

## DRY CELLS AND DRY BATTERIES

### TESTS AND INSPECTIONS

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**1. GENERAL**

**1.01** This section covers tests and inspections of dry cells and dry batteries. Reference can be made to Section 157-421-101 for a general description of dry cells and to Section 157-421-201 for installation information.

**1.02** This section is reissued for the reasons listed below. Revision arrows are used to emphasize the more significant changes. This reissue does affect the Equipment Test List.

- (a) To add a Table of Contents

- (b) To rate the following KS spec batteries in Tables A and B Mfr Disc.

- KS-6522 (replaced by KS-14711)
- KS-6542 (replaced by KS-14367)
- KS-6567 (replaced by KS-6568, L2)
- KS-7342 (replaced by KS-6570)
- KS-7889 (replaced by KS-7890, L2)
- KS-9025 (replaced by KS-6573)

- (c) To add additional battery types to Tables A and B

- (d) To add new maintenance and inspection requirements involving KS-14367 cell installations.

**1.03** Theory of operation of dry batteries and other educational information will be found in Section 157-421-101.

**2. APPARATUS**

**2.01** *List of Test Apparatus:* The following test apparatus is used in this section.

TEST APPARATUS	DESCRIPTION
19G	Resistor, 40 and 100 ohms $\pm 5\%$
19N	Resistor, 5 and 8 ohms $\pm 5\%$
19GC	Resistor, 110 and 75 ohms $\pm 1\%$
19HP	Resistor, 10 and 40 ohms $\pm 1\%$
19JB	Resistor, 20 and 150 ohms $\pm 1\%$
19JL	Resistor, 300 and 2460 ohms $\pm 2\%$
18KF	Resistor, 10,000 ohms $\pm 1\%$

**NOTICE**

Not for use or disclosure outside the  
Bell System except under written agreement

**Note:** Equivalent resistor combinations may be substituted.

- KS-20538 Volt-ohm-milliammeter (or any voltmeter having suitable scales, accuracy, and at least 10,000 ohms/volt input impedance (see Table B, Note 4)
- DC Volt-Ammeter, Weston Model 281 (of suitable scale)
- Voltmeter, Weston Model 931 (of suitable scale)
- ◆— Gloves, Neoprene (for light work)
- 484B Goggles, American Optical
- KS-14666 Cleaning Cloth◆

**Note:** Equivalent meters may be substituted.

**3. MAINTENANCE TESTS**

**A. General**

**3.01** The KS dry batteries are marked with the approximate date of manufacture and will ordinarily be furnished to the field before they are 6

months old. The date of manufacture of large batteries is located on each battery enclosure or jacket in the box designated DATE OF MANUFACTURE. For example, the date 4-18-81 indicates that the battery was packed for shipment during the week ending April 18, 1981. The date of manufacture on small batteries is placed on the bottom of the battery in code. An arrow pointing to the battery bottom will be found in the date of manufacture box. The date code consists of three digits. The first two digits indicate the week of the year the battery was packed for shipment, and the third digit indicates the last digit in the year in which the battery was manufactured. For example, 161 indicates that the battery was packed for shipment during the 16th week of 1981.

**3.02** Since dry batteries are perishable, they should be ordered periodically in quantities sufficient only to provide for regular and possible emergency requirements. To avoid short life replacements, batteries in storage which reach a 12 month age limit without having been placed in service should ordinarily be discarded. ◆The exception to this is the KS-14367 battery; its maximum storage period is six months.◆ Installation age limits for each type of dry battery, based on use at approximately 70°F, are included in Tables A and B. However, under special emergency conditions or where dry batteries have been kept in cold storage, the installation age limits can be exceeded as determined by local conditions.

◆TABLE A◆

## BATTERIES IN GRID SERVICE

TYPE	INSTALLATION AGE LIMIT *	NO.OF CELLS	RATED VOLTAGE	CUTOFF VOLTAGE
KS-6568,L2	2 Years	3	4.5	4.35
KS-6569	2 Years	3	4.5	4.35
KS-6573	2 Years	15	22.5	21.7
KS-7105	1-1/2 Years	15	22.5	21.7
KS-7890,L2	1 Year	60	90.0	87.0
KS-8587	2 Years	21	31.5	30.4
KS-8588	2 Years	15	22.5	21.7
KS-15998	2 Years	5	7.5	7.25

\*See instructions in paragraphs 3.02, 3.06, and 3.07. This age limit applies to cells that are actually in service, starting with the date they are installed.

