

**COMMUNICATIONS
ALLIANCE LTD**



AUSTRALIAN STANDARD

AS/CA S008:2020

Requirements for customer cabling products

Australian Standard – Requirements for customer cabling products

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FOREWORD

General

This Standard was prepared by the *CECRP/WC18 Cabling Standards Working Committee* and most recently revised by the *WC80 : Customer Cabling Installation and Cabling Products Working Committee*. It is one of a series of Telecommunication Standards developed under the Memorandum of Understanding between the Australian Communications Authority (ACA) and the Australian Communications Industry Forum (ACIF).

Note: On 1 July 2005 the ACA became the Australian Communications and Media Authority (ACMA) and the Memorandum of Understanding continues in effect as if the reference to the ACA was a reference to ACMA.

Communications Alliance was formed in 2006 and continues the functions previously fulfilled by ACIF.

This Standard is a revision of *AS/CA S008:2010 Requirements for customer cabling products*.

This Standard is the result of a consensus among representatives on the Communications Alliance Working Committee to produce it as an Australian Standard.

The requirements in this Standard are intended to be consistent with the aims of s376 of the *Telecommunications Act 1997*. Specifically these aims are—

- (a) protecting the integrity of a Telecommunications Network or Facility;
- (b) protecting the health and safety of persons;
- (c) ensuring access to emergency services; and
- (d) ensuring interoperability with a standard telephone service.

It should be noted that some Customer Equipment (CE) may also need to comply with requirements in other Standards.

Applicable electrical safety Standards, EMC, Radiocommunications and EMR Standards may apply under Commonwealth or State/Territory laws, or both.

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Regulatory notice

The 2020 version of AS/CA S008 is mandated by the *Telecommunications Technical Standard (Requirements for customer cabling products – AS/CA S008) 2015* and comes into force on the date it is published. Until that date AS/CA S008:2010+Amdt No1:2014 remains in force.

Details on current compliance arrangements can be obtained from the ACMA website at <https://www.acma.gov.au> or by contacting ACMA at:

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Introduction

This introduction for the AS/CA S008 **Requirements for customer cabling products** Standard is not an authoritative section of this Standard and is only provided as guidance for the user of the Standard to outline its objectives, the factors that have been taken into account in its development and to list the principal differences between the new and the previous edition.

The reader is directed to the clauses of this Standard for the specific requirements and to the Australian Communications and Media Authority (ACMA) for the applicable telecommunications labelling and compliance arrangements.

Note: Further information on the telecommunications labelling and compliance arrangements can be found in the *Telecommunications (Labelling Notice for Customer Equipment and Customer Cabling) Instrument 2018 (the Instrument)*. The Instrument can be obtained from the Australian Communications and Media Authority (ACMA) website at <https://www.acma.gov.au/>.

The objective of this Standard is to provide the requirements for Cabling Products and related Customer Equipment for safety and interoperability in order to meet the regulatory arrangements in Australia.

The objective of this revision is to update the requirements of Customer Cabling Products to reflect product supply in Australia and to update referenced Standards that have been revised since the previous edition of this Standard.

The principal differences between this edition of AS/CA S008 and the previous edition are—

- (i) the References section has been restructured, with publications only referred to in notes and informative appendices relocated to a new Bibliography.
- (ii) all references to regulatory and other publications have been updated, including the revised AS 1049.1-2014 telecommunications cable materials Standard.
- (iii) defined terms used in the requirements are now displayed in 'Leading Capitals' for ease of identification.
- (iv) new voltage, electrical energy source (ES1, ES2, ES3) and related terminology used in AS/NZS 62368.1 has been introduced. Appendix D specifies how equivalence between AS/NZS 62368.1 and AS/NZS 60950.1 is to be implemented, together with a table comparing AS/NZS 60950.1 and AS/NZS 62368.1 terms.
- (v) new definitions, including *generic cabling*, *mains supply*, *pit or access hole product* and *registered engineer*.
- (vi) prohibited markings for underground conduit (Clause 5.3.3.2).
- (vii) requirements for optical fibre distribution devices and enclosure labelling are now only specified in AS/CA S009.
- (viii) a new fitness for purpose requirement for cabling products (Clause 5.1.2).

- (ix) the AS 1660.5.6 flammability requirements have been updated to the new AS/NZS IEC 60332.1 Standard (Clause 5.6.4).
- (x) optical fibre cordage strain relief requirements have been aligned with IEC 61300-2-4 (Clauses 5.6.16.4 and 5.6.16.5).
- (xi) blown fibre tube system requirements now include those with preinstalled elements (Clause 5.6.17).
- (xii) a new specification for ES3 generic cable, including conductor resistance, sheath colour and labelling (Clause 5.6.19).
- (xiii) a new compatibility recommendation for 6-position modular plugs and sockets and the use of '8P-to-6P insert' adaptors (Clause 5.7.3 and Appendix C).
- (xiv) new pit and access hole requirements including cover labelling, installation methods and testing documentation. (Clause 5.8.1)

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1 INTERPRETATIVE GUIDELINES

1.1 Categories of requirements

This Standard contains mandatory requirements as well as provisions that are recommendations only. Mandatory requirements are designated by the words '**shall**' or '**shall not**'. All other provisions are voluntary.

1.2 Compliance statements

Compliance statements, in italics, suggest methodologies for demonstrating that Customer Cabling and related Customer Equipment comply with the requirements.

1.3 Definitions, expressions and terms

If there is any conflict between the definitions used in this Standard and the definitions used in the *Telecommunications Act 1997*, the definitions in the Act take precedence.

1.4 Notes

Text denoted as 'Note' is for guidance in interpretation and is shown in smaller size type.

1.5 Applicable editions of References

- (a) Applicable editions (or versions) of other documents referred to in this Standard are specified in Section 3: REFERENCES.
- (b) If a document refers to another document, the other document is a sub-referenced document.
- (c) Where the edition (or version) of the sub-referenced document is uniquely identified in the reference document, then that edition (or version) applies.
- (d) Where the edition (or version) of the sub-referenced document is not uniquely identified in the reference document, then the applicable edition (or version) is that which is current at the date the reference document is legislated under the applicable regulatory framework, or for a non-legislated document, the date upon which the document is published by the relevant standards organisation.
- (e) A number in square brackets '[]' refers to a normative document listed in Section 3: REFERENCES.
- (f) Either safety standard AS/NZS 60950.1 [18] or AS/NZS 62368.1 [19] may be used where reference is made in this Standard to AS/NZS 62368.1 [19]. Appendix D specifies how this equivalence is to be implemented.

1.6 Units and symbols

In this Standard the International System (SI) of units and symbols is used in accordance with ISO 80000-1 [32].

1.7 Bibliography

The bibliography contains information about other publications referred to in this Standard e.g. publications only referred to in notes and informative appendices in this Standard.

2 SCOPE

- 2.1 This Standard applies to Cabling Products (including Cable and related Customer Equipment) intended for connection to the customer side of the boundary of a Telecommunications Network.
- 2.2 This Standard does not apply to Cabling Products intended primarily for the distribution of Mains Supply.
- 2.3 This Standard does not apply to products intended to be used for telecommunications earthing systems or telecommunications power distribution (e.g. earthing/power conductors, earthing bars, busbars, earthing/power terminals, line tap devices, earth electrodes and associated fittings, batteries, fuses and circuit breakers).
- 2.4 This Standard does not apply to surge suppression devices.

Note: Requirements for surge suppression devices are specified in AS/NZS 4117 *Surge Protection Devices for Telecommunication Applications*. Refer to the *ACMA Telecommunications (Labelling Notice for Customer Equipment and Customer Cabling) Amendment Instrument 2018*.

- 2.5 A Cabling Product is not excluded from the scope of this Standard by reason only that it forms part of equipment that is subject to another Standard, for example, distribution frames or Cable tails that form part of Customer Access Equipment (CAE).

Note 1: The connection of Cabling Products includes connection otherwise than by means of physical contact, e.g. a connection by means of radiocommunication.

Note 2: This Standard should be read in conjunction with AS/CA S009 [20] which specifies the requirements for the installation and maintenance of fixed or concealed cabling or equipment that is connected or is intended to be connected to a Telecommunications Network.

3 REFERENCES

	Publication	Title
	Australian Standards	
[1]	AS 1049 AS 1049.1-2014 Amdt 1:2019 AS 1049.2-2008	Telecommunication cables Part 1: Insulation, sheath and jacket Materials Part 2: Insulation, sheath and jacket Test methods
	AS/NZS 1660	Test methods for electric cables, cords and conductors
[2]	AS/NZS 1660.3:1998 (R2017)	Part 3: Electrical tests (including Amdt 1: 2001 and Amdt 2:2017)
	AS/NZS IEC 60332.1	Tests on electric and optical fibre cables under fire conditions. Part 1: Test for vertical flame propagation for a single insulated wire or cable
[3]	AS/NZS IEC 60332.1.1:2017	Part 1-1: Apparatus
[4]	AS/NZS IEC 60332.1.2:2017	Part 1-2: Procedure for 1 kW pre-mixed flame
[5]	AS/NZS IEC 60332.1.3:2017	Part 1-3: Procedure for determination of flaming droplets/particles
[6]	AS/NZS 1802:2018	Electric cables – Reeling and trailing – For underground coal mining purposes
	AS/NZS 2053	Conduits and fittings for electrical installations
[7]	AS/NZS 2053.1:2001 (R2016)	Part 1: General requirements
[8]	AS/NZS 2373:2003 (R2017)	Electric cables – twisted pair for control and protection circuits
[9]	AS 2700-2011	Colour standards for general purposes
[10]	AS/NZS 3191:2008	Electric flexible cords
	AS/NZS 5000	Electric cables – polymeric insulated
[11]	AS/NZS 5000.1:2005 (R2017)	Part 1: For working voltages up to and including 0.6/1 (1.2) kV
[12]	AS/NZS 5000.2:2006 (R2017)	Part 2: For working voltages up to and including 450/750 V
[13]	AS/NZS 5000.3:2003 (R2017)	Part 3: Multicore control cables
[14]	AS & AS/NZS 11801	Information technology -- Generic cabling for customer premises
	AS/NZS 11801-1:2019	Part 1: General requirements
	AS 11801-2:2019	Part 2: Office premises
	AS 11801-3:2019	Part 3: Industrial premises
	AS 11801-4:2019	Part 4: Single-tenant homes
	AS 11801-5:2019	Part 5: Data centres

	AS 11801-6:2019	Part 6: Distributed building services
[15]	AS 60529:2004	Degrees of protection provided by enclosures (IP Code)
[16]	AS/NZS 60695.2.13:2001	Fire hazard testing – glowing/hot wire based test methods – glow-wire ignitability test method for materials
[17]	AS/NZS 60702.2:2005	Approval and test specification- Terminations and glands for mineral insulated metal-sheathed cables
	AS/NZS 60950	Information Technology Equipment
[18]	AS/NZS 60950.1:2015	Part 1: Safety General requirements
[19]	AS/NZS 62368.1	Audio/video, information and communication technology equipment – Part 1: Safety requirements
	AS/CA Standards	
[20]	AS/CA S009:2020	Installation requirements for customer cabling – Wiring Rules
	IEC Publications	
[21]	ISO/IEC 11801	Information technology -- Generic cabling for customer premises
	ISO/IEC 11801-1:2017	Part 1: General requirements
	ISO/IEC 11801-2:2017	Part 2: Office premises
	ISO/IEC 11801-3:2017	Part 3: Industrial premises
	ISO/IEC 11801-4:2017	Part 4: Single-tenant homes
	ISO/IEC 11801-5:2017	Part 5: Data centres
	ISO/IEC 11801-6:2017	Part 6: Distributed building services
[22]	IEC 60050-151:2001	International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and magnetic devices
[23]	IEC 60096-0-1 (2012-10)	Radio-frequency cables. Part 0-1: Guide to the design of detail specifications – Coaxial cables
[24]	IEC 60189-1 (2007-05)	Low-frequency cables and wires with PVC insulation and PVC sheath. Part 1: General test and measuring methods
[25]	IEC 60352-4 (1994-08)	Solderless connections —Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance
[26]	IEC 60512-3-1 Edition 1.0 (2002-02)	Connectors for electronic equipment - Tests and measurements - Part 3-1: Insulation tests – Test 3a: Insulation resistance
[27]	IEC 60603-7 Edition 3.1 (2011-2012)	Connectors for electronic equipment – Part 7: Detail specification for 8-way, unshielded, free and fixed connectors
[28]	IEC 60793-2:2019	Optical fibres. Part 2: Product specifications – General

[29]	IEC 60794-1-1:2015	Optical fibre cables - Part 1-1 – Generic specification – General
[30]	IEC 60794-1-22:2017	Optical fibre cables Part 1-22: Generic specification – Basic optical cable test procedures – Environmental tests methods
[31]	IEC 61300-2-4:2019	Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 2-4: Tests - Fibre or cable retention
International Standards		
[32]	ISO 80000-1:2009	Quantities and Units – Part 1: General
Other References		
[33]	CFR FCC 47— Part 68.500: October 1999	Code of Federal Regulations Federal Communications Commission Title 47: Telecommunications Part 68: Connection of terminal equipment to the telephone network Sub part F: Connector Specifications. Section 68.500: Specifications U.S Government Publishing Office

4 ABBREVIATIONS AND DEFINITIONS

For the purposes of this Standard, the following abbreviations and definitions apply.

