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Carbon zinc batteries

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Battery Association of Japan (BAJ) / Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

This revision has been made based on **IEC 60086-2:2000**, *Primary batteries — Part 2: Physical and electrical specifications* and Amendment 1: 2001 for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard. Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Symbols and abbreviations	2
5 Classification and type designation symbol	2
6 Nominal voltage	2
7 Performances	2
7.1 Open circuit voltage	2
7.2 Minimum average duration	3
7.3 Resistance to electrolyte leakage	3
7.4 Safety	3
8 Dimensions	3
9 Terminals	3
10 Appearance	3
11 Tests	3
11.1 Classification of tests and test items	3
11.2 Storage condition and test condition of sample battery	4
11.3 Instrument and apparatus	4
11.4 Test methods	4
12 Inspection	5
12.1 Type inspection	5
12.2 Acceptance inspection	5
13 Marking	5
Annex 1 (normative) Precautions for handling	24
Annex 2 (informative) Comparison table between JIS and corresponding International Standard	27

Carbon zinc batteries

Introduction This Japanese Industrial Standard has been prepared based on the tenth edition of **IEC 60086-2**, *Primary batteries — Part 2: Physical and electrical specifications*, published in 2000 and Amendment 1 (2001) by adopting the corresponding parts such as the type designation, performance, dimensions, terminals, etc. of carbon zinc batteries with modification in technical contents.

Portions sidelined or underlined with dots are the matters modified from the original International Standard. The list of modification with its explanation is given in annex 2 (informative).

1 Scope This Standard specifies carbon zinc batteries among primary batteries.

NOTE : The International Standard corresponding to this Standard is as follows:

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21**.

IEC 60086-2:2000, *Primary batteries — Part 2: Physical and electrical specifications* and Amendment 1:2001(MOD)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect or the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of coming into effect apply only to the most recent edition (including amendments).

JIS B 0021 *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out*

Remarks : **ISO/DIS 1101:1996**, *Geometrical product specifications(GPS) — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out* is identical with the said standard.

JIS C 8500:2001 *Primary batteries: General*

Remarks : **IEC 60086-1:1996**, *Primary batteries — Part 1: General* is equivalent to the said standard.

JIS C 8514 *Safety of primary batteries with aqueous electrolyte*

3 Definitions For the purposes of this Standard, the definitions specified in **JIS C 8500** and the following definitions apply.

- a) **carbon zinc batteries** a primary battery employing manganese dioxide as the positive electrode active material, zinc as the negative electrode active material and aqueous solution mainly consisting of zinc chloride and/or ammonium chloride as the electrolyte

- b) **application test** test which simulates the actual use of a battery in a specific application, for example, “portable lighting”, “tape recorder”, or “transistor radio” test
- c) **service output (of a primary battery)** service life, capacity, or energy output of a battery under specified conditions of discharge
- d) **service output test** test designated to measure output of a battery

NOTE : A service output test may be applied, for example, when

- 1) an application test is too complex to replicate;
- 2) the duration of an application test would make it impractical for routine testing purposes

- e) **expiry month and year of recommended use** the period during which a battery operates normally and satisfies the minimum average duration (MAD) specified in attached tables 1 to 5 and attached tables 6.1 to 6.7 when the specified duration test is carried out

Information : This term has the same meaning as the “Year and month or week of manufacture, which may be in code, or the expiration of a guarantee period, in clear” specified in **IEC Standard**.

4 Symbols and abbreviations For the symbols and abbreviations used in this Standard, those specified in **JIS C 8500** and those below apply.

- a) EV : End-point voltage
- b) MAD : Minimum average duration
- c) OCV : Open-circuit voltage, off-load voltage
- d) R : Load resistance
- e) Vn : Nominal voltage of a battery

5 Classification and type designation symbol The classification shall be made by using the type designation, as given in attached tables 1 to 5 and attached tables 6.1 to 6.7. The type designation symbol, the intrinsic symbol and the style and dimension symbol of a carbon zinc battery shall be in accordance with **JIS C 8500**.

Information : The grading P, C and S of batteries with type designation symbols R20, R14, R6 and 3R12 refers to the grading P (high power), C (high capacity) and S (standard) specified in **IEC 60086-2**, respectively. PU denotes that the characteristic value of duration is a grade higher than P. Attached tables 1 to 5 and attached tables 6.1 to 6.7 were created according to the classification specified in **IEC 60086-2**.

