Technical & Technology Development

MAKING ELECTRICAL TECHNOLOGY WORK - SAFELY

Technical & Technology Development

RECOMMENDED CABLE SEPARATIONS TO BS EN 50174 PART 2

ECA
The Electrical Contractors' Association

Introduction

When designing an Information Technology installation, it is normal to take into consideration the separation distances for the different types of cabling utilised within the installation. Consideration should be given to the segregation of sensitive equipment from general power circuits, e.g. controls and information technology cables from power supply cables and lighting.

This guidance leaflet sets out the minimum recommendations for separation distances when installing data cables. However, it must be borne in mind that particular manufacturers' recommendations, client specifications or contractual arrangements should take precedence. If this is the case, then separation distances may have to be adjusted accordingly.

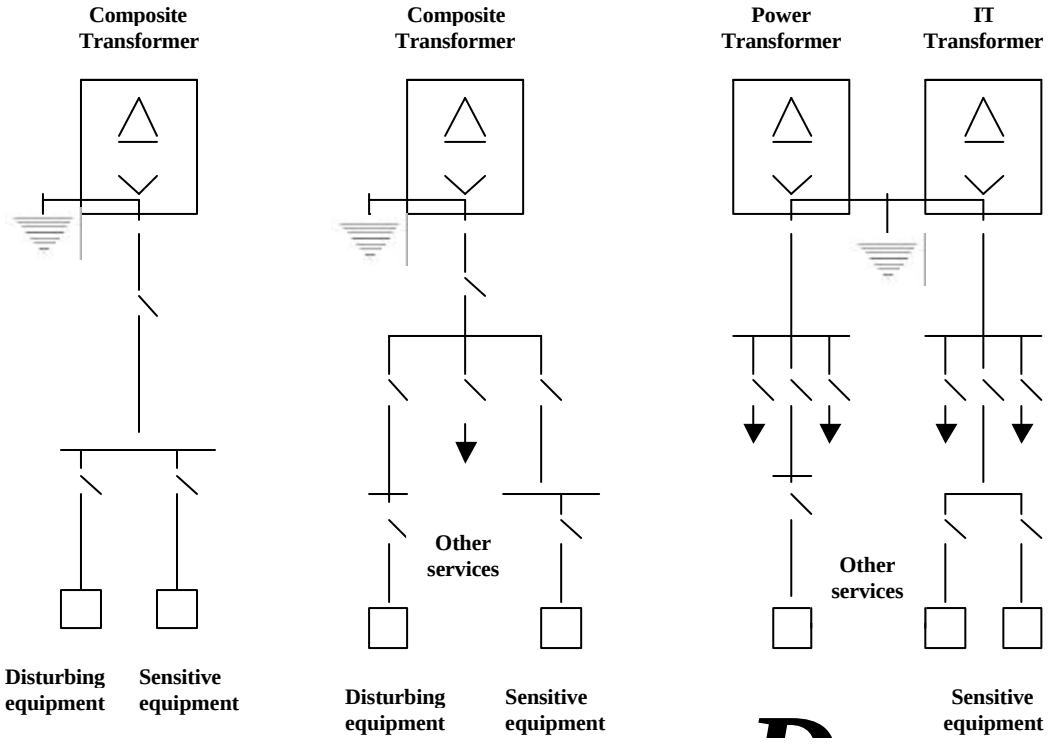
When the requirements for the segregation of sensitive equipment and cables are being considered for an installation, the design information can be found in the series of standards EN 50310, EN 50173, EN 50174 part 1, part 2 and part 3.

Separation of Sensitive Equipment

This is the separation of any interfering equipment from sensitive equipment, which is often the separation of linear loads and non-linear loads. There are different ways of achieving this, however, the basic guideline should be to gain the maximum segregation between the sensitive equipment circuit and general equipment.

As can be seen in 'Figure 1' the best solution is to have the sensitive equipment on a completely isolated supply by use of a separate phase or UPS, this is the best solution. However it is understood that this is not always possible.

