AMP-TWIST Series Jacks for Class E_A systems

1. INTRODUCTION

1.1 Purpose

Qualification testing on AMP-TWIST* Series Jacks for Class E_A Systems, to determine its conformance to the requirements of TE Connectivity Product Specification 108-93044, Rev. D.

1.2 Scope

This report covers the mechanical, electrical, environmental and transmission performance of the AMP-TWIST Series Jacks for Class E_A Systems manufactured by TE Connectivity (PN's 1711160-x, 1711342-x, 1711919-2, 1711895-2, 1711295-2, 1711343-2, 2153000-1 and 2153001-1).

The testing was performed between December 21st, 2012 and May 31st, 2013.
Additional testing was performed over PN 2153000-1, during June 2014.

1.3 Conclusion

Tested AMP-TWIST Series Jacks for Class E_A Systems meet the mechanical, electrical, environmental and transmission performance requirements of TE Connectivity Product Specification 108-93044, Rev. D.

1.4 Product Description

The AMP-TWIST Series Jacks for Class E_A Systems are used to provide a universal connection interface between premise wiring of an office and the user's network of communications equipment for data and voice networking systems.

1.5 Test Samples

Tested samples were randomly selected from pre-production and normal current production lots.
Following part numbers (PN) and wire sizes were used as representative AMP-TWIST Series Jacks for Class E_A Systems for tests:

Test Group	Qty	PN	Wire size (AWG)
1	10	1711160-1	23 (solid), 24 (solid)
2	10		
3	10		
4	10		
5	36 + 36	1711342-2 / 2153000-1	
6	10	1711160-1	
7	7		
8	3		NA

Test Group sequence on next page.

1.6 Qualification Test Sequence

	Test Group							
	1 AP	2 BP	3 CP	4 DP	5 EP	6FP	7GP	8
	Test Sequence *(Numbers indicates sequence in which tests are performed)*							
Examination of product	1,14,21	1,15	1,10	1,9	1,12	1,8	1,6	1
ELECTRICAL								
Contact resistance	2,11,16	2,8,11	2,7	2,10		2	2,7	
Shield Contact resistance	3,12,17	3,9,12	3,8	3,11		3	3,8	
Insulation resistance	4,10	4,13	4,9	4,7		4,7		
Voltage proof	5,13	5,14	5	5,8		5		
Current carrying capacity								2
Surge test						6		
Gauging Continuity				13				
MECHANICAL								
Vibration, Jack-plug interface and IDC-wire interface			6					
Durability, Jack-plug interface		6,10						
Plug insertion force, Jack-plug interface	6,18							
Plug withdrawal force, Jack-plug interface	7,19							
Plug retention in jack, Jack-plug interface	8,20							
Mechanical Gauging				12				
Panel Housing retention								3
ENVIRONMENTAL								
Thermal shock cycling	9							
Humidity-temperature cycling	15						5	
Stress relaxation, (dry heat)				6			4	
Flowing mixed gas corrosion, jack-plug interface		7						
TRANSMISSION (Class E_A Permanent Link test)								
NEXT					2			
PS NEXT					3			
Insertion Loss					4			
Return Loss					5			
ACR-N					6			
PS ACR-N					7			
ACR-F					8			
PS ACR-F					9			
Propagation Delay					10			
Delay Skew					11			
Transfer Impedance							9	
Coupling Attenuation							10	

1.7 Measurement Equipment Used

Lab. Code	Equipment
E1-053	Micro-ohmmeter
C0-041	Temperature Measurer
E1-028	Megaohmmeter
E2-057	Dielectric Strength machine
E0-257 / E0-273	Hand Held Tester Fluke DTX-1800
E1-007	Frequencimeter
E2-039	Digital Osciloscope
F0-014	Tensile strength machine
C1-015	Oven
C1-044	Climatic chamber
C1-011	Climatic chamber
C1-015	Oven
92-320-019-A	Flowing Mixed gas Corrosion Chamber
E0-058	HP8753D Vector network analyzer
E0-054	HP8751A Vector network analyzer
E0-259 / E0-261	Agilent E5071C ENA Vector network analyzer

Tests have been performed at standard conditions: T: 21ºC ± 3ºC / HR: 50% ± 10% with the exceptions detailed in the test descriptions.

