

Australian Standard™

Traction batteries—Lead-acid

Part 1.1: Vented cells—Requirements



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Australian Automotive Aftermarket Association
Australian Chamber of Commerce and Industry
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Traction batteries—Lead-acid

Part 1.1: Vented cells—Requirements

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PREFACE

This Standard was prepared by the Standards Australia Committee EL-005 on Secondary Batteries to supersede (in part) AS 2402—1994, *Lead-acid traction batteries*.

AS 2402—1994 has been split into four parts as follows:

Traction batteries—Lead-acid, Part 1.1 Vented cells—Requirements

Traction batteries—Lead-acid, Part 1.2 Vented cells—Installation and usage

Traction batteries—Lead-acid, Part 2.1 Valve-regulated cells—Requirements

Traction batteries—Lead-acid, Part 2.2 Valve-regulated cells— Installation and usage

It is intended that Parts 1.2 and 2.2 will replace the relevant requirements in AS 2359, *Powered industrial trucks*.

In this Standard, the dimensions of traction battery cells, requirements for measuring instruments, rated capacity and the battery test life are based on IEC 254-1, *Lead-acid traction batteries, Part 1: General requirements and methods of test*, and IEC 254-2, *Lead-acid traction batteries, Part 2: Dimensions of cells and terminals and marking of polarity on cells*. Additional requirements not covered by these IEC publications have been included to cover Australian conditions. Acknowledgment is made of the assistance received from BS 2550, *Specification for lead-acid traction batteries*.

The useful life obtained from a battery is also dependent on the performance of the battery charger. Performance requirements for battery chargers for lead-acid batteries are specified in AS 2548.1, *Battery chargers for lead-acid traction batteries—Battery chargers for vented cells*.

The terms ‘normative’ and ‘informative’ have been used in this Standard 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.

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STANDARDS AUSTRALIA

Australian Standard
Traction batteries—Lead-acid

Part 1.1: Vented cells—Requirements

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for lead-acid batteries of the vented type intended for installation in electric traction vehicles, industrial trucks, mechanical handling equipment, diesel locomotive starting applications, semi-traction applications (e.g. golf buggies and wheelchairs) and other applications where deep cycling is required.

A complete battery consists of one or more self-contained units connected in series or parallel. Each unit consists of individual cells or monoblocs assembled into a battery tray.

NOTE: Recommendations for the design of battery trays are given in Appendix A.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

- | | |
|----------|--|
| 1349 | Bourdon tube pressure and vacuum gauges |
| 1915 | Electrical equipment for explosive atmospheres—Battery-operated vehicles |
| 2359 | Powered industrial trucks |
| 2359.1 | Part 1: General requirements |
| 2402 | Traction batteries—Lead-acid |
| 2402.2.1 | Part 2.1: Valve-regulated cells—Requirements |
| 2668 | Water for use in secondary batteries |
| 2669 | Sulphuric acid for use in lead-acid batteries |

AS/NZS

- | | |
|--------|---|
| 5000 | Electric cables—Polymeric insulated |
| 5000.1 | Part 1: For working voltages up to and including 0.6/1(1.2)kV |

IEC

- | | |
|---------|--|
| 60051 | Direct acting indicating analogue electrical measuring instruments and their accessories |
| 60051-2 | Part 2: Special requirements for ammeters and voltmeters |

1.3 DEFINITIONS

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

1.3.1 Actual capacity

The quantity of electricity, usually expressed in ampere hours (A.h), that a fully charged battery can deliver for a specific set of operating conditions, including discharge rate, temperature, initial state of charge, age and final voltage.

1.3.2 Authorized person

The person in charge of the premises, or other person appointed or selected by the person in charge of the premises, to perform certain duties associated with the traction batteries on the premises.

1.3.3 Breakaway current

The current required by an engine starting battery to overcome the inertial force of an engine.

1.3.4 Capacity

The quantity of electricity, usually expressed in ampere hours (A.h), that a fully charged battery can deliver under specified conditions.

1.3.5 Cell jar

A container of high impact, acid resisting, insulating material (usually a thermoplastic material, e.g. polypropylene) into which the plates and other internal components are fitted.

1.3.6 Cell lid

A component of high-impact, acid-resisting, insulating material which is sealed to the walls of the container near the top and is provided with holes for terminals and vent plugs.

1.3.7 Charge-discharge cycle

A cycle which starts with the flow of a discharge current from a battery of cells, and which ends when a charging current has returned the battery to a fully charged condition.

1.3.8 Charge retention

The capability of a fully charged battery to hold its capacity after it has been stored on open circuit at a specified temperature for a specified time.

1.3.9 Charging

An operation during which a battery receives electric energy, which is converted to chemical energy, from an external circuit. The quantity of electric energy is known as the charge and is usually measured in ampere hours (A.h).

1.3.10 Cover

A removable covering of suitable material enclosing the top of the battery.

