

Document Source:
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Date: 11th January 2009

SID-002

Standards Interpretation Document

EARTHING OF CABINETS, FRAMES AND RACKS

Foreword

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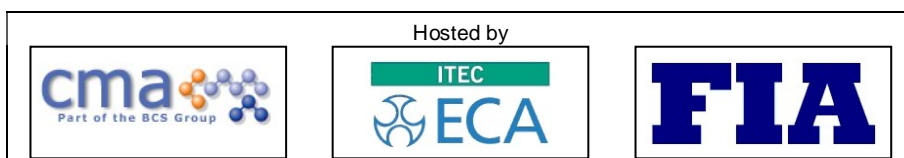


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50 **1 Introduction**

51 The earthing of telecommunications infrastructures is handled in a number of standards, all of which are applicable in the
52 United Kingdom, but most of these address the topic from a specific viewpoint and can appear contradictory.

53
54 With regard to the earthing of cabinets/frames/racks containing, or intended to contain, telecommunications equipment
55 and cabling, installers need to have clear guidance based on accurate interpretation of these standards which is
56 endorsed by the relevant standard bodies.

57
58 This Telecommunications Infrastructure Advisory Board SID contains interpretation of published standards covering the
59 earthing arrangements for cabinets/frames/racks containing, or intended to contain, telecommunications equipment and
60 cabling and:

- 61
- 62 • explains the circumstances under which earthing is required;
 - 63 • provides guidance to the minimum requirements for protective earth conductors;
 - 64 • allows users, consultants and installers to identify any potential or actual non-compliance with the published
65 standards and act accordingly.

66 The specific standards subject to interpretation within the document are BS 6701:2010, BS EN 50174-1:2009, BS EN
67 50174-2:2009 and BS EN 50310:2010 together with together with electrical system standard HD 60364-4-444 (which will
68 form the basis of a future BS 7671 section 444).

69
70 This document provides interpretation of published standards which is intended to be submitted to checking and
71 endorsement by the BSI Technical Committee, or equivalent, responsible for the production of the standards that are
72 subject to TIA-B interpretation.

73

74 **2 Scope**

75 This Telecommunications Infrastructure Advisory Board SID contains interpretation of published standards covering the
76 earthing arrangements for telecommunication cabling infrastructures,

77
78 This Telecommunications Infrastructure Advisory Board SID contains interpretation of the following published standards
79 covering earthing arrangements of cabinets/frames/racks containing, or intended to contain, telecommunications
80 equipment and cabling:

- 81
- 82 • BS 6701:2010;
 - 83 • BS EN 50174-1:2009;
 - 84 • BS EN 50174-2:2009;
 - 85 • BS EN 50310:2010;
 - 86 • CLC HD 60364-4-444:2010.

87 CLC HD 60364-4-444 is the European Harmonisation Document that provides source material for a future clause 444 of
88 BS 7671 (17th Edition of the IEE Wiring Regulations).

89

90 **3 References**

91 The following referenced documents are indispensable for the application of this document. For dated references, only
92 the edition cited applies. For undated references, the latest edition of the referenced document (including any
93 amendments) applies.
94

BS 6701:2010	<i>Telecommunications equipment and telecommunications cabling – Specification for installation, operation and maintenance</i>
BS 7671:2008	<i>Requirements for electrical installations – IEE Wiring Regulations – Seventeenth edition</i>
BS EN 50174-12009	<i>Information technology – Cabling installation – Installation specification and quality assurance</i>
BS EN 50174-2:2009	<i>Information technology – Cabling installation – Installation planning and practices inside buildings</i>
BS EN 50310:2010	<i>Application of equipotential bonding and earthing in buildings with technology equipment</i>
CLC HD 60364-4-444:2010	<i>Low-voltage electrical installations – Part 4-444: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances</i>
CLC HD 60364-5-54:2007	<i>Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors</i>

95

96 **4 Terms, definitions and abbreviations**

97 **4.1 Terms and definitions**

98 For the purposes of this British Standard, the terms and definitions given in BS 6701, BS EN 50174 (all parts) and
99 BS EN 50310 apply.
100

100

101 **4.2 Abbreviations**

102 For the purposes of this British Standard, the terms and abbreviations given in BS 6701, BS EN 50174 (all parts) and
103 BS EN 50310 apply.
104

105 **5 Background**

106 The requirements for the protective earthing of cabinets, frames and racks are not considered in this document. They
107 are contained within the relevant sections of BS 7671.

108
109 The objective of this document is to provide interpretation of the specific earthing requirements of those items in support
110 of the effective operation of telecommunications cabling and equipment contained within them.

