

INCH-POUND
MIL-PRF-49471B(CR)
AMENDMENT 1
25 April 2002

PERFORMANCE SPECIFICATION
BATTERIES, NON-RECHARGEABLE, HIGH PERFORMANCE

This amendment forms a part of MIL-PRF-49471B, dated 30 November 2000, and is approved for use within the Communications-Electronics Command, Department of the Army and is available for use by all Departments and Agencies of the Department of Defense.

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Paragraph 3.3.2.1: Delete the last sentence and replace with the following:

"The material shall be non-flammable, non-toxic, and impervious to the electrolyte of the battery."

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Add as new paragraph:

"3.4.4.5 Cell series string short circuit protection. When specified (see specification sheet), each multi-cell battery shall be protected from cell series string short circuits that might result in leaking, bulging, venting, ruptures, or burning of any battery whenever a string short circuit develops within a battery. This requirement is in addition to the overload protection required by 3.4.4.3. When the protection is applied between cells, at a minimum it shall be applied near the midpoint of the cell string for cell strings containing up to four cells; for cell strings of five or more cells, it shall be applied so that no more than 3 cells are connected in series without the protection. When tested per 4.7.10.8, cell and inter-cell connection insulation (when used) for all cells in the string shall remain intact (no melting or shrinking) and all cells in the series string shall not leak, bulge, vent, rupture, or burn."

3.4.5.2, lines 6 through 8: Delete the third and fourth sentences and substitute:

"The device shall be protected from inadvertent activation. The device shall provide a positive indication of circuit continuity once it has been activated. The circuit for the device shall bypass all nonresetable cutouts and fuses within the battery except for the cell series string short circuit protection (see 3.4.4.5)."

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Add as new paragraph:

"3.11.1 Thermal Shock. Batteries shall not leak, bulge, vent, rupture, or burn as a result of varying rates of thermal expansion or contraction of internal cell and battery components. After the batteries have been tested as specified in 4.7.6.1 they shall meet the visual and mechanical and battery voltage requirements (see Table V and 3.5.1)."

3.12 Delete and substitute:

"3.12 Labeling and marking. All labeling and marking shall be clear and legible throughout all the tests specified herein. Labeling and marking shall contrast in color with the background. Where the labeling and marking are engraved or die stamped, the text may be the same color as the background. When First Article is required by contract, the color of all battery labeling and marking shall be described in the First Article Test Report."

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3.12.3, line 4, after the first sentence, add the following: "When First Article is required by contract, the text of this label shall be included in the First Article Test Report."

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Table I: At "Cell series string insulation" add "1" and enter the following footnote at the bottom of the table:

"1/ This test does not apply to the BA-X567/U or the BA-5372/U battery."

Table I: After "Cell series string voltage" add the following: "Cell series string short circuit protection, 1/, 3.4.4.5, 4.7.10.8, 4.4.1.1."

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4.4.1.1: Delete and substitute:

"4.4.1.1 Cell level sample size. The total number of cells for these tests shall be equal to 5 times the number of cells in a battery ("c") plus 5 ($5c + 5 = x$) except that only $2c + 5$ shall be required for the BA-X567/U and BA-5372/U batteries. Use the quantity of 2 cells ($c=2$) for single cell batteries and test as a series string of two cells. All cells shall be subject to the closed circuit voltage test and the electrolyte leakage test. A quantity of $2c$ of the cells shall be used to perform the cell forced discharge test on two separate cell strings per 4.7.16. For all types except the BA-X567/U and BA-5372/U, a quantity of $3c$ cells shall be separated into three equal groups, except that cells intended for the BA-X590/U and BA-X557/U shall be separated into six equal groups, and assembled into cell strings in the same manner employed for production units. Each cell string shall then be subjected to the cell series string insulation resistance and cell series string voltage tests. When specified (see specification sheet), the strings shall be subjected to the cell series string short circuit protection test of 4.7.10.8. The remaining 5 cells shall be subjected to the safety feature test of 4.7.10.2."