1.3.11 Cranking current

The current required by an engine starting battery to keep the engine turning until it fires.

1.3.12 Discharging

An operation during which a battery delivers current to an external circuit by conversion of chemical energy to electric energy.

1.3.13 Electrolyte

A solution which will react with the electrodes and carry an electric current between them when the cell terminals are connected to form a closed circuit.

1.3.14 End terminal post

A lead post projecting through the lid of the end cell of a battery from which connection is made to an external circuit or to an end terminal post of another battery.

1.3.15 Fully charged battery

A battery is considered to be fully charged if the electrolyte density and the voltage measured across the battery terminals do not vary over three consecutive hourly readings taken at the end of the charging period, account being taken of temperature variations and the charging current is that specified by the battery manufacturer or supplier.

1.3.16 Industrial truck

A powered industrial truck as defined in AS 2359.1.

1.3.17 Lead-acid cell

A cell in which the active materials are as follows:

- (a) Positive electrodes or plates: lead dioxide.
- (b) Negative electrodes or plates: spongy lead.
- (c) Electrolyte: dilute sulphuric acid.

1.3.18 Life

The number of charge-discharge cycles before the capacity of a battery falls to 80% of the rated capacity.

1.3.19 Monobloc battery

A battery in which a number of cells are fitted in a multi-compartment container.

1.3.20 Opportunity charging

The use of periods of inactivity of a partially discharged battery (i.e. state of charge less than 80% of the nominal capacity) to increase its state of charge.

1.3.21 Rated capacity

The quantity of electricity in ampere hours (A.h), declared by the battery manufacturer or supplier which a battery can deliver after a full charge under specified conditions.

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

The capacity of a cell or battery is denoted by the symbol C . Because the capacity varies with rate of discharge, the symbol C is followed by a numerical subscript giving the rate of discharge. Thus C_5 is the capacity in ampere hours (A.h) at the 5 h rate of discharge. The specified temperature is usually 30°C. The final voltage depends on battery type and conditions of service.

1.3.22 Repeat starting test

A test performed to determine the number of effective starting cycles an engine starting battery can achieve.

1.3.23 Separator

A sheet of porous, non-conducting acid-resisting material fitted between adjacent plates.

1.3.24 Service weight

The service weight of a battery, which includes cells, trays, relevant covers and ballast weights used to compensate for lack of battery mass.

1.3.25 Shall

Indicates that a statement is mandatory.

1.3.26 Should

Indicates a recommendation.

1.3.27 Tapered cable thimble

A device fitted to the end of a flexible cable to form the connection between the cable and the battery or battery unit.

1.3.28 Thimble socket

A fitting which forms the connection between the end terminal post and the tapered cable thimble.

1.3.29 Tightening screw

A screw used for securing the tapered cable thimble to the thimble socket.

1.3.30 Traction battery

More than one traction cell permanently and electrically connected in one circuit, intended for use as the power supply of an electric vehicle or an industrial truck.

1.3.31 Traction cell

A cell specifically designed to form part of a traction battery.

1.3.32 Tray (basket)

An outer container enclosing a battery or battery unit and treated to resist corrosion by sulphuric acid.

1.3.33 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. The cell cannot normally receive any addition to the electrolyte.

1.3.34 Vehicle

A mobile, battery-powered machine intended for use on public roads.

1.3.35 Vent plug

A removable plug fitted to the cell cover over the hole used for filling with electrolyte or topping-up with water, and designed to provide for the escape of gases from the cell while obstructing the passage of acid spray.

1.3.36 Vented cell

A battery that has its plates immersed in liquid electrolyte. The volume of electrolyte is sufficient to allow for a reasonable loss of water by evaporation and electrolysis during charging. The battery's cells have a vent in their cover that allows a free exchange of the gases inside the cell with the atmosphere. Water is normally added to vented batteries.

SECTION 2 DESIGN AND CONSTRUCTION

2.1 CELL DIMENSIONS

The most common heights and widths of cells are given in Table 2.1.

TABLE 2.1
MAIN DIMENSIONS OF TRACTION BATTERY CELLS

Width (nom mm)	Height (nom mm)
160	295
	375
	440
	500
	555
	750
198	370
	440
	500
	555
	605
	750

NOTE: Cell lengths are dependent on the number of plates in the cell.

2.2 CONNECTIONS

Connections between cell terminal posts should be made by burning on or by a suitable method to minimize joint resistance.

Intercell connections shall not obstruct the filling apertures, and shall be designed and arranged so that they do not cause any damage to the post seal.

2.3 CONNECTION TO BATTERY

2.3.1 Means of connection

2.3.1.1 General

A battery shall be provided with—

- (a) permanently connected leads; or
- (b) terminals designed to accept a thimble (see Clause 2.3.2); or
- (c) bolted take-offs; or
- (d) other suitable means of connection.

