



## FLEXSTRIP\* Jumpers

### 1. SCOPE

#### 1.1. Content

This specification defines the performance, tests and quality requirements for TE Connectivity FLEXSTRIP Jumpers in 10 position configurations with 12 and 34 inch lengths of Kapton, PTFE, Polyester and Nomex insulation. Additionally, several other lengths of these 4 materials were tested for an enhanced solderability and temperature rating as published in test report 502-13464.

#### 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

#### 1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 11Oct04. The Qualification Test Report number for this testing is 501-590. Additional successful qualification testing to establish higher solderability temperature/time ratings was completed on 10Feb2017, results are reported in Test Report number 502-13464. This documentation is on file at and available from Engineering Practices and Standards (EPS).

### 2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

#### 2.1. TE Connectivity Documents

- 109-197: Test Specification (AMP Test Specifications vs EIA and IEC Test Methods)
- 501-590: Qualification Test Report (FLEXSTRIP Jumpers)
- 502-13464 Test Report Flexstrip, solderability and temperature update

#### 2.2. Commercial Standards

- EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- IEC-60068-2-14: Basic Environmental Testing Procedures Part 2: Tests Test N: Change of Temperature
- IEC-60512: Electromechanical Components for Electronic Equipment; Basic Testing Procedures and Measuring Methods Part 1: General
- IEC-60749-21: Semiconductor Devices - Mechanical and Climatic Test Methods - Part 21: Solderability

### 3. REQUIREMENTS

#### 3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

#### 3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

#### 3.3. Ratings

- Voltage: See Figure 3
- Current: See Figure 4

#### 3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per IEC 60512.

## 3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Initial examination of product.	Meets requirements of product drawing.	IEC 60512-1-1. Visual and dimensional (C of C) inspection per product drawing.
Final examination of product.	Meets visual requirements.	IEC 60512-1-1. Visual inspection.
<b>ELECTRICAL</b>		
Current rating.	Temperature rise shall not exceed 30°C with specified current applied.	IEC 60512-5-3. Apply specified current to conductors connected in series until thermal stabilization occurs and record maximum temperature rise. See Figure 4.
Dielectric withstanding voltage.	1 minute hold with no breakdown or flashover. 1 milliampere maximum leakage current.	IEC 60512-4-1, Method B. Apply specified voltage between odd and even conductors, then between all conductors and aluminum foil wrapped around the jumper with the edges of the foil ¼ inch from the edge of the insulation. See Figure 5.
Dry heat.	See Note.	Precondition specimens at 136°C for 7 days.
Insulation resistance.	> 1.0 X 10 <sup>9</sup> ohms for Polyester, Kapton and PTFE wire. > 1.0 X 10 <sup>8</sup> ohms for Nomex wire.	IEC 60512-3-1, Method B. Apply 500 volts for 1 minute. Odd and even conductors shall be bussed separately.
Capacitance.	Measured values shall be within ± 10% of table values. See Figure 6.	IEC 60512-9, Test 22a. Measure capacitance of foot long specimens bussed in a ground-signal-ground configuration at 1 MHz.
Characteristic impedance.	Measured values shall be within ± 10% of table values. See Figure 7.	EIA-364-108. Measure characteristic impedance of specimens bussed in a ground-signal-ground configuration using Time Domain Reflectometry.
<b>MECHANICAL</b>		
Cold bend.	See Note.	Flex specimens into a “U” shaped bend around a ⅛ inch diameter mandrel and tape into place. Then subject specimens to -20°C for 1 hour.

