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

STANDARDS ASSOCIATION OF AUSTRALIA
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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL ORGANIZATIONS and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Chamber of Commerce

Australian Electrical and Electronics Manufacturers Association

Commonwealth Scientific and Industrial Research Organization

Confederation of Australian Industries

Electrical Apparatus Approvals Authorities

Electrical Contractors Associations of Australia

Electrical Testing Laboratories

Electricity Supply Association of Australia

Electronics Importers Association

Plastics Institute of Australia

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PREFACE

This standard was prepared by the Association's Committee on Electrical Approvals Standards.

The object of this standard is to specify standard test methods which may be used in the assessing of the fire hazard which may arise within electrical equipment incorporating solid insulating materials and non-metallic enclosures.

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

IEC Draft 50D(Central Office)4 Needle-flame Test

The provisions of SAA MP32, SAA Guide for the Presentation, Preparation and Application of Fire Tests, were also taken into account.

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.

This standard requires reference to SAA MP32 and to the following Australian standards:

AS 1042 Direct-acting Indicating Electrical Measuring Instruments and Their Accessories

AS .... Glossary of Terms Relating to Fire*

*In course of preparation.

CONTENTS

*Under consideration.

STANDARDS ASSOCIATION OF AUSTRALIA

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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. The tests contained in this standard are conducted to establish that any fire occurring from internal fault conditions does not spread outside the equipment enclosure.

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 exposure of live parts as a result of a fire test would not constitute a failure of the article provided that the fire criteria are satisfied.

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, such as washers or beads, 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 moulding 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 polarity.

(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.