Copper LAN cable

1. SCOPE

1.1. Content

This specification describes the general requirements for AMP NETCONNECT* copper LAN cable.

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 drawing or any TE Connectivity (TE) documents listed below, the 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

A. Applicable drawing

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

2.2. Industrial Standards

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

B. EN 50288: Multi-element metallic cables used in analogue and digital communication and control.

C. ISO/IEC 11801: Information technology – Generic Cabling for Customer Premises.

D. IEC 60332: Tests on electric and optical fiber cables under fire conditions – Test for vertical flame propagation for a single insulated wire or cable – Test for vertical flame spread of vertically-mounted bunches wires or cables.

E. IEC 60754-1: Test on gases evolved during combustion of electric cables – Determination of the amount of halogen acid gas.

F. IEC 60754-2: Test of gases evolved during combustion of electric cables – Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity.

G. IEC 61034: Measurement of smoke density of cables burning under defined conditions.

H. IEC 61156: Multicore and symmetrical pair/quad cables for digital communications.

I. RAL No 840-HR: Colour register.

J. UL 444 section 6.7: Communications cables – Durability of printing.

3. REQUIREMENTS

3.1. Design and construction

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

3.2. Materials

- Materials shall be as specified on the applicable drawing.
- Product and processing shall be in accordance to TE Connectivity requirements about environmental-related substances as per TE Connectivity standard 230-702.
- Cable jacket material is identified on the cable drawing. This material shall comply to the standards as mentioned in underneath table:

Jacket material	*Fire rating*	*Toxicity*	*Acid gas*	*Smoke density*
PVC	IEC 60332-1-2	-	-	-
LSZH	IEC 60332-1-2	IEC 60754-1	IEC 60754-2	IEC 61034-2
LSFRZH	IEC 60332-3-24	IEC 60754-1	IEC 60754-2	IEC 61034-2

3.3. Ratings

Installation temperature: 0 to 50°C
Operating temperature: -20 to 60°C

3.4. Transmission performance

Transmission performance shall be according to ISO/IEC 11801, EN 50173-1 and standards listed in the table underneath.

Category[1]	*Construction*[1]	*IEC requirement*[2] [3]		*EN requirement*[2] [3]
SOLID CABLE				
5	UTP	ISO/IEC 11801 1st Edition 1995 Cat5		
5e	UTP	IEC 61156-5 Cat 5e		EN 50288-3-1
	F/UTP			EN 50288-2-1
	SF/UTP			
6	UTP	IEC 61156-5 Cat 6		EN 50288-6-1
	U/FTP			EN 50288-5-1
	F/UTP			
	F/FTP			
	S/FTP			
6_A	F/UTP	IEC 61156-5 Cat 6_A		EN 50288-10-1 [7]
7	F/FTP	IEC 61156-5 Cat 7 [6]		EN 50288-4-1
	S/FTP			
7_A	S/FTP	IEC 61156-5 Cat 7_A [6]		
1200MHz	S/FTP	23AWG	IEC 61156-5 Cat 7 [4] [6]	
		22AWG	IEC 61156-7 [6]	-
STRANDED CABLE				
5e	UTP	IEC 61156-6 Cat 5e		EN 50288-3-2
	F/UTP			EN 50288-2-2
	SF/UTP			
6	UTP	IEC 61156-6 Cat 6		EN 50288-6-2
7	S/FTP	IEC 61156-6 Cat 7 [6]		EN 50288-4-2
7_A	S/FTP	IEC 61156-6 Cat 7_A [6]		-
1200MHz	S/FTP	IEC 61156-6 Cat 7_A [5] [6]		

NOTE(1)	*Cable Category and construction are indicated in the drawing NAME*
NOTE(2)	*In the event of conflict between IEC and EN requirements, IEC requirements shall take preference.*
NOTE(3)	*Considered Characteristic/Input Impedance [Z_o/Z_{in}] and Mean Z_o/Z_{in} requirements are not following latest IEC standard edition.* *See Annex included in this document for further information.*
NOTE(4)	*1200MHz S/FTP 23AWG solid cable is according to IEC 61156-5 Cat 7 requirements. Values in the frequency range from 600MHz up to 1200MHz should be according to the proper formulae of mentioned standard (extrapolated) with the exception of Return Loss parameter (only applicable up to 600MHz).*
NOTE(5)	*1200MHz S/FTP stranded cable is according to IEC 61156-6 Cat 7_A requirements. Values in the frequency range from 1000MHz up to 1200MHz should be according to the proper formulae of mentioned standard (extrapolated).*
NOTE(6)	*Coupling attenuation parameter shall be according to requirements defined in EN 50288-4-1.*
NOTE(7)	*This standard is in draft status at the moment of editing this document.*
REMARK	*The absorbing clamp method, as defined in IEC 62153-4-5, is the preferred test methodology for coupling attenuation parameter.*