6 Nominal voltage The nominal voltages (Vn) shall be as given in attached tables 1 to 5 and attached tables 6.1 to 6.7.

7 Performances

7.1 Open circuit voltage When the test is carried out as specified in 11.4.4, the open circuit voltages (OCV) shall be as given in attached tables 1 to 5 and attached tables 6.1 to 6.7.

7.2 Minimum average duration When the test of minimum average duration (MAD) is carried out as specified in 11.4.5, and the average duration is obtained by means of the procedures given below, the average duration (hereafter referred to as the "average value") shall be not less than MAD given in attached tables 1 to 5 and attached tables 6.1 to 6.7.

- a) The sample size of the batteries to be tested shall be 9.
- b) The average value shall be obtained on all the test results.
- c) If the average value so obtained is not less than MAD, and the number of batteries which show a test value less than 80 % of MAD is one or less, these batteries are considered as complying with the characteristic value.
- d) If the average value so obtained is less than MAD, or the number of batteries which show a test value less than 80 % of MAD is two or more, these batteries are not considered as uncomplying with the characteristic value, the test shall be repeated on other nine specimens and the average value same as that in the first test shall be obtained.
- e) If the average value in the second test is not less than MAD, and the number of batteries which show a test value less than 80 % of MAD is one or less, these batteries are considered as complying with the characteristic value.
- f) If the average value in the second test is less than MAD, or the number of batteries which show a test value less than 80 % of MAD is two or more, these batteries are considered as uncomplying with the characteristic value, and the third test is not carried out.

7.3 Resistance to electrolyte leakage When the test is carried out as specified in 11.4.6, there shall be no electrolyte leakage and deformation observed visually.

7.4 Safety When the test is carried out as specified in 11.4.7, the requirements specified in JIS C 8514 shall be satisfied. The precautions for handling shall be in accordance with annex 1.

8 Dimensions Before and during the test specified in clause 11, the dimensions shall conform to those specified in attached tables 1 to 5 and attached tables 6.1 to 6.7.

9 Terminals The terminal shall have the shapes as shown in attached tables 1 to 5 and attached tables 6.1 to 6.7. The terminal shall be made of metallic materials capable of keeping favorable electric contact continuously with corresponding apparatus. It shall be plated with nickel, tin or the like as needed, and there shall be no rust nor stain which will cause trouble in practical use nor deformation which exceeds specified dimensions.

10 Appearance The appearance shall be free from stain, flaw which will cause trouble in practical use, or deformation which exceeds specified dimensions, and the marking shall be clearly legible.

11 Tests

11.1 Classification of tests and test items The classification of tests and test items shall be in accordance with JIS C 8500. However, the initial test items shall include safety.

11.2 Storage condition and test condition of sample battery The storage condition and test condition of sample battery shall be in accordance with **JIS C 8500**. However, the fundamental temperature and humidity conditions with regard to the storage condition, open-circuit voltage, duration and resistance to electrolyte leakage at over discharge of sample battery shall be a temperature of $(20 \pm 2) ^\circ\text{C}$ and a relative humidity of $(60 \pm 15) \%$.

11.3 Instrument and apparatus The voltmeter, load resistance (R) and dimension measuring apparatus shall be in accordance with **JIS C 8500**.

11.4 Test methods

11.4.1 Dimensions The dimensions shall be measured using the dimension measuring apparatus specified in **11.3** may be used.

11.4.2 Terminals The terminal shall be visually examined. However, for deformation, the dimension measuring apparatus specified in **11.3** may be used.

11.4.3 Appearance The appearance shall be visually examined. However, for deformation, the dimension measuring apparatus specified in **11.3** may be used.

11.4.4 Open-circuit voltage The open-circuit voltage (OCV) shall, after the specimens have been allowed to stand under the fundamental temperature and humidity conditions at least for 8 h, be measured with the voltmeter specified in **11.3** under such conditions.

11.4.5 Duration The duration test shall be carried out as follows:

- a) **Start of discharge** The discharge shall be started after the specimens have been allowed to stand under the fundamental temperature and humidity conditions at least for 8 h.
- b) **Temperature and humidity at discharge** The temperature and humidity at discharge shall meet the fundamental temperature and humidity conditions.
- c) **Load resistance** The load resistance shall be as given in attached tables 1 to 5 and attached tables 6.1 to 6.7.
- d) **Discharge method** The discharge method shall be as given in attached tables 1 to 5 and attached tables 6.1 to 6.7. In general the discharge shall be made 5 days or more within a week (7 days).
- e) **End of discharge** The instant when the close-circuit voltage falls less than the end-point voltage (EV) given in attached tables 1 to 5 and attached tables 6.1 to 6.7 for the first time.

