

ELECTROLYTIC CAPACITORS
ALUMINUM-TYPE
REQUIREMENTS AND PROCEDURES

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referring to information on the capacitor case or in the circuit schematic.

An exception to this is on older KS-8531 capacitors on which the 5 and 7 terminals are (+) but not so designated. Any capacitor with polarity markings must be connected (+) to positive of the power and (-) to negative of the power as shown on the circuits.

1. GENERAL

1.01 ♦This section covers all aluminum-type electrolytic capacitors except for the ones covered by specifications KS-16390, KS-19524, and KS-20423. It does not apply to tantalum-type electrolytic capacitors because none of the restrictions of this section are necessary with the tantalum type. The aluminum type are distinguished by the fact that they are stamped or labeled "Electrolytic Condenser," "Electrolytic Capacitor," or "Elect. Cap." Tantalum type are not so designated.♦

1.02 This section is reissued to clarify the film restoration requirements. This reissue does not affect the Equipment Test List.

1.03 There are three general classes: polarized, nonpolarized, and motor-starting capacitors.

- (a) The polarity of polarized electrolytic capacitors is identified by the following:
- By stamping the positive and negative terminals with POS and NEG or (+) and (-) symbols
 - By painting the positive terminal red or the negative terminal black or white
 - By designating the terminals by numbers or symbols which can be interpreted by

Caution: When making connections to a polarized electrolytic capacitor or to any circuit containing a polarized electrolytic capacitor, extreme care should be used to see that the connections are correctly made with respect to the polarity of the capacitor. Reversal of polarity or application of ringing or ac will not only damage the capacitor but also may cause injury to personnel or damage to equipment if the capacitor should explode. The positive and negative terminals of the capacitor may be determined as described in (a). In every case, however, the proper manner of connection should be determined before power is connected to the capacitor or circuit containing the capacitor.

- (b) Nonpolarized capacitors either have no polarity marking or are designated "Nonpolarized" or "N.P." on the container. They are also for dc service but are intended for circuits where the dc polarity reverses.
- (c) Motor-starting types are used on ac circuits where they are subjected to brief intervals of ac voltage during the motor-starting periods. Motor-starting capacitors have no polarity

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markings, and there is usually an ac-voltage rating stamped on the container.

1.04 Because of the drying out of the electrolyte in an electrolytic capacitor, there is a slow rate decrease of capacity and increase in series effective resistance with time, which is maintained until near the end of the useful life of the capacitor. At this time these two characteristics begin to change rapidly with a consequent rapid increase of the impedance of the capacitor. The limit of the effectiveness of a capacitor is based on the impedance which can be tolerated for the particular circuit in which it is used. When the impedance of the capacitor exceeds the tolerable impedance for the circuit, it is necessary that it be replaced. (See paragraph 2.03.)

1.05 Caution: *Capacitors may retain their charge for some time after being disconnected from power. The terminals and the metal container of the capacitor may be above ground potential; therefore, care should be exercised when replacing capacitors or working near them to avoid electrical shock or short circuits.*

2. REQUIREMENTS

2.01 Film

- (a) When not connected to power, the dielectric film tends to deteriorate progressively. If polarized capacitors are connected across a proper dc voltage for a sufficient amount of time, the film can usually be restored provided the deterioration has not progressed too far.
- (b) Polarized electrolytic capacitors installed in operational equipment need not be checked.
- (c) ♦Polarized electrolytic capacitors, as "loose parts," that have been disconnected from power for 30 months or less need not be checked before being put into service. This 30-month interval should be calculated from the manufacturing date stamped on the capacitor. However, if the "loose parts" bear more than one date stamping, the time limit for putting them into service without checking is reduced to 12 months from the latest date stamping. Outdated "loose parts" (more than 12 or 30 months) shall not be put into service as noted in subparagraph 2.01(d).

(d) For replacement purpose only, outdated capacitors (more than 12 or 30 months) as described in (c), in the hands of the telephone company, may be placed in service after having been checked in accordance with paragraph 3.02 (1) and (2) to see that the film can be reformed and then held for two hours at 80 or 100 percent of the capacitor voltage rating.♦

(e) Reforming of film of polarized electrolytic capacitors with more than one section may be in accordance with the above for each section. The reforming of all sections may be carried on simultaneously.

(f) Reforming of film as above may also be applied to nonpolarized electrolytic capacitors, except that they shall have the above forming voltage applied with the voltage poled first in one direction for the specified time and then poled in the reverse direction for the same length of time.

