

ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ ๔๙๗๕ (พ.ศ. ๒๕๖๐)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. ๒๕๑๑

เรื่อง กำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

การวัดความหนาแน่นคว้นของสายไฟฟ้าที่ไหม้ไฟภายใต้ภาวะที่ระบุ

เล่ม ๑ เครื่องทดสอบ

อาศัยอำนาจตามความในมาตรา ๑๕ แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. ๒๕๑๑ ซึ่งแก้ไขเพิ่มเติมโดยพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม (ฉบับที่ ๗) พ.ศ. ๒๕๕๘ รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม การวัดความหนาแน่นคว้นของสายไฟฟ้าที่ไหม้ไฟภายใต้ภาวะที่ระบุ เล่ม ๑ เครื่องทดสอบ มาตรฐานเลขที่ มอก. ๒๗๕๘ เล่ม ๑ - ๒๕๕๙ ไว้ ดังมีรายละเอียดต่อท้ายประกาศนี้

ทั้งนี้ ให้มีผลตั้งแต่วันที่ประกาศในราชกิจจานุเบกษาเป็นต้นไป

ประกาศ ณ วันที่ ๒๓ กุมภาพันธ์ พ.ศ. ๒๕๖๐

อุตตม สาวนายน

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรม การวัดความหนาแน่นควันของสายไฟฟ้า ที่ไหม้ไฟภายใต้ภาวะที่ระบุ เล่ม 1 เครื่องทดสอบ

1. ขอบข่าย

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ระบุรายละเอียดของเครื่องทดสอบที่ใช้สำหรับวัดการปล่อยควันเมื่อสายไฟฟ้าหรือเคเบิลเส้นใยนำแสงไหม้ไฟภายใต้ภาวะที่ระบุ เช่น สายไฟฟ้าหลายเส้นไหม้ไฟในแนวนอน การส่องผ่านของแสง (light transmittance: I_t) ภายใต้ภาวะเปลวไฟเผาไหม้และภาวะคุกรุ่น (smouldering) สามารถใช้เป็นวิธีเปรียบเทียบสายไฟฟ้าที่แตกต่างกันหรือการเป็นไปตามคุณลักษณะที่ต้องการเฉพาะ

หมายเหตุ สำหรับวัตถุประสงค์ของมาตรฐานนี้คำว่า “สายไฟฟ้า” ครอบคลุมสายไฟฟ้าวานาโลหะหุ้มฉนวนทั้งหมดที่ใช้สำหรับการส่งจ่ายพลังงานหรือสัญญาณ

© IEC:2005+A1:2013

เอกสารฉบับนี้เป็นลิขสิทธิ์ของ IEC หากมีได้ระบุไว้เป็นอย่างอื่น ห้ามนำเอกสารฉบับนี้หรือส่วนหนึ่งส่วนใดไปทำซ้ำหรือใช้ประโยชน์ในรูปแบบหรือโดยวิธีใด ๆ ไม่ว่าจะในรูปแบบอิเล็กทรอนิกส์หรือทางกล รวมถึงการถ่ายสำเนาและการถ่ายไมโครฟิล์ม โดยไม่ได้รับอนุญาตเป็นลายลักษณ์อักษรจาก IEC หรือจากสมาชิก IEC ในประเทศของผู้ร้องขอ

หากมีคำถามใด ๆ เกี่ยวกับลิขสิทธิ์ของ IEC หรือมีคำถามเกี่ยวกับการขอรับสิทธิเพิ่มเติมในเอกสารฉบับนี้ โปรดติดต่อตามที่อยู่ด้านล่างหรือติดต่อสมาชิก IEC ในประเทศของผู้ร้องขอเพื่อขอข้อมูลเพิ่มเติม

All right reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax.: +41 22 919 03 00
Email: inmail@iec.ch
Web: www.iec.ch

FOREWORD

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

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

FDIS	Report on voting
20/1428/FDIS	20/1443/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.

The committee has decided that the contents of this publication 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.

10.3 Qualification fire sources

Replace the existing subclause by the following new subclause:

Two mixtures, a) and b), of PA (pro analysis) toluene and alcohol (as defined in Clause 6) shall be made up as follows:

The two mixtures shall be prepared by measuring the required quantity of toluene, 40 ml for a) or 100 ml for b), into a 1,0 l volumetric flask using a pipette and adding alcohol up to the 1,0 l calibration mark.