Figure 1 (continued)

Flexibility.	See Note.	<p>Step One: Both ends of the specimens shall be soldered to circuit boards with conductors connected in series to a continuity tester. Flex specimens with a minimum cycle time of 20 seconds for 75 cycles. See Figure 8.</p> <p>Step Two: One end of the specimens shall be soldered to circuit boards. Apply specified load and rotate specimens through 50 cycles of 1-2-1-3-1. See Figure 9.</p>
Long term flex.	See Note.	Connect conductors in series to a continuity tester. Flex specimens 180 degrees until first specimen fails continuity test. Stop test when greater than 1000 cycles have been performed on remaining specimens. See Figure 10.
Fold.	See Note.	Fold specimens 180 degrees transversely and apply $30 \pm 1$ psi for $15 \pm 1$ minutes. Unfold the specimens and apply $30 \pm 1$ psi for $15 \pm 1$ minutes.
Flammability.	Maximum burn rate of 1 inch per minute.	Clamp specimens with the width vertical and the bottom edge horizontal. Using a Bunsen burner mounted on a 20-degree block, apply flame to the middle of the bottom edge of the specimen for approximately 5 seconds until the specimen ignites and then remove the flame. Measure the time from the flame removal until the specimen stops burning and the distance which is burnt through. Calculate the burn rate for each specimen.
Solderability.	Solderable area shall have minimum of 95% solder coverage. See Note.	IEC 60749-21. Immerse specimens in molten lead-free solder at a temperature of $245 \pm 5^\circ\text{C}$ to a depth of 2 to 2.5 mm for $5 \pm 0.5$ seconds.
Resistance to soldering heat.	See Note.	<p>Subject specimens (except polyester) to molten solder at <math>245 \pm 5^\circ\text{C}</math> to a depth of 2 to 2.5 mm for 10 seconds.</p> <p>Subject polyester specimens to molten solder at <math>245 \pm 5^\circ\text{C}</math> to a depth of 2 to 2.5 mm for 2 seconds.</p>

Figure 1 (continued)

## ENVIRONMENTAL

Thermal shock.	See Note.	IEC 60068-2-14. Subject specimens to 5 cycles between -65 and 125°C, with 30-minute dwell at temperature extremes.
Damp heat, steady state.	Final insulation resistance and dielectric withstanding voltage readings shall be taken a minimum of 48 hours after exposure. See Note.	IEC 60512-6-11. Subject specimens to 40 ± 2°C and 90 to 95% RH for 96 hours.
Solvent resistance.	See Note.	EIA-364-11. Subject specimens to solvent resistance. See Figure 11.

**NOTE**

*Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.*

Figure 1 (end)

## 3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)									
	1	2	3	4	5	6	7	8	9	10
Test Sequence (b)										
Initial examination of product	1	1	1	1	1	1	1	1	1	1
Current rating				2						
Dielectric withstanding voltage	3,8	3,7			4		3,6	3,6	3,6	
Dry heat								4		
Insulation resistance	2,7	2,6			3		2,5	2,5	2,5	
Capacitance			2							
Characteristic impedance			3							
Cold bend	4									
Flexibility					2					
Long term flex						2				
Fold							4			
Flammability										2
Solderability		4								
Resistance to soldering heat		5								
Thermal shock	5									
Damp heat, steady state	6									
Solvent resistance									4	
Final examination of product	9	8	4	3	5	3	7	7	7	3

**NOTE**

- (a) See paragraph 4.1.A.  
 (b) Numbers indicate sequence in which tests are performed.

Figure 2

**4. QUALITY ASSURANCE PROVISIONS**

## 4.1. Qualification Testing

## A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Each test group shall consist of 4 specimens.

## B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

## 4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

## 4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

#### 4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

	Pitch (inch)						Pitch (millimeter)		
	.050	.075	.100	.125	.150	.200	1.00	1.25	2.00
Volts AC	200	200	300	300	300	300	100	200	200

Figure 3  
Voltage Rating

	Pitch (inch)						Pitch (millimeter)		
	.050	.075	.100	.125	.150	.200	1.00	1.25	2.00
Amperes	1.6	2	3	3.5	3.5	4	1	1.6	2

Figure 4  
Current Rating

	Pitch (inch)						Pitch (millimeter)		
	.050	.075	.100	.125	.150	.200	1.00	1.25	2.00
Volts AC	1050	1250	1500	1500	1500	1500	500	1050	1250