4.1 Abbreviations

AC (or a.c.)	alternating current (in r.m.s. value unless stated otherwise)
ACIF	Australian Communications Industry Forum
ACMA	Australian Communications and Media Authority
AS	Australian Standard
CAE	Customer Access Equipment
CE	Customer Equipment
CES	Communications Earth System
DC (or d.c.)	direct current
ELV	Extra-Low Voltage
ES1	Electrical Energy Source Class 1
ES2	Electrical Energy Source Class 2
ES3	Electrical Energy source Class 3
FCC	Federal Communications Commission USA
HV	High Voltage
IEC	International Electrotechnical Commission
IP	International Protection (rating) (sometimes referred to as Ingress Protection)
IPXn	rated for protection against ingress of water only (n = 0 to 8, according to the degree of protection specified)
ISDN	Integrated Services Digital Network
LAN	Local Area Network
LV	Low Voltage
MDF	Main Distribution Frame
MIMS	Mineral Insulated Metal Sheath
NTD	Network Termination Device
NZS	New Zealand Standard
PVC	Polyvinyl Chloride
SELV	Safety Extra-Low Voltage
SWA	Steel Wire Armouring
TNV	Telecommunications Network Voltage
TO	Telecommunications Outlet
TRC	Telecommunications Reference Conductor
TS	Technical Standard
UV	Ultraviolet (radiation/light)
Z ₀	Characteristic Impedance

4.2 Definitions

4.2.1 aerial cable

Cable that is suspended between poles, buildings or other supporting structures external to a building.

4.2.2 cable

an assembly of one or more conductors and/or optical fibres, with a protective covering and possibly filling, insulating and protective material.

Note: The assembly may also include other elements, for example a metallic shield, a moisture barrier, a strengthener or bearer wire.

[Source: Adapted from IEC 60050-151 (MOD)] [22]

4.2.3 cabling product

a passive device (including any Cable, Connecting Hardware, Enclosure, Conduit, factory-made pit or factory-made access hole) that is intended for use on the customer side of the boundary of a Telecommunications Network.

4.2.4 carriage service

a service for carrying communications by means of guided and/or unguided electromagnetic energy.

4.2.5 carriage service provider

if a person supplies, or proposes to supply, a listed Carriage Service to the public using—

(a) a network unit owned by one or more Carriers; or

(b) a network unit in relation to which a nominated Carrier declaration is in force;

the person is a Carriage Service Provider.

4.2.6 carrier

the holder of a Carrier licence.

4.2.7 conduit

a tube or pipe that physically accommodates Cables.

Note: In this Standard, Conduit and pipe have the same meaning. See also Duct and Trunking.

4.2.8 connecting hardware

a passive device used to join or interconnect Lines, or to connect Customer Equipment to a Line.

- 4.2.9 cord
a flexible Cable with a minimum of one termination (e.g. on a plug).
Note: Cords are used for connection of moveable Customer Equipment or to afford flexibility. Examples of Cords are patch Cords, fly leads and Pigtails.
- 4.2.10 cordage
a flexible Cable that is not fitted with connectors, which may be used in the assembly of Cords.
- 4.2.11 Customer Access Equipment (CAE)
Customer Equipment with multiple ports (local or network) that provides access (gateway functions) to a Telecommunications Network and is capable of switching, storage, processing, conversion, integration, line isolation/coupling or multiplexing of analogue or digital voice or voice equivalent communication
Note 1: Examples of CAE include, but are not limited to, PABX or key systems, line isolators, ISDN terminal adaptors, echo cancellers, interactive voice response systems, voice/packet gateway, integrated access devices and voice messaging systems.
Note 2: CAE was formerly referred to as CSS (customer switching system).
- 4.2.12 customer cable
a Cable that is used in Customer Cabling.
- 4.2.13 customer cabling
a Line that is used, installed ready for use or intended for use on the customer side of the boundary of a Telecommunications Network.
Note: In the context of this Standard a reference to Customer Cabling is a reference to Cable, including Cord and Cordage, and Connecting Hardware.
- 4.2.14 Customer Equipment (CE)
(a) any equipment, apparatus, tower, mast, antenna or other structure or thing; or
(b) any system (whether software-based or otherwise);
that—
(1) is used, installed ready for use or intended for use in connection with a Carriage Service; and
(2) under the regulations, is treated as Customer Equipment;
but does not include a Line.

Note: In the context of this Standard a reference to Customer Equipment is a reference to all products excluding Cable, Cord and Cordage.

4.2.15 distributor

a collection of components used to terminate Cables and which provide for cross-connection of Lines.

Note 1: An example of a Distributor is a jumperable distribution frame or a patch panel.

Note 2: Where cable termination equipment is used to interconnect two or more Cables without cross-connection, for the purposes of this Standard, it is not regarded as a Distributor.

Note 3: The definition of Distributor in AS/CA S009 [20] varies from the above definition. A distributor with no more than six outlets in a home is not considered to be a distributor for the purpose of the regulation of cabling work.

4.2.16 duct

a closed passage for housing and protecting Cable and conductors. See also Conduit and Trunking.

4.2.17 Electrical Energy Source Class 1 (ES1)

See Appendix D.

4.2.18 Electrical Energy Source Class 2 (ES2)

See Appendix D.

4.2.19 Electrical Energy Source Class 3 (ES3)

See Appendix D.

4.2.20 enclosure

a housing for Cable or equipment affording the type and degree of protection suitable for the intended application.

Note: Examples of uses for Enclosures may include security of cabling interconnection systems, protection against contact with ES2 and ES3, protection against fire originating within equipment.

4.2.21 facility

- (a) any part of the infrastructure of a Telecommunications Network; or
- (b) any Line, equipment, apparatus, tower, mast, antenna, tunnel, Duct, hole, pit, pole or other structure or thing used, or for use, in or in connection with a Telecommunications Network.

4.2.22 generic cable

is the Cable that is specified under Generic Cabling.

- 4.2.23 generic cabling
- is cabling which meets the cabling installation conformance requirements of a cabling design document in the AS/NZS 11801 series [14] or ISO/IEC 11801 series [21] of Standards.
- 4.2.24 hazardous energy source
- an electrical energy source which exceeds ES2 voltage and current limits existing in a circuit as defined in AS/NZS 62368.1 [19].
- Note: ES3 is treated as a Hazardous Energy Source.
- 4.2.25 hybrid cable
- a composite Cable that—
- (a) uses separate telecommunications technologies; or
 - (b) is used simultaneously for telecommunications and an application other than telecommunications.
- Note 1: The telecommunications component of a Hybrid Cable is required to meet the applicable requirements of this Standard.
- Note 2: An example of a Hybrid Cable is a Cable composed of a coaxial tube and twisted pairs contained under the same sheath.
- Note 3: Another example of a Hybrid Cable is a Cable that is used for distribution or connection of ES2 power and that also contains an optical fibre, coaxial tube or metallic conductors for control purposes.
- 4.2.26 indoor cable
- Cable that is intended for use inside a building, but not underground or exposed to the elements.
- 4.2.27 instructed person
- a person instructed or supervised by a Skilled Person as to energy sources and who can responsibly use equipment safeguards and precautionary safeguards with respect to those energy sources.
- Note 1: Supervised, as used in the definition, means having the direction and oversight of the performance of others.
- [Source: AS/NZS 62368.1 [19]]
- 4.2.28 jumper
- a cable unit or cable element without connectors, typically one to four twisted pairs, either unsheathed or sheathed, used to make a cross connection within a Distributor.
- 4.2.29 lead-in cabling
- a Carrier's Telecommunications Network cabling from the Carrier's distribution point to the boundary of a Telecommunications Network.

- 4.2.30 line
a wire, Cable, optical fibre, tube, Conduit, waveguide or other physical medium used, or for use, as a continuous artificial guide for or in connection with carrying communications by means of guided electromagnetic energy.
- 4.2.31 Main Distribution Frame (MDF)
a Distributor that provides, or is intended to provide, an electrical termination point for a Carrier's twisted pair Lead-in Cabling.
Note: There may be more than one MDF within a building.
- 4.2.32 mains supply
AC or DC power distribution system (external to the equipment) that supplies operating power to the equipment and is power source class 3 (PS3).
Note: Mains includes public or private utilities and equivalent sources such as motor-driven generators and uninterruptible power supplies.
[Source: Adapted from AS/NZS 62368.1 [19]]
- 4.2.33 multidiscipline
A Cable that is intended to be used for an application other than telecommunications but excluding any Cable normally used for distribution or connection of AC Mains Supply.
Note: An example of a Multidiscipline Cable is a Cable that may be used for telecommunications or may be used for such other things as—
(a) emergency lighting (e.g. MIMS Cable);
(b) distribution or connection of ELV power (e.g. 'figure 8' twin conductor cable);
(c) control purposes e.g. (a travelling lift or hoist Cable); or
(d) industrial robotics.
- 4.2.34 ordinary person
a person who is neither a Skilled Person nor an Instructed Person.
Note: This is commonly considered to be the 'user' or the end-user of the equipment, but it has a broader meaning here which includes the general public.
[Source: Adapted from AS/NZS 62368.1 [19]]
- 4.2.35 outdoor cable
Cable that is intended for use external to a building, either underground or exposed to the elements, including Aerial Cable.

4.2.36 pigtail

a length of metallic or optical fibre Cordage with a connector fitted at one end only. The other end is free for terminating or splicing to Customer Equipment or Customer Cabling.

4.2.37 pit or access hole product

a manufactured product which is intended to form part or all of a pit or access hole, with the exception of a cover component supplied separately from other types of pit and access hole components.

Note 1: The terms 'pit' and 'access hole' refer to in-ground chambers which are used to haul, joint and house underground communications cabling.

Note 2: Any sections of a pit or access hole which are constructed on site from building materials, for example bricks or wet concrete, are not Pit Or Access Hole Products.

Note 3: Covers, crossbars, cover gaskets, cover frames, and aesthetic cover and frame sets are examples of cover components. These components are not considered to be Pit Or Access Hole Products if they are supplied separately from a part such as a pit body or a pit riser.

4.2.38 registered structural engineer

an engineer who has formal recognition of the qualification and competency of a structural engineer and is current on an engineer register. The engineer register may be—

- (a) a mandatory jurisdictional registration system for engineers (e.g. RPEQ);
- (b) a National Engineering Register (e.g. NER); or
- (c) a Professional Engineering Registration Organisation (e.g. Engineers Australia).

Note 1: The minimum mandatory requirement for listing on a register is—

- (a) a qualification for structural engineering that complies with the requirements of the Washington Accord,
- (b) accumulation of five years of relevant engineering industry experience over the past seven years; and
- (c) continuing professional development of 150 hours over the past three years.

