Copper Covered Steel Telephone Cables

Report for the ACI

February 2013

Background:

Following a complaint received by the Approved Cables Initiative (ACI) relating to the distribution, within the UK, of Copper Covered Steel (CCS) internal telephone cables this report seeks to clarify the technical and commercial issues surrounding the sale of these products.

The complaint received questioned the compliance of CCS internal telephone cables with the requirements of BS 6701 **– (Telecommunications equipment and telecommunications cabling – Specification for installation, operation and maintenance)**. BS 6701 is not specific in respect to the cable specifications associated with internal cables for use within telecommunication systems albeit an oblique reference is made to BS EN 50174 which is the installation standard associated with communications cables used in data communication systems.

Following the BS EN 50174 route leads you to BS EN 50173 which is the CENELEC standard associated with structured cabling typically known as Category 5e, Category 6, etc. Whilst structured cabling can be successfully deployed as a telecommunications support medium other, more popular, cable solutions exist. British Telecommunications (BT) up until the early 1980s controlled the quality of telecommunications cable inside buildings until demarcation occurred. The BT specification for internal telecommunications cables, CW 1308, defines the materials together with the electrical, mechanical and environmental requirements.

Searching more broadly, for the standards and specifications defining the needs for internal telephone cables, identified BS 4808, Parts 1 & 2, (L.F. cables and wires with PVC insulation and PVC sheath for telecommunication) which defines a range of cables which are similar to those outlined within CW 1308. BS 4808, Parts 1 is described as - Current, Obsolescent whilst Part 2 has been withdrawn from British Standards.

This review also considers the application of the internal telephone cables in an effort to understand how these cables are usually deployed. Internal telephone cables are typically installed between the telecommunications equipment and the user outlet or between the master and the point of use.

Commercial consideration:

Research has demonstrated that CCS internal telephone cables in construction, up to 8-pairs are available in the UK market and these constructions appear to trade at pricing levels that are broadly 50% of those of copper equivalent cables. Some resellers describe the CCS product as simply “telephone cable” whilst others describe the product as “CCS telephone cable”. Many resellers adopt the attitude – “it works and we have had no complaints” as justification and proof that the CCS cable is fit for purpose and safe. No reseller could provide details of the specifications the products were manufactured and tested against.

It however remains unclear if the potential purchaser actually understands what CCS means.

What is an "Internal telephone cable"?

A Google search for "Internal telephone cables" almost exclusively produces results containing CW 1308 with the occasional references to Category 5e or Category 6 which are frequently used, today, as a substitution or replacement technology. The application of Category 5e and Category 6 cabling into telephone networks is addressed within ISO/IEC 11801 and BS EN 50173.

Technical Considerations:

Considering the technical specifications outlined above together with the broader requirements of the UK telephone system it can be concluded that the requirements for cables, deployed within internal telephone system in the UK are not clearly defined.

This lack of definition leaves the subject and requirements open to interpretation. Searching the Internet for guidance on "internal telephone cables" would quickly lead the uninformed to identify CW 1308 as the reference point for systems within the UK. Searches confirmed that to find "CCS telephone cables" required a detailed search beyond the first 5 pages of search engine results for "internal telephone cables."

Further discussions with communications engineers readily confirmed CW 1308 as the reference standard for internal telephone cables. Research also confirmed that in designing the capabilities of the internal network for both voice and broadband communications systems and equipment engineers have assumed that the cables would be in accordance with CW 1308 and incorporate plain annealed copper conductors in accordance with IEC 60228. CW 1308 sets out the constructional, mechanical and environmental requirements for cables installed within customers' premises.

The conductor resistance of CCS telephone cables with 1/0.5mm diameter conductors is confirmed as around 700Ω/km. CW 1308 defines a maximum conductor resistance for a 1/0.5mm conductor as 97.8Ω/km. As telephone systems depend upon resistive load the increase in conductor resistance would therefore limit the length of circuit deployable. Broadband bandwidth is determined by the electrical length of the twisted pair cable. Where the electrical length is greater than 7X the physical length this will have an impact upon the quality of service provided.

