

AS/NZS 4396:1999

AS/NZS 4396

Australian/New Zealand Standard™

**Connectors—Insulation piercing—
For 0.6/1 kV aerial bundled cables**

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL/10, Overhead Lines, in response to requests from electricity supply authorities. It is based on a draft prepared by the Electricity Supply Association of Australia.

The objective of this Standard is to provide users and manufacturers of insulation piercing connectors with definitions, functional requirements and test methods to simplify their specification.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A normative appendix is an integral part of a Standard, whereas an informative appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Connectors—Insulation piercing—For 0.6/1 kV aerial bundled cables**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the functional and test requirements of insulation piercing connectors (IPCs) used to make electrical connections between 0.6/1 kV aerial bundled cables and insulated branch cables.

NOTE: Appendix A provides information which should be supplied by the purchaser at the time of enquiry and order.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|------|---|
| 1214 | Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) |
| 1650 | Hot-dipped galvanized coatings on ferrous articles |
| 2193 | Methods for calibration and grading of force-measuring systems of testing machines |
| 3560 | Electric cables—XLPE insulated—Aerial bundled—For working voltages up to and including 0.6/1 kV |

AS/NZS

- | | |
|------|--|
| 1111 | ISO metric hexagon commercial bolts and screws |
| 1112 | ISO metric hexagon nuts, including thin nuts, slotted nuts and castle nuts |

- | | |
|----------|--|
| ISO 9000 | Quality management and quality assurance Standards |
|----------|--|

BS

- | | |
|-------------|--|
| 2782 | Methods of testing plastics |
| 2782.5 | Part 5: Optical and colour properties, weathering |
| 2782.5.540B | Method 540B: Methods of exposure to laboratory light sources, (xenon arc lamp, enclosed carbon arc lamp, open-flame carbon arc lamp, fluorescent tube lamps) |

IEC

- | | |
|-------|--|
| 60507 | Artificial pollution tests on high-voltage insulators to be used on a.c. systems |
|-------|--|

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Aerial bundled cable (ABC)

A cable manufactured in accordance with AS 3560.

1.3.2 Branch core

A core connected to a mains core.

1.3.3 Cable

A complete laid-up assembly of the required number of cores.

1.3.4 Component

An individual item forming part of an IPC.

1.3.5 Conductor

The current-carrying component of a core.

1.3.6 Contact plate

A component which incorporates piercing teeth and which carries current between the conductors of the mains and a branch core.

1.3.7 Core (of a cable)

A conductor with its insulation.

1.3.8 Mains core

A core of an aerial bundled cable to which a branch core is connected. A mains core is intended to pass through an IPC.

1.3.9 Minimum breaking load (MBL)

The lowest value of a mechanical load at which a conductor may break.

1.3.10 Shearhead

A device which is fitted to or is integral with a connector's fastener and is designed to fracture at a predetermined torque.

1.3.11 Teeth

Those parts of a contact plate which make electrical contact with core conductors.

1.3.12 Test piece

An assembly of an IPC and its associated mains and branch core of a length, size and type required for a particular test.

SECTION 2 FUNCTIONAL REQUIREMENTS

2.1 METHOD OF MAKING CONNECTION

An electrical connection shall be made by piercing the core insulation. There shall be no need to—

- (a) remove core insulation;
- (b) apply insulation, waterproofing grease or compound to the IPC before or after fitting; or
- (c) disassemble the IPC as part of the fitting operation.

NOTE: Relocation of branch core sealing caps is not considered to be disassembling.

2.2 ACCESS TO LIVE PARTS

There shall be no ready access to live metal components during or after fitting an IPC.

2.3 REMOVABILITY

IPCs shall be readily removable.

NOTE: It is not intended that IPCs be reusable.

2.4 CABLE TYPES

IPCs shall be suitable for use with—

- (a) mains and branch cores of cables complying with AS 3560; and
- (b) cross-linked polyethylene (XLPE) insulated branch cores with which the IPC has been tested in accordance with this Standard.

2.5 CABLE TENSION

IPCs shall be suitable for connecting a branch core that is not under mechanical tension, to a mains core that may or may not be under mechanical tension.

2.6 CABLE ENTRY

Each IPC shall provide for the side entry of a mains core, i.e. IPCs shall be designed to fit on a mains core without access to the end of the core.

2.7 ORIENTATION

IPCs shall be suitable for use in any orientation.

2.8 ALIGNMENT

The design of IPCs shall ensure correct alignment of components to themselves and to the cores during fitting.

2.9 CONTACT PLATE

The contact plate material shall be resistant to deterioration due to stress.

2.10 SEALING OF CORE ENDS

IPCs intended for use with a core which ends at the IPC shall include a means of sealing the end of the core to prevent ingress of moisture.

A seal may be either integral with the IPC body or a cable-end seal attached securely to the IPC.

2.11 WATERPROOFING COMPOUND

If grease, mastic or any other compound is used to prevent ingress of water into an IPC it shall not—

- (a) adversely affect XLPE or any other cable insulants for which the IPC is designed;
- (b) adversely affect any component of the IPC;
- (c) be toxic; or
- (d) drip, run or seep from the IPC, be absorbed by any seals, or harden or crack under the service conditions specified in Clause 2.13.

2.12 IPC PROFILE

IPCs shall not have a profile or any projections, burrs or sharp edges with the potential to reduce the electrical integrity of the insulation of adjacent cores.

