

Australian/New Zealand Standard™

**Electrical installations—Extra-low
voltage d.c. power supplies and service
earthing within public
telecommunications networks**



AS/NZS 3015:2004

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Consumers Federation of Australia
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Australian/New Zealand Standard™

Electrical installations—Extra-low voltage d.c. power supplies and service earthing within public telecommunications networks

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-001, Wiring Rules, to supersede AS 3015—1993, *Electrical installations—Extra low-voltage d.c. power supplies within public telecommunications networks*.

The objective of this Standard is to establish safety requirements, consistent with maintaining continuity of essential supply, for the installation of extra-low voltage d.c. power supplies in restricted access locations of public telecommunications networks.

This standard is intended to apply only to installations constructed after its date of publication. The previous edition may be applied to upgrades to installation that were originally constructed prior to the publication of this edition.

Major changes to AS 3015—1993 are as follows:

- (a) The ventilation requirements for valve-regulated cells have been reviewed.
- (b) Requirements for colours of earthing conductors have been added.
- (c) Allowance has been made for the use of main distribution frame or single-point connection as the service earth bar frame in installations with the single power supply rated at less than 2.4 kW.
- (d) Requirements for equipotential bonding conductors for the lightning protection system have been added.
- (e) Appendix C has been extensively reviewed.
- (f) Provision has been made for sharing of sites by two or more carriers
- (g) Requirements for the protection of battery strings against overcurrent have been added
- (h) Requirements for the care and protection of batteries have been aligned with the following:

AS

3011	Electrical installations—Secondary batteries installed in buildings
3011.1	Part 1: Vented cells
3011.2	Part 2: Sealed cells
2676	Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings
2676.1	Part 1: Vented cells
2676.2	Part 2: Sealed cells

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

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FOREWORD

Most public telecommunications network equipment is powered commonly from a 48 V or less supply. This voltage is the nominal voltage between positive and negative regardless of which pole, if either, is earthed. Consequently, these supplies and their power distribution systems fall into the category of extra-low voltage (ELV), as defined in AS/NZS 3000.

The power supplies form an integral part of the public telecommunications facility and their proper function is vital to the continuation of such a facility, especially to essential services such as police, fire brigade and ambulance. The practices that are included in this Standard have been developed over many years of safe operation in public telecommunications networks.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical installations—Extra-low voltage d.c. power supplies and service earthing within public telecommunications networks**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for telecommunications ELV d.c. power supplies used by licensed public telecommunications carriers in the provision of public telecommunications networks where—

- (a) the carrier owns the d.c. power supply;
- (b) the d.c. power supply is located in a restricted access location;
- (c) the d.c. power supply is located in premises and land that are owned, leased or otherwise occupied in whole or in part by the telecommunications carrier; and
- (d) the power supply has a battery with a nominal rating of 2 A.h. or greater at the 10 h rate.

It specifies the minimum requirements for personal safety and safety from fire while maintaining the viability of the public telecommunications network.

1.2 APPLICATION

This Standard applies to the installation of ELV d.c. power supplies in restricted access locations of public telecommunications networks, e.g., telephone exchanges, telecommunications transmission sites and pair gain systems. Application of the requirements should ensure that the installation is safe and that continuity of the ELV d.c. supply is maintained at all times so that telecommunications services are available to agencies such as police, fire and ambulance authorities.

If there is conflict between the Section on ELV in AS/NZS 3000 or with any other Australian/New Zealand Standard, the provisions of this Standard shall apply to the ELV d.c. installations of public telecommunications carriers.

If there is conflict between this Standard and the requirements of the telecommunications carrier's internal documents, this Standard shall apply.