Discussions have confirmed that the copper content will vary from manufacturer to manufacturer. Anecdotal information suggests that conductors with copper content in the range of 15% to greater than 30% are common within CCS telephone cables. The variation in copper content will have a direct impact upon the maximum resistance of the insulated conductor and therefore the operational performance of the cable.

The quality and reliability of the installed system will also be determined by the quality of the cable termination. The typical method for terminating internal telephone cables is using Insulation Displacement Connectors (IDC) blocks where the insulated wire is punched down into a V-shaped contact. As the wire is forced into the contact, the insulation is pierced and the electrical connection is achieved by the contact biting into the surface of the conductor to secure a reliable, gas tight joint which will not oxidise. Oxidisation of the termination will cause an increase in resistance which will inevitably affect the quality of service experienced by the user.

In a minority of installations, terminations are made through a screw type terminal which relies on the insulation being removed from the conductor before the wire is terminated.

Discussions with several manufacturers (Krone, Molex, Austin Taylor) of IDC termination blocks has confirmed that the IDC termination was not designed to terminate copper covered steel. All IDC block designs assume copper as the conductor material. All manufacturers contacted claim to have no experience of terminating copper covered steel wires into IDC blocks and all expressed a concern over reliability.

None of the resellers of CCS telephone cables adequately highlighted the potential risks associated with installing these products in terms of:

1. An increase in conductor resistance
2. The potential termination reliability issues.

The way these products are marketed assumes a certain level of knowledge by the person purchasing and installing the products – an assumption which could be misplaced.

Legislative issues:

Electrical safety is generally assessed under the Low Voltage Directive (LVD) 2006/95/EC. The Directive is aimed at equipment with working voltages of 50V to 1000V AC or 75V to 1500V DC.

The UK's internal telephone system has a base operating voltage of 48V DC. The voltage used to ring the telephone will be at least 75V AC. however if an ISDN system is installed the ringing voltage may increase to 120V AC.

Internal telephone cables used within the UK therefore fall under the LVD and should be CE marked accordingly. The importer or the organisation placing such products on the market within Europe must prepare and maintain a "Declaration of Conformity" which requires that a product is either built to an International or National specification or the manufacturer, importer or distributor has completed a testing regime which proves the product is fit for purpose.

Given that CCS telephone cables do not comply with any published standards it would be a reasonable requirement for the manufacturer, importer or distributor to have commissioned a report to prove the product being marketed is fit for purpose otherwise it cannot be determined as safe.

Alternative applications for Internal Telephone cables:

Internal telephone cables are also used within public address systems and security systems where specific operational criteria, which differ from that defined within telephone systems, need to be considered. Research has highlighted a number of systems issues within specific installations which have been overcome by replacing CCS products with copper alternatives.

Recommendation:

Although there is no clear definition on the use of CCS Telephone cables within the UK it cannot be precluded or disqualified. If CCS telephone cables are to be sourced it is recommended that the

copper content is optimised to at least 30% of the area of the conductor, however even with a 30% copper content the reliability of the product remains unproven.

The risk of failure or systems reliability issues should be a concern given the lack of product and applications testing which should have been undertaken to assure the products 'fitness for purpose.' Using the market as a proving ground for "non-standard" products is irresponsible and high risk and should be avoided.

Given the design, construction, colour coding and presentation of CCS telephone cables it is obvious that they have been derived from the original CW 1308 cable specification purely for commercial reasons and in some instances a claim of "passing off" could be asserted at specific resellers.
Even resellers who openly describe the product as CCS telephone cable do not adequately provide the user or installer with sufficient information to assist with the assessment of risk.

CCS telephone cable, as an individual component, cannot be described as dangerous or an immediate risk to personal safety however a systems failure resulting from poor reliability of the cable and its termination, as key components of the system in a network, is likely to have greater consequence for business credibility.

The burden of proof to demonstrate that CCS telephone cables are safe and reliable rests with the manufacturer, importer or distributor. Currently the Approved Cables Initiative has been unable to obtain any proof of competent testing against a known standard or seen a Declaration of Conformity to cover the product.

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For the Approved Cables Initiative
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