

BRITISH STANDARD**BS EN
1056 : 1996
BS 2782 :
Part 11 :
Method 1107A :
1996****Plastics piping and ducting
systems —****Plastics pipes and fittings —****Method for exposure to direct
(natural) weathering**

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The European Standard EN 1056 : 1996 has the status of a
British Standard

ICS 23.040.20

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PRI/61, Plastics piping systems and components, upon which the following bodies were represented:

British Gas plc
 British Plastics Federation
 British Plumbing Fittings Manufacturers' Association
 British Valve and Actuator Manufacturers' Association
 Chartered Institution of Water and Environmental Management
 Department of the Environment (British Board of Agrément)
 Department of the Environment (Building Research Establishment)
 Department of the Environment (Property and Buildings Directorate)
 Department of Transport
 Electricity Association
 Federation of Civil Engineering Contractors
 Health and Safety Executive
 Institute of Building Control
 Institute of Materials
 Institution of Civil Engineers
 Institution of Gas Engineers
 National Association of Plumbing, Heating and Mechanical Services Contractors
 Pipeline Industries Guild
 Plastics Land Drainage Manufacturers' Association
 Society of British Gas Industries
 Society of British Water Industries
 Water Companies Association
 Water Services Association of England and Wales

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

ERA Technology Ltd.
 Engineering Equipment and Materials Users' Association
 RAPRA Technology Ltd.

This British Standard, having been prepared under the direction of the Sector Board for Materials and Chemicals, was published under the authority of the Standards Board and comes into effect on 15 September 1996

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Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
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National foreword

This British Standard has been prepared by Technical Committee PRI/61 and is the English language version of EN 1056 : 1996 *Plastics piping and ducting systems — Plastics pipes and fittings — Method for exposure to direct (natural) weathering*, published by the European Committee for Standardization (CEN).

It is incorporated into BS 2782 *Methods of testing plastics : Part 11 : Thermoplastics pipes, fittings and valves*, as Method 1107A : 1996, for association with related test methods for plastics materials and plastics piping components.

This test method has been prepared for reference by other standards under preparation by CEN for specification of plastics piping systems and components. It has been implemented to enable experience of the test method to be gained and for use for other fresh applications.

It is also for use for the revision or amendment of other national standards as practicable, but it should not be presumed to apply to any existing standard or specification which contains or makes reference to a different test method until that standard/specification has been amended or revised to make reference to this Method and any requirements are adjusted as appropriate. No existing British Standard is superseded by this Method.

Cross-references

Publication referred to	Corresponding British Standard
ISO 105-A02 : 1993	BS EN 20105 <i>Textiles — Tests for colour fastness</i> BS EN 20105-A02 : 1995 <i>Grey scale for assessing change in colour</i>
ISO 4582 : 1980	BS 2782 <i>Methods of testing plastics</i> Part 5 <i>Optical and colour properties, weathering</i> Method 552A : 1981 <i>Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or artificial light</i>

NOTE. There is no British Standard identical to ISO 877 : 1994 pending the revision of BS 2782 : Part 5 : Method 540A : 1977, which is identical with ISO 877 : 1976.

There is no British Standard identical to ISO 2818 : 1994 pending the revision of BS 2782 : Part 9 : Method 1977, which is identical with ISO 2818 : 1974.

Warning note. This British Standard, which is identical with EN 1056 : 1996, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the test method should be operated only by trained personnel.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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EUROPEAN STANDARD

EN 1056

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 1996

ICS 23.040.20

Descriptors: plastic tubes, pipe fittings, ageing tests: materials, weather resistance

English version

Plastics piping and ducting systems — Plastics pipes and fittings — Method for exposure to direct (natural) weathering

Systèmes de canalisations et de gaines en
plastiques — Tubes et raccords en plastiques —
Méthode pour l'exposition directe aux intempéries

Kunststoff-Rohrleitungs- und Schutzrohrsysteme —
Rohre und Formstücke aus Kunststoffen —
Verfahren für die Bewitterung im Freien

This European Standard was approved by CEN on 1996-01-26. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Ref. No. EN 1056 : 1996 E

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 155, Plastics piping systems and ducting systems, the secretariat of which is held by NNI.

