SOUTH AUSTRALIA

ELECTRICITY (GENERAL) REGULATIONS 1996

SUMMARY OF PROVISIONS

PART 1
PRELIMINARY

PART 2
LICENSING OF ELECTRICITY ENTITIES

PART 3
ELECTRICITY ENTITIES' POWERS AND DUTIES

PART 4
SAFETY AND TECHNICAL ISSUES

DIVISION 1—SAFETY AND TECHNICAL REQUIREMENTS

DIVISION 2—CERTAIN ELECTRICAL INSTALLATION WORK

DIVISION 3—SAFEGUARDING PERSONS WORKING WITH LIVE CONDUCTORS OR ELECTRICAL EQUIPMENT

SUBDIVISION 1—BASIC SAFETY PRINCIPLE

SUBDIVISION 2—WORK ON OR NEAR LIVE ELECTRIC CONDUCTORS OR ELECTRICAL EQUIPMENT

SCHEDULE 3

Requirements for Underground lines and Service Lines
(Regulation 13)

SCHEDULE 4

Requirements for Substations
(Regulation 14)

SCHEDULE 5

Requirements for Earthing and Electrical Protection Systems
(Regulation 15)

SCHEDULE 6

Clearance from Powerlines
(Regulations 43 and 45)

REGULATIONS UNDER THE ELECTRICITY ACT 1996

Electricity (General) Regulations 1996

being

No. 253 of 1996: *Gaz*. 19 December 1996, p. 1990[1]

[1] Came into operation 1 January 1997: reg. 2.

PART 1
PRELIMINARY

Citation

1. These regulations may be cited as the *Electricity (General) Regulations 1996*.

Commencement

2. These regulations will come into operation on the day on which the *Electricity Act 1996* comes into operation.

Revocation

3. The *Electricity Corporations (ETSA) Regulations 1995* (see *Gazette* 29 June 1995, p. 3139), as varied, are revoked.

Interpretation

3. (1) In these regulations, unless the contrary intention appears—

"**Act**" means the *Electricity Act 1996*;

"**active**", in relation to a conductor, means—

(a) any one of the conductors of a power system which is maintained at a difference of potential from—

(i) the neutral conductor; or

(ii) an earthed conductor; or

(b) if a power system does not include a neutral or earthed conductor—all conductors;

"**aerial line**" means a bare, covered or insulated electric conductor (including supports) placed above the ground and in the open air, but does not include bus bars or any direct current conductors used as traction trolley wires;

"**AS**" or "**Australian Standard**" means an Australian Standard, as published by the Standards Association of Australia from time to time;

"**circuit**" means any number of conductors connected together for the purpose of carrying current;

"**conductor**" means a wire, or other form of conducting material suitable for carrying current, other than wires, cables or other metallic parts directly used in converting electrical energy into another form of energy;

"**high voltage**" or "**HV**", in relation to electricity, means electricity at a voltage exceeding 1 000 volts alternating current ("**ac**") or 1 500 volts direct current ("**dc**");

"**insulated**" means contained within a material or medium (including air) in order to limit the flow of current between conductors at different potentials;

"**insulated conductor**" means a conductor that—

(a) is wholly covered with insulating material in accordance with the appropriate requirements of the relevant Approval and Test specification of an Australian Standard; or

(b) is of a type approved by the Technical Regulator;

"**live**"—a term applied to an object when a difference of potential exists or would exist between it and earth under normal conditions of operation, including all metal connected to the neutral conductor of the supply system, even if such neutral is earthed at the source of supply except as follows:

(a) earthing conductors; and

(b) copper sheaths of Mineral Insulated Metal Sheathed ("**MIMS**") cables used in Earthed Sheathed Return ("**ESR**") systems; and

(c) neutral busbars or links in installations where the multiple earthed neutral system is employed; and

(d) parts connected to the neutral;

"**low voltage**" or "**LV**" has the same meaning as in AS 3000;

"**multiple earthed neutral system**" or "**MEN system**" means a system of earthing in which the parts of an electrical installation required by AS 3000 to be earthed—

(a) are connected to the general mass of earth; and

(b) are connected within the installation to the neutral conductor of the supply system;

"**nominal system voltage**" means the voltage by which a system of supply is designated and to which certain operating characteristics of that system of supply are referred in accordance with AS 2926;

"**operator**", in relation to a transmission or distribution network or any electricity infrastructure, means the person who operates, owns or controls the network or infrastructure;

"**other cable system**" means—

(a) telecommunication and control cables; or

(b) aerial earthed cables; or

(c) electrolysis drainage cables,

attached to, or in the vicinity of, structures supporting cables under the control of an electricity entity;

"**service line**" means part of a power system that forms the terminating span of a powerline—

(a) constructed or designed or ordinarily used for the supply of electricity at low voltage; and

(b) through which electricity is or is intended to be supplied by an electricity entity to a customer from the transmission or distribution network of the entity;

"**substation**" means any premises or place in which high voltage supply is converted, controlled or transformed;

"**U**", in relation to voltage of electricity, means Nominal System Voltage;

"**underground line**" means a powerline which is placed under the ground, including those portions which are erected above the ground.

(2) If—

(a) it is a requirement of these regulations that a standard, code, guide or other document, as published from time to time, be complied with; and

(b) a variation to the standard, code, guide or other document is published,

it is sufficient compliance with the requirement during the period of 6 months from publication of the variation if the standard, code, guide or other document, as last published without that variation, is complied with.

(3) A provision contained in a standard, code, guide or other document that is required to be complied with under these regulations is not, despite that requirement, to be taken to be a mandatory provision for the purposes of these regulations unless it is expressed in mandatory terms.

(4) In subregulations (2) and (3), a reference to a standard, code, guide or other document includes a reference to a part of a standard, code, guide or other document.

Interpretation of certain terms used in Act

5. (1) For the purposes of the definition of **private powerline** in section 4 of the Act, the prescribed voltage is 132 kV.

(2) For the purposes of the definition of **retailing** in section 4 of the Act, retailing of electricity does not include the following activities:

(a) a customer selling electricity on to another customer if the other customer does not pay a higher price for the electricity than would have been paid had that other customer purchased the electricity directly from the person who supplied the electricity to the first customer;

(b) a customer charging for the supply of electricity if the charge forms an unspecified part of rent or charges for the occupation or use of premises;

(c) a holder of a licence authorising the operation of an electricity generating plant charging a fee for supplying electricity to another person who is the holder of a licence authorising the operation of a transmission or distribution network.

PART 2
LICENSING OF ELECTRICITY ENTITIES

Exemptions

6. (1) A person who carries on the operation of an electricity generating plant is not required to be licensed under the Act if—

(a) the generator has a rated nameplate output of 100 kVA or less; or

(b) the person does not supply electricity for reward to or by means of a transmission or distribution network; or

(c) the electricity is generated only for the person's own consumption.

(2) A person who carries on the operation of a transmission or distribution network is not required to be licensed under the Act if the network transmits or distributes electricity only for that person's own consumption or for the consumption of others who, in pursuance of rights deriving (whether immediately or otherwise) from that person, occupy or use land or premises served by the network.

(3) However, a person exempted under subsection (1) or (2) from the requirement to be licensed in respect of the operation of a plant or network must comply with any requirement imposed by or under the Act or these regulations as if it were an electricity entity licensed under the Act in respect of the operation of the plant or network.

Licence fees and returns

7. (1) For the purposes of section 20(2) of the Act, the licence fee, or the first instalment of the licence fee, (as the case may require) must be paid on or before the last day of the month in each year (other than the year in which the licence is due to expire) that is the same month as the month in which the licence was granted.

(2) For the purposes of section 20(2) of the Act, an annual return must be lodged—

(a) on or before the last day of the ninth month after the licence was granted;

(b) thereafter, on or before the last day of the month in each year that is the same month as the month in which the first return was lodged.

(3) For the purposes of section 20(5) of the Act, the penalty for default—

(a) for failing to pay a licence fee, or an instalment of a licence fee, is 10% per annum of the outstanding amount calculated daily on a cumulative basis;

(b) for failing to lodge an annual return is $500.

PART 3
ELECTRICITY ENTITIES' POWERS AND DUTIES

Carrying out certain work on public land

8. (1) For the purposes of section 47(5) of the Act, prior notice and agreement are not required under section 47(3) of the Act for—

(a) work in an emergency; or

(b) maintenance or repairs of existing electricity infrastructure, including any necessary excavation or removal of obstructions; or

(c) replacement of existing electricity infrastructure with the same or equivalent infrastructure; or

(d) alterations or additions to existing electricity infrastructure not involving any significant enlargement of the area of public land occupied by the infrastructure or any significant change in appearance; or

(e) relocation of a pole or supporting structure in an existing electricity cable system.

(2) For the purposes of section 47(6) of the Act, agreement is not required under section 47(3) of the Act for—

(a) erection of pad-mount transformers and switching cubicles in connection with the installation of underground lines; or

(b) installation or relocation of electricity infrastructure as a part of road reconstruction.

PART 4
SAFETY AND TECHNICAL ISSUES

DIVISION 1—SAFETY AND TECHNICAL REQUIREMENTS

Purpose of Division

9. The requirements contained in this Division and related Schedules are safety or technical requirements for the purposes of sections 59 and 60 of the Act.

Quality of electricity supply

10. Electricity infrastructure must be designed, installed, operated and maintained so that—

(a) the voltage fluctuations that occur at a customer's point of supply are generally contained within the limits set out in AS 2279; and

(b) the harmonic voltage distortion at a customer's point of supply generally does not exceed the values set out in Tables 1, 2 and 3 in Schedule 1; and

(c) the voltage unbalance factor in three phase supplies generally does not exceed the values set out in Table 4 in Schedule 1.

