ISO/IEC JTC 1/SC 25/WG 3 N 807

Date: 2006-10-11

Replaces ISO/IEC JTC 1/SC 25/WG 3 N/A

ISO/IEC JTC 1/SC 25/WG 3

Customer Premises Cabling

Secretariat: Germany (DIN)

DOC TYPE:	**Liaison report**
TITLE:	**Liaison report from ISO/IEC/JTC 1/SC 25/WG 3 to IEEE 802.3 on Update on cabling issues to support IEEE P802.3at PoEP**
SOURCE:	**ISO/IEC JTC 1/SC 25/WG 3 (Berlin 48A)**
PROJECT:	**25.03.xx.xx: Generic cabling for xx**
STATUS:	**Liaison report developed at Berlin.**
ACTION ID:	**FYI**
DUE DATE:	**N/A**
REQUESTED: ACTION	**to IEEE 802.3 for consideration to WG 3 for information.**
MEDIUM:	**Def**
No of Pages:	**7 (including cover)**

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Secretary - ISO/IEC JTC 1 / SC 25/WG 3 - Dr.-Ing. Walter P. von Pattay
ZVEI FV 7 & FV 8, Germany
Tel.: +49/89/923 967 57, Tfx,: +49/89/923 967 59 (on request only)
EM: Walter@Pattay.com

Home page SC 25: "http:/www.iec.ch/sc25"

Liaison report from ISO/IEC/JTC 1/SC 25/WG 3 to IEEE 802.3 on Update on cabling issues to support IEEE P802.3at PoEP

To: IEEE 802.3

From: ISO/IEC JTC 1/SC 25/WG 3

41st Meeting of WG 3

Berlin, Germany, 2006-09-19/21

Date: 2006-09-25

ISO/IEC/SC 25/JTC 1/WG 3 thanks IEEE 802.3 for the recent liaison letter [from your July 2006 meeting in San Diego distributed in SC 25/WG as WG 3(Berlin/IEEE 802.3)023] related to providing power over Ethernet Plus (PoEP) using balanced pair structured cabling. WG 3 would like to bring to the attention of IEEE 802.3 the following responses to its questions in order to continue SC 25/WG 3 support for PoEP.

IEEE 802.3 question 1: The actual channel loop resistance is a topic of debate, and IEEE would appreciate some guidance for Medium Dependent Interface (MDI) to MDI links on what the loop resistance applies to and applicable operating conditions.

SC 25/WG 3 response 1: Please see ISO/IEC 11801 Ed2 channel definition and drawings (clause 3.1.15 and figure 7 are attached as Annex 1). Figure 7 shows where the channel exactly starts. Please also see Annex 2, MICE table, and note that MICE 1 is for the general commercial office environment. Class D 2002 DC loop resistance is 25 Ω, and Class D 1995 was specified at 40 Ω at 20 °C.

Note A high proportion of the 1995 Class D channels are expected to meet the 25 Ω DC loop resistance.

IEEE 802.3 question 2: What is the current carrying capacity when all pairs in a bundle are powered, and when 50 % of the pairs in a bundle are powered?

SC 25/WG 3 response 2: WG 3 is considering the need to develop rules for telecommunications cabling similar to what we have for power cables under different installation conditions. This area is under investigation and involves expertise on cables (IEC TC 46), pathways and spaces, as well as heat dissipation. The current capacity also depends on the type of cables and the bundle sizes.

IEEE 802.3 question 3: IEEE 802.3 need to understand if there can be any improvement in conductor to conductor DC unbalance within a pair in any channel.

SC 25/WG 3 response 3: Based on input from connector component committee IEC SC 48B (see Annex 3: WG 3 N 791) improvements are not possible. WG 3 is awaiting input on cables from IEC SC 46C very soon and will forward such response to IEEE 802.3.

IEEE 802.3 question 4: What temperature rise should IEEE 802.3 expect in installations (including typical and worst case) and could SC 25/WG 3 provide the bundle size and installation environment (conduit, etc) used for these?

SC 25/WG 3 response 4: See responses to items 2.

IEEE 802.3 question 5: IEEE 802.3 understanding is that the maximum cable operating temperature is 60 °C for PVC. Is this a reasonable assumption?

