BRITISH STANDARD

BS EN 12676-2:2000

Anti-glare systems for roads —

Part 2: Test methods

The European Standard EN 12676-2:2000 has the status of a British Standard

ICS 93.080.30

National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/509, Road equipment, which has the responsibility to:

- — aid enquirers to understand the text;
- — present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- — monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 16, an inside back cover and a back cover.

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Anti-glare systems for roads - Part 2: Test methods

Systèmes anti-éblouissement routiers - Partie 2: Méthodes d'essai

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 226, Road equipment. the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by September 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Standard consists of the following Parts under the general title:

Anti-glare systems for roads:

- Part 1: Performance and characteristics;

- Part 2: Test methods.

NOTE This draft standard was submitted to the CEN Enquiry as prEN 12677:1997.

1 Scope

This part of EN 12676 specifies laboratory test methods which are necessary to ascertain the following characteristics of anti-glare systems:

- wind resistance;
- behaviour during artificial ageing;
- measurement of the transmission factor.

2 Normative references

This part of EN 12676 incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this part of EN 12676 only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

ISO 4892-2	Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon arc sources
ISO 8256:1990	Plastics – Determination of tensile impact strength
ISO 9227:1990	Corrosion tests in artificial atmospheres – Salt spray tests
ISO/CIE 10526:1991	CIE standard colorimetric illuminants
CIE No 15.2:1986	Colorimetry
EN 12676-1	Anti-glare systems for roads – Part 1: Performances and characteristics

3 Definitions and symbols

For the purposes of this Part of EN 12676, the definitions and symbols of EN 12676-1 and the following apply:

3.1 **residual strain:** the change in position of a point on the anti-glare system following the wind tunnel test, expressed as a percentage of its height above the fixed base of the anti-glare system

3.2 C_{ti}**:** light transmission factor at specified angle of incidence i

3.3 I_i**:** incident luminous intensity

3.4 I_{ti}**:** luminous intensity transmitted by the anti-glare system at specified angle of incidence i

3.5 r_l**:** longitudinal position measurement in the wind tunnel

3.6 ***r_t*****:** transversal position measurement in the wind tunnel

3.7 ***T*****:** height of measuring position from fixed base

3.8 ***d_l*****:** longitudinal residual strain (see Figure 2)

3.9 ***d_t*****:** transverse residual strain (see Figure 1)

4 Wind resistance test

4.1 Principle

This clause describes the test to be carried out in order to assess the changes and deformations which are caused to anti-glare systems, together with their mountings, by the action of wind.

The wind tunnel test is referred to as the wind resistance test.

The test is carried out in a wind tunnel. The test sample is subjected to a steady horizontal air stream of 40 m/s (144 km/h). After the test, the values of the strains d_t and d_l exhibited by the system are calculated.

The sample is fixed to a base at a height of 800 mm ± 50 mm above the turntable in the working section as shown in Figures 3 and 4. The base is an open structure allowing the air to pass freely underneath.

At the start of the test the major axis of the system is placed perpendicular to the direction of the air stream. The test is carried out in two phases (see 4.4).

4.2 Apparatus

a) Wind tunnel, capable of producing an air stream of 40 m/s (144 km/h) in the centre of the working section, where a turntable is installed with the following characteristics (see Figure 4):

- diameter: 4,50 m minimum;
- minimum range of rotation: +90° and -90°;
- with a possibility of viewing the sample during the test, either directly or by means of video recording.

b) Device for measuring displacement, accurate to within 5 mm.

4.3 Test sample

The anti-glare system used as a sample shall be a minimum of 4 m in length.

Such a length may be obtained by combining several units or by using fractions of a unit.

One sample shall be tested.

Prior to the test, store the sample for at least 24 h in a room where the temperature conditions are similar to those in the working section of the wind tunnel.

4.4 Procedure

4.4.1 General

Execute the test at a temperature above 10 °C.

With the wind tunnel switched off, mount the sample on the turntable such that its major axis is perpendicular to the direction of the air stream.

4.4.2 Initial measurements

In the case of systems which are composed of separate units, take measurements for each unit. In the case of systems which consist of a continuous screen, take equally spanned measurements (two per metre along the length of the sample). Mark these locations clearly.

Take measurements at the highest point of the system. For each of these measurement points, measure the following parameters:

- T, r_{0t} and r_{0l} as shown (Figures 1 and 2);
- the temperature in the working section.

