

# Installation Practices for Screened Cabling

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*A brief tutorial on requirements & best practices defined by:*

*ISO/IEC 11801 Generic Cabling Systems*

*ISO/IEC 14763-2 Planning & Installation of Cabling Systems*

*CENELEC EN 50174-2 Installation Planning & Practices for Cabling Inside Buildings*

Much knowledge and experience has come from Europe,  
where screened cabling has been deployed for many years.



ISO/IEC 11801

Edition 2.1 2008-05

# INTERNATIONAL STANDARD

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**Information technology –  
Generic cabling for customer premises**



ISO/IEC 11801:2002+A1:2008(E)

## 11 Screening practices

### 11.1 General

This clause applies when screened cables or cables with screened elements or units are used. Only basic guidance is provided. The procedures necessary to provide adequate earthing for both electrical safety and EM performance are subject to national and local regulations, always to proper workmanship in accordance with ISO/IEC TR 14763-2, and in certain cases to installation specific engineering. Some cabling employs components that utilise screening for additional crosstalk performance and is therefore also subject to screening practices. Note that a proper handling of screens in accordance with ISO/IEC TR 14763-2 and suppliers' instructions will increase performance and safety.

### 11.2 Electromagnetic performance

Cabling screens should be properly bonded to earth for electrical safety and to optimise EM performance. All cabling components which form part of a screened channel should be screened and meet the screening requirements given in Clauses 9 and 10. Screened cabling links shall meet cabling screening requirements given in 6.4. Cable screens shall be terminated to connector screens by low impedance terminations sufficient to maintain screen continuity necessary to meet cabling screening requirements. Suppliers' instructions as how to make low impedance terminations shall be asked for and observed. Work area, equipment cords and the equipment attachment should be screened and if so, shall provide screen continuity.

## ISO/IEC 11801 Clause 9 (Cable) & Clause 10 (Connector) Screening Requirements

### 9.2.2.7 Coupling attenuation

Refer to 3.3.9 of IEC 61156-5 with the additional requirement, that for screened cables type II shall be met.

### 9.2.2.8 Transfer impedance

Screened cables shall meet the requirements of grade 2 in table 2 of IEC 61156-5.

**Table 53 – Transfer impedance (screened connectors only)**

Electrical characteristics	Frequency MHz	Requirement			Test standard
		Connector category			
		5	6	7	
Maximum transfer impedance $\Omega$	1 to 10	$0,1 f^{0,3}$	$0,1 f^{0,3}$	$0,05 f^{0,3}$	IEC 60512-25-5
	10 to 80	$0,02 f$	$0,02 f$	$0,01 f$	
Maximum transfer impedance at key frequencies $\Omega$	1	0,10	0,10	0,05	
	10,0	0,20	0,20	0,10	
	80,0	1,60	1,60	0,80	

### 11.3 Earthing

Earthing and bonding shall be in accordance with applicable electrical codes or IEC 60364-1. All screens of the cables shall be bonded at each distributor. Normally, the screens are bonded to the equipment racks, which are, in turn, bonded to building earth.

NOTE High working frequencies and/or high frequencies of parasitic currents or fields require earthing with low impedance, which may be realised with a meshed system.

The bond shall be designed to ensure that

- a) The path to earth shall be permanent, continuous and of low impedance. It is recommended that each equipment rack is individually bonded, in order to assure the continuity of the earth path.
- b) The cable screens provide a continuous earth path to all parts of a cabling system that are interconnected by it.

This bonding ensures that voltages that are induced into cabling (by any disturbances from power lines or any other disturbers) are directed to building earth, and so do not cause interference to the transmitted signals. All earthing electrodes to different systems in the building shall be bonded together to reduce effects of differences in earth potential. The building earthing system should not exceed the earth potential difference limits of 1 V r.m.s. between any two earths on the network.



ISO/IEC 14763-2

Information technology

# INTERNATIONAL STANDARD



Information technology — Implementation and operation of certified systems  
— Part 2: Planning and execution



# 7.9 Segregation of information technology cabling and mains power cabling

## 7.9.1 General

This subclause specifies segregation requirements and recommendations for unscreened and screened cables in accordance with the IEC 61156 series (together with other balanced and unbalanced, including coaxial, cables) with respect to electromagnetic interference from mains power supply cabling. Where appropriate, the requirements and recommendations are specific to particular cable specifications.