111
112 The primary standard in the UK covering the installation and operation of both telecommunications cabling and
113 equipment is BS 6701. This standard simultaneously requires conformance with BS 7671 and BS EN 50174 documents
114 both of which demand conformance with BS EN 50310.

115
116 The original editions of EN 50174-1 and EN 50174-2 have been substantially revised and were published as BS EN
117 50174-1 and BS EN 50174-2 in 2009.

118
119 At the time of publication of this document:

- 120 • BS 6701:2004 (published after, and in response to, the introduction of the original editions of BS EN 50174-1 and
121 BS EN 50174-2) is now being revised, without major technical change, as BS 6701:2010;
122 • EN 50310 is being revised as Edition 3 and BS EN 50310 will be published in 2010.

123
124 The revision of EN 50310 represents a major step forward in both clarity and usability of the standard for the following
125 reasons:

- 126 1. BS EN 50310:2006 stated requirements for an ideal equipotential earthing system based on the presence of a
127 protective earthing system in the form of a common bonded network. However, many premises do not have such a
128 sophisticated protective earthing system and may instead feature star, ring or local mesh protective earthing
129 networks or combinations of these.
130 2. The 2009 revisions of EN 50174-1 and EN 50174-2 have made BS EN 50310 a normative requirement (i.e.
131 conformance to EN 50310 is automatically required in order to claim conformance to the EN 50174 documents).
132 This forced the revision of BS EN 50310:2006 in order to ensure that it could be applied in all circumstances i.e.
133 irrelevant of the protective earthing systems present in the premises.
134 3. As a result of this revision BS EN 50310:2010 states requirements and recommendations for the improvement all
135 types of protective earthing system in order to support the effective operation of telecommunications cabling and
136 equipment within premises.

137
138 At the same time, BS 7671 is being supplemented by a new section 444, which is based on, although not necessarily
139 identical to, CLC HD 60364-4-444 (please note that neither of these two documents is the same as IEC 60364-4-444 –
140 there are some radical differences and IEC 60364-4-444 is irrelevant for the purposes of this document). Much of the
141 content of CLC HD 60364-4-444 is founded on the contents of both EN 50174:2009 documents and EN 50310.

142
143 NOTE A CLC HD differs from a CLC EN in that an:
144 a) an EN has to be published by all CENELEC (CLC) member countries “as is” and is supposed to be identical in all countries
145 (albeit potentially suffering from risk of translation);
146 b) a HD is the foundation of other national standards which, although not conflicting with the HD, may contain more stringent
147 or additional requirements.

148 **6 Summary of requirements and recommendations**

149 The future section 444 of BS 7671 entitled “Measures against electromagnetic disturbances” requires conformance to BS
150 6701, BS EN 50174 series and BS EN 50310, “where appropriate”. It is assumed that the meaning of the words “where
151 appropriate” are used not to be vague in terms of application but to indicate that the referenced standards only cover
152 some areas of within the scope of section 444.

153
154 Therefore, the requirements referenced in clause 7 of this document apply.

155
156 However, EN 50310:2010 will defer the need for equipotential bonding connections between the available protective
157 earthing network and “all cabinets, frames and racks containing, or intended to contain, information technology
158 equipment or metallic information technology cable” to the relevant national or local regulation based on HD 60364.

159
160 Clause 8.3 of this document contains the HD 60364-4-444 statements related to the need to apply equipotential bonding
161 to cabinets, frames and racks. In the UK this text (or equivalent) would be expected to be found in section 444 of BS
162 7671 (which is to be based on HD 60364-4-444). However, the latest draft of the future section 444 of BS 7671 does not
163 contain the relevant contents of HD 60364-4-444. If this continues to be the case, a national foreword to BS EN 50310
164 will be required to state a requirement in relation to HD 60364-4-444 as described in 8.3 .
165

166 **7 Requirements of EN 50310:2010**

167 EN 50310:2010 will require that “all protective earthing and equipotential bonding conductors shall comply with the safety
168 requirements according to HD 60364-5-54”. HD 60364-4-444:2010 contains a similar requirement by stating that “the
169 cross sectional areas of the protective conductor shall be chosen according to HD 60364-5-54:2007, Section 543” but
170 goes on to add its own minimum requirements (see clause 8.2).

171
172 Whether or not single or multiple bonding conductors are required between the cabinet, frame or rack and the protective
173 earthing network depends on the length of the required bonding conductors.

174
175 The break-points into EN 50310:2010 are 6 metres and 3 metres. The design requirements for single or multiple bonding
176 conductors are dependent on the type of protective earthing network at the location of cabinet, frame or rack.

