SRI LANKA STANDARD 1007 : PART 1.2 : 2008
IEC 60332 : PART 1-2 : 2004

METHODS OF TEST ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS

PART 1.2 : TEST FOR VERTICAL FLAME PROPAGATION FOR A SINGLE INSULATED WIRE OR CABLE – PROCEDURE FOR 1 kW PRE-MIXED FLAME

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard

METHODS OF TEST ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS

PART 1.2 : TEST FOR VERTICAL FLAME PROPAGATION FOR A SINGLE INSULATED WIRE OR CABLE – PROCEDURE FOR 1 kW PRE-MIXED FLAME

SLS 1007 : Part 1.2 : 2008
IEC 60332 : Part 1-2 : 2004
(Attached Amd No.1 (AMD 534))
Gr.E

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Sri Lanka.

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

Sri Lanka Standard
METHODS OF TEST ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS
PART 1.2 : TEST FOR VERTICAL FLAME PROPAGATION FOR A SINGLE INSULATED WIRE OR CABLE – PROCEDURE FOR 1 kW PRE-MIXED FLAME

NATIONAL FOREWORD

This standard was approved by the Sectoral Committee on Electric Cables and Conductors and was authorized for adoption and publication as a Sri Lanka Standard by the Council of Sri Lanka Standards Institution on 2008-08-28.

SLS 1007 Part 1.1 and **SLS 1007 Part 1.2** supersede **SLS 1007 Part 1 : 1993**.

SLS 1007 Methods of test for electric and optical cables under fire conditions is published in five parts as follows:

Part 1.1	Tests for vertical flame propagation for a single insulated wire or cable - Apparatus
Part 1.2	Tests for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame
Part 1.3	Tests for vertical flame propagation for a single insulated wire or cable - Procedure for determination of flaming droplets / particles.
Part 2.1	Tests for vertical flame propagation for a single small insulated wire or cable - Apparatus
Part 2.2	Tests for vertical flame propagation for a single small insulated wire or cable - Procedure for diffusion flame.

This part of the standard is identical with **IEC 60332-1-2 : 2004 :** Tests on electric and optical fibre cables under fire conditions – Part 1-2 : Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame, published by the International Electrotechnical Commission (IEC).

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the results of a test or an analysis shall be rounded off in accordance with **CS 102**. The number of significant places to be retained in the rounded off value shall be the same as that of the specified value in the standard.

Terminology and conventions

The text of the International Standard has been accepted as suitable for publication without deviation, as a Sri Lanka Standard. However, certain terminology and conventions are not identical with those used in Sri Lanka Standards; attention is therefore drawn to the following:

a) Wherever the words “International Standard” appear referring to this standard they should be interpreted as “Sri Lanka Standard”.

b) Wherever the page numbers are quoted they are page number of IEC standard.

c) The comma has been used throughout the standard as a decimal marker. In Sri Lanka Standards it is the current practice to use a full point on the base line as the decimal marker.

CROSS REFERENCES

International Standards	**Corresponding Sri Lanka Standards**
IEC 60332 : Tests on electric and optical fibre cables under fire conditions Part 1.1 : Test for vertical flame propagation for a single insulated wire or cable – Apparatus	SLS 1007 : Tests on electric and optical fibre cables under fire conditions Part 1.1 : Test for vertical flame propagation for a single insulated wire or cable – Apparatus

NOTE : *Corresponding Sri Lanka Standards for other international standards listed under references in IEC 60322-1-2, are not available*.

NORME INTERNATIONALE
INTERNATIONAL STANDARD

CEI
IEC
60332-1-2

Première édition
First edition
2004-07

PUBLICATION GROUPÉE DE SÉCURITÉ
GROUP SAFETY PUBLICATION

Essais des câbles électriques et à fibres optiques soumis au feu –

Partie 1-2: Essai de propagation verticale de la flamme sur conducteur ou câble isolé – Procédure pour flamme à prémélange de 1 kW

Tests on electric and optical fibre cables under fire conditions –

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

Numéro de référence
Reference number
CEI/IEC 60332-1-2:2004

Numérotation des publications

Depuis le 1er janvier 1997, les publications de la CEI sont numérotées à partir de 60000. Ainsi, la CEI 34-1 devient la CEI 60034-1.