Figure 5  
Dielectric Withstanding Voltage

Insulation Type	Pitch (inch)						Pitch (millimeter)		
	.050	.075	.100	.125	.150	.200	1.00	1.25	2.00
Polyester	16.5	12.2	11.1	9.2	8.0	6.8	20.4	16.2	11.6
Nomex	16.4	12.1	11.2	9.0	7.9	6.7	23.7	16.7	11.6
PTFE	16.0	12.7	11.4	9.5	8.4	7.1	19.8	16.8	11.6
Kapton	14.9	11.1	10.4	8.8	7.8	6.6	18.5	15.4	10.6

**NOTE**

*All values in picofarads.*

Figure 6  
Capacitance

Insulation Type	Pitch (inch)						Pitch (millimeter)		
	.050	.075	.100	.125	.150	.200	1.00	1.25	2.00
Polyester	98	109	115	138	152	174	89	98	118
Nomex	97	115	117	143	152	176	78	91	116
PTFE	101	113	114	135	149	176	87	95	118
Kapton	100	118	119	140	154	177	83	99	123

**NOTE** All values in ohms.

Figure 7  
Characteristic Impedance

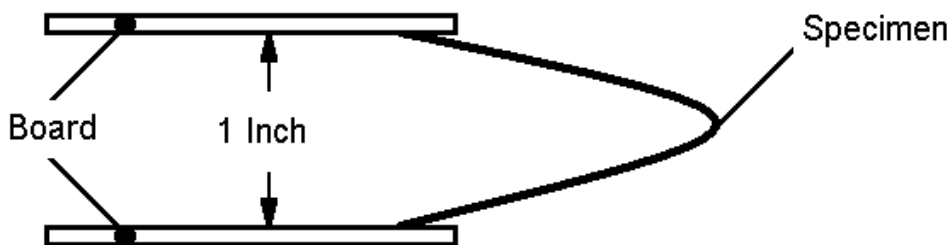


Figure 8A  
Step 1 Flexibility, Minimum Extension



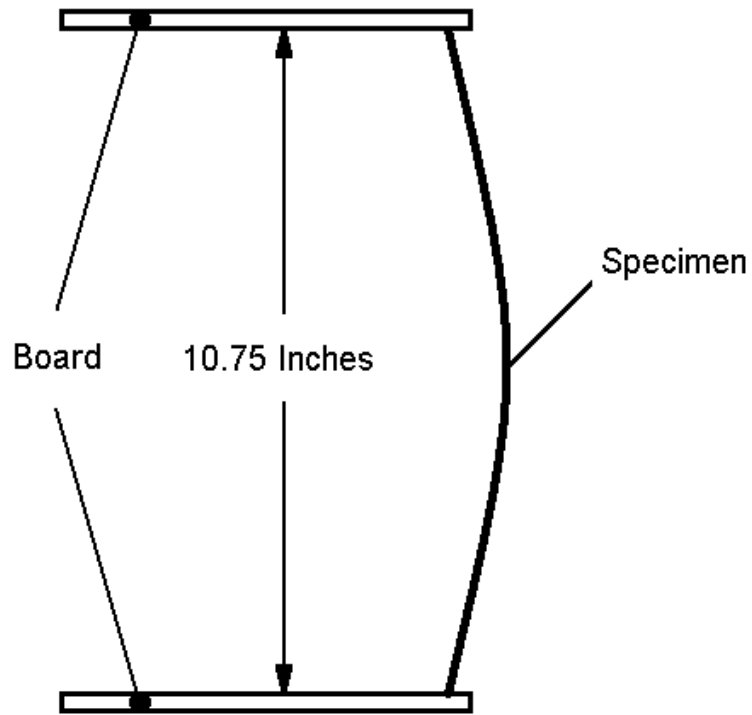
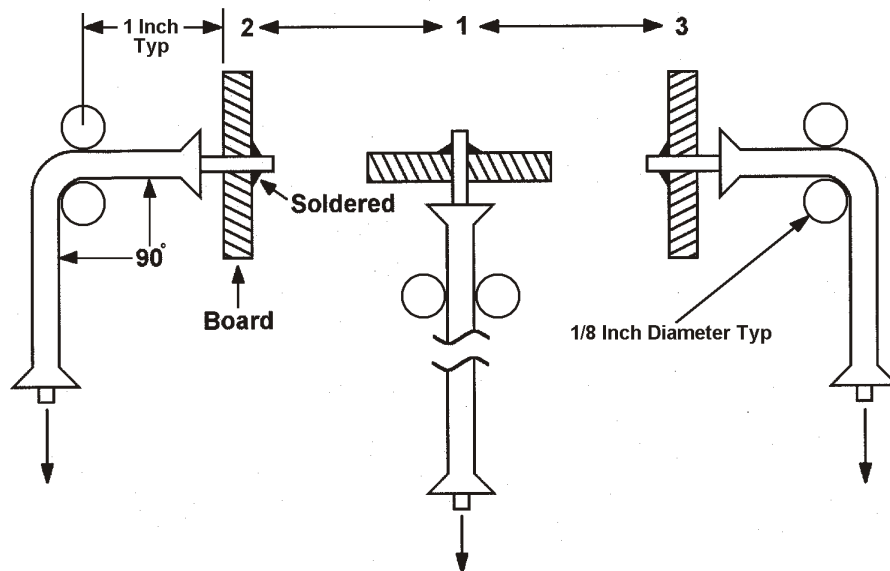


