



British Standards

BSI British Standards
389 Chiswick High Road
London W4 4AL
Tel: 020 8996 9000
Fax: 020 8996 7400
Web: <http://bsi-global.com>

DIRECT

Tel: +44 (0) 20 8996 7413
Fax: +44 (0) 20 8996 7143
E-mail: nicola.harrison@bsi-global.com

To the Members of:

Technical Committee TCT/7

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SUBJECT: CENELEC VOTE - FINAL DRAFT PREN 50174-3 "INFORMATION TECHNOLOGY - CABLING INSTALLATION. PART 3: INSTALLATION PLANNING AND PRACTICES OUTSIDE BUILDINGS". UK CLOSE DATE 28 MARCH 2003

Please find attached the Formal Vote text for prEN 50174-3 "Information technology - Cabling installation. Part 3: Installation planning and practices outside buildings"

If you have any comments on the draft, please send them to me by **28 March 2003**

NOTE: If the UK is to vote positively on the draft, only minor/editorial comments can be submitted with the vote. If there are major/technical comments, a negative UK vote should be submitted.

If I receive no advice to the contrary by the above date, I shall submit a vote of **YES** with **NO COMMENTS** on behalf of the UK.

Yours sincerely,

Nicola Harrison
Programme Manager
BSI Standards Development
Acting Secretary to TCT/7

ICS

English version

Information technology - Cabling installation
Part 3: Installation planning and practices outside buildings

Technologies de l'information - Installation
de câblage
Partie 3: Planification et pratiques
d'installation à l'extérieur des bâtiments

Informationstechnik - Installation von
Kommunikationsverkabelung
Teil 3: Installationsplanung und -praktiken
im Freien

This draft European Standard is submitted to CENELEC members for formal vote.
Deadline for CENELEC: 2003-05-23

It has been drawn up by Technical Committee CENELEC TC 215.

If this draft becomes a European Standard, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CENELEC in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

- 1 **Foreword**
- 2 This draft European Standard was prepared by Technical Committee CENELEC TC 215 "Electrotechnical
3 aspects of telecommunication equipment" under the framework of the Mandates M/212 on
4 "Communication cables and cabling systems" and M/239 on "Air traffic management equipment and
5 systems".
- 6 It is submitted to the Formal Vote.
- 7 The following dates are proposed:
- latest date by which the existence of the EN
has to be announced at national level (doa) dor + 6 months
 - latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) dor + 12 months
 - latest date by which the national standards
conflicting with the EN have to be withdrawn (dow) dor + 36 months
(to be confirmed or modified when voting)
- 8 This standard comprises three parts. All three parts support the specification, implementation and
9 operation of information technology cabling using both balanced copper and optical fibre cabling
10 components. These components may be combined to provide cabling solutions either in accordance with
11 the design requirements of series EN 50173 or to meet the requirements of one or more application-
12 specific standards (such as EN 50098-1 or EN 50098-2).
- 13 This part, EN 50174-3, contains detailed requirements and guidance relating to the installation planning
14 and practices outside buildings and is intended to be used by the personnel directly involved in the
15 planning and installation of information technology cabling. It shall be used during the different
16 implementation phases when installing information technology cabling, i.e. during the planning phase, the
17 design phase and installation phase.
- 18 Annexes designated "informative" are given for information only. In this standard, Annexes A and B are
19 informative.
- 20 To support the commenting of this draft standard, continuous line numbering has been provided.
- 21

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117 Introduction

118 The importance of the information technology cabling infrastructure is similar to that of other fundamental
119 building utilities such as heating, lighting and mains power supplies. As with other utilities, interruptions to
120 service can have serious impact. Poor quality of service due to lack of planning, use of inappropriate
121 components, incorrect installation, poor administration or inadequate support can threaten an
122 organisation's effectiveness.

123 There are four phases in the successful installation of information technology cabling. These are

- 124 a) design - the selection of cabling components and their configuration,
125 b) specification - the detailed requirement for the cabling, its accommodation and associated building
126 services addressing specific environment(s) identified within the premises together with the quality
127 assurance requirements to be applied,
128 c) implementation - the physical installation in accordance with the requirements of the specification,
129 d) operation - the management of connectivity and the maintenance of transmission performance during
130 the life of the cabling.

131 This European standard is in three parts and addresses the specification, implementation and operational
132 aspects. The design issues are covered in series EN 50173 and / or other application standards.

133 EN 50174-1 is intended to be used by personnel during the specification phase of the installation together
134 with those responsible for the quality planning and operation of the installation. It contains requirements
135 and guidance for the specification and quality assurance of the information technology cabling by defining

- 136 - aspects to be addressed during the specification of the cabling,
137 - quality assurance documentation and procedures,
138 - requirements for the documentation and administration of cabling,
139 - recommendations for repair and maintenance.

140 EN 50174-2 and this part, EN 50174-3, are intended to be used by the personnel directly involved in the
141 implementation phase of the installation. EN 50174-2 is applicable inside buildings and EN 50174-3 is
142 applicable outside buildings.

