
Cat 6A Hybrid Patch cords for 1G/10G Ethernet applications

1. SCOPE

1.1 Content

This specification describes performance and material requirements and tests procedures for TE Connectivity Cat 6A Hybrid shielded patch cord assemblies used to connect building wiring for data and voice networking systems.

Interfaces used in these cable assemblies include:

- AMP TWIST 7A S SL 4-pair plug to shielded RJ 45 plug.
- ARJ45™ plug to shielded RJ 45 plug.

1.2 Qualification

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

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 customer drawing or any TE Connectivity (TE) documents listed below, the customer drawing and TE documents shall take precedence. In the event of conflict between the requirements of this specification and the industrial standards, this specification shall take precedence.

2.1 TE Connectivity Documents

A. Relevant customer drawing

B. TEC-138-702: 'Supplier Requirements for Product Environmental Compliance'

C. 108-93018: Product Specification - 'Copper LAN cable'

2.2 Industrial Standards:

A. ISO/IEC 11801 Ed.2.2: Generic Cabling for Customer Premises.

B. EN 50173-1: Information Technology; Generic Cabling Systems.

C. ANSI/TIA/EIA 568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

D. IEC 61076-3-104: Connectors for electronic equipment. Detail specification for 8-way, shielded, free & fixed connectors, for data transmission with frequencies up to 1000MHz.

E. IEC 60603-7-71: Connectors for electronic equipment. Detail specification for 8-way, shielded, free & fixed connectors, for data transmission with frequencies up to 1000 MHz.

F. IEC 60603-7-51: Connectors for electronic equipment. Detail specification for 8-way, shielded, free & fixed connectors, for data transmission with frequencies up to 500 MHz.

G. IEC 61156-5: Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to

1000MHz – Horizontal floor wiring – Sectional specification.

- H. IEC 61156-6: Multicore and symmetrical pair/quad cables for digital communications – Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1000MHz – Work area wiring – Sectional specification.
- I. IEC 61935-1: Generic cabling systems – Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801. Part 1: Installed cabling.
- J. IEC 61935-2: Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801. Patch cords and work area cords. Test Specifications as indicated in Fig. 1.

3. REQUIREMENTS

3.1 Design and Construction

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

3.2 Standard length

Applicable standard lengths: *from 0.5 meter to 20 meter* (both included).
For other lengths, put in contact with your sales representative.

3.3 Materials

Materials shall be in accordance to TE Connectivity requirements about environmental-related substances as per TE Connectivity specification TEC-138-702.
The material of the cable jacket is identified on the customer drawing and shall comply with the standards mentioned in Product Specification 108-93018 *Copper LAN cable*.

3.4 Ratings

Operating Temperature: -20 to 60°C

3.5 Packaging

Each assembly shall be supplied in a clear bag.

3.6 Bending radius

The minimum bending radius is 8x outside diameter during installation and 4x the outside diameter after installation.

3.7 Performance requirements and test procedures

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

Test Description	Requirement	Test Procedure
VISUAL		
Examination of product.	Meets requirements of product drawing.	Visual inspection criteria defined in IEC 61935-2, Paragraph 5.1
ELECTRICAL		
Wire map	Continuity and short circuit Wire map configuration as per: <ul style="list-style-type: none"> ✓ IEC 61076-3-104 standard (AMP-TWIST[®]-7A S SL interface). ✓ IEC 60603-7-71 (ARJ45[™] interface). ✓ TIA 568B (RJ 45 interface). 	Any device which ensures quality
Shield continuity	Shield continuity	Any device which ensures quality.
AMPTRAC connection (9 th wire) (only applicable for AMPTRAC versions)	Continuity Short circuit (between pogo pin and plug shield).	Any device which ensures quality (See Figure 2 as information)
Voltage proof (only applicable for AMPTRAC versions)	1 minute hold with no breakdown or flashover	IEC 60512-4-1 1500 volts AC peak voltage to be applied between pogo pin and plug shield. Maximum leakage current 5mA.
TRANSMISSION		
Return Loss ⁽¹⁾	Cat 6A Patch cord Return Loss requirements according to ISO/IEC 11801 Ed.2.2	IEC 61935-2, Paragraph 5.6
NEXT Loss	Cat 6A Patch cord NEXT Loss requirements according to ISO/IEC 11801 Ed.2.2	IEC 61935-2, Paragraph 5.7
MECHANICAL		
Crimping height (only RJ 45 interface)	Relevant IEC60603-7-X standard	Indicator with needle-point probes or equivalent. It shall be measured at contact front.
Tensile Strength	Force applied: 50 N according to the standard. Duration: 5 seconds	IEC 61935-2, Paragraph 6.2. (See Figure 3 as information)
Torsion Force (only RJ 45 interface, specified by TE Connectivity)	Force applied: 10 N x cm Duration: 5 seconds Maximum rotation angle 45°	(See Figure 4 as information)
NOTE	See Test Sequence in paragraph 4.2 Figure 5	

