

December 2007

Screened cable and data cable segregation

Can an armoured power cable be considered a screened cable and how does this relate to power and data cable segregation?

The short answer is yes; albeit not a very good screened cable. This question is mostly seen when installers consider the separation distances required between power and data cables as described in BS EN 50174-2 and BS 6701.

A screened power cable can be located closer to a data cable than an unscreened one; see the tables below.

Perhaps we should start by asking what is the definition of a screened, or shielded cable: there doesn't seem to be one. One cable manufacturer has written that, 'by definition a screened cable has a metallic element completely surrounding it'. But that is not really the case. If, for example, we look at the definition in EN 50288-1:

"Multi-element metallic cables used in analogue and digital communication and control."

We have the definition, Screening of cabling elements; *"When required by the relevant sectional specification the cabling elements shall be screened by one or any combination of the following:*



Data cable in tray with power cable running diagonally across the room!

- a metal tape
- a metal tape laminated to a plastic tape
- a plain or coated metal braid
- a helical wrap of parallel copper wires
- a semi-conducting layer."

Galvanised steel wire armour is not seen as a screen but then neither do braids or helical copper wires form a complete metallic enclosure of the cable.

How to measure the screening effectiveness of a cable is defined by some rather complex parameters e.g. EN 50289-1-6.

"Two important properties in characterising screening effectiveness of cables are transfer impedance and capacitive coupling (admittance and impedance). These properties can be used to calculate the normalised screening attenuation in dB."

So screening performance can be defined and measured, but what is the limiting factor, below which a cable couldn't be described as screened is not defined. Cable armour is considered as part of the protective earth circuit. In BS 7671, IEE Wiring Regulations 16th edition, we have:

543-02-07 *“Where the protective conductor is formed by conduit, trunking, ducting or the metal sheath and/or armour of a cable, the earthing terminal of each accessory shall be connected by a separate protective conductor to an earthing terminal incorporated in the associated box or other enclosure.”*

The wiring regulations refer to BS 6701:2004 Telecommunications equipment and telecommunications cabling – Specification for installation, operation and maintenance, when it comes to segregation between power and telecommunications circuits. From this Standard we have the requirement to maintain a distance of not less than 50 mm between power cables and communications cables, unless:

- There is a non metallic divider between them
- The power cables are themselves in an earthed metallic conduit
- The power cables are mineral insulated



Riser access with purple data cables entering floor void.

- The power cables are flexible double insulated
- The power cables are of an earthed armoured construction

So the two relevant standards in the UK are BS 6701:2004, which is safety standard, and BS EN 50174-2 Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings. BS EN 50174-2 is more concerned about the electromagnetic compatibility issues (interference) between power and data cables, rather than safety, but does state that safety issues take precedence over EMC issues.

Table 1 on the next page shows the Cable separation rules from EN 50174-2:2000.

Type of installation	Separation distance		
	Without a divider or with a non-metallic divider	Aluminium divider	Steel divider
Unscreened power cable and unscreened IT cable	200-mm	100-mm	50-mm
Unscreened power cable and screened IT cable	50-mm	20-mm	5-mm
Screened power cable and unscreened IT cable	30-mm	10-mm	2-mm
Screened power cable and screened IT cable	0-mm	0-mm	0-mm

Note that EN 50174 permits no separation for the final 15 metres of the horizontal cable run.

Table 1: Cable separation rules from EN 50174-2:2000

From Table 1 we can see that the worst case, unscreened power cable next to unscreened I.T. cable, is 200-mm. The standard makes no distinction between Category 5 or 6 etc., or what kind of screening is used. It is either a screened or an unscreened I.T. cable. The table is mostly self-explanatory but some extra clarification is required.

- The metallic dividers are presumed to be earthed.
- The I.T. cables are balanced and working with a balanced transmission circuit.
- The power cables are standard 50 to 60 Hz operation with no unusual transients or high frequency or high voltage components.

- I.T. cables are expected to be at least 130 mm from any kind of fluorescent lamps.
- For backbone cabling the separation distances must be maintained end-to-end. For the horizontal cabling there is the practical problem of maintaining separations of up to 200-mm in the shared trunking that is encountered around the walls of every office. To overcome this problem the standard adopts a more pragmatic approach.
- If the cable is screened and less than 35 metres in length then no separation is required.
- If the cable is longer than 35 metres then the separation shall be maintained except for the last 15 metres.

The above two statements do not make it clear what happens to unscreened cable shorter than 35 metres. The best interpretation of this clause (section 6.5.2 of EN 50174-2) is that for the last 15 metres of the horizontal cable run no separation is required between the data and power cables (apart from any other over-riding safety standard). Thus traditional office trunking can still be used. If we presume that we need around three metres of cable to drop down the wall into the horizontal trunking system then a twelve-metre run is achievable. This actually equates to 24 metres of wall if the cable run extends to twelve metres in each direction away from the original cable drop.