11.4.6 Resistance to electrolyte leakage The test for resistance to electrolyte leakage shall be carried out as follows:

- a) **Resistance to electrolyte leakage at over discharge** The test for resistance to electrolyte leakage at over discharge shall be carried out as follows :
 - 1) **Discharge conditions** As specified in **11.4.5**.
 - 2) **End of discharge** The instant when the close-circuit voltage decreases below 40 % of the nominal voltage for the first time.
- b) **Resistance to electrolyte leakage at high temperature** The resistance to electrolyte leakage at high temperature shall be checked by exposing the specimen under the following conditions:

- 1) Test temperature and humidity: $(45 \pm 2) ^\circ\text{C}$, and a relative humidity of not more than 70 %
- 2) Test period: 30 days

11.4.7 Safety The safety test shall be carried out in accordance with **JIS C 8514**. The main test items shall be as follows:

- a) Partially used batteries being left
- b) Transportation — impact
- c) Transportation — vibration
- d) Weather — heat cycle
- e) Reversed placement (series connection of four batteries)
- f) External short circuit
- g) Over discharge
- h) Free fall

12 Inspection

12.1 Type inspection The type inspection shall be carried out in accordance with **JIS C 8500**. However, the type inspection shall include safety as one item and its inspection shall be carried out at least once for three years.

12.2 Acceptance inspection The acceptance inspection shall be carried out in accordance with **JIS C 8500**. However, for the acceptance inspection, the initial test item shall be carried out. Furthermore, the dimensions shall be as follows:

- a) For circular batteries, overall height (A) and diameter (ϕ).
- b) For noncircular batteries, overall height (A), length and width.

13 Marking The marking shall be made on the battery body or the minimum package container according to table 1.

- a) **Battery system**
- b) **Type designation**
- c) **Nominal voltage**
- d) **Polarity** Marked with + and –.
- e) **Manufacturer's name or its abbreviation**
- f) **Expiry month and year of recommended use or month and year of manufacture** The expiry month and year of recommended use or month and year of manufacture shall be marked in accordance with **JIS C 8500**. Examples of marking are as follows:

Example 1 : Expiry month and year of recommended use 12-2007, December 2007

Example 2 : Expiry month and year of recommended use 05-06, May 2006

- g) **Precaution for use** The points of the following matter shall be marked:

The reversed placement, charge, short circuit, heating, putting into fire, disassembling, mixed use of different types (battery system, size, etc.) of batteries, mixed use of new batteries and used batteries, etc. shall not be performed.

- h) **Precautions for erroneous swallowing** The points of the following matter shall be marked:

The battery shall be located on a place not accessible by the hands of little children, because a battery of small size may have a risk of erroneous swallowing. In case of emergency due to swallowing, immediately make contact with a doctor, and follow the doctor's direction.

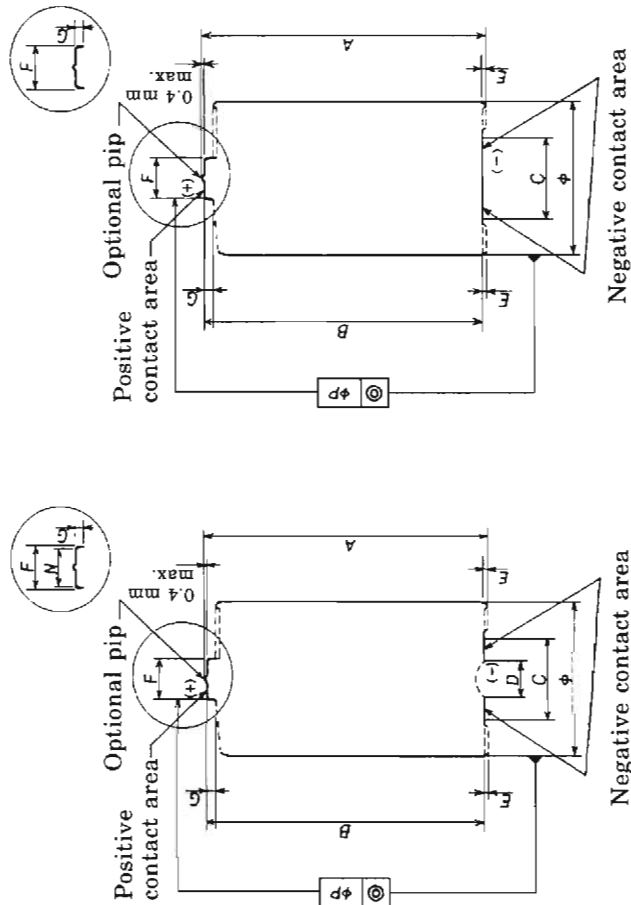
Table 1 Classification of marking according to type designation