**Table 8 – Classification of information technology cables**

Information technology cable				Segregation Class
Screened	Unscreened	Coaxial/wireless		
Coupling attenuation at (30 to 100) MHz dB	TCL at (30 to 100) MHz dB	Screening attenuation at (30 to 100) MHz dB		
>80 (see Note 1)	>70 - 10 × lg f	>85 (see Note 5)		d
>85 (see Note 2)	>80 - 10 × lg f	>85		c
>90 (see Note 3)	>80 - 10 × lg f	>90		b
>95	>90 - 10 × lg f	>95		a

NOTE 1 Category 5, 6, 6A, 7 and 7A cables meeting the Type Ia coupling attenuation requirements of IEC 61156-5 and IEC 61156-6 meet segregation Class "d".

NOTE 2 Category 5, 6, 6A, 7 and 7A cables meeting the Type II coupling attenuation requirements of IEC 61156-5 and IEC 61156-6 meet segregation Class "c".

NOTE 3 Category 5, 6, 6A, 7 and 7A cables meeting the Type III coupling attenuation requirements of IEC 61156-5 and IEC 61156-6 meet segregation Class "b".

NOTE 4 Category 5, 6, 6A, 7 and 7A cables meeting the Level 2 TCL requirements of IEC 61156-5 and IEC 61156-6 meet segregation Class "a". These cables may deliver performance of segregation Class "c" or "d" provided that the relevant requirements are also met.

NOTE 5 Cables in accordance with IEC 61196-7 (ISO/IEC 15018, Category BCT-C) meet segregation Class "d".

**Table 9 – Minimum separation S**

Segregation Class (from Table 8)	Free space separation (i.e. without electromagnetic barrier) mm	Containment applied to information technology or mains power cabling		
		Open metallic containment (NOTE 1) mm	Perforated metallic containment* (NOTE 2) mm	Solid metallic containment (NOTE 3) mm
d	10	8	5	0
c	50	38	25	0
b	100	75	50	0
a	300	225	150	0

a The upper surface of installed cables shall be at least 10 mm below the top of the barrier.

NOTE 1 Screening performance (DC to 100 MHz) equivalent to welded mesh steel wire mesh cable tray of mesh size 50 mm × 100 mm (excluding cable ladders). This screening performance is also achieved with a steel cable tray of less than 1.0 mm wall thickness and/or more than 20 % equally distributed perforated area.

NOTE 2 Screening performance (DC to 100 MHz) equivalent to a steel cable tray of at least 1.0 mm wall thickness and no more than 20 % equally distributed perforated area. This screening performance is also achieved with screened power cables that do not meet the performance defined in Note 3.

NOTE 3 Screening performance (DC to 100 MHz) equivalent to a steel conduit of 1.5 mm wall thickness. Specified separation is in addition to that provided by any divider/barrier.

**Table 10 – Power cabling factor P**

Electrical circuit type (see 7.3.3)	Quantity of circuits	Power cabling factor "P" (see 7)
20 A 230 V 1-phase	1 to 3	0.2
	4 to 6	0.4
	7 to 9	0.6
	10 to 12	0.8
	13 to 15	1.0
	16 to 19	2
	31 to 45	3
	46 to 60	4
61 to 75	5	
>75	8	

a The power cabling factor shall be used as a multiplier for the calculation of distance A from Table 9.

b 3-phase cables shall be treated as 3 off 1-phase cables.

c More than 20 A shall be treated as multiples of 20 A.

d Lower voltage AC or DC power supply cables shall be treated based upon their current ratings, i.e. a 100 A 50 V DC cable = 5 off 20 A cables (P = 0.4).

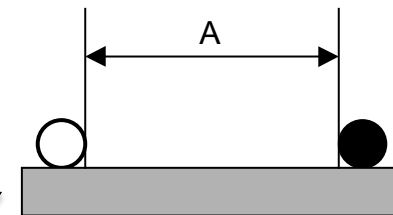
Segregation Class = "a"  
(from Table 8)

Select containment  
(from Table 9)

Determine S  
(from Table 9)

Determine P  
(from Table 10)

Separation  
 $A = S \times P$



● = mains power cabling  
○ = information technology cabling



### **7.10.3 Screened cabling**

The cabling shall be terminated in accordance with 8.10.3.