Note 2: Further information can be found at Engineers Australia at www.engineersaustralia.org.au.

4.2.39 SELV circuit

See Appendix D.

4.2.40 skilled person

a person with relevant education or experience to be able to identify hazards and to take appropriate actions to reduce the risks of injury to themselves and others [AS/NZS 62368.1] [19]

4.2.41 special application cable

a Cable that—

- (a) is intended to carry steady-state or change-of-state DC signals or AC signals less than 300 Hz between devices;
- (b) is intended to carry an industrial data signalling protocol, e.g. RS232 or RS485;
- (c) is intended for Multidiscipline use; or
- (d) is a Hybrid Cable.

Note: A Special Application Cable may include, but is not limited to—

- (a) a Cable used for connection of telecommunications power (usually ES1) and associated status and alarm circuits;
- (b) a MIMS, EWIS or other fire detection or fire warning system Cable;
- (c) a security or control system Cable; or
- (d) a travelling lift or hoist Cable.

4.2.42 telecommunications network

a system, or series of systems that is operated by a Carrier or Carriage Service Provider and which carries, or is capable of carrying, communications by means of guided and/or unguided electromagnetic energy.

Note: This includes the transfer of conducted electrical energy on telecommunications copper Cables.

4.2.43 Telecommunications Network Voltage (TNV)

See Appendix D.

4.2.44 telephone cable

a Cable with metallic conductors (including Cordage or a Cord) designed to carry signals only in the 300 Hz to 100 kHz bandwidth.

4.2.45 trunking

a tray or trough system with removable cover(s) along its length for housing and protecting Cables.

Note: See also Conduit and Duct.

4.2.46 underground cable

Cable that is intended to be buried underground either directly or in Conduit.

5 REQUIREMENTS

5.1 General

5.1.1 Physically distinguishable

Cabling Products, other than pits and access holes, **shall** be physically distinguishable from products used for distribution or connection of Mains Supply.

5.1.2 Fitness for purpose

A Cabling Product **shall** be fit for purpose for its intended use, e.g. a Category 6 Cord that meets its performance requirements.

Note: The component manufacturer should be consulted for confirmation of the intended use and/ or capabilities of the component used. Examples may include confirmation of Cable types to support remote powering (Power over Ethernet) to ensure the Cable has the ability to handle the current required by the end device.

5.1.3 Twisted pair and quad

For the purposes of this Standard, a quad is deemed to satisfy a requirement for which a twisted pair has been specified.

5.2 Markings

5.2.1 Labelling Instrument

The ACMA *Telecommunications (Labelling Notice for Customer Equipment and Customer Cabling) Instrument (the Instrument)* requirements apply to Customer Cabling or related CE.

Note 1: The *Instrument* does not apply to Cable and Cabling Products that are not used for Customer Cabling or related CE (see Schedule 4 of the *Instrument*).

Note 2: The *Instrument* is available from the ACMA website at www.acma.gov.au.

5.2.2 Inappropriate markings

Cabling Products intended solely for ES1 or ES2 telecommunications circuits **shall not** bear markings indicating hazardous services.

5.2.3 Additional markings (excluding cable markings)

5.2.3.1 International Protection (IP) rating

Cabling Products other than Cable, which have been assessed against the requirements of AS 60529 [15] **shall** be legibly and durably marked with the relevant International Protection (IP) rating.

Note: It is recommended that the IP rating along with other markings required by this Standard be located in a visible external or internal position after installation.

5.2.3.2 Multidiscipline telecommunications connecting hardware

Products designed for Multidiscipline use that have permanent markings to distinguish their usage **shall** have their markings positioned so that they are likely to be visible when the products are installed.

Note: This is to distinguish the Cabling Products used for telecommunications from those products used for hazardous circuits.

5.2.3.3 Marking durability

A marking that is required to comply with this Clause **shall**—

- (a) be durable and easily legible after rubbing the marking by hand; and
- (b) withstand being rubbed by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

Note: Petroleum spirit is defined as the aliphatic solvent hexane with a maximum aromatics content of 0.1% by volume, a Kauri-butanol value of 29, an initial boiling point of 65°C, a dry point of 69°C and a density of approximately 0.68 g/cm³.

5.3 Underground conduit

5.3.1 Colour

Non-metallic Conduit for underground use **shall** be—

- (a) coloured white; or
- (b) contain an indelible, durable, continuous, visible white stripe which is incorporated as part of the manufacturing process and is not painted on or applied over the surface of a prefabricated Conduit.

5.3.2 Underground conduit properties

Underground Conduit **shall** meet the following minimum classifications in accordance with Clause 5 of AS/NZS 2053.1 [7] —

- 5.1 Any of the listed types of material;
- 5.2 Threadable or non-threadable;
- 5.3 Medium mechanical stresses ('medium duty');
- 5.4 Rigid or flexible;
- 5.8.1 & 5.8.2 Rated to IP66; and
- 5.8.5 Non-hygroscopic.

5.3.3 Underground conduit markings

5.3.3.1 Conduit identification

Non-metallic Conduit for underground use—

- (a) **shall** be legibly and durably marked 'COMMUNICATIONS' at intervals of no less than 1 m and no greater than 3 m; and
- (b) should be legibly and durably marked 'COMMUNICATIONS' at intervals no greater than 1.5 m.

Note 1: Conduit fittings such as bends and joiners do not need to be marked.

Note 2: Suitable methods of marking include stamping, moulding, printed labels and direct printing.

5.3.3.2 Prohibited markings

Conduit for underground use **shall not** include the word 'ELECTRICAL' or any other marking that may be confusing or misleading.

5.3.3.3 Marking durability

Required markings on Conduit for underground use **shall** comply with Clause 5.2.3.3.

5.4 Cable distribution devices

5.4.1 Common requirements

5.4.1.1 Cable entry

Cable entry holes **shall** be free of sharp edges or burrs or have a grommet of insulating material fitted.

5.4.1.2 Conductive enclosure

5.4.1.2.1 Enclosure, frame and backmount earthing

Provision **shall** be made to enable conductive Enclosures, frames and backmounts to be connected to a building electrical earthing system in accordance with the applicable requirements of AS/CA S009 [20].

5.4.1.2.2 Insulation

All parts intended to carry voltages for Customer Cabling, except Connecting Hardware that is tested separately to Clause 5.7, **shall** be electrically insulated to a minimum value of 1.5 kV a.c. (or 2121 V d.c.) without breakdown for 60 s from any conductive part of Enclosures, or terminals provided to make a connection to the Enclosure itself.

Note: Face plates and mounting hardware intended for use with generic or proprietary connectors are required to comply with this Clause.

5.4.1.3 Enclosure requirements

5.4.1.3.1 Openings

Any openings, other than cable entries, in Enclosures **shall** comply with the physical requirements for electrical Enclosures given in—

- (a) Clause 4.6 of AS/NZS 60950.1 [18]; or
- (b) Clause 5.3.6 and Annex P of AS/NZS 62368.1 [19] for all other openings.

5.4.1.3.2 Sharp edges

An Enclosure **shall** be free from exposed sharp edges that may cause damage to Cable or injury to any person.

5.4.1.3.3 Outdoor enclosures

Enclosures intended for installation in an outdoor location to protect internal equipment from being exposed to adverse conditions **shall** provide a minimum degree of protection of IPX3 in accordance with AS 60529 [15]. The IP code **shall** be declared, however it is not a requirement to mark the IP code on the outdoor Enclosure.

Note: Clause 8 of IEC 60950-22 contains additional requirements for outdoor Enclosures which are recommended for this Standard. These requirements may be included in a future edition of AS/NZS 62368.1 [19].

Compliance with Clause 5.4.1.3.3 should be checked after the Enclosure has been opened and closed at least ten (10) times.

5.4.1.3.4 Shared enclosures

The conductors and terminations of a Customer Cable may be located within the same Enclosure as the conductors and terminations of a mains power cable subject to the following—

- (a) The conductors and terminations of a Customer Cable **shall not** be located within the same Enclosure as the uninsulated and single-insulated conductors and terminations of a mains power cable unless—
 - (i) accidental access to the mains power conductors and terminations by a person working on the Customer Cable conductors and terminations is prevented by means of a physical barrier or obstruction that prevents contact with the mains power conductors or terminations by any part of the body or by any tool being used by a person;

- (ii) the Customer Cable and the mains power cable are to be terminated on building control or monitoring equipment that is to be installed in a restricted access area where only persons who are qualified and authorised to install or maintain both mains power installations and Customer Cabling can gain access; or
 - (iii) there is provision for the Enclosure to be secured by a lock or tool.
- (b) The conductors and terminations of a Customer Cable **shall** be separated from the uninsulated and single-insulated conductors and terminations of a mains power cable by either a minimum distance of 150 mm or by means of a permanent, rigidly-fixed barrier of durable insulating material or metal that is capable of being earthed in accordance with Clause 5.4.1.3.4(c), unless—
- (i) the Customer Cable and the mains power cable are to be terminated on building control or monitoring equipment that is to be installed in a restricted access area where only persons who are qualified and authorised to install or maintain both mains power installations and Customer Cabling will be able to gain access;
 - (ii) separate cables are to be used for mains power and telecommunications; and
 - (iii) any telecommunications circuit that is to be terminated on the building control or monitoring equipment—
 - (A) will not share the same cable sheath as any other telecommunications service; and
 - (B) will only be connected to a Telecommunications Network via a compliant isolating interface.
- (c) Where the barrier referred to in Clause 5.4.1.3.4(b) is of metallic construction, provision **shall** be made for connecting the barrier to a protective earth by a minimum 2.5 mm² conductor.
- (d) Conductors and terminations of telecommunications Cables **shall not** be located within the same Enclosure as those of cables carrying a voltage exceeding 1000 V a.c. or 1500 V d.c.

Note: 'Compliant isolating interface' means Carrier equipment or Customer Equipment that meets the requirements of AS/NZS 62368.1 [19] for an ES2 interface. Examples are a modem or a Line Isolation Device.

5.4.1.4 Earthing or bonding bars and terminals

5.4.1.4.1 Insulation

Where an earthing/bonding bar or terminal is provided other than for the purpose of Clause 5.4.1.2.1, it **shall** be insulated from any conductive material of the Enclosure, backmount or frame to withstand a potential difference of 1.5 kV a.c. (50 Hz) for 60 s.

5.4.1.4.2 Earthing or bonding conductor connections

An earthing/bonding bar or terminal intended for connection of earthing or bonding conductors **shall** comply with the requirements of AS/CA S009 [20] for earthing/bonding bars and terminals used for connection of earthing or bonding conductors.

5.4.1.4.3 Access to earthing or bonding bars or terminals

An earthing/bonding bar or terminal **shall** be enclosed or located to prevent unintentional contact by a person who is not doing cabling work, for example an end-user.

5.4.1.5 Access to cable terminations

All telecommunications terminations **shall** be enclosed or located to prevent unintentional contact with voltages other than ES1 by a person who is not doing cabling work, for example an end-user.

Note: Although it is permissible to allow persons to come into personal contact with ES1 circuits this should be prevented where practicable.

5.4.2 Main distribution frame (MDF)

5.4.2.1 Flame propagation

The MDF Enclosure case materials **shall** be tested and meet the minimum requirements of—

- (a) a resistance to heat to 120°C in accordance with AS/NZS 2053.1 [7];
- (b) non-flame propagating in accordance with AS/NZS 2053.1 [7]; and
- (c) if made of insulating material, the glow wire test of AS/NZS 60695.2.13 [16] at 850°C.

Note: This requirement is to allow for the installation of surge suppression fittings within the MDF, which may become a source of ignition during overvoltage conditions.

5.4.2.2 Security

The MDF **shall** have provision for securing with a key, lock or tool.

5.4.2.3 Terminations

The MDF should be suitable for mounting the Carrier's standard terminating modules for Lead-in Cabling on the Carrier's side of the Distributor.