FIGURE 1
Separation of Sensitive Equipment



(A) Is the sharing the final sub circuits, (B) the sensitive equipment is on separate sub circuit and (C) the sensitive equipment on a separate supply.

The designers of the electrical installation should also consider the following points to prevent the electricity distribution systems adversely influencing sensitive equipment:

1) Where are any potential sources of interference e.g., lifts, power transformers, variable speed drills and high electrical current busbars or HT equipment?

2) Metal pipes (e.g. for water, gas, heating) and cables should enter the building at the same place and be connected to the main equipotential bonding of the building.

3) Metal sheets and metal pipes should be bonded to the main equipotential bonding of the building with low impedance conductors (see BS 7671 for details).

4) The choice of a common route through the building for power and signal cable with the best possible separation (by distance and/or screening) to avoid large inductive loops formed by different power cabling systems.

5) It is recommended to use either one single multi-core cable for power supply purposes or – in cases of higher current levels, a busbars system with low-level magnetic fields.

6) The necessary separation (distance or screening) between power and Information Technology cables must be provided.

7) Power and Information Technology cables must cross over at right angles and use a bridge where necessary.

8) Power cabling systems which use single core conductors should ideally be enclosed in bonded steel metallic enclosures or conduits.

Segregation of Power Supply Cables and Information Technology Cables

When installing Information Technology cables and power supply cables which share the same cable management systems, or building voids, security, safety, and EMI must be taken into consideration. Of these, safety must always have the highest priority and as such BS 7671 - IEE Wiring Regulations shall be followed as an absolute minimum.

When a route is being designed the following should be taken into consideration:

1) The immunity level of all equipment connected to the Information Technology cabling system to different electromagnetic disturbances (transients, lightning pulses, bursts, ring wave, continuous waves, etc.).

2) The distances that the cables will run in parallel (coupling zone).

3) The type of cables to be used.

4) The local electromagnetic environment (simultaneous appearance of disturbances, e.g. harmonics, plus bursts, plus continuous wave).

5) The distances that the cables run in parallel (coupling zone).

6) The quality of the attachment between the connectors and the cable.

7) The coupling attenuation of the cables.

8) The connection of the equipment to the earthing system.

9) The type and the installation of the cable management system.

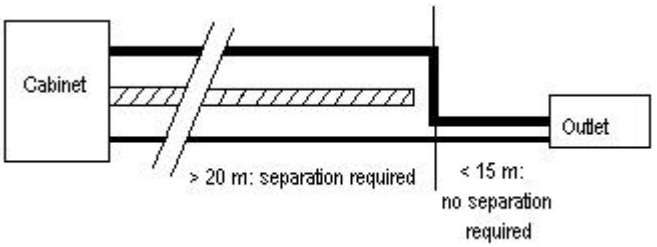
Table 1 – Information Technology Cable Separation from Power Cabling

Type of Installation	Distance A		
	Without divider or non-metallic divider[1]	Aluminium divider	Steel divider
Unscreened power cable and unscreened IT cable	200 mm	100 mm	50 mm
Unscreened power cable and screened IT cable[2]	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[2]	0 mm	0 mm	0 mm
1) It is assumed that in case of metallic divider, the design of the cable management system will achieve a screening attenuation related to the material used for the divider. **2) The screened IT cables shall comply with EN 50288 series.**			

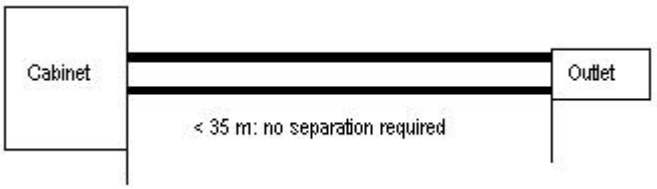
The distances given in 'Table 1' must be used for the separation of backbone cabling from end to end. However, for horizontal cabling where the final circuit length is less than 35 meters no separation is required in the case of screened cabling.
For lengths greater than 35 meters, the separation shall apply to the full length, excluding the final 15 meters before it is attached to the outlet. See figure (2).

