

Australian/New Zealand Standard™

Accessories for electric cables—Test requirements

Part 1: Power cables with extruded insulation for rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV



AS/NZS 4805.1:2007

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Part 1: Power cables with extruded insulation for rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-003, Electric Wires and Cables to supersede AS/NZS 4805.1:2001.

The objective of this Standard is to specify the type test requirements on accessories for power cables with extruded insulation and with rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV.

This Standard is published in two parts. These are:

AS/NZS

4805 Accessories for electric cables—Test requirements

4805.1 Part 1: Power cables with extruded insulation for rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV (this Standard)

4805.2 Part 2: Impregnated paper-insulated metal-sheathed cables for rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV (excluding gas-pressure and oil-filled cables)

In the preparation of these Standards IEC 60502-4, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV), and IEC 60055-1, *Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas-pressure and oil-filled cables) Part 1: Tests on cables and their accessories* were considered.*

The structure of these IEC Standards did not lend itself to straight adoption so the production of a two part Australian/New Zealand Standard was considered appropriate.

This first part of AS/NZS 4805 adopts the content of IEC 60502-4. The second part adopts only part of the content of IEC 60055-1 as this IEC Standard covers tests on cables as well as accessories.

This edition differs from the previous edition in the following significant ways:

- (a) References to transition joints have been removed.
- (b) Definitions have been provided for tracking, erosion and metallic housing.
- (c) A requirement for the identification of dimensions of phase-to-phase and phase-to-earth separations for testing of terminations has been included.
- (d) The range of approval has been revised.
- (e) Test sequences have been simplified by removing initial heating cycles.
- (f) Additional information has been provided for testing separable connectors with a metallic housing.
- (g) An examination has been added to all test sequences for information only.
- (h) A more detailed definition of substantial damage following the humidity and salt fog tests has been provided.
- (i) All test methods, except the hydraulic pressure test, have been referenced to IEC 61442.
- (j) Test sequences and requirements for loadbreak connectors have been deleted and their status has been designated 'under consideration'.

Separable connectors are also addressed in AS 2629, *Separable insulated connectors for power distribution systems above 1 kV*, but they were not considered during the preparation of this Standard. It is planned for AS 2629 to be revised and appropriately changed or assimilated into this Standard.

The term ‘normative’ has been used in this Standard to define the application of an appendix to which it applies. A normative appendix is an integral part of a Standard.

Statements expressed in mandatory terms in notes and footnotes to tables and figures are deemed to be requirements of this Standard.

CONTENTS

	Page
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 REFERENCED DOCUMENTS	5
1.3 DEFINITIONS	6
1.4 VOLTAGE DESIGNATIONS AND TEMPERATURE RATING.....	7
SECTION 2 ASSEMBLY OF ACCESSORIES TO BE TESTED	
2.1 CABLES.....	8
2.2 CONNECTORS.....	8
2.3 ACCESSORIES.....	8
2.4 INSTALLATION AND CONNECTIONS.....	8
SECTION 3 CONDITIONS AND RANGE OF APPROVAL	
3.1 RANGE OF APPROVAL.....	10
3.2 CONDUCTOR MATERIAL	10
3.3 FORM OF CONDUCTOR	10
3.4 INSULATION MATERIAL	10
3.5 INSULATION SCREEN	11
3.6 WATER BLOCKING.....	11
3.7 NUMBER OF CORES.....	11
3.8 CLEARANCES	11
SECTION 4 TESTS	
4.1 CATEGORY OF TESTS	12
4.2 TEST METHODS.....	12
4.3 TEST ARRANGEMENTS	12
4.4 TEST SEQUENCES.....	12
4.5 TEST RESULTS	13
APPENDIX A IDENTIFICATION OF TEST CABLE.....	33

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Australian/New Zealand Standard
Accessories for electric cables—Test requirements

Part 1: Power cables with extruded insulation for rated voltages from
 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the requirements for type testing of accessories for power cables with extruded insulation with rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV, complying with AS/NZS 1429.1 or IEC 60502-2.

The accessories covered by this Standard are listed below:

- (a) Indoor and outdoor terminations of all designs, including those designed for installation in terminal boxes.
- (b) Straight joints, branch joints and stop-ends of all designs, suitable for use underground or in air.
- (c) Screened or unscreened plug-in type or bolted-type separable connectors.

NOTE: Joints connecting cables with extruded insulation to paper-insulated cables are not included. The requirements for these accessories are dealt with in AS/NZS 4805.2.

Accessories for special applications, such as aerial cables, submarine or ship cables or hazardous situations (explosive environments, fire resistant cables or seismic conditions) are not included.