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 1996, and conflicting national standards shall be withdrawn at the latest by September 1996.

This standard is based on ISO 877 : 1994 *Plastics — Methods of exposure to direct weathering, to weathering using glass-filtered daylight, and to intensified weathering by daylight using Fresnel mirrors*, published by the International Organization for Standardization (ISO). It is a modification of those methods for reasons of applicability to plastics pipes and fittings and/or other test conditions and alignment with texts of other standards on test methods.

The modifications are:

- test conditions related to tropical exposures are omitted;
- requirements for test pieces are confined to those relevant to pipes and fittings;
- appropriate tolerances are introduced for the measurement of climatic data;
- a specific radiant energy dose is given for use for evaluating piping components which may be exposed during typical storage prior to installation;
- editorial changes have been introduced.

The material-dependent parameters and/or performance requirements are incorporated in the System Standard(s) concerned.

This standard is one of a series of standards on test methods which support System Standards for plastics piping systems and ducting systems.

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

Introduction

Outdoor-exposure tests of the type specified in this standard are needed to evaluate the performance of plastics piping components or materials when exposed to daylight. The results of such tests should be regarded only as an indication of the effect of exposure to direct weathering by the method described. Results obtained after exposure for a given time may not be comparable to those obtained after other exposures of equal time using the same method. When identical materials are exposed at different times for extended periods of several years, they generally show comparable behaviour after equal-exposure intervals. However, even in long-term tests, the results may be affected by the season in which the tests are started.

The results of short-term direct weathering tests can give an indication of the relative outdoor performance, but should not be used to predict the absolute long-term performance of a pipe, fitting or joint. Even results of tests carried out for longer than 24 months can show an effect of the season in which the exposure started. Comparisons of non-full-year exposure will exhibit seasonable effects.

The test method chosen is usually designed to expose the material to the most severe conditions associated with any particular climate. It should, therefore, be borne in mind that the severity of exposure in actual use is, in most cases, likely to be less than that specified in this standard, and allowance should be made accordingly when interpreting the results. For example, vertical exposure at 90° from the horizontal is considerably less severe in its effects on plastics than near-horizontal exposure, particularly in tropical regions, where the sun is most powerful at high zenith angles.

Polar-facing surfaces are much less likely to be degraded than equator-facing surfaces because they are less exposed to solar radiation. However, the fact that they may remain wet for longer periods may be of significance for materials affected by moisture.

1 Scope

This standard specifies a method for exposing plastics pipes and fittings, individually or assembled, or as pieces therefrom, by direct exposure to natural weathering in order to assess changes produced after specified weathering exposure stages relevant to European latitudes.

NOTE. For exposure appropriate to tropical or equatorial conditions, attention is drawn to ISO 877.

2 Normative references

This standard 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 standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- ISO 105-A02 : *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour* — 1993
- ISO 877 : 1994 *Plastics — Methods of exposure to direct weathering, to weathering using glass-filtered daylight, and to intensified weathering by daylight using Fresnel mirrors*
- ISO 2818 : 1994 *Plastics — Preparation of test specimens by machining*
- ISO 4582 : 1980 *Plastics — Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or artificial light*

3 Principle

Test pieces, comprising all or part of a pipe section, a fitting or a jointed assembly, are mounted on a rack under specified conditions and directly exposed to natural weathering until the rack has received a given minimum total solar radiant exposure per unit area.

Climatic conditions and variations and the radiation dosage during exposure are monitored and reported in accordance with the referenced standards.

If necessary (see note 1), additional, comparable, test pieces are tested to establish initial values for one or more properties and/or are stored under protected conditions before testing to enable comparison of the property(ies) with and without weathering.

NOTE 1. Additional test pieces are unnecessary if the data required can be obtained only from exposed test pieces, e.g. by comparison of quantitative colour measurements before, during and/or after exposure or colour comparisons between masked and unmasked zones on the test piece.

