

British Standard

Primary batteries

Part 1. Specification for general requirements

Piles électriques

Partie 1. Généralités–Spécifications

Primärbatterien

Teil 1. Allgemeines

National foreword

This Part of BS 397 is a revision of BS 397 : Part 1 : 1985 which it supersedes and which is withdrawn. It has been prepared under the direction of the Light Electrical Engineering Standards Policy Committee and is identical with IEC Publication 86-1 : 1987 'Primary batteries' Part 1 'General', published by the International Electrotechnical Commission (IEC).

CENELEC Harmonization Document HD 211.1S6 is identical with IEC Publication 86-1 : 1987.

Terminology and conventions. The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards.

Wherever page numbers are quoted, they are IEC page numbers.

Cross-references

International standard	Corresponding British Standard
IEC 63 : 1963	BS 2488 : 1966 Schedule of preferred numbers for the resistance of resistors and the capacitance of capacitors for telecommunication equipment (Technically equivalent)

The Technical Committee has reviewed the provisions of IEC 130-3, IEC 285 and IEC 410, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. Related British Standards to IEC 285 and IEC 410 are respectively, BS 5932 : 1980 'Specification for sealed nickel-cadmium cylindrical rechargeable single cells' and BS 6001 'Sampling procedures for inspection by attributes' Part 1 : 1972 Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

CONTENTS

	Page
National foreword	Inside front cover
Committees responsible	Back cover
 Specification	
1. Scope	2
2. Basic definitions	2
3. Nomenclature	4
4. Battery dimensions	8
5. Terminals	12
6. Marking	14
7. General design conditions	14
8. Conditions of tests	15
9. Code of practice for shipment, storage, use and disposal of primary batteries	20

British Standard

Primary batteries

Part 1. Specification for general requirements

1. Scope

This standard applies to primary cells and batteries based on any electrochemical system.

The objects of its publication are:

- a) to ensure the electrical and physical interchangeability of products from different manufacturers;
- b) to limit the number of battery types;
- c) to define a standard of quality and provide guidance for its assessment.

These objects are achieved by specifying nomenclature, dimensions, polarity, terminals, marking, test conditions and service output requirements for each battery.

2. Basic definitions

For this standard, the following definitions shall apply:

2.1 *Primary battery*

A source of electrical energy obtained by the direct conversion of chemical energy.

Note. — When ready for delivery, a primary battery includes terminals and may include a case. The word “battery” can refer to one single complete cell.

2.2 *Dry cell or battery*

A cell or battery ready for use in which the electrolyte is made unspillable.

2.3 *Off-load voltage*

The difference of potential existing between the terminals of a battery when the circuit is open.

2.4 *On-load voltage*

The difference of potential existing between the terminals of a battery when it is delivering current.

2.5 *Nominal voltage*

The specified off-load voltage of a cell or battery.

2.6 *End-point voltage*

The specified on-load voltage at which the discharge is considered complete.

2.7 *Discharge*

A procedure by which a battery delivers current to an external circuit. The discharge can be continuous or intermittent.

2.8 Polarization

A phenomenon reducing the electromotive force (e.m.f.) when a battery is in use.

2.9 Service output

The useful service life of a battery under specified conditions. It may be expressed in watt-hours, ampere-hours or as a duration.

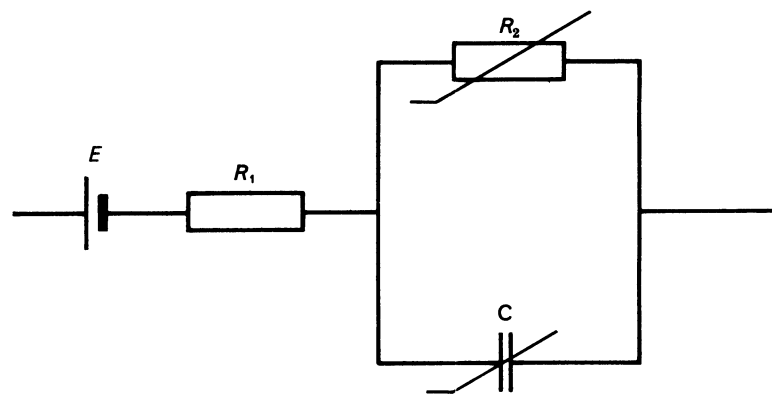
2.10 Storage life

The duration of storage under specified conditions at the end of which a battery retains its ability to give a specified performance.

The discharge performance stated after six or twelve months' storage on the individual specification sheets of batteries do not necessarily indicate the maximum age at which the batteries are capable of meeting the performance requirements.

2.11 Internal resistance and impedance

The current/voltage relationship of primary cells can normally be represented by the equivalent circuit shown below:



in which:

E is a source of e.m.f.

R_1 is a fixed resistance at a specified moment in the life of the cell and is dependent upon the conductivity of mixtures, electrolytes and current collectors, etc.

R_2 is a resistance which decreases in value as the current is increased and is related to polarization

C is a capacitor of which the capacity decreases as the current is increased

R_1 is known as the internal resistance of the cell. The combined effect of R_1 , R_2 and C is known as the impedance of the cell and is characterized by a magnitude and a phase angle.

The component R_1 represents the true ohmic resistance of the cell, whereas R_2 represents that part of the resistance due to electrode polarization effects and is dependent on both the measuring current and its frequency.

Under certain conditions, the behaviour of the cell may not be adequately represented by the equivalent circuit shown above.

2.12 Terminals

The parts to which the external electric circuit is connected.

3. Nomenclature

The battery nomenclature defines unambiguously the physical dimensions, polarity and type of terminals, the electrochemical system and its nominal voltage.