NOTE PA toluene has a purity greater than 99,5 %.

The mixtures shall be contained in a tray as described in Clause 6.

10.4 Test procedure

Replace the existing text of the second sentence by the following:

Record the minimum of the measured transmittance level I_t during the test.

10.5 Calculation

In the first formula, replace " I_t " by " $I_{t(\min)}$ "

Replace "where I_0 is the initial transmittance." by:

where I_0 is the initial transmittance level of incident light and $I_{t(\min)}$ is the minimum of the measured transmittance level during the qualification test"

Annex A – Guidance notes

Clause A.2 Optical system

In the third line of a) replace " I_t " by " I_t " in the English text only.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	7
4 Details of test enclosure	7
5 Photometric system	8
6 Standard fire source	9
7 Smoke mixing.....	9
8 Blank test.....	9
8.1 Purpose	9
8.2 Procedure	9
9 Qualification of test apparatus	9
10 Qualification burning test	10
10.1 Purpose	10
10.2 Preparation of cube	10
10.3 Qualification fire sources	10
10.4 Test procedure	10
10.5 Calculation	10
10.6 Requirements	10
Annex A (informative) Guidance notes.....	14
Bibliography	16
Figure 1 – Plan view of test chamber.....	11
Figure 2 – Photometric system	12
Figure 3 – Metal tray.....	13

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASUREMENT OF SMOKE DENSITY OF CABLES BURNING UNDER DEFINED CONDITIONS –

Part 1: Test apparatus

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61034-1 has been prepared by IEC technical committee 20: Electric cables.

This third edition cancels and replaces the second edition published in 1997 and constitutes a technical revision.

The principal changes with respect to the previous edition are as follows:

- a) closer definition of the draught screen and the chamber orifices;
- b) closer definition of the support for the cable(s) under test;
- c) removal of minor differences with equivalent CENELEC work to allow parallel voting with that body.

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

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

FDIS	Report on voting
20/754/FDIS	20/766/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 61034 consists of the following parts, under the general title *Measurement of smoke density of cables burning under defined conditions*,

Part 1: Test apparatus

Part 2: Test procedure and requirements

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

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

INTRODUCTION

The measurement of smoke density is an important aspect in the evaluation of the burning performance of cables as it is related to the evacuation of persons and accessibility for firefighting.

IEC 61034 is published in two parts, which together specify a method of test for measurement of smoke density of cables burning under defined conditions. Users of this test are reminded that the configurations of cable in the test (i.e. as test pieces or bundles of test pieces) may not represent actual installation conditions.

This Part 1 gives details of the test apparatus and verification procedure to be used for the measurement of smoke density of the products of combustion of cables burnt under defined conditions. It includes details of a test enclosure of 27m³ volume, a photometric system for light measurement, the fire source, smoke mixing method and a qualification procedure. Annex A gives guidance on various aspects of the test apparatus which may be useful when first constructing the test enclosure.

Part 2 gives the test procedure, together with an informative annex giving recommended requirements for compliance where no specified requirement is given in the particular cable standard or specification.

MEASUREMENT OF SMOKE DENSITY OF CABLES BURNING UNDER DEFINED CONDITIONS –

Part 1: Test apparatus

1 Scope

This part of IEC 61034 provides details of the test apparatus to be used for measuring smoke emission when electric or optical fibre cables are burnt under defined conditions, for example, a few cables burnt horizontally. The light transmittance (I_t) under flaming combustion and smouldering conditions can be used as a means of comparing different cables or complying with specific requirements.

NOTE For the purposes of this standard, the term "electric cable" covers all insulated metallic conductor cables used for the conveyance of energy or signals.

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

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO/IEC 13943:2000, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 60695-4 apply, or if a term is not defined in IEC 60695-4 then the definition in ISO/IEC 13943 applies.

4 Details of test enclosure

The equipment shall comprise a cubic enclosure with inside dimensions of 3 000 mm \pm 30 mm and constructed of a suitable material fixed on to a steel angle frame. One side shall have a door, with a glass inspection window. Transparent sealed windows (minimum size 100 mm \times 100 mm) shall be provided on two opposite sides to permit the transmission of a beam of light from the horizontal photometric system. The distance from the floor to the centre of these windows shall be 2 150 mm \pm 100 mm (see Figure 1 for plan view).