NOTE 2. It is assumed that the following test parameters are set by the standard making reference to this standard:

- a) if applicable, the ambient parameters to be recorded (see 4.2.2)
- b) the size, shape and method of preparation of test pieces (see 5.1);
- c) the number of test pieces to be exposed to weathering and, if applicable, to be stored as control test pieces (see 5.2 and 6.1);
- d) if applicable, the sampling procedure to be used (see 5.3);
- e) the solar energy per unit area, if other than 3,5 GJ/m² (see 6.2);
- f) the alignment of the pipe axes, if not north/south (see 6.2);
- g) the frequency and method of cleaning (see 6.3);
- h) if applicable, details of the property(ies) to be measured and the method of measurement, in accordance with the referring standard and whether or not any shaped profiles (see 6.5) should be prepared before or after exposure (see 5.1 and 5.2).

4 Apparatus

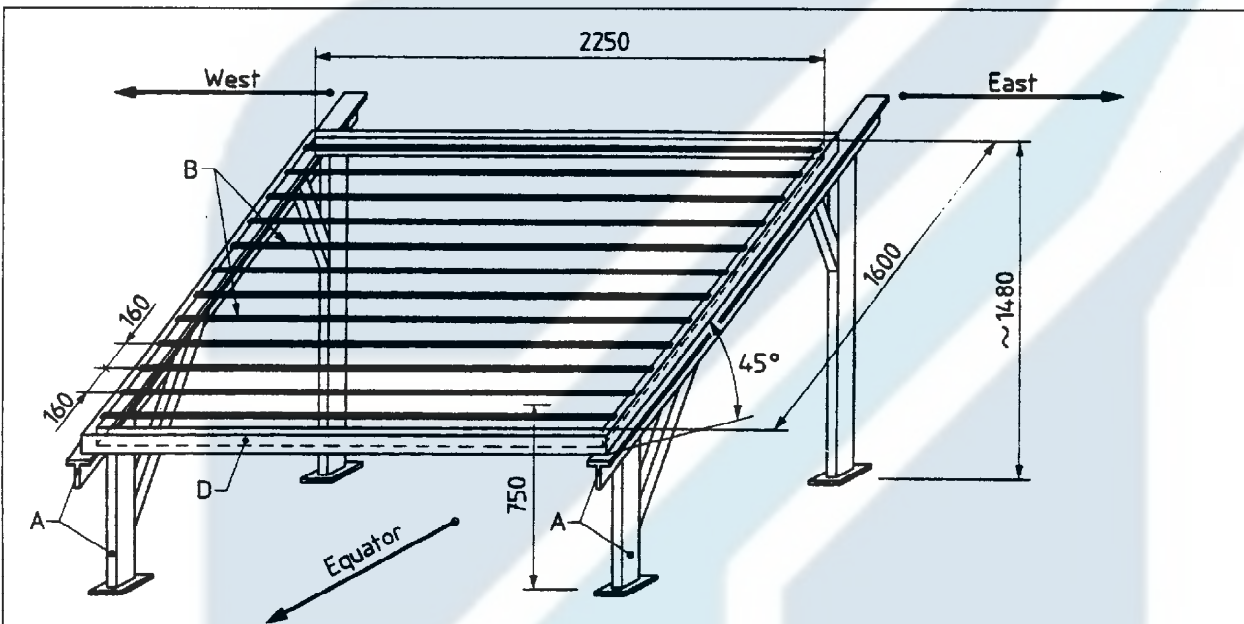
4.1 Test piece support rack

The rack shall conform to ISO 877 for the construction requirements and location of a rack having the following characteristics selected from ISO 877:

- a) it shall be constructed from inert materials which shall not affect the test results (see 5.1 of ISO 877);
- b) it shall be capable of supporting test pieces (see clause 5) such that the exposed surface of the test piece shall be at 45° to the horizontal facing the equator;

