Solderability Dip Test

1. SCOPE

1.1. Content

This specification covers the material, equipment, test procedure and evaluation method for determining the solderability of lead wires, terminals, printed circuit boards, and other components which are to be joined or coated by a soldering operation. Also included in this specification are provisions for selection of various solders (Tin-Lead and Lead-Free), fluxes and test methods (see Tables 1a and 1b).

NOTE
This specification is intended for quality inspection only. Solderability testing for product qualification should be conducted in accordance with J-STD-002, JEDEC JESD22-B102E, Method 1, or IEC 60068-2-20, Rev. 5.0, Test Ta, Method 1; unless another industry standard or customer specification is referenced.

A. Tin-Lead Solder

Table 1a

Specification Number	Test Method	Solder Type	Flux Type	Compliance
TEC-109-11-1	A	Tin-Lead	ROL1 - Rosin, Low Activity Level, containing Halide (< 0.5%)	Complies with the default requirements of J-STD-002D, Coating Durability, Category1, Test A
TEC-109-11-2	A	Tin-Lead	RMA - Mildly activated rosin	----
TEC-109-11-3	A	Tin-Lead	RA - Highly activated rosin	----
TEC-109-11-4	A	Tin-Lead	As specified in the referencing document	----
TEC-109-11-5	B	Tin-Lead	ROL1 - Rosin, Low Activity Level, containing Halide (< 0.5%)	Complies with the default requirements of MIL-STD-202G, Method 208H for through-hole mount and surface mount leaded components
TEC-109-11-6	C	Tin-Lead	R - Non-activated rosin	----
TEC-109-11-7	D	Tin-Lead	R - Non-activated rosin	----
TEC-109-11-8	Z	Tin-Lead	Obsolete	----
TEC-109-11-9	Y	Tin-Lead	R - Non-activated rosin (except RMA - Mildly activated rosin may be used for specimen preparation)	----

| Indicates Change

B. Lead-Free Solder

Table 1b

Specification Number	Test Method	Solder Type	Flux Type	Compliance	Status
TEC-109-11-10	B	Lead-Free	ROL1 - Rosin, Low Activity Level, Containing Halide (< 0.5%)	Complies with the default requirements of JEDEC JESD22-B102E, Method 1, for lead-free solder.	Superseded by TEC-109-11-10-1
TEC-109-11-10-1	B	95.5/3.9/0.6 tin-silver-copper	ROL1 - Rosin, Low Activity Level, Containing Halide (< 0.5%)	Complies with the default requirements of JEDEC JESD22-B102E, Method 1, for lead-free solder.	----
TEC-109-11-11	A	Lead-Free	R - Non-activated rosin	----	Superseded by TEC-109-11-11-1
TEC-109-11-11-1	A	SAC305	R - Non-activated rosin	----	----
TEC-109-11-11-2	A	SnCu (99.3/0.7)	R - Non-activated rosin	Complies with IEC 60068-2-20, Rev. 5.0, Test Ta, Method 1	----
TEC-109-11-12	A	Lead-Free	RMA - Mildly activated rosin	----	Superseded by TEC-109-11-12-1
TEC-109-11-12-1	A	SAC305	RMA - Mildly activated rosin	----	----
TEC-109-11-13-1	A	SAC305	RA-Highly activated rosin	----	----
TEC-109-11-14-1	C	SnCu (99.3/0.7)	R - Non-activated rosin	Complies with IEC 60068-2-20, Rev. 5.0, Test Ta, Method 1	----

1.2. Description

Specimens are coated with a flux and immersed in a molten solder bath of controlled composition and temperature. The soldered surface is evaluated visually to determine solderability. **This procedure is not intended to test or evaluate solder cup, solder eyelet, or other hand-soldered type or SMT type terminations**.

1.3. Safety Considerations

The test contained in this specification may be inherently hazardous. TE Connectivity (TE) disclaims any and all responsibility for any injury or damage to third parties that may occur during, or as a result of performing this test or using this specification. It is the responsibility of the user of this test to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations before its use.

2. MATERIAL

2.1. Solder

A. Nominal Composition

1. **Tin-Lead**

a. 60/40 or 63/37 tin-lead

(1) The allowable variation of tin is ± 1% of the nominal alloy being used.

(2) Solder Bath Control for all methods utilizing Tin-lead solder:

(a) Maintain molten solder at 245 ± 5 ℃ [473 ± 9 ° F].

(b) Stir molten solder occasionally to maintain a uniform temperature.

(c) Skim dross and oxidized flux from the molten solder surface prior to testing each specimen.

2. **Lead-Free**

a. 96.5/3.0/0.5 tin-silver-copper (SAC 305)

(1) The allowable variation of these elements is as follows:

- Tin: 95.5 - 97.5 percent by weight
- Silver: 3.0 - 4.0 percent by weight
- Copper: 0.5 - 1.0 percent by weight

(2) Solder Bath Control

(a) Maintain molten solder at 245 ± 5 ℃ [473 ± 9 ° F].

(b) Stir molten solder occasionally to maintain a uniform temperature.