SC 25/WG 3 response 5: yes with the addition that 60 °C is the maximum operating temperature specified in IEC 61156, irrespective of the materials used, (to be confirmed by IEC SC 46C).

IEEE 802.3 question 6: Can IEEE 802 assume that cables can operate at a mathematical sum of ambient plus cable heating, provided the total is equal to or below 60 °C?

SC 25/WG 3 response 6: Yes, to be confirmed by IEC SC 46C.

NOTE IEC 61156 specifies cabling performance at 20 °C, at least attenuation changes with temperature significantly.

IEEE 802.3 question 7: Can IEEE 802 receive a specification for channel pair to pair DC unbalance?

SC 25/WG 3 response 7: WG 3 is awaiting an answer from IEC SC 46C.

IEEE 802.3 question 8: What differences SC 25/WG 3 expect between stranded patch cable and solid horizontal cable?

SC 25/WG 3 response 8: WG 3 is awaiting an answer from IEC SC 46C. Stranded cables specified in ISO/IEC 11801:2002 use smaller copper conductors with higher DC resistance of up to 50 % increase in DC resistance.

IEEE 802.3 question 9: Is there anything else that SC 25/WG 3 believe IEEE 802.3 should be investigating or consider in developing our specifications?

SC 25/WG 3 response 9: There was discussion about un-mating connecting hardware under load and the WG 3 experts have the following observations and requests for IEEE 802.3at:

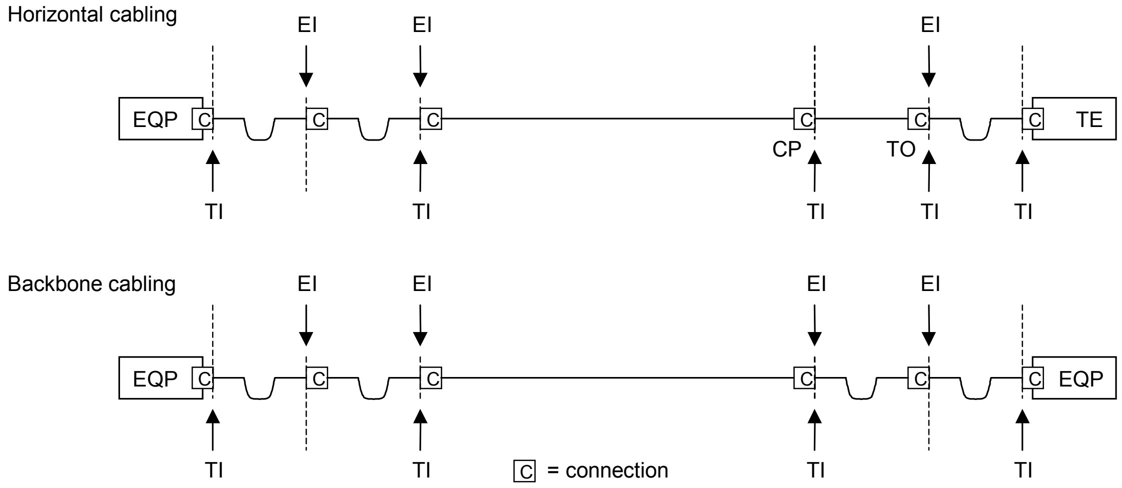
- Current products do not have un-mating under load as a requirement.
  - In order to maintain the operating life of connecting hardware at higher power levels, SC 25/WG 3 urges IEEE 802.3 to include a feature that will allow the removal of power before disconnection.
  - If it not possible, the component groups will need to develop a new generation of connectors with requirements for un-mating under load.
- WG3 requires clarification from IEEE on test conditions, including;
  - correct R, L, C values for the powered device and power supply equipment
  - correct current to use per conductor
- WG 3 requires clarification on the lowest and highest current value under which un-mating is likely to occur.

SC 25/WG 3 looks forward to continue its cooperation and will keep IEEE 802.3 informed as SC 25/WG 3 makes further progress on these issues.

Annex 1: Excerpt from ISO/IEC 11801, Information technology - Generic cabling for customer premises

3.1.15
channel
end-to-end transmission path connecting any two pieces of application specific equipment

NOTE Equipment and work area cords are included in the channel, but not the connecting hardware into the application specific equipment.



