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EIA STANDARD

TP-41E

CABLE FLEXING TEST PROCEDURE FOR ELECTRICAL CONNECTORS

EIA-364-41E

(Draft Revision of EIA-364-41D)

4 March 2008



Electronic Component, Assemblies & Materials Association

ELECTRONIC COMPONENT, ASSEMBLIES & MATERIALS
ASSOCIATION

THE ELECTRONIC COMPONENT SECTOR OF THE ELECTRONIC INDUSTRIES ALLIANCE



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TEST PROCEDURE No. 41D

CABLE FLEXING TEST PROCEDURE
FOR
ELECTRICAL CONNECTORS

(From EIA Standards Proposal No. XXXX, formulated under the cognizance EIA CE-2.0 Committee on National Connector Standards, and previously published in EIA-364-41D.)

1 Introduction

1.1 Scope

This standard establishes a method to determine the effectiveness of circular jacketed cable to plug seal, or flat cable to plug seal or interface to withstand strain under repeated alternating cable-flexing stresses as experienced in use with cable strain-relief design electrical connectors.

[Scope needs to be revised.](#)

1.2 Potential failure modes

1.2.1 Damage to the cable to plug seal (including molded boots and strain reliefs) or cable jacket that could allow undesired substances (air, water, etc.) to enter, and to further deteriorate the seal or jacket, ultimately impairing the effectiveness of either or both.

1.2.2 Weakening or destruction of conductor to contact joint(s) resulting in improper or defective electrical performance.

1.2.3 Intermittent or complete shorting between conductors during and after test.

1.2.4 Evidence of discontinuity between conductors during and after test.

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2 Test resources

2.1 Equipment

2.1.1 Test condition I, circular jacket cable

2.1.1.1 Apparatus cable of applying forces to a molded plug assembly, so as to cause such assembly to be flexed in a plane, through 180° arc, alternately from a position 90° from the vertical on one side to a position 90° from the vertical on the other side, at an adjustable frequency of 12 to 14 complete cycles (of 360° total traverse) per minute; see figure 1, unless otherwise specified in the referencing document.

2.1.1.2 Roller (or rolls): Two smooth, cylindrical, equal-diameter steel, fixed position. Diameter of the rollers shall be approximately but not less than 2-1/2 times the maximum diameter of the cable for diameters less than 20 mm (0.8 in) or as specified in the referencing document.

2.1.1.3 Equipment for checking the electrical continuity of the conductor-to-contact joints, prior to, during, and subsequent to testing.

2.1.1.4 Equipment, such as magnifiers (approximately 3X) for examining cable-to-plug seal or cable jacket prior to and subsequent to testing.

2.1.2 Test condition II, flat cable

2.1.2.1 A fixture capable of gripping the cable 305 mm (12 in) from the connector with uniform tension of 350 N/m ± 20 N/m (2.0 lb/in ± 0.1 lb/in) of cable width and capable of moving either the cable or connector through an arc of 140° ± 10°; see figure 2, method 2, unless otherwise specified in the referencing document.

2.1.2.2 Equipment capable of monitoring current of 100 milliamperes and to indicate a discontinuity of 1 microsecond or longer interruption of current flow.

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3 Test specimen

3.1 Description

The test specimen shall consist of a cable terminated to a plug or receptacle.

3.2 Preparation

3.2.1 Test condition I, circular jacket cable

The test specimen shall be mounted as show in figure 1 with the following conditions:

3.2.1.1 Its cable is loosely but almost tangentially situated between the two rollers that are spaced farther apart than the maximum diameter of the cable, see 2.1.1.2.

3.2.1.2 The bonded joint at the junction of the molded boot and the cable jacket shall be located approximately at 45° above the center line through the two rolls as shown in figure 1, in the case in that there is no cable clamp within the molded boot. If the molded boot contains a cable clamp, the dimension X (see figure 1) in the referencing document shall be used to determine the position of the bonded joint (at the junction of the molded boot and the cable jacket). This is necessary to prevent damage to the internal clamp during flexing over the rollers.

Paragraph 3.2.1.2 is incomplete at best and totally confusing at worst. A better definition is required to establish where dimension X is established so that the position of the rollers can be specifically located.

Reason: Dimension X as currently indicated is "floating" with no visible indication of the locations of the datum plane. Needs clarification.

