

MILITARY SPECIFICATION

CAPACITORS, FIXED, ELECTROLYTIC (SOLID ELECTROLYTE), TANTALUM, MOLDED, CONFORMAL COATED AND METAL CASED WITH PLASTIC END-FILL, NONHERMETICALLY SEALED, GENERAL SPECIFICATION FOR

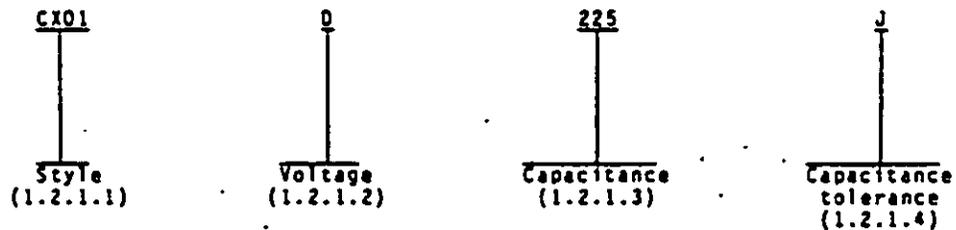
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for fixed, electrolytic (solid electrolyte), tantalum, molded, conformal coated and metal cased with plastic end-fill, nonhermetically sealed capacitors, primarily intended for filter, bypass, coupling, and other applications where the alternating current (ac) component is small compared to the direct current (dc) rated voltage. These capacitors are intended to be used only where supplemental moisture protection is provided or for non-critical applications where hermetic moisture protection is not required.

1.2 Classification. Capacitors covered by this specification are classified by the style, as specified (see 3.1).

1.2.1 Type designation. The type designation shall be in the following form and as specified (see 3.1 and 6.2).



1.2.1.1 Style. The style is identified by the two-letter symbol CX, followed by a two-digit number; the letters identify fixed, electrolytic (solid electrolyte) tantalum, molded, conformal coated and metal cased with plastic end-fill, nonhermetically sealed capacitors, and the number identifies the design of the capacitor.

1.2.1.2 Voltage. The voltage (rated and surge) is identified by a single letter as shown in Table I.

TABLE I. Voltage.

Symbol	Rated (85°C) Volts, dc	Surge (85°C) Volts, dc
D - - - -	6	8.0
F - - - -	10	13.0
H - - - -	15	20.0
J - - - -	20	26.0
K - - - -	25	32.0
M - - - -	35	46.0
N - - - -	50	65.0

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Electronics Research and Development Command, ATTN: DELET-OP, Fort Monmouth, NJ 07703 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

1.2.1.3 Capacitance. The nominal capacitance value, expressed in picofarads (pF), is identified by a three-digit number; the first two digits represent significant figures and the last digit specifies the number of zeros to follow.

1.2.1.4 Capacitance tolerance. The capacitance tolerance is identified by a single letter as shown in table II.

TABLE II. Capacitance tolerance.

Symbol	Capacitance tolerance
	Percent ( $\pm$ )
K - - - - -	10
M - - - - -	20

## 2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

### SPECIFICATIONS

#### FEDERAL

QQ-S-571 - Solder, Tin Alloy; Tin-Lead Alloy; and Lead Alloy.

#### MILITARY

MIL-F-14256 - Flux, Soldering, Liquid (Rosin Base).  
 MIL-C-39028 - Capacitors, Packaging of.  
 MIL-C-45662 - Calibration System Requirements.

(See supplement 1 for list of associated specification sheets.)

### STANDARDS

#### MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.  
 MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.  
 MIL-STD-1285 - Marking of Electrical and Electronic Parts.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern (see 6.2).

3.2 Qualification. Capacitors furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3).

3.3 Materials. Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the capacitors to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product. The use of paper products is not acceptable.

3.3.1 Soldering flux (when applicable). No acid or acid salts shall be used in preparation for or during soldering the terminals. Soldering flux shall be rosin, rosin and alcohol, or rosin and turpentine, and in accordance with type R, RMA, or RA of MIL-F-14256 or QQ-S-571, as applicable (except type RA flux requires special approval to be used on U.S. Army Electronics, Research and Development Command contacts).