2.3.1.2 Sizing of battery leads

A battery lead shall be of a size and amp capacity acceptable for the application. It shall be—

- (a) of the same or greater conductor cross-sectional area as the input cables of the industrial truck;
- (b) cross-linked polychloroprene insulated and sheathed flexible cable to AS/NZS 5000.1;

- (c) resistant to acids or alkalies; and
- (d) able to withstand flexing, handling, and impact at temperatures between 54°C and minus 29°C.

NOTE: Some purchasers may require a millivolt drop test. Details of a suitable test are given in Appendix B.

2.3.2 Thimbles

Thimbles shall conform to the dimensions given in Figure 2.1 or Figure 2.2, as follows:

- (a) Rated capacity ≤ 800 A.h: Figure 2.1.
- (b) Rated capacity > 800 A.h: Figure 2.2.

NOTE: Battery connections should be tightened in accordance with the battery manufacturer's or supplier's instructions. Overtightening can damage connections.

2.4 VENT PLUGS

Vented cells shall incorporate a vent plug in the cell cover that permits both testing and replenishing of the electrolyte.

A vent plug shall be provided with a vent, to permit the escape of gases, while allowing only a minimum loss of electrolyte under normal operating conditions. If a vent plug incorporates a means of indicating the level of electrolyte, it shall comply with all the requirements of this Clause.

NOTE: If batteries are supplied in the unfilled condition and are to be stored for long periods, it is necessary for the filling aperture to be sealed by means of a removable device to restrict the passage of moisture.

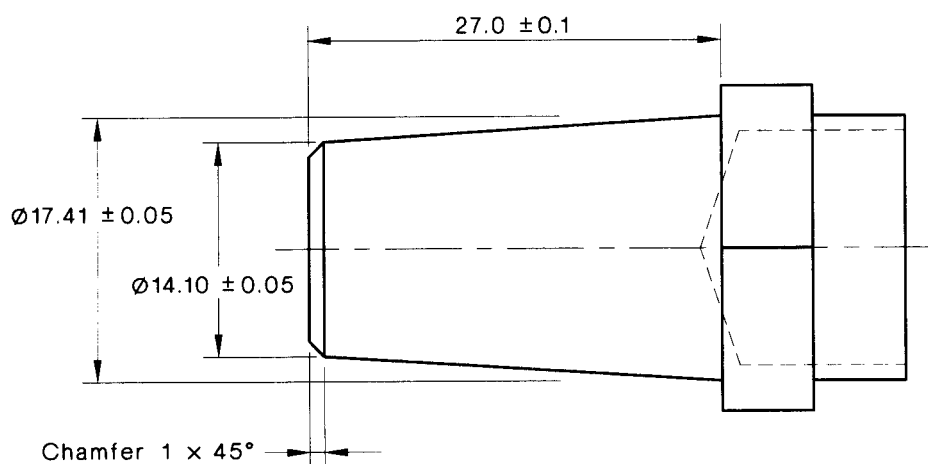
2.5 ELECTROLYTE

The electrolyte shall consist of sulphuric acid complying with AS 2669 diluted with water complying with AS 2668.

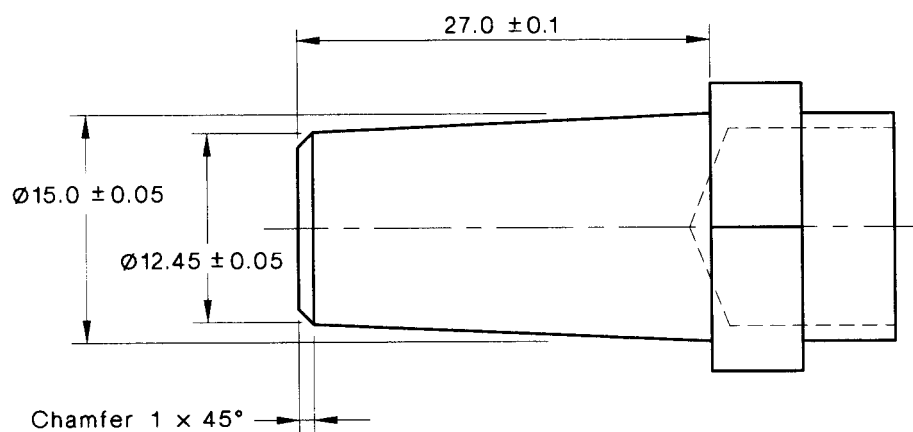
The battery manufacturer or supplier shall specify the density of the electrolyte of a fully charged vented cell.

2.6 SEALING

The arrangements for sealing between the cell lids and jars, and between the terminal posts and the battery unit cover, shall prevent any leakage of electrolyte in service and shall comply with Clause 3.4.



(a) Positive thimble



(b) Negative thimble

DIMENSIONS IN MILLIMETRES

FIGURE 2.1 LIGHT-DUTY THIMBLES