

Australian Standard™

Starter batteries—Lead acid

This Australian Standard was prepared by Committee EL-005, Secondary Batteries. It was approved on behalf of the Council of Standards Australia on 3 October 2003 and published on 14 November 2003.

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- Australian Automobile Association
- Australian Automotive Aftermarket Association
- Australian Chamber of Automotive Industries
- Australian Chamber of Commerce and Industry
- Australian Electrical and Electronic Manufacturers Association
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This Standard was issued in draft form for comment as DR 02294.

Australian Standard™

Starter batteries—Lead acid

Originated as AS D2—1958.
Previous edition AS 2149—1990.
Fourth edition 2003.

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Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 5582 8

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PREFACE

This Standard was prepared by the Standards Australia Committee EL-005 Secondary Batteries, to supersede AS 2149—1990, *Starter batteries—Lead-acid*.

In the preparation of the Standard consideration was given to European Standard EN 60095-1, *Lead-acid starter batteries*, Part 1: *General requirements and methods of test*. EN 60095-1 is a modified version of International Electrotechnical Commission Standard 95-1, *Lead-acid starter batteries*, Part 1: *General requirements and methods of test*.

The method of testing a battery's flame retardant venting system given in Appendix P is taken from the Battery Technical Manual (June 1982) published by the Battery Council International.

The objective of this Standard is to provide users and manufacturers of automotive starter batteries with definitions of terms, safety requirements, methods of specifying performance and methods of test.

The committee recognized that the Standard supplies limited requirements for valve-regulated cells and proposes that separate parts for vented and valve-regulated cells will be produced at the next revision. In the development for the proposed part for valve-regulated cells requirements for —

- (a) control valves;
- (b) integrity of seal (leak test);
- (c) gas recombination efficiency; and
- (d) endurance towards high temperatures and vibration in the areas of sealing integrity will be considered.

The requirement of EN 60095-1 that batteries are considered new not later than—

- (i) 30 days after the acid filling and formation date for filled and charged batteries; and
 - (ii) 60 days after the shipment date of the manufacturer for dry-charged batteries
- has been changed to 60 days and 90 days respectively to reflect Australian conditions.

The principal differences to the previous edition are:

- (A) The addition of a stand and rechargeability test (light load recovery test).
- (B) The addition of a test of the flame retardance of a battery's venting system.

The term 'normative' has been used in this Standard to define the application of the appendix to which it applies. A normative appendix is an integral part of a Standard.

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STANDARDS AUSTRALIA

Australian Standard

Starter batteries—Lead acid

SECTION 1 GENERAL

1.1 SCOPE

This Standard is applicable to lead-acid batteries with a nominal voltage of 12 V, used primarily as a power source for the starting of internal combustion engines, lighting and for auxiliary equipment of internal combustion engine vehicles. These batteries are commonly called ‘starter batteries’. Batteries with a nominal voltage of 6 V are also included within the scope of this Standard. All referenced voltages have to be divided by two for 6 V batteries.

This Standard is applicable to batteries for the following purposes:

- (a) Batteries for passenger cars.
- (b) Batteries for commercial and industrial vehicles for normal use.
- (c) Batteries for commercial and industrial vehicles for severe use.
- (d) Batteries for use in deep-cycling applications (e.g. marine use, taxis and coaches).

This Standard is not applicable to—

- (i) batteries for starting railcar internal combustion engines;
- (ii) motorcycle batteries; or
- (iii) aircraft batteries.

NOTE: Further requirements for valve-regulated batteries including; requirements for control valves, integrity of seal (leak test), gas recombination efficiency and endurance towards high temperatures and vibration in the areas of sealing integrity will be considered in the next revision.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1216	Class labels for dangerous goods
2700	Colour standards for general purposes
IEC	
60051	Direct acting indicating analogue electrical measuring instruments and their accessories
60051-2	Part 2: Special requirements for ammeters and voltmeters
60417	Graphical symbols for use on equipment
61429	Marking of secondary cells and batteries with the international recycling symbol ISO 7000-1135
SAE	
J537	Storage batteries

CEN

EN 60095-1 Lead-acid starter batteries

60095-1 Part 1: General requirements and methods of test

1.3 DEFINITIONS

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

1.3.1 Capacity

The capacity of a battery is specified for an electrolyte temperature of $25 \pm 2^\circ\text{C}$. It may be shown by the manufacturer either as—

- (a) the rated reserve capacity, in minutes in the case of starter batteries; or
- (b) the 20-hour capacity (C_{20}), in ampere hours in the case of deep cycling batteries.