Figure 1: Requirements and test procedures for Cat 6A Shielded Hybrid Patch cords for 1G/10G Ethernet applications

REMARK⁽¹⁾	Return Loss values below 4MHz are for information only according to ISO 11801 Ed.2.2
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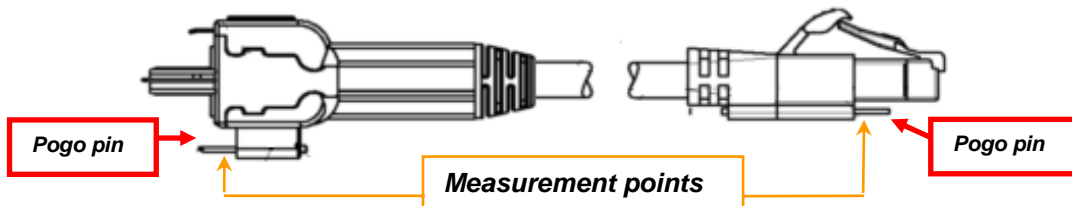


Figure 2: AMPTRAC connection continuity and short-circuit test procedure

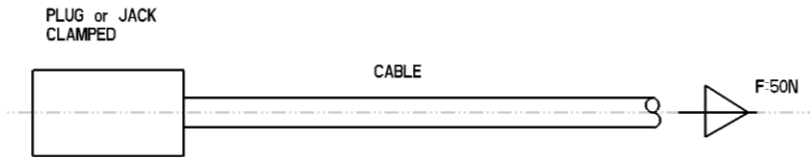


Figure 3: Tensile strength test procedure

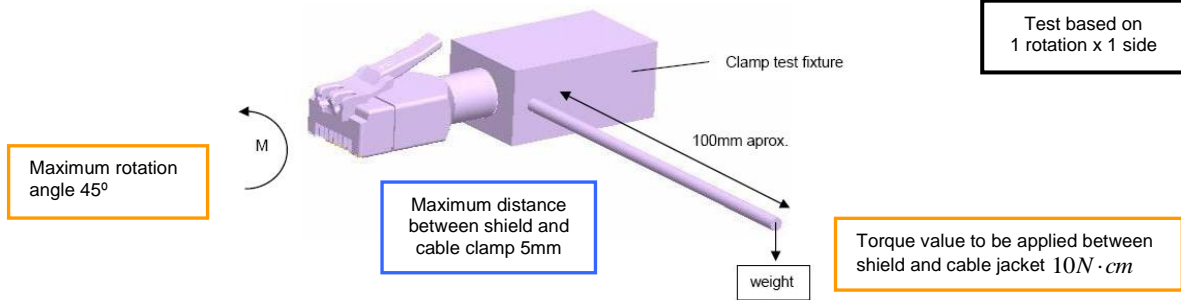
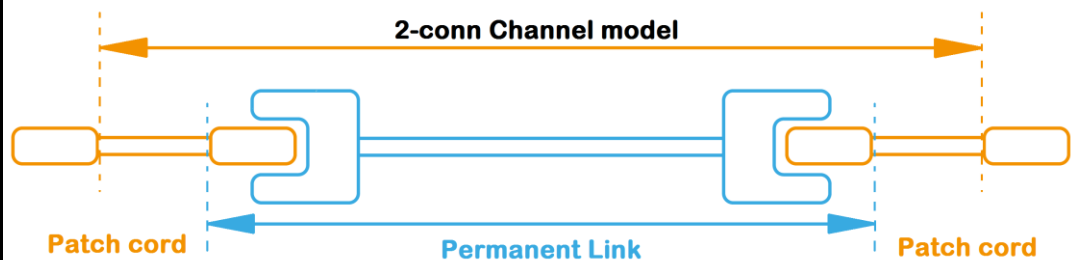


Figure 4: Torsion force test procedure

NOTE

In general, patch cords are components of a Channel cabling configuration. Channels are length limited by standards in order to achieve specific requirements, for this reason all component lengths have to be considered for obtaining the expected cabling performance.