4.4.3 Wind test

Switch the wind tunnel on. Achieve gradually an air stream speed of 40 m/s by increasing the speed at the rate of 1 m/s (40 s required to reach the full speed of 40 m/s).

When the air stream reaches a speed of 40 m/s, rotate the turntable in an anti-clockwise direction (as seen from above), at 15° per minute. Stop the motion at +90°. Switch off the wind tunnel and return the turntable to the initial position.

Take the first series of measurements as described in 4.4.4.

Restart the wind tunnel and, when the air stream reaches a speed of 40 m/s, rotate the turntable in a clockwise direction at 15° per minute. Stop the motion at -90°. Switch off the wind tunnel and return the turntable to the initial position.

Take the second series of measurements as decribed in 4.4.4.

> NOTE If in the course of the test the sample breaks or is subjected to excessive deformation, the turntable should be stopped and the wind tunnel switched off. The angle at which the turntable has been stopped should be measured. The test should be considered unsuccessful.

4.4.4 Measurements after testing

After letting at least 5 min elapse after the wind tunnel has been switched off, repeat the procedure described in 4.4.2. to measure the horizontal distances r_l and r_t.

4.5 Expression of results

Calculate the strains d_t and d_l, as a percentage of T, from the measurements made in accordance with 4.4, as follows:

$$d_t = \frac{r_{0t} - r_t}{T} \times 100$$

$$d_t = \frac{r_{0l} - r_l}{T} \times 100$$

All dimensions being in the same units.

5 Ageing tests

5.1 General

This clause specifies the equipment and laboratory procedures required to verify the durability of materials used in anti-glare systems, i.e.:

- for synthetic materials: artificial weathering process preceded and followed by a tensile impact test in accordance with ISO 8256:1990;
- for metallic parts: saline mist test in accordance with ISO 9227:1990.

5.2 Synthetic materials

5.2.1 Principle

The purpose of the artificial weathering process is to determine the reduction of the mechanical characteristics of the material tested. The reduction is expressed as a percentage of the tensile strength of the material at an ambient temperature of (23 ± 3) °C and at (-30 ± 3) °C.

5.2.2 Artificial weathering

Execute the test in accordance with ISO 4892-2 by taking into account the following:

a) test 40 specimens, 20 of which are aged by means of the artificial weathering test. The artificial weathering comprises the following phases:

   - UV radiation test;
   - artificial rain (duration: 102 min drying period, 18 min artificial rain period).

b) the total duration of the ageing cycle is such that the total radiation is 8 000 MJ/m^2.

The test conditions shall be as follows:

- xenon lamp in accordance with ISO 4892-2;
- black standard temperature between 63 °C and 70 °C (temperature of the test room approximately 40 °C);
- degree of humidity of the air during the drying phase: between 60 % and 80 %.

5.2.3 Tensile impact test

Test 40 specimens as follows:

- 10 specimens at (23 ± 3) °C before ageing;
- 10 specimens at (23 ± 3) °C after ageing;
- 10 specimens at (-30 ± 3) °C before ageing;
- 10 specimens at (-30 ± 3) °C after ageing.

Execute the test in accordance with ISO 8256:1990, method A (mass 60 g; energy 25 J), by using type 3 test specimens, which will be cut out in a vertical direction from the anti-glare system, i.e. from the same area of an anti-glare system.

Prior to carrying out the test, the 10 test specimens of the same series shall have been stored for at least 24 h at (23 ± 3) °C and at (-30 ± 3) °C respectively.

Calculate the arithmetic mean values of the tensile impact strength, E, of each series:

- when new and at (23 ± 3) °C (E_{na});
- when new and at (-30 ± 3) °C (E_{nb});
- after the artificial weathering and at (23 ± 3) °C (E_{va});
- after the artificial weathering and at (-30 ± 3) °C (E_{vb});

and the ratios:

- 100 (E_{va} / E_{na});
- 100 (E_{vb} / E_{nb});
- 100 ($|E_{na} - E_{nb}|/E_{na}$).

5.3 Metallic parts

Carry out the corrosion test in accordance with ISO 9227 (NSS test) on two representative samples taken from the complete system of metallic fixing elements. It is essential that each test specimen is representative of at least one element of each system of fixing elements used for the anti-glare system.

The duration of the test is 720 h.

6 Measurement of the transmission factor

6.1 Principle

This clause describes a test for measuring the transmission factor C_{ti} of anti-glare systems, in order to evaluate their effectiveness with regard to glare.