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Table II, After Group II, No. of Batteries 40, add: "6/"

Table II, Group V, first line: delete "Overload tests", and substitute: "Visual-mechanical, 3.1, 4.7.1."

Table II, Group V, after "Visual-mechanical", add: "10, Thermal Shock, 3.11.1, 4.7.6.1"

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Note 5/: Delete and substitute:

"5/ Overload tests not required for the BA-X567/U and BA-5372/U. For these two types, Group V testing ends after Thermal Shock."

After note 5/, add:

"6/ Only 30 batteries are required for Group II for battery types that do not require a State of Charge Indicator."

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Add as new paragraph:

"4.7.6.1 Thermal Shock.

Step 1. Batteries shall be placed in an environmental chamber. The chamber air temperature shall be adjusted to $-40\pm 5^{\circ}\text{F}$ and maintained for a period of not less than 4 hours.

Step 2. The batteries shall then be transferred to a chamber set at $160\pm 5^{\circ}\text{F}$ within 5 minutes.

During the transfer, the batteries shall be exposed to the inspection conditions of 4.3.

Step 3. After insertion of the batteries into $160\pm 5^{\circ}\text{F}$, they shall remain at this condition for no less than 4 hours*.

Step 4. Batteries shall be transferred to a chamber set at $-40\pm 5^{\circ}\text{F}$ within 5 minutes. During the transfer, the batteries shall be exposed to the inspection conditions of 4.3.

Step 5. After insertion of the batteries into $-40\pm 5^{\circ}\text{F}$, they shall remain at this condition for no less than 4 hours*.

Step 6. Repeat steps 2 through 5 three times.

Step 7. The batteries shall then be transferred to a chamber set at $160\pm 5^{\circ}\text{F}$ within 5 minutes.

During the transfer, the batteries shall be exposed to the inspection conditions of 4.3.

Step 8. After insertion of the batteries into $160\pm 5^{\circ}\text{F}$, they shall remain at this condition for no less than 4 hours*.

Step 9. Store batteries at the inspection conditions of 4.3 for no less than 4 hours.

Step 10. Perform visual-mechanical and battery voltage inspections."

*NOTE: Minimum time after insertion shall be counted from the time that the chamber returns to the set temperature.

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4.7.8, add the following: "NOTE: Cell series strings intended for use in cylindrical batteries need to be tested for between-cell insulation. Due to the cell-stack configuration of these strings, it may be necessary to employ additional fixtures during testing that would not normally be used in production. The method for testing cylindrical cell strings shall be described in the First Article Test Plan when First Article is required by contract."

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4.7.9.1, add: "When a complete discharge device is applicable (see specification sheet) the positive indication of circuit continuity required for the complete discharge device shall be verified per 4.7.10.7 for batteries that have passed all capacity test requirements except for those completing the I (and IP, where applicable) and LR1 tests. Batteries shall meet the requirement for providing a positive indication of circuit continuity of 3.4.5.2."

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4.7.10.5 g, add: "For the BA-X567/U and BA-5372/U, use all 20 samples for this test. The overload test is not required for these two types."

4.7.10.7, line 3: After "Operability shall be verified." Add: "A positive indication of circuit continuity shall be verified once the device has been activated."

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Add as new paragraph:

"4.7.10.8 Cell series string short circuit protection. Each cell series string designated for this test shall be subjected to a direct short between its positive and negative terminations. Where necessary, a minimum length of copper wire No. 16 AWG or larger gauge may be used. Short circuit shall be maintained for a minimum of 30 minutes unless a cell series string experiences an open circuit sooner. Cell series strings shall meet the requirements of 3.4.4.5."

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6.2, add: "h. A statement regarding the requirement for a State of Charge Indicator for battery types other than the BA-X567/U, BA-5372/U, BA-5368/U, and BA-5374/U."

Custodian:
Army - CR

Preparing activity:
Army - CR

(Project 6135-0425)