FIGURE 2

a)



b)



NOTE: The "no separation required" notation is referring to additional EMI protection only and not to the safety requirements of the IEE Wiring Regulations, which still need to be adhered to.

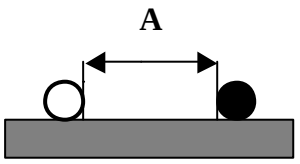
A practical example of a) would be the first 35 meters of the horizontal cabling running on a cable tray above a ceiling to an office area, where it then drops down to a twin compartment plastic dado trunking for the last 15 meters.

A practical example of b) would be the installation of high-density data outlets in a server room, locally to a cabinet where the cabling runs in a large twin compartment plastic dado trunking around the room.

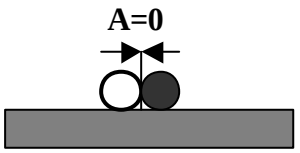
Figures 3 and 4 illustrate the requirements of 'Table 1'for both parallel cable runs without dividers (Figure 3) and with dividers (Figure 4):

FIGURE 3
Examples of Information Technology Cables and Power Cables that are run parallel without a divider

a)



b)

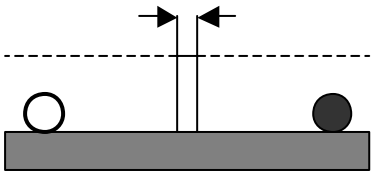


c) The minimum distance 'A' in Figure 3a) is the worst situation between fixing points.

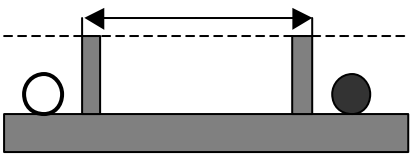
d) Where fixing's are not provided, Figure 3b) or other physical restraints, such as a divider system are not present, as in loose laid cables under a floor, the separation distance 'A' shall be assumed to be 0 mm.

FIGURE 4
Examples of Information Technology Cables and Power Cables that run parallel with a divider

a) Minimum assumed distance
A = divider thickness



b) A = distance between divider



c) Where cables are installed in <u>adjacent compartments</u> of a cable management system (e.g. 3 compartment trunking) that incorporates more than one divider, the minimum separation between cables must be assumed to be equal to the distance 'A' the thickness of the dividers, (Figure 4a) unless cable fixing is provided.

d) Where cables are installed in non-adjacent compartments of a cable management system (e.g. 3 compartment trunking) that incorporates more than one divider, the minimum separation between cables must be assumed to be equal to the distance 'A' between the dividers, (Figure 4b) unless cable fixing is provided.

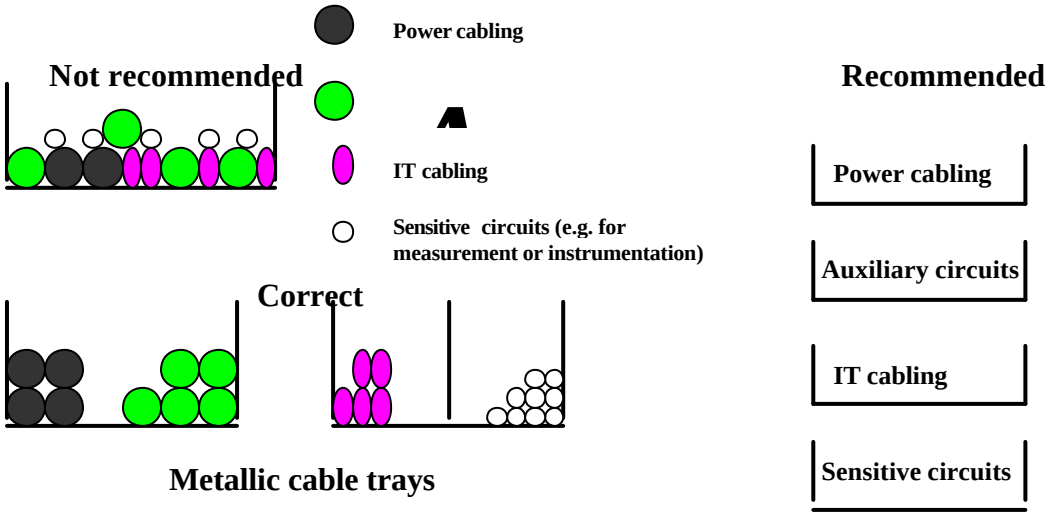
e) The minimum distance between fluorescent**,** neon, and mercury vapour (or other high-density high-frequency discharge) lamps and Information Technology cables shall be 130mm.