The rated reserve capacity C_{rr} is the time (in minutes) for which a battery can maintain a discharge of 25 A to a final voltage $V_f = 10.5 \text{ V}$.

The 20-hour capacity C_n is the electric charge (in A.h) that a battery can supply with a current:

$$I_{20} = \frac{C_{20}}{20} \quad \dots 1.1$$

to a final voltage $V_f = 10.5 \text{ V}$.

NOTE: The relationship between C_{20} and C_{rr} may be estimated by the following equation:

$$C_{20} = -133.3 + \sqrt{(17778 + 208.3 \cdot C_{\text{rr}})} \quad \dots 1.2$$

where

C_{20} = the 20-hour capacity, in ampere hours

C_{rr} = the rated reserve capacity, in minutes

This formula is not recommended for $C_{\text{rr}} \geq 480 \text{ min}$ ($C_{20} \geq 200 \text{ A.h}$).

NOTE: Equation 1.2 is under review and may require modification to reflect the relationship between C_{20} and C_{rr} in the most recent battery designs.

1.3.2 Charge acceptance

The current I_{ca} that a partially discharged battery takes up at 0°C and at constant voltage of 14.4 V.

1.3.3 Charge retention

The cold cranking performance of a charged and filled battery after storage on open circuit under defined conditions (temperature, time).

1.3.4 Conserved-charged battery

A battery that when supplied contains only a small quantity of electrolyte, mainly absorbed within the plates and separators. The plates are in a charged condition and the battery is activated by the addition of further electrolyte.

1.3.5 Dry-charged battery

A new battery may be designated as dry-charged if it can be activated, ready for service, by filling it with the specified electrolyte and in accordance with any specific instructions from the manufacturer.

1.3.6 Electrolyte retention

The ability of a battery to retain electrolyte under specified mechanical conditions.

1.3.7 Endurance in cycles

The ability of a battery to perform repeated discharge/recharge cycles and long rest periods on open circuit. This ability is tested by a series of cycles and rest periods under specified conditions after which the cold cranking performance is determined.

1.3.8 Rated cold cranking amps (CCA)

The discharge current to be shown by the manufacturer that a battery can supply at -18°C for 30 s to a minimum voltage $U_f = 7.2 \text{ V}$ (i.e. 1.2 V per cell).

1.3.9 Valve-regulated cell

A cell which 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.

1.3.10 Vented (flooded) cell

Either—

- (a) a secondary cell having a cover provided with an opening through which gaseous products can escape and providing access to the electrolyte through which electrolyte may be added; or
- (b) a secondary cell having a cover provided with a venting system through which gaseous products can escape but with no access to the electrolyte.

NOTE: This opening may be fitted with a venting system.

1.3.11 Vibration resistance

The ability of a battery to maintain service under acceleration forces.

1.4 CONDITION ON DELIVERY

New batteries may be supplied in one of the following states:

- (a) In a state ready for use, filled with the appropriate electrolyte to the maximum level. After an initial charge (according to Clause 3.2), the electrolyte density or OCV shall be within the ranges specified in Clause 3.5; or
- (b) In a dry-charged state not filled with electrolyte. The density of the electrolyte to fill such batteries before use shall be in the range 1250 kg/m^3 to 1280 kg/m^3 at 25°C unless otherwise specified by the manufacturer.

