

Fire hazard testing —

Part 2: Test methods —

Section 4/sheet 2: 500 W nominal test flames and guidance

ICS 13.220.40

Committees responsible for this Draft for Development

The preparation of this Draft for Development was entrusted to Technical Committee GEL/89, Fire hazard testing, upon which the following bodies were represented:

- Association of Manufacturers of Domestic Electrical Appliances
- British Cable Makers Confederation
- British Electrical Systems Association (BEAMA Ltd.)
- British Plastics Federation
- British Telecommunications plc
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- Electricity Association
- Federation of the Electronics Industry
- Home Office
- Lighting Industry Federation Ltd.
- Ministry of Defence
- National Supervising Inspectorate
- Society of British Aerospace Companies Limited
- Warrington Fire Research Centre

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National foreword

This Draft for Development has been prepared by Technical Committee GEL/89 and is the English language version of European Prestandard ENV 60695-2-4/2:1995, *Fire hazard testing — Part 2: Test methods — Section 4/sheet 2: 500 W nominal test flames and guidance* published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 695-2-4/2:1994 published by the International Electrotechnical Commission (IEC).

Cross-references

Publication referred to	Corresponding British Standard
	BS EN 60695 <i>Fire hazard testing</i>
	BS EN 60695-2 <i>Test methods</i>
EN 60695-2-4/0:1993 (IEC 695-2-4/0:1991)	BS EN 60695-2-4/0:1993 <i>Diffusion type and premixed type flame test methods</i>
EN 60695-2-4/1:1993 (IEC 695-2-4/1:1991)	BS EN 60695-2-4/1:1993 <i>1 kW nominal premixed test flame and guidance</i>
EN 60695-4:1995 (IEC 695-4:1993)	BS EN 60695-4:1996 <i>Terminology concerning fire tests</i>

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European organization responsible for its conversion to a European Standard. A review of this publication will be initiated 2 years after its publication by the European organization so that a decision can be taken on its status at the end of its three-year life. The commencement of the review will be notified by an announcement in *BSI News*.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European Standard, to extend the life of the prestandard or to withdraw it. Comments should be sent in writing to the Secretary of BSI Technical Committee GEL/89 at 389 Chiswick High Road, London, W4 4AL giving the document reference and clause number and proposing, where possible, an appropriate revision of the text.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ENV title page, pages 2 to 24, 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.

ICS 13.220.40

Descriptors: Fire hazard testing, 500 W test flames and guidance

English version

Fire hazard testing
Part 2: Test methods
Section 4/sheet 2: 500 W nominal test flames and guidance
(IEC 695-2-4/2:1994)

Essais relatifs aux risques du feu
Partie 2: Méthodes d'essai
Section 4/feuille 2: Flammes d'essai de 500 W
(valeur nominale) et guide
(CEI 695-2-4/2:1994)

Prüfungen zur Beurteilung der Brandgefahr
Teil 2: Prüfverfahren
Hauptabschnitt 4/Blatt 2: 500 W-Flamme
(Nennwert) und Anleitung
(IEC 695-2-4/2:1994)

This European Prestandard (ENV) was approved by CENELEC on 1995-09-01 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CENELEC will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard (EN).

CENELEC members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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CENELEC

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

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Foreword

The text of the Technical Report IEC 695-2-4/2:1994, prepared by IEC TC 89, Fire hazard testing, was submitted to the CENELEC questionnaire and vote and was approved as ENV 60695-2-4/2 on 1995-09-01.

The following date was fixed:

- latest date by which the existence of the ENV has to be announced at national level (doa) 1996-03-01

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex ZA is normative and Annex A, Annex B, Annex C and Annex D are informative.

Annex ZA has been added by CENELEC.

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Introduction

IEC 695-2-4/0 gives:

- a) guidance on the design and use of flame test methods to assess the effect on the specimen of flames such as may arise from other ignited items in the vicinity, or from a fire in its early stages;
- b) a general description of the apparatus required to produce the test flame;
- c) a general description of the principle of a calibration procedure to check that the flame produced meets the requirements.