(c) Dross and oxidized flux shall be skimmed from the molten solder surface immediately before each test.

b. 95.5/3.9/0.6 tin-silver-copper (Lead-Free)

(1) The allowable variation of these elements is as follows:

- Tin: 94.5 - 96.5 percent by weight
- Silver: 3.0 - 4.0 percent by weight
- Copper: 0.5 - 1.0 percent by weight

NOTE
This solder is required per JEDEC JESD22-B102E.

(2) Solder Bath Control

(a) Maintain molten solder at 245 ± 5 ℃ [473 ± 9 ° F].

(b) Stir molten solder occasionally to maintain a uniform temperature.

(c) Dross and oxidized flux shall be skimmed from the molten solder surface immediately before each test.

c. 99.3/0.7 tin-copper (Pure Tin)

(1) The allowable variation of these elements is as follows:

- Copper: 0.45 - 0.9 percent by weight
- Tin: Balance

(2) Solder Bath Control

(a) Maintain molten solder at 250 ± 3 ℃ [482 ± 5 ° F].

(b) Stir molten solder occasionally to maintain a uniform temperature.

(c) Dross and oxidized flux shall be skimmed from the molten solder surface immediately before each test.

d. Other Compositions - may be used upon agreement with a Quality Manager, Quality Engineer, or the requester.

NOTE
If an alternative solder is used it should be noted on the test report. The use of alternate solder alloys may result in the loss of compliance to listed standards per Tables 1a and b.

B. Contamination Control

1. The contaminant level shall not exceed the values specified in Table 2. Solder contamination shall be controlled by one of the following methods:

a. Periodic Analysis

If the periodic analysis method is selected, the solder shall be analyzed periodically to determine its composition. The solder shall be replaced as necessary to meet the requirements of Table 2. The interval between analyses may be lengthened if the analysis results indicate that the Table 2 limits are not being approached. The interval between analyses shall be shortened if the analysis results indicate that the Table 2 limits have been exceeded.

b. Periodic Replacement

If the periodic replacement method is selected, the solder shall be replaced every 30 operating days. The replacement solder shall meet the requirements of Table 2.

2. Maximum Limits of Solder Bath Contaminates

NOTE

1. The tin content of the solder shall be maintained within ± 1% of the nominal alloy being used.

2. The total of copper, gold, cadmium, zinc, and aluminum contaminants in tin-lead solder shall not exceed 0.4%.

Table 2

Contaminant	Maximum Contaminant % by Weight Limit	
	Tin-Lead	Lead-Free
Copper	.300	N/A
Gold	.200	.200
Cadmium	.005	.005
Zinc	.005	.005
Aluminum	.006	.006
Antimony	.500	.500
Iron	.020	.020
Arsenic	.030	.030
Bismuth	.250	.250
Silver	.100	N/A
Nickel	.010	.010
Indium	0.007	N/A
Lead	N/A	.1

2.2. Flux

A. Classification

All of the fluxes listed below are acceptable for use in quality inspection solderability testing. Fluxes which are acceptable for solderability testing per MIL-STD-202G, Method 208H, and IPC/EIA/JEDEC J-STD-002D Test A are labeled “MIL-STD-202G, Method 208H / J-STD-002D, Test A compliant”. Fluxes which are acceptable for solderability testing per JEDEC JESD22-B102E Method 1 are labeled “JEDEC JESD22-B102E Method 1 compliant”. The flux classification designator ROL1 is per IPC/EIA J-STD-004 (January 1995).

1. **Nonactivated Rosin, Type R**

- Kester 145, PN 1204260-1
- Qualitek 125, PN 1325812-1

2. **Mildly Activated Rosin, Type RMA**
   - Alpha 611, PN 28812-1
   - Kester 197, PN 27560-1
3. **Highly Activated Rosin, Type RA**
   - Alpha 711, PN 987270-1
   - Alpha 809, PN 25920-1
   - Kester 1544, PN 23609-1
4. **Rosin, Low Activity Level, Containing Halide (<0.5%), Type ROL1**
   - Kester 182, PN 1325762-1 (MIL-STD-202G, Method 208H / J-STD-002D Test A compliant, JEDEC JESD22-B102E Method 1 compliant)
   - Alpha ROL1, PN 1325907-1 (MIL-STD-202G, Method 208H / J-STD-002D, Test A compliant, JEDEC JESD22-B102E Method 1 compliant)
   - Superior 99-25.15 PN 1915815-1 (MIL-STD-202G, Method 208H / J-STD-002D, Test A compliant, JEDEC JESD22-B102E Method 1 compliant)
5. Alternate fluxes
   a. Alternate flux with same composition as a listed flux, but different manufacturer

      A flux produced by an alternate manufacturer may be substituted for any of the listed fluxes if the alternate flux has the same composition as the listed flux.

   b. Alternate flux with different composition as a listed flux

      An alternate flux with a composition different from that of a listed flux may be used if approved by the Quality Manager, Quality Engineer, or test requestor. If an alternate flux composition is used, it should be noted on the test report. The use of alternate flux compositions may result in the loss of compliance to listed standards per Tables 1a and b.