Note: Manufacturers should be aware that the Carrier may deny access to their network if they are unable to mount their terminating modules for termination of their Lead-in Cabling in the MDF.

5.4.2.4 Space for surge suppression devices

Allowance **shall** be made for a minimum clearance of 30 mm between the Carrier's standard termination modules and the inside face of the front cover or door of the MDF in the fully closed position, to allow for the fitting of surge suppression devices.

Note: Appropriate clearance should be provided on the customer's side to fit surge suppression, test devices or other devices.

5.5 This clause is deleted

5.6 Cables

5.6.1 General

A Customer Cable **shall** meet the requirements of Clauses 5.6.2 to 5.6.10 where specified in Clauses 5.6.11 to 5.6.18 of this Standard, in addition to any other requirements specified for the particular type of Cable or cable application.

5.6.2 Conductor and optical fibre identification

A Cable that is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard, and which contains more than one metallic conductor, coaxial tube or optical fibre, **shall** use a system of identification such that all conductors, coaxial tubes or optical fibres within the Cable are readily distinguishable visually from one another.

Note: Examples of colour codes are set out in Appendix B.

5.6.3 Insulation and sheath material

A Cable that is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard—

- (a) **shall** use insulation and sheath materials suitable for telecommunications purposes;
- (b) where PVC insulation or sheath materials are used, they **shall** comply with the requirements of Table 1 or 2, as applicable; and
- (c) where non-PVC insulation or sheath materials are used, they **shall** comply with the requirements of AS 1049 [1] for—

- (i) Tensile Strength Test (Aged/Unaged);
- (ii) Elongation Test (Aged/Unaged); and
- (iii) Shrinkback Tests for that particular type of insulation and sheath.

5.6.4 Flammability

A Cable that is required to comply with any of Clauses 5.6.11 to 5.6.18 of this Standard **shall** pass both—

- (a) the resistance to vertical flame propagation test as specified in AS/NZS IEC 60332.1.2 [4] including Annex A; and
- (b) the falling flaming droplets/particles test as specified in AS/NZS IEC 60332.1.3 [5] including Annex A.

5.6.5 UV resistance

A Cable that is required to comply with this Clause by AS/CA S009 [20] or by any of Clauses 5.6.11 to 5.6.18 of this Standard **shall** meet the requirements of AS 1049 [1] for Cables exposed to UV radiation.

Note: Underground Cable is likely be exposed to UV radiation (sunlight) at points where it enters or exits the ground or if a pit or access hole cover is dislodged or damaged for an extended period.

Compliance is assessed by the manufacturer's declaration stating the basis of the declaration, which may include known properties of the material used.

Table 1
PVC insulation requirements

Property	Value	Conditions	Test method
Tensile Strength	13 MPa (minimum)	Unaged	AS 1049.2 Appendix E
Elongation at Break	100% (minimum)	Unaged	AS 1049.2 Appendix E
Elongation at break after aging	50% (minimum) of initial.	After aging, at 100 °C for 120 h	AS 1049.2 Appendix E
Volatile loss	20 g/m ² (maximum)	After aging, at 80 °C for 120 h	AS 1049.2 Appendix Q
Volume resistivity	400 GΩ m (minimum) 0.4 GΩ m (minimum)	at 23 °C at 60 °C	AS 1049.2 Appendix Z

Table 2
PVC sheath requirements

Property	Value	Conditions	Test method
Tensile Strength	12 MPa (minimum)	Unaged	AS 1049.2 Appendix E
Elongation at Break	100% (minimum)	Unaged	AS 1049.2 Appendix E
Elongation at break after aging	75% (minimum) of initial.	After aging at 100 °C for 120 h	AS 1049.2 Appendix E
Volatile loss	20 g/m ² (maximum)	After aging at 80 °C for 120 h	AS 1049.2 Appendix Q

5.6.6 Metallic conductors

5.6.6.1 Conductor composition

Where a Cable is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard, any metallic conductors, other than—

- (a) copper-clad steel used as an inner conductor in coaxial Cable; or
- (b) copper-clad aluminium with a centre conductor greater than 2 mm used as an inner conductor in coaxial Cable;

are to meet the following requirements. Each metallic conductor—

- (1) **shall** be either plain or plated copper;
- (2) may be either a single, solid conductor or multi-stranded;
- (3) **shall** have a DC resistance less than the values given in Table 3; and
- (4) should have a plain or tinned finish.

5.6.6.2 Electrical withstand voltage

A multi-conductor Cable that is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard, when tested at a frequency of 50 Hz on at least 1 m length—

- (a) **shall** be able to withstand the appropriate AC voltage levels and test method listed in Table 4, without breakdown for a period of 60 s or a period of 2 s as stated; and
- (b) for Test 2 and 3, all Cables/ Cordages **shall** comply to the Table 4 limits using the test specified in AS/NZS 3191 [10] Table 2.1, test number 8(a), and using test method referred in Clause 3.5.1 of AS/NZS 1660.3 [2].

Note: Alternatively, the test may be performed using a DC potential equal to the peak voltage of the prescribed AC voltage.

Table 3
Conductor resistance

Wire type	Resistance $\Omega/\text{km @ } 20^{\circ}\text{C}$
Single strand of plain annealed copper	$24/d^2$
Single strand of plated annealed copper	$26/d^2$
Bunched strands of plain or plated copper	$28/N.d^2$

where: N is the number of strands

d is nominal diameter of individual strands or solid single strand in millimetres

Note 1: The DC resistance is based on the diameter of the strand, or in the case of multi stranded conductors, on the number of strands and the diameter of the individual strands.

Note 2: The recommended conductor diameter for copper conductors is in the range 0.4 mm to 0.9 mm.

Table 4
Cable withstand voltages

Test number	High voltage test	Cordage (kV a.c.)	Indoor Cable (kV a.c.)	Outdoor Cable (kV a.c.)
1	Conductor to core Test voltage applied between each conductor and all remaining conductors and to shield if applicable.	0.7 (or 1.7 for 2 s)	1.5	2.0
2	Core to sheath Test voltage applied between all conductors bunched together and sheath exterior or SWA if applicable.	0.7 (or 1.7 for 2 s)	3.0	4.5
3	Shield to sheath (where applicable) Test voltage applied between shield and sheath exterior.	1.5	3.0	4.5

5.6.6.3 Mutual capacitance

Where a Cable is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard, the following requirements are to be met—

- (a) The maximum mutual capacitance between the two wires forming a pair measured at any frequency in the range 800 Hz to 1000 Hz **shall not** exceed the relevant value given in Table 5.

- (b) The measurement, referred to in Clause 5.6.6.3(a) **shall** be performed on a minimum Cable length of 100 m, in accordance with Clause 5.4 of IEC 60189-1 [24] except as varied in Clause 5.6.6.3(c) below.
- (c) The mutual capacitance **shall** be corrected to a length of 1000 m by application of the following equation:

$$\text{Value corrected to 1000 m length} = \text{measured value} \times \frac{1000}{L}$$

where: L is the length in metres of the Cable under test

5.6.6.4 Capacitance unbalance

Where a Cable is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard, the following requirements are to be met—

- (a) The maximum capacitance unbalance between pairs measured at any frequency in the range 800 Hz to 1000 Hz **shall not** exceed the relevant value given in Table 5.
- (b) During the measurement referred to in Clause 5.6.6.4(a), all conductors, other than those under test and the metallic shield (where applicable) **shall** be connected to earth.
- (c) The measurement **shall** be performed on a minimum Cable length of 100 m, in accordance with Clause 5.5 of IEC 60189-1 [24] except as varied in Clause 5.6.6.4(e) below.
- (d) The capacitance unbalance between two pairs of wires with one pair designated 'A' and 'B' and the second pair designated 'C' and 'D' is given by the following expression:

$$(W + Y) - (X + Z)$$

where: W is the capacitance between the 'A' and 'C' wires

Z is the capacitance between the 'A' and 'D' wires

X is the capacitance between the 'B' and 'C' wires

Y is the capacitance between the 'B' and 'D' wires

- (e) The capacitance unbalance **shall** be corrected to a length of 500 m by application of the following equation:

$$\text{Value corrected to 500 m length} = \frac{\text{measured value}}{\sqrt{L/500}}$$

where: L is the length in metres of the Cable under test

5.6.6.5 Insulation resistance

Where a Cable is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard, the minimum insulation resistance between any two conductors forming a pair, a quad or a coaxial tube—

- (a) **shall not** be less than the relevant value given in Table 5;
- (b) the measurement **shall** be made on a minimum length of 100 m of Cable or Cordage at a potential of 500 V d.c. \pm 50 V d.c. and the reading taken after the application of the voltage for 60 s; and
- (c) the insulation resistance **shall** be corrected to a length of 1000 m by application of the following equation:

$$\text{Value corrected to 1000 m length} = \text{measured value} \times \frac{L}{1000}$$

where: L is the length in metres of the Cable under test

Table 5
Metallic Cable performance parameters

Cable parameter	Units	Cordage	Indoor Cable and Jumper wire	Outdoor Cable — aerial	Outdoor Cable — underground
Maximum mutual capacitance in Telephone Cable	nF/km	—	Unshielded twisted pair 80	52	49
			Shielded or parallel 120	52	49
Maximum capacitance unbalance pair to pair in Telephone Cable	pF (corrected to 500 m length)	—	2 pair/star quad Cable 1000	2 pair/star quad Cable 500	2 pair/star quad Cable 500
			> 2 pair Cable 300	> 2 pair Cable 150	> 2 pair Cable 150
Minimum insulation resistance for all metallic Cables	M Ω .km	100	1,000	10,000	10,000

5.6.7 Continuous metallic shield

Where a Cable is required to comply with this Clause by any of Clauses 5.6.11 to 5.6.18 of this Standard—

- (a) any continuous metallic shield provided in the Cable **shall** be electrically conductive; and

- (b) where a continuous foil shield is employed, a drain wire **shall** be placed in continuous contact with the metallic surface of the shield to ensure electrical conductivity.

Note 1: Annex N of AS/NZS 62368.1 [19] gives recommendations for avoiding certain combinations of metals that could lead to corrosion.

Note 2: Annex N of AS/NZS 62368.1 [19] is equivalent to Annex J of AS/NZS 60950.1 [18].

5.6.8 Water penetration test

A Cable that is required to comply with this Clause by AS/CA S009 [20] or by any of Clauses 5.6.11 to 5.6.18 of this Standard **shall** comply with the requirements in Clause 5, Method –F5B or F5C of IEC 60794-1-22:2017 [30].

Note 1: Water penetration refers to the effectiveness of a Cable in restricting the longitudinal movement of water or moisture along the core. This requirement is primarily intended to localise any water penetration to minimise the adverse effect on cable performance and to prevent water or moisture leaking into joints and terminations that may cause corrosion problems.

Note 2: Additionally, Cable installed underground should have a high-density compound sheath material (such as polyethylene) that provides an adequate barrier to moisture entry to the cable core. The addition of a lapped metal tape ('moisture barrier') and/or grease or gel within the core ('filled' or 'flooded' Cable) provides even higher protection against moisture entry.

Note 3: Cable susceptible to ant/termite attack or that is buried directly in the ground without Conduit should be of a type that provides additional mechanical protection against abrasion and insects such as a nylon jacket with an optional sacrificial jacket.

Note 4: Not all Cables marketed as 'outdoor' or 'indoor/outdoor' Cables meet the water penetration requirements for underground use. Manufacturers should clearly identify products intended to be installed underground.

5.6.9 Integral bearer or strengthener

A Cable that is intended for aerial use may contain an integral bearer or strengthener. Where an integral bearer/strengthener is provided—

- (a) The cable sheath **shall** fit closely over, but not adhere to, the bearer/strengthener.

Note: The sheath over the integral bearer/strengthener may be of cottage-loaf (i.e. figure-of-eight) construction.

- (b) The strength of the bearer/strengthener **shall** be sufficient to carry the load of the Cable under the specified conditions.

- (c) The specified conditions referred to in Item (b) **shall** be stated in a product data sheet.