143 This part, EN 50174-3, contains detailed requirements and guidance relating to the installation planning
144 and practices by defining

- 145 1) planning strategy (road map) and guidance depending on the application and physical environment
146 (climatic, mechanical, electromagnetic, etc.),
147 2) design and installation rules for metallic and optical fibre cabling depending on the application,
148 electromagnetic environment, physical environment, etc.,
149 3) requirements on satisfactory operation of the cabling depending on the application, electromagnetic
150 environment, physical environment, etc.,
151 4) the practices and procedures to be adopted to ensure that the cabling is installed in accordance with
152 the specification.

153 Figure 1 shows the relationships between the standards produced by TC 215 for information technology
 154 cabling, namely cabling design standards (EN 50098 series, EN 50173 series), cabling installation
 155 standards (EN 50174 series) and equipotential bonding requirements (EN 50310).

Building design phase	Cabling design phase	Planning phase	Implementation phase	Operation phase
EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50173 (Series) or (and) EN 50098-1 or (and) EN 50098-2 or (and) Other application standards	EN 50174-1 4: Specification considerations 5: Quality assurance 7: Cabling administration and EN 50174-2 4: Safety requirements 5: General installation practices for metallic and optical fibre cabling 6: Additional installation practice for metallic cabling 7: Additional installation practice for optical fibre cabling and EN 50174-3 and (for equipotential bonding) EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50174-1 6: Documentation 7: Cabling administration and EN 50174-2 4: Safety requirements 5: General installation practices for metallic and optical fibre cabling 6: Additional installation practice for metallic cabling 7: Additional installation practice for optical fibre cabling and EN 50174-3 and (for equipotential bonding) EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S) and EN 50346 4: General requirements 5: Test parameters for balanced copper cabling 6: Test parameters for optical fibre cabling	EN 50174-1 5: Quality assurance 7: Cabling administration 8: Repair and maintenance

156

Figure 1 - Relationship between series EN 50174 and other design standards

157 **1 Scope**

158 This European standard specifies the basic requirements for the planning, implementation and operation
159 of information technology cabling using balanced copper cabling and optical fibre cabling. This standard
160 is applicable to:

161 a) cabling designed to support particular analogue and digital communications services including voice
162 services;

163 b) generic cabling systems designed in accordance with series EN 50173 and intended to support a
164 wide range of communications services.

165 This standard is intended for those involved in the procurement, installation and operation of information
166 technology cabling. Furthermore this standard is addressed to:

167 - architects, building designers and builders;

168 - main contractors;

169 - designers, suppliers, installers, maintainers and owners of information technology cabling;

170 - public network providers and local service providers;

171 - end users.

172 This standard is applicable to certain hazardous environments but does not exclude additional
173 requirements which are applicable in particular circumstances, e.g. in the presence of electricity supply
174 and electrified railways.

175 This part of the standard:

176 c) sets out requirements for satisfactory installation and operation of information technology cabling
177 outside buildings; it is not restricted to campus areas.

178 d) excludes specific requirements applicable to other cabling systems (e.g. power cabling, coaxial
179 cabling); however, it takes account of the effects other cabling systems may have on the installation
180 of information technology cabling (and vice versa) and gives general advice.

181 **2 Normative references**

182 This European Standard incorporates by dated or undated reference, provisions from other publications.
183 These normative references are cited at the appropriate places in the text and the publications are listed
184 hereafter. For dated references, subsequent amendments to or revisions of any of these publications
185 apply to this European Standard only when incorporated in it by amendment or revision. For undated
186 references the latest edition of the publication referred to applies (including amendments).