Editions consolidées

Les versions consolidées de certaines publications de la CEI incorporant les amendements sont disponibles. Par exemple, les numéros d'édition 1.0, 1.1 et 1.2 indiquent respectivement la publication de base, la publication de base incorporant l'amendement 1, et la publication de base incorporant les amendements 1 et 2.

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International Electrotechnical Commission
Международная Электротехническая Комиссия

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

FOREWORD

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International Standard IEC 60332-1-2 has been prepared by IEC technical committee 20: Electric cables.

It has the status of a group safety publication in accordance with IEC Guide 104.

This first edition of International Standard IEC 60332-1-2, together with IEC 60332-1-1, cancel and replace the third edition of IEC 60332-1, published in 1993, and constitute a technical revision, calling for the re-structurization of the standard into two separate parts.

The text of this standard is based on the following documents:

FDIS	Report on voting
20/697/FDIS	20/711/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 60332 consists of the following parts, under the general title *Tests on electric and optical fibre cables under fire conditions:*

Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1kW pre-mixed flame

Part 1-3: Test for vertical flame propagation for a single insulated wire or cable – Procedure for determination of flaming droplets/particles

Part 2-1: Test for vertical flame propagation for a single small insulated wire or cable – Apparatus

Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable - Procedure for diffusion flame

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

1 Scope

This part of IEC 60332 specifies the procedure for testing the resistance to vertical flame propagation for a single vertical electrical insulated conductor or cable, or optical fibre cable, under fire conditions. The apparatus is given in IEC 60332-1-1.

NOTE 1 Testing to IEC 60332-1-2 may be performed simultaneously with that to IEC 60332-1-3 if required.

Recommended requirements for performance are given in Annex A.

IEC 60332-1-2 specifies the use of a 1 kW pre-mixed flame and is for general use, except that the procedure specified may not be suitable for the testing of small single insulated conductors or cables of less than 0,5 mm² total cross-section because the conductor melts before the test is completed, or for the testing of small optical fibre cables because the cable is broken before the test is completed. In these cases, the procedure given in IEC 60332-2-2 is recommended.

NOTE 2 Since the use of insulated conductor or cable which retards flame propagation and complies with the recommended requirements of this standard is not sufficient by itself to prevent propagation of fire under all conditions of installation, it is recommended that wherever the risk of propagation is high, for example in long vertical runs of bunches of cables, special installation precautions should also be taken. It cannot be assumed that because the sample of cable complies with the performance requirements recommended in this standard, that a bunch of cables will behave in a similar manner. (See IEC 60332-3 series.)

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60332-1-1, *Tests on electric and optical fibre cables under fire conditions – Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus*

IEC 60695-4, *Fire hazard testing – Part 4: Terminology concerning fire tests*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. The definitions are taken from IEC 60695-4.

3.1
ignition source
source of energy that initiates combustion

[IEC 60695-4:1993, definition 2.76]

3.2
char
carbonaceous residue resulting from pyrolysis or incomplete combustion

[IEC 60695-4:1993, definition 2.12]

4 Test apparatus

The apparatus specified in IEC 60332-1-1 shall be used.

5 Procedure

5.1 Sample

The test sample shall be a piece of single insulated conductor or cable (600 ± 25) mm long.

5.2 Conditioning

Before testing, all test pieces shall be conditioned at (23 ± 5) °C for not less than 16 h at a relative humidity of (50 ± 20) %.

In the case of a single insulated conductor or cable with a finish of paint or lacquer, this conditioning shall follow an initial period where the test piece shall be kept at a temperature of (60 ± 2) °C for 4 h.

