BRITISH STANDARD

BS 7622-2: 1993

Measurement of smoke density of electric cables burning under defined conditions —

Part 2: Test procedure and requirements —

(Implementation of CENELEC HD 606.2 S1)

UDC 621.315.2.3:620.1

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cables and Insulation Standards Policy Committee (CIL/-) to Technical Committee CIL/20, upon which the following bodies were represented:

Aluminium Federation
Association of Consulting Engineers
Association of Manufacturers of Domestic Electrical Appliances
British Approvals Service for Cables
British Cable Makers' Confederation (BCMC)
British Plastics Federation
British Steel Industry
Department of the Environment (Property Services Agency)
Department of Trade and Industry (Consumer Safety Unit, CA Division)
Electricity Association
Engineering Equipment and Materials Users' Association
Institution of Electrical Engineers
London Regional Transport

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

British Railways Board
British Rubber Manufacturers' Association Ltd.
British Telecommunications plc
ERA Technology Ltd.
GAMBICA (BEAMA Ltd.)
Institution of Incorporated Executive Engineers
London Underground Ltd.
Queen Mary and Westfield College
Telecommunications Cables Group of BCMC
Warrington Fire Research Centre

This British Standard, having been prepared under the direction of the Cables and Insulation Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on
15 February 1993

The following BSI references relate to the work on this standard:
Committee reference CIL 20
Draft for comment 89/27410 DC

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Amendments issued since publication

Amd. No.	Date	Comments

Contents

National foreword

This Part of BS 7622 has been prepared under the direction of the Cables and Insulation Standards Policy Committee. It implements HD 606.2 S1:1992, which is based on IEC 1034-2:1991, but with additional coverage for cables between 2 mm and 10 mm diameter. Additional guidance is given in National annex NC on the sequence of burning for the cable test in clause **5**.

The requirements expressed in this Part in respect of smoke density — to be implemented in the absence of any given in the specific cable specification — are based upon transmittance levels quoted in the IEC specification. The measurement may also be compressed in terms of absorbence per unit cable tested, by further computation of the transmittance value. A method of calculation is given in National annex ND.

Part 1 of BS 7622 provides details of the test apparatus, including a verification procedure, to be employed for the measurement of the smoke density of the products of combustion of electric cables burned under defined conditions.

Part 2 of BS 7622 provides details of the test procedure to be employed for the measurement of the smoke density of the products of combustion of electric cables burned under defined conditions using the test apparatus given in Part 1.

The publication of this British Standard will allow the method given as an appendix to a number of existing British Standards (BS 5055, BS 6207, BS 6724, BS 6883 and BS 7211) to be eventually withdrawn. Users should note however that this new standard introduces some differences against the previous UK practice.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the HD title page, pages 2 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

HARMONIZATION DOCUMENT
DOCUMENT D'HARMONISATION
HARMONISIERUNGSDOKUMENT

HD 606.2 S1

August 1992

UDC 621.315.2/.3:620.1

Descriptors: Fire protection, electric cable, smoke density measurement, combustion product, test method, flammability test

English version

Measurement of smoke density of electric cables burning under defined conditions Part 2: Test procedure and requirements

(IEC 1034-2:1991, modified)

Mesure de la densité de fumées dégagées par des câbles électriques brûlant dans des conditions définies
Partie 2: Procédure d'essai et prescriptions
(CEI 1034-2:1991 modifiée)

Messung der Rauchdichte elektrischer Kabel beim Brennen unter definierten Bedingungen
Teil 2: Prüfablauf und Anforderungen
(IEC 1034-2:1991, modifiziert)

This Harmonization Document was approved by CENELEC on 1992-03-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

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

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

Following the decision taken by CENELEC Technical Committee TC 20 at their meeting in Vienna in November 1990, the draft Harmonization Document prHD 606.2 S1 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in June 1991.

The text of the draft was approved by CENELEC as HD 606.2 S1 on 24 March 1992.

The following dates were fixed:

— latest date of announcement of the HD at national level	(doa)	1992-12-01
— latest date of publication of a harmonized national standard	(dop)	1993-12-01
— latest date of withdrawal of conflicting national standards	(dow)	1993-12-01

For products which have complied with the relevant national standard before 1993-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1994-12-01.

