



## **Substations and high voltage installations exceeding 1 kV a.c.**



This Australian Standard® was prepared by Committee EL-043, High Voltage Installations. It was approved on behalf of the Council of Standards Australia on 4 August 2016. This Standard was published on 14 September 2016.

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The following are represented on Committee EL-043:

- Australian Chamber of Commerce and Industry
  - Australian Industry Group
  - Bureau of Steel Manufacturers of Australia
  - CIGRE
  - Communications, Electrical and Plumbing Union—Electrical Division
  - Consult Australia
  - Department of Industry, Skills and Regional Development, NSW
  - Department of Mines and Petroleum, WA
  - Electrical Regulatory Authorities Council
  - Energy Networks Association
  - Engineers Australia
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- 

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Australian Standard<sup>®</sup>

**Substations and high voltage  
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## PREFACE

This Standard was prepared by the Standards Australia Committee EL-043, High Voltage Installations, to supersede AS 2067—2008, *Substations and high voltage installations exceeding 1 kV a.c.*

The objective of this Standard is to provide common rules for the design and the erection of electrical power installations in systems with nominal voltages above 1 kV a.c. and nominal frequency up to and including 60 Hz.

The objective of this revision is to incorporate changes derived from experience and feedback following the issue of the 2008 edition of this Standard, amendments that have been made to IEC 61936, and to incorporate review of consideration of fire issues, requirements related to the mining area for fixed installations, as considered by EL-023, Electrical Equipment in Mines and Quarries, and substantially expand the sections and clauses on earthing, following reference to ENA's Handbook ENA Doc 025, EG-0 on earthing.

This Standard is based on but not equivalent to IEC 61936-1:2010, *Power installations exceeding 1 kV a.c.*, Part 1: *Common rules*, and its Amendment 1 (2014).

Where a reference is made to 'national regulations', it is intended to encompass national, state or territory and local regulations.

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

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

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## STANDARDS AUSTRALIA

### Australian Standard

## Substations and high voltage installations exceeding 1 kV a.c.

### SECTION 1 SCOPE AND GENERAL

#### 1.1 SCOPE

This Standard provides minimum requirements for the design and erection of high voltage installations in systems with nominal voltages above 1 kV a.c. and nominal frequency up to and including 60 Hz, so as to provide safety and proper functioning for the use intended.

For the purposes of this Standard, a high voltage installation is considered to be:

- (a) An electricity network substation, under the control of an electricity network operator or entity authorized by a licence or other legal instrument to convey electricity.
- (b) The high voltage parts of an electrical installation of a power station including all auxiliary systems and interconnecting lines and cables between power stations if on the same site.
- (c) Electrical installations built at offshore platforms, e.g. offshore wind power farms.
- (d) The high voltage parts of an electrical installation that are not covered in (a) or (b) above. This may include but not be limited to consumer and customer electrical installations serving premises such as factories, commercial facilities, industrial plants, institutional facilities and mine sites.

A high voltage installation includes, but is not limited to, the following equipment:

- (i) High voltage electrical installations on masts, poles and towers.
- (ii) Switchgear and/or transformers and/or electrical equipment located outside a closed electrical operating area.
- (iii) Rotating electrical machines.
- (iv) Switchgear, controlgear and assemblies.
- (v) Transformers and reactors.
- (vi) Converters.
- (vii) Cables.
- (viii) Lines.
- (ix) Wiring systems.
- (x) Batteries, battery chargers and associated d.c. supply systems.
- (xi) Capacitors.
- (xii) Earthing systems.
- (xiii) Buildings and fences that are part of a closed electrical operating area.
- (xiv) Associated protection, control, auxiliary and ancillary systems.
- (xv) Structures, foundations, earthworks and drainage.

NOTE: In general, a product Standard for an item of equipment takes precedence over this Standard.

This Standard does not apply to the design and erection of any of the following:

- (A) Overhead lines and underground cables between separate installations.
- (B) Installations on ships and off-shore installations in accordance with IEC 61892 series.
- (C) Underground parts of mine site electrical installations, or parts of such installations, for which mining industry specific legislation sets other requirements.
- (D) Switchgear and/or transformers and/or electrical equipment located within a closed electrical operating area supplied at low voltage and where contact cannot be made with high voltage conductors.
- (E) Test sites.

## 1.2 APPLICATION

### 1.2.1 General

Substations and HV installations shall be designed to fulfil their functional aspects and also to allow safe operation and maintenance. Operational and maintenance requirements are covered in documents such as AS 5804 series and the ENA NENS guidelines.

