

AS/NZS 4509.1:2009

Reconfirmed 2017

AS/NZS 4509.1:2009

Australian/New Zealand Standard™

**Stand-alone power systems**

**Part 1: Safety and installation**

**STANDARDS**  
Australia



**STANDARDS**  
NEW ZEALAND  
PAEREWA AOTEAROA



## **AS/NZS 4509.1:2009**

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-042, Renewable Energy Power Supply Systems and Equipment. It was approved on behalf of the Council of Standards Australia on 16 September 2009 and on behalf of the Council of Standards New Zealand on 4 December 2009. This Standard was published on 21 December 2009.

---

The following are represented on Committee EL-042:

Australian Industry Group  
Clean Energy Council  
Electrical Regulatory Authorities Council  
Electrical Safety Organisation (New Zealand)  
Electricity Engineers Association (New Zealand)  
ElectroComms and Energy Utilities Industries Skills Council  
Energy Efficiency and Conservation Authority of New Zealand  
Energy Networks Association  
Institution of Professional Engineers New Zealand  
Ministry of Economic Development (New Zealand)  
National Electrical and Communications Association  
New Zealand Electrical Institute  
Research Institute for Sustainable Energy  
Sustainable Electricity Association (New Zealand)  
The University of New South Wales

---

### **Keeping Standards up-to-date**

Standards are living documents which 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 Standards may also be withdrawn.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 which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at [www.saiglobal.com.au](http://www.saiglobal.com.au) or Standards New Zealand website at [www.standards.co.nz](http://www.standards.co.nz) and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

---

*This Standard was issued in draft form for comment as DR 08125.*

---

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

---

**RECONFIRMATION  
OF  
AS/NZS 4509.1:2009  
Stand-alone power systems  
Part 1: Safety and installation**

---

**RECONFIRMATION NOTICE**

Technical Committee EL-042 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 10 October 2016.

Approved for reconfirmation in New Zealand on behalf of the Standards Council of New Zealand on 13 December 2016.

The following are represented on Technical Committee EL-042:

Australasian Fire and Emergency Service Authorities Council  
Australian Energy Council  
Australian Energy Market Operator  
Australian Industry Group  
Australian PV Institute  
Australian Solar Council  
Clean Energy Council  
Clean Energy Regulator  
Construction, Environment and Workplace Protection, ACT Government  
Consumer Electronics Suppliers Association  
CSIRO  
Electrical Compliance Testing Association  
Electrical Regulatory Authorities Council  
Electrical Safety Organisation (New Zealand)  
Electricity Engineers Association (New Zealand)  
Energy Networks Association  
Engineers Australia  
Institute of Electrical and Electronics Engineers  
Institute of Electrical Inspectors  
Joint Accreditation System of Australia and New Zealand  
Master Electricians Australia  
National Electrical and Communications Association  
New Zealand Electrical Institute  
NSW Fair Trading  
Office of the Technical Regulator (SA)  
Solar Energy Industries Association  
Sustainable Electricity Association New Zealand  
Sustainable Energy Association  
The University of New South Wales  
Worksafe New Zealand

Australian/New Zealand Standard™

**Stand-alone power systems**

**Part 1: Safety and installation**

Originally in Australia as AS 4509.1—1999 and AS 4509.3—1990.  
Jointly revised, amalgamated and designated as AS/NZS 4509.1:2009.

**COPYRIGHT**

© Standards Australia/Standards New Zealand

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.

Jointly published by Standards Australia, GPO Box 476, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6140

ISBN 0 7337 9343 6

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-042, Renewable Energy Power Supply Systems and Equipment. This Standard supersedes AS 4509.1—1999 and AS 4509.3—1999 on publication.

The object of this Standard is to specify essential safety and installation requirements for stand-alone power systems used for the supply of extra-low (ELV) and low voltage (LV) electric power.

This Standard was prepared following requests from interests involved in the solar energy industry who considered there is need for Standards covering safety, design, installation and maintenance procedures appropriate to the industry.

This Standard is Part 1 of a series, which consists of the following:

### **AS/NZS**

#### **4509 Stand-alone power systems**

##### **4509.1 Part 1: Safety and installation (this Standard)**

##### **4509.2 Part 2: System design guidelines**

It is assumed that persons designing and/or installing stand-alone power systems have access to, and understand the requirements of, AS/NZS 3000.

This Standard was revised to—

- (a) incorporate AS 4509.1 and AS 4509.3 into one document;
- (b) make the Standard a joint Australian/New Zealand Standard;
- (c) expand and clarify the general requirements for the safe installation of stand-alone power systems;
- (d) include information on the connection of stand-alone power systems to loads; and
- (e) clarify and expand requirements for battery enclosures.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendices to which they apply. A ‘normative’ appendix is an integral part of a Standard whereas an ‘informative’ appendix is for information. Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