Contents

1 Introduction

Part 1 of this HD gives details of the test apparatus and verification procedure to be used for the measurement of smoke density of the products of combustion of electric cables burned under defined conditions. It includes details of a test cube of $27m^3$ volume, a photometric system for light measurement, a qualification procedure which also defines the fire source, and a smoke mixing method.

The test procedure defined in this Part of the HD shall be carried out using the apparatus and procedures given in Part 1.

The requirements of this Part in respect of smoke density are expressed in terms of minimum levels of light transmittance. These levels are similar to those required by Mass Transit Authorities.

2 Scope

This is the second part of a two-part HD. It provides details of the test procedure to be employed for measurement of the density smoke emitted from cables burning under defined conditions. It describes the means of preparing and assembling for test cables having an overall diameter from 2mm upwards, the method of burning the cables, and gives the requirements for evaluating test results.

NOTE Requirements for evaluating test results for cable above 70 mm diameter will be the subject of further review.

3 Fire Source

The fire source shall be as specified in Part 1, Clause **4.1.1**.

4 Test Assembly

4.1 Cable Samples

These shall consist of straight samples of cable 1 ± 0.05m which shall be carefully straightened and then conditioned for at least 16 hours at 23 ± 5 °C.

4.2 Cable Selection and Assembly

4.2.1 *Selection of Number of Test Pieces*

The number of test pieces shall be selected in accordance with the table below:

Overall Diameter (D) of the Cable (mm)	Number of Test Pieces	
	Cables	Bundles[a]
$D > 40$	1	—
$20 < D \leq 40$	2	—
$10 < D \leq 20$	3	—
$5 < D \leq 10$	N_1	—
$2 < D \leq 5$	—	N_2

[a] Each bundle shall consist of seven cables twisted together with a lay between 20 and 30D, and bound with two turns of approximately 0.5 mm diameter wire in the centre and at every 100 mm each side from the centre (see Figure 1).

where:

$$N_1 = \frac{45}{D} \; cables$$

$$N_2 = \frac{45}{3D} \; bundles$$

D = *overall diameter of cable (mm)*

The value of N_1 or N_2 shall be rounded downwards to the integer to give the number of cables or bundles.

4.2.2 *Assembly of Test Pieces*

The test pieces shall remain in situ during the test by means of the following.

Cables shall be laid touching and shall be bound together at the ends and at 300 mm from each end, and here the cables shall be clasped to the support by means of wire binders.

Bundles shall be tensioned at one or both ends by means of an appropriate device, e.g. a spring or weight.

NOTE See also National annex NB.

4.3 Positioning of Cable Samples

The tray containing the alcohol shall be raised above the ground surface to permit air circulation. The test pieces (cables or bundles) shall be laid touching in a horizontal position and centred above the tray so that the distance between the underneath of the cable samples and the bottom of the tray is 150 ± 5mm (see Figure 2).

5 Test Procedure

NOTE See also National annex NC

5.1 Maintain the test cube in external environment, the temperature of which is 20 ± 10 °C. The temperature within the cube prior to starting a test should be in the range of 25 ± 5 °C.

5.2 Before a test or a series of tests, carry out one blank test by burning 1 ± 0.01 litre of the test fuel (as defined in Clause **4.1.1** of Part 1).

5.3 After each test it may be necessary to clean the window of the photometric system to regain 100 % light transmission after stablisation of the voltage. (See also clause **A.2** of Annex A, Part 1.)

5.4 With the test samples supported above the tray, start the air circulation and ignite the alcohol. Ensure that all persons leave the cube immediately and that the door is closed.

5.5 The test is considered as ended when there is no decreases in light transmittance for five minutes during the period after the fire source has extinguished or when the test duration reaches 40 minutes.

5.6 Record the minimum light transmittance.

5.7 Extract the combustion products at the end of each test.

6 Evaluation of Test Results

Unless otherwise specified in the relevant product specification the test is satisfactory if the following levels of light transmittance are exceeded throughout the test.