The screen shall be continuous at and between connectors providing the connection to the application-specific equipment via a cabling channel.

### **8.10.3 Screened balanced cabling**

Cable screens shall be terminated at each termination point. Balanced cabling screens shall be terminated in accordance with the connecting hardware manufacturer's instructions to maintain the intended performance of the cable screen termination to the connecting hardware.

Where instructions for termination of cables are not available from the manufacturer/supplier of the connecting hardware, the conductive surface of the cable screen shall be terminated to conductive surface of the connector screen.

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 50174-2:2009+A1**

February 2011

ICS 35.110; 91.140.50

Incorporating corrigendum April 2011

English version

**Information technology -  
Cabling installation -  
Part 2: Installation planning and practices inside buildings**

Technologies de l'information -  
Installation de câblages -  
Partie 2: Planification et pratiques  
d'installation à l'intérieur des bâtiments

Informationstechnik -  
Installation  
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Teil 2: Installationsplanung  
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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

#### 4.7.1.2 Screened cabling

The installation of the cabling shall be in accordance with 5.3.6.3.

The screen shall be continuous from the transmitter to the receiver.

The planning of the installation shall consider the effect that the earthing of the cabling screen has on the electromagnetic performance of the screened cabling. Independent of earthing for the purposes of safety:

- a) where the screen is earthed at one end only the screening effectiveness for low frequency electrical fields depends upon the performance of the cable screen;
- b) additional screening effectiveness is provided against high frequency electromagnetic fields if the screen is earthed at both ends.

NOTE 1 The connection of equipment to installed screened cabling which has been earthed at one end only may result in the system becoming earthed at both ends.

Special materials (e.g.  $\mu$ -metal, Permalloy etc.) are typically required to improve screening performance at very low frequencies magnetic fields (e.g. 50 Hz).

NOTE 2 Further information is provided in Annex A.

## **5.3.6 Jointing and termination of cables**

### **5.3.6.1 General**

Cables shall be jointed or terminated in accordance with the instructions provided by the manufacturer/supplier of the connecting hardware. If special tools are required for jointing or termination, then only those recommended by the manufacturer shall be used.

Cable elements not terminated within connecting hardware shall be treated as detailed in the installation specification.


Sharp bending that would compromise transmission performance of cables shall be avoided.

Following jointing or termination, the cable elements shall be arranged within the closure in a manner that allows access to individual connectors, joints and cable elements with minimal disruption to neighbouring components during subsequent repair, expansion or extension of the installed cabling.

The presentation of cable elements within joints, terminating and connecting hardware and closures shall be in accordance with the installation specification.

### 5.3.6.3 Screened cabling

The cable screen shall totally surround the cable along its entire length (a screening contact applied only through the drain wire has little effect at high frequencies).

Cable screens shall be terminated at each termination point to maintain the intended performance of the cable screen termination of connecting hardware. Where instructions for termination of a specific cable are not available from the manufacturer/supplier of the connecting hardware: 

- a) special attention shall be paid to the assembly of connection elements. The screen contact shall be applied over 360 degrees according to the Faraday cage principle. The screening connection shall be of a low impedance design;
- b) the screening shall continue through an appropriate screen connection; normal pin contacts alone shall not be used;
- c) discontinuities in the screening shall be avoided: e.g. even small holes in the screen, pigtails or loops;  
NOTE Discontinuity dimensions of the order of 1 % to 5 % of the wavelength can reduce the overall screening effectiveness.
- d) screen connections shall be firmly fixed, for instance by strapping or clamping;
- e) screens shall not be used as a strain relief;
- f) screens shall be bonded in accordance with the installation specification and additional planning information (see 4.7);
- g) screen connections shall be safeguarded against corrosion and a good electrical contact between all parts is ensured (maintenance periods may be dependent upon the environment, see EN 50174-1).

## Where to Obtain Copies?

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