

Australian/New Zealand Standard™

Test methods for electric cables, cords and conductors

Method 2.3: Insulation, extruded semi- conductive screens and non-metallic sheaths—Methods specific to PVC and halogen free thermoplastic materials



AS/NZS 1660.2.3:1998

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-003, Electric Wires and Cables. It was approved on behalf of the Council of Standards Australia on 19 March 1997 and on behalf of the Council of Standards New Zealand on 5 March 1997.

This Standard was published on 5 March 1998.

The following are represented on Committee EL-003:

Australasian Railway Association
Australian Electrical and Electronic Manufacturers Association
Department of Defence Australia
Electrical Regulatory Authorities
Electricity Supply Association of Australia
Institution of Engineers, Australia
Ministry of Commerce, New Zealand
New Zealand Electrical Contractors Association
New Zealand Electrical and Electronic Manufacturers Federation
Office of Energy, N.S.W.
Testing Interests

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com or Standards New Zealand web site at www.standards.govt.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 97071.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION

OF

AS/NZS 1660.2.3:1998

Test methods for electric cables, cords and conductors

Method 2.3: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to PVC and halogen free thermoplastic materials

RECONFIRMATION NOTICE

Technical Committee EL-003 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 10 October 2016.

Approved for reconfirmation in New Zealand on behalf of the Standards Council of New Zealand on 13 December 2016.

The following are represented on Technical Committee EL-003:

Australian Cable Makers' Association
Australian Industry Group
Electrical Compliance Testing Association
Electrical Regulatory Authorities Council
National Electrical and Communications Association
Queensland University of Technology

NOTES

Australian/New Zealand Standard™

Test methods for electric cables, cords and conductors

Method 2.3: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to PVC and halogen free thermoplastic materials

First published in Australia as part of AS 1660.2—1974.
Jointly revised and redesignated in part as AS 1660.2.3—1993.
Jointly revised and designated AS/NZS 1660.2.3:1998.
Reissued incorporating Amendment No. 1 (June 2000).
Reconfirmed 2017.
Reissued incorporating Amendment No. 2 (August 2017).

COPYRIGHT

© Standards Australia Limited

© The Crown in right of New Zealand, administered by the New Zealand Standards Executive

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, PO Box 1473, Wellington 6140.

ISBN 0 7337 1841 8

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-003, Electric Wires and Cables, to supersede AS 1660.2.3—1993, *Test methods for electric cables, cords and conductors, Method 2.3: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to PVC and halogen free thermoplastic compounds*. It is one of a set of tests for electric cables included in the AS/NZS 1660 series. Details of the series are given in Appendix A.

This Standard incorporates Amendment No. 1 (June 2000) and Amendment No. 2 (August 2017). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure, or part thereof affected.

The objective of this Standard is to provide manufacturers and testers with appropriate test methods for PVC and halogen free insulation and sheaths of electric cables and cords.

This edition of the Standard differs from the 1993 edition as follows:

- (a) The title has been modified.
- (b) The table of materials and oven ageing temperatures has been revised.
- (c) This edition is published as a Joint Australian/New Zealand.
- (d) A compatibility test has been added.
- (e) A test for exudation of plasticizer has been added.

In the preparation of the Standard, consideration was given to IEC 811:1985, *Common test methods for insulating and sheathing materials of electric cables, Part 3: Methods specific to PVC compounds*. Acknowledgment is made for the assistance received from this source.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	4
1.2 REFERENCED DOCUMENTS.....	4
1.3 DEFINITIONS.....	4
1.4 TESTING TEMPERATURE	4
1.5 SELECTION OF SPECIMENS	4
SECTION 2 METHODS OF TEST FOR INSULATION AND NON-METALLIC SHEATHS	
2.1 THERMAL AGEING	5
2.2 LOSS OF MASS TEST	6
2.3 PRESSURE TEST AT HIGH TEMPERATURE	10
2.4 HEAT SHOCK TEST (FOR RESISTANCE TO CRACKING)	14
2.5 THERMAL STABILITY OF PVC	16
2.6 TEST FOR EXUDATION OF PLASTICIZER (LOOP TEST).....	17
APPENDICES	
A LIST OF METHODS OF TEST IN THE AS/NZS 1660 SERIES.....	18

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Test methods for electric cables, cords and conductors**

Part 2.3: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to PVC and halogen free thermoplastic materials

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out the methods of testing insulation, non-metallic sheaths for PVC and halogen free thermoplastic insulated electric cables.