In case of a Class E_A Channel 2-connector model:



Maximum patch cords total length allowed is obtained by the following equation:

$$(Max_Length_{Patch_cords}[m] \cdot RatioA) = 104[m] - (Length_{Permanent_Link}[m] \cdot RatioB)$$

Where RatioA and RatioB are the cable insertion loss ratios which depend on cable type (solid or stranded). In general, they take the following values:

- ✓ For stranded cables, Ratio_{stranded} = 1.5
- ✓ For solid cables, Ratio_{solid} = 1.0

4. PRODUCT QUALIFICATION AND REQUALIFICATION

4.1 Sample Selection

Samples shall be selected at random from current production. For qualification purpose, all test groups shall consist of a minimum of 5 samples per relevant length per product family.

4.2 Test sequence

Test Description	Test Sequence	
	<i>Standard version</i>	<i>AMPTRAC version</i>
Examination of product	1, 8	1, 10
Wire Map & Shield continuity	2	2
AMPTRAC connection: Continuity and shortcircuit (only for AMPTRAC versions)	-	3, 11
Voltage Proof (only for AMPTRAC versions)	-	4, 12
Return Loss	4, 9	6, 13
NEXT	5, 10	7, 14
Crimping height	3	5
Tensile Strength	6	8
Torsion Force	7	9

Figure 5: Test sequence

4.3 Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, requalification testing shall be initiated, consisting of all or part of the original testing sequence as determined by TE Connectivity.

5. QUALITY ASSURANCE PROVISIONS

Quality provisions are based upon the philosophy of TQM (Total Quality Management) with a system approved to EN ISO 9001 by Lloyds Register Quality Assurance.

5.1 Responsibility for quality

Unless otherwise stated in the purchase order, it shall be the supplier's responsibility to assure qualification and lot conformance to this specification. The supplier may utilize his own or other testing and inspection facilities acceptable to the buyer.

5.2 Qualification conformance

For the purposes of internal qualification, the program shall consist of examinations and tests to determine conformance with the requirements of this specification. It shall be performed once, on introduction of the product. Subsequent design changes shall be partially or fully re-qualified depending upon their area of impact in the context of product functionality. Regular requalification testing shall be performed as defined by the Quality Department.

5.3 Manufacturing follow-up

TE Connectivity products target Six Sigma levels of performance by the integration of capable processes from the development throughout the entire supply chain. The goal is to reduce variability to achieve zero defects for products and services. Systems used are based on preventive and statistical techniques during development and manufacturing. This also includes suppliers of materials, components or systems. Dedicated procedures for supplier selection, development and follow-up are implemented to ensure conformance to TQM and specification requirements.

Best demonstrated practices are identified and implemented throughout the company, with a continuing challenge to identify opportunities for innovation and improvement.

6. REVISION SUMMARY

This paragraph is reserved for a revision summary of changes and additions made to this specification.

- TE Connectivity AMP España, S.L.U. was Tyco Electronics AMP España, S.A.
- TE Connectivity logo is included in this revision.
- TE Connectivity was AMP NETCONNECT* in paragraph 1.1. Content.
- TE Connectivity was Tyco Electronics in paragraphs 2. Applicable Documents, 3.3. Materials, 4.3. Requalification Testing, 5.3 Manufacturing follow up and Figure 1.
- TE Connectivity specification TEC-138-702 was Tyco Electronics specification 230-702 in paragraph 3.3. Materials and 2. Applicable documents.
- From paragraph 2.2. Industrial Standards, Figure 1 and Remark 1, ISO/IEC 11801, Amendment 1 and Amendment 2 have been superseded by ISO 11801 Ed.2.2.
- From paragraph 2.2. Industrial Standards, ANSI/TIA/EIA 568-B.2-1 and ANSI/TIA/EIA 568-B.2-10 have been superseded by ANSI/TIA/EIA 568-C.2.