Type designation	Classification	
	Items to be marked on battery body	Items to be marked on battery body or smallest packing container
R1, R03	a), b), c), d), e), f), h)	g)
R6C, R6P, R6PU, R6S, R14C, R14P, R14PU, R14S, R20C, R20P, R20PU, R20S, 2R10, R40, S4, 3R12C, 3R12P, 3R12S, 4R25X, 4R25Y, 4R25-2, 6F22, 6F100	a), b), c), d), e), f), g)	—

Attached table 1 Category 1 batteries

Type designation	Open-circuit voltage (OCV)	
	Max.	Min. (informative)
R1, R03 R6C, R6P, R6PU, R6S, R14C, R14P, R14PU, R14S, R20C, R20P, R20PU, R20S, 2R10	1.725	1.50
	3.45	3.00

- Remarks 1 The cap and base terminal is insulated from the cylindrical side face of battery.
- 2 Negative contact *C* of attached figure 1a may not be flat over the whole area.
- 3 Negative contact *C* of attached figure 1b shall be essentially flat over the whole area.
- 4 Negative contact of attached figures 1a and 1b is not necessarily recessed from the cylindrical side face of battery.
- 5 When the flat negative contact surface forms the lowest part of the battery, dimensions "A" and "B" are both measured from the surface, and dimension "E" is zero.
- 6 Dimension " ϕ " is coaxiality tolerance (degree of eccentricity), and it is in accordance with **JIS B 0021**.



Attached Figure 1b
Cap and base terminal

Attached Figure 1a
Cap and base terminal

Attached Table 1 (continued)

Type designation	Popular name of shape (informative)	Nominal voltage (V _N)	Outline										Test condition			Duration		Applications	Type designation		
			Dimensions mm										Load resistance (R) Ω	Discharge time per day	End-point voltage (EV) V	Characteristics					
			A (overall height)		B	C	D	E	F		G					φ (diameter)				φ P	
			Max.	Min.	Min.	Max.	Max.	Max.	Min.	Min.	Max.	Min.				Max.	Max.				
Battery system		V	Max.	Min.	Min.	Min.	Max.	Max.	Max.	Max.	Max.	Min.	Min.	Max.	Max.	Min.	Max.	Initial After storage of 12 months, and within expiry month and year of recommended use	Minimum average duration (MAD) (1)		
			30.2	29.1	29.1	5.0	—	0.2	4.0	2.0	0.5	12.0	10.9	0.5	300	12 h	0.9			76 h	60 h
			5.1	5 min	0.9	30 min	24 min														
			5.1	(2)	0.9	45 min	36 min														
			10	1 h	0.9	1.4 h	1.1 h														
Carbon zinc battery		1.5	75	4 h	0.9	20 h	16 h														
			24	(3)	1.0	4 h	3.2 h														
			3.6	(4)	0.9	120 times	96 times	(5)													
			43	4 h	0.9	25 h	20 h														
			3.9	1 h	0.8	47 min	37 min														
R6C	UM-3	1.5	50.5	49.2	49.2	7.0	4.0	0.5	5.5	4.2	1.0	14.5	13.5	0.5	43	4 h	0.9	25 h	20 h	Transistor radios	R6C
			10	1 h	0.9	3.5 h	2.8 h	Personal cassette players and tape recorders													
			24	(3)	1.0	10.9 h	8.7 h	Remote controllers													
			1.8	(4)	0.9	46 times	36 times	(6)													
			43	4 h	0.9	27 h	21 h	Transistor radios													
R6P		V	3.9	1 h	0.8	60 min	48 min	Motors/toys	Personal cassette players and tape recorders												
			10	1 h	0.9	4.1 h	3.2 h														
			24	(3)	1.0	11 h	8.8 h	Remote controllers													
			1.8	(4)	0.9	75 times	60 times	(6)													

Notes (1) Fundamental temperature and humidity conditions, a temperature of (20±2)°C, a relative humidity of (60±15) %

(2) A cycle consisting of 4 min discharge and 56 min rest per hour is repeated continuously for 8 h while the specified load resistance is connected.