This Standard does not apply to the design of factory-built, type-tested equipment for which separate Australian Standards exist (or IEC Standards where Australian Standards do not exist) to the extent of the scope of the Standards. However, all other requirements of this Standard not covered by the type tests for the type-tested equipment shall comply with this Standard. In particular, ground safety clearances and section safety clearances shall comply with this Standard.

The relevant regulatory authority or electricity network operator may require proof that the design and construction of the high voltage electrical installation complies with this Standard and other relevant Standards and regulatory requirements, including local service and installation rules. Therefore the relevant regulatory authority or electricity network operator should be consulted prior to commencement of the design of the installation.

#### NOTES:

- 1 Users of this Standard should be aware of existing local, state territory and national regulations.
- 2 Further requirements for specific locations may also be referenced or applied through legislation.
- 3 High voltage a.c. installations associated with electric traction systems are included in the scope of this Standard.

### 1.2.2 Existing installations

Existing installations are not automatically required to comply with this Standard.

In recognition of changes introduced, existing installations should be reviewed against the requirements of this Standard.

## 1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

NOTE: Documents for informative purposes are listed in the Bibliography.

#### AS

1170	Structural design actions
1170.4	Part 4: Earthquake actions in Australia
1210	Pressure vessels
1319	Safety signs for the occupational environment

AS	
1824	Insulation co-ordination
1824.1	Part 1: Definitions, principles and rules
1824.2	Part 2: Application guide
1905	Components for the protection of openings in fire-resistant walls
1905.1	Part 1: Fire-resistant doorsets
1931	High-voltage test techniques
1931.1	Part 1: General definitions and test requirements
1940	The storage and handling of flammable and combustible liquids
2293	Emergency escape lighting and exit signs for buildings
2293.3	Part 3: Emergency escape luminaires and exit signs
2676	Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings (series)
2865	Confined spaces
3600	Concrete structures
3700	Masonry structures
4100	Steel structures
60529	Degrees of protection provided by enclosures (IP Code)
62271	High-voltage switchgear and controlgear
62271.1	Part 1 Common specifications
62271.200	Part 200: a.c. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (IEC 62271-200, Ed. 1 (2003) MOD)
62271.201	Part 201: High-voltage switchgear and controlgear—AC insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
62271.202	Part 202: High-voltage switchgear and controlgear—High-voltage/low voltage prefabricated substation
62271.203	Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
AS ISO	
10007	Quality management systems—Guidelines for configuration management
AS/NZS	
1170	Structural design actions
1170.0	Part 0: General principles
1170.1	Part 1: Permanent, imposed and other actions
1170.2	Part 2: Wind actions
1170.3	Part 3: Snow and ice actions
1768	Lightning protection
2344	Limits of electromagnetic interference from overhead a.c. powerlines and high voltage equipment installations in the frequency range 0.15 to 1000 MHz
2802	Electric cables—Reeling and trailing for mining and general use (other than underground coal mining)
3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS/NZS	
3008	Electrical installations—Selection of cables
3008.1.1	Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV— Typical Australian installation conditions
7000	Overhead line design—Detailed procedures
60076	Power transformers
60076.2	Part 2: Temperature rise for liquid-immersed transformers (IEC 60076-2, Ed.3.0 (2011) MOD)
60079	Explosive atmospheres
60079.10.1	Part 10.1: Classification of areas—Explosive gas atmospheres (IEC 60079-10-1, Ed.1.0 (2008) MOD)
60079.10.2	Part 10.2: Classification of areas—Combustible dust atmospheres
60479	Effects of current on human beings and livestock
60479.1	Part 1: General aspects
IEC	
60071	Insulation co-ordination
60071-1	Part 1: Definitions, principles and rules
60071-2	Part 2: Application guide
60255	Measuring relays and protective equipment (series)
60287	Electric cables—Calculation of the current rating (series)
60865	Short-circuit currents—Calculation of effects
60865-1	Part 1: Definitions and calculation methods
60909	Short-circuit currents in three-phase a.c. systems (series)
60949	Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects
61219	Live working—Earthing or earthing and short-circuiting equipment using lances as a short-circuiting device—Lance earthing
61230	Live working—Portable equipment for earthing or earthing and short- circuiting
IEC/TS	
60815	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
60815-1	Part 1: Definitions, information and general principles
60815-2	Part 2: Ceramic and glass insulators for a.c. systems
60815-3	Part 3: Polymer insulators for a.c. systems
IEC/TR	
61000	Electromagnetic compatibility (EMC)
61000-5-2	Part 5-2: Installation and mitigation guidelines—Earthing and cabling
Australian Building Code Board (ABCB)	
NCC	National Construction Code

## 1.4 DEFINITIONS

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

### 1.4.1 Automatic reclosing

Automatic reclosing of a circuit-breaker associated with a faulted section of a network after an interval of time that permits that section to recover from a transient fault.