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Australian Standard®
1660.5.3—1988

METHODS OF TEST FOR ELECTRIC CABLES, CORDS AND CONDUCTORS

Part 5—FIRE TESTS

Method 5.3—DETERMINATION OF THE AMOUNT OF HALOGEN ACID GAS EVOLVED DURING THE COMBUSTION OF POLYMERIC MATERIALS TAKEN FROM CABLES

This Australian Standard was prepared by Committee EL/3, Electric Wires and Cables. It was approved on behalf of the Council of the Standards Association of Australia on 14 December 1987 and published on 7 March 1988.

The following interests are represented on Committee EL/3:

Australian Electrical and Electronic Manufacturers Association

Confederation of Australian Industry

Department of Aviation

Department of Defence

Department of Industrial Relations and Employment (New South Wales)

Electrical Contractors Associations of Australia

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AUSTRALIAN STANDARD

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PREFACE

This Standard was prepared by the Association's Committee on Electric Wires and Cables. It is based closely on IEC 754.1—1982, *Tests on gases evolved during combustion of electric cables, Part 1: Determination of the amount of halogen acid gas evolved during the combustion of polymeric materials taken from cables*, and is one of a series of fire tests for electric cables to be included in the AS 1660 Series. Other Standards in the series are as follows:

Method 5.1—*Fire tests—Tests on bunched cables* (Published as SAA Int 88001—1988.)

Method 5.2—*Fire tests—Smoke density* (Published as SAA Int 88002—1988.)

Method 5.4—*Fire tests—Determination of the amount of acid and corrosive gas evolved during the combustion of materials taken from cables* (Published as SAA Int 88003—1988.)

Method 5.5—*Fire tests—Performance requirements for electric cables required to maintain circuit integrity under fire conditions* (Published as SAA Int 88004—1988.)

NOTE: It is intended that further tests will be included in this series as data becomes available.

Cable users have expressed concern over the amount of hydrochloric acid gas which is evolved when conventional cable compounds based on PVC, PCP and CSP (see Note below) are burned, as this acid can cause extensive damage to electrical and electronic equipment not involved in the fire itself. Some authorities have specified a maximum level of hydrochloric acid evolution for cables being installed in new buildings. It has been considered necessary, therefore, to develop an approved method for determining the amount of hydrochloric acid evolved by burning cable components so that limits can be agreed to for cable specifications.

Fluorocarbon components are used in some special cable constructions. Work is being carried out within the International Electrotechnical Commission to establish methods for the determination of the amount of hydrogen fluoride evolved from burning cable compounds, and these will eventually be specified in other parts of this Standard.

This Standard specifies a method for the determination of the amount of halogen acid gas, other than hydrofluoric acid, evolved during the combustion of compounds based on halogenated polymers and compounds containing halogenated additives taken from cable.

NOTE: In IEC 754-1, PCP is CR and CSP is CSM.

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1 SCOPE. This Standard specifies a method for determining the amount of halogen acid gas, other than hydrofluoric acid, evolved during the combustion of compounds based on halogenated polymers and compounds containing halogenated additives taken from cable constructions.

This Method is not recommended for use where the amount of halogen acid evolved is less than 5 mg/g of the sample taken.

NOTE: In this Method the amount of halogen acid evolved is expressed as milligrams of hydrochloric acid per gram of sample tested.

2 APPLICATION. The method specified in this Standard is intended for the type testing of individual components used in cable construction. The use of this method will enable the requirements for individual components of a cable construction to be stated in the appropriate cable specification.

3 PRINCIPLE. The material under test is heated in a stream of dry air and the gases absorbed in 0.1 M sodium hydroxide solution. The amount of halogen acid is then determined by acidifying the solution with nitric acid, adding a measured volume of 0.1 M silver nitrate solution, and back titrating the excess with standardized 0.1 M ammonium thiocyanate solution, using ferric ammonium sulphate as the indicator.

Duplicate tests are carried out on the sample of material, and a blank determination carried out without the sample, following exactly the same procedure.

The result is taken as the mean of the two determinations.

4 APPARATUS. The following apparatus is required:

(a) Tube furnace with thermostatic temperature control up to 1000°C. The heated length of the furnace shall be at least 100 mm.

(b) Quartz or other suitable combustion tube approximately 19 mm × 25 mm × 700 mm.

(c) Porcelain or other suitable combustion boat approximately 76 mm × 10 mm × 9 mm.

(d) Three cylindrical gas washing bottles having a volume of approximately 250 cm^3.

(e) Glass tubing and silicone rubber stoppers shall be used to connect the wash bottle to the combustion tube. Connections between the wash bottles shall be made using silicone rubber with the glass tubing butting together in the connection, or by using ground glass joints.

(f) Suitable supply of dry air.

(g) Air flow meter capable of indicating 110 mL/min.

(h) Reagents used shall be of recognized analytical quality.

(j) Suitable volumetric glassware shall be used where necessary.

5 PROCEDURE. The procedure shall be as follows:

(a) Place between 0.5 g and 1.0 g of the sample in the combustion boat. Record the mass of the sample to the nearest milligram.

(b) Insert the combustion tube in the tube furnace, and place the combustion boat in the tube.

NOTE: In order to reduce condensation in the tube, the exit end of the combustion tube should not project more than 60 mm from the end of the furnace.

(c) Connect the combustion tube to the three wash bottles, each of which shall contain 100 cm^3 of approximately 0.1 M sodium hydroxide solution.

(d) Fit the second and third bottles with sintered glass diffusers and pass dry air through the apparatus at a rate of 110 ±10 cm^3/min.

(e) Raise the temperature of the tube furnace to 800 ±20°C at a rate of approximately 20°C/min and maintain at 800 ±20°C for 20 min; that is, to obtain a total test time of 60 min.

(f) Disconnect the three wash bottles and when cool, wash the combustion tube and the connecting tubes with distilled water. Combine the washings with the water in the wash bottles and make up the total volume to 500 cm^3 with distilled water.

(g) Measure into a flask and mix the following:

(i) 100 cm^3 of the diluted solution from Step (f).

(ii) 2 cm^3 of concentrated nitric acid.

(iii) 20.0 cm^3 of 0.1 M silver nitrate solution.

(iv) 1 cm^3 of a 40 percent aqueous solution of ferric ammonium sulphate containing a few drops of 6 M nitric acid.