ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ ๔๙๘๘ (พ.ศ. ๒๕๖๐)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. ๒๕๑๑

เรื่อง กำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

วิธีทดสอบสายไฟฟ้าและเคเบิลเส้นใยนำแสงในภาวะที่เกิดการลุกไหม้

เล่ม ๑ (๓) การทดสอบความต้านทานการลุกลามของเปลวไฟในแนวดิ่ง

สำหรับสายไฟฟ้าหุ้มฉนวนหรือเคเบิล เส้นเดี่ยว – วิธีดำเนินการประเมินหยด/อนุภาคที่ติดไฟ

อาศัยอำนาจตามความในมาตรา ๑๕ แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. ๒๕๑๑ ซึ่งแก้ไขเพิ่มเติมโดยพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม (ฉบับที่ ๗) พ.ศ. ๒๕๕๘ รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม วิธีทดสอบสายไฟฟ้าและเคเบิลเส้นใยนำแสงในภาวะที่เกิดการลุกไหม้ เล่ม ๑ (๓) การทดสอบความต้านทานการลุกลามของเปลวไฟในแนวดิ่งสำหรับสายไฟฟ้าหุ้มฉนวนหรือเคเบิล เส้นเดี่ยว – วิธีดำเนินการประเมินหยด/อนุภาคที่ติดไฟ มาตรฐานเลขที่ มอก. 2756 เล่ม 1 (3) – 2559 ไว้ ดังมีรายละเอียดต่อท้ายประกาศนี้

ทั้งนี้ ให้มีผลตั้งแต่วันที่ประกาศในราชกิจจานุเบกษาเป็นต้นไป

ประกาศ ณ วันที่ ๗ มีนาคม พ.ศ. ๒๕๖๐

อุตตม สาวนายน

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรม
วิธีทดสอบสายไฟฟ้าและเคเบิลเส้นใยนำแสง ในภาวะที่เกิดการลุกไหม้
เล่ม 1(3) การทดสอบความต้านทานการลุกลามของเปลวไฟในแนวดิ่ง สำหรับสายไฟฟ้าหุ้มฉนวนหรือเคเบิล เส้นเดี่ยว – วิธีดำเนินการประเมินหยด/อนุภาคที่ติดไฟ

1. ขอบข่าย

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ระบุวิธีดำเนินการทดสอบสำหรับการประเมินหยด/อนุภาคที่ติดไฟ (flaming droplet/particle) ที่ตก เมื่อทดสอบสายไฟฟ้าหุ้มฉนวน เคเบิล หรือเคเบิลเส้นใยนำแสง เส้นเดี่ยวในแนวดิ่ง ในภาวะที่เกิดการลุกไหม้ที่กำหนด

หมายเหตุ 1 การทดสอบตาม มอก.2756 เล่ม 1(3) อาจทำพร้อมกับการทดสอบตาม มอก.2756 เล่ม 1(2) ได้ถ้าต้องการ ข้อกำหนดด้านสมรรถนะที่แนะนำให้ไว้ใน Annex A

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ระบุการใช้เปลวไฟแบบพรีมิกซ์ 1 kW และเป็นการใช้โดยทั่วไป ยกเว้นวิธีดำเนินการที่ระบุอาจไม่เหมาะสมกับการทดสอบสายไฟฟ้าหุ้มฉนวนหรือเคเบิล เส้นเดี่ยวขนาดเล็กที่มีภาคตัดขวางรวมน้อยกว่า 0.5 mm^2 และเคเบิลเส้นใยนำแสงขนาดเล็ก เนื่องจากตัวนำจะหลอมเหลวและเส้นใยนำแสงจะแตกก่อนเสร็จสิ้นการทดสอบ

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

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

FOREWORD

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This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 60332-1-3 bears the edition number 1.1. It consists of the first edition (2004-07) [documents 20/698/FDIS and 20/712/RVD] and its amendment 1 (2015-07) [documents 20/1592/FDIS and 20/1599/RVD]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 60332-1-3 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 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 the base publication and its amendment will remain unchanged until the stability 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

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

1 Scope

This part of IEC 60332 specifies a test procedure for assessment of falling flaming droplets/ particles when a single vertical electrical insulated conductor or cable, or optical fibre cable, is subjected to defined fire conditions.

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

Recommended requirements for performance are given in Annex A.

IEC 60332-1-3 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 mm^2 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.

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

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. Some definitions are taken from IEC 60695-4.

3.1
ignition source
source of energy that initiates combustion

[SOURCE: ISO 13943:2008, 1.489]

3.2
flaming debris
matter flowing or separating from the specimen during the test procedure and falling below the initial lower edge of the specimen, continuing to flame as it falls, and igniting the filter paper beneath

4 Test apparatus

4.1 General

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

4.2 Ignition source

The ignition source shall comply with IEC 60332-1-1.

4.3 Filter paper

The filter paper shall consist of undyed cellulose filter paper of a density of (80 ± 15) g/m^2 with an ash content of less than 0,1 %. The filter paper shall be conditioned at (23 ± 2) °C for not less than 4 h at a relative humidity of (50 ± 10) %.

5 Procedure

5.1 Sample

The test sample shall be a piece of 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.

5.2 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 an 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 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).

Two pieces of filter paper (300 ±10) mm × (300 ±10) mm shall be placed flat, one on top of the other, on the base of the metal enclosure, no more than 3 min before the start of the test. The filter papers shall be positioned centrally beneath the test piece.

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

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

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** s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[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.

