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(BAJ/JSA)

**Secondary lithium cells and batteries
for use in industrial applications—
Part 1: Tests and requirements of
performance**

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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) and 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. Consequently **JIS C 8715-1:2012** is replaced with this Standard.

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JIS C 8715 series consist of the following two parts under the general title “*Secondary lithium cells and batteries for use in industrial applications—*”

Part 1: Tests and requirements of performance

Part 2: Tests and requirements of safety

Secondary lithium cells and batteries for use in industrial applications— Part 1: Tests and requirements of performance

Introduction

This Japanese Industrial Standard has been prepared based on **IEC 62620**:2014, Edition 1, with some modifications of the technical contents, aimed at conformance with the relevant **JIS**.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the requirements of performance and marking for lithium secondary cells and batteries (hereafter referred to as “cells” and “battery systems”, respectively) used in industrial applications including stationary applications.

When there exists a **JIS** or **IEC** standard specifying test conditions and requirements for cells used in special applications and which is in conflict with this Standard, the former takes precedence (e.g. **IEC 62660** series on road vehicles).

This Standard is applicable to the secondary lithium cells and batteries for stationary application and mobile application for industrial use. Practical examples for main applications are as follows.

- a) **Stationary applications:** telecom, uninterruptible power supplies (UPS), electrical energy storage system, utility switching, emergency power and similar applications.
- b) **Motive applications:** fork-lift truck, golf cart, automated guided vehicle (AGV), railway, and marine, excluding road vehicles.

NOTE 1 Some lithium secondary cells are intended for portable devices. The performances of such secondary lithium cells and batteries are specified in **JIS C 8711**.

Since this Standard covers batteries for various industrial applications, it includes those requirements, which are common and minimum to the various applications.

This Standard applies to cells and batteries. If the battery is divided into smaller units, the smaller unit can be tested as the representative of the battery. The manufacturer clearly declares the tested unit. The manufacturer may add functions, which are present in the final battery, to the tested unit.

The safety requirements for secondary lithium cells and batteries for use in industrial applications are specified in **JIS C 8715-2**.

NOTE 2 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 62620:2014 *Secondary cells and batteries containing alkaline or other non-acid electrolytes—Secondary lithium cells and batteries for use in industrial applications* (MOD)

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 21-1**.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Standard. The most recent edition of the standard (including amendment) indicated below shall be applied.

JIS C 8715-2 *Secondary lithium cells and batteries for use in industrial applications—Part 2: Tests and requirements of safety*

3 Terms and definitions

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

3.1 charge recovery, capacity recovery

capacity that a cell or battery can deliver after storage, at a specific temperature, for a specific time and subsequent recharge, as a percentage of the rated capacity

NOTE : Charge retention is defined in **3.2**.

3.2 charge retention, capacity retention

capacity that a cell or battery can deliver after storage, at a specific temperature, for a specific time without subsequent recharge as a percentage of the rated capacity

3.3 final voltage, end-of-discharge voltage

specified closed circuit voltage at which the discharge of a cell or battery is terminated

3.4 nominal voltage

suitable approximate value of the voltage used to designate or identify a cell or a battery

NOTE 1 The cell or battery manufacturer (hereafter referred to as the manufacturer) may provide the nominal voltage.

NOTE 2 The nominal voltage of a battery of n series connected cells is equal to n times the nominal voltage of a single cell.

3.5 rated capacity

capacity value of a cell or battery determined under specified conditions and declared by the manufacturer, C_n (ampere-hours, Ah)

NOTE : The rated capacity is the quantity of electricity C_n Ah declared by the manufacturer which a single cell or battery can deliver during a n h period when charging, storing and discharging under the conditions specified in **6.3.1**. n is 5 for an E, M and H discharge rate type cell or battery. n is 8, 10, 20 or 240 for an S discharge rate type battery.