The appropriate requirements of AS/NZS 3000, AS/NZS 3100 and related Standards shall apply to power supplies that are not installed in restricted access locations within the telecommunications carrier's network.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1170	Minimum design loads on structures
1170.4	Part 4: Earthquake loads
1768	Lightning protection

AS

- 2676 Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings
- 2676.1 Part 1: Vented cells
- 2676.2 Part 2: Sealed cells
- 3011 Electrical installations—Secondary batteries installed in buildings
- 3011.1 Part 1: Vented cells
- 3011.2 Part 2: Sealed cells

AS/NZS

- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3008 Electrical installations—Selection of cables
- 3008.1.1 Part 1.1: Electrical installations—Selection of cables—Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions
- 3008.1.2 Part 1.2: Electrical installations—Selection of cables—Cables for alternating voltages up to and including 0.6/1 kV—Typical New Zealand installation conditions
- 3100 Approval and test specification—General requirements for electrical equipment
- 3439 Low voltage switchgear and controlgear assemblies
- 3439.2 Part 2: Particular requirements for busbar trunking systems (busways)
- 4836 Safe working on low-voltage electrical installations
- 5000 Electric cables—Polymeric insulated
- 5000.1 Part 1: For working voltages up to and including 0.6/1 kV
- 5000.2 Part 2: For working voltages up to and including 450/750 V
- 60079.10 Electrical apparatus for explosive gas atmospheres—Classification of hazardous areas (IEC 60079-10:2002 MOD)

NZS

- 4219 Specification for seismic resistance of engineering systems in buildings

ITU-T Recommendation

- K.27 Bonding configurations and earthing inside a telecommunication building

1.4 DEFINITIONS

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

1.4.1 Authorized personnel

Any person authorized by the telecommunications carrier.

1.4.2 Battery

An arrangement consisting of strings that may be electrically connected in a series, parallel or series-parallel arrangement to supply the voltage and current requirements of a connected load.

1.4.3 Battery rack

An open rack or pallet for supporting a battery.

1.4.4 Battery cabinet

A cabinet or enclosure suitable for mounting cells.

1.4.5 Battery room

A room intended for the installation of batteries.

1.4.6 Boost-charge (boost)

A charge at higher voltage than constant-potential (float) voltage. It is typically at 2.4 V and above for lead-acid cells and 1.55 V and above for nickel-cadmium cells.

1.4.7 Capacity

The quantity of electrical energy which a fully charged cell or battery can deliver under specified conditions.

NOTES:

- 1 Capacity is measured in ampere hours (A.h.) or in Watthours (W.h.).
- 2 The capacity of a cell or battery is denoted by the symbol C. As the capacity varies with rate of discharge, the symbol C is followed by a numerical suffix giving the rate of discharge. Thus C_{10} is the capacity in ampere hours at the 10 h rate of discharge. The specified temperature is usually 25°C. The final voltage depends on battery type and conditions of service.

Capacity may be specified as follows:

- (a) *Actual capacity* The quantity of electrical energy, in ampere hours, that can be withdrawn from a cell or battery for a specific set of operating conditions including discharge rate, temperature, initial state of charge, age, and final voltage.
- (b) *Rated capacity* The quantity of electrical energy in ampere hours, declared by the manufacturer, which a cell or battery can deliver after a full charge under specified conditions.

NOTE: The specified conditions are rate of discharge, final voltage and temperature.

1.4.8 Cell

An assembly of electrodes and electrolyte within a container, which constitutes the basic unit of a battery.

1.4.9 Charge (of a battery)

An operation during which a battery receives, from an external circuit, electrical energy which is then converted into chemical energy.

1.4.10 Charge/Discharge rate

The current at which a battery is charged or discharged, which may be expressed in amperes or as a multiple of the rated capacity of the battery (see Clause 1.4.7).

NOTE: For example, if a battery is rated at 500 A.h at the 10 h rate of discharge and is being discharged at a current of 50 A, its discharge rate is expressed as $0.1C_{10}$.

1.4.11 Constant-potential (float) operation

A method of maintaining a battery in a fully charged (float) state by applying a steady voltage above the open circuit voltage of the battery, but below the boost-charge voltage.

1.4.12 Converter

A device whereby electrical energy is converted to ELV d.c.

NOTE: A rectifier is considered to be a converter.

1.4.13 Equalizing charge

An extended charge to ensure complete charging of all the cells in a string or battery. Equalizing voltage is done at a voltage above float voltage and below equalizing and boost voltage.