Need to discuss at the meeting. If the is a weight at end of cable why is it fixed. Max currently hangs a 1pound weight as has recommendation. This allows the rear of the connector housing to rest on the rollers. Performing the test as illustrated fails every connector especially with small size conductors (24 – 32 AWG). On very small size wires the roller diameter could be less that 1/16 inch. Specific roller diameters need to be developed.

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3.2.1.3 The non-free section of the cable shall be clamped by a fixed cable holding fixture capable of applying uniform radial pressure to the cable core, so that slippage is minimized. Care should also be exercised that clamping pressure is not excessive.

Unacceptable statement. Using the holding fixture to apply pressure to the cable core, will or can, cause failure contingent on conductor size, particularly on small stranded conductors. Testing in this manner can cause excessive stress to be applied. Also, what is the purpose of the weight at the free end of the conductor if the holding fixture prevents movement? The holding fixture should allow movement of the cable up and down to avoid premature failures.

A default of a 1.0 lb. weight should also be established to take the slack off of the cable.

3.2.2 Test condition II, flat cable

The test specimen shall be mounted as shown in figure 2.

3.2.2.1 The assembled wired connector shall be installed in the fixture described in 2.1.2.1.

3.2.2.2 Connector mounting and cable tension fixture shall be clamped so slippage is minimal.. Care shall be taken that applied clamping pressure is not so great as to damage connector or cable.

4 Test procedure

4.1 Test condition I, circular jacket cable

NOTE — For cross reference to previous MIL-STD-1344 designations see Annex A.

4.1.1 Check the electrical continuity of the conductor to contact joints.

4.1.2 With the test specimen mounted as in 3.2.1 and figure 1, forces are applied so as to cause the molded boot to be repeatedly flexed 180° in opposite directions in the plane, over the rollers. A traverse of 180° in one direction plus 180° in the opposite direction shall be called one cycle. Unless otherwise specified, the cycling rate shall be 12 to 14 cycles per minute.

4.1.3 Unless otherwise specified in the referencing document, at the completion of 100 cycles, examination of seal, jacket and cable holding fixture shall be made to determine the presence or absence of failure modes; see 1.2.1. Electrical continuity shall then be checked to determine presence or absence of failure mode; see 1.2.2 through 1.2.4.

For non circular connectors there are some requirements to rotate the connector 90 degrees at the half way point. Need to discuss.

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4.1.4 The cable holding fixture shall then be sufficiently loosened to allow rotation of the cable 90°, and retightened as in 3.2.1.3. Repeat the procedures of 4.1.2 and 4.1.3.

4.2 Test condition II, flat cable

NOTE — For cross reference to previous MIL-STD-1344 designations see Annex A.

4.2.1 With test specimen mounted as in 3.3.2 each cable shall be individually loaded with specified weight.

4.2.2 The cable or the connector shall be moved through an arc of $140^\circ \pm 10^\circ$ for 500 cycles using either method 1 or 2 of figure 2.

4.2.3 One complete cycle shall consist of the rotation of the cable or connector from the neutral position to $70^\circ \pm 5^\circ$ in both directions. Unless otherwise specified, the cycling rate shall be 10 ± 1 cycles per minute.

4.2.4 A monitoring current of 100 milliamperes maximum shall be applied through the conductor of the test cables and the contacts of the connector in series. Either a dummy plug or receptacle or the actual test counterpart connector may be mated to the connector under test to facilitate making the series circuit.

4.3 Final measurement

4.3.1 Visual

The specimens shall be visually inspected for the failure modes indicated in 1.2.

4.3.2 Electrical

Electrical continuity, insulation resistance and dielectric withstanding voltage shall be measured.

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5 Details to be specified

The following details shall be specified in the referencing document:

- 5.1 Dimension “X” in figure 1
- 5.2 Roller diameter for cables larger than 20 mm (0.8 in)
- 5.3 Test procedure, condition and method, as applicable
- 5.4 Total cycles, if other than specified herein
- 5.5 Cable to be used
- 5.6 Dielectric withstanding voltage
- 5.7 Insulation resistance
- 5.8 Allowable electrical discontinuity
- 5.9 Cycling rate, if other than specified herein
- 5.10 Special environmental conditions
- 5.11 Cable to be used
- 5.12 Magnitude and nature of test voltage, if other than specified in table 1

Table 1 - Test voltage at sea level

Contact center spacing	Voltage at 60 cycles rms
1.27 mm (0.050 in)	800
1.90 mm (0.075 in)	1,500
2.54 mm (0.100 in)	2,000

The “Details to be specified should be reviewed to remove redundant and conflicting statements relative to the procedure statements included in Paragraph 4.