3.4 Design and construction. Capacitors shall be of the design, construction, and physical dimensions specified (see 3.1).

3.4.1 Body structure. The body structure shall be of the encapsulated form (see 3.1).

3.4.2 Terminals. Terminals shall be of a solid conductor, of the dimensions specified (see 3.1), and shall be suitably treated to facilitate soldering.

3.5 Voltage aging. When tested as specified in 4.7.2, capacitors shall withstand the application of voltage at high temperature without visible mechanical damage.

3.6 Construction analysis (metal cased units only). When capacitors are inspected as specified in 4.7.3, construction analysis shall disclose no evidence of voids of the plastic end-fill exceeding 20 percent of the total case volume.

3.7 DC leakage. When measured as specified in 4.7.4, the dc leakage shall not exceed the applicable value specified (see 3.1).

3.8 Capacitance. When measured as specified in 4.7.5, the capacitance shall be within the applicable tolerance specified (see 3.1).

3.9 Dissipation factor. When measured as specified in 4.7.6, the dissipation factor shall not exceed the value specified (see 3.1).

3.10 Shock (specified pulse). When capacitors are tested as specified in 4.7.7, there shall be no intermittent contacts of 0.5 millisecond (ms) or greater duration, or arcing or other indication of breakdown, nor shall there be any open- or short-circuiting or evidence of mechanical damage.

3.11 Vibration, high frequency. When capacitors are tested as specified in 4.7.8, there shall be no intermittent contacts of 0.5 millisecond (ms) or greater duration, or arcing or other indication of breakdown, nor shall there be any open- or short-circuiting or evidence of mechanical damage.

3.12 Thermal shock. When tested as specified in 4.7.9, capacitors shall meet the following requirements:

- DC leakage - - - - - Shall not exceed the requirement specified in 3.7.
- Capacitance - - - - - Shall change not more than  $\pm 10$  percent from the initial measured value (see 3.1 and 3.8).
- Dissipation factor - - - - - Shall not exceed the requirement specified in 3.9.
- Visual examination - - - - - There shall be no evidence of harmful corrosion, mechanical damage, and obliteration of marking wherever applicable.

3.13 Resistance to soldering heat. When capacitors are tested as specified in 4.7.10, there shall be no evidence of mechanical damage.

3.14 Terminal strength. When capacitors are tested as specified in 4.7.11, there shall be no loosening of the terminals or permanent damage to the terminals.

3.15 Moisture resistance. When tested as specified in 4.7.12, capacitors shall meet the following requirements:

DC leakage - - - - -	Shall not exceed 300 percent of the requirement specified in 3.7.
Capacitance - - - - -	Shall change not more than $\pm 15$ percent from the initial measured value (see 3.1 and 3.8).
Dissipation factor - - -	Shall not exceed 150 percent of the requirement specified in 3.9.
Visual examination - - -	There shall be no evidence of harmful corrosion, mechanical damage, and obliteration of marking wherever applicable.

3.16 Stability at low and high temperatures. When tested as specified in 4.7.13, capacitors shall meet the following requirements:

Step 1 (+25°C):

DC leakage - - - - -	Shall not exceed the applicable value specified (see 3.1).
Capacitance - - - - -	Shall be within tolerance of the nominal value specified (see 3.1).
Dissipation factor - - -	Shall not exceed the applicable value specified (see 3.1).

Step 2 (-55°C):

Capacitance - - - - -	Shall change not more than the applicable value specified (see 3.1) from the step 1 measured value.
Dissipation factor - - -	Shall not exceed the applicable value specified (see 3.1).

Step 3 (+25°C):

DC leakage - - - - -	Shall not exceed the applicable value specified (see 3.1).
Capacitance - - - - -	Shall change not more than 10 percent from the step 1 measured value.
Dissipation factor - - -	Shall not exceed the requirement specified in 3.9.

Step 4 (+85°C):

DC leakage - - - - -	Shall not exceed the applicable value specified (see 3.1).
Capacitance - - - - -	Shall change not more than the applicable value specified (see 3.1) from the step 1 measured value.
Dissipation factor - - -	Shall not exceed the requirement specified in 3.9.