The walls of the enclosure shall include orifices at ground level (i.e. not greater than 100 mm above the level of the chamber floor) for the passage of cables, etc., and to permit the enclosure to be at atmospheric pressure.

No orifice shall be directly behind the fire source or on the same wall. A minimum of two orifices shall be provided and the total area of the orifices open during the test shall be 50 cm² \pm 10 cm².

NOTE 1 Two orifices, each with an area of 25 cm² \pm 5 cm², and located on two opposite walls, one under the light source and one under the receiver have been found to be suitable.

The ambient temperature outside the enclosure shall be $20\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ and the enclosure shall not be directly exposed to sunlight or extreme climatic changes.

NOTE 2 It should normally be possible to extract fumes from the enclosure after each test through a duct complete with valve which should be closed during the test. The duct may include a fan to increase the rate of extraction. It is recommended that the door of the enclosure be opened to assist the extraction process.

A draught screen, $1\ 500\text{ mm} \pm 50\text{ mm}$ long and $1\ 000\text{ mm} \pm 50\text{ mm}$ high, shall be placed in the enclosure, at the position shown in Figure 1. It shall abut on the back wall (with a maximum gap of 10 mm) at a point $750\text{ mm} \pm 25\text{ mm}$ from the side wall, and shall be curved to intersect the centre line of the enclosure at a point $1\ 400\text{ mm} \pm 25\text{ mm}$ from the point of abutment.

5 Photometric system

5.1 The photometric system is illustrated in Figure 2. The light source and the receiver shall be placed externally in the centre of both windows in the two opposite walls of the cube without making physical contact. The light beam shall traverse the cube through the glass windows in the side walls.

5.2 The light source shall be a halogen lamp with a tungsten filament with a clear quartz bulb having the following characteristics:

nominal power:	100 W;
nominal voltage:	12 V d.c.;
nominal luminous flux:	2 000 lm to 3 000 lm;
nominal colour temperature:	2 800 K to 3 200 K.

The bulb shall be supplied with a voltage of $12,0\text{ V} \pm 0,1\text{ V}$ (mean value). During the test, the voltage shall be stabilized to a range of $\pm 0,01\text{ V}$ (see A.2c) for additional guidance.) The lamp shall be mounted in a housing and the beam adjusted by a lens system to give an evenly illuminated circular area of $1,5\text{ m} \pm 0,1\text{ m}$ diameter on the interior of the opposite wall.

5.3 The receptor photocell shall be of the selenium or silicon type with a spectral response matching the International Commission on Illumination (CIE) photopic observer (equivalent to the human eye). The photocell shall be mounted at the end of $150\text{ mm} \pm 10\text{ mm}$ tube with a dust protection window at the other end. The inside of the tube shall be matt black to prevent reflections. The photocell shall be connected to a potentiometric recorder to produce a linear proportional output. The cell shall be resistance-loaded to operate in its linear range and the input impedance of the recorder shall be at least 10^4 times greater than the load resistance of the cell which shall not exceed $100\ \Omega$.

5.4 The photometric system shall be energized before the blank test. When stability has been attained, the zero and full scale reading of the recorder shall be adjusted for light on the detector corresponding to 0 % (absence of light) and 100 % luminous transmission.

NOTE 1 Periodically, for example at the beginning of a test series, the performance of the photocell should be verified by placing standard neutral density filters in the light beam. It is essential that these filters cover the entire optical port of the photocell and the values of transmittance measured by the photocell give a value of parameter A within $\pm 5\%$ of the calibrated value of the filter. The filters should also permit the verification of the linearity of response of the detector which should be proportional to the transmittance of light in the range used.

NOTE 2 Most neutral density filters are designated according to a parameter defined as absorbance which is the same as the parameter A defined in 10.5 which may be used to convert measured transmittance.

6 Standard fire source

The standard fire source shall be 1,00 l \pm 0,01 l of alcohol having the following composition by volume:

ethanol:	90 % \pm 1 %
methanol:	4 % \pm 1 %
water:	6 % \pm 1 %.

When a denaturing agent is added to the alcohol, it shall have no effect on the smoke emission of any cable under test.

The alcohol shall be contained in a tray made from galvanized or stainless steel with jointed sealed edges, a trapezoidal trunk section and the following interior dimensions (see Figure 3):

bottom base:	(210 \pm 2) mm \times (110 \pm 2) mm;
top base:	(240 \pm 2) mm \times (140 \pm 2) mm;
height:	(80 \pm 2) mm;
thickness of tray:	(1,0 \pm 0,1) mm.