3.5. Physical & esthetical characteristics

A. Stripability of the jacket: max. 80N to strip 50 mm of the jacket.

B. Min. bending radius of the cable during installation: 8 x outer diameter

C. Min. bending radius of the cable after installation: 4 x outer diameter

D. Insulation colours shall be blue, orange, green, brown and white in accordance with IEC 60304.

Pair 1	White and Blue
Pair 2	White and Orange
Pair 3	White and Green
Pair 4	White and Brown

Coloured trace on white wires is optional.

E. Jacket colour shall be in accordance with RAL Colour register No 840-HR.

Cable colour	*RAL*	*Cable colour*	*RAL*
Black	9011	Blue	5012
White	9003	Violet	4005
Brown	8016	Red	3000
Grey	7035	Orange	2003
Green	6018	Yellow	1021

3.6. Cable print legend

`TE CONNECTIVITY AMP NETCONNECT ISO-EN COMPLIANT XXXXXX <basenr specific info>`
`YYWW Z (SEQUENTIAL No) METER`

A. *XXXXXX* – is TE Connectivity' manufacturing location.

B. *<basenr specific info>* is described on the drawing of the relevant base number.

C. *YYWW* is date code: YY - Year, WW – Week *i.e.*: 0921 = year 2009, week 21 (per TE specification 102-60)

D. *Z* is manufacturing batch #.

E. *Sequential meter marking every meter*. Sequential meter is not returned to zero for each length. Sequential meter accuracy to be ±1%.

F. *Print legend shall be in capital characters*, font '`Courier`', font style 'Regular', character height:

- 2,5 mm for cable Ø < 5,5 mm
- 3,0 mm for cable Ø ≥ 5,5 mm

G. *Print colour* shall be white or yellow for black or brown jackets and shall be black for all other jacket colours

H. *Print durability* shall be per UL 444 section 6.7.

3.7. Packaging Length Tolerance

Tolerance applicable for different length should be as follow:

Length [meter]	*Tolerance*
305	0 + 6%
500	0 + 4%
1000	0 + 2%

For any other non specified length, the tolerance of the immediately lower length should be applied, for instance in case of 600 m, then 0 + 4% shall be applied.

3.8. Packaging

Product should be delivered according to specified in drawing.

4. PRODUCT QUALIFICATION AND REQUALIFICATION TEST SEQUENCE

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.

4.1 Responsibility for quality

Unless otherwise stated in the customer order, it shall be TE Connectivity' responsibility to assure qualification and lot conformance to this specification. TE Connectivity may utilize its own or other testing and inspection facilities acceptable to the customer.

4.2 Qualification conformance & re-qualification test sequence.

For the purposes of internal qualification, the program shall consist of:

4.2-A Sample selection

For each cable type, 3 samples of 110m of different date code shall be provided for qualification purpose. These samples shall comply with the requirements defined on the drawing and in this specification. Deviations in the cable jacket color and the cable print legend are accepted for qualification samples. Third party certificate can be accepted from an independent laboratory recognized by TE.

4.2-B Re-qualification testing

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

5. REVISION SUMMARY

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

- TE connectivity logo is included in this revision.
- TEC-138-702 document is included in paragraph §2.1.
- Regarding paragraph §3.4
  - Cat 6_A F/UTP cable is included.
  - Note(6) is applicable to Cat 7 and Cat 7_A solid and stranded cables.
  - Note(7) is added regarding EN 50288-10-1 standard status.

ANNEX

Characteristic/Input Impedance [Z_o/Z_{in}] and Mean Z_o/Z_{in} considerations

		Test Parameter	
		Characteristic/ Input Impedance(1)	***Mean Characteristic/ Input Impedance***
Test Requirement	***Solid cable***	*Available limits from* IEC 61156-5 Ed. 1.0 Mar '02	*100Ω ± 5 % @ 100MHz per Case A* included in *Corrigendum 1* to IEC 61156-5 Ed. 2.0 Feb'09
	Stranded cable	*Available limits from* IEC 61156-6 Ed. 1.0 Mar '02	*100Ω ± 5 % @ 100MHz*
Additional comments		*Upper and lower limits from* IEC 61156-5 Ed. 2.0 Feb '09 and IEC 61156-6 Ed. 3.0 Jan'10 *are considered ONLY for information.*	--

NOTE(1)	*Due to test method followed by TE, obtained parameter is Input impedance instead of Characteristic impedance. In any case, the same requirement is applicable for both.*