Traceability of the calibration due date of each equipment is according to the standard documentation and it is saved in our calibration files.

2. SUMMARY OF TESTING

2.1 Examination of product – All groups

All samples submitted for testing were selected from production with definitive tooling and normal current production batch. They were inspected and accepted by the Quality Assurance Department.

2.2 Contact and Shield contact resistance – Groups 1, 2, 3, 4, 6 and 7

Contact and shield contact resistance measured values were less than 6 mΩ. (Specified: 20 mΩ max.)

2.3 Insulation resistance – Groups 1, 2, 3, 4 and 6

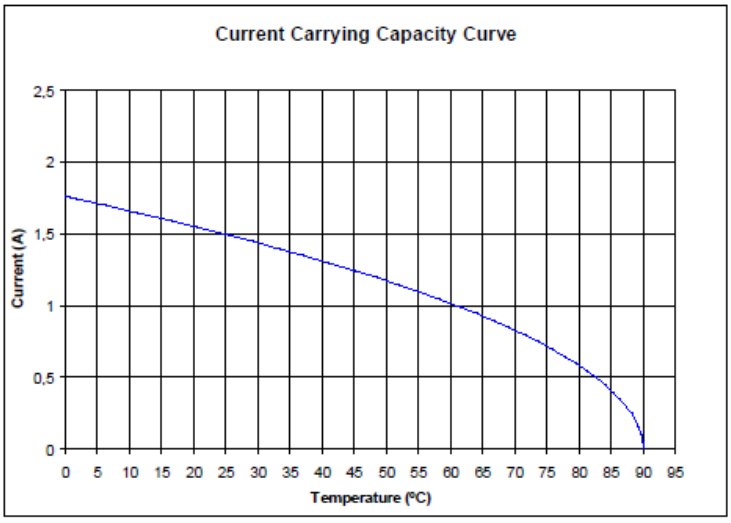
Insulation resistance measured values were higher than $1x10^{12}\Omega$. (Specified: $>5x10^{8}\ \Omega$)

2.4 Voltage Proof – Groups 1, 2, 3, 4 and 6

No dielectric breakdown or flashover occurred during the test.

2.5 Current Carrying capacity – Group 8

Current carrying capacity exceeds the specified values given by: $I(t) = 1.76\ (1-(t/90))^{0.5}$.



2.6 Surge – Group 6.

All tested samples meet the requirements for the performed test.
All samples meet visual requirements, show no physical damages and meet the requirements of additional tests specified in test sequence.

2.7 Gauging Continuity – Group 4

No electrical discontinuities have been produced during the test.

2.8 Vibration, jack plug interface and IDC-wire interface – Group 3

No electrical discontinuities have been produced during vibration test.

2.9 Durability, jack-plug interface - Group 2

No physical damage occurred to the samples after durability.

2.10 Plug insertion force, jack-plug interface – Group 1

Mating force values were less than 10N (Specified: 30N max.)

2.11 Plug withdrawal force, jack-plug interface – Group 1

Unmating force values were less than 13N (Specified: 30N max.)

2.12 Plug retention in jack, jack-plug interface – Group 1

Plug retention force values between jack-plug are higher than 50 N. (Specified: >50N)

2.13 Mechanical Gauging – Group 4

Samples pass successfully the GO / NO GO test.

2.14 Panel Housing retention– Group 8

Panel housing retention forces are higher than 220N (Specified: 90N min.)

2.15 Thermal shock, IDC-wire interface– Group 1

No physical damage occurred to the samples after thermal shock.

2.16 Humidity-temperature cycling, IDC-wire interface– Groups 1 and 7

No physical damage occurred to the samples after Humidity-temperature cycling.

2.17 Stress relaxation, (dry heat), IDC-wire interface – Groups 4 and 7

No physical damage occurred to the samples after Stress relaxation test.

2.18 Corrosion test, jack-plug interface – Group 2

No physical damage occurred to the samples after corrosion test.