The detailed description of the apparatus needed to produce and verify the test flames is given in a series of sheets, of which this is one.

The status of the series, currently under study, is summarized in the following table:

Nominal power of the flame W	Type	Gas	Present status	Remarks Nominal height mm
1 000	Pre-mixed	Propane	IEC 695-2-4/1	ca 175
500 (A)	Pre-mixed	Methane	Method A of this document	ca 125
500 (B)	Pre-mixed	Propane	Method B of this document	ca 125
500 (C)	Pre-mixed	Methane/propane	Under consideration	ca 125
50	Pre-mixed	Methane	Under consideration	ca 20

The aim of the work, which was initiated by ACOS, is to make available an appropriate (minimum) series of standardized test flames, covering a range of powers for the use of all committees needing test flames. Wherever possible these test flames have been based on existing types, but with improved specifications.

Two methods (A and B) of producing the 500 W flame have been developed and are described in this present report. A third method which uses non-adjustable hardware but which should be more versatile than the hardware used in method B is under evaluation in the working group. If successful, the third method will be published as an addendum to this report to enable an extensive evaluative comparison to be made.

The three test flames are as follows:

- flame A, based on methane, makes use of a more tightly specified version of a burner that has been used in some countries for many years;
- flame B, based on propane, makes use of the same hardware as IEC 695-2-4/1;
- flame C, which is under evaluation in a working group, will make use of a more highly developed version of the burner that is used in method A, and should be capable of being produced with both methane and propane.

1 Scope

This technical report gives the detailed requirements for the production of a nominal 500 W, pre-mixed type test flame. The approximate overall height is 125 mm.

Two methods (A and B) are given: flame A based on methane; flame B based on propane.

2 Normative references

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

IEC 695-1-1:1982, *Fire hazard testing — Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products — General guidance*.

IEC 695-1-2:1982, *Fire hazard testing — Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products — Guidance for electronic components*.

IEC 695-1-3:1986, *Fire hazard testing — Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products — Guidance for use of preselection procedures.*

IEC 695-2-4/0:1991, *Fire hazard testing — Part 2: Test methods — Section 4/sheet 0: Diffusion type and pre-mixed type flame test methods.*

IEC 695-2-4/1:1991, *Fire hazard testing — Part 2: Test methods — Section 4/sheet 1: 1 kW nominal pre-mixed test flame and guidance.*

IEC 695-4:1993, *Fire hazard testing — Part 4: Terminology concerning fire tests.*

ISO 1337:1980, *Wrought coppers (having minimum copper contents of 99,85 %) — Chemical composition and forms of wrought products.*

3 Definitions

For the purpose of this technical report, the following definition applies:

standardized 500 W test flame

one that conforms with this technical report, meets all of the requirements given in either clause 4 for method A, or clause 5 for method B

4 Method A

4.1 Requirements

A standardized 500 W nominal test flame, according to this method, is one that is produced:

- using hardware according to Figure A.1 and Figure A.2 (see Annex A);
- supplied with methane gas of purity not less than 99 % at a flow rate equivalent to 965 ml/min $\pm$ 30 ml/min at 23 °C, 0,1 MPa¹⁾, and at a back pressure of 125 mm $\pm$ 5 mm water, using the arrangements of Figure A.2.

The flame shall be symmetrical, stable and give a result of 54 s $\pm$ 2 s in the confirmatory test described in 4.4.

The confirmatory test arrangement shown in Figure A.3 shall be used.

The blue cone shall have a height of 40 mm $\pm$ 2 mm, when measured using the jig described in Figure 2, in subdued light against a dark background.

The overall height of the flame, when measured using the jig described in Figure 2, in subdued light against a dark background, shall be approximately 125 mm.

4.2 Apparatus and fuel

4.2.1 Burner

The burner shall be in accordance with Figure A.1.