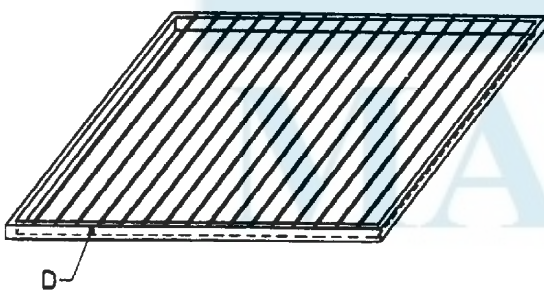
- c) there shall be no obstructions, including adjacent racks, in an easterly, westerly or equatorial direction, subtending a vertical angle greater than 20°C, or in a polar direction an angle greater than 45°;
- d) it shall have mounting fixtures that are secure but apply as little stress as possible to the test pieces and permit shrinkage, expansion or warpage to occur without constraint greater than would apply in normal service or necessary to prevent sagging during exposure.

A typical rack for exposing pipe test pieces is shown in figures 1 and 2.



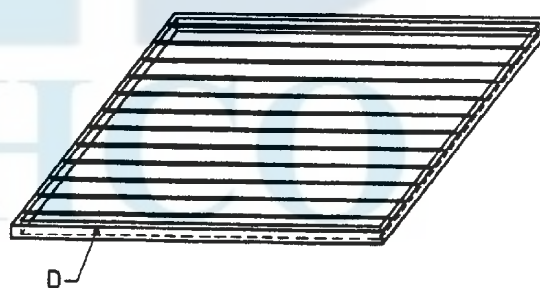
D Removable metal rack, 1600 mm × 2250 mm
A Support for rack
B Removable carrier bars
Dimensions in millimetres

Figure 1A. Typical exposure rack for plastics pipes



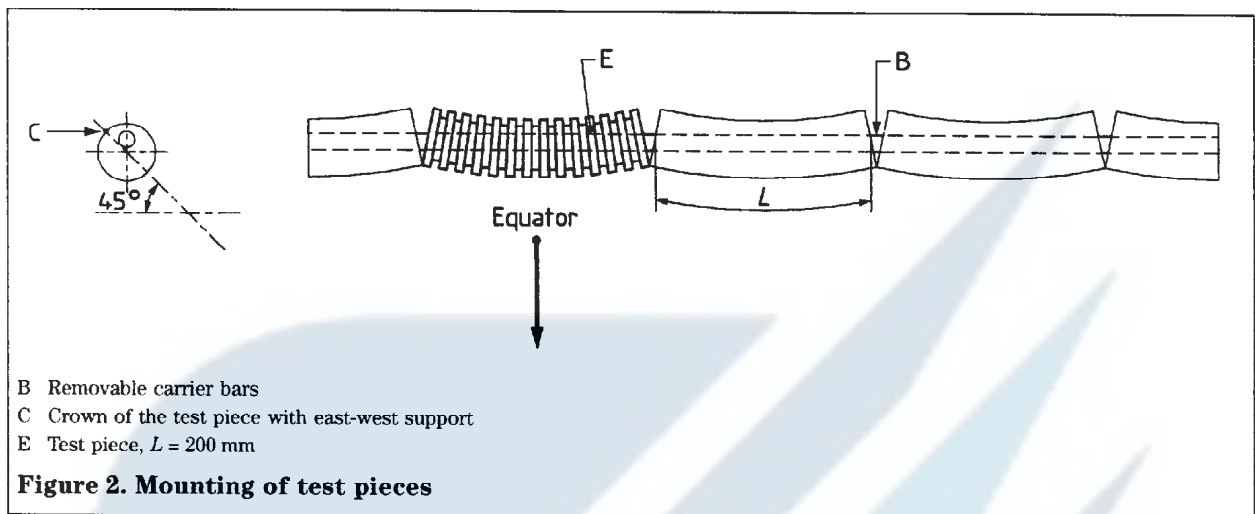
D Removable metal rack,
1600 mm × 2250 mm

Figure 1B. Schematic test arrangement north/south alignment



D Removable metal rack,
1600 mm × 2250 mm

Figure 1C. Schematic test arrangement east/west alignment



4.2 Apparatus for measurement of climatic factors

4.2.1 Solar radiation

The test site shall be equipped with instruments conforming to 5.5.1 of ISO 877 or equivalent, capable of recording the total received solar radiant exposure cumulatively to an accuracy of $0,05 \text{ GJ/m}^2$.