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

## CONTENTS

	<i>Page</i>
<b>SECTION 1 SCOPE AND GENERAL</b>	
1.1 SCOPE .....	5
1.2 APPLICATION .....	5
1.3 REFERENCED DOCUMENTS .....	5
1.4 DEFINITIONS .....	6
<b>SECTION 2 GENERAL REQUIREMENTS</b>	
2.1 A.C. OUTPUT VOLTAGE.....	9
2.2 APPLICATION OF AS/NZS 3000 .....	9
2.3 SIGNS .....	9
2.4 INFORMATION SIGN FOR EMERGENCY SERVICES .....	9
2.5 SHUTDOWN PROCEDURE .....	10
2.6 IDENTIFICATION AND LOCATION OF EQUIPMENT .....	10
2.7 METERS AND INFORMATIVE DISPLAYS.....	10
2.8 MECHANICAL AND THERMAL PROTECTION OF EQUIPMENT .....	10
<b>SECTION 3 INSTALLATION, WIRING AND CIRCUIT PROTECTION</b>	
3.1 CABLE PROTECTION.....	11
3.2 ELECTRICAL PROTECTION.....	11
3.3 EQUIPMENT LAYOUT .....	11
3.4 WIRING ISSUES .....	12
<b>SECTION 4 CONNECTION OF STAND-ALONE POWER SYSTEM TO LOAD(S)</b>	
4.1 GENERAL .....	13
4.2 D.C. LOADS .....	13
4.3 A.C. LOADS .....	13
4.4 STAND-ALONE POWER SYSTEMS DIRECTLY FEEDING A SINGLE A.C. LOAD.....	13
4.5 SYSTEMS FEEDING A SINGLE ELECTRICAL MAIN (INSTALLATION) SWITCHBOARD .....	14
4.6 A.C. SYSTEMS SUPPLYING SEVERAL BUILDINGS .....	18
<b>SECTION 5 RENEWABLE ENERGY GENERATORS</b>	
5.1 PHOTOVOLTAIC ARRAYS.....	20
5.2 WIND TURBINE GENERATORS.....	20
5.3 HYDRO GENERATORS .....	21
<b>SECTION 6 GENERATING SETS</b>	
6.1 GENERAL .....	22
6.2 INSTALLATION OF GENERATING SETS .....	22
6.3 AUTOMATIC-START WARNING .....	22
6.4 FUEL STORAGE .....	22
<b>SECTION 7 BATTERIES</b>	
7.1 GENERAL .....	25
7.2 LOCATION OF BATTERIES .....	25
7.3 EQUIPMENT ROOM OR BATTERY ENCLOSURE .....	25
7.4 LOCATION OF BATTERY PROTECTION EQUIPMENT .....	26
7.5 INSTALLATION .....	27

## SECTION 8 REGULATORS AND BATTERY CHARGERS

8.1	TEMPERATURE SENSING .....	29
8.2	LOCATING THE REGULATOR.....	29
8.3	BATTERY CHARGERS .....	29
8.4	SURGE PROTECTION.....	29

## SECTION 9 INVERTERS

9.1	CABLING .....	30
9.2	INVERTER FIXING .....	30
9.3	INSTALLATION .....	30
9.4	CONNECTION OF GENERATORS TO INVERTERS .....	30

## SECTION 10 TESTING AND COMMISSIONING

10.1	GENERAL .....	31
10.2	WIRING .....	31
10.3	D.C. POLARITY .....	31
10.4	PRE-COMMISSIONING CHECKS .....	31
10.5	SYSTEM FUNCTIONAL TEST .....	31

## SECTION 11 SYSTEM DOCUMENTATION

11.1	GENERAL .....	33
11.2	SYSTEM MANUAL .....	33
11.3	SYSTEM AND BATTERY RECORD BOOK .....	33
11.4	GENERATING SET LOGBOOK.....	33

## APPENDICES

A	SYSTEM MAINTENANCE.....	34
B	RCD ISSUES.....	36
C	BATTERY ENCLOSURE EXAMPLES .....	37

## STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

**Australian/New Zealand Standard**  
**Stand-alone power systems**

**Part 1: Safety and installation**

## SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE**

This Standard sets out safety and installation requirements for stand-alone power systems used for the supply of extra-low (ELV) and/or low voltage (LV) electric power to a single load, or an electrical installation in a single residence or building, or a group of residences or buildings and associated items with switchboards to AS/NZS 3000 requirements.

This Standard covers—

- (a) equipment up to, and including, the output of the stand-alone power system (i.e. the point of supply—see the definition in Clause 1.4.12); and
- (b) direct connection of a stand-alone power system to—
  - (i) a single load (e.g. a water pump);
  - (ii) a single electrical installation (e.g. a residence); or
  - (iii) a group of independent electrical installations (e.g. a number of separate residences and/or buildings).

This Standard includes minimum rating and over-current protection requirements for the consumers mains and earthing arrangements.

NOTE: The connection from the output of the stand-alone power system to the electrical installation is regarded as the consumer's mains (see AS/NZS 3000).

This Standard, with additional safety requirements, shall be applied to systems with energy storage at LV.

System design considerations are detailed in AS 4509.2.

NOTE: System maintenance matters are considered in Appendix A.

**1.2 APPLICATION**

Stand-alone power systems and the connection to an electrical installation shall be in accordance with AS/NZS 3000, except as varied herein and with the applicable additional requirements of this Standard.

This Standard shall be read in conjunction with the regulations and any relevant requirements of any regulatory authority.

**1.3 REFERENCED DOCUMENTS**

The following documents are referred to in this Standard:

AS	
1170	Structural design actions
1170.4	Part 4: Earthquake actions in Australia