(3) A cycle consisting of 15 s discharge and 45 s rest per minute is repeated continuously for 8 h while the specified load resistance is connected.

(4) A cycle consisting of 15 s discharge and 45 s rest per minute is repeated continuously for 24 h while the specified load resistance is connected. For duration, the time of end of discharge of 15 s per minute is counted as one time.

(5) Pulse discharge

Attached Table 1 (continued)

Type designation	Popular name of shape (informative)	Nominal voltage (V _N)	Outline										Test condition				Duration		Applications	Type designation			
			Dimensions mm										Load resistance (R) Ω	Dis-charge time per day	End-point voltage (EV) V	Characteristics							
			A (overall height)		B	C	D	E	F	G	φ (diameter)					φ P							
			Max.	Min.	Min.	Max. (informative)	Max.	Max. (informative)	Min.	Max.	Min.	Max.											
Battery system	R6PU	UM-3	1.5	50.5	49.2	49.2	7.0	4.0	0.5	5.5	4.2	1.0	14.5	13.5	0.5	43	4 h	0.9	32 h	25 h	Transistor radios	R6PU	
																3.9	1 h	0.8	72 min	57 min	Motors/toys		
																10	1 h	0.9	4.8 h	3.8 h	Personal cassette players and tape recorders		
																24	(¹)	1.0	13 h	10 h	Remote controllers		
																1.8	(⁴)	0.9	90 times	72 times	(⁵)		
	Carbon zinc battery	R14C	UM-2	1.5	50.0	48.6	48.6	13.0	5.0	0.9	7.5	5.5	1.5	26.2	24.9	1.0	3.9	(²)	0.9	250 min	200 min	Transistor radios	R6S
																	6.8	1 h	0.9	7 h	5.6 h	Portable lighting	
																	20	4 h	0.9	25 h	20 h	Tape recorders	
																	3.9	1 h	0.8	2.5 h	2.0 h	Transistor radios	
																	3.9	(²)	0.9	300 min	240 min	Toys	
Carbon zinc battery	R14P															6.8	1 h	0.9	9 h	7.2 h	Portable lighting	R14P	
																20	4 h	0.9	30 h	24 h	Tape recorders		
																3.9	1 h	0.8	4.8 h	3.8 h	Transistor radios		
																3.9	(²)	0.9	410 min	325 min	Toys		
																6.8	1 h	0.9	12.5 h	10 h	Portable lighting		
Carbon zinc battery	R14PU															20	4 h	0.9	42 h	33 h	Tape recorders	R14PU	
																3.9	1 h	0.8	6.6 h	5.3 h	Transistor radios		
																3.9	(²)	0.9	120 min	96 min	Toys		
																6.8	1 h	0.9	3 h	2.4 h	Portable lighting		
																20	4 h	0.9	15 h	12 h	Tape recorders		
Carbon zinc battery	R14S															3.9	1 h	0.8	1.5 h	1.2 h	Transistor radios	R14S	
																3.9	1 h	0.9	3 h	2.4 h	Toys		
																6.8	1 h	0.9	3 h	2.4 h	Portable lighting		
																20	4 h	0.9	15 h	12 h	Tape recorders		
																3.9	1 h	0.8	1.5 h	1.2 h	Toys		

- Notes (1) Fundamental temperature and humidity conditions, a temperature of (20±2)°C, a relative humidity of (60±15) %
- (2) A cycle consisting of 4 min discharge and 56 min rest per hour is repeated continuously for 8 h while the specified load resistance is connected
- (3) A cycle consisting of 15 s discharge and 45 s rest per minute is repeated continuously for 8 h while the specified load resistance is connected
- (4) A cycle consisting of 15 s discharge and 45 s rest per minute is repeated continuously for 24 h while the specified load resistance is connected. For duration, the time of end of discharge of 15 s per minute is counted as one time.
- (5) Pulse discharge