5.3 Positioning of test piece

The test piece shall straightened and be secured to two horizontal supports by means of a suitable size of copper wire, in a vertical position in the centre of the metal screen, as described in 4.2 of IEC 60332-1-1, so that the distance between the bottom of the upper support and the top of the lower support is (550 ± 5) mm. In addition, the test piece shall be positioned so that the bottom of the specimen is approximately 50 mm from the base of the screen (see Figure 1).

The vertical axis of the test piece shall be arranged centrally within the screen (i.e. 150 mm from each side and 225 mm from the rear).

5.4 Flame application

Safety warning

Precautions shall be taken to safeguard personnel against the following when conducting tests:

a) the risk of fire or explosion;

b) the inhalation of smoke and/or noxious products, particularly when halogenated materials are burned;

c) harmful residues.

5.4.1 Positioning of flame

One burner, as described in 4.3 of IEC 60332-1-1, shall be ignited and the recommended flow rates of gas and air adjusted. The burner shall be positioned so that the tip of the inner blue cone impinges on the surface of the test piece at a distance of (475 ± 5) mm from the lower edge of the upper horizontal support, whilst the burner is at an angle of 45° ± 2° to the vertical axis of the test piece (see Figure 2).

For flat-form cables, the flame impingement shall be on the middle of the flat side of the cable.

5.4.2 Test duration

The flame shall be applied continuously for the period of time corresponding to the diameter shown in Table 1.

Table 1 – Time for flame application

Overall diameter of test piece [a] mm	Time for flame application [b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.

[b] For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.

At the end of the specified test duration, the burner shall be removed and the flame of the burner extinguished.

6 Evaluation of test results

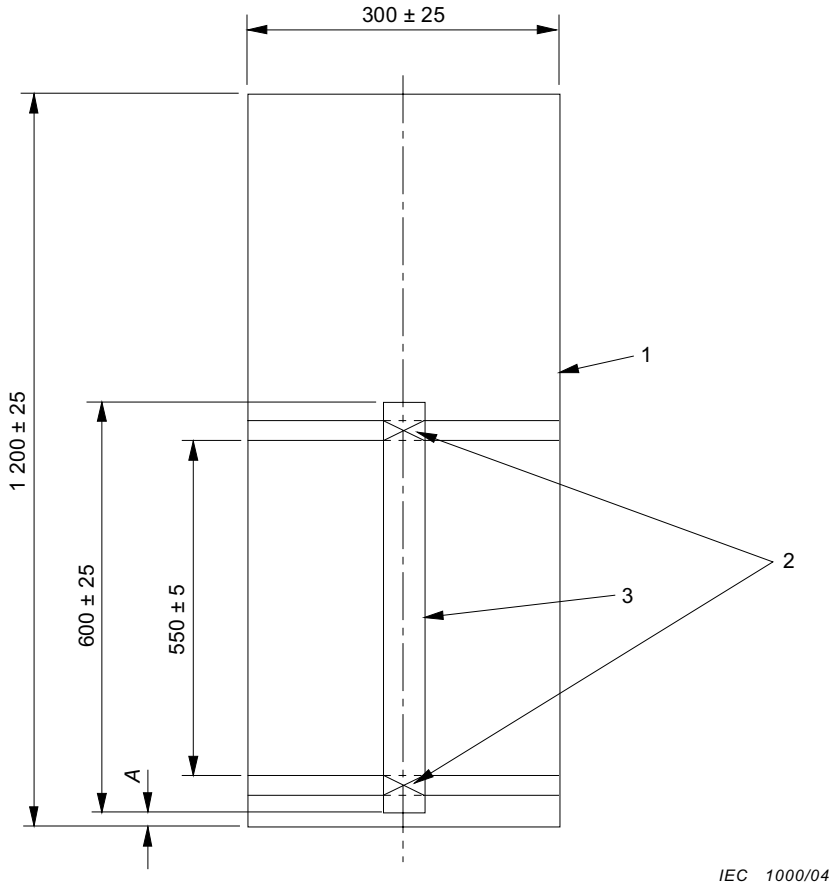
After all burning has ceased, the test piece shall be wiped clean.