TIA/EIA-569 and ANSI/NECA/BICSI 568-2001 also give separation distances between power and data cables. This is summarised in Table 2 below.

BS 6701 says that for power cable voltages not exceeding 600 volts a.c. there must be a separation of at least 50-mm or else a non-conducting divider must be placed between them (7.7.4.1). For voltages above 600 volts a.c. the requirement is 150-mm. Table 3 overlays EN50174 and BS 6701 to show all the requirements tabulated together.

Table 3 shows the worst case conditions of EN 50174 and BS 6701 overlaid on each other.

Condition	Minimum separation distance		
	< 2kVA	2-5 kVA	>5kVA
Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways.	127-mm	305-mm	610-mm
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	64-mm	152-mm	305-mm
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	-	76 mm	152-mm
Electrical motors and transformers	-	-	1220-mm

Table 2: ANSI/NECA/BICSI 568-2001 separation distances between power and data cables

Type of installation	Separation distance			
	Without a divider	With a non-metallic divider	Aluminium divider	Steel divider
Unscreened power cable and unscreened IT cable	200-mm	200-mm	100-mm	50-mm
Unscreened power cable and screened IT cable	50-mm	50-mm	50-mm	50-mm
Screened power cable and unscreened IT cable	50-mm	30-mm	50-mm	50-mm
Screened power cable and screened IT cable	50-mm	0-mm	50-mm	50-mm

Note that EN 50174 permits no separation for the final 15 metres of the horizontal cable run but BS6701 always requires the separation, regardless of length except in the two highlighted cases seen in the table above.

Table 3: Worst case conditions of EN 50174 and BS 6701 overlaid on each other

And finally from TIA 942 we have Table 4: TIA 942 cable segregation

If the power cables are unshielded, then the separation distances provided in Table 4 shall be doubled. However, these distances can apply to unshielded power cables if either the power cables or data cables are installed in bonded and grounded metal tray. The side or the bottom of the metal tray shall separate the power cables from the twisted-pair cables, this separation surface should be solid metal.

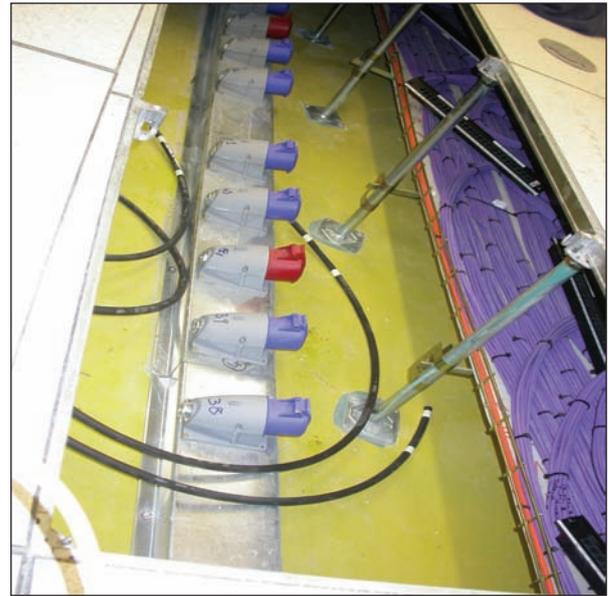
Quantity of circuits	Electrical Circuit Type		Separation Distance (mm)	Separation Distance (in)
1 - 15	20A 110/240V 1-phase unshielded	shielded or unshielded	Refer to 569B annex C	Refer to 569B annex C
16 - 30	20A 110/240V 1-phase shielded		50 mm	2 in
31 - 60	20A 110/240V 1-phase shielded		100 mm	4 in
61 - 90	20A 110/240V 1-phase shielded		150 mm	6 in
91+	20A 110/240V 1-phase shielded		300 mm	12 in
1+	100A 415V 3-phase shielded feeder		300 mm	12 in

Table 4: TIA 942 cable segregation

Conclusion

Connectix recommends that:

- Power and data cables are installed with a 200 mm separation wherever possible
- A 600 mm separation should be maintained between data and three phase power cables
- Where 200 mm separation isn't possible then the reduced distances of Table 3 may be used
- A 50 mm separation must be included as defined in BS 6701
- A suitably earthed armoured power cable may be considered as 'screened' for the purposes of cable segregation
- Failure to observe the above rules may lead to non compliance with The Electricity at Work Regulations 1989 and the EMC Regulations 2006 (SI 2006/3418) July 2007
- Failure to observe the above rules may lead Connectix to withdraw any terms of Warranty associated with their cabling products



Final phase of installation. IEC 309 16A and 32A sockets positioned on steel trunking with pre-terminated data cables in tray work.

UK Head Office:
Connectix Limited
33 Broomhills Industrial Estate
Braintree, Essex CM7 2RW