The instruments used to measure radiant exposure shall be mounted on fixtures that are closely adjacent to the sample exposure rack area. The solar irradiance shall be measured with a pyranometer (see 5.5.1.1 of ISO 877 : 1994), with the plane of its receiver mounted parallel to the plane of the exposure test rack, i.e. at 45° . The solar irradiance shall be recorded and integrated to give the solar radiant exposure in joules per square metre for each exposure stage. Care shall be exercised to ensure that no objects are permitted to reflect disproportionate amounts of sunlight onto the receiver, and to ensure that the pyranometer's foreground matches that of the exposure test pieces as closely as possible. The pyranometer glass dome shall be cleaned daily with distilled or deionized water and dried with a soft lens-type tissue.

4.2.2 Ambient conditions

If comparative records of other ambient parameters are required by the referring standard, the test site, or a nearby climatically comparable weather station, shall be equipped with instruments capable of measuring at least the following:

- daily maximum and minimum levels of air and/or test piece temperature, to the nearest degree Celsius; daily maximum and minimum levels of air and/or test piece temperature, to the nearest degree Celsius;
- daily maximum and minimum levels of relative humidity, to within 5 % relative humidity;
- monthly total amounts of rainfall, to within 10 mm.

4.2.3 Climate classification

The climate at the location of the apparatus shall be described using the applicable classification in accordance with annex B of ISO 877.

5 Test pieces

5.1 Preparation of test pieces from pipe and fittings

The size and shape of the test piece(s) shall be as specified in the referring standard, depending upon the property(ies) to be measured.

In the absence of such guidance, for pipe the test piece as exposed shall comprise a complete section about 1 m long, and for fittings the test piece as exposed shall comprise a complete fitting and for joints the test piece as exposed shall comprise a complete joint.

Except for obtaining initial values prior to exposure, any shaped profiles (see 6.5) for obtaining comparative values for exposed and non-exposed test pieces shall be prepared after the same period of time, i.e. all before or all after the relevant exposure stage.

Any necessary machining of test pieces, from the wall of a pipe or fitting, shall be done in accordance with ISO 2818, as applicable, and any preconditioning necessary to enable such machining shall be recorded. For components of composite structure, such test pieces shall be cut from the component, or a part thereof, after exposure or shall have sealed edges, to avoid inducing spurious interlaminar damage, unless weathering effects on the cross-section are to be incorporated into the assessment of results.

5.2 Number of test pieces

The number of test pieces for each test condition (see clause 6) shall be as specified in the referring standard, if applicable, and otherwise shall be at least that specified in the appropriate test method for the property or properties to be measured after exposure. The total number of test pieces required shall be determined by any necessity for establishment of initial values, if the test method is destructive, and any necessity for establishment of values on control samples maintained without exposure to weathering.

NOTE. For determination of mechanical properties, it is recommended that the number of test pieces exposed be increased as appropriate (typically doubled) relative to that required by the test method concerned, to compensate for any greater standard deviation in the data for the property from weathered test pieces.

5.3 Sampling

Sampling to obtain specimens for use as, or sources of, test pieces shall be carried out as specified by the referring standard, if applicable, and otherwise samples shall be selected from a product range as those comprising the thinnest wall section within a random range of diameters.

6 Procedure

6.1 General

Identify the relevant test pieces, and, if applicable, obtain initial data measurements and store any control samples or test pieces in the dark and any applicable standard atmosphere in accordance with the referring standard and/or test method.

6.2 Exposure

6.2.1 Identify each test piece on the rear face relative to its mounting on the rack by indelible marking of a type and/or in an area that will not affect the results of subsequent tests.