General requirements for electricity infrastructure

11. (1) No circuit in electricity infrastructure may be allowed to remain in service unless every part of the circuit functions in the proper manner for circuits of that class.

(2) Each active conductor of a high voltage powerline or other high voltage equipment must be protected by an automatic disconnecting device.

(3) Electricity infrastructure must be connected to earth.

(4) The points at which electricity infrastructure is connected to earth must be such as to permit the connection of devices for protecting the system against earth faults.

Aerial lines

12. Aerial lines and service lines must be designed, installed, operated and maintained to be safe for the electrical service conditions and the physical environment in which they will operate and so as to comply with the requirements of Schedule 2.

Underground lines

13. Underground lines and service lines must be designed, installed, operated and maintained to be safe for the electrical service conditions and the physical environment in which they will operate and so as to comply with the requirements of Schedule 3.

Substations

14. Substations must be designed, installed, operated and maintained to be safe for the electrical service conditions and the physical environment in which they will operate and so as to comply with the requirements of Schedule 4.

Earthing and electrical protection systems

15. Earthing and electrical protection systems must be designed, installed, operated and maintained to safely manage abnormal electricity network conditions likely to significantly increase the risk to people or cause significant damage to property and so as to comply with the requirements of Schedule 5.

Electrical installations

16. Electrical installations must comply with AS 3000 and any other Australian Standard called up by AS 3000.

DIVISION 2—CERTAIN ELECTRICAL INSTALLATION WORK

Certain electrical installation work and certificates of compliance

17. (1) For the purposes of section 61(1) of the Act, the person who carries out work on an electrical installation or proposed electrical installation that is work of any kind referred to in AS 3000 or another Australian Standard called up by AS 3000 must—

(a) carry out the work and examine and test the installation—

(i) in accordance with AS 3000 and any Australian Standard called up by AS 3000 and so that the installation complies with any other technical and safety requirements under these regulations; and

(ii) in accordance with any requirements specified by the operator of the transmission or distribution network to which the installation is or is to be connected; and

(b) when satisfied that the work has been carried out in accordance with AS 3000 and any such other standards and requirements, complete a certificate of compliance in a form approved by the Technical Regulator to that effect.

(2) The person must—

(a) provide a copy of the completed certificate of compliance to—

(i) the person on whose behalf the work was carried out; and

(ii) if the work is associated with the making of a connection to a transmission or distribution network, the operator of the network; and

(b) keep a copy of the completed certificate of compliance for at least 5 years after the completion of the work.

DIVISION 3—SAFEGUARDING PERSONS WORKING WITH LIVE CONDUCTORS OR ELECTRICAL EQUIPMENT

SUBDIVISION 1—BASIC SAFETY PRINCIPLE

Basic safety principle

18. A person engaging or preparing to engage in work on or near a powerline or electrical installation must treat exposed conductors as live until they are—

(a) isolated and proved to be de-energised; and

(b) if they are high voltage conductors—earthed.

SUBDIVISION 2—WORK ON OR NEAR LIVE ELECTRIC CONDUCTORS OR ELECTRICAL EQUIPMENT

Application of Subdivision

19. This Subdivision applies if a person performs electrical work—

(a) by indirect contact with exposed live high or low voltage conductors or exposed live parts of high or low voltage electrical equipment; or

(b) in proximity to exposed live high or low voltage conductors or exposed live parts of high or low voltage electrical equipment; or

(c) by direct contact with exposed live low voltage conductors or exposed live parts of low voltage electrical equipment; or

(d) on de-energised exposed conductors or exposed parts of electrical equipment if there is a possibility of the conductors or parts becoming live,

unless the work is necessary to avoid a possible danger to life or serious personal injury.

Employer must ensure work can be performed safely

20. An employer must take reasonable steps to ensure an employee can work safely, and is suitably protected from adjacent electrical conductors or equipment that are live or at a different potential, by ensuring the employee uses—

(a) insulated tools and equipment; and

(b) equipment and plant designed and made in accordance with recognised electricity industry practice; and

(c) safe work practices.

Employer to provide competent assistant

21. (1) If there is a danger of accidental direct contact with exposed live conductors or exposed live parts of electrical equipment, an employer must provide an employee with an assistant who—

(a) is competent to help in carrying out the electrical work; and

(b) is competent to rescue and provide resuscitation to a person who has stopped breathing or is unconscious because of electric shock; and

(c) has, to the satisfaction of the employer, displayed a suitable knowledge of rescue and resuscitation and of the type of work to be performed.

(2) A person is competent for the purposes of subregulation (1) if the person has been suitably trained in the work required to be performed and has received, in the previous 12 months, training in—

(a) resuscitation; and

(b) releasing a person from live electrical apparatus; and

(c) if appropriate, rescuing a person from a pole, structure or elevated work platform; and

(d) if appropriate, rescuing a person from a confined space.

SUBDIVISION 3—WORK ON OR NEAR EXPOSED HIGH VOLTAGE CONDUCTORS OR ELECTRICAL EQUIPMENT

Application of Subdivision

22. This Subdivision does not apply to work to which Subdivision 4 applies (live line work).

Work on or near exposed high voltage conductors or electrical equipment

23. An employer must ensure that electrical work to be carried out by an employee is not carried out by direct or indirect contact with, or in proximity to, exposed high voltage conductors or exposed parts of high voltage electrical equipment.

Electrical work by direct contact with exposed high voltage conductors, etc.

24. (1) Despite regulation 23, such electrical work may be carried out by direct contact if the exposed high voltage conductors or exposed parts of high voltage electrical equipment are—

(a) isolated from all sources of electricity supply; and

(b) tests are conducted to ensure they are isolated from all sources of electricity supply; and

(c) earthed.

(2) If any such conductor or equipment cannot be directly contacted to prove isolation from all sources of electricity supply, it is sufficient if—

(a) the conductor or equipment includes an earthing switch designed to be safely operated if the high voltage conductor or equipment has not been isolated from all sources of supply; and

(b) the employer has given written instructions that, if complied with, will isolate the conductor or equipment from all sources of electricity supply.

Electrical work by indirect contact with exposed high voltage conductors, etc.

25. (1) Despite regulation 23, a person may carry out electrical work by indirect contact with, or in proximity to, exposed high voltage conductors or exposed parts of high voltage electrical equipment if—

(a) the person—

(i) is suitably trained and qualified as a powerline worker; or

(ii) has been instructed in the identification of high and low voltage overhead conductors and the safety aspects of work near live powerlines; and

(b) the person works beyond the approach limits set out in this regulation.

(2) However, the person may work within the approach limits if—

(a) the work can be carried out safely in any of the following circumstances:

(i) there are installed suitable barriers or earthed metal shields between the person carrying out the work and the conductors or electrical equipment;

(ii) the work to be carried out is testing of equipment and the equipment is designed so the approach limits cannot be complied with;

(iii) the work to be carried out is earthing of the conductors or equipment and is carried out after the exposed high voltage conductors have been isolated and proved to be de-energised; and

(b) the person's employer has given the person written instructions, either generally or in a particular case, about the work and the precautions to be taken.

(3) For the purposes of this regulation, the approach limits for a person, an article of clothing worn by a person, or a conductive object held or carried by a person, are set out below—

Voltage of conductor or equipment	**Approach limit A** (in metres)	**Approach limit B** (in metres)
Not more than 1000V	0.3	0.3
More than 1000V but not more than 11kV	0.6	0.6
More than 11kV but not more than 33kV	0.7	0.9
66kV	1.0	1.4
132kV	1.4	2.4
275kV	2.2	4.0

where—

(a) approach limit A applies to a person suitably qualified and trained as a powerline worker;

(b) approach limit B applies to a person who has been instructed in the identification of high and low voltage overhead conductors and the safety aspects of work near live powerlines.

SUBDIVISION 4—LIVE LINE WORK

Application of Subdivision

26. This Subdivision applies to electrical work on exposed live high voltage conductors or exposed live parts of electrical equipment ("**live line work**").

Carrying out of live line work

27. (1) A person must not carry out live line work unless authorised in writing by the operator of the electricity infrastructure on which the work will be carried out.

(2) An electricity infrastructure operator may authorise a person to carry out live line work if the operator is satisfied the person—

(a) has successfully finished a course of training approved by the Technical Regulator; and

(b) has been assessed by the training provider as competent to carry out the work.

(3) The voltage of the powerlines on which live line work is carried out must be as stated by the electricity infrastructure operator in the authorisation.

(4) The electricity infrastructure operator must conduct assessments regularly of a person authorised to carry out live line work to ensure the person remains competent to carry out the work.

SUBDIVISION 5—MISCELLANEOUS

Rescue and resuscitation training

28. An employer must ensure employees who are required to carry out, or help in carrying out, electrical work are suitably trained in rescue and resuscitation in accordance with recognised practices in the electricity industry.

Employer must ensure suitability of testing instruments

29. The employer of a person required under the Act to perform tests on electricity infrastructure, an electrical installation or safety equipment must ensure—

(a) the test instruments used are designed for and capable of correctly performing the required tests; and

(b) each testing instrument is tested and calibrated to ensure it is in proper working order; and

(c) records of tests performed are kept for at least two years.

DIVISION 4—REPORTING OF ACCIDENTS

Reporting of accidents

30. For the purposes of section 63 of the Act, if an accident happens that involves electric shock caused by the operation or condition of electricity infrastructure or an electrical installation, a report must be made to the Technical Regulator of the details of the accident—

(a) in the case of a death resulting from the accident—immediately by telephone;

(b) in the case of a person requiring medical assistance resulting from the accident—within 1 working day of the accident;

(c) in any other case—within 10 working days of the accident.