1.4.14 Extra-low voltage (ELV)

A potential normally existing between conductors and between conductors and earth not exceeding 120 V ripple-free d.c.

1.4.15 High ohmic distribution (HOD)

A specialized d.c. distribution switchboard (cubicle or panel) and associated secondary d.c. distribution cabling for limiting voltage transients. The switchboard may be mounted in a rack with other power or telecommunications equipment.

1.4.16 Isolated bonding network (IBN)

A bonding network that has a single point of connection to the service earthing system at the single point connection (SPC).

1.4.17 Lead-acid cell

An electrochemical cell using lead oxide as the positive electrode, sponge lead as the negative electrode and sulphuric acid as the electrolyte.

1.4.18 Low ohmic distribution (LOD)

A d.c. distribution switchboard (cubicle or panel) and distribution cabling.

1.4.19 Live

A term applied to a conductor when there is a difference of potential between it and earth under normal conditions of operation.

1.4.20 Main service earthing conductor

The conductor that connects the telecommunications service earthing bar of an installation to the telecommunications service earthing electrode system.

1.4.21 May

Indicates that a statement is optional.

1.4.22 Monobloc

A secondary battery in which two or more cells are fitted in a multi-compartment container.

1.4.23 NiCd cell

An electrochemical cell using nickel oxide as the positive electrode, cadmium as the negative electrode and potassium hydroxide (or other alkali) as the electrolyte.

1.4.24 Nominal voltage of a cell

A stated value of voltage used to identify a type of cell. For the purpose of this Standard the nominal voltage of a lead-acid cell is 2.00 V, whether the cell is vented or valve-regulated and of a nickel-cadmium cell is 1.20 V, whether the cell is vented or valve-regulated.

1.4.25 Primary d.c. distribution

All the d.c. conductors and other equipment from the converter output terminals, up to and including the terminals of a battery and the input terminals of the first switchboard, which is the commencement of the secondary d.c. distribution.

1.4.26 Protective earthing

Connection to the general mass of the earth, in a manner that will ensure the electrical isolation of any defective equipment within a mains supplied electrical installation, through the operation of protective devices.

1.4.27 Public telecommunications carrier

Person or organization licensed by the Government of Australia or the Government of New Zealand as an authorized carrier of public telecommunications services.

1.4.28 Public telecommunications network

A network that is available for public telecommunications services. It is owned and operated by a public telecommunications carrier.

1.4.29 Restricted access location (RAL)

A location for equipment where both of the following apply:

- (a) Access can only be gained by authorized personnel, or by users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that must be taken.
- (b) Access is through the use of a special tool, or lock and key, or other means of security, and is controlled by the authority responsible for the location.

1.4.30 Secondary d.c. distribution

The first d.c. distribution switchboard and the protected circuits originating from it, for the purpose of distributing the d.c. power to the telecommunications equipment.

1.4.31 Service earthing bar (service earthing link)

The termination point for the main service earthing conductor and other service earthing and bonding conductors.

1.4.32 Shall

Indicates that a statement is mandatory.

1.4.33 Should

Indicates a recommendation.

1.4.34 Single point connection (SPC)

The connecting point for earthing and bonding conductors from the converter cubicle frame, the battery return and the service earthing system. Where multiple power supplies feed common equipment, one SPC is used.

1.4.35 String (of cells)

Two or more cells connected in series electrically, so as to provide the required terminal voltage.

1.4.36 Switchboard

An assembly of circuit protective devices, with or without switchgear, instruments or connecting devices, suitably arranged and mounted for distribution to, and protection of, one or more submains or final subcircuits or a combination of both.

1.4.37 Telecommunications facility

All or part of a site where telecommunications equipment comprising part of a public telecommunications network is installed.

1.4.38 Telecommunications service earth

A connection to the general mass of earth provided by the telecommunications carrier in a way that provides a functional requirement for the telecommunications equipment and cabling. Conductors used in a telecommunications service earthing system do not normally carry battery return current.