SECTION 2 GENERAL REQUIREMENTS

2.1 IDENTIFICATION AND LABELLING

Batteries shall be marked with the following information:

- (a) The name or registered trademark of the manufacturer or supplier, or of both the manufacturer and supplier.
- (b) The address of the manufacturer or supplier whose name, trade-name or trademark is given under (a) above.
- (c) The rated cold cranking amps, in amperes for starter batteries (see Clause 1.3.8).
- (d) The rated reserve capacity, in minutes for starter batteries (see Clause 1.3.1).
- (e) The 20-hour capacity for deep cycling batteries (see Clause 1.3.1)
- (f) The maximum recharging voltage that can safely be applied to the battery.

The information required by Item (b) may be omitted, if the manufacturer or supplier has offices or agents in every State and Territory of Australia and if the omitted information is available from catalogues or similar publications.

All markings and labels shall be legible and durable for the expected service life of the battery.

2.2 WARNING LABEL

Batteries shall carry a warning label as shown in Figure 2.1 and a warning label including the following advisory statement or words that clearly convey that meaning, pointing out the explosive hazard associated with the process of charging batteries and the corrosive contents of the battery:

WARNING: Lead-acid batteries generate explosive gases. Keep sparks, flames, and lighted cigarettes away from battery, when charging or using battery in an enclosed space, provide ventilation. This battery contains sulphuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately.

The warning label shall be prominently displayed on the battery in a position that is not likely to be hidden from view when installed in a vehicle. The wording shall be in contrasting colours to the background. The word WARNING shall be written in letters having a minimum height of 3 mm. The text of the label shall have letters with a minimum height of 2 mm.



NOTE: For further details see AS 1216.

FIGURE 2.1 WARNING LABEL

2.3 MARKING OF POLARITY

Batteries shall carry the marking of polarity, at least of the positive terminal.

2.3.1 Positive terminal

This marking shall take the form of the symbol +, indented or in relief, either on the upper surface of the positive terminal or on the lid adjacent to the positive terminal.

The symbol used for marking the positive terminal shall be in accordance with symbol 5005-a:Plus; positive polarity of IEC 60417-2. The value of the dimensions 'a' should be equal to or greater than 5 mm.

2.3.2 Negative terminal

If the negative terminal is also marked, the symbol used shall be in accordance with symbol 5006: Minus; negative polarity of IEC 60417-2. This marking shall also be placed either on the upper surface of the negative terminal or on the lid next to the negative terminal. The size of the negative marking shall correspond to that of the positive marking.

2.3.3 Colours

If, in addition to the above marking, colours are used for the marking of polarity, the colours used shall be as follows:

- (a) Positive terminal—red (refer to AS 2700, Colour 538).
- (b) Negative terminal—black or blue (refer to AS 2700, Colour 104).

NOTE: The marking of polarity by colours is not a requirement of this Standard.

2.4 WATER LOSS

Batteries are classified as low water loss if they pass the water consumption test of Appendix I.

NOTE: Low water loss batteries are commonly known as 'maintenance free batteries'.

2.5 RECYCLING SYMBOL

If batteries are to be marked with a recycling symbol, they shall be marked in accordance with IEC 61429.