- (d) The product data sheet **shall** state the maximum allowable span, tension, sag, wind speed, ambient temperature range, and other parameters applicable to its use.

Note: Some of the data should be provided in the form of a table specifying, for example, allowable tension/sag values at various span lengths and temperatures.

5.6.10 Cable with specific attributes

Where a Cable is claimed to have specific attributes, such as rodent or termite resistance or armouring strength, evidentiary documentation **shall** be made available on request to support the claim.

Compliance is assessed by the manufacturer's declaration stating the basis of the declaration, which may include known properties of the materials used.

5.6.11 Metallic paired cable

5.6.11.1 General requirements

Metallic paired Cable, other than Cordage, a Cord or a Special Application Cable, **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification
- 5.6.3 Insulation and sheath material
- 5.6.4 Flammability (if intended for use within a building)
- 5.6.5 UV resistance (if intended for use external to a building, including underground)
 - 5.6.6.1 Conductor composition
 - 5.6.6.2 Electrical withstand voltage
 - 5.6.6.3 Mutual capacitance (if intended for use as a Telephone Cable)
 - 5.6.6.4 Capacitance unbalance (if intended for use as a Telephone Cable)
 - 5.6.6.5 Insulation resistance
- 5.6.7 Continuous metallic shield (if applicable)
- 5.6.8 Water penetration test (if intended for use underground)
- 5.6.9 Integral bearer or strengthener (if intended for aerial use without a separate catenary support)
- 5.6.10 Cable with specific attributes (if applicable)

5.6.11.2 Construction

A Cable intended to carry a frequency of 300 Hz or greater **shall** be shielded or of twisted pair construction.

5.6.11.3 Operating Temperature

A Cable **shall** have a minimum continuous operating temperature rating of 60 °C.

Note: Provision of remote power over Cables may increase the operating temperature above ambient.

5.6.12 Cordage with metallic conductors

5.6.12.1 General requirements

Cordage with metallic conductors **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification
- 5.6.3 Insulation and sheath material
- 5.6.4 Flammability
- 5.6.5 UV resistance (if intended for use external to a building)
- 5.6.6.1 Conductor composition
- 5.6.6.2 Electrical withstand voltage
- 5.6.6.3 Mutual capacitance (if intended for use as telephone Cordage)
- 5.6.6.4 Capacitance unbalance (if intended for use as telephone Cordage)
- 5.6.6.5 Insulation resistance
- 5.6.7 Continuous metallic shield (if applicable)
- 5.6.10 Cable with specific attributes (if applicable)

5.6.12.2 Conductor composition

Conductors in metallic Cordage should be of stranded conductor construction when frequent movement of the Cordage is anticipated.

5.6.13 Cords with metallic conductors

5.6.13.1 General requirements

A Cord with metallic conductors **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification
- 5.6.4 Flammability
- 5.6.5 UV resistance (if intended for use external to a building)
- 5.6.6.1 Conductor composition
- 5.6.6.2 Electrical withstand voltage
- 5.6.6.5 Insulation resistance
- 5.6.7 Continuous metallic shield (if applicable)
- 5.6.10 Cable with specific attributes (if applicable)

5.6.13.2 Cords exceeding a length of 10 m

A Cord with metallic conductors that exceeds a length of 10 m **shall** comply with Clause 5.6.13.1 and the following Clauses:

- 5.6.3 Insulation and sheath material
- 5.6.6.3 Mutual capacitance (if intended for use as a telephone Cord)
- 5.6.6.4 Capacitance unbalance (if intended for use as a telephone Cord)

5.6.13.3 Cord anchorage or strain relief

A Cord with metallic conductors—

- (a) **shall** be secured in any plug or socket connected to a Cord by an appropriate anchorage or strain relief; and
- (b) when subjected to a force of 45 N gradually applied between the Cord and the plug or socket for a period of 60 s, the Cord **shall not** be longitudinally displaced by more than 2 mm, nor show any appreciable strain at the connection.

Note: For measurement of longitudinal displacement, a mark is made on the Cord approximately 20 mm from the Cord anchorage or other suitable point before the test. The displacement of the mark is measured 60 s after the removal of the force from the Cord.

5.6.14 Metallic jumper wire and jumper cable

5.6.14.1 General requirements

Metallic Jumper wire and Jumper Cable **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification
- 5.6.3 Insulation and sheath material
- 5.6.4 Flammability
- 5.6.6.1 Conductor composition
- 5.6.6.2 Electrical withstand voltage
- 5.6.6.5 Insulation resistance
- 5.6.7 Continuous metallic shield (if applicable)
- 5.6.10 Cable with specific attributes (if applicable)

5.6.14.2 Twist rate

Metallic Jumper wire and Cable **shall** have a minimum of 13 twists/metre in each pair.

5.6.15 Coaxial cable

5.6.15.1 General requirements

Coaxial Cable **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification (if applicable, i.e. contains more than one coaxial tube)
- 5.6.3 Insulation and sheath material
- 5.6.4 Flammability (if intended for use within a building)
- 5.6.5 UV resistance (if intended for use external to a building, including underground)
 - 5.6.6.1 Conductor composition
 - 5.6.6.2 Electrical withstand voltage
 - 5.6.6.5 Insulation resistance
- 5.6.7 Continuous metallic shield
- 5.6.9 Integral bearer or strengthener (if intended for aerial use without a separate catenary support)
- 5.6.10 Cable with specific attributes (if applicable)

Note: Coaxial Cable intended for underground use is not required to meet the water penetration test of Clause 5.6.8 but should be of the 'flooded' type.

5.6.15.2 Velocity ratio

The velocity ratio, determined according to Clause 13 of IEC 60096-0-1 [23], **shall** be a minimum of 0.65.

5.6.15.3 Characteristic impedance

The characteristic impedance, measured according to Clause 14 of IEC 60096-0-1 [23], **shall** be $Z_o \pm Z_o/25$, where Z_o is the nominal characteristic impedance specified by the manufacturer.

5.6.15.4 Attenuation

The attenuation should be less than or equal to that specified by the manufacturer at 200 MHz when measured in accordance with Clause 16 of IEC 60096-0-1 [23].

5.6.16 Optical fibre cable

5.6.16.1 General requirements

Optical fibre Cable, other than a blown fibre tube system or similar system with preinstalled elements, **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification
- 5.6.3 Insulation and sheath material (sheath requirement only)
- 5.6.4 Flammability (if intended for use within a building)

- 5.6.5 UV resistance (if intended for use external to a building, including underground)
- 5.6.8 Water penetration test (if intended for use underground)
- 5.6.9 Integral bearer or strengthener (if intended for aerial use without a separate catenary support)
- 5.6.10 Cable with specific attributes (if applicable)

5.6.16.2 Fibre requirements

Multimode and single-mode fibres **shall** meet the relevant requirements of IEC 60793-2 [28].

5.6.16.3 Mechanical and environmental performance

The supplier **shall** make available to the customer, on request, a Product Data Sheet as per the appropriate procedures in IEC 60794-1-1 [29], specifying the mechanical and the environmental performance of a particular cable design.

5.6.16.4 Optical fibre cordage used in a cord or pigtails

Optical fibre Cordage used in a Cord, including Pigtails, **shall—**

- (a) be secured in any plug or socket by an appropriate anchorage or strain relief; and
- (b) retain its optical performance as specified by the Cordage manufacturer.

5.6.16.5 Optical fibre cords and optical fibre pigtails

A completed optical fibre Cord or optical fibre Pigtail **shall** meet the requirements in Table 6.

After the test is complete the optical fibre Cord or optical fibre Pigtail should not show any sign of appreciable strain at the connection between the Cordage and the plug or socket.

The test method utilised **shall** be as per that outlined in IEC 61300-2-4 [31].

Table 6
Optical fibre/cable retention as per IEC 61300-2-4

Cable type	Minimum Force applied	Minimum Duration
Reinforced cables	50 N ± 2 N	120s
Secondary coated fibres (900µm)	5 N ± 0.5 N	60s
Primary coated fibres (250µm)	2 N ± 0.2 N	60s

5.6.17 Blown fibre tube systems or similar system with preinstalled elements

5.6.17.1 General requirements

A blown fibre tube system or similar system with preinstalled elements **shall** comply with the following Clauses:

- 5.6.2 Conductor and optical fibre identification
- 5.6.3 Insulation and sheath material
- 5.6.4 Flammability (if intended for use within a building)
- 5.6.5 UV resistance (if intended for use external to a building, including underground)
- 5.6.9 Integral bearer or strengthener (if intended for aerial use without a separate catenary support)
- 5.6.10 Cable with specific attributes (if applicable)

Note: A blown fibre tube system or similar system with preinstalled elements has characteristics that are distinct from those of conventional Cable and is therefore exempt from the water penetration test of Clause 5.6.8 when used underground.

5.6.17.2 Outer tube or sheath

The outer tube or sheath of an underground blown fibre tube system or similar system with preinstalled elements **shall** comply with the requirements of IPX8 of AS 60529 [15].

5.6.18 Special application cables

5.6.18.1 Compliance

A Cable intended for a special application **shall**—

- (a) comply with Clauses 5.6.18.2 and 5.6.18.3;
- (b) comply with Clause 5.6.10 if applicable; and
- (c) have insulation, sheath and jacket material that complies with AS 1049.1 [1] when tested to AS 1049.2 [1].

5.6.18.2 General requirements

A Special Application Cable installed within a building **shall** comply with Clause 5.6.4.

5.6.18.3 Cable with metallic conductors

A Special Application Cable with metallic conductors—

- (a) **shall** comply with the testing requirements of the relevant Standard, in order of priority, from Australian/New Zealand Standard or ISO/IEC Standard or other national published Standard applicable to that particular type of Cable, as listed by way of example in Table 7, to meet the requirements for its intended use; or

- (b) where Clause 5.6.18.3(a) is not applicable—
 - (i) the Cable should comply with the following Clauses of this Standard:
 - 5.6.6.1 Conductor composition;
 - 5.6.6.2 Electrical withstand voltage;
 - 5.6.6.5 Insulation resistance;
 - 5.6.7 Continuous metallic shield (if applicable);
and
 - (ii) where the Cable is intended to be used as a Telephone Cable, it **shall** comply with the following Clauses of this Standard:
 - 5.6.6.3 Mutual capacitance;
 - 5.6.6.4 Capacitance unbalance.

Table 7

Australian Standards applicable for cables used in special applications

Cable type	Standard to be tested to	Name of Standard	Additional notes
Multicore control Cables (Screened and unshielded polymeric insulated multicore control Cables)	AS/NZS 5000.3 [13]	Electrical cables – polymeric insulated. Multicore control cables	Intended for use in control, supervisory, protection and instrumentation circuits. This Standard does not apply to Cables that are used solely for telecommunications purposes.
Twisted pair control Cables (Screened polyethylene (PE) insulated twisted pair control Cables)	AS/NZS 2373 [8]	Twisted Pair Control Cables	Intended for use in control, supervisory, protection and instrumentation circuits. This Standard does not apply to Cables that are used solely for telecommunications purposes.
Fire resistant or retardant rated Cable (with polymeric materials)	AS/NZS 5000.1 [11]	Electric cables-Polymeric insulated. For working voltages up to and including 0.6/1 kV	This Standard does not apply to specialised polymeric insulated Cables for which there are separate AS/NZS Standards, e.g. flexible lift control Cables, neutral screened Cables, and aerial bundled Cables.
	AS/NZS 5000.2 [12]	Electric cables-Polymeric insulated. For working voltages up to and including 450/750 V	
Pyro MIMS (mineral-insulated metal sheathed) Cables (with copper conductors and sheaths)	AS/NZS 60702 [17]	Approval and test specification- Terminations and glands for mineral-insulated metal-sheathed cables	Often used in telecommunications installations to connect the fire alarm panel to the Carrier's network.
Reeling and trailing Cables	AS/NZS 1802 [6]	Electric cables-Reeling and trailing- For underground coal mining purposes	For underground mining purposes.
Flexible Cord, unshielded PVC insulated, multicore, sheathed or unshielded	AS/NZS 3191 [10]	Flexible Cords	Often used in Fire Alarm situations between fire alarm panel and warning devices.
Other applications			
<ul style="list-style-type: none"> Hybrid Cables 	The relevant Standard for the non-telecommunications component of the Cable		The equivalent of double insulation is to be provided between any power component and the telecommunications component of the Cable.
<ul style="list-style-type: none"> Other Cables 	Clause 5.6.18.3 of this Standard		

5.6.19 ES3 generic cable

ES3 Generic Cable **shall**—

- (a) comply with the requirements of Clause 5.6.11 for metallic paired Cable;
- (b) have a maximum conductor resistance of 0.0938 Ω /m at 20°C;
- (c) have an outer sheath colour *Homebush Gold* (as defined in AS 2700) [9]; and
- (d) be clearly labelled 'ES3 circuit' every 2 m in the colour *Homebush Red* (as defined in AS 2700 [9]).