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6 Test documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

- 6.1 Title of test
- 6.2 Specimen description including fixturing
- 6.3 Test equipment used, and date of last and next calibration
- 6.4 Test procedure
- 6.5 Values and observations
 - 6.5.1 Test conditions and environments
 - 6.5.2 Electrical continuity checks
- 6.6 Name of operator and start/finish date(s) of test

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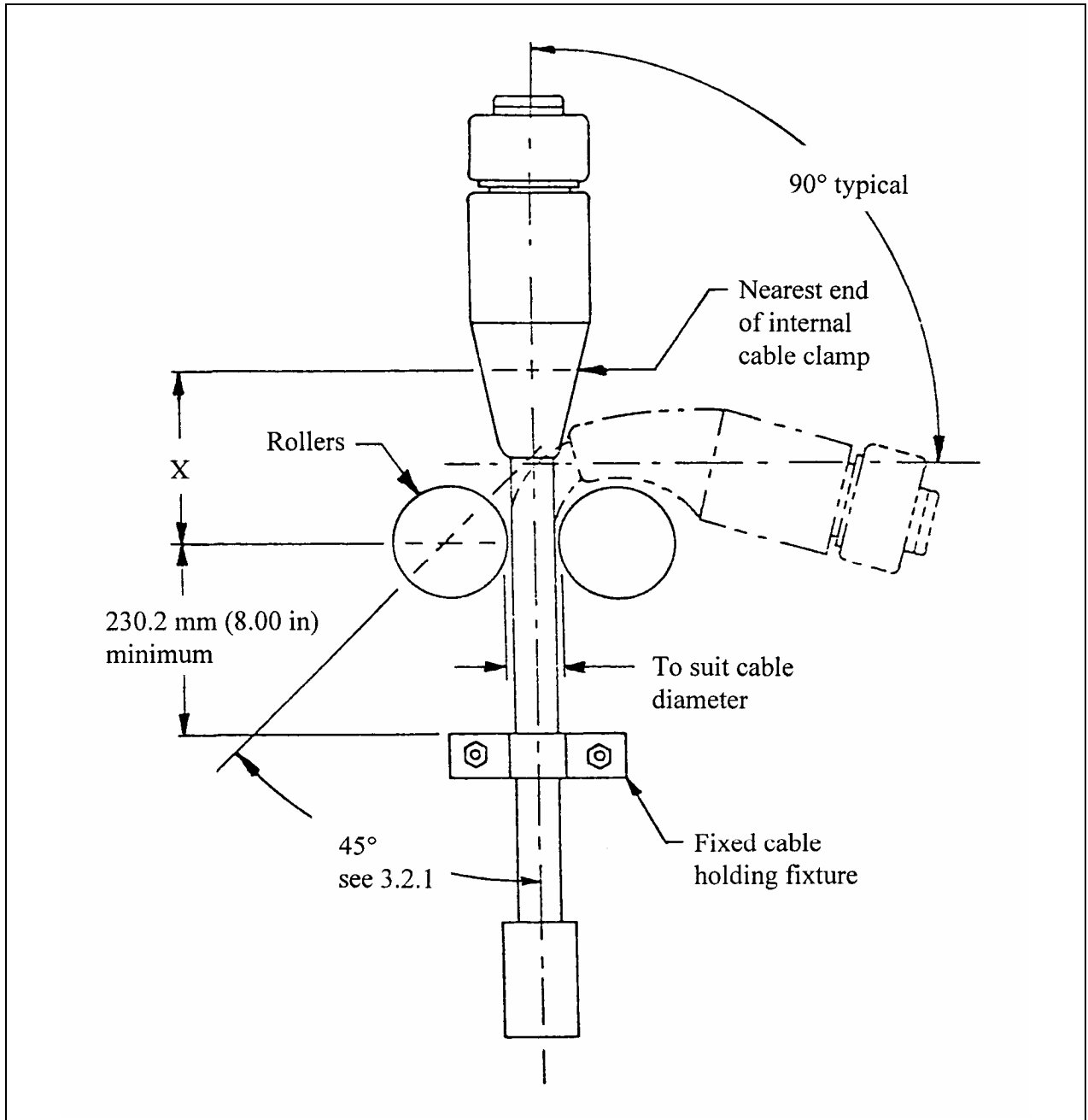


Figure 1 - Circular cable flexing test setup

Change figure 1 accordingly if other comments are accepted.

