

MIL-STD-202G

METHOD 215K

RESISTANCE TO SOLVENTS

1. PURPOSE. The purpose of this test is as follows:

- a. To verify that markings or color coding will not become illegible or discolored on the parts (including printed wiring boards) when subjected to solvents and processes normally used to clean solder-flux, fingerprints, and other contaminants from printed-wiring and terminal-board assemblies, etc.
- b. To verify that component protective coatings and encapsulant materials are not degraded to the point where electrical or mechanical integrity is disturbed when subjected to solvents and processes normally used to clean solder flux, fingerprints, and other contaminants from printed-wiring and terminal-board assemblies, etc.

1.1 Formulation of solvents. The formulation of solvents is considered typical and representative of the solvents used in printed wiring assembly processing of electronic components. Processing conditions are representative of processes used for printed wiring assembly.

1.2 Checks for conflicts. When this test is referenced, care should be exercised to assure that conflicting requirements, as far as the properties of the specified finishes and markings are concerned, are not invoked.

2. MATERIALS

2.1 Solvent solutions. The solvent solutions used in this test shall consist of the following (see table I for summary).

- a. A mixture consisting of the following:
  1. One part by volume of isopropyl alcohol, American Chemical Society (ACS) reagent grade, or isopropyl alcohol in accordance with TT-I-735, grade A or B, and
  2. Three parts by volume of mineral spirits in accordance with MIL-PRF-680, type I, or three parts by volume of a mixture of 80 percent by volume of kerosene and 20 percent by volume ethylbenzene.
- b. This solvent has been deleted. When a suitable replacement solvent has been determined, it will be added as solution b.
- c. A terpene defluxer consisting of a minimum of 90 percent d-limonene and 10 percent surfactant. 1/
- d. A mixture consisting of the following:
  1. Forty-two parts by volume water, 1 megohm-cm minimum resistivity.
  2. One part by volume of propylene glycol monomethyl ether (glycol ether PM, 1-methoxy-2-propanol).
  3. One part by volume of monoethanolamine. 2/

2.1.1 Solvent solutions, safety aspects. Solvent solutions listed in 2.1a through 2.1d exhibit some potential for health and safety hazards. Safety precautions as listed in the appropriate manufacturers material safety data sheet shall be observed.

1/ A commonly used terpene defluxer is BIOACT EC-7R. "BIOACT" is a registered Trademark of Petroferm INC; "EC-7 and EC-7R" are trademarks of Petroferm INC.

2/ Normal safety precaution for handling this solution (e.g., same as those for diluted ammonium hydroxide) based on O.S.H.A. rules for monoethanolamine.

2.2 Vessel. The vessel for solvent immersion shall be a container made of non-reactive material and of sufficient size to permit complete immersion of the specimens in the solvent solutions specified in 2.1.

2.3 Brush. The brush shall be a toothbrush with a handle made of a non-reactive material. The brush shall have three or four long rows, 1 and 1/8  $\pm$ 1/8 inch in length, of hard bristles. Each row shall contain eight to twelve tufts, the free ends of which shall lie substantially in the same plane. The brush shall be used with a single solvent and when there is any evidence of softening, bending, wear, or loss of bristles, it shall be discarded.

### 3. PROCEDURE

3.1 Procedure. The specimens subjected to this test shall be divided into three groups of approximately equal size.

- a. The first group shall be exposed to the solution specified in 2.1a.

The solution shall be maintained at a temperature of 25°C  $\pm$ 5°C. The specimens shall be completely immersed for 3 minutes +0.5, -0 minutes in the specified solution contained in the vessel specified in 2.2. Immediately following immersion, each specimen shall be tested as follows: The bristle portion of the brush, specified in 2.3, shall be dipped in the solution until wetted and the specimen shall be brushed with normal hand pressure (approximately 2 to 3 ounce force applied normal to the surface) for ten strokes on the portion of the specimen where marking has been applied. The brush stroke shall be directed in a forward direction across the surface of the specimen being tested. Immediately after brushing, the procedure shall be repeated two more times, for a total of three immersions, followed by brushing. After completion of the third immersion and brushing, the specimens shall be air-blown dry. The specimens shall be inspected in accordance with 4.1 and 4.2 to determine the extent, if any, of deterioration that has occurred.

- b. This solvent solution has been deleted.