B. Concentration Control

Due to the volatility of the flux solvent, prolonged exposure of flux baths will result in solvent loss and increased rosin concentration. When not in use, the flux shall always be stored in a tightly sealed container (i.e., screw top lid). Flux concentration in the flux bath shall be controlled by one of the following methods:

1. Specific Gravity Method

   If the specific gravity method is selected, the specific gravity of the flux shall be maintained as follows:

   a. Type R (Non-activated Rosin)

      The flux shall be maintained at a specific gravity of between 0.838 and 0.858 at 25 ℃ during use of the flux.

   b. Type RMA (Mildly Activated Rosin) and Type RA (Highly Activated Rosin)

      The flux shall be maintained at a specific gravity within -1/+3% of the manufacturer's specified nominal specific gravity during the use of the flux.

   c. Type ROL1 (Rosin, Low Activity Level, Containing Halide (< 0.5%))

      The flux shall be maintained at a specific gravity of between 0.842 and 0.846 at 25 ± 2 ℃ [77 ± 3.6 ℉] during use of the flux, and shall be discarded after 168 hours of atmospheric exposure.

2. Periodic Replacement Method

   If the periodic replacement method is selected, the flux shall be discarded and replaced after a total of 8 hours of atmospheric exposure.

2.3. Removal

Flux may be removed by use of a removal solvent such as isopropyl alcohol (PN 23189-1), or other suitable solvent.

3. EQUIPMENT

3.1. Solder Pot

Thermostatically controlled, with a minimum of 900 grams [2 lb] of solder

3.2. Mechanical or Mechanical/Electro-Mechanical Dipping Device

- Capable of controlling the rate of immersion and removal of specimens, immersion depth, and dwell time (same or similar to Figure 1).

NOTE
The use of a mechanical or mechanical/electro-mechanical dipping device as described above is recommended for repeatability and required to maintain compliance to MIL-STD-202G. Other dipping means (such as hand dipping) may be used upon agreement with a Quality Manager or Quality Engineer, or upon agreement with the requester. For alternative dipping method (including hand dipping), the rate of immersion, immersion depth and dwell times may be approximated by the attending operator. Dipping method shall always be noted.

- Specimen holding fixtures shall be designed to avoid any excess flux being trapped in the fixture.

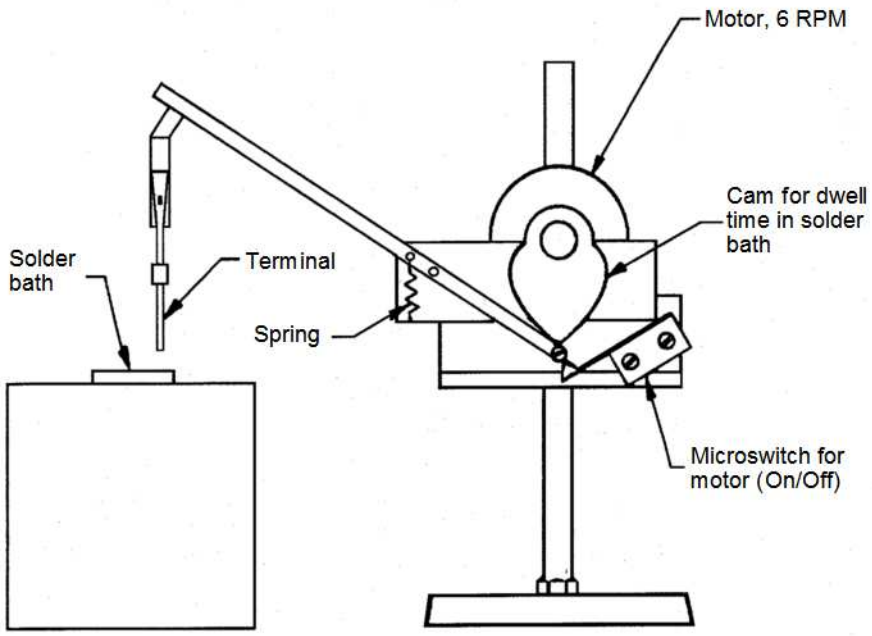


Figure 1

3.3. Binocular Microscope (or equivalent)

- Capable of 8x minimum (10x preferred) magnification
- Equipped with reticules (or equivalent) for measurement
- Shadow-less lighting shall be suitable for proper inspection

3.4. Timing Device

3.5. Glass or Stainless Steel Container

- Of sufficient size to allow suspension of specimens a minimum of 40 mm [1.57 in] above boiling distilled or deionized water and a minimum of 12.7 mm [0.5 in] from the container walls
- The specimen holder shall be non-metallic to prevent galvanic corrosion
- The container may be insulated but it should have a heat loss sufficient to allow continuous boiling of the water
- The controlling temperature sensor shall be placed in the steam aging zone
- A safe means to prevent excessive pressure and a means of maintaining adequate water level shall be provided; neither shall cause the water to cool below the boiling point
- Condensate shall drip freely back to the water without striking the specimens being aged

3.6. Air Circulating Oven

Capable of maintaining 155 ± 5 ℃ [311 ± 9 ℉]

3.7. Temperature/Humidity Chamber

Capable of maintaining 40 ± 2 ℃ [104 ± 3.6 ℉], 90 to 95% Relative Humidity

4. TEST SPECIMENS

4.1. The test specimens shall be selected as specified by the referencing document. Preparation of the sample(s) shall be for all variations of the test methods (paragraph 5) unless approved by the Quality Manager, Quality Engineer or test requestor.