Key:

EI Equipment interface

TI Test interface

Figure 7 – Equipment and test interfaces

Annex 2: Excerpt from ISO/IEC 24702, Information technology - Generic cabling - Industrial premises

Table 1 – Details of environmental classification

Mechanical	M_1	M_2	M_3
Shock/bump (see a))			
Peak acceleration	40 ms^{-2}	100 ms^{-2}	250 ms^{-2}
Vibration			
Displacement amplitude (2 Hz to 9 Hz)	1,5 mm	7,0 mm	15,0 mm
Acceleration amplitude (9 Hz to 500 Hz)	5 ms^{-2}	20 ms^{-2}	50 ms^{-2}
Tensile force	See b)	See b)	See b)
Crush	45 N over 25 mm (linear) min.	1 100 N over 150 mm (linear) min.	2 200 N over 150 mm (linear) min.
Impact	1 J	10 J	30 J
Bending, flexing and torsion	See b)	See b)	See b)
Ingress	I_1	I_2	I_3
Particulate ingress (∅ max.)	12,5 mm	50 µm	50 µm
Immersion	None	Intermittent liquid jet ≤12,5 l/min ≥6,3 mm jet >2,5 m distance	Intermittent liquid jet ≤12,5 l/min ≥6,3 mm jet >2,5 m distance and immersion (≤1 m for ≤30 min)
Climatic and chemical	C_1	C_2	C_3
Ambient temperature	−10 °C to +60 °C	−25 °C to +70 °C	−40 °C to +70 °C
Rate of change of temperature	0,1 °C per min	1,0 °C per min	3,0 °C per min
Humidity	5 % to 85 % (non-condensing)	5 % to 95 % (condensing)	5 % to 95 % (condensing)
Solar radiation	700 Wm^{-2}	1 120 Wm^{-2}	1 120 Wm^{-2}
Liquid pollution (see c)) Contaminants	Concentration $\times 10^{-6}$	Concentration $\times 10^{-6}$	Concentration $\times 10^{-6}$
Sodium chloride (salt/sea water)	0	<0,3	<0,3
Oil (dry-air concentration) (for oil types see b))	0	<0,005	<0,5
Sodium stearate (soap)	None	>5 $\times 10^4$ aqueous non-gelling	>5 $\times 10^4$ aqueous gelling
Detergent	None	ffs	ffs
Conductive materials	None	Temporary	Present

a) Bump: the repetitive nature of the shock experienced by the channel shall be taken into account.

b) This aspect of environmental classification is installation-specific and should be considered in association with IEC 61918 and the appropriate component specification

c) A single dimensional characteristic, i.e. Concentration $\times 10^{-6}$, was chosen to unify limits from different standards.

Gaseous pollution (see c)) Contaminants	Mean/Peak (Concentration × 10^{-6})	Mean/Peak (Concentration × 10^{-6})	Mean/Peak (Concentration × 10^{-6})
Hydrogen sulphide	<0,003/<0,01	<0,05/<0,5	<10/<50
Sulphur dioxide	<0,01/<0,03	<0,1/<0,3	<5/<15
Sulphur trioxide (ffs)	<0,01/<0,03	<0,1/<0,3	<5/<15
Chlorine wet (>50 % humidity)	<0,000 5/<0,001	<0,005/<0,03	<0,05/<0,3
Chlorine dry (<50 % humidity)	<0,002/<0,01	<0,02/<0,1	<0,2/<1,0
Hydrogen chloride	–/<0,06	<0,06/<0,3	<0,6/3,0
Hydrogen fluoride	<0,001/<0,005	<0,01/<0,05	<0,1/<1,0
Ammonia	<1/<5	<10/<50	<50/<250
Oxides of Nitrogen	<0,05/<0,1	<0,5/<1	<5/<10
Ozone	<0,002/<0,005	<0,025/<0,05	<0,1/<1
Electromagnetic	**E_1**	**E_2**	**E_3**
Electrostatic discharge – Contact (0,667 µC)	4 kV	4 kV	4 kV
Electrostatic discharge – Air (0,132 µC)	8 kV	8 kV	8 kV
Radiated RF – AM	3 V/m at (80 to 1 000) MHz 3 V/m at (1 400 to 2 000) MHz 1 V/m at (2 000 to 2 700) MHz	3 V/m at (80 to 1 000) MHz 3 V/m at (1 400 to 2 000) MHz 1 V/m at (2 000 to 2 700) MHz	10 V/m at (80 to 1 000) MHz 3 V/m at (1 400 to 2 000) MHz 1 V/m at (2 000 to 2 700) MHz
Conducted RF	3 V at 150 kHz to 80 MHz	3 V at 150 kHz to 80 MHz	10 V at 150 kHz to 80 MHz
EFT/B (comms)	500 V	1 000 V	1 000 V
Surge (transient ground potential difference) – Signal, line to earth	500 V	1 000 V	1 000 V
Magnetic Field (50/60 Hz)	1 Am^{-1}	3 Am^{-1}	30 Am^{-1}
Magnetic Field (60 Hz to 20 000 Hz)	ffs	ffs	ffs

