NOTICE OF
CHANGE

INCH-POUND
MIL-STD-202F
NOTICE 14
6 February 1998

DEPARTMENT OF DEFENSE

TEST METHOD STANDARD
ELECTRONIC AND ELECTRICAL COMPONENT PARTS

TO ALL HOLDERS OF MIL-STD-202F:

1. THE FOLLOWING PAGES OF MIL-STD-202F HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
3	6 February 1998	3	31 January 1996
4	11 April 1986	4	REPRINTED WITHOUT CHANGE

2. THE FOLLOWING TEST METHODS OF MIL-STD-202F HAVE BEEN REVISED AND SUPERSEDE THE TEST METHODS LISTED:

NEW METHOD	DATE	SUPERSEDED METHOD	DATE
210E	6 February 1998	210D	31 January 1996

3. RETAIN THIS NOTICE PAGE AND INSERT BEFORE THE TABLE OF CONTENTS.

4. Holders of MIL-STD-202F will verify that the changes indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the standard is completely revised or canceled.

5. The margins of this notice are marked with asterisks to indicate where changes were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - EC
Air Force - 85

Preparing activity:
DLA - CC

(Project 59GP-0156)

Review activities:
Army - AR, AT, AV, CR4, MI, SM, TE
Navy - AS, OS, SH
Air Force - 17, 19, 99
NSA - NS

AMSC N/A

FSC 59GP

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5. NUMERICAL INDEX OF TEST METHODS

Method Number	Date	Title
Environmental tests (100 class)		
101D	16 April 1973	Salt spray (corrosion)
102A	Cancelled	Superseded by Method 107 (See note on method 102)
103B	12 September 1963	Humidity (steady state)
104A	24 October 1956	Immersion
105C	12 September 1963	Barometric pressure (reduced)
106F	8 June 1990	Moisture resistance
107G	28 March 1984	Thermal shock
108A	12 September 1963	Life (at elevated ambient temperature)
109B	16 April 1973	Explosion
110A	16 April 1973	Sand and dust
111A	16 April 1973	Flammability (external flame)
112E	11 October 1988	Seal
Physical characteristics tests (200 class)		
201A	24 October 1956	Vibration
202D	Cancelled	Superseded by Method 213 (See note on method 202)
203B	16 April 1973	Random drop
204D	1 April 1980	Vibration, high frequency
205E	Cancelled	Superseded by Method 213 (See note on method 205)
206	12 September 1963	Life (rotational)
207A	12 September 1963	High-impact shock
208H	31 January 1996	Solderability
209	18 May 1962	Radiographic inspection
* 210E	6 February 1998	Resistance to soldering heat
211A	14 April 1969	Terminal strength
212A	16 April 1973	Acceleration
213B	16 April 1973	Shock (specified pulse)
214A	28 March 1984	Random vibration
215J	12 July 1993	Resistance to solvents
216	Cancelled	Superseded by Method 210 (See note on method 216)
217	1 April 1980	Particle impact noise detection (PIND)
Electrical characteristics tests (300 class)		
301	6 February 1956	Dielectric withstanding voltage
302	6 February 1956	Insulation resistance
303	6 February 1956	DC resistance
304	24 October 1956	Resistance-temperature characteristic
305	24 October 1956	Capacitance
306	24 October 1956	Quality factor (Q)
307	24 October 1956	Contact resistance
308	29 November 1961	Current-noise test for fixed resistors
309	27 May 1965	Voltage coefficient of resistance determination procedure
310	20 January 1967	Contact-chatter monitoring
311	14 April 1969	Life, low level switching
312	16 April 1973	Intermediate current switching

Custodians:	Preparing activity:
Army - CR	DLA - CC
Navy - EC	
Air Force - 85	(Project ENVR-0002)

Review activities:
Army - AR, AT, AV, CR4, MI, SM, TE
Navy - AS, OS, SH
Air Force - 17, 19, 99
NSA - NS