Step 5 (+25°C):

DC leakage - - - - -	Shall not exceed the applicable value specified (see 3.1).
Capacitance - - - - -	Shall change not more than the applicable value specified (see 3.1) from the step 1 measured value.
Dissipation factor - - -	Shall not exceed the applicable value specified (see 3.1).

3.17 Surge voltage. When tested as specified in 4.7.14, capacitors shall meet the following requirements:

DC leakage - - - - -	Shall not exceed the requirement specified in 3.7.
Capacitance - - - - -	Shall change not more than the applicable value specified (see 3.1) from the initial measured value.
Dissipation factor - - -	Shall not exceed the requirement specified in 3.9.

3.18 Life. When tested as specified in 4.7.15, there shall be no evidence of harmful corrosion, mechanical damage, or obliteration of marking (if applicable) and capacitors shall meet the following requirements:

- DC leakage (at 25°C) - - - - Shall not exceed the applicable value specified (see 3.1).
- Capacitance (at 25°C) - - - - Shall change not more than the applicable value specified (see 3.1) from the initial measured value.
- Dissipation factor (at 25°C) - Shall not exceed the applicable value specified (see 3.1).

3.19 Solderability. When capacitors are tested as specified in 4.7.16, the criteria for evaluation shall be as specified in method 208 of MIL-STD-202.

3.20 Resistance to solvents (see 4.7.17). When tested as specified in 4.7.17, marking shall remain legible and shall not smear, and capacitors shall meet the following requirements:

- DC leakage - - - - - Shall not exceed the requirement specified in 3.7.
- Capacitance - - - - - Shall change not more than  $\pm 2$  percent from the initial measured value.
- Dissipation factor - - - - Shall not exceed the requirement specified in 3.9.

3.21 Marking. Capacitors shall be marked in accordance with method I of MIL-STD-1285. Polarity for polarized units shall be indicated by a plus (+) symbol near the positive terminal. At the option of the manufacturer, a contrasting color may also be used to indicate polarity. Paper labels shall not be used. Marking shall remain legible after all tests. Capacitor marking shall include the specified information, in the sequence shown in the following example.

Example (all case sizes, all styles)

105K - Coded capacitance (in picofarads); capacitance tolerance  
+90T - Polarity, voltage, manufacturers' trade mark

3.22 Workmanship. Capacitors shall be processed in such a manner, that when examined under 3X magnification, they shall be uniform in quality and shall be free from pits, cracks, rough edges, and other defects that will affect life, serviceability, or appearance.

3.22.1 Soldering. All excess flux or solder shall be removed. Electrical connections shall be electrically continuous after soldering.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.4).
- b. Retention of qualification (see 4.5).
- c. Quality conformance inspection (see 4.6).

### 4.3 Inspection conditions.

4.3.1 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.3.2 AC measurements. AC measurements shall be made at the frequency specified. The magnitude of the ac voltage shall be equal to or less than 1.0 volt root mean square (rms). The maximum dc bias voltage shall be equal to or less than 2.2 volts for all ac measurements of polarized capacitors.

4.3.3 Reference measurements. When requirements are based on comparative measurements made before and after conditioning, the reference measurement shall be considered the last measurement made at  $25^{\circ} \pm 5^{\circ}\text{C}$  prior to conditioning. Unless reference measurements have been made within 30 days prior to the beginning of conditioning, they shall be repeated.

4.3.4 Power supply. The power supply used for life testing shall have a regulation of  $\pm 2$  percent or less of the rated voltage. The power source employed for dc leakage current measurements shall be stabilized to at least  $\pm 100$  parts per million. During measurements there must be no voltage fluctuations of sufficient amplitude to produce a variation in the current measurement as read with any dc leakage current tester used to test capacitors.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. The number and style combinations of capacitors to be subjected to qualification inspection shall be as specified in the appendix to this specification.

4.4.2 Inspection routine. The sample units shall be subjected to the inspections specified in table III, in the order shown.

4.4.3 Failures. Failures in excess of those allowed in table III shall be cause for refusal to grant qualification approval.