1.4.39 Valve-regulated cell

A cell that is closed under normal conditions but which has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value. Electrolyte is not normally added to a valve-regulated cell.

1.4.40 Vented (flooded) cell

A cell that is housed in a non-sealed container and which may require the addition of distilled water during its service life.

1.5 ALTERATIONS, ADDITIONS AND REPAIRS

In general, alterations, additions and repairs to an existing installation shall comply with the requirements of this Standard.

This requirement need not apply where the alteration or addition uses methods and equipment that were acceptable when the facility was installed, provided that the safety of the original installation is not affected. For example, where a power system has been designed to comply with the prevailing requirements, with specific provision for the addition of extra components such as converters or batteries, then the later installation of these components to the original Standard shall be adequate.

1.6 INSPECTION AND CERTIFICATION OF WORK

The telecommunications carrier's authorized representative shall be responsible for the inspection and certification of work covered by the provisions of this Standard.

SECTION 2 BATTERIES

2.1 GENERAL

The installation of batteries shall comply with AS 3011.1 and AS 3011.2, as applicable, except as varied in Clauses 2.2 to 2.5 of this Standard. These variations are based on the following:

- (a) The system operates only at extra-low d.c. voltage.
- (b) The battery is in a restricted access location.
- (c) There are specific ventilation requirements to control the hydrogen-air concentration.
- (d) Specific steps have been taken to minimize short-circuiting within the battery and primary d.c. distribution system.

Where there is conflict between the requirements of AS 3011.1 and AS 3011.2 and the requirements of this Standard, this Standard shall take precedence.

NOTE: Guidance on the installation, maintenance and testing of secondary batteries is given in AS 2676.1 and AS 2676.2.

2.2 BATTERY ARRANGEMENT

2.2.1 Location

Batteries shall be installed in restricted access locations. If the battery accommodation is ventilated in accordance with Clause 2.3, it shall be considered to be a non-hazardous area, with respect to an explosive gas atmosphere.

NOTES:

- 1 AS/NZS 60079.10 gives guidance on the classification of explosive gas atmospheres.
- 2 Converters, d.c. and a.c. switchboards, batteries and telecommunications equipment may be located within the same room, under the conditions of Clause 2.1, subject to appropriate aisle space and clearance requirements.
- 3 Cells may be mounted on racks or be located in cabinets, as appropriate to the type of cell and its application.

2.2.2 Battery layout

2.2.2.1 *Battery not in a cabinet*

The battery layout and floor area shall meet the following requirements:

- (a) The minimum aisle width shall be 600 mm or sufficient to facilitate removal of a cell or equipment from service, whichever is the greater.
- (b) Where the weight of individual cells, monoblocs or equipment exceeds the safe manual lifting limit, as prescribed by relevant regulatory authorities, the aisle width shall be sufficient to facilitate the use of mechanical handling equipment.
- (c) Where access is required to electrical equipment on one or more sides of an aisle for the purposes of operating control devices, the minimum aisle width shall be 900 mm except as varied below:
 - (i) Where doors on the electrical equipment are not readily removable and open to less than 170 degrees, the minimum aisle width shall be the width of the door plus 600 mm.
 - (ii) Where doors on the electrical equipment are not readily removable and open to at least 170 degrees, a minimum aisle width of 900 mm or the width of the door plus 200 mm, whichever is the greater, shall be provided.

- (iii) Where removable doors or panels are used on the electrical equipment, a minimum aisle width of 900 mm shall be provided.
- (d) Barriers, shrouds, panels or doors shall be provided to minimize the risk of cell damage or short-circuit where batteries are installed in or adjacent to areas where metallic equipment, iron work, equipment racks, and other equipment are commonly used. This requirement need not apply in a dedicated battery room.