2.19 Transmission Tests – NEXT Loss (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.20 Transmission Tests – PS NEXT Loss (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.21 Transmission Tests – Insertion Loss (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.22 Transmission Tests – Return Loss (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.23 Transmission Tests – ACR-N (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.24 Transmission Tests – PS ACR-N (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.25 Transmission Tests – ACR-F (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.26 Transmission Tests – PS ACR-F (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.27 Transmission Tests – Propagation Delay (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.28 Transmission Tests – Delay Skew (Class E_A 2-connector Permanent Link) – Group 5.

Tested samples meet the requirements of Class E_A Permanent Link Transmission tests for ISO/IEC 11801, 2.2 edition.

2.29 Transmission Tests – Transfer impedance - Group 7

Tested samples meet the requirements of $Cat6_A$ connecting hardware Transfer impedance test for ISO/IEC 11801, 2.2 edition.

2.30 Transmission Tests – Coupling attenuation – Group 7.

Tested samples meet the requirements of $Cat6_A$ connecting hardware Coupling Attenuation test for ISO/IEC 11801, 2.2 edition.

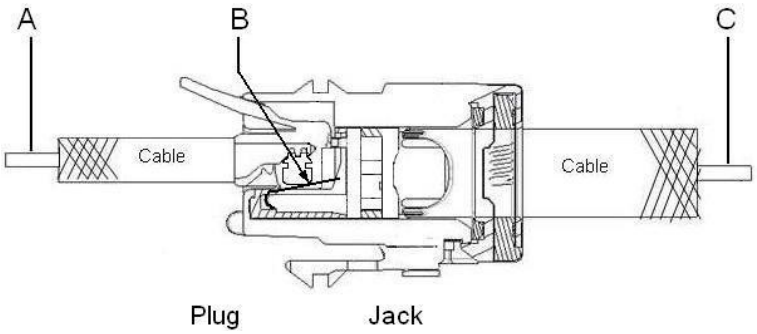
3. TEST METHODS

3.1 Examination of product (Reference Standard: IEC 60512, test 1a, 1b)

Product drawings and inspections plans were used to examine the samples. They were examined visually and functionally.

3.2 Contact and Shield Contact (Reference Standard: IEC 60512-2-1, test 2a)

Contact resistance measurements between jack and plug were done as shown in next figure with a micro-ohmmeter using the low level method: 20 mV max. and 100 mA max. open circuit.
Contact Resistance calculated as $R_{contact} = R_{AC} – (R_{AB}+R_{CB})$



3.3 Insulation resistance (Reference Standard: IEC 60512 test 3a)

100Vdc during 1 minute applied between adjacent contacts.

3.4 Dielectric Withstanding voltage (Reference Standard: IEC 60512 test 4a)

A 1000 V_{AC} peak voltage was applied between adjacent contacts during 60s and 1500 V_{AC} peak between contact and test panel. Maximum leakage current: 5 mA.

3.5 Current carrying capacity (Reference Standard: IEC 60512-3, test 5b).

The contact temperature at several current steps was measured. The maximum allowed temperature minus the measured temperature increase was plotted vs. current.

3.6 Surge (Reference Standard: IEC 60603-7, Ed. 3 Jul 08).

Samples were submitted to the tests according ITU-T K.20 (2000-02).
ITU-T K.20 conditions and criteria considered applicable are:
Contact/contact. Unexposed environments and the following:

Test 2.1.1.a.
Waveshape: 10/700 µs.
Uc(max) = 1.0 kV.
5 impulses of each polarity.

Test 2.1.1.b.
Waveshape: 10/700 µs.
Uc(max) = 1.0 kV.
5 impulses of each polarity.

Test 2.2.1.a.
Ua.c.(max) = 600 V.
t = 0.2 s.
5 times.

Test 2.3.1.a.
Ua.c. = 230 V.
t = 15 min.

3.7 Gauging Continuity (Reference Standard: IEC 60603-7-1 Annex A)

Electrical continuity was checked over all contacts and shield.
A gauge was used and a current of 100 mA was applied for all contacts, series connected. A forwards force of 20N minimum has been applied during the movement and any discontinuity greater than 10 microseconds was allowed.