NOTE: Refer to individual cable Standards for test results criteria. Details of the AS/NZS 1660 series of Standards are given in Appendix A.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS

1660 Test methods for electric cables, cords and conductors

1660.2.1 Method 2.1: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods for general application

1660.2.2 Method 2.2: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to elastomeric, XLPE and XLPVC materials

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in the relevant cable Standard and that below apply.

1.3.1 Median value

Value obtained from a succession of test results as follows:

- (a) Even number of results average value of the two middle results.
- (b) Odd number of results value of middle result.

1.4 TESTING TEMPERATURE

Unless otherwise specified, all tests shall be carried out in an ambient temperature of $23 \pm 5^{\circ}\text{C}$.

1.5 SELECTION OF SPECIMENS

All specimens used for testing shall be taken at least 300 mm from the end of a factory length of finished cable, flexible cable or flexible cord.

SECTION 2 METHODS OF TEST FOR INSULATION AND NON-METALLIC SHEATHS

2.1 THERMAL AGEING

2.1.1 Ageing in an air oven

2.1.1.1 General

An ageing treatment in an air oven may be required by the relevant cable Standard. Ageing procedures shall be as follows:

- (a) For prepared test pieces, Clause 2.1.1.3 shall apply.
- (b) For pieces of completed cable, Clause 2.1.1.4 shall apply.
- (c) For the loss of mass test, Clause 2.2 shall apply.

2.1.1.2 Test equipment (*apparatus and oven for air ageing*)

Specimens shall be suspended, free from strain, in a tube approximately 100 mm in diameter and 300 mm long.

Each specimen shall be at least 20 mm from any other specimen and from the wall of the tube. No test specimen from any other test shall be exposed in the tube at the same time.

The tube containing the suspended specimens shall be mounted vertically in a suitable thermostatically controlled air oven, uniformly maintained at the specified temperature.

Air, preheated to the specified temperature, shall be supplied to the tube at the rate of 0.25 ± 0.025 m³/h, entering at the bottom and flowing upward and out at the top of the tube. The air flow rate shall be measured by variable area flowmeters or rotameters. Air turbulence shall be maintained by paddle blades carried on a spindle concentric with the tube. The blades shall be formed from two rectangular pieces of metal approximately 85 mm × 50 mm × 0.4 mm and 85 mm × 25 mm × 0.4 mm respectively, each in a vertical plane placed one above the other with their planes symmetrical to the spindle so that they can rotate at a distance of 10 mm above the base of the tube. The spindle shall be rotated at a speed of approximately 60 r/min.

2.1.1.3 Procedure for prepared test pieces

The ageing shall be carried out in an atmosphere having the composition and pressure of the ambient air.

The test pieces shall be kept in the oven at the temperature and the time specified for the material in the Standard for the type of cable.

As soon as the ageing period is completed, the test pieces shall be removed from the oven and left at ambient temperature, avoiding direct sunlight, for at least 16 h. The tensile test shall then be carried out in accordance with AS/NZS 1660.2.1.

2.1.1.4 Procedure for pieces of complete cable

Three pieces of complete cable about 200 mm long shall be taken, preferably from a position close to those where the samples for the tensile test without ageing (see AS/NZS 1660.2.1) are taken.

The pieces of cable shall be kept in the oven at the temperature and for the time specified in the relevant cable Standard.

As soon as the specified heating period is completed, the pieces of cable shall be removed from the oven and left at ambient temperature, avoiding direct sunlight, for at least 16 h.