

PERFORMANCE CHARACTERISTICS TEST PROCEDURES

1.0 Operating Temperature Range.

1.1 The operating temperature specified is the range over which the capacitor can be safely operated.

1.2 Derating may be necessary for optimum operation at the maximum temperature specified on the individual data sheet.

2.0 Current Rating. Unless otherwise specified, the maximum charging and discharging current for all capacitors shall be 1 ampere per microfarad.

3.0 Insulation Resistance.

3.1 The minimum product of insulation resistance, expressed in megohms, and the capacitance, expressed in microfarads, is specified for each capacitor type over its operating temperature range.

3.1.1 The insulation resistance need not exceed the minimum specified value in megohms.

3.1.2 Where the case is not a terminal the insulation resistance between the case and either terminal shall not be less than the minimum value expressed in megohms.

3.2 Unless otherwise specified, measurements shall be made after a 2 minute charge at the rated voltage or 500 volts dc, whichever is less.

4.0 Capacitance and Tolerance.

4.1 The capacitance shall be within the specified tolerance limits of the nominal rating.

4.2 Unless otherwise specified, capacitors of 1.0 μ F or less shall be measured at a frequency of 1000 Hz at a temperature of +25°C, or else referred to measurements made at that frequency and temperature.

4.3 Unless otherwise specified, capacitors of greater than 1.0 μ F shall be measured at a frequency of 100 Hz at a temperature of +25°C, or else referred to measurements made at that frequency and temperature.

5.0 Dissipation Factor.

5.1 The maximum dissipation factor is specified for each capacitor type.

5.2 Unless otherwise specified, capacitors of 1.0 μ F or less shall be measured at a frequency of 1000 Hz at a temperature of +25°C, or else referred to measurements made at that frequency and temperature.

5.3 Unless otherwise specified, capacitors of greater than 1.0 μ F shall be measured at a frequency of 100 Hz at

a temperature of +25°C, or else referred to measurements made at that frequency and temperature.

6.0 DC Voltage Test.

6.1 Capacitors shall withstand the specified dc voltage potential applied between the terminals, and between the case and each terminal.

6.2 The test voltage shall be applied and discharged through a resistor of at least one ohm per volt.

7.0 AC Voltage Test.

7.1 Capacitors shall withstand an ac voltage potential applied between the terminals, as specified.

8.0 Thermal Shock and Immersion Cycling.

8.1 Capacitors shall be tested in accordance with following requirements, when specified.

8.2 Capacitance, dissipation factor, and insulation resistance shall be measured prior to start of test.

8.3 Capacitors shall be subjected to thermal shock cycling per MIL-STD-202, Method 107G, Test Condition B except high test temperature (step 3) shall be the maximum operating temperature of the parts being tested.

8.4 Within 4 to 24 hours after completion of thermal shock, the capacitors shall be subjected to Immersion Testing per Mil-STD-202, Method 104A, Test Condition B.

8.4.1 After completion of final cycle, the capacitor shall be conditioned at +25°C \pm 5°C at relative humidity of 50% \pm 5% for a period of 4 to 24 hours prior to final measurements.

8.4.2 Final Measurements:

Visual — shall show no deterioration or permanent damage to case or terminals, corrosion of terminal, obliteration of marking, unwrapping of, or mechanical damage to insulating sleeves (as applicable).

Insulating Sleeves (metal tubulars only). — Insulation resistance and dielectric withstanding voltage shall be measured between two wire windings, placed around sleeve, 0.500 inch apart, each winding consisting of three close turns of 0.040 inch (#18 AWG) bare copper wire. Dielectric withstanding voltage shall be tested

at 4000 VDC.

Insulation resistance shall be 100 megohms, minimum, when tested at rated voltage or 500 VDC, whichever is less.

Dielectric withstanding voltage, insulation resistance, capacitance and dissipation factor shall be measured. Post test requirements for those parameters shall be as specified for each capacitor type. The insulating sleeve (as applicable) shall be removed from metal tubular capacitors for these latter tests.