Figure 8B

Step 1 Flexibility, Maximum Extension



Conductor Diameter (mm [in])	Wire Size (AWG)	Load (grams/conductor)
0.32 [.0126]	28	5
0.40 [.0157]	26	15
0.50 [.0197]	24	50

Figure 9  
Step 2 Flexibility Test Fixtures

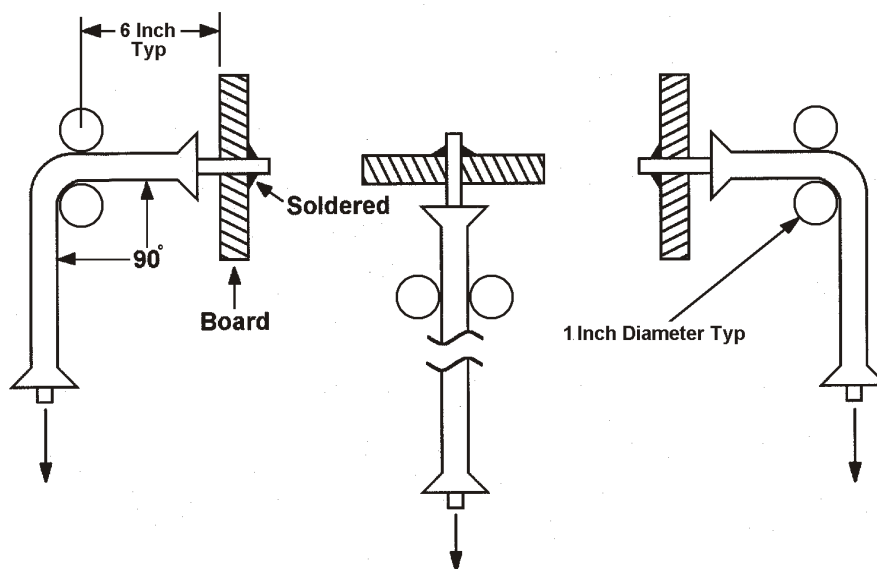


Figure 10  
Long Term Flex

Solvent	Description	Chemical Class	Temperature (°C)	Time (Minutes)
A	Ionox fc	Alcohol based	65.6	5
B	Axarel 32	Aliphatic Hydrocarbon with DBE	60.0	10
C	Bioact EC-15	Ester plus glycol	71.1	10
D	Synergy CCS	Terpene and alcohol	25.0	10

Figure 11  
Solvent Resistance