MIL-STD-202F
NOTICE 14

METHOD 210E

RESISTANCE TO SOLDERING HEAT

1. PURPOSE. This test is performed to determine whether wire and other component parts can withstand the effects of the heat to which they will be subjected during the soldering process (solder iron, solder dip, solder wave, or solder reflow). The heat can be either conducted heat through the termination into the component part, or radiant heat from the solder bath when in close proximity to the body of the component part, or both. The solder dip method is used as a reasonably close simulation of the conditions encountered in wave soldering, in regard to radiated and conducted heat. This test also is intended to evaluate the impact of reflow techniques to which components may be exposed. The heat of soldering can cause solder reflow which may affect the electrical characteristics of the component part and may cause mechanical damage to the materials making up the part, such as loosening of terminations or windings, softening of insulation, opening of solder seals, and weakening of mechanical joints.

2. APPARATUS.

2.1 Solder pot. A static solder pot, of sufficient size to accommodate the mounting board (see 2.4) and to immerse the terminations to the depth specified for the solder dip (without touching the bottom of the pot), shall be used. This apparatus shall be capable of maintaining the solder at the temperature specified. The solder bath temperature shall be measured in the center of the pot at a depth of at least .500 inch (12.7 mm), but no deeper than 1 inch (25.4 mm) below the surface of the solder.

2.2 Heat sinks or shielding. The use of heat sinks or shielding is prohibited except when it is a part of the component. When applicable, heat sinks or shielding shall be specified in the individual specification, including all of the details, such as materials, dimensions, method of attachment, and location of the necessary protection.

2.3 Fixtures. Fixtures, when required, shall be made of a non-solderable material designed so that they will make minimum contact (i.e., minimum heat sink) with the component. Further, they shall not place undue stress on the component when fixtured.

2.4 Mounting board. A mounting board, in accordance with MIL-P-13949 (type GF unclad), 9 square inches (i.e., 3 x 3, 1 x 9, etc.) minimum area, .062 ±.0075 inch (1.57 ±.191 mm) thick, shall be used, unless otherwise specified. Component lead holes shall be drilled such that the diametrical clearance between the hole and component terminals shall not exceed .015 inch (0.38 mm). Metal eyelets or feed throughs shall not be used. Surface mount boards, when specified in the individual specification, shall have pads of sufficient size and number to accomodate the component being tested.

2.5 Solder iron. A solder iron, capable of maintaining a temperature of 350°C ±10°C, shall be used.

2.6 Reflow chambers. The reflow chambers or equivalent (Vapor Phase Reflow (VPR) chamber, Infrared Reflow (IRR) oven, air circulating oven, etc.) shall be of sufficient size to accomodate the mounting board and components to be tested. The chamber shall be capable of generating the specified heating rate, temperatures, and environments.

2.7 Temperature measurement. Low mass thermocouples that do not effect the heating rate of the sample shall be used. A temperature recording device is recommended. The equipment shall be capable of maintaining an accuracy of ±1°C at the temperature range of interest.

3. MATERIALS.

3.1 Solder. The solder or solder paste shall be tin-lead alloy with a nominal tin content of 50 percent to 70 percent per ANSI/J-STD-006, "Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications" or ANSI/J-STD-005, "Requirements for Soldering Pastes". When specified in the individual specification, other solders can be used provided they are molten at the specified temperature.

3.2 Flux. When flux is used it shall conform to type A of ANSI/J-STD-004, "Requirements for Soldering Fluxes", or as specified in the individual specification.

3.3 VPR fluid. A perfluorocarbon fluid that has a boiling point of 215° C shall be used.

4. PROCEDURE.

4.1 Special preparation of specimens. Any special preparation of specimens prior to testing shall be as specified in the individual specification. This could include specific instructions such as bending or any other relocation of terminations, cleaning, application of flux, pretinning, or attachment of heat sinks or protective shielding (see 2.2), prior to the solder immersion.

4.2 Preparation of solder bath. The molten solder shall be agitated to assure that the temperature is uniform. The surface of the solder shall be kept clean and bright.

4.3 Application of flux. When flux is used, the terminations to be tested shall be immersed in the flux (see 3.2), which is at room ambient temperature, to the depth specified for the solder dip. The duration of the immersion shall be from 5 seconds to 10 seconds.

