

Australian Standard[®]

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

STANDARDS
Australia



This Australian Standard® was prepared by Committee EL-043, High Voltage Installations. It was approved on behalf of the Council of Standards Australia on 6 November 2008. This Standard was published on 12 December 2008.

The following are represented on Committee EL-043:

- Association of Consulting Engineers Australia
 - Bureau of Steel Manufacturers of Australia
 - CIGRE
 - Electrical Regulatory Authorities Council
 - Energy Networks Association
 - Engineers Australia
 - Institute of Electrical Inspectors
-

This Standard was issued in draft form for comment as DR 07281.

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.

Keeping Standards up-to-date

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting www.standards.org.au

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.org.au, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard[®]

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

First published (as AS C13, being endorsement of BS 158:1961 with Australian amendment; AS C52, being endorsement of BS 159:1957 with Australian amendment; and AS C340, being endorsement of BS 162:1962 with Australian amendment) 1967.

AS 2067 first published 1977.

Fourth edition 2008.

Reissued incorporating Amendment No. 1 (February 2010).

COPYRIGHT

© Standards Australia

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 8979 X

PREFACE

This Standard was prepared by the Standards Australia Committee EL-043, High Voltage Installations, to supersede AS 2067—1984, *Switchgear assemblies and ancillary equipment for alternating voltages above 1 kV*.

This Standard incorporates Amendment No. 1 (February 2010). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

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.

In the preparation of this Standard, consideration was given to IEC 61936-1:2002 *Power installations exceeding 1 kV a.c.—Part 1: Common rules*, and its proposed revision (IEC 61936-1 CDV/2008.05), and acknowledgement is made of the assistance received.

A1 | Following publication of this Standard, AS/NZS 3000:2007 is to be amended such that, in Australia, those portions of electrical installations operating at high voltage shall be designed and installed in accordance with this Standard. Appendix K of AS/NZS 3000:2007 will be deleted when this Standard is published.

Where a reference is made to ‘national regulations’, it is intended to encompass national, state 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.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 REFERENCED DOCUMENTS	6
1.3 DEFINITIONS	10
SECTION 2 FUNDAMENTAL REQUIREMENTS	
2.1 GENERAL	19
2.2 ELECTRICAL REQUIREMENTS	20
2.3 STRUCTURAL REQUIREMENTS	22
2.4 CLIMATIC AND ENVIRONMENTAL CONDITIONS	24
2.5 SPECIAL REQUIREMENTS	26
SECTION 3 INSULATION COORDINATION	
3.1 GENERAL	28
3.2 SELECTION OF INSULATION LEVEL	28
3.3 VERIFICATION OF WITHSTAND VALUES	28
3.4 MINIMUM CLEARANCES OF LIVE PARTS	29
3.5 MINIMUM CLEARANCES BETWEEN PARTS UNDER SPECIAL CONDITIONS	32
3.6 TYPED TESTED EQUIPMENT	32
SECTION 4 EQUIPMENT	
4.1 GENERAL REQUIREMENTS	33
4.2 SPECIFIC REQUIREMENTS	34
SECTION 5 INSTALLATIONS	
5.1 MINIMUM REQUIREMENTS	43
5.2 OUTDOOR INSTALLATIONS OF OPEN DESIGN	47
5.3 INDOOR INSTALLATIONS OF OPEN DESIGN	55
5.4 INSTALLATION OF PREFABRICATED TYPE-TESTED SWITCHGEAR	55
5.5 REQUIREMENTS FOR BUILDINGS	57
5.6 HIGH VOLTAGE/LOW VOLTAGE PREFABRICATED SUBSTATIONS	61
5.7 ELECTRICAL INSTALLATIONS ON A MAST, POLE OR TOWER	61
SECTION 6 SAFETY MEASURES	
6.1 GENERAL	62
6.2 PROTECTION AGAINST DIRECT CONTACT	62
6.3 MEANS TO PROTECT PERSONS FROM INDIRECT CONTACT	64
6.4 MEANS TO PROTECT PERSONS WORKING ON OR NEAR ELECTRICAL INSTALLATIONS	64
6.5 PROTECTION FROM DANGER RESULTING FROM ARC FAULT	67
6.6 PROTECTION AGAINST DIRECT LIGHTNING STRIKES	67
6.7 PROTECTION AGAINST FIRE AND EXPLOSIONS	68
6.8 PROTECTION AGAINST LEAKAGE OF INSULATING LIQUID AND SF ₆	77
6.9 IDENTIFICATION AND MARKING	79

SECTION 7 PROTECTION, CONTROL AND AUXILIARY SYSTEMS	
7.1	DETERMINING THE NEED FOR PROTECTION 83
7.2	MONITORING AND CONTROL SYSTEMS 83
7.3	A.C. AND D.C. SUPPLY CIRCUITS 84
7.4	COMPRESSED AIR SYSTEMS 86
7.5	SF ₆ GAS HANDLING PLANT 86
7.6	BASIC RULES FOR ELECTROMAGNETIC COMPATIBILITY OF CONTROL SYSTEMS 87
SECTION 8 EARTHING SYSTEMS	
8.1	GENERAL 90
8.2	FUNDAMENTAL REQUIREMENTS 90
8.3	DESIGN OF EARTHING SYSTEMS 92
8.4	CONSTRUCTION OF EARTHING SYSTEMS 95
8.5	COMMISSIONING AND ONGOING MONITORING 96
8.6	RISK REVIEW AND DOCUMENTATION 96
SECTION 9 INSPECTION AND TESTING	
9.1	INSPECTIONS AND TESTS 97
9.2	DOCUMENTATION AND RECORDS 98
9.3	VERIFICATION OF SPECIFIED PERFORMANCES 98
9.4	TESTS DURING INSTALLATION AND COMMISSIONING 98
9.5	TRIAL RUN 98
SECTION 10 OPERATION AND MAINTENANCE MANUAL	
SECTION 11 ADDITIONAL REQUIREMENTS FOR CONSUMER HIGH VOLTAGE INSTALLATIONS	
11.1	DESCRIPTION OF INSTALLATIONS 100
11.2	PRELIMINARY CONSIDERATIONS 100
11.3	TESTING AND VERIFICATION 100
APPENDICES	
A	VOLTAGE LIMITS 101
B	DISTRIBUTION SUBSTATIONS EARTHING SYSTEM 105
C	FIRE RISK ZONES FOR DISTRIBUTION SUBSTATIONS 113
D	EMF AND SAFETY ISSUES 121
E	(Deleted) 121

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) The high voltage parts of an electrical installation that are not covered in (a) and (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 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 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.