- c. The second group shall be exposed to the solution specified in 2.1c.

The solution shall be maintained at a temperature of 25°C  $\pm$ 5°C. The specimens shall be completely immersed for 3 minutes +0.5, -0 minutes in the specified solution contained in the vessel specified in 2.2. Immediately following immersion, each specimen shall be tested as follows: The bristle portion of the brush, specified in 2.3, shall be dipped in the solution until wetted and the specimen shall be brushed with normal hand pressure (approximately 2 to 3 ounce force applied normal to the surface) for ten strokes on the portion of the specimen where marking has been applied. The brush stroke shall be directed in a forward direction across the surface of the specimen being tested. Immediately after brushing, the procedure shall be repeated two more times, for a total of three immersions, followed by brushing. After completion of the third immersion and brushing, the specimens shall be rinsed in approximately 25°C water and all surfaces air-blown dry. The specimens shall be inspected in accordance with 4.1 and 4.2 to determine the extent, if any, of deterioration that has occurred.

- d. The third group shall be exposed to the solution specified in 2.1d.

The solution shall be maintained at a temperature of 63°C to 70°C. The specimens shall be completely immersed for 3 minutes +0.5, -0 minutes in the specified solution contained in the vessel specified in 2.2. Immediately following immersion, each specimen shall be tested as follows: The bristle portion of the brush, specified in 2.3, shall be dipped in the solution until wetted and the specimen shall be brushed with normal hand pressure (approximately 2 to 3 ounce force applied normal to the surface) for ten strokes on the portion of the specimen where marking has been applied. The brush stroke shall be directed in a forward direction across the surface of the specimen being tested. Immediately after brushing, the procedure shall be repeated two more times, for a total of three immersions, followed by brushing. After completion of the third immersion and brushing, the specimens shall be rinsed in approximately 25°C water and all surfaces air-blown dry. The specimens shall be inspected in accordance with 4.1 and 4.2 to determine the extent, if any, of deterioration that has occurred.

3.2 Optional exposure procedure for the third group. The test specimens shall be located on a test surface of known area which is located  $6 \pm 1$  inches ( $15 \pm 2.5$  centimeters) below a spray nozzle which discharges  $.16 \pm .005$  gpm ( $0.62 \pm 0.02$  liters per minute) of solution per  $\text{in}^2$  ( $6.5$  square centimeters) of surface area at a pressure of  $20 \pm 5$  lbs/ $\text{in}^2$  ( $138 \pm 34$  kilopascal). The solvent shall be held at a temperature range of  $63^\circ\text{C}$  to  $70^\circ\text{C}$ . The specimens shall be subjected to this spray for a period of 10 minutes. After completion of the spray exposure, the specimens shall be thoroughly rinsed in water and all surfaces air-blown dry and inspected in accordance with 4.1 and 4.2 to determine the extent, if any, of deterioration that has occurred. If this optional procedure is specified, brushing of the samples in the third group is not required. If a conflict arises from the use of the spray option, the brush method of 3.1d shall be used as the referee procedure. The measurements shown in parentheses are not exact equivalents and are shown for convenience only.

3.3 Immersion test for components with marking protected by a sleeve material. Components with a protective sleeve shall be divided into three groups as specified in 3, and each group shall be subjected to testing using the solution defined for that group. Each solution shall be maintained at a temperature of  $25^\circ\text{C} \pm 5^\circ\text{C}$ , except the solution in 2.1d shall be maintained at a temperature of  $63^\circ\text{C}$  to  $70^\circ\text{C}$ . The specimens shall be completely immersed for 3 minutes  $\pm .5$ ,  $-0$  minutes in the specified solution contained in the vessel specified in 2.2. Immediately following immersion, each specimen shall be tested as follows: The bristle portion of the brush specified in 2.3 shall be dipped in the solution until wetted and the specimen shall be brushed with normal hand pressure (approximately 2 to 3 ounce force applied normal to the surface) for ten strokes on the sleeve directly above the area of the marking. Immediately after brushing, the procedure shall be repeated two more times for a total of three immersions followed by brushing. The brush stroke shall be directed in a forward direction across the sleeve area above the marking. After completion of the third immersion and brushing, the specimens shall be air-blown dry. The specimens shall be inspected in accordance with 4.1 and 4.2 to determine the extent, if any, of deterioration that has occurred, including the sleeve.