(g) In the case of motor-starting capacitors, reforming of film is not recommended.

2.02 Fuse Blowing: Precautions shall be taken to avoid blowing associated fuses by the capacitor charging current when the capacitors are connected or reconnected to power.

2.03 Capacitor Replacement

- (a) Polarized and nonpolarized electrolytic capacitors should be replaced when the impedance of the capacitor exceeds the tolerable impedance for the circuit. [See (b) through (d).]
- (b) When test requirements are specified on circuits or other job information, the capacitors shall be replaced when they fail to meet such requirements.
- (c) When test requirements are not specified on **motor starting** capacitors, they should be replaced only when failing to cause the associated motor to start.
- (d) When testing requirements are not specified on capacitors in **rectifier units**, the capacitor should be replaced only when causing noise or other trouble in the rectifier unit.

3. PROCEDURES

3.01 List of Materials and Test Apparatus (Equivalents May Be Substituted)

CODE OR SPEC NO. MATERIALS	DESCRIPTION	CAPACITOR KS NO.	FILM FORMING DC VOLTAGE
18 or 19 type	Resistance (values as required)	7160	24 to 30
—	Dry cells	7450	160 to 200
—	Lamp, 110 to 120 volts, any wattage	7480	52 to 65
—	Short-circuiting switch (obtain locally)	7481	144 to 180
		7763	64 to 80
TEST APPARATUS		7868	40 to 50
KS-14510,L1	Volt-ohm-milliammeter	7869	10 to 12
		7870	360 to 450 (See Note.)
3.02 Film (Reqt 2.01)		7896	24 to 30
Testing and Reforming After Being Disconnected From Power for More Than 30 Months			
(1) Make up a test circuit locally with a dry cell battery, milliammeter, and resistance in series and with a switch to short-out the milliammeter and resistance. The battery voltage should be 80 to 100 percent of capacitor rating. See Table A for capacitors not stamped with voltage rating. The milliammeter can be of any range from 0-50 to 0-150 milliamperes. The resistance in ohms should be approximately the battery voltage divided by the milliammeter range in amperes (millampere range divided by 1000); for example, with a 200-volt battery and a 150-millampere instrument, the resistance should be 200 divided by 0.150 or 1333 ohms. A 1300-ohm 18BK or a 1340-ohm 18GN resistance would be satisfactory.	8021	52 to 65	
		8025	132 to 165
		8045	72 to 90
		8056	48 to 60
		8188	160 to 200
		8373	20 to 25
		8374	160 to 200
		8418	160 to 200
		8531	200 to 250
		8676	20 to 25
		8677	160 to 200
		8679	160 to 200

and discarded. If the current is decreasing, reclose the switch and continue to apply the voltage to the capacitor for 2 hours.

TABLE A

POWER EQUIPMENT CO NO.	FILM FORMING DC VOLTAGE
C-36	160 to 200
C-60	200 to 250
C-80	12 to 15

Note: Due to the high-voltage rating of the KS-7870 capacitor, every effort should be made to avoid the necessity of film forming by procedure using dry cells. Where this is unavoidable, proper precaution should be taken.

3.03 **Fuse Blowing (Reqt 2.02)**

- (1) The charging current of a capacitor when added to the load and leakage currents may be sufficient to blow the associated fuse unless precautions are taken when fuse or capacitor is installed. Blowing is more likely to occur with a large capacitor and a small fuse; for example, a KS-8056 capacitor and 2-ampere fuse in station equipment.

(2) A lamp or a 10- to 100-ohm resistance held for a few minutes in series with the capacitor and source of power will allow the capacitor to charge and avoid the chance of the fuse blowing. Permanent connections should be completed immediately after removal of the lamp or resistance while the capacitor is still charged.

(3) Where a lamp or resistance is not available, the capacitor can sometimes be charged without blowing the fuse by tapping the final connections together several times before completing the permanent connection. This allows the capacitor to take on some charge at each tap. This method will not be successful if the total load represents too much of the fuse capacity and should not be attempted with voltage above 60. In such cases, proceed as covered in (2).

3.04 **Capacitor Replacements (Reqt 2.03)**

- (1) When replacing a polarized electrolytic capacitor, be sure that the new capacitor is connected into the circuit properly. [See paragraphs 1.03(a) and 1.05.]