1	cable	70 %
2	cables	60 %
3	cables	60 %
N_1	cables	50 %
N_2	bundles	50 %

These are provisional values, especially for cables having diameters D > 70 mm.

NOTE The method of calculation for converting transmittance values to absorbence values is given in National annex ND.

7 Retest procedure

In the event of a failure being recorded, a further two tests should be undertaken using similar cables.

Both test results should comply with Clause **6**.

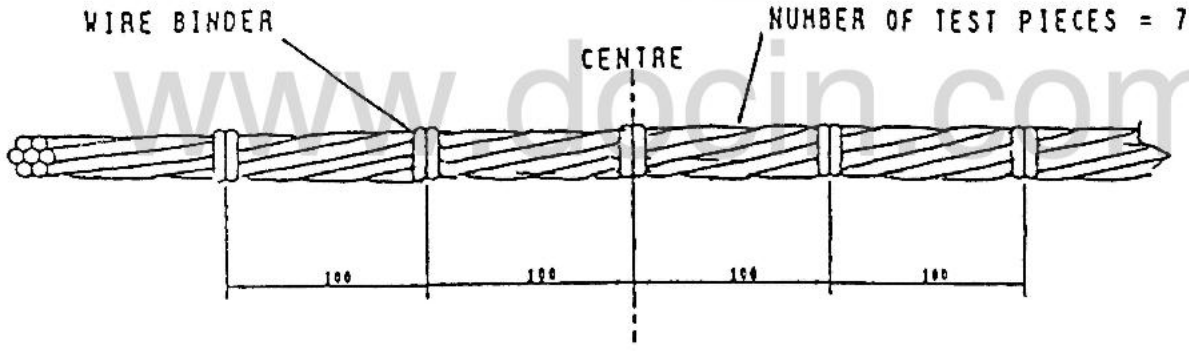

Figure 1 — Method of binding for cable bundles

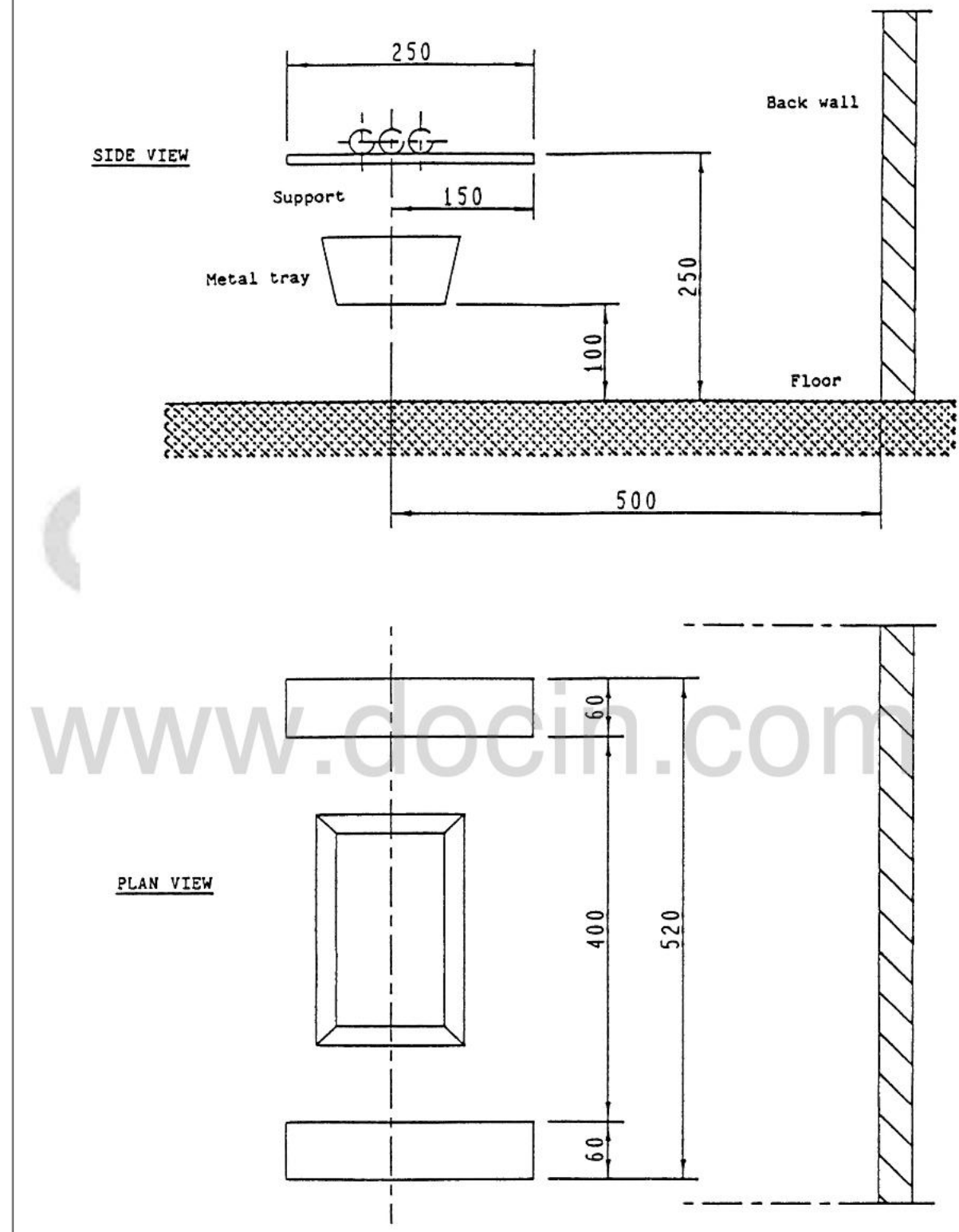

Figure 2 — Method of support of test piece dimensions in mm

National annex NA (informative)

Publications referred to

The following publications are referred to in the national foreword:

BS 5055:1991, *Specification for elastomer-insulated cables for electric signs and high-voltage luminous-discharge-tube installations.*

BS 6207:1991, *Specification for mineral-insulated copper-sheathed cables with copper conductors.*

BS 6724:1990, *Specification for armoured cables for electricity supply having thermosetting insulation with low emission of smoke and corrosive gases when affected by fire.*

BS 6883:1991, *Specification for elastomer insulated cables for fixed wiring in ships and on mobile and fixed offshore units.*

BS 7211:1989, *Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire.*

BS 7622, *Measurement of smoke density of electric cables burning under defined conditions.*

BS 7622-1:1993, *Test apparatus.*

IEC 1034, *Measurement of smoke density of electric cables burning under defined conditions.*

IEC 1034-2:1991, *Test procedures and requirements.*

HD 606, *Measurement of smoke density of electric cables burning under defined conditions.*

HD 606-2:1992, *Test procedures and requirements.*

National annex NB (informative)