The tray shall be supported at a height of 100 mm \pm 10 mm from the floor on an open sided framework to permit air circulation around and beneath the tray.

7 Smoke mixing

In order to ensure uniform distribution of the smoke, a table-type fan shall be placed on the floor of the cube as shown in Figure 1, the fan axis being between 200 mm and 300 mm from the floor and the distance from the wall being 500 mm \pm 50 mm. The fan shall have a blade sweep of 300 mm \pm 60 mm and a flow rate of 7 m³/min to 15 m³/min. Air shall then be blown horizontally by the fan during the tests but the ignition source shall be protected by the screen as shown.

NOTE Suitable fans may be found by reference to IEC 60879: 1986.

8 Blank test

8.1 Purpose

The purpose of the blank test is to condition the interior of the cube to the specified temperature range, when necessary, prior to carrying out tests.

8.2 Procedure

8.2.1 Burn approximately 1 l of alcohol as detailed in Clause 6, in order to preheat the test enclosure.

8.2.2 Purge the inside of the cube of all combustion products by operating the extraction system.

9 Qualification of test apparatus

In order to ensure that the combination of the test cube and the optical system produce results consistent with other test cubes when identical cables are burnt under the same conditions, the test apparatus shall be subject to qualification. Qualification shall be achieved by carrying out the qualification burning test (see Clause 10). The test apparatus shall meet the stated requirements.

10 Qualification burning test

10.1 Purpose

The purpose of the qualification burning test is to verify that the smoke produced in the cube gives A_C values within the limits quoted in 10.6 for both of the alcohol/ toluene fire sources described in 10.3.

10.2 Preparation of cube

Clean the windows of the photometric system to regain 100 % transmission after stabilization of the voltage.

Immediately before commencing the test, the temperature inside the cube shall be within the range $25\text{ °C} \pm 5\text{ °C}$ when measured at the internal door surface at a height of 1,5 m to 2,0 m and a minimum of 0,2 m from the walls. If necessary, carry out a blank test in order to condition the interior of the cube to the specific temperature range.

10.3 Qualification fire sources

Mixtures of PA (pro analysis) toluene and alcohol (as defined in Clause 6) shall be made up in the following proportions by volume:

- a) 4 parts toluene to 96 parts alcohol,
- b) 10 parts toluene to 90 parts alcohol,

using a pipette and volumetric flask for accuracy of measurement.

NOTE PA toluene has a purity greater than 99,5 %.

The mixtures shall be contained in a tray as described in Clause 6.

10.4 Test procedure

Burn $1\text{ l} \pm 0,01\text{ l}$ of the test solutions specified in 10.3. Record the minimum measured transmittance level I_t during the test.

10.5 Calculation

Calculate the measured parameter (A_m) as follows:

$$A_m = \lg_{10} \frac{I_0}{I_t}$$

where I_0 is the initial transmittance.

Calculate the standard parameter (A_C):