4.5 Retention of qualification. To retain qualification, the contractor shall forward a report at 6-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B), indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of tests performed for periodic inspection (group C), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 6-month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 6-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of the specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during three consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit a representative product of each style to testing in accordance with the qualification inspection requirements.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A, B, and C inspections. Except as specified in 4.6.1.4.3, delivery of products which have passed groups A and B inspections shall not be delayed pending the results of group C inspection.

4.6.1.1 Inspection lot. An inspection lot shall consist of all capacitors of the same style (see 3.1), produced under essentially the same conditions with the same basic materials, and offered for inspection during a single month. The capacitance values and voltages produced shall be represented in the lot in approximately the ratio of production. Voltage groups shall be as follows:

- I - - - - - 6 to 20 volts inclusive
- II - - - - - 25 to 50 volts inclusive

TABLE III. Qualification inspection.

Inspection	Requirement paragraph	Test Method paragraph	Number of sample units to be inspected	Number of failures allowed
<u>Group I</u>				
Voltage aging - - - - -	3.5	4.7.2	} 154 or 160 <sup>1/</sup>	} 0
Construction analysis (metal cased units only)	3.6	4.7.3		
DC leakage - - - - -	3.7	4.7.4		
Capacitance - - - - -	3.8	4.7.5		
Dissipation factor - - - - -	3.9	4.7.6		
Visual and mechanical inspection - - - - -	3.1,3.3,3.3.1,3.4,3.4.1,3.4.2,3.21 and 3.22	4.7.1		
<u>Group II</u>				
Shock (specified pulse) (polarized capacitors only)-	3.10	4.7.7	} 12	} 0
Vibration, high frequency - -	3.11	4.7.8		
Thermal shock - - - - -	3.12	4.7.9		
<u>Group III</u>				
Resistance to soldering heat-Terminal strength (when specified, see 3.1) - - - -	3.13	4.7.10	} 18	} 1
Moisture resistance - - - - -	3.14	4.7.11		
	3.15	4.7.12		
<u>Group IV</u>				
Stability at low and high temperatures - - - - -	3.16	4.7.13	} 12	} 0
Surge voltage - - - - -	3.17	4.7.14		
<u>Group V</u>				
Life (1,000 hours at +85°C) -	3.18	4.7.15	102	1
<u>Group VI</u>				
Solderability - - - - -	3.19	4.7.16	} 10	} 0
Resistance to solvents - - -	3.20	4.7.17		

<sup>1/</sup> For metal cased units.

4.6.1.2 Prescreen inspection. All capacitors submitted for group A inspection shall be 100 percent prescreened for the inspections specified in table IV, in the order shown.

TABLE IV. Prescreen inspection.

Inspection	Requirement paragraph	Test method paragraph
Voltage aging - - - - -	3.5	4.7.2
DC leakage - - - - -	3.7	4.7.4
Capacitance - - - - -	3.8	4.7.5
Dissipation factor - - -	3.9	4.7.6

4.6.1.3 Group A inspection. Group A inspection shall consist of the inspections specified in table V, in the order shown.

TABLE V. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (%)	
			Major	Minor
<u>Subgroup 1</u>				
DC leakage - - - - -	3.7	4.7.4	} 0.65	
Capacitance - - - - -	3.8	4.7.5		
Dissipation factor - - -	3.9	4.7.6		
<u>Subgroup 2</u>				
Visual and mechanical - - inspection	3.1,3.3,3.3.1,3.4, 3.4.1,3.4.2,3.21 and 3.22	4.7.1	1.0	4.0
Construction analysis (metal cased units only)-	3.6	4.7.3	0.65	---

4.6.1.3.1 Sampling plan. The sampling plan for subgroups 1 and 2 shall be in accordance with MIL-STD-105 for special inspection level II. The acceptable quality levels (AQL) shall be as specified in table V. Major and minor defects shall be as defined in MIL-STD-105.

4.6.1.3.2 Rejected lots. Lots rejected by the group A inspection shall be segregated from new lots and those lots that have passed inspection. Lots rejected because of failures in subgroup 2 may be offered for acceptance only if the contractor inspects all units in the lot for those quality characteristics found defective in the sample and after removing all defective units found, reinspects the lot using the tightened inspection procedure of MIL-STD-105. Resubmitted lots shall be kept separate from new lots, and shall be clearly identified as reinspected lots.