3.8 Vibration, jack plug and IDC-wire interface (Reference Standard: IEC 60068-2-6 test method Fc)

Frequency range 10-55Hz. Displacement amplitude 0,35mm. Sweep cycles 5 per direction (each of 3 linear axis).

3.9 Durability, jack-plug interface (Reference Standard: IEC 60603-7-1 level A)

Plug and jack were mated and un-mated for 750 cycles total at a maximum speed of 10mm/s.

3.10 Plug insertion force, jack-plug interface

Force required to mate plug and jack was measured with latch depressed at a maximum rate of 25mm/min.

3.11 Plug withdrawal force, jack-plug interface

Force required to unmate plug and jack was measured with latch depressed at a maximum rate of 25mm/min.

3.12 Plug retention in jack, jack-plug interface (Reference Standard: IEC 512-8 test 15f)

An axial load of 50 N was applied to the cable which is terminated to the plug, at a rate of 4.5N/s, with plug mated in jack and latch engaged. Maintain load for 60 ± 5 seconds.

3.13 Mechanical Gauging (Ref. Standard IEC 60603-7, Annex C)

A go-gauge was inserted and removed at a rate of 10 mm/min and a maximum insertion/extraction force = 8,9N.
A no-go-gauge was inserted with a force of 8,9N at a rate of 1mm/min and maximum insertion = 1.78mm.

3.14 Panel Housing retention (Product Specification 108-1389)

Panel retention force was measured at a rate of 12.5mm/min., using nominal panel cut-out dimensions as specified in appropriate TE Connectivity customer drawing.

3.15 Thermal shock, IDC-wire interface (Ref. standard IEC 60068-2-14)

Samples were placed into a climatic chamber during 25 cycles between -40ºC and 70ºC. Duration exposure = 30 minutes.

3.16 Humidity-temperature cycling, IDC-wire interface (Ref. Standard: IEC 60068-2-38 Test Method Z/AD)

Samples were placed into a climatic chamber during 21 cycles between 25 and 65ºC at (93± 3) % RH with cold sub-cycle -10ºC. Cycle time 24 hours.

3.17 Stress relaxation, (dry heat), IDC-wire interface (Ref. standard: IEC 60068-2-2, Test Method Ba)

Samples were placed into an oven at 70ºC for 500 hours. (Half samples connected to 0.5A and other samples not connected)

3.18 Corrosion test, jack-plug interface (Ref. Standard: IEC 60512-11-7 and IEC 60068-2-60).

SO_2 = 0.5 ppm (volume)
H_2S = 0.1 ppm (volume)
T =25 +- 2ºC; HR =75% +- 3%
Test time: 4 days
Half of samples in mated state and half of samples in unmated state.

3.19 Transmission Tests – NEXT Loss (Ref. Standard: ISO/IEC 11801).

NEXT Loss was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.19 Transmission Tests – PS NEXT Loss (Ref. Standard: ISO/IEC 11801).

PS NEXT Loss was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.20 Transmission Tests – Insertion Loss (Ref. Standard: ISO/IEC 11801).

Insertion Loss was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.21 Transmission Tests – Return Loss (Ref. Standard: ISO/IEC 11801).

Return Loss was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.22 Transmission Tests – ACR-N (Ref. Standard: ISO/IEC 11801).

ACR-N was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.23 Transmission Tests – PS ACR-N (Ref. Standard: ISO/IEC 11801).

PS ACR-N was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.24 Transmission Tests – ACR-F (Ref. Standard: ISO/IEC 11801).

ACR-F was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.25 Transmission Tests – PS ACR-F (Ref. Standard: ISO/IEC 11801).

PS ACR-F was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.26 Transmission Tests – Propagation Delay (Ref. Standard: ISO/IEC 11801).

Propagation Delay was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.27 Transmission Tests – Delay Skew (Ref. Standard: ISO/IEC 11801).

Delay Skew was measured in Class E_A 2-connector Permanent Link configuration according to the standard IEC 61935-1.

3.28 Transfer Impedance (Ref. Standard: ISO/IEC 11801).

The Transfer Impedance was measured using a HP8751A network analyzer and a triaxial tube.

3.29 Coupling attenuation (Reference Standard: ISO/IEC 11801)

Coupling Attenuation was measured according to the EN 50289-1-14.