

NATIONAL AIRCRAFT STANDARDS COMMITTEE

AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC., 610 SHOREHAM BUILDING, WASHINGTON 5, D. C.

SPECIFICATION

CAPACITORS, FIXED, STACKED DIELECTRIC, MINIATURE

1. SCOPE AND CLASSIFICATION

- 1.1 Scope - This specification covers fixed capacitors of the stacked dielectric variety which are encased in a protective envelope. The size shall be as shown in the attached drawing.
- 1.2 Classification - Capacitors shall be furnished in the following types, grade and characteristic.
- 1.2.1 Type - Capacitors shall be of two types, to cover the required temperature ranges.
Type A; for operation at ambient temperatures up to 85°C.
Type C; for operation at ambient temperatures up to 125°C.
- 1.2.2 Grade - All capacitors shall be of one grade capable of meeting the humidity and moisture resistance requirements specified herein.
- 1.2.3 Characteristic - All capacitors shall be of one characteristic capable of meeting the temperature coefficient and capacitance drift as outlined herein.
- 1.3 Type Designation - The method of type designation shall be in the following form:
- | ACM
Component | 15
Case | C
Type | 050
Capacitance | H
Tolerance |
|------------------|------------|-----------|--------------------|----------------|
|------------------|------------|-----------|--------------------|----------------|
- 1.3.1 Component Designation - Fixed capacitors of the stacked dielectric variety are identified by the symbol "ACM".
- 1.3.2 Case Designation - The case designation is a two digit symbol which appears on the detailed figures and identifies a particular case size and shape.
- 1.3.3 Type - Capacitors shall be of two types, to cover the required temperature ranges.
Type A; for operation at ambient temperatures up to 85°C.
Type C; for operation at ambient temperatures up to 125°C.
- 1.3.4 Capacitance - The nominal capacitance value in micro-microfarads is identified by a three digit number, the first two of which represent significant figures and the last of which specifies the number of zero's to follow (or decimal multiplier).
- 1.3.5 Tolerance - The capacitance tolerance in percent is identified by a single letter in accordance with Table I.

TABLE I

Tolerance	Designation Letter
± 2% or 1 mfd. whichever is greater	G
± 5%	J
±10%	K
±20%	M

2. APPLICABLE SPECIFICATIONS

- Military Specifications -
 *JAN-P-14 Plastic - Materials, Molded, Thermosetting.
 MIL-STD-105A Sampling Procedures and Tables for Inspection by Attributes or other suitable plan.

* The paragraph which requires a molded test piece shall not be applicable.

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SEE MIL-C-5

PREPARED BY THE ELECTRONIC PARTS COMMITTEE

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3. REQUIREMENTS.

- 3.1 Materials - The material for each part shall be as hereinafter specified. A suitable material shall be used when a definite material is not designated. (Acceptance or approval of a constituent material shall not be construed as a guarantee of the acceptance of the finished product.)
- 3.1.1 Iron and Steel - The use of ferrous material, such as copperweld, for leads will be permitted unless specifically prohibited by the order.
- 3.1.2 Insulating and Impregnating Compounds - Insulating and impregnating compounds, including varnishes, waxes, and the like shall be suitable for each particular application. Compounds shall adequately preserve the electrical characteristics of the insulation to which applied, by the exclusion therefrom of moisture. A compound either in the state of its original application or as the result of cracking or aging, shall show no injurious effect on any part of the capacitor with which it may come into contact and shall not leak when the capacitor is mounted in any position, under the most severe combination of conditions outlined herein.
- 3.2 Enclosure - Capacitors shall be effectively sealed against the entry of atmospheric moisture, and the elements shall be mounted so as to prevent injurious movement in their cases. The capacitor elements shall be completely enclosed by their cases except where terminals or leads project.
- 3.3 Marking - Each capacitor shall be permanently and legibly marked in accordance with either of the following two methods which are given in the order preferred:
- 3.3.1 Each capacitor shall be marked with the manufacturer's name or symbol and type designation¹ (See Paragraph 1.3).
- 3.3.2 Where marking of the type designation is not permitted by space or existing molds, the capacitance, characteristic, and tolerance may be indicated by color coding. The colors and their meanings are given in Table II. The arrangement of the spots shall be as shown on the applicable figure (drawing), in the form of six dots arranged in two rows of three dots each with an indicator to avoid ambiguity as to the order in which they are to be read. If the spots are not applied to a single surface of the capacitor, three spots shall be on one face of the capacitor in a row along an axis parallel to that of the leads with an indicator to show which face is to be read first and the order in which the spots are to be read. The additional three spots shall be applied in a row to another surface of the capacitor, but not to an end, and shall be read as though they were the lower row of dots shown in the applicable figure (drawing), being made visible by rotating the capacitor about the axis of its leads.