The transmission factor of the anti-glare system is determined with the system illuminated by a light source with a luminous intensity I_i, the transmitted luminous intensity I_{ti} being measured by a photoelectric receptor.

6.2 Apparatus

- A light source, CIE-type A standard illuminant in accordance with ISO/CIE 10526:1999. The power supply of this lamp is stabilized and adjusted such that the colour temperature of the lamp is equal to 2 856 K ± 20 K. The source consists of a spotlight with an aperture which does not exceed 3°;

- A photoelectric receptor, with spectral response curve identical to the relative luminous efficiency $V(\lambda)$ in accordance with CIE publication no. 15.2.

For a diagram of the assembly, see Figure 5.

6.3 Test sample

The test sample shall consist of one or more basic elements of the anti-glare system to obtain a minimum length of 2 m.

The test sample shall be clean and dry and shall have remained for 24 h in the room in which the measurements are to be taken.

6.4 Procedure

6.4.1 Measurement of the incident luminous intensity

Place the sensitive surface of the photoelectric receptor at a distance D of between 10 m and 20 m from the source and oriented such that the axis of the light beam is normal at its centre.

Measure the response R_0 of the receptor and calculate the luminous intensity (I_0) in candelas using the equation:

$$I_0 = \mathrm{K} R_0$$

where K is the calibration constant of the photoelectric receptor.

6.4.2 Measurement of the transmitted luminous intensity

Place the anti-glare system in the luminous beam as specified in 6.4.1, equidistant from the light source and the photoelectric receptor, mounted on a base in a vertical position, with its axis at an angle *i* with the axis of the beam, as shown in Figure 5.

In the case of a sample whose structure is uniform over its entire surface, take measurements at three different heights. For a given angle *i*, take measurements at at least three points distributed along the length of the sample at each of the heights H_1, H_2 and H_3 as follows:

- at the top of the system (H_1) between 90 % and 100 % of the height *T* of the anti-glare system;
- in the middle of the system (H_2) between 45 % and 55 % of the height *T* of the anti-glare system;
- at the bottom of the system (H_3) between 0 % and 10 % of the height *T* of the anti-glare system.

In the case of a sample with a variable structure (variations in thickness, colour, design and materials, etc.), take measurements at as many additional points as is necessary.

At each measurement point, measure the response R_{ti} of the photoelectric receptor and calculate the luminous intensity I_{ti} in candelas using the equation:

$$I_{ti} = KR_{ti}$$

Repeat the entire procedure for values of *i* of 3°, 6°, 9°, 12°,15° and if necessary 18°.

6.5 Expression of results

For each measurement point, where a given angle *i* is used, calculate the value of the transmission factor C_{ti} using the equation:

$$C_{ti} = \frac{I_{ti}}{I_0}$$

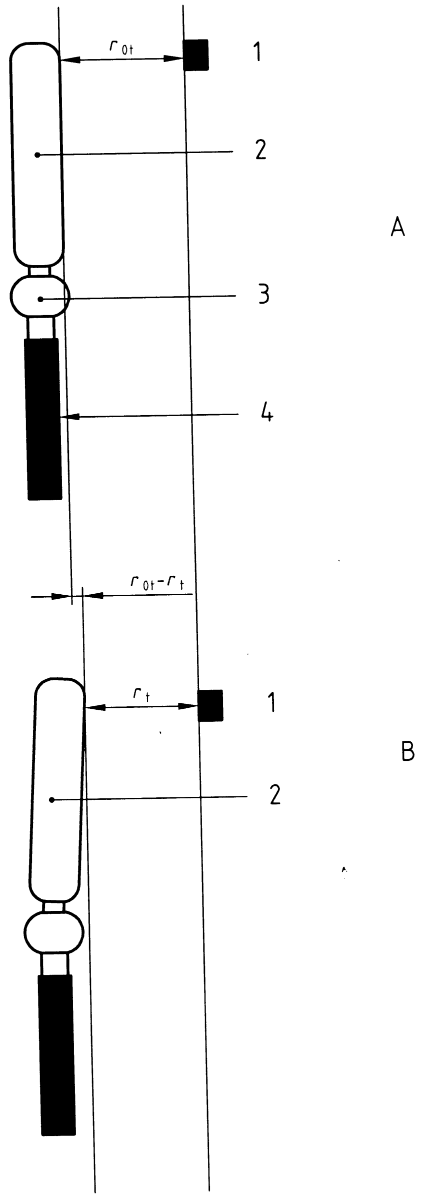
For each angle *i* determine the highest value of C_{ti} ($C_{ti,max}$).