PART 5
CATHODIC PROTECTION SYSTEMS

Interpretation

31. In this Part—

(a) "**foreign structure**", in relation to a cathodic protection system, means a structure—

(a) normally continuous and electrically conducting; and

(b) laid in ground or water, but not electrically connected to or forming part of the primary circuit of the cathodic protection system; and

(c) likely to be adversely affected by the system;

(b) electrical terms are the terms as they apply for direct current.

Application of Part

32. (1) This Part does not apply to a cathodic protection system installed on—

(a) a floating mobile structure; or

(b) fishing equipment; or

(c) a fixed off shore structure not connected with land above sea level.

(2) This Part does not apply to a cathodic protection system installed on an internal surface of an apparatus, equipment or structure to which Part 4 of AS 2832.4 refers.

Preliminary steps to be taken before installation of cathodic protection system

33. The person for whom a cathodic protection system is to be installed must, at least 60 days before the installation, advise the owners of a relevant foreign structure of the proposal to install the system and allow them to examine the proposal.

Conditional operation of cathodic protection system

34. (1) The owner of a cathodic protection system must not operate the system unless—

(a) the system is operated in accordance with this Part; and

(b) the system is tested in accordance with this Part; and

(c) the owners of foreign structure, whom the owner of the system is required to advise, have agreed that interference mitigation is satisfactory or is not required.

(2) Despite subregulation (1), a person may operate a cathodic protection system for a reasonable period to perform tests in accordance with this Part.

Tests before operating cathodic protection system

35. (1) The owner of a cathodic protection system must, within 90 days before starting to operate the system, perform—

(a) interference tests on all relevant foreign structures;

(b) if the system has an anode immersed in water or a marine environment—tests to ensure that the potential difference between any 2 accessible points spaced 1 metre apart in the water or marine environment is not more than 3V when the system is energised.

(2) The tests must be based on the maximum value of the current at which the cathodic protection system will operate (other than during short term testing).

(3) The owner of the cathodic protection system must—

(a) make arrangements for the tests under which the tests are carried out at a time agreed with all relevant foreign structure owners and those foreign structure owners are allowed to observe the carrying out of the tests; and

(b) provide all facilities and equipment and bear all costs associated with the tests.

Further tests during operation of cathodic protection system

36. The owner of—

(a) a cathodic protection system in which the current flowing between the cathodically protected structure and the anode is supplied by an external source; or

(b) any cathodic protection system with a total anode mass greater than 25 kg,

must perform interference tests in accordance with this Part on relevant foreign structures—

(c) any time an anode forming part of the system is replaced; and

(d) any time the system or its method of operation is changed.

PART 6
MISCELLANEOUS

Testing measurement of consumption of electricity

37. (1) An electricity entity authorised by a licence to carry on retailing of electricity must, if requested by a customer, test the accuracy of a meter installed on the customer's premises for the purposes of measuring the customer's consumption of electricity.

(2) The electricity entity may—

(a) require the request to be made in writing; and

(b) before testing, require the customer to pay—

(i) a charge for electricity or another amount owing to the entity by the customer for supplying electricity; and

(ii) a test fee not exceeding $20 or a greater amount fixed by the Technical Regulator for each meter to be tested.

(3) The electricity entity must advise the customer when and where the test is to be carried out and the customer, or a person nominated by the customer, may be present during the test.

(4) A meter must be tested where it is installed, except in the case of a meter used for metering high voltages or current transformers which may be taken away for testing at a place determined by the electricity entity.

(5) The electricity entity must, as soon as practicable after a test on a meter has been conducted, give written notice to the customer of the test results.

(6) If the test shows the meter is registering incorrectly, the electricity entity must—

(a) include in the notice the extent to which the registration falls outside the allowable margin; and

(b) refund the test fee to the customer; and

(c) adjust the previous relevant electricity accounts to reflect the actual or a reasonable estimation of the electricity supplied.

Inaccurate measuring

38. (1) A meter measuring consumption of electricity supplied to a customer will be taken to be registering incorrectly if it overregisters or underregisters the amount of electricity supplied by more than a margin of 2 per cent.

(2) However, an electricity entity may, unless prevented from doing so by a condition of the entity's licence, agree a different allowable margin with a customer.

Register of underground lines

39. (1) An electricity entity authorised to operate a transmission or distribution network must keep and maintain a register describing the nature and precise location of each line installed underground that is under the control of the entity.

(2) The transmission or distribution network operator in an area must be notified by any other electricity entity of the nature and precise location of any line installed underground in the area by that other entity and that information must be recorded in the register kept by the network operator under subregulation (1).

(3) The register must be made available for inspection by a member of the public during normal business hours.

Protection of underground lines

40. A person must not—

(a) place or maintain, or cause to be placed or maintained, any corrosive, abrasive, heavy or deleterious material or substance above any underground line; or

(b) make any opening in the ground surface that may endanger any underground line,

without the written authority of the operator of the electricity infrastructure of which the line forms part.

Maximum penalty: $2 500.
Expiation fee: $210.

Entangled objects

41. A person must not, without the written authority of the person who operates, owns or controls the electricity infrastructure or an electrical installation, pull or interfere with any object resting on or entangled in electricity infrastructure or the electrical installation unless the action is reasonably necessary to prevent or reduce injury to a person or property.

Maximum penalty: $2 500.
Expiation fee: $210.

Excavating and altering levels

42. A person must not, without the written authority of the electricity infrastructure operator—

(a) cut away, excavate or remove, or cause to be cut away, excavated or removed, earth or material supporting electricity infrastructure so as to endanger the stability of the infrastructure; or

(b) make an excavation deeper than 1800 mm within 3000 mm of, or deeper than 900 mm within 1500 mm of—

(i) a pole structure or stand, not being a tower or tower structure supporting electricity infrastructure; or

(ii) any pole or bed log to which is affixed a staywire used to support electricity infrastructure; or

(c) make an excavation deeper than 900 mm within 15000 mm of, or deeper than 300 mm within 1500 mm of any tower or tower structure supporting electricity infrastructure; or

(d) make an excavation deeper than 300 mm within 600 mm of any wall, fence or foundation of a substation; or

(e) place any soil, stone, rock or filling or construct any artificial surface above ground level—

(i) below an electric line or within the vertical projection of any points to which a conductor of the electric line may sway; or

(ii) adjacent to electricity infrastructure,

in a manner that may alter the level of the ground at any place so as to infringe any permissible clearance distance under these regulations.

Maximum penalty: $2 500.
Expiation fee: $210.

Prohibition of certain activities in proximity to powerlines, service lines and other cable systems

43. (1) A person must not, without the written authority of the electricity infrastructure operator—

(a) erect or maintain a building or structure closer than the relevant distance set out in Table 1 in Schedule 6 to any point to which a powerline or service line or other cable system may swing or sag; or

(b) place or maintain any material within the relevant distance set out in Table 2 in Schedule 6 to any point to which a powerline or service line or other cable system may swing or sag; or

(c) operate a machine, vehicle or vessel equipped with an elevating component or shear legs so that any part of the vehicle or its load comes within the distances set out in Table 3 in Schedule 6 to any point which a powerline or service line or other cable system may swing or sag; or

(d) attach or keep attached to electricity infrastructure any conductors of circuits or other cable system; or

(e) erect or maintain conductors of circuits, or other cable system, so as to cross the circuit of a powerline, or other cable system, unless clearances in excess of the distance set out in Table 4 in Schedule 6 can be maintained; or

(f) erect a circuit or other cable system unless the clearance in any direction from the circuit or system to any structure forming part of electricity infrastructure (other than a structure supporting the circuit or system) is greater than the distance set out in Table 5 in Schedule 6.

Placement of materials

44. A person must not, without the written authority of the electricity infrastructure operator—

(a) place or maintain any timber or inflammable material within 3000 mm in any direction of a wall or fence surrounding a substation or switch yard; or

(b) impede access to any door, gate or entrance of a substation or switch yard or interfere in any way with the free flow of air through any openings or fittings used for ventilation in the walls of substations or switch yards; or

(c) place or maintain any material adjacent to a wall or fence of a substation or switch yard so as to enable unauthorised access.

Maximum penalty: $2 500.
Expiation fee: $210.

Transportation

45. (1) A person who transports (the "**transporter**") anything in the vicinity of a powerline must ensure that—

(a) at all times during transportation the distance between the load transported and the powerline is greater than the distance set out in Table 6 in Schedule 6;

(b) arrangements satisfactory to the operator of the electricity infrastructure of which the powerline is part have been made before, and are observed during, transportation.

Maximum penalty: $2 500.
Expiation fee: $210.

(2) A transporter must give written notice of intention to undertake the transportation to the electricity infrastructure operator at least 3 clear business days before the commencement of the transportation with the notice clearly stating—

(a) the nature of the vehicle and the load; and

(b) the height of the load; and

(c) the date and the time of the proposed movement; and

(d) the starting point and finishing point of the transportation; and

(e) the proposed route; and

(f) the name and contact address of the transporter; and

(g) the transporter will meet all reasonable costs incurred by the other person as a result of the transportation; and

(h) any other particulars which the operator may in the circumstances require.

Maximum penalty: $2 500.
Expiation fee: $210.

(3) The transporter is liable for all costs incurred by the electricity infrastructure operator as a result of the transportation.

Interference and obstruction

46. (1) A person must not obstruct any road under the control of an electricity infrastructure operator or otherwise do anything to prevent or impede access to the electricity infrastructure.

Maximum penalty: $2 500.
Expiation fee: $210.