A. Specimen Preparation

1. Unless noted otherwise, specimens shall be tested in the condition that they would normally be at the time of assembly soldering.
2. Specimens shall not be touched by fingers (or otherwise contaminated), wiped, cleaned, scraped, or abraded prior to testing.

5. TEST METHODS

5.1. Method A

A. Test Procedure

1. Immerse area of specimen to be evaluated in the specified flux; maintained at room ambient temperature, for 5 to 10 seconds, to the minimum depth necessary to cover the surfaces to be tested.

   Maintain perpendicularity of the leads to the flux surface during the immersion

2. Withdraw specimen from flux and allow excess flux to drain off for 5 to 20 seconds at room ambient conditions.

NOTE
Any droplets of flux that form shall be removed by blotting, taking care not to remove the flux coating from the surfaces to be tested.

3. Immerse specimen in molten solder

   - Immerse at a rate of 25 ± 6 mm [.98 ± .24 in] per second until entire surface to be evaluated is coated
   - Maintain perpendicularity of the leads to the solder surface during the immersion.
   - Immersion depth shall be to within 1.25 mm [0.049 in] of the product housing, unless specified otherwise for product specimens intended to be mounted into through-holes on printed circuit boards.
   - Hold specimen in solder for 5 +0/-0.5 seconds, unless specified otherwise.

NOTE
For compliance with IEC 60068-2-20 when using pure tin (99.3/0.7 tin/copper) solder; (paragraph 2.1.A.2.c.), hold specimen in molten solder for 3 ±0.3 seconds.

4. Withdraw specimen at a rate of 25 ± 6 mm [.98 ± .24 in] per second.
5. Allow solder to solidify by air cooling while the specimen is maintained in its test attitude.
6. Remove flux residue from specimen by immersing in isopropyl alcohol or other suitable flux removal solvent.

5.2. Method B

A. Specimen Aging

1. Prior to the application of flux and immersion in solder, all specimens shall be aged as follows:

   a. Within five working days before using, clean the steam-aging apparatus with deionized or distilled water, or a 3% solution of hydrogen peroxide (PN 21734-3), to remove any accumulated residue.

   b. Fill steam-aging apparatus with a suitable amount of distilled or deionized water and bring to a boil.

NOTE
Additional hot distilled water may be added throughout the age period so long as boiling continues.

   c. Suspend specimens not less than 40 mm [1.57 in] above the boiling water, and not less than 12.7 mm [0.5 in] from the container walls, using a nonmetallic holder. **Place specimens such that no specimens have their leads or terminations touching each other or the water, and that condensation forming will drain from the terminations to the water.**

NOTE
Do not stack specimens in a manner that restricts their surface exposure to steam.

NOTE
Specimens fabricated of different materials shall not be steam-aged together due to the possibility of cross-contamination influencing the test results.

   d. The steam-aging temperature shall be in accordance with Table 3.

Table 3

Altitude m [ft]	Average Local BP C [F]	Steam Temperature Limits C [F]
0 to 304.8 [0 to 1000]	100 [212]	90 to 96 [194 to 204.8]
304.8 to 609.6 [1000 to 2000]	99 [210.2]	89 to 95 [192.2 to 203]
609.6 to 914.4 [2000 to 3000]	98 [208.4]	88 to 94 [190.4 to 201.2]
914.4 to 1219.2 [3000 to 4000]	97 [206.6]	87 to 93 [188.6 to 199.4]
1219.2 to 1524.0 [4000 to 5000]	96 [204.8]	86 to 92 [186.8 to 197.6]
1524.0 to 1828.8 [5000 to 6000]	95 [203]	85 to 91 [185 to 195.8]

e. Fix the cover over the container and expose specimen surfaces to the steam in the container for a period of time as specified:
   - 1 hour ± 5 minutes
   - 8 hours ± 15 minutes
   - 16 hours ± 60 minutes

NOTE
If no time is specified, expose the specimens for 8 hours ± 15 minutes.

f. After completion of the steam-aging exposure, air-dry the specimens at room ambient conditions for a minimum of 15 minutes. **Solderability testing shall be performed within 72.0 hours of the specified aging exposure**.

B. Test Procedure

1. Immerse area of specimen to be evaluated in the specified flux; maintained at room ambient temperature, for 5 to 10 seconds, to the minimum depth necessary to cover the surfaces to be tested.

