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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electric and optical fibre cables – Test methods for non-metallic materials – Part 601: Physical tests – Measurement of the drop point of filling compounds

Câbles électriques et à fibres optiques – Méthodes d’essai pour les matériaux non-métalliques – Partie 601: Essais physiques – Mesure du point de goutte des matières de remplissage

IEC 60811-601:2012

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC AND OPTICAL FIBRE CABLES – TEST METHODS FOR NON-METALLIC MATERIALS –

Part 601: Physical tests – Measurement of the drop point of filling compounds

FOREWORD

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International Standard IEC 60811-601 has been prepared by IEC technical committee 20: Electric cables.

This Part 601 of IEC 60811 cancels and replaces Clause 4 of IEC 60811-5-1:1990, which is withdrawn. Full details of the replacements are shown in Annex A of IEC 60811-100:2012.

There are no specific technical changes with respect to the previous edition, but see the foreword to IEC 60811-100:2012.

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

FDIS	Report on voting
20/1310/FDIS	20/1359/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.

This part of IEC 60811 shall be used in conjunction with IEC 60811-100.

A list of all the parts in the IEC 60811 series, published under the general title *Electric and optical fibre cables – Test methods for non-metallic materials*, can be found on the IEC website.

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- withdrawn,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.

INTRODUCTION

The IEC 60811 series specifies the test methods to be used for testing non-metallic materials of all types of cables. These test methods are intended to be referenced in standards for cable construction and for cable materials.

NOTE 1 Non-metallic materials are typically used for insulating, sheathing, bedding, filling or taping within cables.

NOTE 2 These test methods are accepted as basic and fundamental and have been developed and used over many years principally for the materials in all energy cables. They have also been widely accepted and used for other cables, in particular optical fibre cables, communication and control cables and cables for ships and offshore applications.

ELECTRIC AND OPTICAL FIBRE CABLES – TEST METHODS FOR NON-METALLIC MATERIALS –

Part 601: Physical tests – Measurement of the drop point of filling compounds

1 Scope

This Part 601 of IEC 60811 specifies the test procedure for measuring the drop point of filling compounds.

2 Normative references

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

IEC 60811-100:2012, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 100: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60811-100 apply.

4 Test method

4.1 General

This part of IEC 60811 shall be used in conjunction with IEC 60811-100.

Unless otherwise specified, tests shall be carried out at room temperature.

The drop point test may be used as an indication of the maximum temperature to which a filling compound can be exposed without complete liquefaction or excessive oil separation.

In case of dispute, method A shall be used as reference method.

4.2 Method A (reference method)

4.2.1 Apparatus

The apparatus consists of the following parts:

a) A chromium plated brass cup conforming to the dimensions shown in Figure 1.

b) A heat-resistant glass test tube conforming to the dimensions shown in Figure 2 with three indentations to support the cup.

c) Thermometers with a range – 5 °C to 300 °C (76 mm immersion) marked in degrees Celsius with a scale accuracy of 1 °C. The bulb lengths shall be 10 mm to 15 mm, and the bulb diameters shall be 5 mm to 6 mm.

d) An oil bath consisting of a 400 ml beaker and suitable oil, a ring stand and ring for the support of the oil bath, clamps for the thermometers, two corks as shown in Figure 2, a polished metal rod 1,2 mm to 1,6 mm in diameter and 150 mm in length, and a suitable means for heating and stirring the oil bath.

4.2.2 Test procedure

Place the corks on one of the thermometers as shown in Figure 2 and adjust the position of the upper cork so that the tip of the thermometer bulb is about 3 mm above the bottom of the cup when the apparatus is assembled for test. Suspend a second thermometer in the oil bath so that its bulb is at approximately the same level as the bulb of the thermometer in the test tube.

Fill the cup by presenting its larger opening into the filling compound until the cup is filled, taking care to avoid working the filling compound as far as possible. Cut away any excess compound. The cup shall be held in a vertical position with its smaller opening at the bottom while it is gently pressed down over the metal rod until the rod protrudes about 25 mm above the larger opening. Press the rod against the cup in such a manner that the rod makes contact with both the upper and lower peripheries of the cup. Maintain this contact while rotating the cup around its axis and simultaneously moving the cup down the rod until the cup passes over the lower end of the rod. This spiral-like motion will cause the compound to adhere along the rod leaving a conical void of compound in the cup and a compound coating having reproducible geometry on the inside of the cup.