(2) A person must not interfere with or damage the surface of a road made by an electricity infrastructure operator that is used for the purposes of works.

Maximum penalty: $2 500.
Expiation fee: $210.

(3) An electricity infrastructure operator may, without notice to the owner, remove anything which causes or may cause a danger to people or property using or on the road.

General penalty

47. A person who contravenes or fails to comply with a provision of these regulations for which a specific penalty is not provided is guilty of an offence.

Maximum penalty: $5 000.
Expiation fee: $315.

Fees for reinspection, etc.

48. (1) A person to whom a direction has been given under section 62, 70 or 72 of the Act is liable to pay a fee of an amount equal to the reasonable costs of any reinspection or reattendance by an authorised officer for the purpose of ensuring compliance with the direction or approving reconnection of the electricity supply.

(2) The Technical Regulator may recover a fee payable under subregulation (1) as a debt by action in a court of competent jurisdiction.

22.

SCHEDULE 1
Quality of Electricity Supply
(Regulation 10)

TABLE 1: Voltage Distortion Limits (%)—For voltage levels less than 66kV

CATEGORY	LIMIT (%)
Individual Odd Harmonics	4
Individual Even Harmonics	2
Total Harmonic Distortion	5

TABLE 2: Odd Harmonic Voltage Distortion Limits (%)—For voltage levels greater than or equal to 66kV

HARMONIC ORDER (n)	VOLTAGE LIMIT (%)
3	1.0
5	0.9
7	0.9
9	0.8
11	0.8
13	0.7
15	0.6
17	0.5
19	0.5
21	0.4
23	0.4
25	0.3
27-49	0.2
Total (Odd + Even)	1.5

TABLE 3: Even Harmonic Voltage Distortion Limits (%)—For voltages greater than or equal to 66kV

HARMONIC ORDER (n)	VOLTAGE LIMIT (%)
2	0.5
4	0.5
6	0.4
8	0.4
10	0.4
12	0.4
14	0.3
16	0.3
18	0.3
20-50	0.2
Total (Odd + Even)	1.5

TABLE 4: Voltage Unbalance Factor (%)—For three phase supplies

TIME PERIOD	VOLTAGE UNBALANCE FACTOR (%)
Continuous	1.0
5 minutes	1.5
Instantaneous	3.0

SCHEDULE 2

Requirements for Aerial Lines and Service Lines
(Regulation 12)

Interpretation

1. In this Schedule—

"**industry standards**" means the standards, codes, guides and other documents, as published from time to time, listed in the Appendix at the end of this Schedule;

"**maximum design temperature**" means the maximum temperature that conductors may reach under the influence of load current (excluding fault current), ambient temperature of the air and solar radiation.

Design

2. Aerial lines and service lines must be designed so that the lines—

(a) have safe levels of electrical insulation; and

(b) will carry the electrical load currents for which they are designed without failure; and

(c) will allow the passage of electrical short circuit currents which will enable the correct operation of protective devices; and

(d) are structurally secure for the environmental and service conditions for which they are designed; and

(e) maintain safe clearances,

and so as to comply with the industry standards.

Materials

3. Aerial line structures, their components, conductors and accessories must be manufactured or purchased to the industry standards so as to ensure safe operational performance.

Thermal ratings

4. (1) The thermal capacity of a conductor must be sufficient to pass the electrical load for which it is designed without losing any mechanical properties that would affect the safety of the line.

(2) Thermal ratings of conductors must be determined so as to comply with the industry standards.

Short circuit ratings

5. (1) The conductors of aerial lines must be of sufficient size to pass short circuit currents so as to enable the correct operation of protective devices without losing any mechanical properties that would affect the safety of the line.

(2) Short circuit capacity of conductors must be determined so as to comply with the industry standards.

Mechanical loading conditions

6. (1) The mechanical loads used for the design of aerial lines must be based on the local environment and electrical service conditions.

(2) In determining electrical service conditions and the physical environment under which the line will operate, due care must be given to the consideration of extremes that may occur, the likelihood of their occurrence and the associated risks.

(3) Mechanical loading conditions must be determined so as to comply with the industry standards.

Conductor tensions

7. (1) The conductors for use with aerial lines must be designed to withstand the mechanical loads determined for their operation over the designed operational life of the line without failure.

(2) Conductors for lines must be designed so as to comply with the industry standards.

Structures and footings

8. (1) The structures and footings for use with aerial lines must be designed to withstand the mechanical loads determined for their operation over the designed operational life of the line without failure.

(2) Structures and footings for lines must be designed so as to comply with the industry standards.

Facade mounted cables

9. (1) Cables and accessories designed for facade mounting must be constructed with suitable insulated conductors and be manufactured to be durable for the environment and service conditions for which they are designed.

(2) In determining electrical service conditions and the physical environment under which the line will operate, due care must be given to the consideration of extremes that may occur, the likelihood of their occurrence and the associated risks.

(3) Mechanical loading conditions must be determined so as to comply with the industry standards.

Safety clearances

10. (1) Aerial lines must be designed to maintain safety clearances to the ground and other buildings or structures under the environmental and electrical service conditions determined for the line.

(2) In determining circuit arrangement, electrical service conditions and the physical environment under which the line will operate, due care must be given to the consideration of extremes that may occur, the likelihood of their occurrence and the associated risks.

(3) The environmental and electrical conditions for the determination of clearances to lines must be determined in accordance with the industry standards.

(4) Aerial lines must be designed so that safety clearances are as follows:

(a) for all aerial lines (other than lines attached to buildings ("**facade mounted lines**"))—so that the distance from any structure, building, post or line support (other than a support to which a line under consideration is attached or a support of another overhead line which crosses the line under consideration) to any position to which a conductor in an aerial line or other cable system may sag at maximum design temperature or move as a result of normal prevailing wind pressures is not less than the relevant distance set out in Table 1; *(Figure 1 is to be used to assist in understanding the information contained in Table 1.)*

(b) for aerial lines (other than service lines, other cable system or aerial lines within substations)—so that the distance to the ground in any direction from any position to which any part of a line may sag at maximum design temperature or move as a result of normal prevailing wind pressures is not less than the relevant distance set out in Table 2;

(c) for aerial service lines and other cable systems—so that the distance to the ground in any direction from any position to which any part of the line may sag at maximum design temperature or move as a result of normal prevailing wind pressures is not less than the relevant distance set out in Table 3;

(d) for a facade mounted line—

(i) so that the distance from any part of a facade of a building which supports a line to any position the line may sag at maximum design temperature is not less than the relevant distance set out in Table 4;

(ii) where it is designed so the line is more than 300mm from the facade of the building supporting it, the requirements of paragraphs *(a)* and *(c)* apply;

(5) The arrangement of and clearances between circuits, either attached to a common structure, unattached, in shared spans or crossing, must be designed to be safe for the environmental and electrical service conditions for which it is designed and so as to comply with the industry standards.

(6) Every conductor of an aerial line must be erected so that clearance from any point to which that conductor may swing or sag is not less than—

(a) 600 mm for any conductor having a voltage not exceeding 1kV; and

(b) 1800 mm for any conductor having a voltage exceeding 1kV but not exceeding 66kV volts,

from a street traction trolley wire, street traction feeder conductor or any wire or cable supporting the trolley wire or feeder conductor.

Installation of aerial lines and service lines

11. Aerial lines must be installed so as to comply with the industry standards.

Maintenance of aerial lines

12. (1) Aerial lines, their structures and components must be maintained to be in a safe operating condition.

(2) A system of maintenance must be instituted for aerial lines, their structures and their components, including—

(a) predetermined inspection programs to confirm the safe state of components;

(b) regular maintenance programs consistent with manufacturers' recommendations and industry standards;

(c) managed replacement programs for components approaching the end of their serviceable life.

(3) A maintenance program for aerial lines must comply with the standards, codes, guides and other documents, as published from time to time, listed in the Appendix at the end of Schedule 3.

TABLE 1: Clearance distances for all aerial lines (other than facade mounted lines) from structures

Direction from Structure	Clearance Distance (in metres)									
	U≤1000 V			U>1000 V		1000 V <U≤ 33kV	33kV <U≤ 132kV	132kV <U≤ 275kV	275kV <U≤ 330kV	330kV <U≤ 500kV
	Insulated	Bare neutral	Bare active	Insulated with earthed screen	Insulated without earthed screen	Bare or covered	Bare	Bare	Bare	Bare
Vertically above those parts of any structure normally accessible to persons (A)	2.7	2.7	3.7	2.7	3.7	4.5	5.0	6.8	8.0	9.8
Vertically above those parts of any structure not normally accessible to persons but on which a person can stand (B)	0.1	2.7	2.7	0.1	2.7	3.7	4.5	6.0	7.0	8.0
In any direction (other than vertically above) from those parts of any structure normally accessible to persons, or from any part not normally accessible to persons but on which a person can stand (C)	0.1	0.9	1.5	0.1	1.5	2.1	3.0	4.6	5.5	6.4
In any direction from those parts of any structure not normally accessible to persons (D)	0.1*	0.3*	0.6*	0.1	0.6	1.5	2.5	3.7	4.7	6.4
In any direction from ground (G)	Refer to Table 2 or 3			Refer to Table 2		Refer to Table 2				

** This clearance can be further reduced to allow for termination at the point of attachment.*

FIGURE 1

1. Figure 1 illustrates the application of Table 1 to a particular structure. The letters A to D refer to distances A to D as set out in Table 1. The letter G refers to distance to ground of insulated cables.

2. The clearances specified in A and B of Table 1 must be maintained above a horizontal line extending outward for the distance specified in C from the outer extremities of those parts of any structure on which a person can stand.