8.4.2.1 Not more than 1 failure shall be permitted in 12 units tested.

8.4.3 Capacitors subjected to this test shall not be subjected to any other test.

9.0 Moisture Resistance Test.

9.1 When specified, capacitors shall be tested in accordance with MIL-STD-202, Method 106E. The following details and exceptions shall apply.

9.1.1 Capacitance, dissipation factor, and insulation resistance shall be measured prior to start of test.

9.1.2 Polarization voltage shall be 100 VDC or rated DC voltage, whichever is less.

9.1.3 Capacitors shall be subjected to 10 continuous cycles.

9.1.4 After final cycle, capacitors shall be conditioned at +25°C ±5°C at relative humidity of 50% ±5% for a period of 22 hours to 24 hours prior to final measurements.

9.1.5 Final Measurements:

Visual — shall show no deterioration or permanent damage to case or terminals, corrosion of terminal, obliteration of marking, unwrapping of, or mechanical damage to insulating sleeves (as applicable).

Insulating Sleeves (metal tubulars only) — Insulation resistance and dielectric withstanding voltage shall be measured between two wire windings placed around sleeve, 0.500 inch apart, each winding consisting of three close turns of 0.040 inch (#18 AWG) bare copper wire. Dielectric withstanding voltage shall be tested at 4000 VDC.

Insulation resistance shall be 100 megohms, minimum, when tested at rated voltage or 500 VDC, whichever is less.

Dielectric withstanding voltage, insulation resistance, capacitance and dissipation factor shall be measured.

Post test requirements for those parameters shall be as specified for each capacitor type. The insulating sleeve (as applicable) shall be removed from metal tubular capacitors for these tests.

9.1.5.1 Not more than 1 failure shall be permitted in 12 units tested.

9.1.6 Capacitors subjected to this test shall not be subjected to any other test.

10.0 Humidity Test.

10.1 When specified, capacitors shall be tested in accordance with MIL-STD-202, Method 103B. The following details and exceptions shall apply.

10.1.1 Capacitance, dissipation factor and insulation resistance shall be measured prior to start of test.

10.1.2 Unless otherwise specified, duration of exposure shall be per Test Condition A (240 hours).

10.1.3 Measurements at high humidity shall not apply.

10.1.4 Final Measurements.

10.1.4.1 After completion of test and drying period, measure capacitance, dissipation factor and insulation resistance.

10.1.4.2 Post test requirements shall be as specified for each capacitor type.

10.1.4.3 Not more than 1 failure shall be permitted in 12 units tested.

10.1.5 Capacitors subjected to this test shall not be subjected to an other test.

11.0 Vibration Test.

11.1 When specified, capacitors shall be tested in accordance with following requirements.

11.2 The capacitors shall be rigidly mounted by suitable mounting means other than the lead wires. (It is recommended that the capacitor be encapsulated in wax or other suitable material when subjected to this test.)

11.3 Test Conditions.

11.3.1 Condition “A” (10g Peak): Test in accordance with MIL-STD-202, Method 204D, Test condition A except as specified herein. Rated voltage (dc) shall be applied during the vibration cycle.

11.3.2 Condition “B” (15g Peak): Test in accordance with MIL-STD-202, Method 204D, Test Condition B except as specified herein. Rated voltage (dc) shall be applied during the vibration cycle.

11.3.3 Condition “D” (20g Peak): Test in accordance with MIL-STD-202, Method 204D, Test condition D except as specified herein. Rated voltage (dc) shall be

applied during the vibration cycle.

11.3.4 Condition “E” (50g Peak): Test in accordance with MIL-STD-202, Method 204D, Test condition E except as specified herein. Fifty percent rated voltage (dc) shall be applied during the vibration cycle.

11.3.5 The vibration shall be applied for 4 hours in each of 2 directions, parallel and perpendicular to the major axis of the capacitor.

11.4 Not more than 1 failure shall be permitted in 6 units tested.

11.4.1 During the last cycle in each direction, an electrical measurement shall be made to determine intermittent contacts of 0.5ms or greater duration, or open, or permanent short circuiting.

11.4.2 There shall be no mechanical damage as a result of this test.

11.5 Capacitors subjected to this test shall not be subjected to any other tests

12.0 DC Life Test.

12.1 When specified, capacitors shall withstand dc voltage life testing as follows. Test potential, test temperature and test duration shall be specified for each capacitor type.