2.2.2.2 Battery in a cabinet

Battery cabinets shall have doors or removable panels. Where cabinets with doors are used to enclose batteries or are located adjacent to batteries, the following clearances in front of the cabinets shall be provided:

- (a) Where doors on the cabinets are not readily removable and open to less than 170 degrees, the minimum aisle width shall be the width of the door plus 600 mm.
- (b) Where doors are not readily removable and open to at least 170 degrees, the minimum clearance shall be 600 mm or the width of the door plus 200 mm, whichever is the greater.
- (c) Where removable doors or panels are used, the minimum clearance shall be 600 mm. Removable doors or panels shall be able to be lifted by an individual, or a mechanism to move them shall be provided.

2.2.3 Cell arrangement

The following applies to cell arrangement:

- (a) The space between adjacent rows of cells shall be at least 10 mm, regardless of the cell arrangement or type, in order to reduce the risk associated with insulation failure between cells or monoblocs. The space between cell containers shall be at least 3 mm.
- (b) Valve-regulated lead-acid cells on float charge may suffer reduced field service life or even be destroyed as a result of thermal runaway by excessive cell internal heat build-up when not housed in a temperature-controlled environment. To reduce the risk of cells overheating the following actions are recommended:
 - (i) Application of float voltage temperature compensation.
 - (ii) Provision of space between cells for air circulation in accordance with Item (a) above.
 - (iii) Ventilation of battery enclosures and cabinets.
 - (iv) Positioning batteries away from direct sunlight and heat sources.
 - (v) Monitoring increases in normal float current.
- (c) Vented cells shall be accessible for examination of electrolyte level and for topping up.
- (d) Cells of all types shall be accessible for normal maintenance, inspection of terminals and voltage measurements.
- (e) A battery cabinet or rack shall be capable of providing support and restraint for the cells during seismic activity. Battery accommodation shall be capable of withstanding the earthquake forces given in AS 1170.4 in Australia or NZS 4219 in New Zealand to prevent collapse, sliding, overturning or the spilling of the cells from the cabinet or rack during a 'design' earthquake

NOTE: AS 1170.4 gives details of the seismic zone areas of Australia. NZS 4219 gives details of the seismic zone areas of New Zealand.

- (f) When more than one string of cells is used, they may be arranged in two or more rows, provided that access to any cell can be obtained by disconnecting only the affected battery string from the load.
- (g) Where valve-regulated cells are installed in sliding trays or drawers, maintenance access need only be provided in the withdrawn position. In this case, the tray or drawer shall be secured in the open position in such a manner that personnel can operate on the battery without having to hold the tray or to risk toppling the cells. When the tray or drawer is in the closed position, there shall be a minimum clearance of 12 mm between the non-insulated conductive parts of the battery and any other conductors. It shall not be possible to completely remove a sliding tray or drawer from its rack without the use of a tool.
- (h) Cells may be arranged so that personnel are required to reach over other cells. Where this is necessary, live terminals or parts shall be temporarily or permanently shrouded to reduce the risk of short-circuits.
- (i) For batteries on racks, durable protection against accidental exposure (by impact) of live terminals or connectors shall be provided with a shroud to all accessible termination points of cells or monoblocs. The shroud shall be securely fixed into position so as to avoid accidental exposure. To avoid the possibility of accidentally dislodging the protective shrouds, battery racks shall be designed to provide a recess of at least 50mm for the cells inside the outer vertical face of the structure unless they are covered by additional physical protection.

2.2.4 Barriers

Barriers or shrouding shall be provided where there is a risk of injury to personnel or damage to the cells from the movement of heavy or conducting objects.

2.2.5 Battery isolation

Each string of cells shall be provided with a separate convenient and safe means of electrical isolation from the primary d.c. distribution system for maintenance purposes.

2.2.6 Overcurrent protection

Overcurrent and short-circuit protection shall be provided for battery strings as close as practicable to the string.

The battery shall be protected by either—

- (a) providing overcurrent protection on each string; or
- (b) providing alarms, installed in accordance with carrier's emergency services requirements, requiring immediate response in the event of imminent failure of a battery.

If option (b) is used, provision shall be made for quick and safe manual or automatic isolation of the defective battery string or strings.

The protective devices may be fitted in either the live non-earthed pole only or, where neither pole is earthed, in both poles. The nominal rating of the protective devices should exceed the maximum expected current drain from the strings such that removal of a string or pair of strings will not result in the increased current drain exceeding the nominal rating of the remaining protective devices.