TABLE B

## STANDARD BELL SYSTEM DRY BATTERIES

TYPE	INSTALLATION AGE LIMIT*	NO. OF CELLS	TEST RES. OHMS	RATED VOLTAGE	CUTOFF VOLTAGE	SEE NOTE	USUAL TYPE OF SERVICE
KS-6569	2 Years	3	30	4.5	3.0	2	Grid, Test Set
KS-6570	2 Years	3	30	4.5	3.25		Test Set
KS-6571	1-1/2 Years	16	150	24.0	15.0		Plate, Test Set
KS-6572	1-1/2 Years	15	150	22.5	15.0		Plate, Test Set
KS-6573	2 Years	15	150	22.5	15.0	2	Grid, Plate, Test Set
KS-6700	2-1/2 Years	3	30	4.5	3.25		Transmitter
KS-6948	2 Years	30	300	45.0	30.0	1	Plate, Test Set, Aux, Reserve
KS-7105	1-1/2 Years	15	150	22.5	15.0	2	Grid, Plate
KS-7595	2-1/2 Years	2	20	3.0	2.17		Transmitter
KS-8128	2 Years	30	75	22.5	15.0	1, 3	Plate, Aux, Reserve
KS-8587	2 Years	21	210	31.5	21.0	2	Grid, Plate, Test Set
KS-8588	2 Years	15	150	22.5	15.0	2	Grid, Pate, Test Set
KS-13493	2 Years	5	50	7.5	5.0		Test Set
KS-14196	1 Year	30	300	45.0	30.0		Test Set
KS-14196	1 Year	30	300	45.0	30.0		Test Set
KS-14367 (No. 6)	1 Years	1	10	1.5	0.9	1	Test Set, Aux, Reserve
KS-14368	1 Year	1	10	1.5	0.75		Flashlight
KS-14369	1-1/2 Years	30	300	45.0	30.0		Test Set
KS-14370	1-1/2 Years	30	300	45.0	30.0		Plate, Test Set
KS-14371	2 Years	4	40	6.0	3.6		Lantern
KS-14495	2 Years	2	5	1.5	1.0	3	Test Set

TABLE B (Contd)

## STANDARD BELL SYSTEM DRY BATTERIES

TYPE	INSTALLATION AGE LIMIT*	NO. OF CELLS	TEST RES. OHMS	RATED VOLTAGE	CUTOFF VOLTAGE	SEE NOTE	USUAL TYPE OF SERVICE
KS-14711	1-1/2 Years	1	10	1.5	0.9		Test Set
KS-14757	1-1/2 Years	30	300	45.0	30.0		Plate, Flasher
KS-14773	1 Year	15	3000	22.5	15.0	4	Plate, Test Set
KS-15936	1 Year	15	3000	22.5	18.0	4	Test Set
KS-15937	1 Year	20	4000	30.0	20.0	4	Test Set
KS-15939	2 Years	20	50	7.5	3.0	3	Emergency Floodlight
KS-15998	2 Years	5	50	7.5	5.0	2	Grid, Test Set

**Note 1:** "Aux" denotes battery used in central office for coin control, ringing, tripping, or superimposed ringing. "Reserve" denotes battery used as standby for rectifier power supply in case of ac power failure.

**Note 2:** Where these batteries are used for grid service, use cutoff voltage in Table A.

**Note 3:** Series parallel arrangement.

**Note 4:** Because of small size of KS-14773, KS-15936, and KS-15937 batteries, the artificial load shall be 200 ohms per cell and the test shall be made with a voltmeter, such as the KS-20538 or a digital meter having a resistance of at least 10,000 ohms per volt of full-scale deflection.

\*See instructions in paragraphs 3.02, 3.06, and 3.07. This age limit applies to cells that are actually in service starting with the date they are installed.

## SECTION 157-421-501

### B. Acceptance Tests

**3.03** Generally, it is not necessary to make acceptance or preinstallation tests of KS dry batteries. Dry batteries shall be assumed to be in good serviceable condition unless they are beyond the storage limit; the shipping containers are wet or damaged; the cells are wet or leaking; or the jackets, seals, or terminals are damaged. Batteries that do not meet these standards or whose performance is so poor as to be readily apparent should not be accepted. Due to recent instances of random defects in the manufacture of KS-14367 dry cells, users are strongly advised to measure the open-circuit voltage of each cell prior to installation. Cells having an open-circuit voltage of less than 1.60 volts should not be used.

**Note:** With few exceptions, (see exceptions in paragraph 3.02) the storage limit is considered to be 12 months from the date stamped on the cell.

### C. Replacement

**3.04** In certain services, practices have been established for replacing batteries on a periodic basis. Because improvements which may extend their service life are constantly being incorporated into dry batteries, these replacement intervals should be reviewed periodically. Where batteries are readily accessible and where a battery failure can be tolerated, it will be economical to operate a battery to almost complete exhaustion. However, in most cases, specific maintenance tests have been provided in connection with standard circuits and when these tests are available, they should be followed.

**3.05** Where specific maintenance tests have not been provided, the tests described in paragraphs 3.06 and 3.07 should be used to determine whether the cells or batteries should be replaced. However, individual cells or batteries which are part of a series string with other cells or batteries should not be replaced unless the entire string is replaced. It is permissible in specific cases to add a relatively small number of cells to such a string. This is particularly applicable for batteries requiring close voltage regulation, where, without the addition of extra cells, only a relatively small proportion of the battery capacity could be used. Additions should not be carried to the point where any one of the existing units will be in danger of being entirely depleted since such a condition will increase the hazard of sudden failure,

leakage, or fire. Where these series strings of dry cells are a part of a power plant supplying current for coin control, ringing, etc, specific maintenance tests or maximum cell quantities and minimum voltage limits are specified in most cases and shall be followed when determining whether cells should be added.

