed on a flat surface.

NOTE 1 In general, sheets of sizes A4, A2 and A0 are cut in the machine direction whilst sheets of sizes A3 and A1 are cut in the cross direction.

7.1.2 Test specimens

For draughting film sheets of size A4, select two sheets as the test specimens.

For draughting film sheets of size larger than A4, select two sheets of the film and cut from the centre of each sheet a test specimen of size A4 with the long side in the machine direction.

7.1.3 Procedure

Label the upper and lower surfaces of the test specimens. Place the two sheets, with different surfaces facing down, on a flat surface and condition the sheets at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 16 h.

Measure the curl, in millimetres, of the upward-curling sheet at the ends of the curled sides using a suitable measuring method. Calculate the mean value.

7.2 Bulging

7.2.1 Principle

Unrolling of a draughting film (of size in accordance with 7.2.3) on a flat surface and visual inspection for bulges.

7.2.2 Apparatus

7.2.2.1 Flat surface, larger than the draughting film, with a straightness tolerance of 0,5 mm per 0,5 m.

7.2.2.2 Cotton gloves, or similar.

7.2.3 Test specimens

For draughting film in the form of a roll, cut a minimum of four test specimens of at least 2 m in length from the full width of the roll.

For draughting film in the form of pre-cut sheets, select a minimum of four sheets as the test specimens.

7.2.4 Procedure

Condition the specimens at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 16 h.

Roll the film up carefully on the flat surface (7.2.2.1) with both hands, using cotton gloves or similar (7.2.2.2). Handle the film carefully. Do not apply any pressure on the film when rolling.

Unroll the film slowly on the flat surface, using both hands. Make sure that no air bubbles are trapped between the film and the flat surface.

Visually inspect the film for bulges between 2 min and 5 min after unrolling.

8 Tape stripping adhesion test

8.1 General test

8.1.1 Principle

Application of pressure-sensitive tape to the surface of the draughting film and rapid removal from the film at an angle of approximately 180°.

8.1.2 Apparatus

8.1.2.1 Apparatus for measuring maximum force, for example a tensile tester (see ISO 4624[4]) or a maximum reading spring scale.

8.1.2.2 Pressure-sensitive tape, producing a maximum bonding force between the tape and the particular film surface under test of 3 N to 4 N per 10 mm of tape width. Tape with a thin, transparent, plastic backing is preferred.

8.1.3 Test specimens

Select four test specimens of the draughting film, two for testing each side of the film. The dimensions of the specimens are not critical, but one dimension shall be greater than 150 mm.

8.1.4 Procedure

Condition the specimens at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 16 h.

Apply a strip of pressure-sensitive tape (8.1.2.2), about 150 mm long, to the surface under test of each of the test specimens. Press the tape down with thumb pressure to ensure adequate contact, leaving enough tape at one end to grasp. No portion of the tape shall extend to the edges of the test specimens.

Within 5 min after applying the tape, hold the test specimens firmly on a flat surface and remove the tape rapidly from the film surface. This shall be accomplished by pulling the end of the tape so that the complete length of tape is removed from the film at an angle of approximately 180° to the surface of the film.

The force required to remove the tape shall be 3 N to 4 N per 10 mm of tape width. Measurement of the force shall be made using for example a tensile tester or a maximum reading spring scale (8.1.2.1).

NOTE 2 The binding force is, to a certain extent, dependent on the application pressure and the contact time.

If the pressure and time cannot be adjusted so that the force is 3 N to 4 N, another tape should be chosen. However, further testing need not be performed if

— failure is observed with a force less than 3 N per 10 mm, or

— failure is not observed with a force greater than 4 N per 10 mm.

8.2 Testing of adhesion after immersion in water

Select four test specimens in accordance with 8.1.3.

Immerse the test specimens in distilled water at (23 ± 2) °C for 5 min. Hang up the samples and allow them to dry.

Carry out the tape stripping adhesion test in accordance with 8.1.4.

Examine the samples visually and note any loss of coating or any other defects.

8.3 Testing of adhesion after immersion in ammonia solution

Select four test specimens in accordance with 8.1.3.

Immerse the test specimens in 25 % ammonia solution at (23 ± 2) °C for 1 min. Hang up the samples and allow them to dry.

Carry out the tape stripping adhesion test in accordance with 8.1.4.

Examine the samples visually and note any loss of coating or any other defects.

9 Determination of susceptibility to fold marks

9.1 Principle

Formation of a fold mark by applying pressure on a double-folded draughting film. Evaluation by visual inspection of copies of the test sample.