2.13 ELECTRICAL SERVICE CONDITIONS

IPCs shall be suitable for connecting mains and branch cores which may—

- (a) operate continuously at a temperature of 80°C; and
- (b) reach a conductor temperature of 200°C when subjected to a short-circuit for 1 s.

2.14 RESISTANCE TO WEATHERING

2.14.1 Insulating and sealing materials

Insulating and sealing materials shall be durable, weather resistant and stabilized against ultra-violet radiation.

2.14.2 Metallic components

All metallic components, except fasteners and contact plates, shall be stainless steel, or galvanized in accordance with AS 1650.

2.15 FASTENERS

2.15.1 Type

All fasteners shall be threaded.

2.15.2 Corrosion protection of ferrous fasteners

Ferrous fasteners, except those made of stainless steel, shall be protected by galvanizing in accordance with AS 1650 or AS 1214, as appropriate.

2.15.3 Form and dimensions of fastener heads

Fastener heads, shearheads, and nuts shall have an external hexagonal form, in accordance with either AS/NZS 1111 or AS/NZS 1112, except that they shall have an across-the-flats dimension of either 13 mm or 17 mm.

2.15.4 Fasteners with shearheads

2.15.4.1 *Storage and handling*

A shearhead shall remain attached to a fastener at temperatures up to 70°C during handling, storage and transport.

2.15.4.2 *Removal*

A fastener shall be able to be undone by means of a wrench after its shearhead has fractured. A residual part of the shearhead may be removed in order to apply a wrench.

2.15.4.3 *Absence of sharp edges*

After a shearhead has fractured, there shall be no sharp edges remaining on the fastener, including any residual part of the shearhead, that is likely to cause injury to personnel.

2.15.4.4 *Tightening*

Fasteners provided with a shearhead shall only be able to be tightened by a force applied to the shearhead.

SECTION 3 PERFORMANCE REQUIREMENTS

3.1 GENERAL

For each test specified in this Standard, the satisfactory performance of an IPC with the mains and branch core sizes specified for the test, proves the IPC for all core sizes marked on the IPC.

3.2 ELECTRICAL HEAT CYCLING

3.2.1 General

If an IPC meets the requirements of this Clause, it is expected that in service—

- (a) the electrical resistance of the IPC will remain stable;
- (b) the temperature of the IPC will not exceed that of a conductor to which it is attached; and
- (c) any short-circuit current will not adversely affect the performance of a Class B IPC.

3.2.2 Class A and B IPCs

When six IPCs are tested in accordance with Appendix C, both Class A and Class B IPCs shall satisfy the following criteria:

- (a) The initial resistance of an IPC shall differ by less than 30% from the mean of the initial resistance of the six IPCs.
- (b) The temperature of an IPC, measured every 50 ± 10 cycles, when the test current is flowing, shall not exceed that of the reference conductor.
- (c) The mean resistance of an IPC over the last 250 cycles shall not exceed its initial resistance by more than 50%.
- (d) A graph of the resistance of an IPC against a number of cycles shall demonstrate with a reasonable probability that the change in its resistance over the last 250 cycles is not more than 15% of the mean resistance over the same period, i.e. $D = M + S$ as calculated in Paragraph C8.3 shall not exceed 0.15.

3.2.3 Class B IPCs

When six IPCs are tested in accordance with Paragraph C7.5 the resistance of Class B IPCs, measured after the application of the short circuits, shall not exceed their resistance measured before the short circuits by more than 50%.

3.3 WATER PENETRATION

When IPCs are tested to tests I and II of Appendix D none shall—

- (a) allow flashover at high voltage or breakdown of insulation or current flow in excess of 10 mA; or
- (b) show the presence of the test solution in any core.

Dielectric failure of an IPC body shall not be considered a failure; however, if this occurs, the test shall be repeated on another IPC. Polymeric seals are not considered part of an IPC body.

3.4 MECHANICAL DAMAGE TO CONDUCTORS

When six IPCs and their associated mains and branch cores are tested in accordance with Appendix E—

- (a) there shall be no severed wires in either the mains or branch cores conductors; and
- (b) none of the mains core conductors shall have a breaking load less than 85% of the minimum breaking load specified in AS 3560.

3.5 BRANCH CORE MECHANICAL PULL-OUT

When three IPCs and their associated mains and branch core are tested in accordance with Appendix F there shall be no severed wires in the mains cores.

3.6 LOW TEMPERATURE ASSEMBLY

When three IPCs and their associated mains and branch cables are tested in accordance with Appendix G each IPC shall establish electrical continuity between its mains core and its branch core.

3.7 RESISTANCE TO WEATHERING

When six IPCs and their associated mains and branch core are tested in accordance with Appendix H the IPCs shall not exhibit—

- (a) surface cracks in the IPC's components, including seals; or
- (b) any corrosion of metal components that will reduce the performance of the IPCs.

3.8 RESISTANCE TO OVERTORQUE

When six IPCs are tested in accordance with Appendix I none of the following shall occur:

- (a) Stripping of any fastener thread.
- (b) Mechanical fracture of any IPC components.
- (c) Splitting of any seal.
- (d) IPC body pressure causing damage to core insulation likely to reduce its performance.

3.9 ATTACHMENT OF SHEARHEADS

When six IPCs are tested in accordance with Appendix J there shall be no separation of any of the shearheads and fasteners.