a) Bump: the repetitive nature of the shock experienced by the channel shall be taken into account.

b) This aspect of environmental classification is installation-specific and should be considered in association with IEC 61918 and the appropriate component specification.

c) A single dimensional characteristic, i.e. Concentration × 10^{-6}, was chosen to unify limits from different standards.

Annex 3: excerpt from SC 25/WG 3 N 791: Liaison report from IEC SC 48B to ISO/IEC JTC 1/SC 25 on potential changes in resistance unbalance requirements

1. Initial resistance unbalance measurements on existing mated connectors

Several IEC SC48B/SG5 experts recently performed resistance unbalance measurements on existing IEC 60603-7 series connectors (category 5e, 6 and 6_A mated (plug and jack) connectors). The measured values for resistance unbalance within a designated pair ranged from 0.5 to 29 mΩ. Measurements were taken from the IDC/wire interface on the jack through the plug/jack to the plug IPC/wire interface. Five of ten different manufacturers' products tested exceed the proposed 15 mΩ in-pair limit. Other experts reported mated connectors that exceeded this proposal.

2. Manufacturing variability and environmental considerations

The measurements above are ideal, and conducted on individual samples of new and unconditioned product.

These resistance unbalance measurements did not take into account the allowed contact resistance ranges for each of:

- the insulation displacement contact (IDC) of the back end connecting block (up to 10 mΩ);
- the jack/plug interface (up to 20 mΩ);
- the plug insulation piercing contact (IPC) (up to 10 mΩ)

that are permitted in the existing, published IEC standards. Therefore, the installed base of connectors, with the associated solder-less connections to cables, can be expected to have initial resistance unbalance variations as high as 40 mΩ. Also this may not be uniform within designated pairs of the mated connector.

Further, these resistance unbalance measurements do not take into account the additional allowed contact resistance ranges for each of:

- the insulation displacement contact (IDC) of the back end connecting block (up to 5 mΩ);
- the jack/plug interface (up to 20 mΩ);
- the plug insulation piercing contact (IPC) (up to 15 mΩ)

that are permitted by the published IEC standards after environmental conditioning. Therefore, the installed base of connectors, with associated solder-less connections to cables, can be expected (through natural environmental conditioning over the life of the mated connector) to have additional resistance unbalance variations as high as 40 mΩ. This too would not be uniform within designated pairs of the mated connector.

3. Applying a new requirement to new components

One possibility that was considered is to apply a new, lower limit for the resistance unbalanced of mated connectors within a designated pair to the new IEC 60603-7-41, -51 and -71 (category 6_A and 7_A) components only.

We note that, since an IEC 60603-7-7 (category 7) connector standard exists, and its requirements are specified to be a superset of IEC 60603-7-41 and -51 (category 6_A) requirements, IEC 60603-7-7 (category 7) connector resistance unbalance could not remain at 50 mΩ and maintain this status. The ability of IEC 60603-7-7 connectors to meet this new requirement would need to be evaluated, although existing EC 61076-3-104 type connectors would meet the proposed new requirement.

However, since the design of these new components employs fundamentally the same technology (IDC, plug/jack interface, and IPC) as the existing IEC 60603-7 series components we expect they will be similarly affected by design constraints, manufacturing variability, environmental conditioning, etc..

Considering all of these issues, the SC48B WG experts do not believe the existing 50 mΩ requirement for resistance unbalance, for the mated connector as a whole as well as within a designated pair of the mated connector, can be changed for either existing or new IEC 60603-7 series products.