9.2 Apparatus

Use an apparatus suitable for making a fold in a test specimen of the draughting film by applying a pressure of 2,5 N ± 0,1 N.

A suitable apparatus comprising a flat metal plate with a polished surface and a metal cylinder of width 50 mm and diameter 50 mm is shown in figure 1. The pressure applied by the metal cylinder on the draughting film is adjusted by means of a counterweight.

9.3 Test specimen

Prepare a test specimen of the draughting film of width 40 mm and of length at least 150 mm.

9.4 Procedure

Place the draughting film on the flat metal plate, fold together the two short sides of the film and attach them to the plate (see figure 1).

Move the metal cylinder or pull the plate (with the test specimen) at a speed of approximately 0,3 m/s so that a fold mark is made at position A (see figure 1).

Unfold the test specimen and make a copy of the draughting film in a diazo copying machine adjusted to the normal position.

NOTE 3 The equipment should be adjusted so that a black area on a transparent background is reproduced as a dark area of uniform density and the background is essentially non-coloured.

Make a copy of the same draughting film in a plain-paper copying machine adjusted to the normal position, ensuring that the draughting film is pressed firmly and uniformly on to the glass plate.

NOTE 4 The equipment should be adjusted so that a black area on a white background is reproduced as a dark area of uniform density on a non-coloured background.

Inspect the copies for any signs of the fold marks.

10 Testing of surface resistance

10.1 Test specimens

Select at least three specimens of the draughting film.

10.2 Procedure

Condition the test specimens at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 16 h.

Measure the surface resistance in accordance with IEC 93.

11 Testing of visual density

11.1 General test

11.1.1 Test specimens

For draughting film in the form of a roll, cut a minimum of four test specimens of size A4.

For draughting film in the form of pre-cut sheets, select a minimum of four sheets as the test specimens.

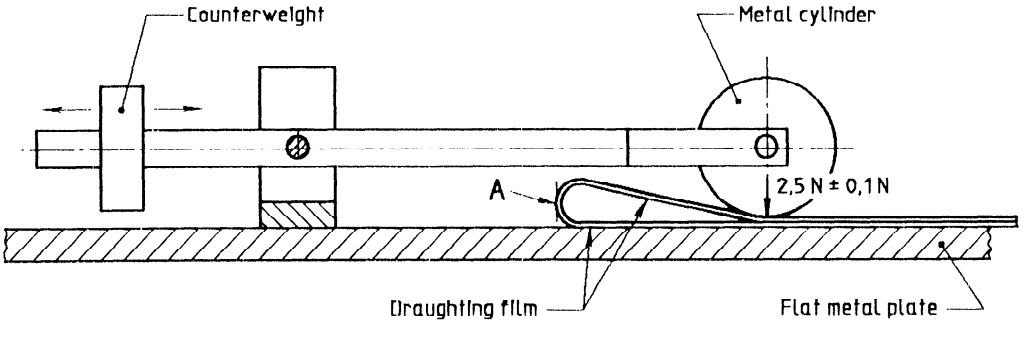

Figure 1

11.1.2 Procedure

Measure the visual density of the draughting film with a densitometer designed to read ISO standard diffuse visual transmission density, as defined in ISO 5-2 and ISO 5-3.

11.2 Testing of visual density after heat ageing

11.2.1 Test specimens

Take test specimens in accordance with 11.1.1.

11.2.2 Procedure

Heat the test specimens, mounted in a sample rack so that they are freely exposed to the surrounding air, in a forced air circulating oven for 16 h at (100 ± 2) °C.

Measure the visual density in accordance with 11.1.2.

12 Testing of draughting quality and redraughting quality

12.1 Draughting quality using tubular technical pens

12.1.1 Principle

Measurement of the line width using a microscope.

12.1.2 Apparatus

12.1.2.1 Tubular technical pen, complying with ISO 9175-1, with a nominal line width of 0,35 mm. The pen shall be prepared for use in accordance with the manufacturer's recommendations (i.e. for cleaning, kind of draughting fluid complying with ISO 9957-1 to be used, method of filling, etc.).

12.1.2.2 Test machine, comprising an electro-mechanical line-drawing device with adjustable writing angle, writing head and line pitch.[1)]

12.1.2.3 Microscope, with a micrometer scale in the ocular, or a **projector microscope**, with a minimum accuracy of 0,01 mm.

12.1.3 Procedure

The line-drawing device settings shall be as follows:

— angle of contact: 87°

— writing force on the tips: 0,2 N

— speed: (5 ± 0,3) cm/s

Ensure that the test sample is free from surface contamination.