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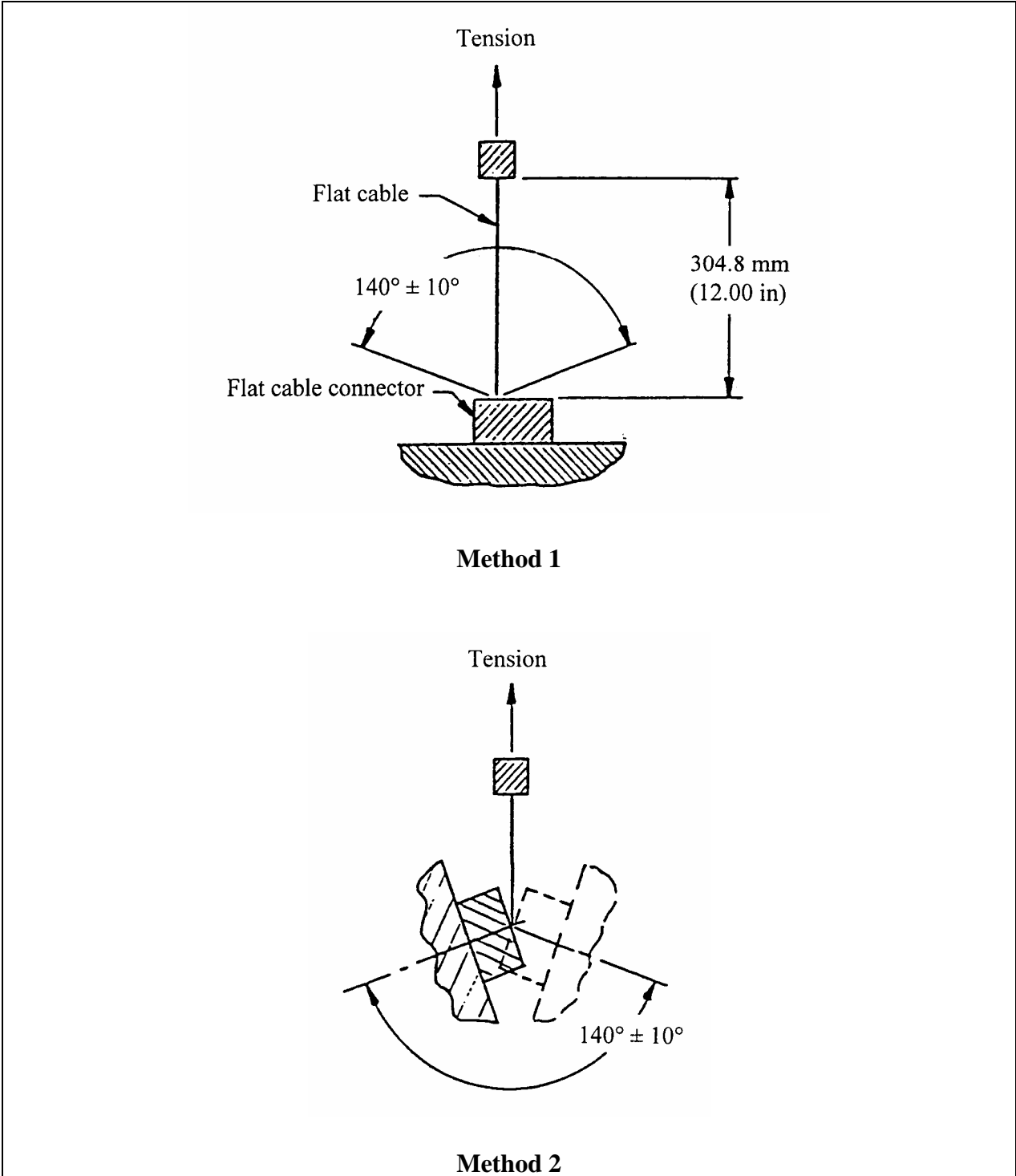


Figure 2 - Flat cable flexing methods

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Annex

A Previous MIL-STD-1344 designations (Informative)

This informative annex is provided as a cross reference to the designations previously contained in MIL-STD-1344, method 2017.

Table A.1 – Test condition designation

EIA-364-41 designations	MIL-STD-1344, method 2017 designations
Condition I	Procedure I
Condition II	Procedure II

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EIA Document Improvement Proposal

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Revision History

Revision letter	Project number	Additions, changes and deletions
D	SP-5170	Added note under paragraph 4.1 and 4.2, and add Annex A
E	SP-XXXX	