**3.06** The following additional maintenance criteria for all applications in which KS-14367 (formerly KS-6542) dry cells are already installed:

- (1) Measure the open circuit voltage of each individual cell every 3 months. Cells that measure less than 1.40 volts dc should be replaced. Usually, in the case of multi-cell strings, spare cells are available for this purpose.
- (2) During the quarterly voltage check, examine each cell for leakage or corrosion. Replace a cell which shows dry salt deposits, or is actually wet with electrolyte, or if the cardboard jacket is blackened or perforated.
- (3) If the installation date of the string is not known, but most or all of the cells in it are more than 1-1/2 years old, replace the entire string.
- (4) If the installation date of the string is known, and it has been in service longer than 1 year, replace the entire string, regardless of date of manufacture.

### D. Tests on Batteries Subjected to Negligible Current Drain

**3.07** Dry batteries, used to provide potential only, or a drain so small that its effect on the life of the cells is negligible, such as in some grid services, shall be tested with a voltmeter of suitable scale having a sensitivity of at least 1000 ohms per volt. Cells and batteries which may be used in grid service are listed in Table A. Table A shows cutoff voltages which might be used to determine whether replacement is necessary, provided other values have not been specified for the particular service. Installation age limits are also included for the batteries listed in Table A.

### E. Tests on Batteries Subjected to Steady or Variable Current Drain

**3.08** Dry batteries subjected to steady or variable current drains, such as plate supply, test set

supply, transmitter supply, etc, shall be tested with a voltmeter having a sensitivity of at least 1000 ohms per volt (except as noted in Table B.) These tests should be made 5 seconds after the application of an artificial load and, where possible, with the service load disconnected. The suggested cutoff voltages in Table B should be used to determine whether replacement is necessary, provided other values have not been specified for the particular service. However, service conditions to which the batteries were previously subjected, the period of time that will elapse before the next test is made, the temperature at which the batteries are being operated, or other local conditions may indicate that some other cutoff voltage between 0.8 and 1.2 volts per cell may be more appropriate. Installation age limits are also included for the batteries listed in Table B.

#### F. Fire Prevention

**Note:** It is strongly recommended that periodic inspections be made (at least quarterly) for electrolyte leakage, which may cause a short circuit, result in premature dissipation of the battery, and create a fire hazard. Cells and batteries showing bulging or leaking electrolyte, or a deposit of salts on the outside, should be replaced at once.

**3.09 Causes of Leakage:** A cell or battery in dc service will usually leak and cause damage only after it is exhausted (completely discharged) and left in service. The electrolyte simply leaks out through the perforated zinc electrode. However, there have been confirmed reports of cells or batteries leaking before they reach exhaustion in applications such as auxiliary service. In this case, dry cells are a part of a power plant supplying current for coin control, ringing, tripping, or superimposed ringing and receive a superimposed ac current, or at times, a dc charging current. Charging currents in primary cells generate gas instead of charging up active material on the electrodes. This is why dry cells often appear bulged after having received charging currents. Additionally, the internal gas pressures may pump out electrolyte, and this leakage, when it occurs, can be severe.

**3.10 Cleanup of Electrolyte:** When LeClanche or standard carbon zinc cells or batteries leak, the leakage is acidic and usually consists of a mixture of ammonium chloride, zinc chloride, and water. A safe method to clean up leakage from carbon zinc batteries is to neutralize the leakage with a dilute. This is achieved as follows:

**Caution: Do not install batteries in wet or damp fixtures or holders.**

- (1) Obtain safety goggles and rubber gloves
- (2) Prepare solution of baking soda (sodium bicarbonate) and water by dissolving a rounded teaspoonful of sodium bicarbonate in a cup of water
- (3) Using safety goggles and rubber gloves, thoroughly flush the affected areas with the solution, wipe with cleaning cloth, and allow to dry completely.
- (4) Visually inspect the fixtures and holders for permanent damage and replace if necessary
- (5) Install the replacement cells and dispose of old cells in accordance with paragraph 3.11.

**3.11 Disposal of Primary Batteries:** As a rule, small single cells and small low voltage batteries may be safely disposed of in the regular trash. But some care should be taken to prevent the possibility of sparks and/or high short circuit currents occurring when disposing of partially discharged large cells and high voltage batteries (12 volts or more). It is recommended that the lead wires be cut flush to the battery case, or insulate (cover with tape) exposed terminals. Another safe method of disposing of batteries taken out of service is to put them in the boxes in which the replacement cells were shipped, tape them shut, and mark them as scrap. They can then be disposed of as ordinary trash.