TABLE II

COLOR CODING

Capacitance

Color	Significant Figure	Decimal Multiplier	Tolerance in %	Type
Black	0	1	20 (M)	A
Brown	1	10	--	
Red	2	100	**2 (G)	C
Orange	3	1,000	--	
Yellow	4	-	--	
Green	5	-	--	
Blue	6	-	--	
Violet	7	-	--	
Gray	8	-	--	
White	9	-	--	
Gold	-	0.1	5 (J)	
Silver	-	.01	10 (K)	

¹ No space between groups of symbols in type designation required. Type designation may be set in 2 lines if necessary.

**or 1 mfd. whichever is greater.

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4. METHODS OF SAMPLING, INSPECTION AND TESTS.

4.1 Classification of Tests - The methods of sampling, inspection, and tests conducted upon fixed stacked dielectric capacitors shall be classified as follows:

Inspection Tests (at place of manufacture)

Qualification (type or brand approval) tests (at a Laboratory designated by the purchaser). 1/

4.2 Test Conditions - Unless otherwise specified herein, all measurements shall be made at a temperature between 20 and 35°C, at a barometric pressure between 24 and 32 inches of mercury, and at ambient humidity.

4.3 Qualification Tests -

4.3.1 Applicability (Sampling) - Forty-eight samples of the highest capacity value made in a given case style shall be subjected to the qualification tests in the order listed in Table III. Twelve additional samples of the 47 uuf capacitor, or of the closest value thereto in production, shall be subjected to the "Q and dissipation factor" test (4.3.3.4). All test samples shall be from production lots made with production tools.

4.3.2 Rejection - If the number of failures exceed that permitted, the entire set of samples shall be rejected. A second set of samples may be submitted and shall be accompanied by a description of the changes incorporated to overcome the defects which caused the failure of the preceding ones.

4.3.2.1 Failures Permitted - The total number of failures permitted for all tests combined shall not exceed three. If one failure occurs during the "Temperature coefficient and capacitance drift" test, an additional set of six shall be tested with no failures permitted.

TABLE III

Test	Number of Specimens To be Tested (4.3.1)	Failures Permitted (4.3.2.1)
<u>Test Group I</u>		
Visual (4.3.3.1)	48	0 out of 48
Dielectric Strength (4.3.3.2)	48	1 out of 48
Insulation Resistance (4.3.3.3)	48	0 out of 48
Q and dissipation factor (4.3.3.4)	60	0 out of 60
Temperature coefficient and capacitance drift (4.3.3.5)	6	0 out of 6
Capacitance (4.3.3.6)	48	0 out of 48
<u>Test Group II</u>		
Temperature & Immersion Test (4.3.3.7)	12 of the 48	1 out of 12
<u>Test Group III</u>		
Vibration and Corrosion (4.3.3.8)	12 of the 48	1 out of 12
<u>Test Group IV</u>		
Humidity (4.3.3.9)	12 of the 48	1 out of 12
<u>Test Group V</u>		
Life (4.3.3.10)	12 of the 48	1 out of 12

4.3.3 Outline of Tests -

4.3.3.1 Visual Inspection - Capacitors shall be inspected as to workmanship and quality and to determine that the physical dimensions are within the specified limits and that the marking is such that the capacitors may be identified thereby.