6.2.2 Mount and expose the test pieces in accordance with method A of ISO 877 so that the crown of the test piece is exposed at 45° to the equator.

For pipes, unless otherwise specified in the referring standard (see note), the pipe axis shall be aligned with the north-south axis. In this case the crown of the test piece shall comprise the line for passing through the uppermost point of each cross-section along the test piece.

If the pipe is aligned with the east-west axis, the crown of the test piece shall comprise the line on the exposed surface corresponding to the section radii at 45° to the horizontal (see figure 2).

NOTE. For pipes with external profiles which would give rise to persistent shadows in a north/south alignment, it may be more appropriate to align the pipe axis with the east/west axis (e.g. see figure 1C).

6.2.3 During exposure, determine and record the following climatological data:

- a) temperature and relative humidity, if required (see 4.2.2):
 - 1) monthly mean of daily maxima;
 - 2) monthly mean of daily minima;
 - 3) monthly maximum and minimum.
- b) solar radiation: total received solar radiant exposure (irradiation), in gigajoules per square metre, monthly;
- c) precipitation (rainfall): monthly total amount, if required (see 4.2.2);
- d) any other observations of conditions likely to affect the results, e.g. any atmospheric pollution or other contamination or interference with the test pieces.

6.2.4 Continue the exposure until the test site has received a total received solar radiant exposure of not less than 3,5 GJ/m² (see notes).

NOTE 1. This exposure is considered appropriate for evaluating components subject to yard storage prior to installation and use without further exposure to direct weathering, and is quantified to promote rationalization of exposure doses and comparability of data.

NOTE 2. Time alone is not acceptable for quantifying the amount of natural weathering (see introduction).

6.3 Cleaning of test pieces

Unless otherwise specified by the referring standard, clean the test pieces by using water and non-abrasive wipes or brushes prior to any testing, but not during exposure.

6.4 Monitoring of colour change

If the effects of exposure are to be monitored using assessment of colour change, determine the changes in accordance with ISO 4582 and using a grey scale conforming to ISO 105-A02 for determination of colour contrast.

6.5 Testing

6.5.1 If shaped profiles are to be removed from the exposed test piece for subsequent testing (e.g. tensile testing) after weathering, obtain at least one (set of) sample(s) from the weathered crown of the test piece.

6.5.2 If complete weathered test pieces are to be subjected to subsequent localized testing (e.g. impact testing), select the test zone as that associated with the weathered crown of the test piece.

7 Test report

The test report shall include the following information:

- a) a reference to this standard and to the referring standard;
- b) test piece details, including:
 - 1) a full description of the sample(s) and its (their) origin;
 - 2) the shape and method of any preparation of the test piece(s);
 - 3) the number(s) of test pieces exposed;
 - 4) if applicable, the number(s) of test pieces tested without exposure;
 - 5) details of the shape and number of any profiles removed from test pieces, and whether or not these were exposed to natural weathering as individual profiles;

c) test conditions, including:

- 1) the exposure aspect of the test pieces (i.e. 45°, facing the equator);
- 2) the location and details of the exposure site (e.g. longitude, latitude, altitude, annual climate characteristics: see 4.2.3);
- 3) the nature of any support, masking or attachments used;
- 4) details of marking applied to indicate the crown of the test piece as exposed;
- 5) the method for determining exposure and stages;
- 6) details of washing, if any;

d) test results, including:

- 1) the total solar radiant exposure used, in gigajoules per square metre, and the dates of the beginning and end of the exposure;
- 2) climatological data, obtained in accordance with 4.2.1, 4.2.2 and 6.2, if applicable;
- 3) the results of any tests conducted in accordance with the referring standard;

e) any factors which may have affected the results, such as any incidents or any operating details not specified in this standard;

f) the date of the test.

A large, light blue watermark logo is centered on the page. It consists of a stylized, abstract shape that resembles a flame or a series of overlapping geometric forms, with the word "MAHCO" printed in a large, serif font directly below it.

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List of references

See national foreword.



**BS EN
1056 : 1996
BS 2782 :
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Method 1107A :
1996**

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