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

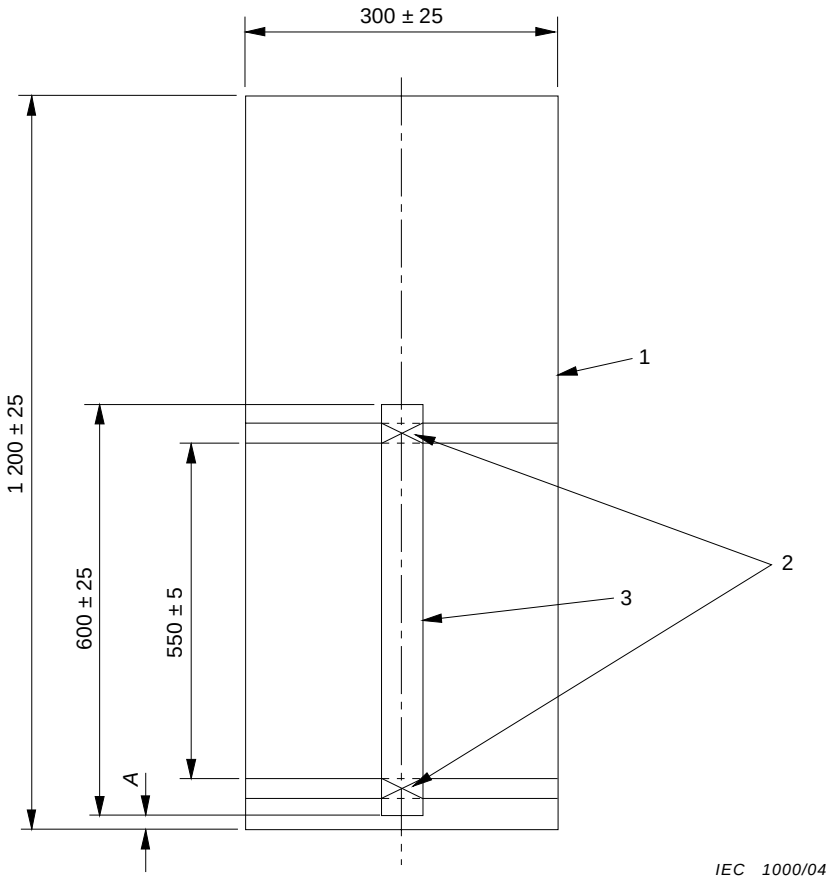
6 Evaluation of test results

During the test duration, it shall be recorded:

a) if the filter paper has ignited or not;

b) if the filter paper has ignited, the time from ignition of the filter paper to cessation of the burning.

Dimensions in millimetres



Key

1 metal enclosure

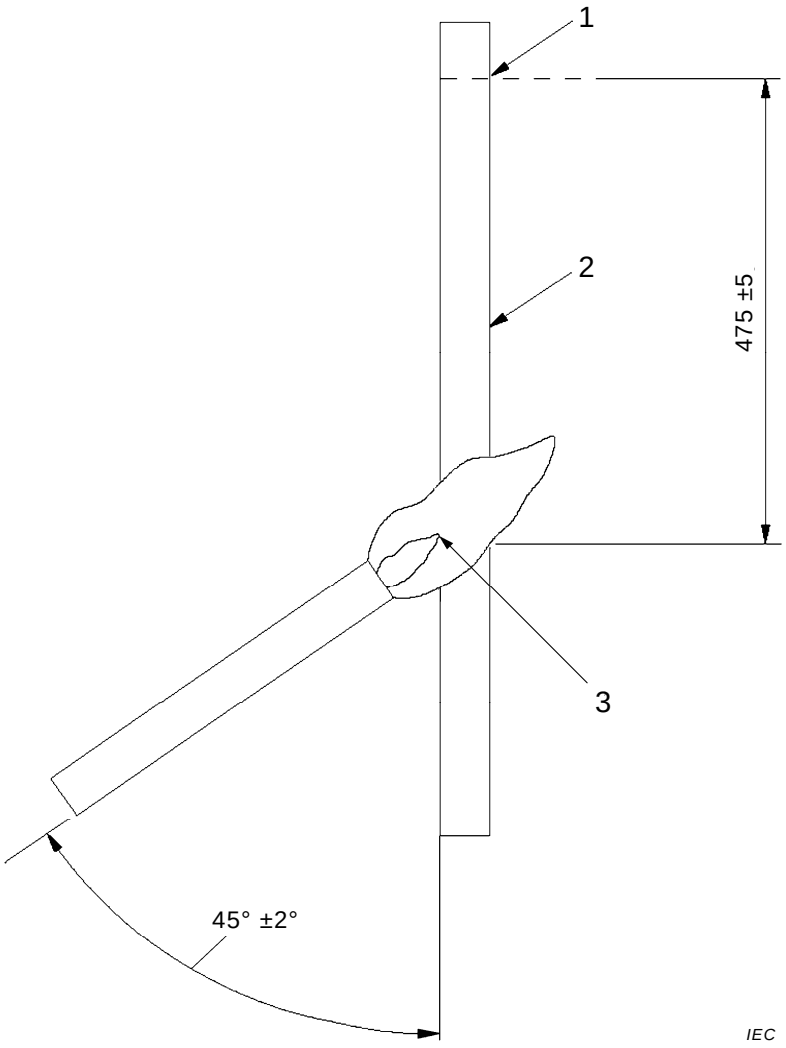
2 support arm and copper wire fixing

3 test piece

Distance A: Length from base of enclosure 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

3 position of impingement of blue cone

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 insulated conductor or cable shall pass the test if the filter paper has not ignited during the test duration.

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

Bibliography

IEC 60332-1-2, *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*

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

ISO 13943, *Fire safety – Vocabulary*