4.6.1.4 Group B inspection. Group B inspection shall consist of the inspections specified in table VI in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection.

TABLE VI. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
<u>Subgroup 1</u>		
Stability at low and high temperatures - - - - -	3.16	4.7.13
<u>Subgroup 2</u>		
Surge voltage - - - - -	3.17	4.7.14

4.6.1.4.1 Sampling plan. The sampling plan for subgroup 1 shall be in accordance with MIL-STD-105 for special inspection level S-4. The AQL shall be 1.5 percent defective. For subgroup 2, 12 sample units taken from subgroup 1 shall be subjected to the test. There shall be no more than one failure.

4.6.1.4.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.6.1.4.3 Disposition of sample units. Sample units which have been subjected to subgroup 2, group B inspection shall not be delivered on the contract.

4.6.1.5 Group C inspection. Group C inspection shall consist of the inspections specified in table VII, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the groups A and B inspection.

4.6.1.5.1 Sampling plan. Sixty-five sample units of each style shall be selected from the first lot produced, and thereafter from each production of 500,000 units or once every 3 months whichever occurs first. The 65 sample units shall be subdivided as specified for each subgroup in table VII.

4.6.1.5.2 Disposition of sample units. Sample units which have been subjected to group C inspection, shall not be delivered on the contract.

TABLE VII. Group C inspection.

Inspection	Requirement paragraph	Test method paragraph	Units to be inspected	No. of defectives allowed
<u>Subgroup 1</u>				
Shock (specified pulse) (polarized capacitors only) - - - - -	3.10	4.7.7	12	
Vibration, high frequency- Thermal shock - - - - -	3.11 3.12	4.7.8 4.7.9		
<u>Subgroup 2</u>				
Resistance to soldering heat - - - - -	3.13	4.7.10	18	1
Terminal strength (when specified (see 3.1)) - -	3.14	4.7.11		
Moisture resistance - - -	3.15	4.7.12		
<u>Subgroup 3</u>				
Solderability - - - - -	3.19	4.7.16	10	
Resistance to solvents - -	3.20	4.7.17		
<u>Subgroup 4</u>				
Life (1,000 hours at +85°C)	3.18	4.7.15	25	1

4.6.1.5.3 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall immediately notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspection may be

reinstated; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.6.2 Inspection of packaging. The sampling and inspection of the preservation-packaging, packing, and container marking shall be in accordance with the requirements of MIL-C-39028.

#### 4.7 Methods of inspection.

4.7.1 Visual and mechanical inspection. Capacitors shall be inspected to verify that the materials, design, construction, physical dimensions, marking and workmanship are in accordance with the applicable requirements (see 3.1, 3.4, 3.4.1, 3.4.2, 3.21, and 3.22).

4.7.2 Voltage aging (see 3.5). Capacitors shall be subjected to a minimum of 125 percent of dc rated voltage for 2 hours, minimum, at a temperature of  $85^{\circ}\text{C} \pm 5^{\circ}$ . The voltage aging circuit shall have a series resistance of 3.0 ohms, maximum. Power source shall not be less than 5 amperes. Capacitors shall then be stabilized at room temperature and examined for evidence of mechanical damage.

4.7.3 Construction analysis (metal cased units only) (see 3.6). Six pieces from each inspection lot shall be dissected in such a way that the plastic end-fill can be inspected to determine the extent of the filling.

4.7.4 DC leakage (see 3.7). DC leakage shall be measured using the dc rated voltage  $\pm 2$  percent at the applicable test temperature (see 3.1), after a maximum electrification period of 5 minutes. A 1,000-ohm resistor shall be placed in series with the capacitor to limit the charging current. A steady source of power, such as a regulated power supply, shall be used. Unless otherwise specified (see 3.1), measurement accuracy shall be within  $\pm 2$  percent or 0.02 microampere ( $\mu\text{A}$ ) whichever is greater (see 4.3.4).

4.7.5 Capacitance (see 3.8). Capacitors shall be tested in accordance with method 305 of MIL-STD-202. Unless otherwise specified (see 3.1), the following details shall apply.