3.6 cell, secondary lithium cell

secondary cell where electrical energy is derived from the insertion/extraction reactions of lithium ions or oxidation/reduction reaction of lithium between the negative electrode and the positive electrode

NOTE : The cell typically has an electrolyte that consists of a lithium salt and organic solvent compound in liquid, gel or solid form and has a metal or a laminate film casing. It is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

3.7 cell block

group of cells connected together in parallel configuration

It is a type of battery modules and a construction alternatively used for the test of a cell, with or without protective devices (e.g. fuse or positive temperature coefficient, PTC).

NOTE : It is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

3.8 module

group of cells connected together either in a series and/or parallel configuration

It can go with or without protective devices (e.g. fuse or PTC) and monitoring circuitry.

3.9 battery pack

energy storage device, which is comprised of one or more cells or modules electrically connected

NOTE : It may incorporate a protective housing and be provided with terminals or other interconnection arrangement. It may include protective devices and control and monitoring, which provides information (e.g. cell voltage) to a battery system.

3.10 battery system, battery

system which incorporates one or more cells, modules or battery packs and has a battery management system (BMS) to keep cells usable

NOTE : It may have cooling or heating units. Two or more battery systems may constitute a larger battery system.

3.11 battery management system, BMS

electronic system associated with a battery which monitors and/or manages its state to keep all cells usable

It calculates secondary data, reports that data and/or controls its environment to influence the battery's safety, performance and/or service life and has the functions to cut off in case of over charging, over current and over heating.

NOTE 1 The function of the BMS can be assigned to the battery pack or to equipment that uses the battery. In the latter case the battery system has the BMS function.

NOTE 2 A BMS is sometimes also referred to as a battery management unit (BMU).

3.11A cycle application

type of application where cells or batteries are intended to repeatedly alternate between discharging and recharging

3.11B stand-by application

type of application where cells or batteries are kept charged for urgent need for use

4 Parameters measurement tolerances

Unless otherwise specified, the tolerances on the controlled or measured values of the test apparatus for parameters shall be as follows.

- a) For voltage: $\pm 0.5 \%$
- b) For current: $\pm 1 \%$
- c) For temperature: $\pm 2 ^\circ\text{C}$
- d) For time: $\pm 0.1 \%$
- e) For dimensions: $\pm 1 \%$

These tolerances comprise the combined accuracy of the measuring instruments, the measurement techniques used, and all other sources of error in the test procedure.

The details of the instrumentation used shall be provided in any report of results.

5 Marking and designation

5.1 Marking

The marking items shown in Table 1 are indicated on the cell, battery system or instruction manual.

The following options are allowed:

- if there are designations on a battery system, designations are not necessary on the battery pack, module or cell;
- if there are designations on a battery pack, designations are not necessary on the module and cell;

- if there are designations on a module, designations are not necessary on the cell.

However, for a transportable unit (i.e. a unit that is being shipped), it is necessary to provide the marking information on the main transportable unit or in its instruction manual. Furthermore, if there is a marking matter of arrangement between the purchaser and the manufacturer, it shall comply with the agreement.

Each cell or battery that is installed or maintained shall carry clear and durable markings giving the following information:

- secondary (rechargeable) Li or Li-ion;
- polarity (can be deleted if there is an agreement between cell and pack manufacturer);
- date of manufacture (which may be in code);
- name or identification of manufacturer or supplier;
- rated capacity;
- nominal voltage;
- appropriate caution statement.

The model name and manufacturing traceability shall be marked on the cell and battery surface. The other items listed above can be marked on the smallest package or supplied with the cell or the battery.

The following information shall be marked on or supplied with the cell or the battery:

- disposal instructions;
- recommended charge instructions.

The cell designation as specified in **5.2** shall be marked on the cell or when there is no marking place on the cell, it shall be marked in the manual.