177
178 EN 50310:2010 will state that:

179
180 **In all cases** the conductor (independent of cross-sectional area or shape) shall either:

- 181 a) be no greater than 6 m long, or;
182 b) n conductors shall be installed where $n = L (m)/6$ if the required length (L) of the conductor is greater than 6
183 m (due to the location of the points to be connected).

184
185 **If the conductors are part of the recommended improvements to local or common mesh bonded**
186 **networks** then the conductor (independent of cross-sectional area or shape) shall either:

- 187 a) be no greater than 3 m long, or;
188 b) n conductors shall be installed where $n = L (m)/3$ if the required length (L) of the conductor is greater than 3
189 m (due to the location of the points to be connected).

190
191 Conductors in accordance with HD 60364-4-444 provide satisfactory d.c. performance (*this provision further*
192 *links EN 50310 to HD 60364-4-444*).

193
194 There is a great deal of confusion about the cross-sectional areas of these conductors with “apocryphal” statements of
195 length/width/thickness being promoted in many areas. EN 50310:2010 will provide clarity in this area based on the
196 following:

- 197 • above lengths of 1.0 m the only relevant parameter of the conductor is its length, independent of cross-sectional
198 dimensions or area. The critical factor is the inductance of the bonding conductor and this equates to approximately
199 1 uH per metre length.
200 • below 1.0 m, the cross-sectional dimensions and area are important and EN 50310:2010 will recommend that the
201 length:width ratio of bonding conductors should not exceed 5:1. Such bonds are not implemented for the

connections of cabinets, frames or racks to the protective earthing network depends but may be relevant inside the cabinets, frames or racks.

Equally confusing are the various assumptions regarding cross-sectional area of bonding conductors. EN 50310:2010 will provide clarity in this area based on the following:

- the effectiveness of an equipotential bonding conductor cannot be improved by increasing its cross-sectional area;
- instead multiple bonding conductors are required;
This is the reason behind the statements in the bullets (b) in the text above which require the installation of n conductors if the lengths of the conductors exceed a specified value. This is similar to the effect of installation of parallel resistors.
- it is necessary to physically separate these “parallel” bonding conductors. Ideally they need to be separated by at least 150 mm over their entire length but this may be impractical.

As a result, EN 50310:2010 will state that “Where multiple bonding conductors are installed they shall be separated by at least 150 mm except where physical constraints (e.g. points of connection or routes through building structures) force a reduction of this separation. The lengths over which this separation is not provided shall be minimised.”

8 Requirements of HD 60364-4-444

8.1 General

Clause 444.5.7.Z1 of HD 60364-4-444 contains the remainder of the requirements for the earth connection to “communications cubicles/cabinets and racks”. The terms cubicles/cabinets and racks should be considered to synonymous with telecommunications cabinets, frames and racks. There is no restriction to the cabinets, frames and racks having to contain, or being intended to contain, information technology equipment or metallic information technology cable – but this has to be assumed to be the intention.

8.2 Additional requirements for bonding conductors

The requirements of clause 444.5.7.Z1 of HD 60364-4-444 are:

- the cross sectional areas of the protective conductor shall be chosen according to HD 60364-5-54:2007, Section 543 and the cross-sectional area of the conductor shall not be less than the following:
 - 4 mm² for a cabinet smaller or equal to 21U;
 - 16 mm² for a cabinet larger than 21U;
 - 25 mm² to an earthing bar for multiple cabinet locations;
- the bonding conductor shall not be coiled or doubled back on itself.

8.3 Are bonding conductors required?

The requirements of clause 444.5.7.Z1 of HD 60364-4-444 are:

- each cabinet shall be connected to the earth separately;
- where multiple cabinets are located within one area, an earthing bar shall be fitted within the area.
The length of the earthing bar shall be sufficient for the immediate requirements and have at least a 20 % allowance for future growth. The earthing bar should be fitted with a disconnection/test point.

Clause 444.5.7.Z1 of HD 60364-4-444 also requires that “suitable precautions shall be taken to avoid any potential difference between the existing earth and a new installation” and recommends that “earth connections should be a low impedance path”. This is achieved by following the requirements of the bonding conductors specified in EN 50310:2010.

There is also a statement regarding the treatment of screened telecommunications cables as follows:

- where shielded cables are terminated within a cabinet, a separate earth connection with a low impedance shall be installed from the point of termination to the earth point within the cabinet. The metallic frame of the communication cabinet/frame shall not be used as the only earth connection.

252 **9 Bibliography**

Future section 444 of BS
7671

Measures against electromagnetic disturbances

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