   Maintain perpendicularity of the leads to the flux surface during the immersion

2. Withdraw specimen from flux and allow excess flux to drain off for 5 to 20 seconds at room ambient conditions.

NOTE
Any droplets of flux that form shall be removed by blotting; taking care not to remove the flux coating from the surfaces to be tested.

3. Immerse specimen in molten solder
   - Immerse at a rate of 25 ± 6 mm [.98 ± .24 in] per second until entire surface to be evaluated is coated
   - Maintain perpendicularity of the leads to the solder surface during the immersion.
   - Immersion depth shall be to within 1.25 mm [0.049 in] of the specimen body or to the seating plane (whichever is further from the specimen body), unless specified otherwise for product specimens intended to be mounted into through-holes on printed circuit boards.
   - Hold specimen in solder for 5 +0/-0.5 seconds, unless specified otherwise.

NOTE
For compliance with IEC 60068-2-20 when using pure tin (99.3/0.7 tin/copper) solder; (paragraph 2.1.A.2.c.), hold specimen in molten solder for 3 ±0.3 seconds.

4. Withdraw specimen at a rate of 25 ± 6 mm [.98 ± .24 in] per second.
5. Allow solder to solidify by air cooling while the specimen is maintained in its test attitude.
6. Remove flux residue from specimen by immersing in isopropyl alcohol or other suitable flux removal solvent.

5.3. Method C

A. Specimen Preparation

1. Unless noted otherwise, specimens shall be tested in the as-received condition.
2. Specimens shall not be touched by fingers (or otherwise contaminated), wiped, cleaned, scraped, or abraded prior to testing.

B. Specimen Aging

1. Prior to the application of flux and immersion in solder, all specimens shall be heat-aged as follows:
   a. In a dry heat air circulating oven, specimens shall be suspended from a rack in a manner preventing any restriction to the air flow and exposed to 155 ± 5 ℃ [311 ± 9 ℉] for 16 ± .25 hours.

NOTE
Specimens fabricated of different materials shall not be heat-aged together due to the possibility of cross-contamination influencing the test results.

   b. Remove specimens from the oven at the conclusion of the exposure period and allow to cool to room temperature. **The specimens shall be subjected to standard atmospheric conditions for not less than 2 hours and not more than 24 hours prior to solderability testing**.

C. Test Procedure

1. Immerse area of specimen to be evaluated in the specified flux; maintained at room ambient temperature, for 5 to 10 seconds.
2. Withdraw specimen from flux and allow excess flux to drain off for a suitable time. In case of dispute, drainage shall be carried out for 1 minute ± 5 seconds.
3. Immerse specimen in molten solder
   - Immerse at a rate of 25 ± 2.5 mm [.98 ± .098 in] per second until entire surface to be evaluated is coated
   - Hold specimen in solder for 2 ± 0.5 seconds, unless specified otherwise.

NOTE
For components having a high thermal capacity, the referencing document may specify an immersion time of 5 ± 0.5 seconds.

NOTE
For compliance with IEC 60068-2-20 when using pure tin (99.3/0.7 tin/copper) solder; (paragraph 2.1.A.2.c.), hold specimen in molten solder for 3 ±0.3 seconds.

4. Withdraw specimen at a rate of 25 ± 2.5 mm [.98 ± .098 in] per second.
5. Remove flux residue from specimen by immersing in isopropyl alcohol or other suitable flux removal solvent.

5.4. Method D

A. Specimen Preparation

1. Unless noted otherwise, specimens shall be tested in the as-received condition.
2. Specimens shall not be touched by fingers (or otherwise contaminated), wiped, cleaned, scraped, or abraded prior to testing.

B. Specimen Aging

1. Prior to the application of flux and immersion in solder, all specimens shall be temperature/humidity -aged as follows:
   a. In a suitable chamber, specimens shall be suspended and exposed to 40 ± 2 ℃ [104 ± 3.6 ℉], 90 to 95% Relative Humidity, for a duration of 10 days.

NOTE
Specimens fabricated of different materials shall not be heat-aged together due to the possibility of cross-contamination influencing the test results.

   b. Remove specimens from the chamber at the conclusion of the exposure period and allow to cool to room temperature. **The specimens shall be subjected to standard atmospheric conditions for not less than 2 hours and not more than 24 hours prior to solderability testing**.

C. Test Procedure

1. Immerse area of specimen to be evaluated in the specified flux; maintained at room ambient temperature, for 5 to 10 seconds.
2. Withdraw specimen from flux and allow excess flux to drain off for a suitable time. In case of dispute, drainage shall be carried out for 1 minute ± 5 seconds.
3. Immerse specimen in molten solder
   - Immerse at a rate of 25 ± 2.5 mm [.98 ± .098 in] per second until entire surface to be evaluated is coated.
   - Hold specimen in solder for 2 ± 0.5 seconds, unless specified otherwise.

NOTE
For components having a high thermal capacity, the referencing document may specify an immersion time of 5 ± 0.5 seconds.

NOTE
For compliance with IEC 60068-2-20 when using pure tin (99.3/0.7 tin/copper) solder; (paragraph 2.1.A.2.c.), hold specimen in molten solder for 3 ±0.3 seconds.