4.3.3.2 Dielectric Strength - Each capacitor shall withstand 200% of the rated DC working voltage to be applied through a resistor limiting the current to 10 ma for a period not greater than 5 seconds nor less than 1 second.

1/ These tests may be performed by the manufacturer providing a certified test report, showing all detailed data on test performed in the required order, is available to the purchaser.

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4. METHODS OF SAMPLING, INSPECTION AND TESTS (Contd)

- 4.3.3.3 Insulation Resistance - After electrification for one minute by 100 volts direct current in a relative humidity between 0 and 80 percent and at the temperatures specified below, capacitors of the temperature ratings indicated shall meet the insulation resistance specified. Condensed moisture may be removed by a blast of air.

Minimum Resistance	Test Temperature	Temperature Rating
7500 megohms	25°C	A and C
2000 megohms	85°C	A
600 megohms	125°C	C

- 4.3.3.4 Q and Dissipation Factor -

- 4.3.3.4.1 Q - The Q (Figure of Merit) shall be measured on capacitors with nominal capacitance values of 400 uuf or less at a frequency of 1 megacycle by means of a Boonton Q-Meter or its equivalent. The Q shall be greater than that specified by Figure 1.

- 4.3.3.4.2 Dissipation Factor - The dissipation factor of the capacitors shall be measured at a frequency of 1 kc and shall be less than that specified by Figure 2.

- 4.3.3.5 Temperature Coefficient and Capacitance Drift - Capacitance measurements shall be made at the following temperatures in the order shown:

Rating A 25°C, -40°C, -10°C, 25°C, 55°C, 85°C, 125°C

Rating C 25°C, -40°C, -10°C, 25°C, 55°C, 85°C, 125°C, 150°C

Each measurement shall be made after the capacitor has reached thermal stability. Capacitance change values in percent shall be determined at these points and recorded.

Capacitance drift for Qualification Testing shall be computed by dividing the greatest single difference between any two of the three measurements of capacitance at 25°C by the intermediate value at 25°C. For production sampling, the drift measurement may be the difference between the two measurements at room temperature when the temperature is raised from room temperature to the high temperature to room temperature.

- 4.3.3.5.1 Temperature coefficient shall be within ± 200 p/m/°C. Drift shall be .5% maximum.

- 4.3.3.6 Capacitance - Each capacitor shall be measured to insure that the capacitance is within the specified tolerance limits. If the capacitor has a nominal capacitance of 1,000 micromicrofarads or less, the measurement shall be made at, or referred to, a measurement made at a frequency of 500 kilocycles per second. If the capacitor has a nominal capacitance greater than 1,000 micromicrofarads, the measurement shall be made at, or referred to, a measurement made at a frequency of 1 kilocycle per second. No measurement need be more accurate than $0.2\% \pm 1/2$ micromicrofarad.

- 4.3.3.7 Temperature and Immersion Test: Each capacitor shall be exposed to five of the temperature cycles listed below:

	Degrees Centigrade Rating A	Degrees Centigrade Rating C
Start at	25 $\pm$ 5	25 $\pm$ 5
To	-55	-55
To	25 $\pm$ 5	25 $\pm$ 5
To	85 $\pm$ 0	125 $\pm$ 0
To	+5	+5
To	25 $\pm$ 5	25 $\pm$ 5

The air within the conditioning chamber shall be circulated. The temperature within the cold chamber shall be in accordance with the chart above. The rate of change of temperature within the conditioning chamber shall be at least 2°C per minute, or the capacitors may be transferred from one chamber to another, in which case they shall be held at the minimum and maximum ambient temperature for at least 15 minutes and at room temperature for no more than 15 minutes. The temperature cycling shall be followed by 2 cycles of 15-minute immersions in tap water at 65°C and 20°C. (149 and 68°F.) or lower. The elapsed time between the removal of the capacitors from the immersion tank and the measurements shall not exceed 30 minutes. Surface moisture shall be removed by circulating air at room temperature, wiping with a clean, dry cloth, or both.

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