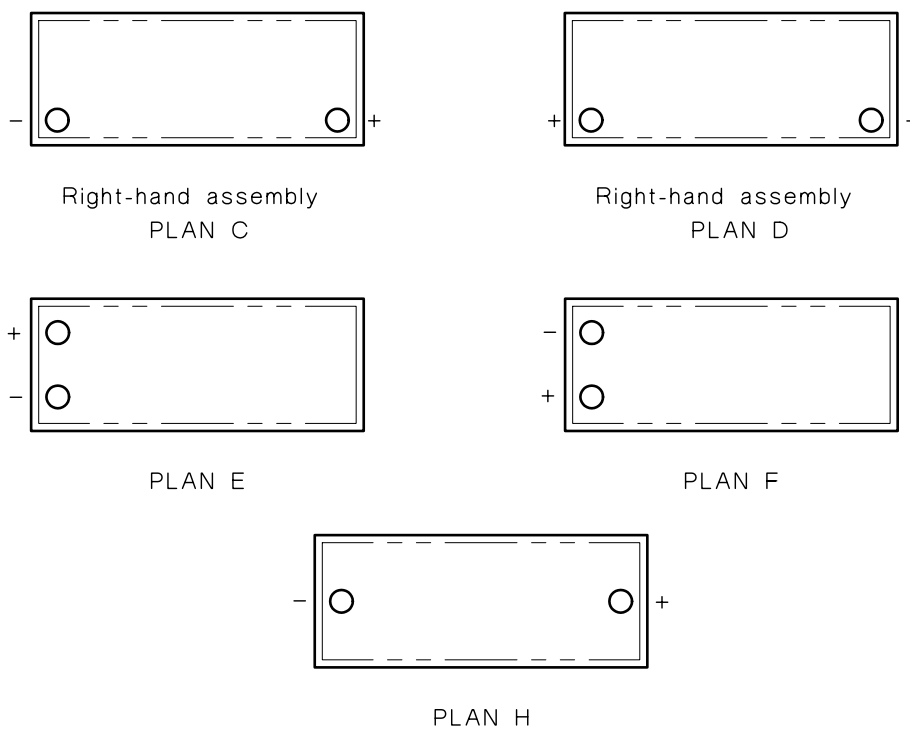
2.6 TERMINAL POSTS

The preferred type of positive and negative terminal are the two types of tapered terminal posts classified in Table 2.1 and illustrated in Figure 2.4 with the dimensions given in Table 2.2. Provision may be made for the connection of lug type terminals.

Figures 2.2 and 2.3 are the preferred arrangements of terminal location. However, Plan H of Figure 2.3 is the preferred terminal layout for future original equipment batteries.



FIGURE 2.2 TERMINAL LAYOUTS—6 VOLT BATTERIES

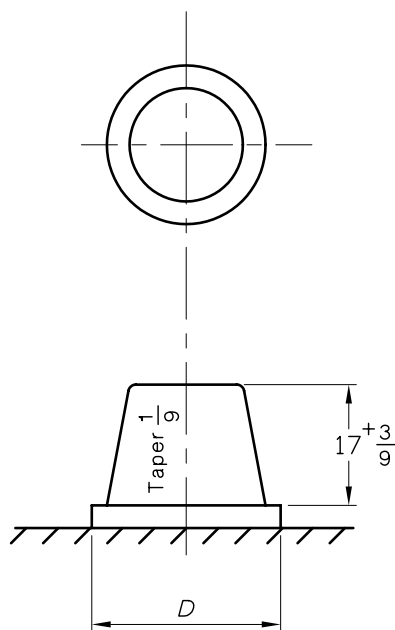


NOTE: Plans C, D and H may also have screw-in type terminals in addition to the top mounted post terminals shown in the above plans.

FIGURE 2.3 TERMINAL LAYOUTS—12 VOLT BATTERIES

TABLE 2.1
CLASSIFICATION OF TAPERED TERMINAL POSTS

Classification		Symbol
Tapered terminal	Thin type	T ₁
	Thick type	T ₂



DIMENSIONS IN MILLIMETRES

FIGURE 2.4 DIMENSIONS OF TAPERED TERMINAL POSTS

TABLE 2.2
DIMENSIONS OF TAPERED TERMINAL POSTS T₁ AND T₂

Unit : mm

Classification of tapered terminals	<i>D</i> dimensions	
	Positive terminal	Negative terminal
T ₁	14.7 ⁰ _{-0.3}	13.0 ⁰ _{-0.3}
T ₂	19.5 ⁰ _{-0.3}	17.9 ⁰ _{-0.3}

SECTION 3 GENERAL TEST CONDITIONS

3.1 SAMPLING OF BATTERIES

All tests shall be carried out on new battery samples. Samples shall be considered as new not later than—

- (a) 60 days after the acid filling and formation date for filled and charged batteries; and
- (b) 90 days after the manufacturer's shipment date for dry-charged batteries.

3.2 PREPARATION OF BATTERIES BEFORE TEST—DEFINITION OF A FULLY-CHARGED BATTERY

All tests, except the cold cranking amps test of a dry or conserved charge battery, shall commence with fully-charged batteries.