Note 1: Generic Cable may include one pair, four pair or multipair Cables.

Note 2: 0.5 mm nominal conductor diameter (24 AWG) would typically meet the requirement in Item (b).

5.7 Connecting hardware, including plugs and sockets of all designs

5.7.1 General

5.7.1.1 Insulation resistance

The insulation resistance between any two points which are required to be electrically insulated **shall** be a minimum of 100 M Ω . The insulation resistance measurement is to be made after 500 V \pm 50 V d.c. has been applied for a period of 60 s.

Compliance with Clause 5.7.1.1 should be checked using the method specified in IEC 60512-3-1 [26].

5.7.1.2 Contact resistance

5.7.1.2.1 Insulation Displacement contacts

The contact resistance of the interface between a single insulated solid or stranded conductor and a single Insulation Displacement (ID) contact in Connecting Hardware other than the types of plugs and sockets covered in Clauses 5.7.2, 5.7.3 and 5.7.4 **shall** comply with the requirements of IEC 60352-4 [25] Clause 12.3.1, including Table 2 of that Clause.

5.7.1.2.2 Plug and socket connection

For connectors using a plug and socket, including the connection of shield or drain-wire conductors, other than the types of plugs and sockets described in Clauses 5.7.2, 5.7.3 and 5.7.4, the interface resistance of the overall mated connection or shield connection **shall not** exceed 50 m Ω when measured between the Cord terminated on the plug and the Cable terminated on the socket using the test method described in Clause 12.3.1 of IEC 60352-4 [25].

Note 1: Annex N of AS/NZS 62368.1 [19] gives recommendations for avoiding certain combinations of different metals, the combination of which could lead to corrosion.

Note 2: Annex N of AS/NZS 62368.1 [19] is equivalent to Annex J of AS/NZS 60950.1 [18].

5.7.1.3 Electric strength

The insulation of electrically conductive elements in Connecting Hardware **shall** have a minimum dielectric withstand capability of 1.5 kV for 60 s in accordance with Clause 6.4.2 of IEC 60603-7 [27].

5.7.1.4 Protection against contact with exposed circuits

Connectors, plugs and sockets with metallic conductors and shields **shall** comply with the blunt probe test of Clause 5.4.10.1(b) (Separation requirements) of AS/NZS 62368.1 [19].

Note: Clause 5.4.10 of AS/NZS 62368.1 [19] is equivalent to Clause 6.2.1(b) of AS/NZS 60950.1 [18].

5.7.1.5 Weather resistance

Plugs and sockets intended for use in situations exposed to weather and damp areas **shall** have a minimum degree of protection of IPX3 against the ingress of water when tested in accordance with AS 60529 [15].

Compliance with Clause 5.7.1.5 should be checked with a plug both inserted into and removed from the socket.

5.7.1.6 Access to cable terminations

All telecommunications terminations **shall** be enclosed or located to prevent unintentional contact with voltages other than ES1 by an Ordinary Person.

Note: Although it is permissible to allow an Ordinary Person to come into personal contact with ES1 circuits this should be prevented where practicable.

5.7.1.7 Prohibited arrangements

A connecting device's faceplate for telecommunications wiring **shall not** incorporate a mains power fixed socket-outlet or switch.

Note: This is also a prohibited arrangement under AS/NZS 3112.

5.7.2 Eight (8) position modular plugs and sockets

In addition to the general requirements of Clause 5.7.1, eight (8) position modular plugs and sockets **shall** comply with the following Clauses of IEC 60603-7 [27]:

6.4.2 Voltage proof

6.4.3 Current - temperature derating

6.4.4 Initial contact resistance

6.6.1 Mechanical operation (Cycle)

6.6.2 Effectiveness of a connector coupling device

5.7.3 Six (6) position modular plugs and sockets

5.7.3.1 Modular Plugs and sockets

Six (6) position modular plugs and sockets **shall**—

- (a) be mechanically designed according to CFR FCC 47 Figure 68.500(a) and (b) [33]; and
- (b) in addition to the general requirements of Clause 5.7.1, **shall** comply with the following Clauses of IEC 60603-7 [27]:

6.4.2 Voltage proof

6.4.3 Current - temperature derating

6.4.4 Initial contact resistance

6.6.1 Mechanical operation (Cycle)

6.6.2 Effectiveness of a connector coupling device

5.7.3.2 Modular 6P plug compatibility with 8P sockets

A six (6) position modular plug (for compatibility with eight (8) position sockets (8P8C)) should—

- (a) be mechanically designed according to CFR FCC 47 Figure 68.500(a)(2)(i) including Notes 6,7,8 and 9 [33]; and
- (b) to avoid possible damage to the 8P8C socket, incorporate two additional grooves/slots in the plug moulding according to CFR FCC 47 Figure 68.500(a)(3)(i) – Note 3 [33]; to suit contacts 1 and 8 of 8P8C socket CFR FCC 47 Figure 68.500(d) [33].

Note: Refer to Figure C1 in Appendix C.

5.7.3.3 Adaptor ('8P-to-6P insert')

In this clause, an 'adaptor' is a device used to align a six (6) position modular plug in an eight (8) position modular socket. The adaptor, which restricts the socket entry width to that of a six (6) position modular socket, is intended to prevent sideways or angular movement of the plug, which may damage the contacts of the wider socket.

An adaptor should be mechanically designed in accordance with Figure C2.

5.7.4 600 series plugs and sockets

600 series plugs and sockets **shall** comply with Appendix A.

Note: 600 series plugs and sockets are not recommended for new installations.

5.8 Cabling products for underground and aerial installations

5.8.1 Pits and access holes

5.8.1.1 Moisture and sunlight

The structural and mechanical integrity of a Pit Or Access Hole Product **shall not** be adversely affected by long-term exposure to moisture and sunlight (UV radiation).

Compliance should be checked on the basis of known properties of the materials used.

5.8.1.2 Labelling of covers

A cover which is a component of a Pit Or Access Hole Product, other than a cover designed to be infilled on site, **shall** be legibly and permanently labelled with the word 'Communications' or 'Comms', to distinguish the pit or access hole from pits of other services.

5.8.1.3 General product information

Illustrated information **shall** be provided for a Pit Or Access Hole Product, which is to include—

- (a) the intended range of installation environments (e.g. lawn, footway, driveway, roadway, airport taxiway); and
- (b) a statement from a Registered Structural Engineer describing the tests and methods used by the manufacturer to demonstrate structural integrity.

Note 1: Testing of a pit or access hole should be carried out with covers in place. If a product is supplied without covers, compatible covers should be used in testing, and the type used should be stated.

Note 2: Pit risers and other modular parts should be tested as part of a complete pit or access hole. Installation instructions for a pit riser should describe how to integrate the pit riser with a compatible pit body and covers, and give all other applicable methods and information, such as a method for integrating the top of the pit riser with the surrounding terrain.

Note 3: The structural integrity requirements in AS/CA S008:2010 have been replaced by the Registered Structural Engineer's statement as the former requirements were not suitable for all types of pit and access hole products.

Note 4: AS/CA S009 Section 18.1 [20] contains requirements for a cabling provider to obtain certification from a Registered Structural

Engineer for any pit or access hole installed or constructed in an area likely to be subject to heavy loads.

5.8.1.4 Specific methods

Information for a Pit Or Access Hole Product **shall** be provided either as an illustrated method for carrying out the operation named, or a statement that the operation is not applicable to the product, on the following topics:

- (a) Installing the product in specific soil conditions.
- (b) Making sealed entries for Conduits and direct buried Cables.
- (c) Closing over redundant Conduit or cable entries.
- (d) Interfacing the top of the product with the surrounding terrain (e.g. lawn, rolled asphalt, paving bricks) to minimise formation of trip hazards and minimise damage to the product during maintenance or alteration of the adjacent area.
- (e) Adjusting the top of the product to a new level or new angle after initial installation.
- (f) Installing the product over an existing Cable to provide access to the Cable.
- (g) Operating and maintaining all movable parts of the product, such as covers.
- (h) Attaching Cable bearers, joint mounting brackets and other supports for cabling, to the product.

Note: Recommended fixing methods for Cable bearers should take likely sources of strain into account.

5.8.1.5 Information to be provided with pits and access holes

Directions for readily obtaining the information required by Clauses 5.8.1.3 and 5.8.1.4. **shall** be provided with a Pit Or Access Hole Product.

Note: The most substantial part of the Pit Or Access Hole Product should be prominently labelled with a brand name, a model number, the words 'installation instructions' and the address of a page on the World Wide Web, a page which contains a direct link to the required information.

5.8.1.6 Compatibility information

Information should be provided about whether a Pit Or Access Hole Product is intended to be compatible with any common designs of pit, access hole, pit riser, pit collar, cover, cover gasket, cover frame, crossbar, Cabling support, or similar item.

5.8.1.7 Hazards arising from misuse or mis-installation

A description should be provided of any hazards which are likely to arise from common forms of misuse or mis-installation of a Pit Or Access Hole Product.

5.8.1.8 Supplementary product information

Supplementary product information for a Pit Or Access Hole Product should be available, as the manufacturer's standard product information may not cover every potential application for the product.

5.8.2 Underground joint/termination enclosures

The following requirements apply to underground joint/termination Enclosures:

- (a) Underground Enclosures **shall** provide protection of the joint or termination of at least IPX8 in accordance with AS 60529 [15], with test conditions to simulate normal conditions of use.
- (b) The test **shall** be carried out with a depth of 500 mm of water for a duration of 24 hours.
- (c) Enclosures which are re-openable **shall** be opened and closed 10 times prior to the test.
- (d) Terminations may form part of the Enclosure or they may be separate. In either case the terminations **shall** be protected to at least IPX8 in accordance with AS 60529 [15] when installed in the Enclosure. See Clause 5.8.2(a) above.

Note: For testing purposes, Cable may be required to be supplied by the manufacturer.

5.8.3 Underground and Aerial Cable terminations

Underground and aerial terminations **shall** comply with Clauses 5.7.1.1 to 5.7.1.4.

5.8.4 Pillars and cabinets

The following requirements apply to pillars and cabinets:

- (a) The mechanical integrity of pillars and cabinets **shall not** be adversely affected by long-term exposure to moisture and sunlight (UV radiation).

Compliance with Clause 5.8.4(a) should be checked on the basis of known properties of the materials used.

- (b) Pillars and cabinets **shall** provide protection of at least IPX3 in accordance with AS 60529 [15] after opening and closing 10 times prior to the test.
- (c) Provision **shall** be made for locking pillars and cabinets.

- (d) Terminations within pillars and cabinets **shall** comply with Clauses 5.7.1.1 to 5.7.1.4.
- (e) Pillars and cabinets should be legibly and permanently labelled to distinguish them from those used for other services.