[Figure 1 appears in *Gaz*. 19 December 1996, p. 1990]

TABLE 2: Clearance distance for aerial lines (excluding service lines, other cable systems and aerial lines within substations)

Nominal System Voltage (U)	Clearance Distance (in metres)		
	Over carriageway of road	Over land other than carriageway of road	Over land not traversable by vehicles
Bare or insulated conductor U ≤ 1kV or Insulated conductor with earthed screen U> 1kV	5.5	5.5	4.5
Insulated conductor without earthed screen U > 1kV	6.0	5.5	4.5
Bare or covered conductor 1kV < U ≤ 33kV 33kV < U ≤ 132kV 132kV < U ≤ 275kV 275kV < U ≤ 330kV 330kV > U ≤ 500kV	 6.7 6.7 11.5 12.5 14.0	 5.5 6.7 6.7 6.7 10.7	 4.5 5.5 6.7 6.7 10.7

TABLE 3: Clearance distances for aerial service lines and other cable systems

Location of Line	Clearance Distance (in metres)
Over any part of a main road within the meaning of the *Highways Act 1926*	5.5
Over the centre of each carriageway of a public road	5.5
Over any other part of a road	4.6
Over any part of a driveway	3.9
Elsewhere	3.0

TABLE 4: Facade mounted lines

	Facade Situation	Clearance Distances (in metres)
A	Clearance vertically from ground at footway level	2.5*
B	Above windows and doors	0.3*
C	Each side and below windows	0.5*
D	Each side of doors and balconies	1.0*
E	From metallic parts of buildings, *eg* downpipes	0.05*

* *This clearance may be reduced where additional mechanical protection is provided to the cable.*

FIGURE 2

Figure 2 is to be used in understanding the information in Table 4.

[Figure 2 appears in *Gaz*. 19 December 1996, p. 1990]

APPENDIX

Standards, Codes, Guides and Other Documents Relating to Aerial Lines and Service Lines

In this Appendix—

"**ESAA**" means Electricity Supply Association of Australia;

"**NZS**" means New Zealand Standard.

Conductors

Bare overhead - Hard - drawn copper	AS 1746
Bare overhead - Aluminium & aluminium alloy	AS 1531
Bare overhead - Aluminium & aluminium alloy - steel reinforced	AS 3607
Steel conductors & stays - Bare overhead: Galvanised	AS 1222.1
Steel conductors & stays - Bare overhead: Aluminium alloy	AS 1222.1
Galvanised steel strand	AS 2841

Insulated Cables

Approval & test specification - elastomer insulated - 0.6/1kV	AS 3116
Approval & test specification - thermoplastic insulated - 0.6/1kV	AS 3417
Approval & test specification — neutral screened — 0.6/1kV	AS/NZS 3155
XLPE insulated - Aerial bundled - 0.6/1kV	AS 3560
Mechanical fittings for low voltage aerial bundled cable	AS 3766
Aerial bundled - Polymeric insulated - 6.35/11kV, 12.7/22kV: (metallic screened)	AS 3599.1
Aerial bundled - Polymeric insulated - 6.35/11kV, 12.7/22kV: (non-metallic screened)	AS 3599.1
Conductors - Covered overhead - 6.35/11kV to 19/33kV	AS 3675

Insulators

Guidelines for the design & maintenance of overhead distribution and transmission lines—

Selection	ESAA C(b)1 s. 4
Porcelain & glass indoor & outdoor station post, U>1000V ac	AS 1137.3
Porcelain & glass for O/H lines, U>1000V ac: Test methods	AS 2947.1
Porcelain & glass for O/H lines, U>1000V ac: Characteristics	AS 2947.2
Porcelain & glass for O/H lines, U>1000V ac: Couplings	AS 2947.3
Porcelain & glass, pin & shackle U<1000V	AS 3608
Porcelain stay type U>1000V	AS 3609

Insulator and Conductor Fittings

For overhead lines: Performance & general requirements	AS 1154.1
For overhead lines: Dimensions	AS 1154.2
For overhead lines: Performance & general requirements for helical fittings	AS 1154.3

Thermal Limits
Guidelines for the design & maintenance of overhead distribution & transmission lines—

Thermal limits	ESAA C(b)1 Appendix A2
Current rating of bare overhead line conductors	ESAA D(b)5

Short Circuit Capacity
Guidelines for the design & maintenance of overhead distribution & transmission lines—

Fault ratings	ESAA C(b)1 Appendix A2

Mechanical Loading Conditions
Guidelines for the design & maintenance of overhead distribution & transmission lines—

Mechanical Loading Conditions	ESAA C(b)1 s. 3
Minimum design loads on structures (Loading Code)	AS 1170
Dead & live loads	AS 1170.1
Wind loads	1170.2
Earthquake loads	1170.4

Conductor Tensions
Guidelines for the design & maintenance of overhead distribution & transmission lines—

General	ESAA C(b)1 s. 6
Calculations	ESAA C(b)1 Appendix B

Structures and Footings
Guidelines for the design & maintenance of overhead distribution & transmission lines—

General	ESAA C(b)1 ss. 7 & 8 & Appendix C
Methods of testing soils for engineering purposes	AS 1298 Series
Piling - Design & installation	AS 2159
Design of steel lattice towers & masts	AS 3995
Steel structures	AS 4100
Concrete structures	AS 3600

Clearances from Ground
Guidelines for the design & maintenance of overhead distribution & transmission lines—

Environmental & loading conditions	ESAA C(b)1 s. 9

Clearances from Structures
Guidelines for the design & maintenance of overhead distribution & transmission lines—

Environmental & loading conditions	ESAA C(b)1 s. 10

Spacing of Conductors
Guidelines for the design & maintenance of overhead distribution & transmission lines—

Clearances	ESAA C(b)1 s. 11
Environmental & loading conditions	ESAA C(b)1 s. 11

33.

Maintenance

Guidelines for the design & maintenance of overhead distribution & transmission lines—

Maintenance & inspection procedures . . . . . ESAA C(b)1 Appendix E

SCHEDULE 3

Requirements for Underground lines and Service Lines
(Regulation 13)

PART A—INTERPRETATION

In this Schedule—

"**industry standards**" means the standards, codes, guides and other documents, as published from time to time, listed in the Appendix at the end of this Schedule.

PART B—DESIGN

General

1. (1) Underground lines and service lines must be designed so that—

(a) cables have safe levels of electrical insulation; and

(b) cables will carry load currents for which they are designed without failure; and

(c) cables will pass short circuit current which will enable the correct operation of protective devices; and

(d) safe clearances are maintained,

and so as to comply with the industry standards.

(2) In determining electrical service conditions and the physical environment under which the line will operate, due care must be given to the consideration of extremes that may occur, the likelihood of their occurrence and the associated risks.

Cables and accessories

2. (1) Cables and their accessories must be manufactured or purchased to industry standards so as to ensure safe operational performance.

(2) Manufacture and purchase of cables and their accessories must be done so as to comply with the industry standards.

Cable ratings

3. (1) The rating of a cable must be sufficient to pass the electrical load for which it is designed without failure or excessive heating up.

(2) Rating of cables must be determined so as to comply with the industry standards.

Short circuit rating of conductors and cable screens

4. (1) The cable conductors and cable screens must be of sufficient size to pass short circuit currents which will enable the correct operation of protective devices.

(2) The short circuit capacity of cable must be determined so as to comply with the industry standards.

PART C—INSTALLATION

General

1. Underground lines and service lines must be installed in a safe manner in accordance with this Schedule and so as to comply with the industry standards.

Installation of underground lines

2. (1) An underground line must be installed using one of the methods described in Table 1 below and, subject to this clause, at the depth fixed for the designated voltage and cable type.

(2) For the mechanical cover and enclosures referred to above one of the following must be used:

(a) a layer of concrete at least 50 mm thick with a characteristic strength defined by AS 1480 and AS 1012 and determined to be not less than 15 MPa at 28 days placed not less than 50 mm and not more than 150 mm above the cable and overlapping the cable by at least 40 mm on each side; or

(b) concrete slabs of at least 40 mm thickness with a characteristic strength defined as AS 1480 and AS 1012 and determined to be not less than 15MPa at 28 days with—

(i) each slab touching the next so that there are no spaces left between slabs; and

(ii) the slabs being placed not less than 50 mm and not more than 150 mm above the cable and overlapping the cable by at least 40 mm on each side of the cable; or

(c) a plastic or composite material that offers comparable protection.

(3) The enclosure referred to in the last column of Table 1 must be a medium or heavy galvanised steel tube conforming to AS 1074 or a non-metallic heavy duty conduit conforming to AS 2053.

(4) If it is impractical to lay an underground line or service line at a depth which complies with Table 1 then they may be laid at a lesser depth provided that additional covers or enclosures are installed to provide equivalent protection to that prescribed.

(5) The underground line, from where it enters the ground to a position where it complies with the requirements of depth and protection in Table 1, must be protected by a cover or enclosure described above.

TABLE 1: Minimum depth of burial from surface of ground to top of cable or enclosure

Voltage Volts	**Method of Burial and Burial Depth (in millimetres)**		
	Direct Buried	Direct Buried and Covered by Mechanical Cover	Enclosed in Conduit or Pipe
U ≤ 1kV Single core type Multi core type	 750 750	 600 450	 450 450
1kV < U ≤ 22kV Both cable types	750	600	600
22kv < U ≤ 66kV Both cable types	1000	750	750

Part of underground line or service line installed on or above ground

3. (1) If an underground line or service line is located on the surface of the ground or attached above the surface of the ground, it must be mechanically protected to a height of 2400 mm from any surface on which a person can stand to the point where it enters the ground.