Approval to this Standard is obtained by satisfying the requirements of the appropriate tests as specified in Section 4.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS

- | | |
|--------|---|
| 1429 | Electric cables—Polymeric insulated |
| 1429.1 | Part 1: For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV |
| 4325 | Compression and mechanical connectors for power cables with copper or aluminium conductors |
| 4325.1 | Part 1: Test methods and requirements |
| 4805 | Accessories for electric cables—Test requirements |
| 4805.2 | Part 2: Impregnated paper-insulated metal-sheathed cables for rated voltages from 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV (excluding gas-pressure and oil-filled cables) |

IEC

- | | |
|-----------|---|
| 60050 | International Electrotechnical Vocabulary (IEV) |
| 60050-461 | Chapter 461: Electric cables |
| 60183 | Guide to the selection of high-voltage cables |

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- 60502 Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV)
- 60502-2 Part 2: Cables for rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)
- 61442 Test methods for accessories for power cables with rated voltage from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)

1.3 DEFINITIONS

For the purpose of this Standard the definitions below apply.

1.3.1 Bolted-type separable connector

A separable connector in which the electrical contact is made by a bolted device. [IEV 461-10-18]

1.3.2 Branch joint

An accessory making a connection of a branch cable to a main cable. [IEV 461-11-07, modified]

1.3.3 Connector

A metallic device to connect cable conductors together. [IEV 461-17-03]

1.3.4 Deadbreak connector

A separable connector designed to be connected and disconnected on de-energized circuits only. [IEV 461-10-19]

1.3.5 Erosion

Irreversible and non-conducting degradation of the surface of the insulator that occurs by loss of material and which may be uniform, localized or tree shaped.

NOTE: Shallow surface traces, commonly tree-shaped, may occur on terminations after partial flashover. These traces are acceptable as long as they are non-conductive. When they are conductive they are classed as tracking.

1.3.6 Indoor termination

A termination intended for use where it is not exposed to either solar radiation or weathering. [IEV 461-10-13]

1.3.7 Loadbreak connector

A separable connector designed to be connected and disconnected on energized circuits. [IEV 461-10-20]

1.3.8 Metallic housing

Metal enclosure in intimate contact with the outer screen of a separable connector and having at least the same current-carrying capacity to earth as the metallic screen of the cable with which the separable connector is to be used.

1.3.9 Outdoor termination

A termination intended for use where it is exposed to either solar radiation or weathering or both. [IEV 461-10-14]

1.3.10 Plug-in type separable connector

A separable connector in which the electrical contact is made by a sliding device. [IEV 461-10-17]

1.3.11 Range-taking accessory

An accessory designed to take more than one cross-section of cable.

1.3.12 Screened separable connector

A separable connector which has a fully screened external surface. [IEV 461-10-15]

1.3.13 Separable connector

A fully insulated termination permitting the connection and the disconnection of a cable to other equipment. [IEV 461-10-06]

1.3.14 Shrouded termination

An indoor termination with additional insulation at the bushing connection and used in an air-filled terminal box. [IEV 461-10-21]

1.3.15 Straight joint

An accessory making a connection between two cables to form a continuous circuit. [IEV 461-11-01]

1.3.16 Stop-end

An accessory providing a means of insulating the unconnected end of an energized cable. [IEV 461-10-07, modified]

1.3.17 Terminal box

An air- or compound-filled box fully enclosing a termination. [IEV 461-10-03, modified]

1.3.18 Termination

A device fitted to the end of a cable to ensure electrical connection with other parts of the system and to maintain the insulation up to the point of connection. [IEV 461-10-01]

1.3.19 Tracking

Irreversible degradation by formation of paths, which are conductive even under dry conditions, starting and developing on the surface of an insulating material and which may occur on surfaces in contact with air and also on the interfaces between different insulating materials.

1.3.20 Unscreened separable connector

A separable connector which does not have a screened external surface. [IEV 461-10-16]

1.4 VOLTAGE DESIGNATIONS AND TEMPERATURE RATING

1.4.1 Rated voltages

The rated voltage U_m of accessories considered in this Standard are given in AS/NZS 1429.1 or IEC 60502-2.

For a given application, the rated voltage (U_m) of an accessory shall be consistent with that of the cable, and shall be suitable for the operating condition of the system in which they are used, in accordance with the recommendations of IEC 60183.

1.4.2 Rated temperature

The accessories shall be suitable for use on cables having the conductor temperatures specified in AS/NZS 1429.1 or IEC 60502-2 for normal operation and for short-circuit operation.

SECTION 2 ASSEMBLY OF ACCESSORIES TO BE TESTED

2.1 CABLES

Cables used for testing shall comply with AS/NZS 1429.1 or IEC 60502-2 and shall be of the same rated voltage as the accessories to be tested.

Cables shall be correctly identified as in Appendix A.

2.2 CONNECTORS

Connectors used within the accessories shall be correctly identified with respect to—

- (a) assembly technique;
- (b) tooling, dies and necessary setting;
- (c) preparation of contact surfaces;
- (d) type, reference number and any other identification of the connector; and
- (e) details of the type test approval.

NOTE: See AS/NZS 4325.1.

2.3 ACCESSORIES

Accessories to be tested shall be correctly identified with respect to—

- (a) name of manufacturer;
- (b) type, designation, manufacturing date or code;
- (c) cable insulation material;
- (d) minimum and maximum cable cross-sections, material and shape of cable conductor;
- (e) minimum and maximum cable insulation diameters;
- (f) rated voltage (see Clause 1.4);
- (g) installation instructions (reference and date); and
- (h) for terminations, dimensions of phase-to-phase and phase-to-earth separation.