NOTE The burner tube, gas injector and needle valve are removable for cleaning purposes. Care should be taken on re-assembly that the needle valve tip is not damaged and that the needle valve and valve seat (gas injector) are correctly aligned.

4.2.2 Flowmeter

The flowmeter shall be appropriate for the measurement of the gas flow rate of 965 ml/min at 23 °C, 0,1 MPa to an accuracy of $\pm$ 2 %.

4.2.3 Manometer

The manometer shall be appropriate for the measurement of pressure in the range of 0 to 7,5 kPa. A water manometer may be used for this purpose. It should be adapted to read 0 to 7,5 kPa.

4.2.4 Control valve

A control valve is required to set the gas flow rate.

4.2.5 Copper block

A copper block of 9 mm diameter, of mass 10,00 g $\pm$ 0,05 g in the fully machined but undrilled state (Figure 1).

¹⁾ Corrected from the measurements taken under actual conditions of use.

4.2.6 Thermocouple

Sheathed fine wire type K (NiCr/NiAl), outer sheath diameter 0,5 mm, suitable for long-term operation at $> 1\,050\text{ }^{\circ}\text{C}$.

The preferred method of fastening the thermocouple to the block is by compressing the copper around the thermocouple (see Figure A.3).

4.2.7 Temperature/time indicating/recording and timing devices

The devices shall be appropriate for the measurement of the time for the block to heat up from $100\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ to $700\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ with a tolerance on the measured time of $\pm 0,5\text{ s}$.

4.2.8 There shall be a means of measuring the ambient air temperature and pressure.

4.2.9 The fuel gas shall be methane with a purity of not less than 99 %.

4.3 Production of test flame

The gas supply arrangements for the burner, given in Figure A.2, shall be used. Care shall be taken to ensure leak-free connections.

The gas shall be ignited, and the gas flow and back pressure adjusted to the required values. The air inlet shall be adjusted until the blue cone height is $40\text{ mm} \pm 2\text{ mm}$, when measured using the jig described in Figure 2 in subdued light against a dark background, and then locked in position with the lock nut.

The flame shall appear stable and symmetrical on examination.

4.4 Confirmation of the test flame

4.4.1 Principle

The time taken for the temperature of the copper block, described in Figure 1, to increase from $100\text{ }^{\circ}\text{C}$ to $700\text{ }^{\circ}\text{C}$ shall be $54\text{ s} \pm 2\text{ s}$, when the flame confirmatory test arrangement of Figure A.3 is used.

4.4.2 Procedure

- Set up the arrangement according to Figure A.3 in a draught-free environment, ensuring leak-free gas connections.
- Temporarily remove the burner away from the block to ensure no influence of the flame on the block during the preliminary adjustment of the gas flow, gas back pressure and air inlet.
- Ignite the gas, and adjust the gas flow and back pressure to the prescribed conditions. Adjust the air inlet until the blue cone height is $40\text{ mm} \pm 2\text{ mm}$, when measured using the jig described in Figure 2, and viewed in subdued light against a dark background. Lock the air inlet in position with the lock nut.
- Ensure that the overall height of the flame, measured using the jig described in Figure 2, in subdued light against a dark background is approximately 125 mm and that the flame is symmetrical.
- Wait for a period of at least 5 min to allow the burner conditions to reach equilibrium. Check that the gas flow and back pressure and the blue cone height are within the prescribed limits.
- With the temperature/time indicating/recording devices operational, re-position the burner under the block.
- Make three determinations of the time for the temperature of the block to increase from $100\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ to $700\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$. Allow the block to cool naturally in air to below $50\text{ }^{\circ}\text{C}$ between determinations.
- If the copper block has not been used before, make a preliminary run to condition the block surface. Discard the result.
- Calculate the mean time in seconds as the result.

4.4.3 The flame is confirmed and may be used for test purposes if the result is within the range $54\text{ s} \pm 2\text{ s}$.

5 Method B

5.1 Requirements

A standardized 500 W nominal test flame, according to this method, is one that is produced:

- using hardware according to Figure B.1 to Figure B.5 (see Annex B);