(2) The mechanical protection must be provided—

(a) by a cable guard made of mild steel of 2.5 mm thickness for HV cables and 1.6 mm thickness for LV cables, galvanised to AS 1650; or

(b) a galvanised steel tube conforming to AS 1074; or

(c) some other material giving equivalent mechanical protection.

(3) If the attachment of the underground line is more than 2400 mm from a surface on which a person can stand, the cable need not be mechanically protected provided that—

(a) the cable is beyond reach (determined in accordance with AS 2607 Appendix G) from windows or other accessible parts of the building; or

(b) the cable is less than 1000 volts; or

(c) the cable is more than 1000 volts but is metallic screened.

(4) If the cable is high voltage, it must be enclosed in metallic piping or casing which is earthed in accordance with these regulations.

Shared trenches

4. Separation between cables and service lines of other utilities laid parallel must comply with the industry standards.

Maintenance

5. (1) Underground lines must be maintained to be in a safe operating condition.

(2) A system of maintenance must be instituted for underground lines and their components, including—

(a) predetermined inspection programs to confirm the safe state of components;

(b) regular maintenance programs consistent with manufacturers' recommendations and industry standards;

(c) managed replacement programs for components approaching the end of their serviceable life.

(3) A maintenance program for underground lines must comply with the industry standards.

APPENDIX

Standards, Codes, Guides and Other Documents Relating to Underground Lines and Service Lines

In this Appendix—

"**ANSI**" means American National Standards Institute;

"**ESAA**" means Electricity Supply Association of Australia;

"**IEC**" means International Electrotechnical Commission;

"**IEEE**" means Institute of Electrical and Electronic Engineers;

"**NZS**" means New Zealand Standard.

High Voltage Cables

Polymeric Cables 3.3kV to 33kV	AS 1429.1
Impregnated paper insulated - U<33kV	AS 1026
Underground residential systems	AS 4026
Extruded solid dielectric - 1kV to 30kV	IEC 502
Tests for solid dielectric cables 30kV to 150kV	IEC 840

Low Voltage Cables

Impregnated paper insulated - U<33kV	AS 1026
Conductors in insulated cables & flexible cords	AS 1125
Concentric wire neutral - XLPE insulated - 0.6/1kV	AS 1178
Approval & test specification - elastomer insulated - 0.6/1kV	AS 3116
Approval & test specification - thermoplastic insulated - 0.6/1kV	AS 3147
Approval & test specification - neutral screened - 0.6/1kV	AS/NZS 3155
Underground residential systems	AS 4026

High Voltage Cable Accessories

High Voltage Cable Joints	ANSI/IEEE 48
High Voltage Cable Terminations	ANSI/IEEE 404
Separable insulated connectors - U>1kV	AS 2629

Continuous Cable Ratings

Calculation methods	IEC 287
Selection of cables - U<0.6/1kV	AS 3008.1

Short Circuit Currents

Calculation of Short Circuit Currents	IEC 949

Installation

ESAA *Guide to the Installation of Underground Cables*	C(b)2
ESAA *Guide to the Use of Separable Connectors*	D(b)30

Maintenance

ESAA *Guide for the Maintenance of High Voltage Paper Oil Insulated Cables & Accessories*	D(b)31

SCHEDULE 4

Requirements for Substations
(Regulation 14)

Interpretation

6. In this Schedule—

"**Building Code of Australia**" means the *Building Code of Australia* as published from time to time;

"**industry standards**" means the standards, codes, guides and other documents, as published from time to time, listed in the Appendix at the end of this Schedule.

Design

1. (1) Substations must be designed so that—

(a) buildings and enclosures are secure; and

(b) plant, equipment and lines have safe levels of electrical insulation; and

(c) plant, equipment and lines will carry electrical load currents for which they are designed without failure; and

(d) plant, equipment and lines will carry short circuit currents which will enable the correct operation of protective devices; and

(e) safe clearances to live apparatus are maintained,

and so as to comply with the industry standards.

(2) In determining electrical service conditions and the physical environment under which the line will operate, due care must be given to the consideration of extremes that may occur, the likelihood of their occurrence and the associated risks.

(3) Substations must be designed so as to comply with the industry standards.

Plant and equipment

2. Substation plant and equipment including busbars, cables, circuit breakers and ancillary equipment, transformers, capacitors and surge diverters must be manufactured or purchased so as to comply with the industry standards.

Clearances to live equipment and lines

3. (1) Substations must be designed to provide safe operating and working clearances from live equipment and lines.

(2) Clearances between live equipment to structures and buildings and the provision of safe operating and working clearances must be determined so as to comply with the industry standards.

Buildings and roofed enclosures

4. The provisions of the *Building Code of Australia* apply in relation to substations, including provisions dealing with—

(a) plant and equipment that may be installed; and

(b) ventilation requirements for such plant and equipment; and

(c) the control of ground waters in sub-surface buildings; and

(d) the control of the products of explosion that may occur; and

(e) forces due to short circuit conditions.

Containment of fire

5. The provisions of the *Building Code of Australia* dealing with fire prevention and containment apply in relation to substations.

Containment of insulating liquids

6. Buildings must be designed in respect of the containment of insulating liquids in an enclosure or in an area in which the equipment is housed so as to comply with the industry standards.

Security of substation buildings and enclosures

7. (1) Buildings and enclosures must be secured so as to prevent entry by unauthorised persons.

(2) Buildings and enclosures must have signs on all entrances prohibiting unauthorised entry and warnings of the danger associated with unlawful entry.

(3) The ventilation system of buildings and enclosures must be designed so to prevent the intrusion of foreign objects into the building or enclosure likely to interfere with the safe operation of the electrical equipment.

Kiosk type substations

8. (1) A kiosk type substation is a totally enclosed, free-standing, self-contained substation not designed for bodily entry that is generally operated from door openings.

(2) The design of the enclosure must be robust and sturdy. *(For example, it may include a steel frame with the walls and roof constructed of sheet steel of a minimum thickness of 1.6 mm or be constructed of other material that will provide equivalent or superior strength.)*

(3) The installation design must ensure that no part of the kiosk enclosure is within 1200 mm of any part of a building or wall which has a fire rating less than three hours as determined by the *Building Code of Australia*.

Ground type substations

9. (1) A ground type substation is a semi-enclosed, free-standing substation which is connected to a high voltage aerial line or underground line.

(2) The calculations for the design of structures supporting aerial lines in ground type substations must, in addition to allowing for the maximum loading in accordance with clause 6 of Schedule 3, also allow for forces under short circuit conditions.

(3) Walls and fences enclosing a substation must be designed—

(a) so that the minimum horizontal clearances from any building or structure (including fences or walls which are not solid) within the boundary, or forming the boundary of the ground type substation to any live and bare equipment is no less than—

$U \leq 22kV$	1500 mm
$22kV < U \geq 66kV$	3000 mm;

(b) to be constructed of a substantive material (such as brick, masonry, wood, sheet metal or galvanised chain-wire mesh with a dimension of not more than 50 mm for any aperture) and be a minimum height of 2500 mm;

(c) so as to comply with the *Building Code of Australia* for the containment of fire where the wall or fence is less than 1200 mm from the wall or fence of an adjacent building or structure and the advance wall or structure has a fire rating of less than three hours, as determined by the *Building Code of Australia*.

(4) The distances in subclause (3)*(a)* may be reduced in circumstances where the height of the fences enclosing the substation are such that any bare and live equipment are safe from reach from any structure or building outside the enclosure.

(5) The top 500 mm of a wall or fence enclosing a substation may consist of securely supporting barbed wire with a maximum separation of the strands of 150 mm.

(6) Clearances between any building or structure within the boundary of the substation and any live equipment must be determined so as to comply with the industry standards.

Pole mounted substations

10. Pole mounted substations must be designed so that—

(a) the calculations for the design of structures supporting aerial lines and busbars in substations, in addition to allowing for the maximum loading in accordance with clause 6 of Schedule 3, also allow for forces under short circuit conditions;

(b) all insulated conductors comply with the requirements of Schedule 4 with regard to conductor insulation, cable construction and the mechanical protection of cables;

(c) all parts of supporting platforms and equipment which are mounted on or attached to the pole or cross arms, except for conductors, are at height not less than that set out in Table 1;

(d) any equipment mounted at a height less than that prescribed in paragraph *(c)*, is less than 200 mm from the surface of the pole and at least 500 mm from the vertical projection of the kerb line of any road.

TABLE 1: Heights of supporting platforms and mounted equipment

	Outside 500mm of the vertical projection of the kerbline (on the non road side) of any road	Elsewhere
Height above ground surface	3 600 mm	4 600 mm

Installation

11. Substations must be constructed to the requirements of a design that complies with the requirements of this Schedule.

Maintenance

12. (1) Substations, substation enclosures, associated plant, components and lines must be maintained in a safe operating condition.

(2) A system of maintenance must be instituted for substation buildings and enclosures and associated plant, equipment and lines, including—

(a) predetermined inspection programs to confirm the safe state of components; and

(b) regular maintenance programs consistent with manufacturers' recommendations and industry standards; and

(c) managed replacement programs for components approaching the end of their serviceable life.

(3) The maintenance program must comply with the industry standards.

APPENDIX

Standards, Codes, Guides and Other Documents Relating to Substations

In this Appendix—

"**ESAA**" means Electricity Supply Association of Australia;

"**IEC**" means International Electrotechnical Commission;

"**IP Code**" means International Protection Code.