3.4 Open construction parts and parts not intended for PCB mounting. Parts of open construction which are susceptible to internal damage by immersion in solvents and parts not intended for mounting on printed circuit boards, shall be divided into three groups as specified in 3, and each group shall be subjected to testing using the solution defined for that group. Each solution shall be maintained at a temperature of  $25^\circ\text{C} \pm 5^\circ\text{C}$ , except for the solution in 2.1d, which shall be maintained at a temperature range of  $63^\circ\text{C}$  to  $70^\circ\text{C}$ , and shall be contained in the vessel specified in 2.2. Each group shall be tested as follows: The bristle portion of the brush specified in 2.3 shall be immersed in the respective solution for each group until wetted. The marking area of the specimen to be tested shall then be immediately brushed with normal hand pressure (approximately 2 to 3 ounce force applied normal to the surface) for ten strokes on the portion of the specimen where marking has been applied (test area not to exceed one-half inch square). The brush stroke shall be directed in a forward direction across the marked surface. This test shall be repeated twice for a total of three times for each specimen. The specimens shall then be inspected in accordance with 4.1 and 4.2 to determine the extent of deterioration, if any.

#### 4. EXAMINATION AND MEASUREMENTS

4.1 Marking resistance to solvents. After subjection to the test, any specified markings which are missing in whole or in part, faded, smeared, blurred, or shifted (dislodged) to the extent that they cannot be readily identified from a distance of at least 6 inches with normal room lighting without the aid of magnification or with a viewer having a magnification no greater than 3X shall constitute failure.

4.2 Component protective coating, encapsulation material and sleeve material resistance. After subjection to the test, the specimen shall be examined for cracks, separations, crazing, swelling, softening, and degradation of body material, end caps and seals if present, or any other damage or degradation that has occurred due to solvent exposure and which effects the mechanical integrity or reliability shall constitute a failure. The examination shall be made with a viewer having a magnification of 10X maximum.

5. SUMMARY. The following details are to be specified in the individual specification:

- a. The number of specimens to be tested.
- b. Optional procedure for the third group allowed (see 3.2).

TABLE I. Summary table for resistance to solvents.

Solvent 1	Solvent 2	Solvent 3	Solvent 4
1 part (by volume) of isopropyl alcohol (ACS) reagent grade or TT-I-735, grade A or B and 3 parts (by volume) of mineral spirits per Mil-Prf-680, type I, or three parts (by volume) of a mixture of 80% (by volume) of kerosene and 20% (by volume) ethylbenzene.	This solvent has been deleted.	Terpene defluxer	42 parts (by volume) of water 1 part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolamine
Immersion 3 +.5, -0 minutes, 25°C ±5°C		Immersion 3 +.5, -0 minutes, 25°C, ±5°C	Immersion 3 +.5, -0 minutes, 63°C to 70°C
Brush 10 strokes (wet bristle) 2 to 3 oz.		Brush 10 strokes (wet bristle) 2 to 3 oz.	Brush 10 strokes (wet bristle) 2 to 3 oz.
Immersion 3 +.5, -0 minutes, 25°C ±5°C.		Immersion 3 +.5, -0 minutes, 25°C ±5°C.	Immersion 3 +.5, -0 minutes, 63°C to 70°C.
Brush 10 strokes (wet bristle) 2 to 3 oz.		Brush 10 strokes (wet bristle) 2 to 3 oz.	Brush 10 strokes (wet bristle) 2 to 3 oz.
Immersion 3 +.5, -0 minutes, 25°C ±5°C.		Immersion 3 +.5, -0 minutes, 25°C ±5°C.	Immersion 3 +.5, -0 minutes, 63°C to 70°C.
Brush 10 strokes (wet bristle) 2 to 3 oz.		Brush 10 strokes (wet bristle) 2 to 3 oz.	Brush 10 strokes (wet bristle) 2 to 3 oz.
		Rinse in water	Rinse in water.
Air blow dry.		Air blow dry	Air blow dry.
Inspect at 3X maximum for marking. Inspect at 10X maximum for part damage.		Inspect at 3X maximum for marking. Inspect at 10X maximum for part damage.	Inspect at 3X maximum for marking. Inspect at 10X maximum for part damage.