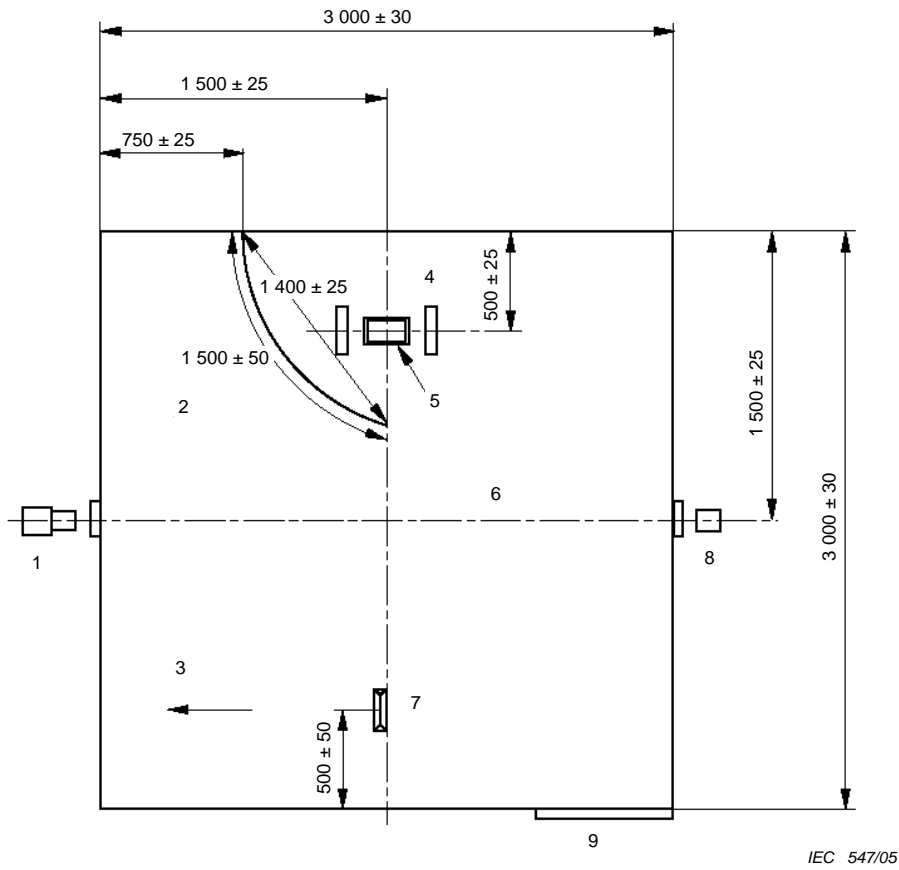
$$A_C = \frac{A_m}{\% \text{ toluene}} \times \frac{\text{Volume of cube (m}^3\text{)}}{\text{Optical light path (m)}}$$

10.6 Requirements

The calculated values of A_C shall fall between the following limits:

- 4 % toluene: $0,18\text{ m}^2$ to $0,26\text{ m}^2$;
10 % toluene: $0,80\text{ m}^2$ to $1,20\text{ m}^2$.

Dimensions in millimetres



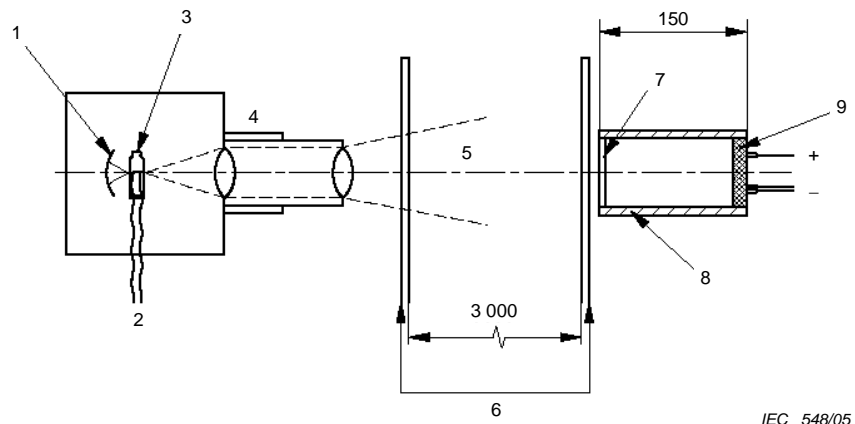
IEC 547/05

Key

- | | |
|--|--|
| 1 light source | 6 optical path height $2\,150 \pm 100$ |
| 2 draught screen (height $1\,000 \pm 50$) | 7 fan flow $7\text{ m}^3/\text{min}$ to $15\text{ m}^3/\text{min}$ |
| 3 direction of air flow from fan | 8 photocell |
| 4 cable support | 9 door |
| 5 alcohol tray | |

Figure 1 – Plan view of test chamber

Dimensions in millimetres



IEC 548/05

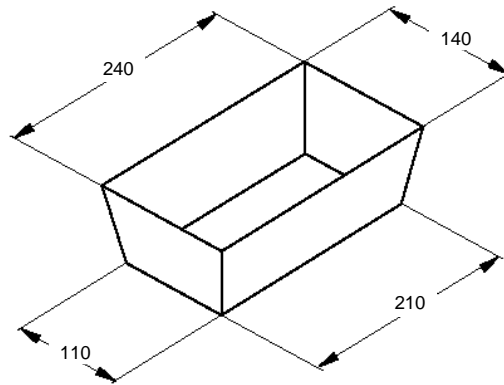
Key

- | | |
|--|------------------------------|
| 1 reflector | 5 light beam |
| 2 voltage supply 12,0 V \pm 0,1 V(stabilized range \pm 0,01 V) | 6 windows of the cube |
| 3 quartz/halogen bulb | 7 window for dust protection |
| 4 lens system | 8 tube, matt finished inside |
| | 9 photocell |

The light source and the photocell shall be physically isolated from the walls of the cube.
The diameter of the cone of light on the opposite face from the source is approximately 1,5 m.

