AS 60092.350—2005

Australian Standard™

Electrical installations in ships

Part 350: Shipboard power cables—General construction and test requirements

This Australian Standard was prepared by Committee EL-003, Electric Wires and Cables. It was approved on behalf of the Council of Standards Australia on 9 November 2005.
This Standard was published on 5 December 2005.

The following are represented on Committee EL-003:

Australasian Railway Association
Australian Electrical and Electronic Manufacturers Association
Australian Industry Group
Canterbury Manufacturers Association New Zealand
Department of Defence (Australia)
Department of Primary Industries, Mine Safety (NSW)
Electrical Contractors Association of New Zealand
Electrical Regulatory Authorities Council
Energy Networks Association
Engineers Australia
Ministry of Economic Development (New Zealand)

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 Standards may also be withdrawn.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 Standards can be found by visiting the Standards Web Shop at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

Australian Standards™ and other products and services developed by Standards Australia are published and distributed under contract by SAI Global, which operates the Standards Web Shop.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.org.au, or write to the Chief Executive, Standards Australia, GPO Box 476, Sydney, NSW 2001.

This Standard was issued in draft form for comment as DR 05370.

Australian Standard™

Electrical installations in ships

Part 350: Shipboard power cables—General construction and test requirements

First published as AS 60092.350—2005.

Published by Standards Australia GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 7024 X

PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee EL-003, Electric Wires and Cables. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify the general constructional and test requirements for shipboard cables for power systems at voltages up to and including 8.75/15 kV.

This Standard is identical with, and has been reproduced from IEC 60092-350, Ed. 2 (2001), *Electrical installations in ships—Part 350: Shipboard power cables—General construction and test requirements*.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text ‘IEC 60092’ should read ‘AS 60092’.

(c) A full point should be substituted for a comma when referring to a decimal marker.

The terms ‘normative’ and ‘informative’ are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

CONTENTS

Page

1 Scope 1
2 Normative references 1
3 Definitions 2
3.1 Definitions concerning cables 2
3.2 Definitions of dimensional values 4
3.3 Definitions concerning the tests 4
4 Conductors 5
4.1 Material 5
4.2 Metal coating and separator 5
4.3 Class and form 5
5 Insulation 6
5.1 Material 6
5.2 Application of the insulation 6
5.3 Insulation thickness 6
6 Cabling 6
7 Inner covering, fillers and binders 6
7.1 Material 6
7.2 Inner covering thickness 7
8 Protective covering 7
8.1 Constituent elements of protective coverings 7
8.2 Metal braid armour 7
8.3 Metal wire armour 8
8.4 Metal tape armour 8
8.5 Dimensions of the metal armours 8
8.6 Non-metallic sheath 8
8.6.1 Material 8
8.6.2 Thickness of sheath 8
8.7 Impregnated textile braid 9
8.8 Bedding of armour 9
8.9 Removal of the protective coverings 9
9 Test conditions 9
9.1 Ambient temperature 9
9.2 Frequency and waveform of power frequency test voltages 9
10 Routine tests 9
10.1 General 9
10.2 Electrical resistance of conductors 10
10.3 High-voltage test 10
10.4 Measurement of insulation resistance 11
11 Special tests 12
11.1 General 12
11.2 Frequency of special tests 12
11.3 Conductor examination 13
11.4 Measurement of thickness of insulation 13