- a. Test frequency -  $120 \pm 5$  hertz (Hz.)
- b. Limit of accuracy - Measurement accuracy shall be within  $\pm 2$  percent of the reading.
- c. Magnitude of polarizing voltage - Maximum dc bias shall be 2.2 volts for all ac measurements. The magnitude of the ac voltage shall be limited to 1.0 volt rms.

4.7.6 Dissipation factor (see 3.9). The dissipation factor shall be measured at a frequency of  $120 \pm 5$  Hz (unless otherwise specified, see 3.1) by means of a polarized capacitance bridge. The bridge shall provide a dial reading accuracy of 0.1 percent dissipation factor and a measuring accuracy of  $\pm 2$  percent of the measured dissipation factor plus 0.1 percent).

4.7.7 Shock (specified pulse) (see 3.10). Capacitors shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply:

- a. Special mounting means - Capacitors shall be rigidly mounted on a mounting fixture by the body. (Potting compounds may be used to secure the capacitor body as long as the compound does not support the leads.) Leads shall be secured to rigidly supported terminals, spaced so that the length of each lead from the capacitor is approximately 0.375-inch when measured from the edge of the supporting terminal. Leads shall be within 30 degrees of being parallel. When securing leads, care shall be taken to avoid pinching the leads.
- b. Test-condition letter - I (100 g peak).
- c. Measurements and electrical loading during shock - During the test, observations shall be made to determine intermittent contact or arcing or open- or short-circuiting. Detecting equipment shall be

sufficiently sensitive to detect any interruption with a duration of 0.5 ms. The dc rated voltage (see 3.1) shall be applied to the capacitors during the test.

- d. Examinations after test - Capacitors shall be visually examined for evidence of arcing, breakdown, and mechanical damage.

**4.7.8 Vibration, high frequency (see 3.11).** Capacitors shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting of specimens - Capacitors shall be mounted on a fixture by the body. Leads shall be supported by rigidly supported terminals.
- b. Electrical load conditions - During the test, the specified dc rated voltage (see 3.1) shall be applied to the capacitors.
- c. Test condition letter - D. (20 g).
- d. Duration and direction of motion - 4 hours in each of two mutually perpendicular directions (total of 8 hours), one parallel and the other perpendicular to the axis.
- e. Measurements during vibration - During the last cycle, an electrical measurement shall be made to determine intermittent operation or open- or short-circuiting. Observations shall also be made to determine intermittent contact or arcing or open- or short-circuiting. Detecting equipment shall be sufficiently sensitive to detect any interruption with a duration of 0.5 ms, or greater.
- f. Measurements after vibration - Not applicable.
- g. Examination after test - Capacitors shall be visually examined for evidence of mechanical damage.

**4.7.9 Thermal shock (see 3.12).** Capacitors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

- a. Test condition letter - A.
- b. Measurements after thermal shock - DC leakage, capacitance, and dissipation factor shall be measured as specified in 4.7.4, 4.7.5, and 4.7.6, respectively.
- c. Examination after test - Capacitors shall be visually examined for evidence of harmful corrosion, mechanical damage, and obliteration of marking (wherever applicable).

**4.7.10 Resistance to soldering heat (see 3.13).** Capacitors shall be tested in accordance with method 210 of MIL-STD-202. The following details and exceptions shall apply:

- a. Test condition letter - B. Procedure 1, leads shall be immersed to within 1/4-inch of the end seal or capacitor body.
- b. Cooling time prior to final examinations and measurements after test - Not applicable.
- c. Examination after test - Capacitors shall be visually examined for evidence of mechanical damage.

**4.7.11 Terminal strength (see 3.14).** Capacitors shall be tested in accordance with method 211 of MIL-STD-202. The following details shall apply, unless otherwise specified (see 3.1):

- a. Test condition letter - A; the body of the capacitor shall be secured; 2-pound applied force.
- b. Test condition letter - C; 1-pound applied force - 3 bends.
- c. Measurements after test - After the test, capacitors shall be visually examined for loosening of the terminals and permanent damage to the terminals.

**4.7.12 Moisture resistance (see 3.15).** Capacitors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting - Special mounting not required.
- b. Initial measurements - Capacitance as specified in 4.7.5.

