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INTERNATIONAL STANDARD

Test on gases evolved during combustion of materials from cables – Part 3: Measurement of low level of halogen content by ion chromatography

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TEST ON GASES EVOLVED DURING COMBUSTION OF MATERIALS FROM CABLES –

Part 3: Measurement of low level of halogen content by ion chromatography

FOREWORD

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International Standard IEC 60754-3 has been prepared by IEC technical committee 20: Electric cables.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
20/1784/FDIS	20/1791/RVD

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

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

A list of all the parts in the IEC 60754 series, published under the general title *Test on gases evolved during combustion of materials from cables*, can be found on the IEC website.

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

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

IEC 60754 consists of the following parts, under the general title: *Test on gases evolved during combustion of materials from cables*:

– Part 1: *Determination of the halogen acid gas content*

– Part 2: *Determination of acidity (by pH measurement) and conductivity*

– Part 3: *Measurement of low level of halogen content by ion chromatography*

NOTE Guidance on the corrosivity of fire effluent is given in IEC 60695-5-1.

IEC 60754-1 and IEC 60754-2 were developed due to concerns expressed by cable users over the amount of acid gas which is evolved when some cable insulating, sheathing and other materials are burned, as this acid and such corrosive effluents can cause extensive damage to electrical and electronic equipment not involved in the fire itself.

IEC 60754-1 provides a method for determining the amount of acid gases evolved by burning cable components so that limits can be agreed for cable specifications.

IEC 60754-2 provides a method for determining the acidity (by pH measurement) and conductivity of an aqueous solution of gases evolved during the combustion of materials so that limits can be agreed for cable specifications

IEC 60754-1 is not able to determine hydrofluoric acid and, for reasons of precision, this method is not recommended for reporting values of halogen acid evolved less than 5 mg/g of the sample taken.

This document provides a method for measurement of low level of halogen content of the gases evolved by burning cable and has a high accuracy in the low range of concentration.

The ion chromatic system has an inherently high accuracy. However, the overall accuracy of the test method is limited by other factors (see Annex A for further information).

This part of IEC 60754 is linked with IEC 60754-2, using the same test procedure for obtaining the absorption solution.

TEST ON GASES EVOLVED DURING COMBUSTION OF MATERIALS FROM CABLES –

Part 3: Measurement of low level of halogen content by ion chromatography

1 Scope

This part of IEC 60754 specifies the apparatus and procedure for the measurement of the amount of halogens evolved during the combustion of materials taken from electric or optical fibre cable constructions.

The method specified in this document is intended for the measurement of the content of chlorine (Cl), bromine (Br), fluorine (F) and iodine (I), by using the analytical technique of ion chromatography for analysing an aqueous solution resulting from the gases evolved during the combustion.

The heating (combustion) procedure in this part of IEC 60754 is the same as in IEC 60754-2.

The method is intended for materials with an individual halogen content not exceeding 10 mg/g.

The method specified in this document is intended for the testing of individual components used in a cable construction. The use of this method will enable the verification of requirements which are stated in the appropriate cable specification for individual components of a cable construction.

NOTE 1 The relevant cable standard indicates which components of the cable are tested.

NOTE 2 This test method is sometimes used to test materials to be used in cable manufacture.

For reasons of precision, this method is not recommended for detecting values of halogens less than 0,1 mg/g of the sample taken.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 1042, *Laboratory glassware – One-mark volumetric flasks*

ISO 3696, *Water for analytical laboratory use – Specification and test methods*

ISO 10304-1, *Water quality – Determination of dissolved anions by liquid chromatography of ions – Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
halogen
element of periodic table group 17, specifically fluorine, chlorine, bromine, iodine

3.2
individual halogen content
amount of a halogen in a test specimen that can be converted to water soluble halide ion in the gaseous combustion effluent from the test specimen

Note 1 to entry: Halide ions are fluoride, chloride, bromide or iodide.

Note 2 to entry: The halogen in the test specimen may be in the form of organic or inorganic compounds.

Note 3 to entry: The individual halogen content is expressed as milligrams of halogen per gram of test specimen.

Note 4 to entry: Halide ions in any solid combustion residue that remains in the combustion boat are not measured by this test method.

4 Test method principle

The material under test shall be heated in a stream of dry air. The evolved gases shall be trapped by bubbling through wash bottles filled with distilled or demineralized water.

Each individual halogen content of the resulting solution shall then be determined by using ion chromatography (IC).

The ion chromatography analysis can be done off line and does not have to be in line.

5 Test apparatus

5.1 General

The apparatus is shown in Figure 1 to Figure 5.

The assembly of the components which constitute the test apparatus shall be leak-tight. The connecting distances between the quartz glass tube and the first bottle and between subsequent bottles shall be as short as possible. Quartz glass or polypropylene tubing shall be used for these connections, unless it is not required to measure and report fluorine, in which case glass or silicone rubber may be used.

At the exit side of the quartz glass tube, as close to the end as possible, it is permitted to place a plug of silica wool to aid collection of condensates.

A third empty bottle, of the same size as the gas washing bottles, placed before the gas washing bottles may be used to improve safety, i.e. to prevent suck-back of water into the quartz glass tube.

5.2 Tube furnace

The length of the heating zone of the furnace shall be within the range 480 mm to 620 mm and its inside diameter shall be within the range 38 mm to 62 mm. It shall be equipped with an adjustable electrical heating system.