All soot shall be ignored if, when wiped off, the original surface is undamaged. Softening or any deformation of the non-metallic materials shall also be ignored. The distance from the lower edge of the top support to the upper onset of charring and the distance from the lower edge of the top support to the lower onset of charring shall be measured to the nearest millimetre.

The onset of char shall be determined as follows.

Press against the cable surface with a sharp object, for example, a knife blade. Where the surface changes from a resilient to a brittle (crumbling) surface indicates the onset of charring.

Dimensions in millimetres



Key

1 metallic screen

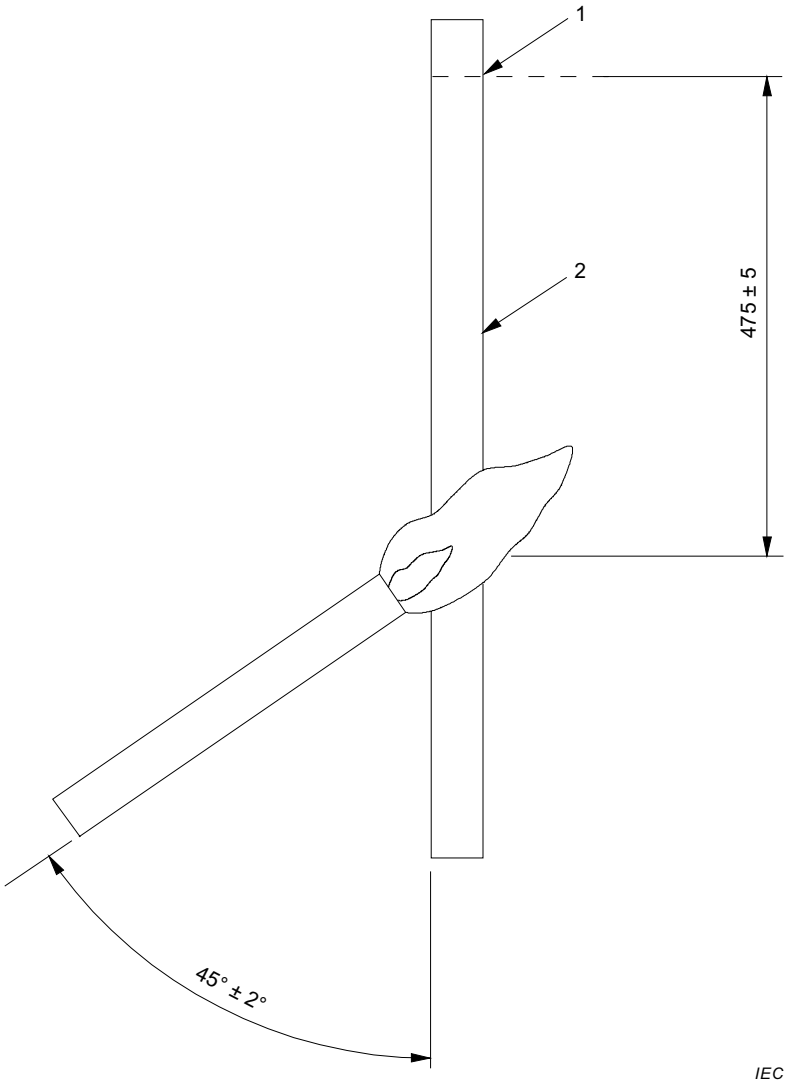
2 support arm and copper wire fixing

3 test piece

Distance A: Length from base of screen to bottom of test piece = 50 mm (approximately)

Figure 1 – Arrangement of test piece in test apparatus

Dimensions in millimetres



Key

1 lower edge of top support

2 test piece

Figure 2 – Application of flame to test piece

Annex A
(informative)

Recommended performance requirements

The performance requirements for a particular type or class of insulated conductor or cable should preferably be given in the individual cable standard. In the absence of any given requirement it is recommended that those given below should be taken as a minimum acceptable level.

The single insulated conductor or cable shall pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50 mm.