2.2.7 Earthing of battery cabinets

Battery cabinets and stands shall be bonded to the telecommunications earthing system. A single bonding conductor linking all battery cabinets or stands to the SPC is satisfactory. The equipotential bonding conductor shall have a minimum size of 16 mm².

2.3 VENTILATION

NOTE: Appendix A gives details on ventilation together with sample calculations.

2.3.1 Arrangement of ventilation

NOTE: AS 2676.1 provides guidance on the arrangement of vented cells. NZS 4219 gives details of the seismic zone areas of New Zealand.

2.3.2 Rate of ventilation

The average hydrogen concentration by volume in a battery room or enclosure shall be maintained below 2%. The minimum exhaust ventilation rate required to maintain hydrogen concentration below 2% is calculated by means of the following equation:

$$q_v = 0.006 nI \quad \dots 1$$

where

q_v = minimum exhaust ventilation rate, in litres per second

n = number of battery cells

I = charging rate, in amperes (see Clause 2.3.3)

NOTE: The derivation of equation (1) is given in Paragraph A2, Appendix A.

If there is more than one battery in a room or enclosure, then the total exhaust ventilation rate is the sum of the rates of all the batteries.

2.3.3 Charging rate

2.3.3.1 Vented batteries

For vented batteries, the charging rate in Equation (1) is the maximum output rating of the convertor or the rating of the output fuse or circuit breaker of the convertor.

2.3.3.2 Valve-regulated batteries

For valve-regulated batteries, the charging rate (I) in Equation (1) is determined for two conditions as follows:

- (a) *Condition I* If the convertor does not have an automatic overvoltage cut-off, the charging current is the maximum output rating of the convertor or the rating of the output fuse or circuit breaker of the convertor.
- (b) *Condition II* If the convertor has an automatic overvoltage cut-off that is operated at no more than 3% above a voltage of 2.40 V per cell and is delayed by no more than 15 s, the charging rate is—
 - (i) 0.5 A for each 100 A.h at the 10 h rate of discharge of battery capacity for lead-acid batteries; and
 - (ii) 1.5 A for each 100 A.h at the 10 h rate of discharge of battery capacity for nickel-cadmium batteries.

NOTE: These charging rates are based on a float voltage of 2.27 V per cell for lead-acid batteries and 1.45 V per cell for nickel-cadmium batteries and have been selected to provide a safe level of ventilation for all types of battery construction. The charging rates are referenced at 25°C and are subject to the battery manufacturer's recommendations at other temperatures.

2.3.3.3 *Boost-charging*

The charging rate shall be determined in accordance with Clauses 2.3.3.1 and 2.3.3.2.

NOTES:

- 1 Where only one of several converters is required for the boost charging, the output current of one converter need only be used for the calculation.
- 2 Where several converters are used for boost charging by operation of one common switch, the summed total of their output currents should be used for the calculation.

2.3.4 **Method of ventilation**

2.3.4.1 *General*

Where possible, natural ventilation should be used for battery rooms and enclosures because of the fault potential of mechanical ventilation.

2.3.4.2 *Natural ventilation*

If natural ventilation is used, the minimum unobstructed size of inlet and outlet apertures is determined from the following equation:

$$A = 100 q_v \quad \dots 2$$

where

A = minimum area of the apertures, in square centimetres

q_v = minimum exhaust ventilation rate, in litres per second (see Clause 2.3.2)

With natural ventilation, an air velocity of at least 0.1 m/s is assumed to flow through the apertures.

2.3.5 **Batteries in enclosures**

For batteries mounted in cabinets, the ventilation rate between the enclosure and room shall be not less than that calculated in Clause 2.3.2. Where natural ventilation is utilized, a vent aperture shall be provided at the lowest (inlet) and the highest (outlet) points in the room or enclosure to avoid the accumulation of gas. The unobstructed vent aperture area (A) shall be calculated in square centimetres, on the following basis:

$$A > Q \times 100 \text{ cm}^2 \quad \dots 3$$

The minimum area of actual vent aperture shall be 5 cm². Provision shall be made for any filtering or vermin proofing installed.