2.4 INSTALLATION AND CONNECTIONS

2.4.1 Cable conductor size

Unless otherwise specified, the nominal conductor cross-sectional area of the cable shall be as follows:

- (a) For terminations, joints and stop-ends: 120 mm², 150 mm² or 185 mm².
- (b) For separable connectors: each rating shall be tested as indicated in Table 1, using either aluminium or copper conductors.

2.4.2 Assembly instructions

Accessories shall be assembled in the manner specified by the manufacturer's instructions, with the grade and quantity of materials supplied, including any lubricants.

2.4.3 Condition of accessories

Accessories shall be dry and clean, but neither the cables nor the accessories shall be subjected to any form of conditioning, other than that allowed in Clause 2.4.2, which might modify the electrical, thermal or mechanical performance of the test assemblies.

TABLE 1
CONDUCTOR CROSS-SECTIONAL AREA
FOR TESTING OF SEPARABLE CONNECTORS

Rating	Nominal cross-sectional area of conductor mm ²	
	Cu	Al
200/250	50	70
400	95	150
600/630	185	300
800	300	400
1 250	500	630

NOTES:

- 1 The current value should be sufficient to achieve the specified conductor temperature (see IEC 61442).
- 2 The use of these conductor cross-sectional areas may lead to overheating of the bushing while achieving the required conductor temperature. Under these circumstances, it is permissible to use a conductor cross-sectional area one size smaller. If a bushing failure occurs, the test should be declared void (see Clause 4.5.2).

2.4.4 Connection of separable connectors

Unless otherwise specified, separable connectors shall be connected to their mating bushing.

2.4.5 Lug or bushing sizes

Where terminations or separable connectors are to be tested, the connection between either lugs or bushings shall have the same electrical cross-section as that of the cable conductor.

2.4.6 Unscreened separable connectors

For unscreened separable connectors, the minimum phase-to-phase and phase-to-earth clearances recommended by the manufacturer shall be tested.

2.4.7 Branch joints

Where branch joints are to be tested, only the main cable shall carry the heating current.

2.4.8 Recording

The main details regarding test mounting, especially supporting devices, shall be recorded.

2.4.9 Test arrangements

Test arrangements and number of samples shall be as detailed in Figures 1 to 6.

SECTION 3 CONDITIONS AND RANGE OF APPROVAL

3.1 RANGE OF APPROVAL

3.1.1 Terminations, joints and stop-ends

Approval of a range of conductor cross-sectional areas from 95 mm² to 300 mm² of one type of accessory for both range-taking and non-range-taking shall be obtained by successfully completing the full range of type tests of this Standard as listed in the relevant table (Tables 4, 5 or 6), on a cable conductor cross-sectional area as indicated in Clause 2.4.1(a).

Extension of approval to a range wider than that given above shall be achieved by carrying out the additional tests listed in Table 10 on the smallest and/or largest conductor cross-sectional area of the required range.

3.1.2 Separable connectors

Approval of a range of conductor cross-sectional areas for a separable connector shall be obtained by successfully completing the full range of type tests of this Standard, as listed in Tables 7, 8 and 9, on a conductor cross-sectional area as indicated in Table 1 and in Clause 2.4.1(b) and/or largest conductor cross-sectional areas in the range.

3.1.3 Range of applicable voltages

Approval of an accessory tested for a specified U_0 shall extend to operation of the accessory at a lower U_0 .

3.2 CONDUCTOR MATERIAL

Approval is independent of the cable conductor material. Tests may therefore be carried out using cables with either aluminium or copper conductors.

3.3 FORM OF CONDUCTOR

Tests performed on accessories installed on cables having shaped conductors shall be deemed to cover the same type of accessory when used on cables having circular conductors. The converse shall not apply.

In order to achieve extension of approval from round to sector-shaped conductors, additional tests shall be performed according to Table 11 using cable having shaped conductors. Stop-ends shall be tested as in Table 6 using half the number of samples in Figure 3.

3.4 INSULATION MATERIAL

Approval is dependent on the cable insulation tested as detailed in Table 2.

TABLE 2
RANGE OF APPROVAL FOR
CABLE INSULATION

Insulation of test cable	Range of approval
XLPE	XLPE, EPR and HEPR
EPR or HEPR	EPR and HEPR

3.5 INSULATION SCREEN

The additional tests specified in Table 11 shall be carried out to achieve extension of approval for different types of cable insulation screen. Stop-ends shall be tested as in Table 6 using half the number of samples in Figure 3.

3.6 WATER BLOCKING

Approval obtained by testing on a non-longitudinally water-blocked type of cable shall be extended to a cable with means of longitudinal water-blocking in the metallic screen area but otherwise of the same design. The converse shall not apply.

3.7 NUMBER OF CORES

Tests performed on three-core accessories shall be deemed to cover single-core accessories of the same design. The converse shall not apply.

3.8 CLEARANCES

The dimensions of separators nominated in Clause 2.3(h) qualify the minimum clearances for application of the termination within terminal boxes or adjacent to earthed surfaces and structures (including components of switchgear or transformers).