Place the cup and the thermometer in the test tube and suspend the test tube in the oil bath with the oil level within 6 mm of the rim. If the cork holding the thermometer in the test tube has been properly chosen, the 76 mm immersion mark on the thermometer will coincide with the lower edge of the cork. The assembly should be immersed to this point.

Stir the oil bath and heat at a rate of 4 K/min to 7 K/min until the bath reaches a temperature approximately 17 °C below the expected drop point of the compound. Then reduce the rate of heating so that the temperature in the test tube will be within 2 °C or less of the temperature in the oil bath before the oil bath temperature increases an additional 2,5 K.

Continue heating at a rate such that the difference between the temperature in the test tube and in the oil bath is maintained between 1 °C and 2 °C. This condition is established when the oil bath is heated at a rate of about 1 K/min to 1,5 K/min. As the temperature increases, material will gradually protrude through the orifice of the cup. When the first drop of material falls, note the temperature on the two thermometers.

4.2.3 Expression of results

Record the average of the two thermometers as the drop point of the filling compound.

4.3 Method B

4.3.1 Apparatus

The apparatus consists of the following parts:

a) A chromium plated brass cup conforming to the dimensions shown in Figure 3. The cup may be made from another suitable metal which is not affected by the compound being tested. The top of the cup and the bottom of the tube forming the orifice are smooth, parallel to each other, and at right angles to the axis of the cup. The wide part of the cup has an approximately hemispherical lower portion and an internal depth such that when a steel ball 7,0 mm in diameter is placed in the cup, the top of the ball is (12,2 ± 0,15) mm above the bottom of the tube forming the orifice. The bottom edge of the orifice should have neither chamfer nor radius.

b) A cylindrical metal sleeve, attached to the thermometer, and a metal case which screws to the sleeve, conforming to the dimensions shown in Figures 4 and 5. The metal sleeve is

fixed to the thermometer so that, when the metal case is screwed on to the sleeve, the bottom of the thermometer bulb is (8,0 ± 0,1) mm below the rim stop and the thermometer stem is coaxial with the sleeve and case. The thermometer is fixed to the sleeve with cement that is suitable for the temperature range of the thermometer.

c) Thermometers with a range of 20 °C to 120 °C (100 mm immersion) marked in degrees Celsius with a scale accuracy of 1 °C. The bulb length shall be 6 mm maximum with bulb diameter between 3,35 mm and 3,65 mm.

d) A heat-resistant, glass test tube (110 ± 2) mm long and with a (25 ± 1) mm internal diameter.

e) A beaker large enough to allow the test tube to be immersed vertically to two-thirds of its length in the liquid heating medium and with the bottom of the tube being about 25 mm above the bottom of the beaker.

f) A stirrer to ensure uniformity of temperature throughout the bath.

g) A stand to hold the test tube and the bath thermometer and to support the beaker above the heat source.

h) A gas burner capable of heating the liquid bath at the specified rate.

NOTE Water is recommended as the heating medium for drop points below 80 °C, and glycerol or white oil for higher drop point materials.

4.3.2 Test procedure

By means of a spatula, fill the cup with the compound and cut away any excess material. Take precautions to exclude air bubbles, but do not melt the compound.

Push the cup, without lateral movement, into the metal case as far as the stop and cut away any excess material squeezed out of the bottom. Take care that the orifices in the side of the metal case are not blocked. Fit the thermometer, with the cup attached, centrally in the test tube, through a bored cork having a side notch, so that the bottom of the cup is (25 ± 1,0) mm above the bottom of the test tube. Then fix the test tube vertically in the beaker containing the liquid heating medium, so that two-thirds of its length are immersed and the bottom is about 25 mm above the bottom of the beaker, as shown in Figure 6.

Heat the liquid bath, keeping it stirred at such a rate that the drop point thermometer shows a rise in temperature of 1 K/min for 20 °C below the drop point of the sample. Record the temperature at which the first drop, whatever its composition, falls from the cup or at which the continuous stream of material, if formed, reaches the bottom of the test tube.