Draw five lines, at least 150 mm long, on each test sample. Allow the ink to dry for 5 min and examine the lines for continuity. If any line is interrupted, reject the sample. Two further attempts are allowed with samples from the same batch. If all these samples fail, the draughting quality shall be considered unacceptable.

The line width shall be measured in the middle third of each of the five lines. Use preferably a single-barrel measuring microscope with a light source above and × 30 magnification. Measure each line twice in the same spot. Refocus the microscope each time in order to remove inaccuracies due to possible movement in the screw mechanism. Take care when measuring to centre the measuring head over the middle contour of the line edge (see figure 2).

Report the line width as the average of the 10 measurements, rounded to the nearest 0,01 mm.

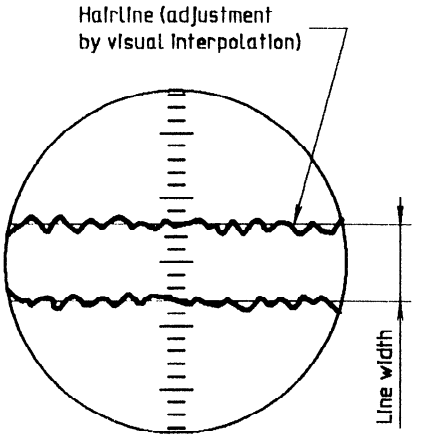

Figure 2

1) The ISO Central Secretariat will provide a list of suppliers on request.

12.2 Redraughting quality

12.2.1 Tubular technical pens

12.2.1.1 Draw by hand on the test sample an ink line of minimum length 50 mm using a tubular technical pen of nominal line width 0,35 mm complying with ISO 9175-1. After allowing the ink to dry for at least 5 min, erase a section of approximately 30 mm completely from the centre of the line using any erasure technique recommended by the draughting film manufacturer or retailer.

12.2.1.2 Clean the corrected area of eraser dust. Draw lines over the same place according to the pattern of corrections given in figure 3.

12.2.1.3 Measure the line width after each correction in the corrected area using the method specified in 12.1.3 and report the line width of each of the four corrections.

12.2.2 Mechanical pencils with ceramic leads

Draw by hand on the test sample a line of minimum length 50 mm using a mechanical pencil complying with ISO 9177-1 with a ceramic lead complying with ISO 9177-2. Erase a section of approximately 30 mm from the centre of the line with an eraser recommended by the draughting film manufacturer or retailer.

Clean the corrected area of eraser dust. Draw lines over the same place according to the pattern of corrections given in figure 3.

Measure the line width in accordance with 12.2.1.3.

12.2.3 Mechanical pencils with polymer leads

Perform the test described in 12.2.2 with a polymer lead complying with ISO 9177-2.

Measure the line width in accordance with 12.2.1.3.

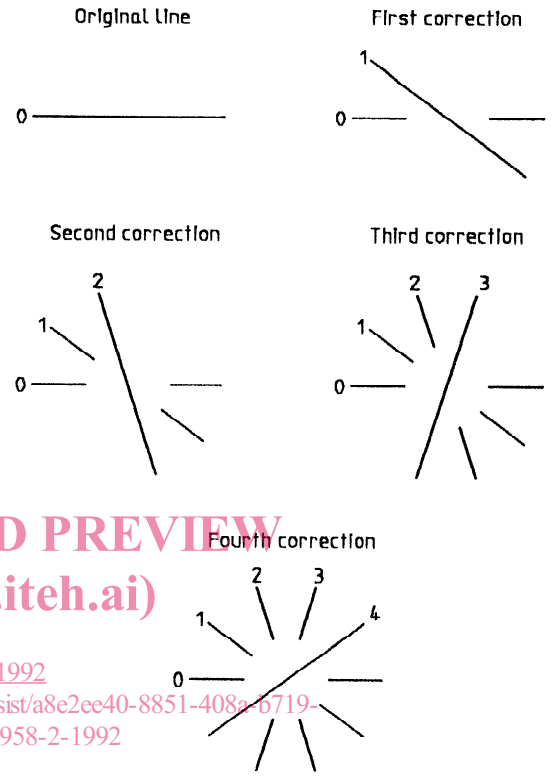

Figure 3

Annex A
(informative)

Bibliography

[1] ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications.*

[2] ISO 4046:1978, *Paper, board, pulp and related terms — Vocabulary.*

[3] ISO 4330:1987, *Photography — Determination of the curl of photographic film.*

[4] ISO 4624:1978, *Paints and varnishes — Pull-off test for adhesion.*