f) Electrical wiring and data wiring should ideally be in separate cabinets. Data wiring racks and electrical equipment should always be separated in accordance with BS 7671, the IEE Wiring Regulations.

g) Cables for different purposes should not be in the same bundle (e.g. mains power and Information Technology cables).

h) Different bundles should be separated electromagnetically from each other.

FIGURE 5
Separation of Cables in Cable Management Systems



Cable Containment

Cable management systems are available in metallic and non-metallic forms. Some metallic materials offer an improved protection from EMI. The cable management system, if conductive, must provide a continuous, efficient conducting metallic structure over its full length to ensure that it can take effect as a parallel-earthing conductor (PEC). All metallic parts must be electrically well bonded to the earthing system (see EN 50310).

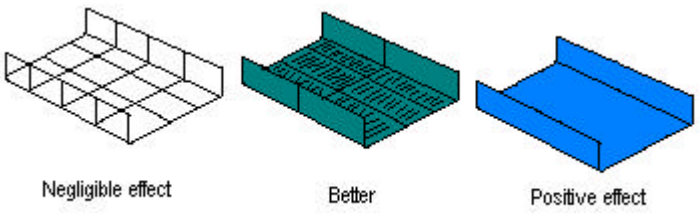
The choice of material and the shape should be selected depend on the following considerations:

1) The strength of any electromagnetic fields along the pathway (e.g. the location of any disturbing sources);
2) The type of cabling (optical fibre, screened, twisted pair,);
3) The immunity of the equipment connected to the Information Technology cabling system;
4) Any other environmental constraints (chemical, mechanical, climatic, heat, etc.).
5) Any allowance for the future expansion of the Information Technology cabling system.

Non-metallic cable management systems are only suitable where the electromagnetic environment has a permanently low level of disturbance, the cabling system has a low emission level, or where optical fibre cabling is used.

Where metallic system components are used, the shape (flat, U-shape, tube, etc.), rather than the cross section will determine the characteristic impedance of the cable management system. Enclosed shapes are the best (by reducing the Common Mode coupling). Trays often have slots for easy attachment of cables and those that are most effective in shielding from EMI are those with a small slot, parallel to the axis of the tray. Those with slots perpendicular to the tray axis have a very limited effect.

FIGURE 6
Cable Management Systems



Earthing and Bonding for Information Technology Systems

Without adequate earthing and bonding the effectiveness of other mitigation methods will be impaired.

The terms ‘earthing’ and ‘bonding’ are often confused. Earthing is defined in BS 7671 as: “The act of connecting exposed-conductive-parts of an installation to the main earthing terminal of an installation”. Equipotential bonding is defined as “Electrical connection maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential” (N.B. referred to as bonding throughout this document).

It is important to note at this point that the primary function of an earthing network is for safety. Safety must take precedence over any mitigation methods that are implemented to reduce the EMI in the environment.