11.5 Measurements of thickness of non-metallic sheaths (excluding inner coverings) ... 13
11.6 Dimensions of armourings ... 14
11.7 Measurement of external diameter ... 14
11.8 Hot-set test for insulation and for sheaths (see tables 2 and 3 for applicability of compounds in the test method) ... 14
11.9 Test for the behaviour at low temperature of PVC insulation and PVC, SHF 1 and SHF 2 sheaths ... 14
11.10 Watertightness test ... 15
11.11 Test of the metal coating of copper wires ... 15
11.12 Galvanizing test ... 15
12 Type tests, electrical ... 16
12.1 General ... 16
12.2 Insulation resistance measurement ... 16
12.2.1 Measurement at room temperature ... 16
12.2.2 Measurement at maximum rated temperature ... 17
12.3 Increase in a.c. capacitance after immersion in water ... 17
12.4 High-voltage test for 4 h ... 18
13 Type tests, non-electrical ... 18
13.1 Measurement of thickness of insulation ... 18
13.2 Measurement of thickness of non-metallic sheaths (excluding inner coverings) ... 18
13.3 Tests for determining the mechanical properties of insulation before and after ageing ... 19
13.4 Tests for determining the mechanical properties of sheaths before and after ageing ... 19
13.5 Additional ageing test on pieces of completed cables (compatibility test) ... 19
13.6 Loss of mass test on PVC insulation and sheaths ... 20
13.7 Test for the behaviour at high temperature of PVC insulation and PVC and SHF 1 sheaths (pressure test) ... 20
13.8 Test for the behaviour at low temperature of PVC insulation and PVC, SHF 1 and SHF 2 sheaths ... 20
13.9 Test for resistance to cracking of PVC insulation and PVC and SHF 1 sheaths (heat shock test) ... 21
13.10 Ozone resistance test for insulation and for sheaths (see tables 1 and 2 for applicability of compounds in the test method) ... 21
13.11 Hot-set test for insulations and for sheaths (see tables 2 and 3 for applicability of compounds in the test method) ... 21
13.12 Oil immersion test for elastomeric sheaths ... 21
13.13 Flame retardance test ... 21
13.14 Test for fire-proof or fire-resisting cables ... 21
13.15 Determination of hardness for HEPR and HF HEPR insulations ... 22
13.16 Determination of elastic modulus for HEPR and HF HEPR insulation ... 22
13.17 Determination of degree of acidity of gases evolved during the combustion of insulating materials by measuring pH and conductivity ... 22
13.18 Determination of the amount of halogen acid gas for sheathing materials ... 22
Annex A (normative) The fictitious calculation method for determination of dimensions of protective coverings ... 25
Annex B (normative) Rounding of numbers ... 29
Annex C (Informative) Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors ... 30
Annex D (normative) Procedure for checking the efficacy of the spark testing method ... 34

Annex E (normative) Test of the metal coating of copper wires 36
Annex F (normative) Galvanizing test for steel wires 37

NOTES

STANDARDS AUSTRALIA

Australian Standard

Electrical installations in ships
Part 350: Shipboard power cables—General construction and test requirements

1 Scope

This part of IEC 60092 specifies the general constructional requirements and general test recommendations for shipboard cables with copper conductors intended for power systems at voltages up to and including 8,7/15 kV.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60092. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60092 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

References to international standards that are struck through in this clause are replaced by references to Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is identified as such.

~~IEC 60092-351, *Electrical installations in ships – Part 351: Insulating materials for shipboard and mobile and fixed offshore units power, telecommunication and control data cables*~~

AS 60092.351, *Electrical installations in ships*, Part 351: *Insulating materials for shipboard and offshore units, power, control, instrumentation, telecommunication and data cables* (identical to IEC 60092-351)

~~IEC 60092-359, *Electrical installations in ships – Part 359: Sheathing materials for shipboard power and telecommunication cables*~~

AS 60092.359, *Electrical installations in ships*, Part 359: *Sheathing materials for shipboard power and telecommunication cables* (identical to IEC 60092-359)

IEC 60228, *Conductors of insulated cables*

~~IEC 60331, *Tests for electric cables under fire conditions – Circuit integrity* (all parts)~~

AS/NZS 1660.5.5, *Test methods for electric cables, cords and conductors*, Method 5.5: *Fire tests—Circuit integrity*

~~IEC 60332-3, *Tests on electric cables under fire conditions – Part 3: Tests on bunched wires or cables*~~

AS/NZS 1660.5.1, *Test methods for electric cables, cords and conductors*, Method 5.1: *Fire tests—Test for vertical flame spread of vertically-mounted bunched wires or cables*