4.4 Test conditions. Unless otherwise specified in the individual specification, the test shall be performed on all solder terminations attached to the component part. There are six types of soldering techniques covered by these test conditions. The test conditions are outlined below and in table I.

Test condition A: Solder iron - Hand soldering of solder cups, through hole components, tab and post terminations, solder eyelet terminations.

Test condition B: Solder dip - Simulates hot solder dipping (tinning) of leaded components.

Test condition C: Wave solder - Simulates wave solder of topside board mount product.

Test condition D: Wave solder - Simulates wave solder of bottomside board mount product.

Test condition H: VPR - VPR environment without preheat.

Test conditions I, J, K: Infrared/Convection reflow - Simulates IRR, natural convection, and forced air convection reflow environments.

4.4.1 Test condition A: Solder iron.

a. When testing a solder cup, tab and post termination, or solder eyelet termination, the applicable wire size, properly prepared for the solder termination, shall be attached in the appropriate manner.

When testing a board mount component, the component shall be placed on a mounting board (see 2.4).

b. When specified, the components shall be fluxed (see 4.3).

c. Unless otherwise specified, a solder iron in accordance with 2.5 shall be used.

d. The solder iron shall be heated to 350°C ±10°C and applied to the termination for a duration of 4 seconds to 5 seconds as specified in table I. The solder and iron shall be applied to the area of the assembly closest to the component body that the product is likely to experience. For surface mount components, the iron shall be placed on the pad only.

e. Remove the iron and allow the component to cool and stabilize at room ambient conditions. If flux was used, the component shall be cleaned using an appropriate cleaning solution.

f. The component shall be visually examined under 10X magnification.

4.4.2 <u>Test condition B: Solder dip</u>.

a. Place the component in an appropriate fixture (see 2.3).

b. When specified, the leads shall be fluxed (see 4.3).

c. The specific combination of temperature, immersion and emersion rate, immersion duration, and number of heats shall be as specified in table I. Unless otherwise specified, terminations shall be immersed to within .050 inch (1.27 mm) of the component body. Terminations shall be immersed simultaneously, if the geometry of the component permits.

d. After the solder dip, the component shall be allowed to cool and stabilize at room ambient conditions. If flux was used, the component shall be cleaned using an appropriate cleaning solution.

e. The component shall be visually examined under 10X magnification.

4.4.3 <u>Test condition C: Wave solder - topside board mount component</u>.

a. The component under test shall be mounted on a mounting board (see 2.4).

Wire leads: Wire leads shall be brought through the board holes and bent at least 30 degrees from a line perpendicular to the board. Leads shall extend from .050 inch to .100 inch (1.27 mm to 2.54 mm) from the bottom of the board. Axial leads shall be bent at a 90 degree angle at a point between .06 inch and .08 inch (1.5 mm and 2.1 mm) from the body, eyelet fillet or weld unless otherwise specified (see figure 210-1).

Pin leads: Where the component is designed with rigid pin leads, the full length of the termination shall be retained. Pin leads shall not be cut or bent (see figure 210-1).

b. When specified, the leads shall be fluxed (see 4.3).

c. The specific combination of temperature, duration, and number of heats shall be as specified in table I.

d. The components, mounted on the board, shall be immersed in the solder pot so that the bottom of the board floats on the molten solder.

e. After the float, the components shall be allowed to cool and stabilize at room ambient conditions. If flux was used, the components shall be cleaned using an appropriate cleaning solution.

f. The components shall be visually examined under 10X magnification.

4.4.4 <u>Test condition D: Wave solder - bottomside board mount product</u>.

a. Place the component in an appropriate fixture (see 2.3).

b. When specified, the terminations shall be fluxed (see 4.3).

c. The specific combination of temperature, preheat conditions, immersion and emersion rates, immersion duration, and number of heats shall be as specified in table I.

d. The component shall be preheated and fully immersed in the solder bath in accordance with 4.4.4c.

e. After the immersion, the component shall be allowed to cool and stabilize at room ambient conditions. If flux was used, the component shall be cleaned using an appropriate cleaning solution.

f. The component shall be visually examined under 10X magnification.