Electrical Design

Switchgear assemblies & ancillary equipment - U>1kV	
General	AS 2067

Circuit Breakers & Ancillary Equipment

Classification of degrees of protection provided by enclosures for electrical equipment (IP Code)	AS 1939
High voltage, ac switchgear & control gear - circuit breakers - U>1000V	AS 2006

Switchgear Assemblies & Ancillary Equipment

High voltage, ac switchgear & control gear—	
Switches & disconnectors - 1kV to 52kV	AS 1025.1
Switches & disconnectors - U>52kV	AS 1025.2
Isolators & earthing switches	AS 1306
Fuse/switch & fuse/circuit breaker combinations	AS 2024
Common requirements	AS 2650
AC metal enclosed switchgear & control gear - 1kV to 72.5kV	AS 2086
AC insulation enclosed switchgear - 1kV to 38kV	AS 2264
Switchgear assemblies & ancillary equipment - U>1kV	AS 2067
Classification of degrees of protection provided by enclosures for electrical equipment (IP Code)	AS 1939
Insulating oil for transformers & switchgear	AS 1767

Control Equipment

Low voltage switchgear & control gear	AS 3947
General rules	AS 3947.1
Switches, disconnectors, switch disconnectors & fuse combination units	AS 3947.3
Contactors & motor starters: Electromechanical contactors & motor starters	AS 3947.4.1
Circuit control devices & switching elements: Electromechanical control circuit devices	AS 3947.5.1
Control circuit devices & switching elements: Proximity switches	AS 3947.5.2

Insulating Panels

Sheets & Boards for electrical purposes—

- Classification & general requirements . . . . . AS 1795.1
- Dimensions of switchboard panels . . . . . AS 1795.2

Power Transformers

- Power Transformers . . . . . AS 2374
  - General requirements . . . . . AS 2374.1
  - Temperature rise . . . . . AS 2374.2
- Insulation Levels & dielectric tests—
  - General requirements . . . . . AS 2374.3.0
  - External clearances in air . . . . . AS 2374.3.1
- Tappings & connections . . . . . AS 2374.4
- Ability to withstand short circuit . . . . . AS 2374.5
- Determination of transformer & reactor sound levels . . . . . AS 2374.6
- Insulating oil for transformers & switchgear . . . . . AS 1767

Bushings

Bushings for ac U>1000V . . . . . AS 1265

Surge Arresters

- Surge Arresters (diverters)—
  - Silicon carbide type for ac systems . . . . . AS 1307.1
  - Metal oxide type for ac systems . . . . . AS 1307.2

Batteries

- Stationary batteries—
  - Lead acid - vented type . . . . . AS 4029.1
  - Lead acid - valve regulated sealed . . . . . AS 4029.2
- Stationary batteries - lead acid - pure lead positive pasted type . . . AS 4029.3

Insulation Coordination

- Insulation Coordination—
  - Definitions, principles & rules . . . . . AS 1824.1
  - Phase to earth & phase to phase: Application Guide . . . . . AS 1824.2
- Insulation to coordination within LV systems: Principles, requirements & tests . . . . . IEC 664.1

Safety Clearances

- Classification of degrees of protection provided by enclosures for electrical equipment (IP Code) . . . . . AS 1939
- Switchgear assemblies & ancillary equipment - U>1kV . . . . . AS 2067

Buildings and Enclosures

Australian Building Code

Fixed platforms, walkways, stairways & ladders: Design construction & installation	AS 1657
The use of mechanical ventilation & air conditioning in buildings—	
Mechanical ventilation for acceptable indoor air quality	AS 1661.1
Fire & smoke control	AS 1661.2
Classification of degrees of protection provided by enclosures for electrical equipment (IP Code)	AS 1939
The storage & handling of flammable & combustible material	AS 1940
Oil containment	Environment Protection Authority
Fire protection of electricity substations	ESAA D(b)29
Electrical installations—	
Secondary batteries installed in buildings - Vented cells	AS 3011.1
Secondary batteries installed in buildings - Sealed cells	AS 3011.2

Switchyard Structures, Footings and Foundations

Minimum design loads on structures (Loading Code)	
Dead & live loads	AS 1170.1
Wind loads	AS 1170.2
Earthquake loads	AS 1170.4
Design of steel lattice towers & masts	AS 3995
Steel structures	AS 4100
Concrete structures	AS 3600

Maintenance

Guide to maintenance & supervision of insulating oils in service	AS 1883
Maintenance of electrical switchgear	AS 2467
Guide to the installation, maintenance, testing & replacement of secondary cells in buildings:	
Vented cells	AS 2676.1
Sealed Cells	AS 2676.2

SCHEDULE 5

Requirements for Earthing and Electrical Protection Systems
(Regulation 15)

PART A—PRELIMINARY

Interpretation

1. In this Schedule—

"**ESAA**" means Electricity Supply Association of Australia;

"**industry standards**" means the standards, codes, guides and other documents, as published from time to time, listed in the Appendix at the end of this Schedule;

"**neutral conductor**" means a conductor or a group of conductors of a multi-wired system of supply which is maintained at an intermediate and approximate uniform electrical potential in respect of the other conductors of the same circuit, or the conductor of a two-wire system that is earthed at its origin;

"**protective devices or equipment**" means devices or equipment intended to isolate the active conductors of a circuit in the event of an electrical fault.

PART B—DESIGN

General

1. (1) Earthing and protection systems must be designed to ensure—

(a) reliable passage of fault and Single Wire Earth Return (**SWER**) load currents to ground source; and

(b) reliable and speedy operation of circuit protection devices; and

(c) step, touch and transfer potentials with respect to assets associated with the circuit are safe; and

(d) detection and isolation of electrical conditions likely to significantly increase risk to people or cause significant damage to property,

and so as to comply with the industry standards.

(2) In determining abnormal electrical service conditions, due care must be given to the consideration of extremes that may occur, the likelihood of their occurrence and the associated risks.

Protection equipment and ancillaries

2. (1) Protection equipment including sensing mechanisms, operating mechanisms and ancillary circuits must be manufactured or purchased to industry standards whose requirements will ensure safe operational performance.

(2) Protection equipment and ancillaries must be manufactured and purchased so as to comply with the industry standards.

Earthing equipment and ancillaries

3. (1) Earthing systems must be designed to be constructed of corrosion resistant, high conductivity materials specifically manufactured for earthing electrical installations.

(2) Copper, copper alloy, aluminium, stainless steel or other materials having superior electrical conductivity and corrosion resistance must be used.

Earthing of low voltage electrical supply networks

4. (1) The earthing of low voltage electrical networks of supply must be designed to be a MEN system, unless otherwise approved by the Technical Regulator.

(2) A MEN system must be designed so that—

(a) a continuous neutral conductor connects all customers' premises in accordance with AS 3000; and

(b) the neutral conductor is connected to earth at each distribution substation or generator; and

(c) with the exception of cable guards used for the protection of cables on poles, every metallic part of equipment, including the reinforced metal of structures, at a height less than 2400 mm above ground on every structure that supports or encloses conductors used for the electricity supply network is earthed.

(3) A direct earthing system must be approved by the Technical Regulator and must be designed so that—

(a) a continuous earthed conductor connects—

(i) all customers' premises in accordance with AS 3000; and

(ii) the neutral conductor at the distribution substation or generator; and

(iii) every surge diverter,

to earth at the generating station or distribution substation only; and

(b) the earthed conductor is formed from—

(i) the metallic sheath of an insulated cable providing the LV supply to the customers' premises; or

(ii) a separate conductor of an insulated cable providing the LV supply to the customers' premises; or

(iii) a separate earthing conductor affixed to structures supporting the LV supply circuit to the customers' premises; and

(c) the system is earthed at the substations or generating stations.

Earthing of substations

5. Substations must be designed to have an earthing system that complies with the industry standards.

Protection systems for low voltage aerial lines and underground lines

6. (1) Each of the aerial and underground service lines of a transmission or distribution network must form part of a circuit that is protected by protective equipment that can isolate each of the active conductors of the electric lines.

(2) The following provisions relate to LV aerial and underground service lines of a transmission or distribution system:

(a) each aerial and underground service line must form part of a circuit that is protected by protective equipment that can isolate each of the active conductors of the electric lines;

(b) the protective equipment for aerial service lines must be installed—

(i) at or adjacent to the point of attachment; or

(ii) at or adjacent to any point where a customer's unmetered mains are attached to the customer's premises; or

(iii) at any pole to which a customer's mains are attached; or

(iv) at the operator's pole;

(c) the protective equipment for underground service lines must be installed—

(i) at or adjacent to the point where the service line is connected to the operator's supply mains; or

(ii) at the point or not more than 3000 mm from the point where the customer's mains commence; or

(iii) at or adjacent to the operator's apparatus located at the customer's premises provided that the unmetered portion of the customer's mains are installed in accordance with the requirements of Table 1 and—

(A) the customer's mains from the relevant depth set pit in Table 1 to the point where it enters the building must be provided with additional protection;

(B) the customer's main within the building must be enclosed in a heavy duty non-metallic conduit to AS 2053 (or its equivalent).

TABLE 1: **Customer mains**

Type of customer's mains cable	Minimum cover above cable protection/enclosure		
	Heavy duty non-metallic conduit to AS 2053	Medium or heavy galvanised steel tube to AS 1074	Buried direct using covered slabs
Stranded copper conductor, elastomer, thermoplastic or x.1.p.e. insulated single-core cable with elastomer or thermoplastic sheathing, complying with AS 3116, 3147 or 3198 for underground line	0.5 m	0.5 m	Not permitted
Stranded copper conductor, elastomer, thermoplastic or x.1.p.e. insulated multi-core cable with elastomer or thermoplastic sheathing, complying with AS 3116, 3147 or 3198 for underground line	0.5 m	0.5 m	0.5 m
Stranded copper conductor, neutral screened cable complying with As 3155 for underground line	0.5 m	0.5 m	0.5 m

Step and Touch Potentials

7. Uninsulated metal or concrete that—

(a) forms part of a circuit in a transmission or distribution network (excluding the current carrying conductors); and

(b) is accessible to persons; and

(c) may, in the event of a primary insulation failure of the circuit, be energised,

must be effectively earthed to comply with the requirements of Clause 12 of the ESAA *Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines* C(b)1, as published from time to time.

