AS 2420 - 1987

AS 2420—1983
UDC 621.3:621.315.616

see also AS 2420 - 1983 Japanese Translation by Japan Electric and Machinery Institute (JAA retains copyright)

Australian Standard 2420—1983

FIRE TEST METHODS FOR SOLID INSULATING MATERIALS AND NON-METALLIC ENCLOSURES USED IN ELECTRICAL EQUIPMENT

PUBLISHED BY THE STANDARDS ASSOCIATION OF AUSTRALIA
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Incorporated by Royal Charter

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This Australian standard was prepared by Committee EL/2, Electrical Approvals Standards. It was approved on behalf of the Council of the Standards Association of Australia on 5 July 1983 and published on 5 September 1983.

The following interests are represented on Committee EL/2:

Australian Chamber of Commerce

Australian Electrical and Electronic Manufacturers Association

Commonwealth Scientific and Industrial Research Organization

Confederation of Australian Industry

Electrical Apparatus Approvals Authorities

Electrical Testing Laboratories

Electricity Supply Association of Australia

Electronics Importers Association

Plastics Institute of Australia

This standard was issued in draft form for comment as DR 81324 (Appendix A).

First published 1980
Second edition 1983

ISBN 0 7262 3010 0

PREFACE

This edition of this standard was prepared by the Association's Committee on Electrical Approvals Standards to supersede AS 2420—1980.

The technical changes in this edition comprise:

- The inclusion of two new test methods, viz Appendix A, Heat-behaviour Test Method, and Appendix D, Surface Tracking Test Method
- The addition of three new clauses to Section 1, viz Clause 1.2, Referenced Documents, Clause 1.3.7, Gas Burner Flame Test (under consideration), and Clause 1.4, Precautions to Safeguard Personnel.

The examples of equipment which were included in Clause 1.2.3 of the previous edition have been deleted from Clause 1.3.3 of this edition.

In the preparation of the standard, reference was made to the following documents and acknowledgement is made of the assistance received therefrom:

IEC Draft 50D(Central Office)3—Glow-wire Test—now published as IEC 695-2-1

IEC Draft 50D(Central Office)4—Needle-flame Test—now published as IEC 695-2-2

IEC Draft 50D(Central Office)12—Bad Connection Test

IEC 112—Method for Determining the Comparative and the Proof Tracking Indices of Solid Insulating Materials under Moist Conditions

IEC 553—Report on Evaluation of Non-metallic Enclosures and Other Parts of Household and Similar Appliances with Regard to Resistance to Fire

Underwriters Laboratories Publication UL 746C—Polymeric Materials Used in Electrical Equipment Evaluations (Clause 19)

IEC Draft 61(Central Office)311—Proposal for Amendment to IEC Publication 335-1, Safety of Household and Similar Electrical Appliances—General Requirements

IEC Draft 50D(Secretariat)21 and 29—Gas Burner Flame Tests.

As it is unlikely that a single test method will completely assess the fire hazard of an electrical device, considerable explanatory material is included with regard to the use of the test methods and how the results of one test are used to provide data for subsequent tests.

This standard was prepared primarily for use by technical committees wishing to specify fire test methods for electrical products. However, it is not envisaged that the test methods would be repeated in the standards for the individual products and guidance is given in this standard on how the cross-reference to the various test methods should be made.

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*Under consideration.

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
FIRE TEST METHODS FOR SOLID INSULATING MATERIALS AND NON-METALLIC ENCLOSURES USED IN ELECTRICAL EQUIPMENT

FOREWORD

The fire hazard of electrical equipment may be controlled by the use of materials which do not ignite readily or by the use of designs which minimize the possibility of ignition or propagation of fire in the event of ignition.

Generally an individual test will not assess the total fire hazard of the equipment. However, it is not intended that all the tests would be applicable to each article and therefore the relevant product standard should specify the tests which are to be applied and nominate the test conditions.

NOTE: The product standard for a particular electrical equipment may also specify abnormal operation tests (locked rotor and overload tests) which, in addition to the tests described in this standard, contribute to the overall assessment of the product fire hazard.

The tests should be applied wherever possible to complete equipment, but where this is not possible the test may be applied to a sub-assembly or component. In such circumstances, the actual construction of the equipment should be simulated as closely as possible.

Under some circumstances, the tests may be applied to separate samples of the material used within the equipment. However, the results from such tests may not correlate exactly with the performance of the actual equipment.

The tests are not intended for parts of ceramic and like inorganic materials.

The height of any flames which may occur during testing should be measured. This measurement can then be used as guidance when the locale of the needle flame test is being decided.

Small insulating parts having low calorific potential, e.g. washers or beads, and parts such as decorative trim, small knobs and other similar small parts unlikely to be ignited and transmit flames, need not normally be subjected to any of the tests.

NOTE: Fire characteristics, other than ignitability and flame propagation, may be of relevance and consideration should be given to these characteristics, e.g. smoke and toxic products. However, if ignition or flame propagation is prevented, these characteristics are not generally considered to be a problem.

Many factors, other than the materials of which the product is made, influence the fire behaviour of the complete equipment. These factors include the potential electrical energy of the circuit, and the arrangement, selection and dimensions of components.

In the determination of the shape of components, particular attention should be given to the thickness of material as thinner sections tend to ignite and burn more readily. Also moulding flashes should be removed as they may ignite easily. Metallic or fire-retardant screens may be used to protect the insulating material from an ignition source.

The testing of materials in the form of sample bars, etc, as used in quality control, is usually inappropriate by itself for assessing the fire behaviour of complete equipment, sub-assemblies or components.

Examples of the probable sources of heat and ignition, and the tests considered suitable for assessing the fire hazard of components and finished equipment under such conditions, are as follows:

(a) *Heat behaviour.* The properties of insulating mouldings may change when exposed to heat, thus causing—

(i) the material to contact or encroach on a heat source such as heat-producing components; or

(ii) changes to physical properties which could impair the mechanical or electrical suitability of the material.

These changes may also be caused by an external heat source such as the environment in which the device is used.

(b) *Ignition due to component failure.* Combustible insulating materials associated with electrical equipment may be ignited under certain conditions such as component failure or insulation failure. These conditions may be simulated and tested as follows:

(i) Glow-wire test is intended to simulate a component subject to abnormally high power dissipation, e.g. resistors, coil windings, conductors, components breaking open or exploding and emitting flames.

(ii) Bad-connection test is intended to simulate high resistance termination or connections.

(iii) Surface-tracking test is intended to simulate the surface breakdown of insulation separating parts of different potential.

(c) *Ignition due to adjacent burning components.* Insulating material may be ignited by an adjacent burning component or abnormally hot component, giving rise to flames or flaming droplets. Also a component may break open or explode thus emitting flames. Such flames are usually small, and have low heat energy and a limited burning time. The needle-flame test is applied to surfaces of material within 50 mm of a potential fire source to simulate such a condition.

(d) *Ignition due to external fire source.* Flames may occur in the environment of electrotechnical products and may impinge upon external combustible parts. The gas burner flame tests described in this standard and produced by bunsen burners are presently specified in many standards for fire hazard testing of insulated wires and cables, of conduits and cable trunking. They are also used as ignition sources for specimens of insulating materials.

(e) *Fire load.* The effect of the equipment as a fire load in an external fire situation may need to be considered. However, special tests to assess this hazard are outside the scope of this standard.