NOTES:

- 1 This equation is based on an air velocity of at least 0.1 m/s through the ventilation aperture.
- 2 Natural ventilation is the preferred option. The use of passive devices to enhance air movement should be considered in the design of the enclosure.

2.3.6 **Battery cabinets within buildings**

Where batteries are mounted in a cabinet within a building, the ventilation rate for the cabinet and building shall be not less than that calculated in Clause 2.3.2.

2.3.7 **Boost-charging of vented cells**

Where additional ventilation is required as a result of the boost-charging of vented cells, the following methods are acceptable:

- (a) *Automatic* The permanently connected additional ventilation automatically operates whenever the charger is in the boost-charge mode.
- (b) *Manual* The permanently connected additional ventilation may be controlled manually by personnel carrying out a boost-charge providing clear unambiguous mandatory instructions are clearly displayed at a location adjacent to the boost-charge switch.

- (c) *Separate additional ventilation* Where it is impracticable to provide permanent additional ventilation, portable ventilators are provided and used during boost charging. Labelling adjacent to the boost-charge switch shall clearly state the requirement for, and details of, the additional ventilation to be provided.

Where a separate portable charger is required to boost-charge the battery, additional ventilation and labelling as in Items (b) or (c) shall be provided.

2.4 INTERMEDIATE VOLTAGES

The battery shall not be tapped at any intermediate voltage for the purpose of supplying power to any load, because of the increased risk of some cells reaching gassing voltages while other cells in the same string of cells are discharging. This shall not preclude the connection of cell monitoring or control devices.

NOTE: There is also a serious risk of reduced battery capacity and life expectancy as a result of the tapped load.

2.5 CHARGING AND MAINTENANCE

Appropriate charging and cell replacement regimes shall be observed.

The thermal management of valve-regulated cells during recharge is more critical than for vented cells, and generally the valve-regulated cell will be irreversibly damaged when subjected to sustained electrical abuse.

SECTION 3 DIRECT CURRENT DISTRIBUTION AND PROTECTION

3.1 GENERAL

The installation of ELV d.c. distribution and protection shall comply with the requirements of AS/NZS 3000, except as varied by Clauses 3.2 to 3.16 of this Standard.

The reasons for departure from AS/NZS 3000 are the need to ensure the viability of the public telecommunications network and the need to ensure continuity of supply at all times.

To ensure reliable operation of the ELV d.c. system, the following matters should be considered:

- (a) Use of converters as a primary source.
- (b) Provision of standby generating sets.
- (c) Provision of batteries.
- (d) Duplication of converter and battery sources, recognizing redundancy and the need to isolate supply components for maintenance without shutting down the system.
- (e) Duplication of reticulation.
- (f) Equipment capacity and design for emergency overload operation.

3.2 CIRCUIT ARRANGEMENT

A typical ELV d.c. distribution system, as shown in Figure 3.1, includes the following:

- (a) One or more converters.
- (b) Battery.
- (c) Primary d.c. distribution.
- (d) Secondary d.c. distribution.
- (e) Telecommunications equipment.

It does not include wiring in racks, HODS and switchboards.

3.3 DESIGN REQUIREMENTS

To ensure continuity of operation of the public telecommunications network, automatic disconnection of the total battery installation is undesirable. At network critical sites, automatic disconnection of the total battery is not normally permissible; however, the provision of low voltage disconnection for the battery is permissible. These undervoltage devices are often needed (particularly in smaller unmanned sites) to prevent destructive discharge of the batteries, or sometimes to prevent overload of equipment (due to undervoltage), and subsequent fire hazards.

NOTE: At solar-powered installations, disconnection of the battery could result in the open circuit solar array voltage being applied to the telecommunications load, thereby destroying the equipment due to overvoltage. In any such non-network critical applications, it is recommended that the load be disconnected, under extreme high or low voltage conditions, and not the battery.