When making bonding connections between earthed metal conductors it is important to take account of a number of environmental factors to ensure a successful long-term connection:

Temperature
Humidity
Vibration
Mechanical Damage
Corrosion

It is also essential that when making the connection the contact surfaces should be clean, i.e. free from grease, paint, corrosion, insulating materials and any other effect that may cause a high contact resistance. This is a practical point to note when bonding to cabinets, cable trays, trunking etc. that have protective painted coatings applied during manufacture.

When bonding connections are made it is important that compatible metals are used, to minimise the effects of corrosion that would inevitably lead to a deterioration of the initial low contact impedance.

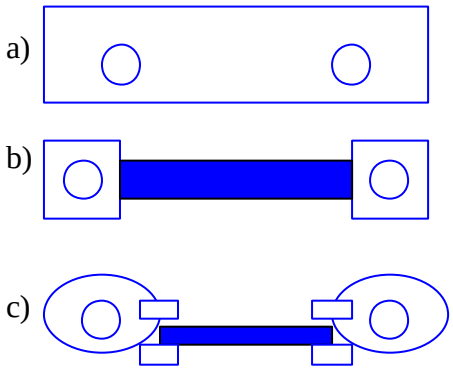
Two ways of achieving good bonding connections are:

i. Ensure that earthing contact areas are of the same or similar contact potentials; and
ii. Use a grounding strap or fastening of intermediate contact potential to separate the two (this, for direct contact, would take the form of plating one of the metallic contacts or for indirect contact a bonding strip with an intermediate contact potential).

For low-impedance bonding, the length of the strap between the apparatus and the earthing network should be a minimum. In practice, this implies that apparatus should always be connected to the nearest earthing network conductor.

For bonding straps, suitable conductors include metal strips, metal (7a) mesh straps (7b) or round cables (7c). Yet, round cables are not effective above 10 MHz, because they have higher impedance than flat conductors with the same material cross-section:

FIGURE 7
Examples of bonding straps
(the length to width ratio for these straps should be five or less)



For cable terminations the most effective bonding is to have a 360º peripheral connection around the shield. The best to worst methods are shown at figure 8.

Cable Screening & Termination

As well as the implementation of effective earthing and bonding, it is important to consider the most appropriate cable screen and its correct termination.

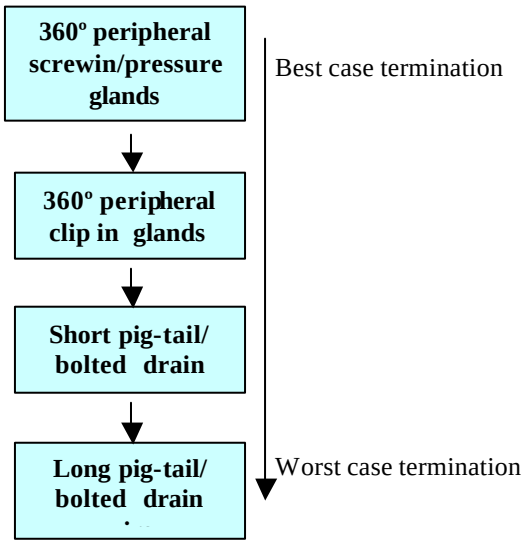
Table 2 - Types of Cable Screens

Cable type	**Noise reduction**	
	50 Hz magnetic	**RF**
Plain (no screen, no twist)	None	None
Twisted pair	Good	None
MICC	None	Good
Twisted pair MICC	Good	Good
Plain in steel trunking or conduit	Good	Good
Plain with braid or metal tape screen	None	Good
Twisted pair with braid or metal tape screen	Good	Good
Steel wire armoured	Good	Good
Plain in correctly designed and installed aluminium trunking or conduit	None	Good
Twisted pair in correctly designed and installed aluminium trunking or conduit	Good	Good

Remember that the best screen without good bonding is ineffective in most situations.

As stated previously, the effectiveness of the cable screen will be significantly reduced if it is not terminated correctly. The following diagram (figure 3) gives a best to worst case of termination methods.

FIGURE 8
Best to worst case cable screen termination



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