In addition, a failure shall be recorded if charring extends downwards to a point greater than 540 mm from the lower edge of the top support.

If a failure is recorded, two more tests shall be carried out. If both tests result in passes, the single insulated conductor or cable shall be deemed to have passed the test.

Bibliography

IEC 60332-1-3, *Tests on electric and optical fibre cables under fire conditions – Part 1-3: Test for vertical flame propagation for a single small insulated conductor or cable – Procedure for determination of flaming droplets/particles*

IEC 60332-2-2, *Tests on electric and optical fibre cables under fire conditions – Part 2-2: Test for vertical flame propagation for a single small insulated conductor or cable – Procedure for diffusion flame*

IEC 60332-3 (all parts), *Tests on electric cables under fire conditions – Test for vertical flame spread of vertically-mounted bunched wires or cables*

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AMENDMENT 1
AMENDEMENT 1

Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

Essais des câbles électriques et à fibres optiques soumis au feu – Partie 1-2: Essai de propagation verticale de la flamme sur conducteur ou câble isolé – Procédure pour flamme à prémélange de 1 kW

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FOREWORD

This amendment has been prepared by IEC technical committee 20: Electric cables.

The text of this amendment is based on the following documents:

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20/1591/FDIS	20/1598/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

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- amended.

———————

2 Normative references

Add the following new reference:

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions*

3 Terms and definitions

Replace the existing source of item 3.1 by the following new source:

[SOURCE: ISO 13943:2008, 1.489]

Replace the existing source of item 3.2 by the following new source:

[SOURCE: ISO 13943:2008, 4.38]

5.1 Sample

Replace the existing subclause by the following new subclause:

The test sample shall be a piece of single insulated conductor or cable (600 ± 25) mm long.

The test sample diameter shall be measured using the method given in IEC 60811-203. The measurement shall be made at each of three places, separated by at least 100 mm.

The average of the three values obtained shall be rounded to obtain the overall diameter. If the calculation gives 5 or more for the second decimal figure, raise the first to the next number; thus, for example, 5,75 is rounded to 5,8. If the calculation gives 4 or less for the second decimal figure, maintain the first number; thus, for example, 5,74 is rounded to 5,7.

The overall diameter obtained shall be used for the selection of the time for flame application.

5.3 Positioning of test piece

Replace the existing subclause by the following new subclause:

The test piece shall be straightened and secured to two horizontal supports by means of a suitable size of copper wire, in a vertical position in the centre of the metal enclosure, as described in IEC 60332-1-1, so that the distance between the bottom of the upper support and the top of the lower support is (550 ± 5) mm. In addition, the test piece shall be positioned so that the bottom of the specimen is approximately 50 mm from the base of the enclosure (see Figure 1).

The vertical axis of the test piece shall be arranged centrally within the enclosure (i.e. 150 mm from each side and 225 mm from the rear).

5.4.1 Positioning of flame

Replace the existing subclause by the following new subclause:

A burner, as described in IEC 60332-1-1, shall be ignited and the flow rates of gas and air adjusted to the specified values. The burner shall be positioned so that the tip of the blue cone impinges on the surface of the test piece at a distance of (475 ± 5) mm from the lower edge of the upper horizontal support, whilst the burner is at an angle of (45 ± 2)° to the vertical axis of the test piece (see Figure 2). The burner position shall be fixed throughout the flame application time.

For flat-form cables, the flame impingement shall be on the middle of the flat side of the cable.

In case of an electrical insulated conductor or cable, should the test piece move significantly during the test so as to render the result invalid, the test piece shall be held straight by the attachment of a load of approximately 5 N/mm^2 of conductor area to the lower part of the sample so that the distance between the point where the load is attached and the lower edge of the top support measures (550 ± 5) mm. In such cases, the test piece shall not be secured to the lower support.

5.4.2 Test duration

Replace the second paragraph by the following new paragraph:

At the end of the specified flame application time, the burner shall be removed and the flame of the burner extinguished.