4.4.5 Test condition H: Vapor phase reflow soldering.

a. Components shall be mounted on a mounting board (see 2.4). Through-hole mounted components shall have their terminals inserted into the termination holes. Surface mount components shall be placed on top of the board.

b. A test chamber (see 2.6) shall be used which is large enough to suspend the mounting board without touching the sides or the solution. The VPR fluid shall be placed in the test chamber and shall be heated until it is boiling. The solution shall be allowed to boil for 5 minutes prior to suspending the mounting board.

c. The specific combination of temperature, duration of exposure, and number of heats shall be as specified in table I.

d. After chamber equalization, the mounting board shall be suspended into the vapor in a horizontal plane. The mounting board shall not touch the solution.

e. After the heat, the components shall be allowed to cool and stabilize at room ambient conditions. If a solder paste was used, the component shall be cleaned using an appropriate solution.

f. The components shall be visually examined under 10X magnification.

4.4.6 Test conditions I, J, K: Infrared/convection reflow soldering.

a. Components shall be mounted on a mounting board (see 2.4). Through-hole mounted components shall have their terminals inserted into the termination holes. Surface mount components shall be placed on top of the board.

b. A test chamber as specified in 2.6 shall be used.

c. A low mass thermocouple shall be attached tightly to the component at an appropriate position away from the edges.

d. The specific combination of temperature, preheat, duration, and number of heats shall be as specified by test condition I, J, or K in table I and the individual procurement document.

e. The board shall be placed into the test chamber and the temperature of the component ramped at a rate of 1°C/s to 4°C/s as measured by the thermocouple. The assembly shall be above 183°C for 90 seconds to 120 seconds and held at the final temperature and time designated by the test condition. The assembly shall then be allowed to cool to room ambient temperature. This constitutes one heat cycle. The assembly shall be exposed to three heat cycles.

f. After the final heat, components shall be allowed to cool and stabilize at room ambient conditions. If a solder paste or flux was used, the components shall be cleaned using an appropriate cleaning solution.

g. The components shall be visually examined under 10X magnification.

5. EXAMINATIONS AND MEASUREMENTS. Examinations and measurements to be made before and after the test, as applicable, shall be as specified in the individual specification. After the procedure, the specimens shall be allowed to cool and stabilize at room ambient conditions, for the time specified in the individual specification.

5.1 Internal examination. When specified, internal examination of the part shall be made after the test to check for solder reflow or heat damage.

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

a. The use of heat sinks or shielding is prohibited except when they are part of the component (see 2.2).

b. Solder terminations that are not to be tested, if applicable (see 4.4).

c. Special preparation of specimens if applicable (see 4.1).

d. Immersion of terminations in flux, if applicable (see 4.1 and 4.3).

e. Depth of immersion in the molten solder, if applicable (see 4.4.2).

f. Test condition letter (see 4.4).

g. Cooling time prior to final examinations and measurements (see 4.4 and 5).

h. Examinations and measurements before and after test, as applicable (see 5).

i. Method of internal inspection, if required (see 5.1).

TABLE I. Test conditions.

Solder technique simulation	Test condition	Temperature (°C)	Time (s)	Temperature ramp/ immersion and emersion rate	Number of heat cycles
Solder iron	A	350 ± 10 (solder iron temp)	4 - 5		1
Dip	B	260 ± 5 (solder temp)	10 ± 1	25 ± 6 mm/s	1
* Wave: Topside	C	260 ± 5 (solder temp)	20 ± 1		1
* Wave: Bottomside	D	260 ± 5 (solder temp)	10 ± 1	Preheat 1°C/s-4°C/s to within 100°C of solder temp. 25 mm/s ± 6 mm/s	1
	E	CANCELLED			
	F	CANCELLED			
	G	CANCELLED			
Vapor phase reflow	H	215 ± 5 (vapor temp)	60 ± 5		1
IR/convection reflow	I	215 ± 5 (component temp)	30 ± 5	1°C/s-4°C/s; time above 183°C, 90 s - 120 s	3
	J	235 ± 5 (component temp)	30 ± 5	1°C/s-4°C/s; time above 183°C, 90 s - 120 s	3
	K	250 ± 5 (component temp)	30 ± 5	1°C/s-4°C/s; time above 183°C, 90 s -120 s	3

* Test condition E is cancelled; use test condition C.
Test condition F is cancelled; use test condition B.
Test condition G is cancelled.