12.2 Not more than 1 failure shall be permitted in 25 units tested.

12.3 A failure shall be considered to be any of the following:

- A permanent open or short circuit.
- Insulation resistance less than the value specified.
- Dissipation factor greater than the value specified.
- A change in capacitance greater than the value specified.
- A leakage of impregnant or deformation of the case.

12.4 Capacitors subjected to this test shall not be subjected to any other test.

13.0 AC Life Test.

13.1 When specified, capacitors shall withstand ac voltage life testing as follows. Test potential (RMS voltage), test frequency, test temperature and test duration shall be specified.

13.2 Not more than 1 failure shall be permitted in 25 units tested.

13.3 A failure shall be considered to be any of the following:

- A permanent open or short circuit.
- Insulation resistance less than the value specified.

- Dissipation factor greater than the value specified.
- A change in capacitance greater than the value specified.

13.4 Capacitors subjected to this test shall not be subjected to any other test.

14.0 Discharge Life Testing.

14.1 When specified, energy storage capacitors shall withstand discharge life testing as follows.

14.2 Unless otherwise specified, capacitors shall be subjected to charge/discharge life testing in accordance with the following requirements.

14.2.1 Peak charging voltage, test temperature, discharge rate, number of discharges and test load conditions shall be specified.

14.2.2 There shall be no voltage reversal on the capacitors during test.

14.3 Not more than 1 failure shall be permitted in 12 units tested.

14.4 A failure shall be considered to be any of the following:

- A permanent open or short circuit.
- Insulation resistance less than the value specified.
- Dissipation factor greater than the value specified.
- A change in capacitance greater than the value specified.

15.0 DC Resistance.

15.1 The dc resistance shall be measured directly using a Kelvin bridge or indirectly using the voltmeter-ammeter method, ammeter-potentiometer method, or other suitable means. The point of contact shall be along the lead, where the lead is normally connected in an actual circuit, except that for axial wire leads, the contact shall be made 0.625 inch (16mm) from the insulator. The maximum allowable measurement error shall be $\pm 5\%$.

16.0 Dielectric Absorption.

16.1 When specified, capacitors shall be tested as follows.

16.1.1 Capacitors shall be charged at rated dc voltage or 100 VDC, whichever is less, for 5 minutes, minimum. Charging current shall not exceed 50 milliamperes.

16.1.2 The capacitor shall then be disconnected from the power source and discharged through a 5 ohm $\pm 1\%$ resistor for 5 seconds ± 0.5 seconds.

16.1.3 Disconnect capacitor from discharge resistor and after one (1) minute measure voltage on capacitor (recovery voltage) with an electrometer, or other

suitable device having an input resistance of 10,000 megohms, minimum.

16.1.4 Calculate dielectric absorption as follows:

$$\% \text{ d.a} = V1/V2 \times 100$$

where

d.a = Dielectric Absorption (%)

V1 = Maximum recovery voltage (para 16.1.3)

V2 = Charging voltage (para 16.1.1)

17.0 Lead Pull.

17.1 When specified the capacitors shall be capable of withstanding the following test.

17.2 Test in accordance with MIL-STD-202, Method 211A, Test Condition A. The following details shall apply.

17.2.1 The capacitor shall be held securely by the body.

17.2.2 Unless otherwise specified the applied force shall be 5 pounds (2.3 KG).

17.3 There shall be no mechanical damage to the capacitor or terminals.

18.0 Lead Bend.

18.1 When specified, the capacitors shall be capable of withstanding the following test.

18.2 Test in accordance with MIL-STD-202, Method 211A, Test Condition C. The following details shall apply.

18.2.1 The capacitor shall be held securely by the body.

18.2.2 Unless otherwise specified the load shall be 1 pound (0.44 KG).

18.3 There shall be no mechanical damage to the capacitor or terminals.

19.0 Torque Test.

19.1 When specified, the capacitors shall be capable of withstanding the following test.

19.2 Test in accordance with MIL-STD-202, Method 211A, Test Condition E.

19.3 There shall be no mechanical damage to the terminals.