Table 1 – Time for flame application

Replace the existing footnote a by the following new footnote a:

[a] For non-circular cables in which the major to minor axis ratio is less than 3, the nominal minor axis shall be used as the overall diameter (D). For non-circular cables in which the major to minor axis ratio lies between 3 and 16, the overall diameter (D) shall be taken as the sum of the major and minor axis divided by 3,14 (π). For cables in which the major to minor axis ratio exceeds 16, the test criteria shall be given in the product standard or, if not, agreed between manufacturer and purchaser.

Delete the reference to footnote b in the second column heading and delete footnote b.

Figure 1 – Arrangement of test piece in test apparatus

Replace, under **Key,** *the first line by the following new line:*

1 metal enclosure

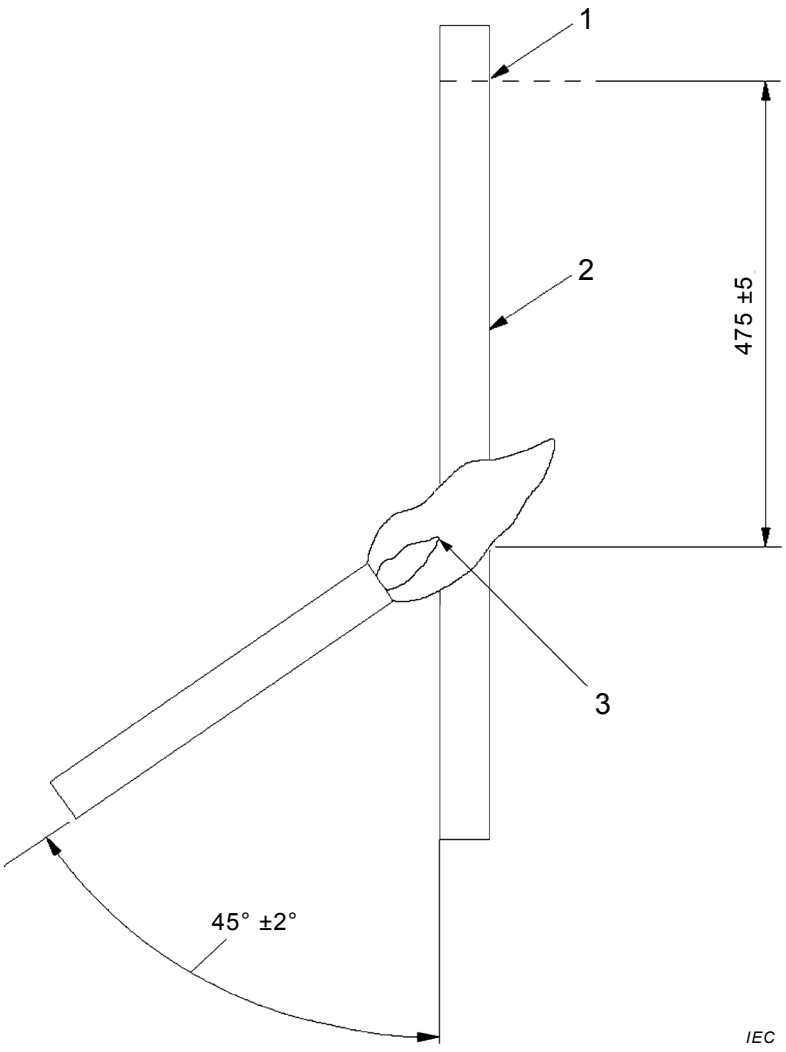
Replace the existing description for Distance A by the following new description:

Distance A: Length from base of enclosure to bottom of test piece = 50 mm (approximately)

Figure 2 – Application of flame to test piece

Replace the existing Figure 2 by the following new Figure 2:

Dimensions in millimetres



Key

1 lower edge of top support
2 test piece
3 position of impingement of blue cone

Figure 2 – Application of flame to test piece

Bibliography

Add the following new reference:

ISO 13943, *Fire safety – Vocabulary*

———————

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

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The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in turn are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of standardization as are of special interest to Sri Lanka.

Printed at the Sri Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.

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Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*

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