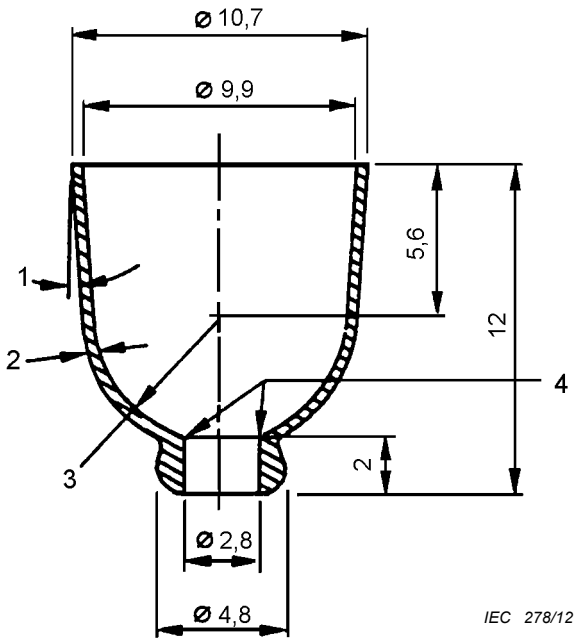
4.3.3 Expression of results

Record the temperature of the drop point thermometer to the nearest 1,0 °C as the drop point of the filling compound.

5 Test report

The test report shall be in accordance with that given in IEC 60811-100.

Dimensions in millimeters

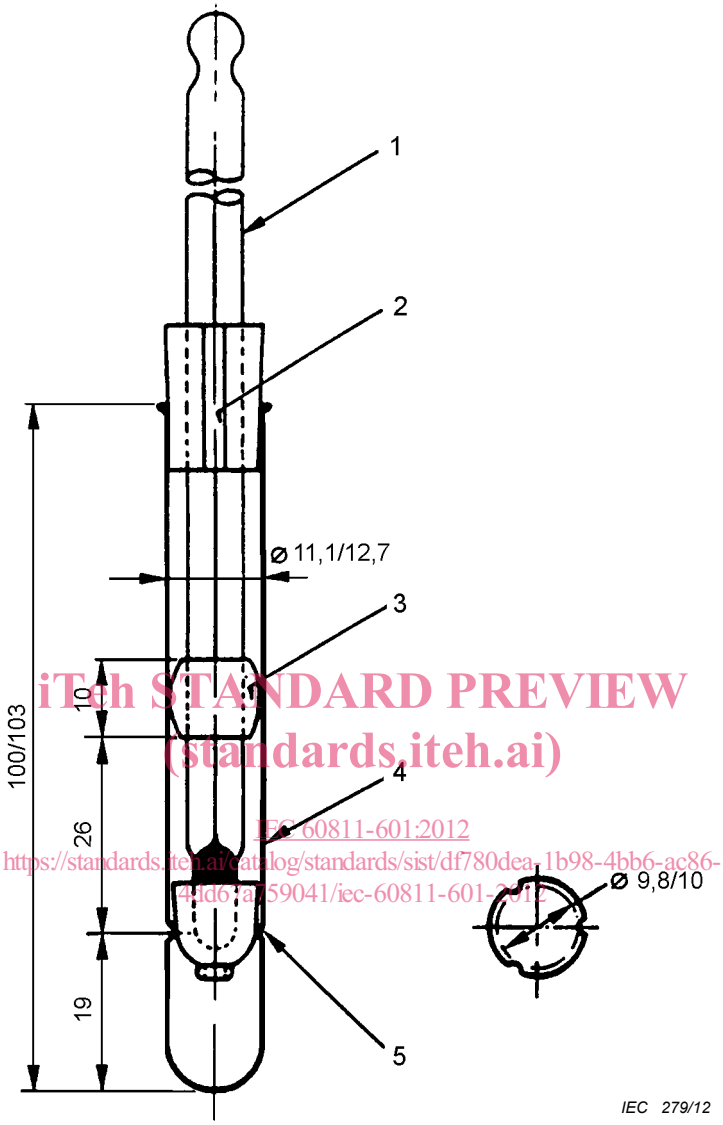


Key

1 4' taper
2 0,4 mm wall thickness
3 internal radius 4,5/4,7
4 sharp edge, remove burr only

Figure 1 – Cup (Method A)

Dimensions in millimeters



Key

1 thermometer

2 notch in cork for vent

3 cork ring guide, 1,5 total clearance between ring and test tube

4 test tube borosilicate glass

5 three indentations equally spaced to support cup

Figure 2 – Assembled apparatus (Method A)