Tensioning of test pieces (see 4.2.2)

Experience also shows that, depending upon construction, small cables and flexible cables may be subject to movement during the test. In these cases it is also recommended that tensioning be applied to prevent the movement while the test is in progress.

National annex NC (informative)
Sequence of burning for the cable test

The purpose of this annex is to reinforce the procedures in the text in respect of the sequence of burning.

Clause 5 Test procedure (for cable test)

When conducting a test on cable the sequence of burning is as follows.

a) Carry out a blank burning test exactly as for the qualification of the test apparatus in BS 7622-1.

b) Carry out the cable burning test using the alcohol fire source in **4.1.1** of BS 7622-1.

National annex ND (informative)
Calculation of absorbence

The absorbence (A_o), i.e. the absorbence produced across the opposite faces of a cube of side 1 m when one unit of material is burned, is calculated from the expression:

$$A_o = \frac{A_m V}{n l}$$

where

A_m is the measured absorbence as calculated in **4.2.4** of BS 7622-1 using the minimum light transmittance (I_t) recorded by the photocell in **5.6** of this Part;

V is the measured volume of the cube (in m^3);

n is the total number of samples of cable tested in the assembly;

NOTE Where bundles are tested n is the number of bundles multiplied by the number of cable samples in each bundle.

l is the measured length of the optical path (in m).

The absorbence value obtained is of significance if the system involves different cables/products and an overall assessment of smoke density level is required.

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British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

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W4 4AL