To be considered fully-charged a battery shall:

- (a) For vented batteries

Be charged at a voltage of $16\text{ V} \pm 0.1\text{ V}$ for 24 h with the maximum current limited to $0.15 C_{rr}$ (see Clause 1.3.1). The battery temperature shall be maintained in the range 25°C to 35°C . If necessary, an appropriate environmental control system shall be used, e.g. a water bath.

- (b) For valve-regulated batteries

Be charged at a voltage of $14.1\text{ V} \pm 0.1\text{ V}$ for 24 h. The battery temperature shall be maintained below 25°C . If necessary, an appropriate environmental control system shall be used, e.g. a water bath.

3.3 ACTIVATION OF DRY-CHARGED BATTERIES

Any manufacturer's recommendations concerning activation shall be followed.

3.4 MEASURING INSTRUMENTS

3.4.1 Electrical measuring instruments

The accuracy and type of the instruments to be used in the performance of the tests specified in this Standard shall be as follows:

- (a) Voltmeter—Accuracy Class 0.5, resistance not less than $1000\ \Omega/\text{V}$, in accordance with IEC 60051-2, or digital voltmeters.
- (b) Ammet—Moving coil, accuracy Class 1, in accordance with IEC 60051-2 or digital ammeters.

3.4.2 Temperature measurement

The thermometers used for measuring temperatures shall have an appropriate range, and the value of each scale division shall not be greater than 1°C . The accuracy of the calibration of the instruments shall be not less than 0.5°C .

3.4.3 Density measurement

The density of the electrolyte shall be measured with a hydrometer with a graduated scale. The value of each division of the scale shall be 5 kg/m^3 . The accuracy of calibration shall be 5 kg/m^3 or better.

3.4.4 Time measurement

The instruments used for measuring time shall be graduated in hours, minutes and seconds. They shall have an accuracy of at least $\pm 1\%$.

3.5 ELECTROLYTE DENSITY

For the purpose of testing, the density of the electrolyte shall be $1275 \pm 10 \text{ kg/m}^3$ at 25°C . However, where the manufacturer's design of a battery makes the use of 1275 kg/m^3 impractical, the test may be performed at the manufacturer's recommended density if this density is clearly stated in both the test results and is marked on the battery.

SECTION 4 ASSESSMENT OF COMPLIANCE WITH THIS STANDARD

4.1 GENERAL

- (a) All tests shall be carried out in the order stated in Table 4.1.
- (b) Before the commencement of the test methods of Appendices A, B, E to K and Q, batteries shall be restored to their fully charged state in accordance with the manufacturer's instructions. If applicable, the level and density of the electrolyte shall be checked and, if necessary, adjusted.

TABLE 4.1
SCHEDULE FOR ASSESSMENT OF COMPLIANCE

Characteristic	Test method Appendix	Application	
		Category	
		Batteries not designated low water loss	Low water loss batteries
Leak test*	B	M	M*
Terminal post torque test	C	M	M
Rechargeability and charge rate acceptance test	D	M	M
Cold cranking amps test	E	M	M
Cold cranking amps test of dry or conserved charged battery	F	O	NA
Rated reserve capacity test	G	M	M
20-hour discharge capacity test	H	O	O
Water consumption test	I	O	M
Charge-discharge cycling test	J	M	M
Endurance test	K	M	M
Vibration test	A	M	M
Electrolyte retention test—Tilt	L	M	M †
Electrolyte retention test—Tilt and vibration	M	O	O †
Self-discharge characteristics test	N	M	M
Environment temperature test	O	M	M
Battery flame retardant venting system test	P	O	O

* Only applied to batteries with accessible electrolyte

† Not applied to valve-regulated batteries that are not used in vehicles, i.e. batteries used for starting stationary engines.

LEGEND:

M Mandatory test
NA Not applied
O Optional test

4.2 NUMBER OF SPECIMENS FOR TESTS

Eleven batteries are required to assess compliance with this Standard, i.e. to apply the mandatory tests of Table 4.2. An additional battery is required for the optional test 4 of Table 4.3, if it is to be applied. This arrangement allows an extra battery if the mandatory tests 4, 5, 6, 7, 8 or 9 of Table 4.2 or the optional test 4 of Table 4.3 are to be repeated.