PART C—INSTALLATION OF EARTHING AND PROTECTION SYSTEMS

General

1. Earthing and protection systems must be installed in accordance with design requirements set out in this Schedule and so as to comply with the industry standards.

Connections and joints of earthing systems

2. Terminations to earthing conductors and joints in earthing conductors must be of a type that utilises materials and techniques specifically developed for earthing electrical installations to comply with the industry standards.

Mechanical strength and protection of earthing systems

3. Earthing conductors and other components of an earthing system must be installed in a manner that provides protection against likely mechanical damage, inadvertent interference and chemical deterioration.

PART D—MAINTENANCE

General

1. (1) Protection and earthing systems must be maintained to be in a safe operating condition.

(2) A system of maintenance must be instituted for protection and earthing systems and their components, including—

(a) predetermined inspection programs to confirm the safe state of components; and

(b) regular maintenance programs consistent with manufacturers' recommendations and industry standards; and

(c) managed replacement programs for components approaching the end of their serviceable life.

(3) The maintenance program must comply with the industry standards.

Inspection and testing of earthing systems

2. (1) Earthing systems must be inspected and tested at regular intervals to ensure that the design requirements of—

(a) resistance to the general mass of earth; and

(b) electrical capacity; and

(c) step, touch and transfer potentials; and

(d) corrosion resistance,

are being maintained.

(2) The condition of earthing systems must be verified by instruments designed for this purpose.

(3) Inspection and testing of earthing systems must be carried out to ensure the system complies with the industry standards.

Inspection and test results of earthing systems

3. The results of visual inspections and resistance to ground tests must be recorded and audited to identify changes that would influence the frequency of inspections, tests and maintenance.

Inspection and testing of protection systems

4. (1) Protection systems must be inspected and tested at regular intervals commensurate with the risk of damage to, or aging of components, or changes in the network electrical parameters, to ensure that the systems'—

(a) detection sensitivity; and

(b) speed of operation; and

(c) discrimination of load currents; and

(d) co-ordination with other protection systems,

are being maintained.

(2) The performance of protection systems must be verified by instruments designed for this purpose.

(3) Inspection and testing of protection systems must be carried out to ensure the system complies with the industry standards.

Inspection and test results from protection systems

5. The results of visual inspections and performance tests must be recorded and audited to identify changes that would influence the frequency of inspections, tests, maintenance and replacements.

APPENDIX

Standards, Codes, Guides and Other Documents Relating to Earthing and Electrical Protection Systems

In this Appendix—

"**ESAA**" means Electricity Supply Association of Australia;

"**IEEE**" means Institute of Electrical and Electronic Engineers.

Protection

All or nothing relays	AS 2481
Voltage transformers for measurement & protection	AS 1243
Current transformers for measurement & protection	AS 1675
Low voltage switchgear & control gear	AS 3947
General rules	AS 3947.1
Switches, disconnectors, switch disconnectors and fuse combination units	AS 3947.3
Contactors & motor starters: Electromechanical contactors & motor starters	AS 3947.4.1
Circuit control devices & switching elements: Electromechanical control circuit devices	AS 3947.5.1
Control circuit devices & switching elements: Proximity switches	AS 3947.5.2

Earthing

Switchgear assemblies & ancillary equipment - U>1kV	AS 2067 Appendix C
Substations, earthing guide	ESAA EG1
Guide to safety in substation grounding	IEEE 80
Customer installations	AS 3000 & AS 3001
Guidelines for the design & maintenance of overhead distribution & transmission lines—	
Stay wires	ESAA C(b)1 s. 13
Step & touch potentials	ESAA C(b)1 s. 13
Switchgear assemblies & ancillary equipment - U>1kV	AS 2067 Appendix C2.6
ESAA - Australian Telecommunications Commission - *Earth Potential Rise* Code of Practice	
ESAA - Australian Telecommunications Commission - *Earth Return High Voltage Power Lines* Code of Practice	

Maintenance	
Switchgear assemblies & ancillary equipment - U>1kV	AS 2067
Electrical installations	AS 3000
Guide to safety in substation grounding	IEEE 80
Guidelines for the design & maintenance of overhead distribution & transmission lines	ESAA C(b)1
ESAA - Australian Telecommunications Commission - *Earth Potential Rise* Code of Practice	
ESAA - Australian Telecommunications Commission - *Earth Return High Voltage Power Lines* Code of Practice	
Testing	
Earthing	AS 3000 IEEE 80 ESAA C(b)1

SCHEDULE 6

Clearance from Powerlines
(Regulations 43 and 45)

TABLE 1: Clearance distance between powerlines and certain structures

Direction of Distance from Powerlines for Certain Structures	**Type and Voltage of Powerline—Clearance distance in millimetres**					
	Other cable systems & service lines U≤ 1kV	U > 1kV U ≤ 33kV	U > 33kV U ≤ 132kV	U > 132kV U > 330kV	U > 220kV U ≤ 330kV	U > 330kV U ≤ 500kV
Vertically above those parts of a structure normally accessible to pedestrians	3700	4600	4600	6800	8000	9800
Vertically above those parts of a structure not normally accessible but on which a person can stand	2700	3700	4600	6000	7000	8000
In any direction from those parts of a structure not normally accessible to pedestrians	600	2700	3000	3700	4700	6400
In any direction from those parts of a structure normally accessible to pedestrians, windows openings or balconies	1500	2700	3000	4600	5500	6400
In any direction from a footbridge	4600	4600	4600	6800	8000	9800

54.

TABLE 2: Clearance distance between certain materials and powerlines

Direction of Distance from Powerlines for Certain Materials	**Type and Voltage of Powerline—Clearance distance in millimetres**					
	Other cable systems & service lines U≤ 1kV	U > 1kV U ≤ 33kV	U > 33kV U ≤ 132kV	U > 132kV U > 330kV	U > 220kV U ≤ 330kV	U > 330kV U ≤ 500kV
Any material—						
(a) horizontal distance	1500	2100	3000	4600	5500	6400
(b) vertical distance	3700	4600	4600	6800	8000	9800
Inflammable materials—						
(a) horizontal distances	3000	3000	3000	4600	5500	6400
(b) vertical distances	3700	4600	6800	6800	8000	9800

TABLE 3: Clearance distance between operation of certain machinery and powerlines

Direction of Distance from Powerlines for Certain Machinery	**Type and Voltage of Powerline—Clearance distance in millimetres**	
	Other cable systems and service lines *U* ≤ 66kV	*U* > 66kV
Vertical distance	2000	6000
Horizontal distance	2000	6000

TABLE 4: Clearance distance between erection of circuits or other cable systems and powerlines

Type or Circuit and Voltage		Clearance distance in millimetres		
Upper Circuit	Lower Circuit	Attached to a common structure	Between Structures	
			No wind condition	Wind condition
LV aerial line	Private powerline (LV) and other cable systems	900	Not permitted	Not permitted
LV aerial line	LV aerial line	380	600	380
Aerial lines U > 1kV V ≤ 11kV	Private powerline (LV) and other cable systems	1800	Not permitted	Not permitted
Aerial lines U > 1kV	LV aerial line or, Aerial lines < 11kV	1200	1200	600
Aerial lines U > 11kV U ≤ 33kV	Private powerline (LV) and other cable systems	1800	Not permitted	Not permitted
Aerial lines U > 11kV U ≤ 33kV	LV Aerial line or, Aerial lines < 33kV	1200	1200	750
Aerial lines U > 33kV U ≤ 66kV	Private powerline (LV) and other cable systems	2400	Not permitted	Not permitted
Aerial lines U > 33kV U ≤ 66kV	LV aerial line or, aerial lines < 66kV	1800	1800	1200

Notes relating to Table 4

1. Any combination of circuits not shown in Table 4 are not permitted.

2. For the purpose of Table 4—

   (a) no wind refers to—

      (i) undercrossing conductors at 15°C with no wind blowing; and

      (ii) overcrossing conductors at maximum design temperature with no wind blowing; and

   (b) wind refers to—

      (i) undercrossing conductors at 15°C, and displaced by a 500 Pa horizontal wind at right angles to the undercrossing conductors; and

      (ii) overcrossing conductors at maximum design temperature and not displaced by wind.

TABLE 5: Clearance distance between circuits and other cable systems and other structures

Any direction	**Clearance distance in millimetres**							
	Other cable system & U ≤ 1kV insulated conductor	U ≤ 1kV bare conductor	U > 1kV U ≤ 33kV insulated conductor	U > 1kV U≤ 33kV bare conductor	U > 33kV U ≤ 132kV	U > 132kV U ≤ 220kV	U > 220kV U ≤ 330kV	U > 330kV U ≤ 500kV
Clearance in any direction	100	1500	1500	2100	3000	4500	5000	6000

TABLE 6: Clearance distance between anything being transported and powerlines

Direction of Distance	**Clearance distance in millimetres**				
	Other cable system and U ≤ 1kV insulated conductor	U ≤ 132kV except for U ≤ 1kV insulated conductors	U > 132kV U ≤ 220kV	U > 220kV U ≤ 330kV	U > 330kV U ≤ 500kV
vertical distance	330	1500	3700	4700	6400
horizontal distance	300	1500	4600	5500	6400