4. Withdraw specimen at a rate of 25 ± 2.5 mm [.98 ± .098 in] per second.
5. Remove flux residue from specimen by immersing in isopropyl alcohol or other suitable flux removal solvent.

5.5. Method Y

A. Specimen Preparation

1. Gold plated specimens - shall be pre-tinned twice, using the procedure detailed in paragraph 5.5.C., except that RMA flux may be used.

2. All other specimens - shall be pre-tinned once, using the procedure detailed in paragraph 5.5.C, except that RMA flux may be used.

B. Specimen Aging

1. After preparation, all specimens shall be aged as follows:

a. Within five working days before using, clean the steam-aging apparatus with deionized or distilled water, or a 3% solution of hydrogen peroxide (PN 21734-3), to remove any accumulated residue.

b. Fill steam-aging apparatus with a suitable amount of distilled or deionized water and bring to a boil.

NOTE
Additional hot distilled water may be added throughout the age period so long as boiling continues.

c. Suspend specimens not less than 38.1 mm [1.5 in] above the boiling water, and not less than 12.7 mm [0.5 in] from the container walls, using a nonmetallic holder. **Place specimens such that no specimens have their leads or terminations touching each other or the water, and that condensation forming will drain from the terminations to the water.**

NOTE
Do not stack specimens in a manner that restricts their surface exposure to steam.

NOTE
Specimens fabricated of different materials shall not be steam-aged together due to the possibility of cross-contamination influencing the test results.

d. The steam-aging temperature shall be in accordance with Table 3.

e. Fix the cover over the container and expose specimen surfaces to the steam in the container for a period of time as specified:

- 1 hour ± 5 minutes
- 8 hours ± 15 minutes
- 16 hours ± 60 minutes

NOTE
If no time is specified, expose the specimens for 8 hours ± 15 minutes.

2. After completion of the steam-aging exposure, air-dry the specimens at room ambient conditions for a minimum of 15 minutes. **Solderability testing shall be performed within 72.0 hours of the specified aging exposure**.

C. Test Procedure

1. Immerse area of specimen to be evaluated in the specified flux; maintained at room ambient temperature, for 5 to 10 seconds, to the minimum depth necessary to cover the surfaces to be tested.

   Maintain perpendicularity of the leads to the flux surface during the immersion

2. Withdraw specimen from flux and allow excess flux to drain off for 5 to 20 seconds at room ambient conditions.

NOTE
Any droplets of flux that form shall be removed by blotting; taking care not to remove the flux coating from the surfaces to be tested.

3. Immerse specimen in molten solder

   - Immerse at a rate of 25 ± 6 mm [.98 ± .24 in] per second until entire surface to be evaluated is coated
   - Maintain perpendicularity of the leads to the solder surface during the immersion.
   - Immersion depth shall be to within 1.27 mm [0.050 in] of the product housing for product specimens intended to be mounted into through-holes on printed circuit boards.
   - Hold specimen in solder for 5 +0/-0.5 seconds, unless specified otherwise.

NOTE
For compliance with IEC 60068-2-20 when using pure tin (99.3/0.7 tin/copper) solder; (paragraph 2.1.B.1.e.), hold specimen in molten solder for 3 ±0.3 seconds.

4. Withdraw specimen at a rate of 25 ± 6 mm [.98 ± .24 in] per second.
5. Allow solder to solidify by air cooling while the specimen is maintained in its test attitude.
6. Remove flux residue from specimen by immersing in isopropyl alcohol or other suitable flux removal solvent.

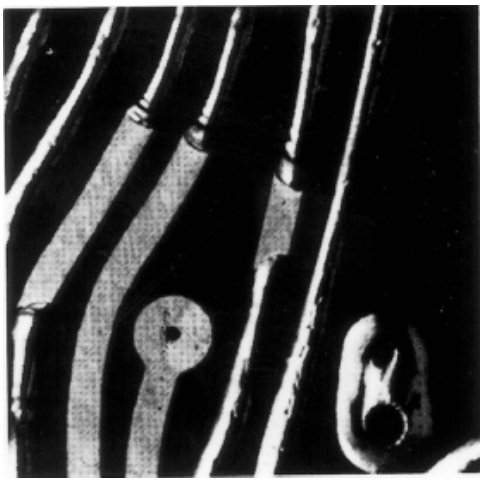
6. EVALUATION

6.1. The soldered surface shall be examined at 8x minimum (10x preferred) magnification for evidence of non-wetting, de-wetting, and pin holes. For fine pitch termination parts (0.5 mm [.019 in] pitch or less) the inspection magnification shall be 30x. Typical examples of solder defects are shown in Figures 2 thru 9.

6.2. Unless otherwise specified, a surface is considered solderable if 95% of the soldered area is covered with a smooth, bright, uniform coating of adherent solder (see Figures 10 thru 16). The remaining 5% of the surface may show pin holes, non-wetting, or de-wetting areas; provided such defects are not concentrated in one area. If more than 5% of the surface shows defects, the surface is not considered solderable. Anomalies other than de-wetting, non-wetting, and pin holes are not cause for rejection.