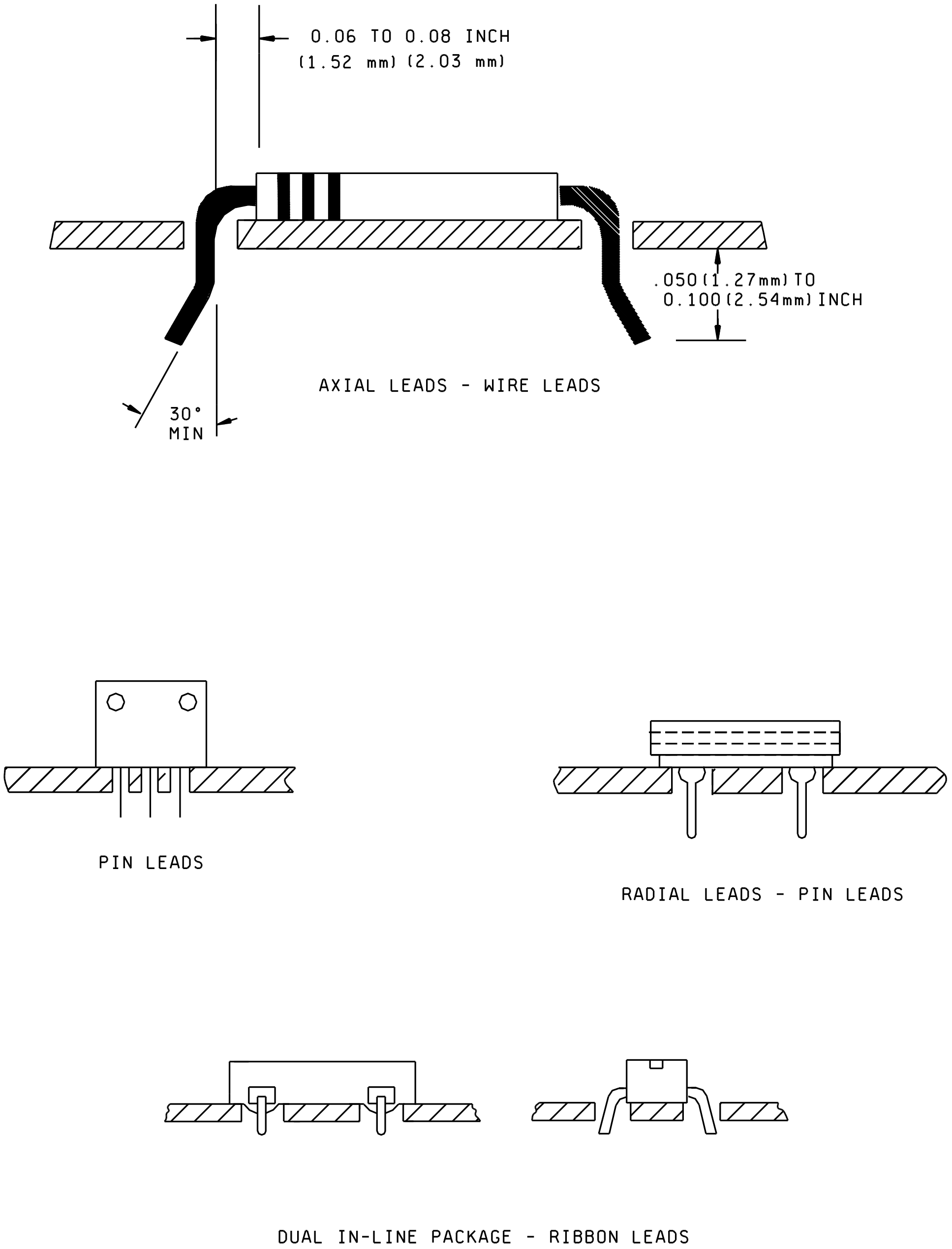

FIGURE 210-1. Component lead and mounting examples.