3.1 *Cells*

A cell is designated by a capital letter followed by a number. The letters R, F and S define round, flat (layer built) and square (or rectangular) cells respectively. This letter, together with a following number*, is defined by a set of nominal dimensions.

Where a single cell battery is specified, the maximum diameter and overall height of the battery are given instead of the nominal dimensions of the cell, in Tables I, Ia, II and III.

* At the present time, numbers are allocated sequentially. Omissions in the sequence arise because of deletions or by the different approach to numbering used previously.

TABLE I

*Designation and dimensions of round cells and batteries **

Designation	Nominal cell dimensions (mm)		Maximum battery dimensions (mm)	
	Diameter	Height	Diameter	Height
R06	10	22	—	—
R03	—	—	10.5	44.5
R01	—	—	12.0	14.7
R0	11	19	—	—
R1	—	—	12.0	30.2
R3	13.5	25	—	—
R4	13.5	38	—	—
R6	—	—	14.5	50.5
R9	—	—	16.0	6.2
R10	—	—	21.8	37.3
R12	—	—	21.5	60.0
R14	—	—	26.2	50.0
R15	24	70	—	—
R17	25.5	17	—	—
R18	25.5	83	—	—
R19	32	17	—	—
R20	—	—	34.2	61.5
R22	32	75	—	—
R25	32	91	—	—
R26	32	105	—	—
R27	32	150	—	—
R40	—	—	67.0	172.0
R41	—	—	7.9	3.6
R42	—	—	11.6	3.6
R43	—	—	11.6	4.2
R44	—	—	11.6	5.4
R45	9.5	3.6	—	—
R48	—	—	7.9	5.4
R50	—	—	16.4	16.8
R51	16.5	50.0	—	—
R52	—	—	16.4	11.4
R53	—	—	23.2	6.1
R54	—	—	11.6	3.05
R55	—	—	11.6	2.1
R56	—	—	11.6	2.6
R57	—	—	9.5	2.7
R58	—	—	7.9	2.1
R59	—	—	7.9	2.6
R60	—	—	6.8	2.15
R61	7.8	39	—	—
R62	—	—	5.8	1.65
R63	—	—	5.8	2.15
R64	—	—	5.8	2.70
R65	—	—	6.8	1.65
R66	—	—	6.8	2.60
R67	—	—	7.9	1.65
R68	—	—	9.5	1.65
R69	—	—	9.5	2.10

* The complete dimensions of batteries are given in the relevant specifications sheets.

TABLE Ia

*Designation and dimensions of round cells and batteries
having a temporary designation*

Designation	Nominal cell dimensions (mm)		Maximum battery dimensions (mm)	
	Diameter	Height	Diameter	Height
R0772	—	—	7.90	7.2
R1220	—	—	12.50	2.0
R1620	—	—	16.0	2.0
R2016	—	—	20.0	1.6
R2020	—	—	20.0	2.0
R2025	—	—	20.0	2.5
R2032	—	—	20.0	3.2
R2320	—	—	23.0	2.0
R2420	—	—	24.5	2.0
R2425	—	—	24.5	2.5
R2430	—	—	24.5	3.0

TABLE II

*Designation and nominal overall dimensions of flat cells**

Designation	Dimensions in millimetres			
	Diameter	Length	Width	Thickness
F15	23	14.5	14.5	3.0
F16		14.5	14.5	4.5
F20		24	13.5	2.8
F22		24	13.5	6.0
F24		—	—	6.0
F25		23	23	6.0
F30		32	21	3.3
F40		32	21	5.3
F50		32	32	3.6
F70		43	43	5.6
F80		43	43	6.4
F90		43	43	7.9
F92		54	37	5.5
F95		54	38	7.9
F100		60	45	10.4

* The complete dimensions of batteries are given in the relevant specification sheets.

TABLE III

*Designation and dimensions of square cells and batteries**

Designation	Nominal cell dimensions (mm)			Maximum battery dimensions (mm)		
	Length	Width	Height	Length	Width	Height
S4	—	—	—	57.0	57.0	125.0
S6	57	57	150	—	—	—
S8	—	—	—	85.0	85.0	200.0
S10	95	95	180	—	—	—

* The complete dimensions of batteries are given in the relevant specification sheets.

In some cases, cell sizes which are not used in IEC Publication 86-2 have been retained in the tables because of their use in national standards.

3.2 Electrochemical system

With the exception of the manganese dioxide — ammonium chloride, zinc chloride — zinc system, the letters R, F and S are preceded by an additional letter which denotes the electrochemical system, as shown:

Letter	Positive electrode	Electrolyte	Negative electrode	Nominal voltage (V)
—	Manganese dioxide	Ammonium chloride, zinc chloride	Zinc	1.5
A	Oxygen	Ammonium chloride, zinc chloride	Zinc	1.4
B	Carbon monofluoride	Organic electrolyte	Lithium	3
C	Manganese dioxide	Organic electrolyte	Lithium	3
L	Manganese dioxide	Alkali metal hydroxide	Zinc	1.5
M	Mercuric oxide	Alkali metal hydroxide	Zinc	1.35
N	Mercuric oxide and manganese dioxide	Alkali metal hydroxide	Zinc	1.4
P	Oxygen	Alkali metal hydroxide	Zinc	1.4
S	Silver oxide (Ag ₂ O)	Alkali metal hydroxide	Zinc	1.55
T	Silver oxide (AgO, Ag ₂ O)	Alkali metal hydroxide	Zinc	1.55

Note. — The letter K will not be used for primary cells and batteries since it relates to nickel-cadmium secondary batteries for which standards are given in IEC Publication 285.