7 Test report

The test report shall contain the following information:

a) the number of this standard, EN 12676-2;
b) the identity of the product:
   - manufacturer's name;
   - material used and any symbol used in the appropriate standard;
   - height;
   - types of safety barriers to which it can be fixed;
   - any other relevant information.
c) for each test:
   - the date and location and the name of the operator;
   - designation of the tests which have been conducted;
   - in the case of the wind resistance test, a description of the working section of the wind tunnel (length, width, height), the temperature at the time of the test, major deformations or disorders observed during the test;
   - in the case of the tensile impact test and the ageing test, the shape and dimensions of the samples;
   - in the case of measurement of the transmission factor, the type of light source and photoelectric receptor;
   - any factor which could have affected the results.

d) the results:
- wind resistance test: all the individual strain values in accordance with 4.5.
- ageing tests:
  - tensile impact test: the arithmetic mean values of each series of 10 specimens and the ratios described in 5.2.3;
  - corrosion test: the degree of corrosion in accordance with 5.3 for each sample;
- measurement of the transmission factor: all the individual values of the transmission factors C_{ti} in accordance with 6.5.



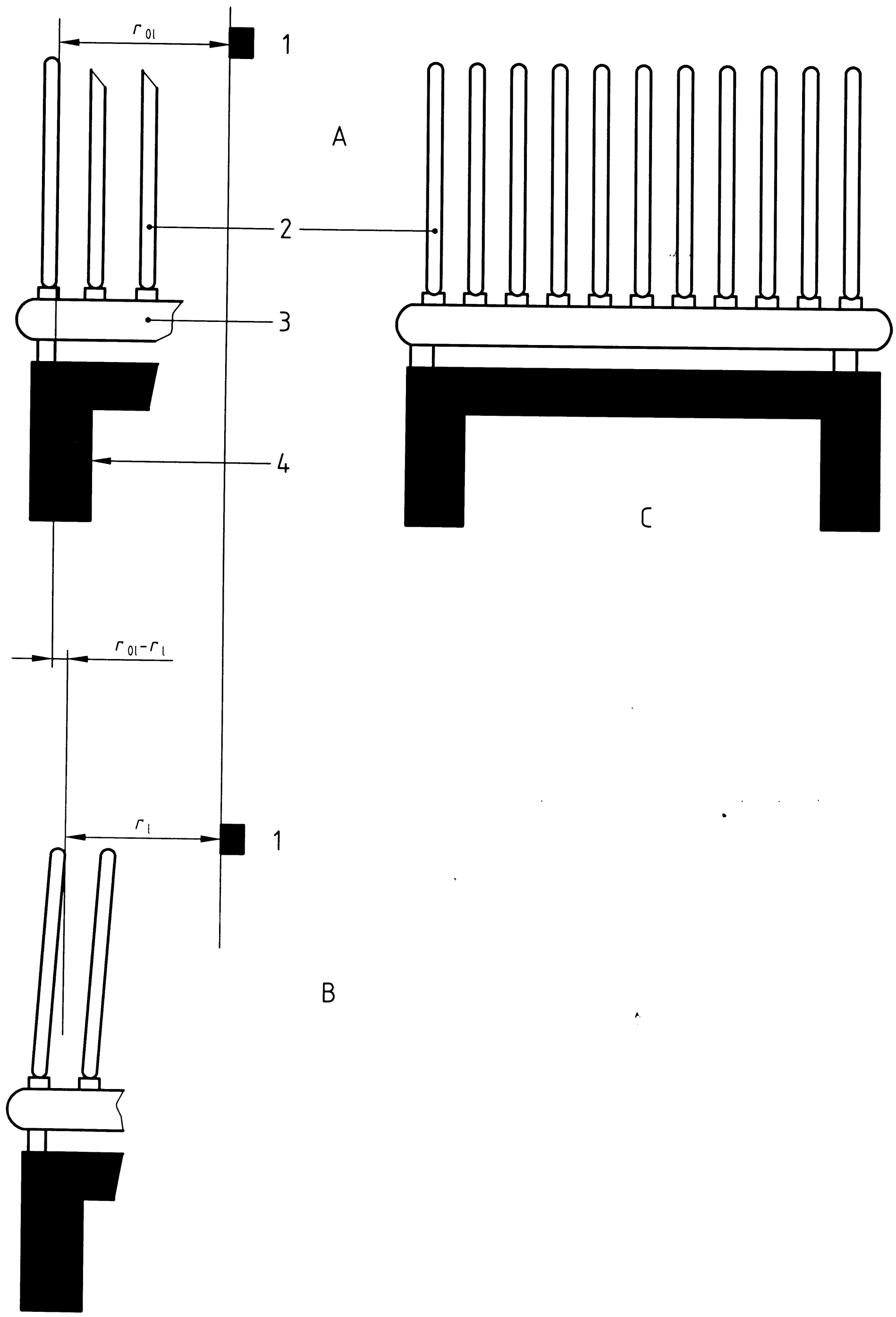
Key

A initial measurement

B measurement after the test

1 Fixed reference point
2 Element
3 Support
4 Base

Figure 1 – Measurement of transverse residual strain



Key

A initial measurement

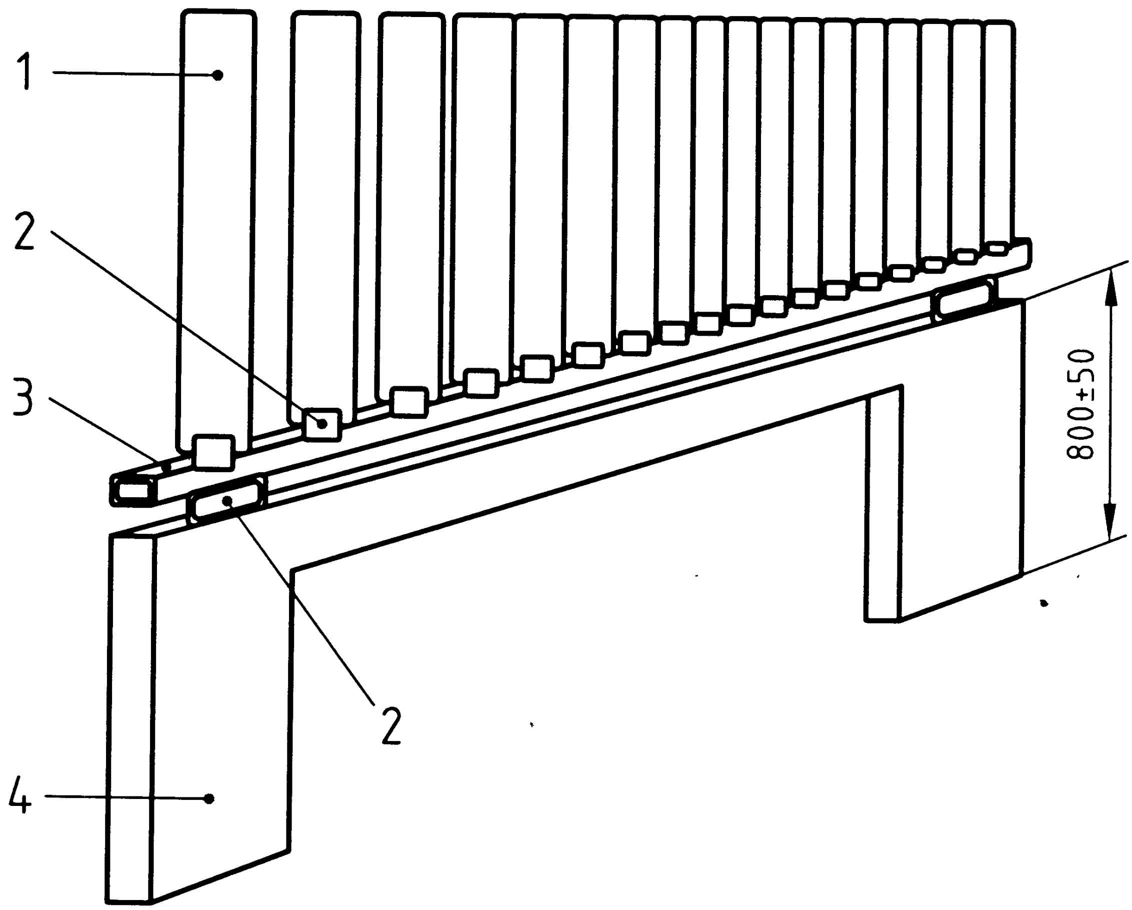
B measurement after the test

C General view of sample suggested to the wind resistance test

1 Fixed reference point
2 Element
3 Support
4 Base

Figure 2 – Measurement of longitudinal residual strain

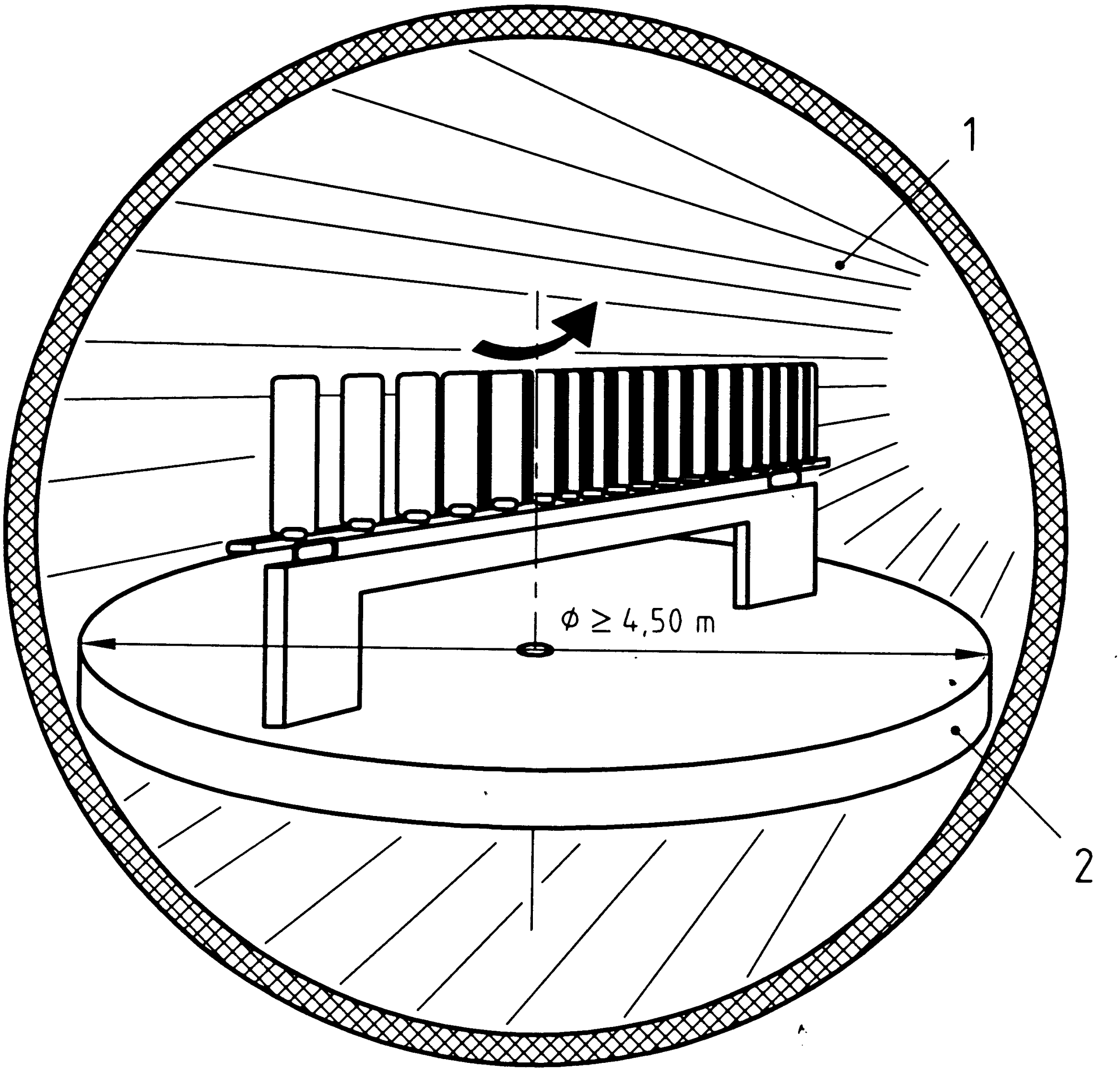
Dimensions in millimetres



Key

1 Occluding element
2 Fixing element
3 Support
4 Example of a base

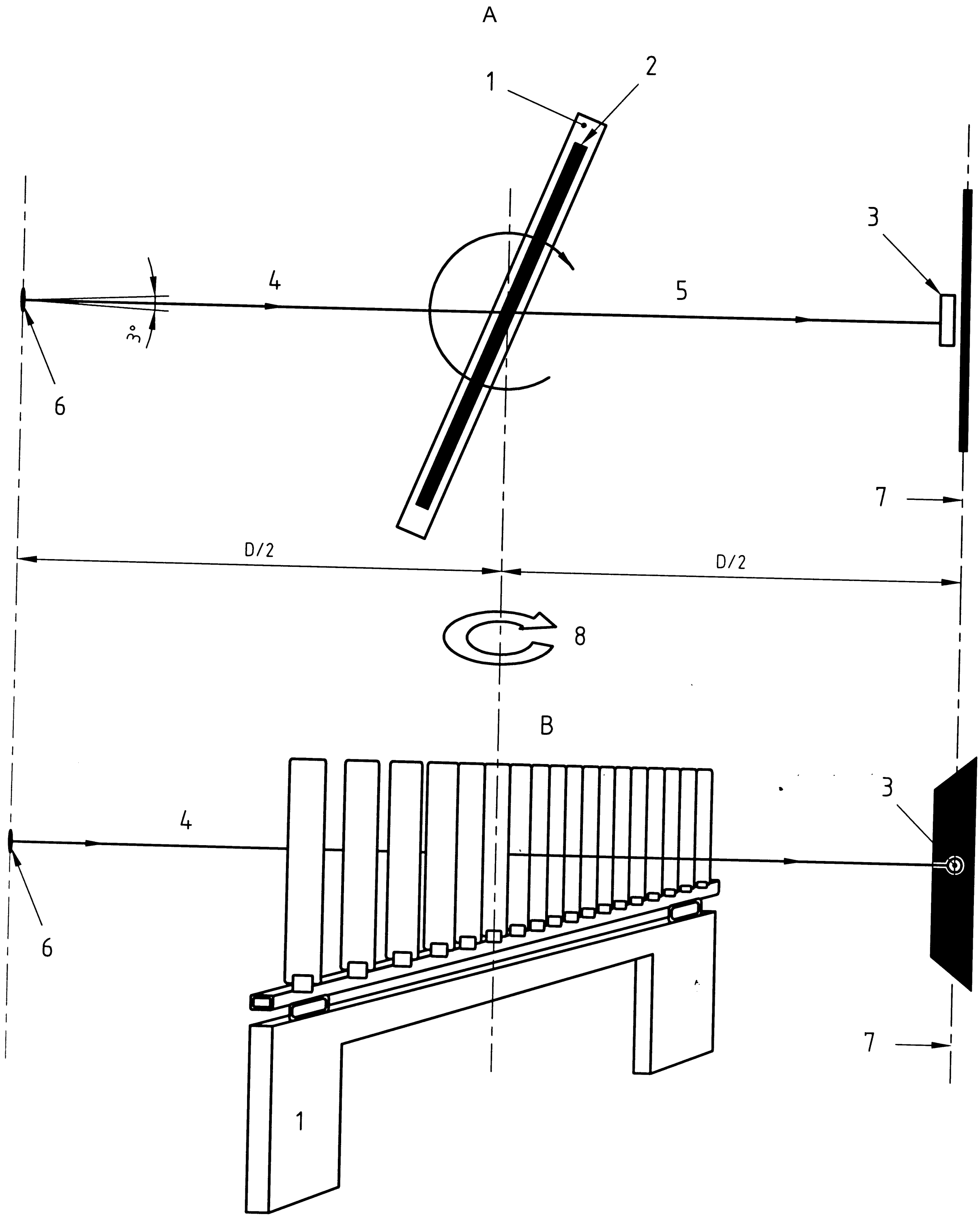
Figure 3 – Composition of the sample for the wind resistance test



Key

1 Working section
2 Turntable allowing the sample to be rotated from –90° to +90°

Figure 4 – Positioning of a sample in the working section



Key

A top view

B front view

1 Base
2 Anti-glare system under test
3 Photoelectric receptor
4 Axis of the incident beam
5 Normal to the photoelectric receptor plane
6 Spotlight, standard illuminant A
7 Photoelectric receptor plane
8 Rotation

Figure 5 – Measurement of the transmission factor

Bibliography

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ISO 1043- 2		Plastics – Symbols – Part 2: Fillers and reinforcing materials
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