- c. Number of cycles - 10 continuous cycles except steps 7a and 7b are not required.
- d. Loading voltage - Not applicable.
- e. Final measurements - After removal from chamber, capacitors shall be dried for 1 hour at room temperature and, within 2 to 6 hours, dc leakage, capacitance, and dissipation factor shall be measured as specified in 4.7.4, 4.7.5, and 4.7.6, respectively.
- f. Examination after test - Capacitors shall be visually examined for evidence of harmful corrosion, mechanical damage, and obliteration of marking (wherever applicable).

4.7.13 Stability at low and high temperature (see 3.16). DC leakage, capacitance, and dissipation factor shall be measured as specified in 4.7.4, 4.7.5, and 4.7.6, respectively, at each of the temperatures specified in table VIII except that dc leakage measurements at -55°C (step 2) are not required. The capacitors shall be brought to thermal stability at each test temperature. Thermal stability will have been reached when no further change in capacitance is observed between two successive measurements taken at intervals of 15 ±2, -0 minutes. Capacitors may be dried at 85°C for 30 +4, -0 minutes prior to start of tests. However, the decision to reject the parts shall be made on those parts that have been dried.

TABLE VIII. Temperature for stability test.

Step	Test temperature (°C)
1 - - - - -	+25 ±2
2 - - - - -	-55, +0 -3
3 - - - - -	+25 ±2
4 - - - - -	+85, +4 -0
5 - - - - -	+25 ±2

4.7.14 Surge voltage (see 3.17). Capacitors shall be subjected to 1,000 cycles of the applicable surge voltage specified in table I. The ambient temperature during cycling (see 3.1), shall be +85° ±5°C. Each cycle shall consist of a 30 +2, -0 second surge voltage application followed by a 30 +2, -0 seconds discharge period. Voltage application shall be made through a resistor of 33 ohms. The tolerance of the resistor shall be ±5 percent. Each surge voltage cycle shall be performed in such a manner that the capacitor is shorted terminal to terminal through a copper bar, or an equivalent low resistance at the end of the 30 +2, -0 seconds application. An alternate method of shorting the capacitors is discharge through the same resistance that is utilized for charging. After the final cycle, the capacitors shall be stabilized at the inspection conditions specified in 4.3, and the dc leakage, capacitance, and dissipation factor shall be measured as specified in 4.7.4, 4.7.5, and 4.7.6, respectively.

4.7.15 Life (see 3.18). Capacitors shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

- a. Test temperature and tolerance - Capacitors subjected to the test of group V of table III shall be tested at +85°C +4, -0.
- b. Operating conditions - DC rated voltage (see 3.1), shall be applied gradually (not to exceed 5 minutes either by a slow buildup of the voltage or through a resistor which shall be shorted out within 5 minutes). Voltage shall be applied continuously, except for measurement periods. The impedance of the voltage source, as seen from the terminals of each capacitor, shall not exceed 3 ohms. Storage batteries or an electronic power supply capable of supplying at least 1 ampere when a capacitor is shorted shall be used.
- c. Test condition letter - D (1,000 hours).
- d. Measurements during exposure - DC leakage shall be measured as specified in 4.7.4 at 0; 240 +48 -0; 1000 +48 -0 hours. The manufacturer may option to measure dc leakage at 85°C; however, if the capacitors fail to meet the dc leakage requirement in 3.18 the measurement shall be made at 25°C.

- e. Measurements after exposure - Capacitors shall be returned to the inspection conditions specified in 4.3 and visually examined for evidence of harmful corrosion, mechanical damage, or obliteration of marking (if applicable); dc leakage, capacitance and dissipation factor shall then be measured as specified in 4.7.4, 4.7.5, and 4.7.6, respectively.

4.7.16 Solderability (see 3.19). Capacitors shall be tested in accordance with method 208 of MIL-STD-202. The following details shall apply:

- a. The number of terminations of each capacitor to be tested - 2 (except C104 shall be 4).
- b. Depth of immersion in flux and solder - All terminals shall be immersed to within 0.125-inch of the capacitor body.