5.8.5 Aerial joint/termination enclosures

The following requirements apply to aerial joint/termination Enclosures:

- (a) Aerial Enclosures **shall** provide protection of the joint or termination of at least IPX3 in accordance with AS 60529 [15].
- (b) Enclosures that are re-openable **shall** be opened and closed 10 times prior to the test.
- (c) Covers of aerial Enclosures should be removable to allow access to terminations when installed.
- (d) Aerial Enclosures **shall** provide double insulation from internal terminations to 230 V a.c. mains grade in accordance with AS/NZS 62368.1 [19].
- (e) The mechanical integrity of aerial Enclosures **shall not** be adversely affected by long-term exposure to weather and sunlight (UV radiation).

Compliance with Clause 5.8.5(e) should be checked on the basis of known properties of the materials used.

- (f) Terminations may form part of the aerial Enclosure or may be separate. In either case the terminations **shall** be protected to at least IPX3 in accordance with AS 60529 [15] when installed in the Enclosure.

Note: Terminations in aerial Enclosures also need to comply with Clauses 5.7.1.1 to 5.7.1.4.

APPENDIX A (Normative) 600 SERIES PLUGS AND SOCKETS

A.1 General

600 series plugs and sockets **shall** comply with this Appendix A.2 to A.5.

Note 1: 600 series sockets are not recommended for new installations but are still supplied as spare parts for older installations. See Clause 5.7.4 of this Standard.

Note 2: Appendix C of AS/CA S009 [20] provides more information about 600 series sockets.

A.2 Contact composition

Contact metal **shall** be composed of solid Monel Alloy 400 in accordance with the standard composition of nickel copper alloy type NA 13.

A.3 Mechanical compatibility

Sockets should be designed to accept one or more of the 600 series plugs. The nominal mating dimensions of 600 series plugs and sockets **shall** be in accordance with Figure A1.

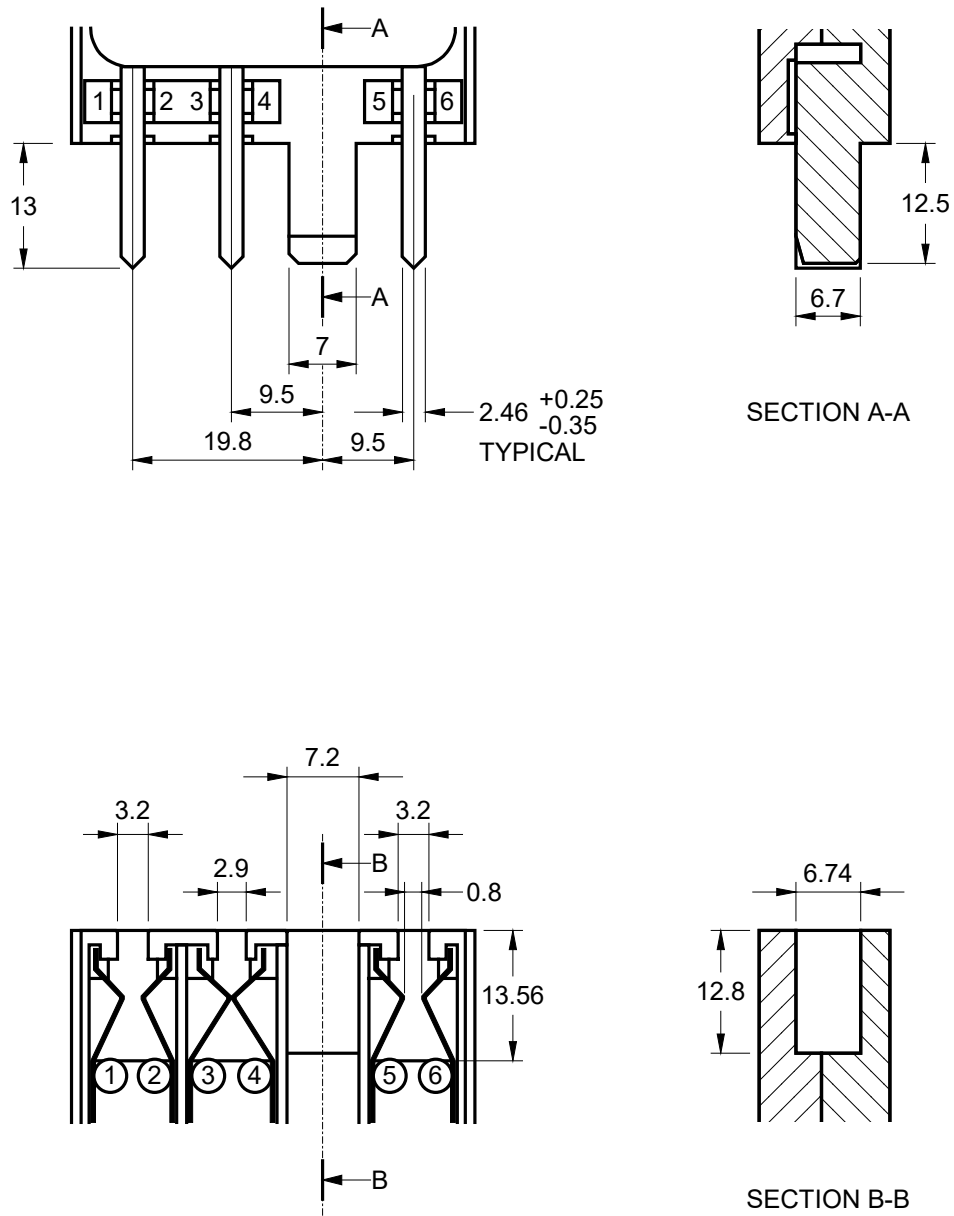
Note: Sockets may incorporate switching facilities that operate on the insertion and withdrawal of the plug.

A.4 Connections

Plugs and sockets **shall** have, as a minimum, electrical connections corresponding to contacts 2 and 6 in accordance with Figure A1.

A.5 Resistance of plug/socket combination

With the plug inserted into the socket, the maximum resistance between the Cord terminated onto the plug and the Cable terminated onto the socket **shall not** exceed 50 m Ω when tested with an applied voltage not exceeding 50 mV d.c. and an applied current not exceeding 100 mA.



Note 1: On both views, the cover has been removed for clarity.

Note 2: Dimensions are in mm.

Figure A1
Mating dimensions for 600 series plugs and sockets

APPENDIX B (Informative) CABLE COLOUR CODES

Common colour codes for various types of Cable are described in AS/CA S009 [20] Tables B1 to B7. These tables are reproduced here to provide continuity between the Standards. Cable manufacturers usually follow these colour codes. Cables are required to use some method of coding that enables pairs and conductors to be visually distinguishable from one another (refer to Clause 5.6.2 of this Standard) but it is not mandatory for cable manufacturers to follow these colour codes.

Table B1

2-pair (quad) and 3-pair telephone cable colour code

Pair Number	Colours
1	White Blue
2	Red Black
3	Orange Green

Table B2

4-pair cable colour code

Pair number	Colour code variations		
1	White Blue	White-Blue Blue	White-Blue * Blue-White *
2	White Orange	White-Orange Orange	White-Orange * Orange-White *
3	White Green	White-Green Green	White-Green * Green-White *
4	White Brown	White-Brown Brown	White-Brown * Brown-White *
* The first-named colour is the predominant colour			

Table B3
Colour code for 5-pair to 100-pair cables (20-pair units)

Pair number	A Leg (L+)	B Leg (L-)	Pair range	Mate colour
1	White	Blue	1-20	White
2	White	Orange		
3	White	Green		
4	White	Brown		
5	White	Grey		
6	White	Blue-White	21-40	Yellow
7	White	Blue-Orange		
8	White	Blue-Green		
9	White	Blue-Brown		
10	White	Blue-Grey		
11	White	Orange-White	41-60	Black
12	White	Orange-Green		
13	White	Orange-Brown		
14	White	Orange-Grey		
15	White	Green-White		
16	White	Green-Brown	61-80	Violet
17	White	Green-Grey		
18	White	Brown-White		
19	White	Brown-Grey		
20	White	Grey-White		
			81-100	Red

Note: These Cables are normally constructed using layer stranding, with the pair count sequence commencing from the centre and progressing through successive outer layers.

Table B4
Colour code for 25-pair to 100-pair cables (25-pair units)

Pair number	Mate	Colour
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Grey
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Grey
11	Black	Blue
12	Black	Orange
13	Black	Green
14	Black	Brown
15	Black	Grey
16	Yellow	Blue
17	Yellow	Orange
18	Yellow	Green
19	Yellow	Brown
20	Yellow	Grey
21	Violet	Blue
22	Violet	Orange
23	Violet	Green
24	Violet	Brown
25	Violet	Grey

Pair range	Whipping colour
1-25	Blue
26-50	Orange
51-75	Green
76-100	Brown

Note 1: 50 to 100 pair Cables are constructed with 25 pair sub-units and coloured whipping.

Note 2: The mate conductor may include a thin band of the corresponding colour, while the coloured conductor may have a thin band of the corresponding mate colour.

Table B5

Colour code for 5-pair to 100-pair cables (10-pair units)

Pair number	A Leg (L+)	B Leg (L-)
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Grey
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Grey

Pair range	Whipping colour
1-10	Blue
11-20	Orange
21-30	Green
31-40	Brown
41-50	Grey
51-60	Blue-White
61-70	Orange-White
71-80	Green-White
81-90	Brown-White
91-100	Grey-White

Table B6

Colour code for 5-pair to 200-pair cables (10-pair units)

Pair number	A Leg (L+)	B Leg (L-)
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Grey
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Grey

Pair range	Whipping colour
1-10	Blue-White
11-20	Orange-White
21-30	Green-White
31-40	Brown-White
41-50	Grey-White
51-60	Blue-Blue
61-70	Orange-Orange
71-80	Green-Green
81-90	Brown-Brown
91-100	Grey-Grey
101-110	White-White
111-120	Red-Red
121-130	Yellow-Yellow
131-140	Violet-Violet
141-150	Black-Black
151-160	Blue-Red
161-170	Orange-Red
171-180	Green-Red
181-190	Brown-Red
191-200	Grey-Red

Table B7
Optical fibre colour code

Fibre number	Colour
1	Blue
2	Orange
3	Green
4	Brown
5	Grey
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Pink
12	Aqua

Note 1: This colour code applies to both loose tube and tight buffered fibre.

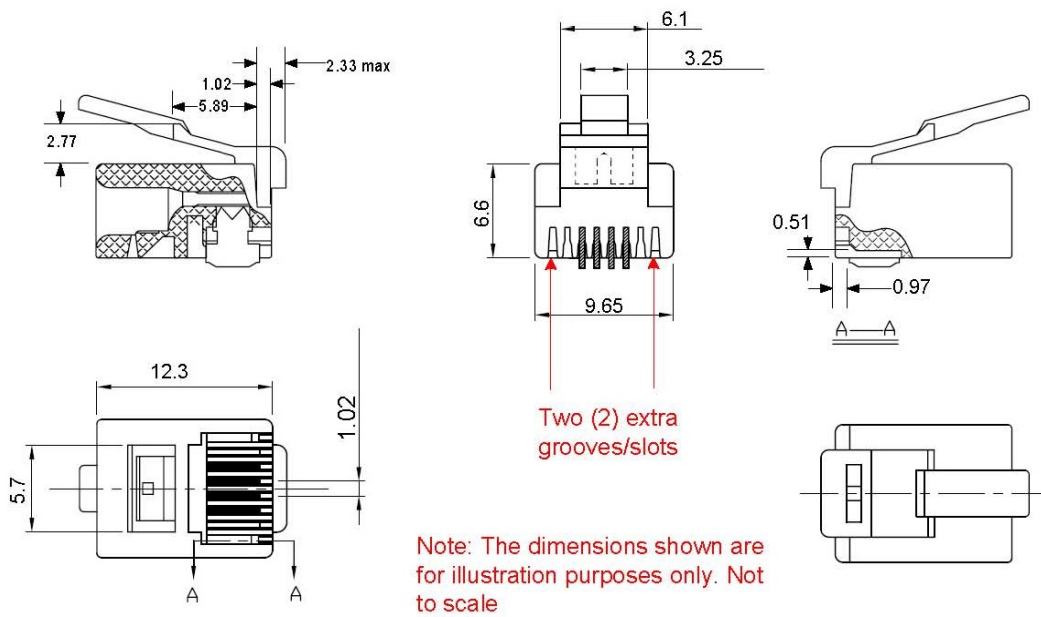
Note 2: For stranded (multiple) loose tube constructions, the tube colour sequence is the same as the fibre colour sequence.