Figure 2 – Photometric system

Dimensions in millimetres



IEC 549/05

Height: 80
Thickness: $1 \pm 0,1$
Other tolerances: ± 2

Figure 3 – Metal tray

Annex A (informative)

Guidance notes

A.1 The chamber environment and ignition source

- a) Early test chamber requirements included a specification for the walls to ensure that the heat loss was uniform, for example similar to 2 mm of steel. This has lost its significance now that the toluene verification procedure has been introduced.
- b) It is important to provide for pressure equalization and suitable arrangements should be made.
- c) Condensation at the lower end of the operating temperature range can cause anomalous results; for example, 15 °C is unacceptable, 18 °C is the minimum, and 20 °C (as specified) the safe minimum.
- d) The tray containing the toluene mixture should be raised above floor level to permit air circulation.
- e) The water content in the alcohol can significantly affect values of smoke production. Thus, for the calibration test it is important to take into account the water content in the ethanol to ensure that the percentage is within the defined limits, and to carry out the test within 2 h of mixing.
- f) The fan throughput should either be certified or checked by a suitable means, for example using an anemometer at the end of a tube having a diameter of the blade sweep and of sufficient length, i.e. 1,0 m.

A.2 Optical system

- a) There is no reason to verify the output of the light source as the actual power plays no part in the accuracy of the test and the bulbs may be operated until failure; this is because all measurements of I_t are relative to the initial I_0 .
- b) The effect of the colour temperature and the emissivity of the bulbs at various wavelengths are also minimal, particularly when the fact that the receptor is weighted for human eye response is considered. Loss of some intensity at the "blue" end or gain of intensity at the "red" end of the spectrum due to the normal ageing of these bulbs, is irrelevant because these wavelengths contribute very little when "weighted" by the receptor.
- c) The above effects also make the precision of the initial d.c. voltage applied across the bulb of little importance. Thus, if 12,1 V or 11,9 V is used instead of 12,0 V d.c. the effect is merely to change the absolute intensity and also to alter the colour temperature. These two effects, as stated above, have minimal effects on the results. The crucial feature of the voltage applied to the bulb is that it be kept stable to a very close tolerance. Thus, it is ideal to maintain the voltage at $\pm 0,01$ V for the duration of the test but it is largely irrelevant whether the absolute voltage is stabilized at 11,9 V, 12,0 V or 12,1 V.
- d) The receptor cell is designed to operate well within its linear range. For example, the selenium cell Megatron MF45 ¹ becomes non-linear at an output voltage of 40 mV. The actual output under the illumination conditions in the cube is about 3,5 mV.

¹ Megatron MF45 is an example of a suitable product available commercially. This information is given for the convenience of users of this standard and does not constitute an endorsement by the IEC of this product.

- e) The use of standard neutral density filters is needed to determine that the relative response of the system stays in the same order on a month-by-month basis.

Before the calibration of the photometric system, it is desirable that the filters are calibrated to confirm the specified nominal values.

When any change is made to the intensity of the light beam after calibration, confirmation of linear response to the filters should be obtained, for example by using a suitable light meter.

- f) The relative nature of the I_0/I_t measurement means that, in theory, there is little or no need to clean the windows of the optical system prior to use. In practice, there is a reason for cleaning after each test. The reason is related to the reflection from the detector window which varies considerably with small amounts of deposited smoke. It is possible to have more light transmitted after some smoke has been deposited because of the reduction in reflection quality of the surface. Cleaning the windows after each test or series of tests ensures more consistency.

Alternatively, a continuous flow of air having a maximum flow rate of 2 l/min may be permitted to sweep the window surfaces during the test.

- g) The light source is set up to give a diffuse and defocused area for two reasons. One has already been described, but the main one is to allow the photocell to sample a small part of a large, evenly illuminated area. This will prevent the situation where, for example, a bright patch exists just outside of the area monitored by the cell which then, when some smoke is produced, scatters light into the cell giving a false reading.

For this reason, the diameter of the light area should not be too small and should conform to the specified limits.

Bibliography

IEC 60879:1986, *Performance and construction of electric circulating fans and regulators*