4.7.17 Resistance to solvents (see 3.20). Capacitors shall be tested in accordance with method 215 of MIL-STD-202. The following exceptions shall apply:

- a. Brushing is required.
- b. Measurements and examination after test - DC leakage, capacitance, and dissipation factor shall be measured as specified in 4.7.4, 4.7.5, and 4.7.6, respectively. The marking shall remain legible and shall not smear.

## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-C-39028.

## 6. NOTES

6.1 Intended use. Capacitors covered by this specification are intended mainly for use in filter, bypass, coupling, blocking, and other low-voltage applications (such as transistor circuits) where stability, size, weight, and shelf life are important factors. These capacitors are intended to be used only where supplemental moisture protection is provided or for noncritical applications where hermetic moisture protection is not required.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Title, number and date of the applicable specification sheet, and the complete type designation (see 3.1).

6.3 Qualification. <sup>1/</sup> With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list, whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification, in order that they may be eligible to be awarded contracts for the products covered by this specification. The activity responsible for the qualified products list is US Army Electronics Research and Development Command; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), 1507 Wilmington Pike, Dayton, Ohio 45444.

<sup>1/</sup> SD-6, "Provisions Governing Qualification," is issued for the information of applicants requesting qualification of products. Copies of this publication may be obtained from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

MIL-C-49137A

**Custodians:**

Army - ER  
Navy - EC  
Air Force - 11

**Review activities:**

Navy - SH  
Air Force - 17, 85, 99  
DLA - ES

**User activities:**

Army -  
Navy - MC, AS, OS, CG  
Air Force - 19

**Preparing activity:**

Army - ER

**Agent:**

DLA - ES

(Project 5910-1257)

APPENDIX  
PROCEDURE FOR QUALIFICATION INSPECTION

## 10. SCOPE

10.1 This appendix details the procedure for submission of samples, with related data, for qualification inspection of capacitors covered by this specification. The procedure for extending qualification of the required sample to other capacitors covered by this specification is also outlined herein.

## 20. SUBMISSION

20.1 Sample.

20.1.1 Single-style submission. A sample consisting of 154 (160 for metal-cased units) sample units of the highest capacitance value in each voltage rating in each style for which qualification is sought shall be submitted.

20.1.2 Combined-voltage submission. A sample consisting of sample units of the highest capacitance value in each voltage group in each style for which qualification is sought shall be submitted (see table IX).

TABLE IX. Combined voltage submission

Style	Type designation	Number of units	Rated volts
CX01	CX01D686-	77	6
	CX01J186-	77	20
	CX01K126-	77	25
	CX01N565-	77	50
CX02	CX02D337	77	6
	CX02J107	77	20
	CX02K686	77	25
	CX02N226	77	50
CX12	CX12D686	77	6
	CX12J156	77	20
	CX12K106	77	25
	CX12N475	77	50
CX03	CX03D476	80	6
	CX03J156	80	20
	CX03K106	80	25
	CX03N475	80	50
CX04	CX04J156	77	20
	CX04M685	77	35
CX05	CX05D476	77	6
	CX05J156	77	20
	CX05K106	77	25
	CX05N475	77	50

**INSTRUCTIONS:** In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY

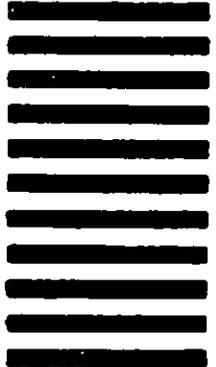


NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300

**BUSINESS REPLY MAIL**  
FIRST CLASS PERMIT NO. 12062 WASHINGTON D. C.  
POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

COMMANDING OFFICER  
U.S. ARMY ELECTRONICS COMMAND  
ATTN: AMSEL-TD-S  
FORT MONMOUTH, N.J. 07703



# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

VENDOR

USER

MANUFACTURER

OTHER (Specify): \_\_\_\_\_

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

d. DATE OF SUBMISSION (YYMMDD)

DD FORM 1426  
82 MAR

PREVIOUS EDITION IS OBSOLETE.

Source: <https://assist.dla.mil> -- Downloaded: 2016-11-16T21:07Z  
Check the source to verify that this is the current version before use.

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)