NOTE
Lead-free solder may have a greater surface roughness than tin-lead solder. This greater surface roughness should not be interpreted as a non-wetting, de-wetting or pinhole condition.

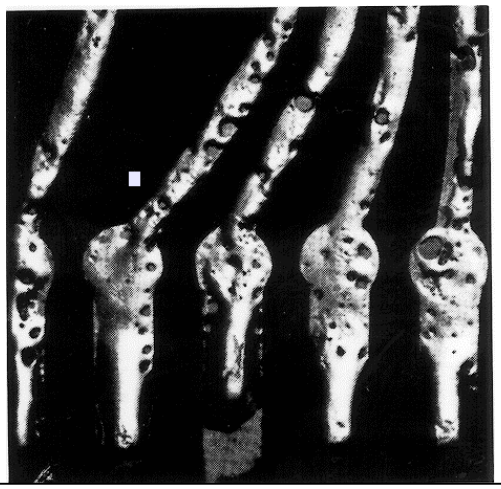
6.3. (Applicable to TEC-109-11-10 only) There shall be no solder bridging between any termination area and any other metallization not connected to it by design. In the event that the solder dipping causes bridging, the test shall not be considered a failure provided that a local application of heat; e.g., gas, soldering iron, or re-dipping, results in a solder pullback with no wetting of the dielectric area (as indicated by microscopic examination).



The solder coating is absent or intermittent. Bare areas exhibit the color of the basis material (e.g., copper, gold, nickel)

Figure 2

x



Non-wetting may extend only to pin holes and eyes in the solder coating, but the color of the basis metal is usually seen at the bottom of these defects.

Figure 3

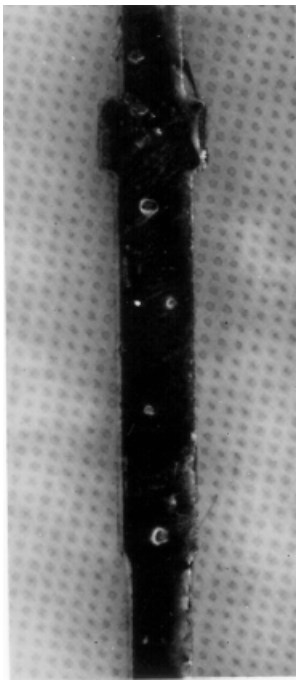


Figure 4

Views of non-wetted posts

Figure 5

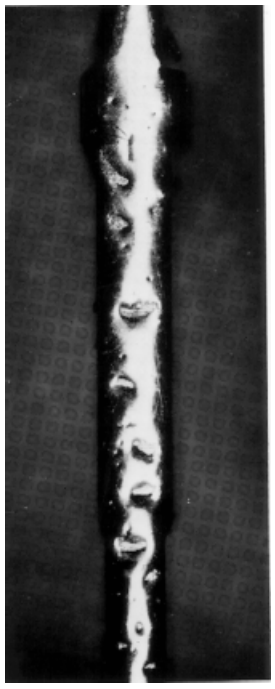
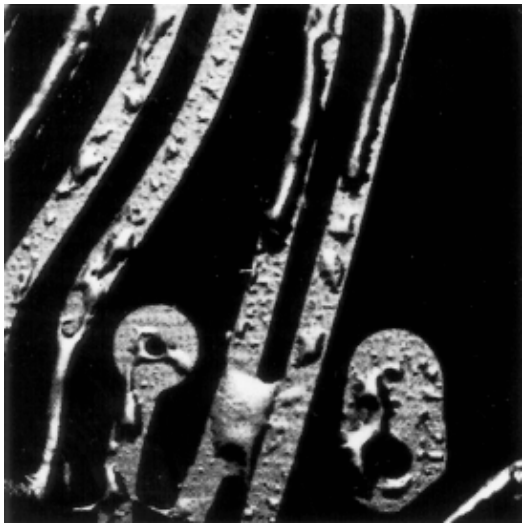


Figure 6

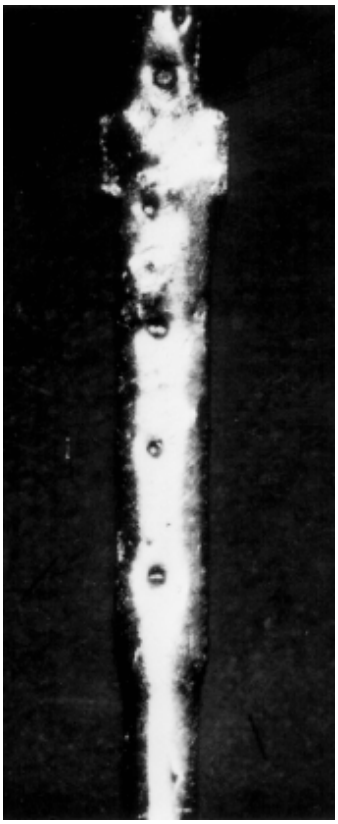


The solder retracts into globules. The bared surface is the color of the solder, but matte or semi-bright. In less severe cases, considerable areas of wetting are interspersed with de-wetted regions.