Table 1 Marking

Marking information	Cell	Cell block Module or Battery pack	Battery system
Secondary (rechargeable) Li or Li-ion	○	○	○
Polarity (see NOTE 1)	○	○	○
Date of manufacture (see NOTE 2)	○	○	○
Name or identification of manufacturer or supplier	○	○	○ ^{a)}
Rated capacity	○	○	○ ^{b)}
Calculated rated capacity ^{c)}	—	—	○
Method for calculating rated capacity ^{c)}	—	—	○
Nominal voltage	○	○	○
Watt-hour (see NOTE 3)	△	△	△
Appropriate caution statement (Including disposal instructions)	○	○	○
Cell designation as specified in 5.2	○	—	—
Battery designation as specified in 5.3	—	○	○
Recommended charge instructions	○	○	○
“○” = required; “△” = voluntary, “—” = unnecessary or not applicable			
NOTE 1 There is an exception, see 5.1. NOTE 2 The date can be in the form of a code. NOTE 3 Watt-hour (Wh) = Rated capacity (Ah) or Calculated rated capacity (Ah) × Nominal voltage (V) Notes ^{a)} It is necessary to mark designations on the main battery system. ^{b)} Tested by main battery system; shall be indicated on the main battery system. ^{c)} If evaluated by testing the split unit of a battery system; it shall be indicated as the rated capacity and shall be the amount calculated by a reasonable method. For example: Measured rated capacity of module: 10 Ah Number of modules connected in parallel: 5 Calculated rated capacity (Ah) = 10 Ah × 5 = 50 Ah			

5.2 Cell designation

Cells shall be designated as follows.

$A_1A_2A_3N_2/N_3/N_4/A_4/T_LT_H/N_C$

where

- A_1 designates the negative electrode basis in which:
 - I is carbon;
 - T is titanium;
 - X is other material.
- A_2 designates the positive electrode basis in which:
 - C is cobalt;
 - F is iron;

Fp is iron phosphate;
N is nickel;
M is manganese;
Mp is manganese phosphate;
V is vanadium;
X is other material.

- A_3 designates the shape of the cell in which:
 - R is cylindrical;
 - P is prismatic (including cell with laminate film case).
- A_4 designates the rate capability of the cell in which:
 - E is low rate long-time discharge type;
 - M is medium rate and middle-period discharge type;
 - H is high rate discharge type.

NOTE 1 These types of cells are typically but not exclusively used for the following discharge rates at +25 °C:

E up to $0.5 I_t$ A,
M up to $3.5 I_t$ A,
H above $3.5 I_t$ A.

NOTE 2 These currents are expressed as multiples of I_t A, where, (see **IEC 61434**)

$$I_t (\text{A}) = C_5 (\text{Ah}) / 1 (\text{h})$$

- T_L is the low temperature grade defined in **6.3.2**. For cells, the test identifies the temperature at which a capacity of not less than 70 % of the rated capacity can be discharged. This temperature can be declared at 10 °C intervals, by rounding up the first digit. For example in the case of test performed at -27 °C, the declared low temperature should be -20 °C, and be indicated by the sign + or - followed by the temperature value in °C (e.g. -30 °C: -30, 0 °C: 0, +10 °C: +10).
- T_H is the high temperature grade defined in **6.6.2**. The cells are classified according to the temperature at which not less than 85 % of the rated capacity can be retained after 90 days as the standby state retaining durability. This temperature can be declared at 10 °C intervals, by rounding down the first digit. For example in the case of test performed at 57 °C, the declared high temperature should be 50 °C, and be indicated by the sign + or - followed by the temperature value in °C (e.g. +40 °C: +40, +50 °C: +50). If a battery is designed only for cycle application, T_H should be mentioned as "NA".
- N_C is the proportion of the capacity after performing 500 cycles of charge and discharge specified in **6.6.1** to the rated capacity. The proportion of the discharge capacity measured in the sixth step of **6.6.1** to the rated capacity is expressed in two-digit percentage (%) and by the figure truncated in units of 5 % (for example, 87 % is noted as 85). If a battery is designed only for stand-by application, N_C should be mentioned as "NA".