Note 3: Units containing more than 12 fibres can be identified by combining the basic twelve colours sequence with an added identification (e.g. ring marking, dashed mark, tracer or coloured unit binders).

APPENDIX C (Informative) MODULAR PLUGS

C.1 Six (6) position modular plugs

Figure C1 shows a six (6) position modular plug demonstrating compatibility with an eight (8) position modular socket (8P8C).

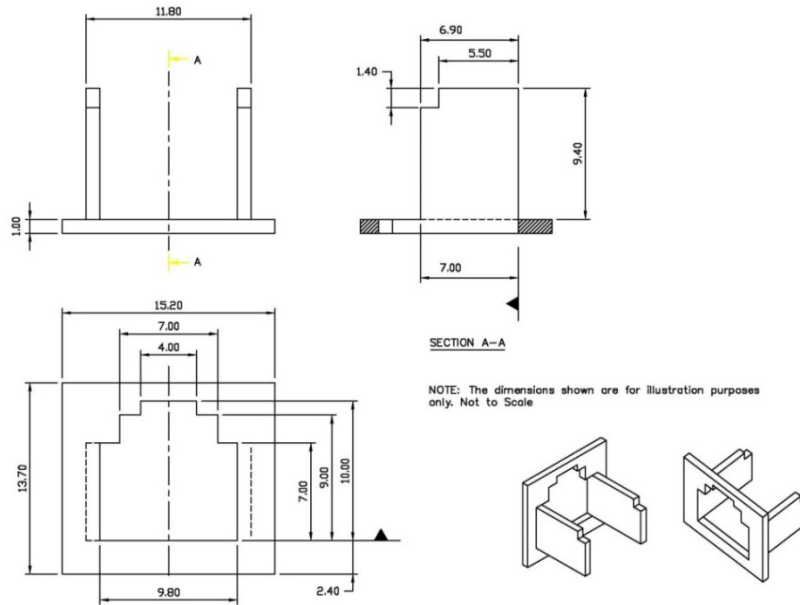


Note: Dimensions are in mm.

Figure C1
Two extra grooves/slots in six (6) position modular plug

C.2 Adaptor

Figure C2 shows an adaptor, commonly known as an '8P-to-6P insert', designed for connection of a six (6) position modular plug into an eight (8) position modular socket.



Note: Dimensions are in mm.

Figure C2
Illustration of 8P-to-6P Adaptor

APPENDIX D (Normative)

AS/NZS 60950.1 and AS/NZS 62368.1 EQUIVALENCE

D.1 General

AS/CA S008 has been revised to use the terminology and requirements of the AS/NZS 62368.1 [19] equipment safety Standard, which was published on 15 February 2018 as a replacement for AS/NZS 60950.1 [18].

As documented in the preface of AS/NZS 62368.1 [19], AS/NZS 60950.1 [18] is to be superseded four years after publication of AS/NZS 62368.1 [19]. Either Standard may be complied with during this four-year transition period, but the compliance report is to be based on requirements from only one of the two Standards.

During the transition period, references to AS/NZS 62368.1 [19] safety clauses and terminology in AS/CA S008 may be replaced with references to the equivalent clauses in AS/NZS 60950.1 [18] for a customer Cabling product that has been assessed to AS/NZS 60950.1 [18].

After the transition period, requirements of AS/NZS 60950.1 [18] may no longer be substituted for the AS/NZS 62368.1 [19] requirements and terminology in the compliance report.

AS/NZS 62368.1 [19] uses different terminology from AS/NZS 60950.1 [18]. To aid with the transition process in AS/CA S008, this Appendix specifies how equivalence between the two referenced safety Standards is implemented.

The term and definition for ELV is an exception to the above, since AS/CA S008 [15] uses the term with respect to electrical building wiring in accordance with AS/NZS 3000, even though the term is no longer used in AS/NZS 62368.1 [19].

D.2 Definitions for use with AS/NZS 60950.1 products

D.2.1 Extra-low voltage (ELV)

ELV is a voltage not exceeding 42.4 V peak or 60 V d.c.

Note: This differs from the ELV definition contained in AS/NZS 3000, which is more closely aligned to the TNV limits described below, i.e. 120 V d.c. or 70.7 V a.c. peak (50 V a.c. r.m.s.).

D.2.2 Safety Extra Low Voltage (SELV) circuit

An SELV Circuit is a secondary circuit which is so designed and protected that—

- (a) under normal operating conditions, its voltages do not exceed ELV limits at any time; and
- (b) under single fault conditions, its voltages do not exceed ELV limits for longer than 200 ms and, in any case, do not exceed 71 V peak or 120 V d.c. at any time.

Note 1: An example of an SELV Circuit is a power feed from a battery or a double insulated 'plug pack'.

Note 2: Adapted from AS/NZS 60950.1 [18].

Note 3: A circuit that meets the above requirements, but which is subject to overvoltages from a Telecommunications Network or a cable distribution system, is classified as a TNV circuit.

D.2.3 Telecommunications network voltage (TNV)

TNV is a voltage not exceeding—

- (a) when telephone ringing signals are not present—
 - (i) 71 V peak or 120 V d.c.; or
 - (ii) if a combination of AC voltage and DC voltage is present, the sum of the AC peak voltage divided by 71 and the DC voltage divided by 120 must not exceed 1; and
- (b) when telephone ringing signals are present, voltages such that the signal complies with the criteria of either Clause M.2 or Clause M.3 of AS/NZS 60950.1 [18] (the signal is required to be current limited and cadenced).

[Adapted from AS/NZS 60950.1 [18].]

D.2.4 Hazardous voltage

A hazardous voltage is a voltage exceeding ELV limits existing in a circuit which does not meet the requirements for either a limited current circuit or a TNV circuit as defined in AS/NZS 60950.1 [18].

D.2.5 Restricted access location

A restricted access location is a locked room or Enclosure where appropriate signage is used to ensure accidental access is not obtained by persons who are not qualified or authorised to gain access.

D.3 Definitions for use with products complying with AS/NZS 62368.1

For the purposes of this Standard, ES1, ES2 and ES3 refer to voltage and current classifications only.

Voltage and current limits for ES1, ES2 and ES3 are those specified in AS/NZS 62368.1 [19].

Note: There is no voltage and current limits for ES3.

D.3.1 Electrical Energy Source Class 1 (ES1)

ES1 is a class 1 electrical energy source with touch current or prospective touch voltage levels not exceeding ES1 limits under—

- (a) normal operating conditions;
- (b) abnormal operating conditions; and

- (c) single fault conditions of a component, device or insulation not serving as a safeguard;

and not exceeding ES2 limits under single fault conditions of a basic safeguard or of a supplementary safeguard.

ES1 may be accessible to an Ordinary Person.

Note: ES1 provides the equivalent level of safety to SELV as specified in AS/NZS 60950.1 [18].

[Source: Adapted from AS/NZS 62368.1 [19]]

D.3.2 Electrical Energy Source Class 2 (ES2)

ES2 is a class 2 electrical energy source where—

- (a) both the prospective touch voltage and the touch current exceed the limits for ES1; and
- (b) under—
 - (i) normal operating conditions;
 - (ii) abnormal operating conditions; and
 - (iii) single fault conditions;

and either the prospective touch voltage or the touch current does not exceed the limit for ES2.

At least one basic safeguard is required between ES2 and an Ordinary Person. ES2 may be accessible to an Instructed Person and a Skilled Person.

A circuit with telephone ringing signals as defined in Annex H of AS/NZS 62368.1 [19] is also considered ES2.

Note: ES2 provides the equivalent level of safety to ELV as specified in AS/NZS 60950.1 [18].

[Source: Adapted from AS/NZS 62368.1 [19]]

D.3.3 Electrical Energy Source Class 3 (ES3)

ES3 is a class 3 electrical energy source where both the prospective touch voltage and the touch current exceed the limit for ES2.

Note 1: ES3 is considered hazardous.

Note 2: ES3 provides the equivalent level of safety to Hazardous Energy Source as specified in AS/NZS 60950.1 [18].

[Source: Adapted from AS/NZS 62368.1 [19]]

D.4 Comparison of AS/NZS 60950.1 and AS/NZS 62368.1 terms

An informative comparison of terms between AS/NZS 62368.1 [19] and earlier standards can be found in Annex W of AS/NZS 62368.1 [19]. Table W.3 of

AZ/NZS 62368.1 [19] compares AS/NZS 60950.1 [18] terms with AS/NZS 62368.1 [19] terms. The following guidelines in Table D1 are provided for information only. Where terms are compared, it means that they provide equivalent safety outcomes, provided all the requirements in the applicable standard have been fulfilled. Equivalence in these cases does not mean the technical parameters are identical.

Table D1
AS/NZS 60950.1 comparison of terms with AS/NZS 62368.1

AS/NZS 60950.1	AS/NZS 62368.1	Notes
ELV	ES2	ELV (up to 42.4 V peak or 60 V d.c. in AS/NZS 60950.1 [18]) is separated from Hazardous Energy Source by basic insulation only. ELV may receive transient voltages or currents from circuits external to the building, as such it is classified as ES2 for the purposes of this Standard.
SELV	ES1	SELV (60 V d.c. or 42.4 V peak) and ES1 both have protection against Hazardous Energy Source by double or reinforced insulation (safeguards) and both may be touched by the user (Ordinary Person).
Limited current circuit	ES1	In AS/NZS 60950.1 [18] a limited current circuit is limited to 2 mA d.c. or 0.7 mA peak. AS/NZS 62368.1 [19] does not use the term 'limited current circuit' but does, have comparable requirements by way of current limits for ES1.
TNV	ES2	Telecommunications Network Voltage can be one of three levels. Generally, TNV-1 is up to 60 V d.c. but may have higher transients from circuits external to the building; TNV-2 is up to 120 V d.c. but no transients; TNV-3 is up to 120 V d.c. but may have transients. The Ordinary Person must be separated from contact with possible transient circuits. All TNV circuits are classified as ES2 unless a professional engineer advises otherwise for each situation.
Hazardous voltage	ES3	AS/NZS 62368.1 [19] does not use the term 'hazardous'. Instead it states that any electrical energy source exceeding ES2 limits is classified as ES3 and as such is classified as hazardous. ES3 circuits must not be accessible to the Ordinary Person or the Instructed Person by the use of double or reinforced safeguards. The Skilled Person may have access to ES3 for safe work but protection must be provided to guard against accidental contact with another class 3 electrical energy source.

BIBLIOGRAPHY

This bibliography contains information about documents referred to in notes and informative appendices in this Standard. Further information on the listed documents, including how to obtain copies, can be found on the following internet sites:

www.iec.ch
www.saiglobal.com
www.standards.org.au

Australian Standards

AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS/NZS 3112 Approval and test specification - Plugs and socket-outlets

AS/NZS 4117 Surge Protection Devices for Telecommunication Applications

International Standards

IEC 60950-22 Information technology equipment - Safety - Part 22: Equipment to be installed outdoors

PARTICIPANTS

The Working Committee responsible for the revisions made to this Standard consisted of the following organisations:

Organisation	Membership
Amazon	Voting
Australian Communications and Media Authority (ACMA)	Non-voting
Australian Digital & Telecommunications Industry Association (ADTIA)	Voting
Building Industry Consulting Service International (BICSI South Pacific)	Voting
Casa Systems	Voting
CommScope	Non-voting
Cumarsáid	Voting
nbn	Voting
National Electrical and Communications Association (NECA)	Voting
Optus	Voting
Prysmian	Voting
Siemon Company	Voting
Telstra	Voting
The University of Sydney	Voting

This Working Committee was chaired by Murray Teale of VTI Services. Mike Johns and James Duck of Communications Alliance provided project management support.

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