Figure 7

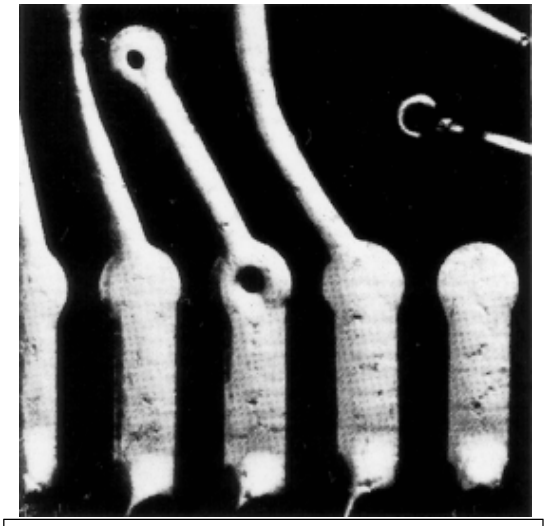
Gross de-wetting

Figure 8



Pin Holes

Figure 9



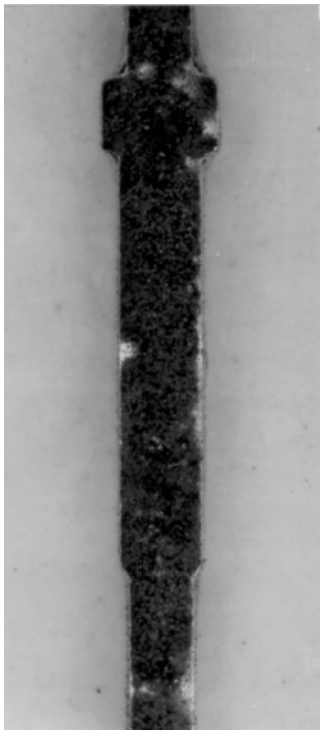
The solder retracts into globules. The bared surface is the color of the solder, but matte or semi-bright. In less severe cases, considerable areas of wetting are interspersed with de-wetted regions.

Figure 10

x

Complete Wetting

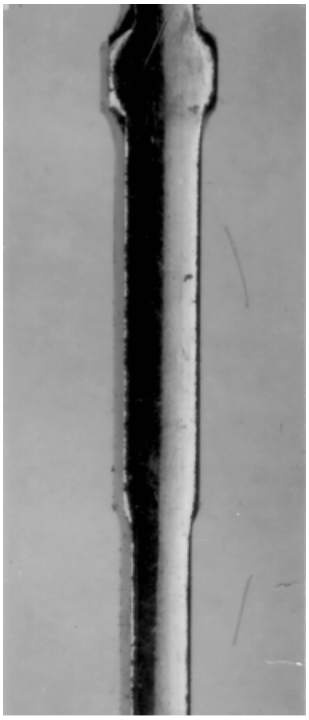
Figure 11



Acceptable grainy solder surfaces

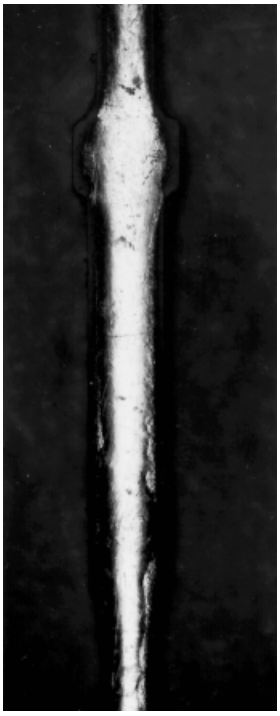
Figure 12

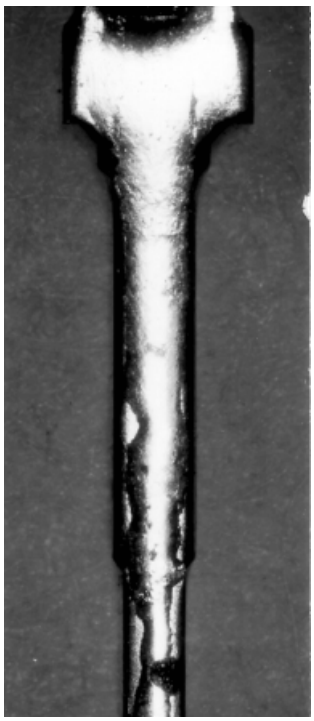
Figure 13



Edge pull-back

Figure 14





5% de-wetting (minimum acceptable condition)

Figure 15

Figure 16

7. DOCUMENTATION

7.1. Test documentation shall contain the following:

- Title of test
- Specimen description
- Specification number (see Table 1)
- Name of operator and date of test
- Results

7.2. The following shall be specified in the referencing document:

- Area of examination
- Specification number (see Table 1)
- Type of flux to be used TEC-109-11-4 only)
- Any deviations to the method or material called out above