187 EN 12613, *Plastics warning devices with visual characteristics for underground cables and pipelines*

188 EN 41003, *Particular safety requirements for equipment to be connected to telecommunication networks*

189 EN 50173-1, *Information technology – Generic cabling systems – Part 1: General requirements and office
190 areas*

191 EN 50174-1, *Information technology – Cabling installation - Part 1: Specification and quality assurance*

- 192 EN 50174-2, *Information technology – Cabling installation - Part 2: Installation planning and practices*
193 *inside buildings*
- 194 EN 50310, *Application of equipotential bonding and earthing in buildings with information technology*
195 *equipment*
- 196 EN 60950-1, *Information technology equipment – Safety – Part 1: General requirements*
197 *(IEC 60950-1:2001, modified)*
- 198 EN 61663-1, *Lightning protection – Telecommunication lines – Part 1: Fibre optic installations*
199 *(IEC 61663-1:1999 + Corrigendum Oct. 1999)*
- 200 EN 61663-2, *Lightning protection – Telecommunication lines – Part 2: Lines using metallic conductors*
201 *(IEC 61663-2:2001)*
- 202 HD 384.4.41 S2, *Electrical installations of buildings – Part 4: Protection for safety - Chapter 41: Protection*
203 *against electric shock (IEC 60364-4-41:1992, modified)*
- 204 HD 384.4.47 S2, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 47:*
205 *Application of protective measures for safety – Section 470: General – Section 471: Measures of*
206 *protection against electric shock (IEC 60364-4-47:1981 + A1:1993, modified)*
- 207 HD 384.4.482 S1, *Electrical installations of buildings - Part 4: Protection for safety - Chapter 48: Choice of*
208 *protective measures as a function of external influences - Section 482: Protection against fire where*
209 *particular risks or danger exist*
- 210 ITU-T K.33, *Limits for people safety related to coupling into telecommunications system from a.c. electric*
211 *power and a.c. electrified railway installations in fault conditions*
- 212 ITU-T K.50, *Safe limits of operation voltages and currents for telecommunication systems powered over*
213 *the network*
- 214 ITU-T K.51, *Safety criteria for telecommunication equipment*
- 215 ITU-T K.53, *Values of induced voltages on telecommunication installations to establish telecom and a.c.*
216 *power and railway operators responsibilities*
- 217 **3 Definitions and abbreviations**
- 218 **3.1 Definitions**
- 219 For the purposes of this European standard the following definitions apply.
- 220 **3.1.1**
221 **bonding network (BN)**
222 set of interconnected conductive structures that provides an “electromagnetic shield” for electronic
223 systems and personnel at frequencies from Direct Current (DC) to low Radio Frequency (RF).
- 224 NOTE The term “electromagnetic shield” denotes any structure used to divert, block or impede the passage of electromagnetic
225 energy. In general, a BN does not need to be connected to earth, but all BNs considered in the present document will have an earth
226 connection
- 227 [3.1.2 of EN 300 253:2002]
- 228

228 **3.1.2**
 229 **campus**
 230 premises containing one or more buildings
 231 [3.1.11 of EN 50173-1:2002]

232 **3.1.3**
 233 **hot zone**
 234 area around a high voltage installation (e.g. substation, transformer, pylon) whose earth potential rise in
 235 normal operation or when an earth fault occurs, is over the limits given in ITU-T.K.53 for typical fault
 236 situations

237 **3.1.4**
 238 **rural area**
 239 area which has a low density of local metallic structures in direct electrical contact with soil
 240 [3.10 of EN 50352]

241 NOTE In a rural environment the earthing systems of the substations have their own earth electrodes which are not normally
 242 connected together.

243 **3.1.5**
 244 **urban area**
 245 area which contains a high density of local metallic structures in direct electrical contact with soil such as
 246 water pipes, cables with bare metal sheaths, tracks of tramways or underground or overground traction
 247 systems and earth-terminations and structures of buildings, masts and foundations
 248 [3.11 of EN 50352]

249 **3.2 Abbreviations**

250	AC	alternating current
251	BN	bonding network
252	CBN	common bonding network
253	CMS	cable management system
254	DC	direct current
255	EMC	electromagnetic compatibility
256	EPR	earth potential rise
257	ESD	electrostatic discharge
258	GDT	gas discharge tube
259	HV	high voltage
260	LV	low voltage
261	MOV	metal oxide varistor
262	PEC	parallel earthing conductor
263	SPD	surge protective device

264 TVS transient voltage suppressor

265 **4 Safety requirements**

266 **4.1 Prerequisite**

267 This clause only deals with general safety requirements, however, all other clauses in this document
268 contain specific safety requirements.

269 Provisions shall be taken to make all concerned persons present in the campus aware of

- 270 a) the locations and boundaries of hazardous areas outside buildings,
- 271 b) the procedures to be adopted when working in or in proximity to these hazardous areas,
- 272 c) fire precautions.

273 It is assumed that mains power cabling is installed in accordance with the requirements of relevant
274 international or regional standards, national or local regulations.

275 All the installed cable shall comply with the relevant product safety requirements.

276 The requirements of EN 50174-2:2000, Clause 4, shall apply.

277 **4.2 Protection against electric shock**

278 **4.2.1 Active equipment requirements**

279 Only equipment that incorporates safe signal circuitry complying with EN 60950-1, EN 41003, ITU-T K.50
280 and ITU-T K.51 shall be connected to information technology cabling.

281 Equipment connected shall comply with the requirements for protection against electric shock of the
282 relevant product safety standards.

283 The connection of active equipment to information technology cabling shall not introduce hazards for
284 users or operators of the system.

285 **4.2.2 Cabling components**

286 Conductors with hazardous voltages shall not be accessible at any entry and distribution points. The
287 coexistence of power and information technology cables requires proper insulation for the information
288 technology cabling components (e. g. connecting hardware, cable, terminals) or other protection
289 measures to achieve adequate protection from indirect contact. The requirements of HD 384.4.41 S2,
290 HD 384.4.47 S2 and HD 384.4.482 S1 or relevant national or local regulations shall apply.

291 Connection of the main earthing terminal (MET) (as close as possible to the building entrance point), or of
292 a local earth with a low resistance (if outside the premises) to the following is necessary:

- 293 a) metallic cable screen(s) at both ends; if high unbalance currents are expected, due to different
294 earthing potential, precautions should be taken to limit such currents;
- 295 b) conductive parts of the entry, distribution and termination points, including metallic cabinets, covers
296 and other metallic parts of the cable management system;
- 297 c) protection devices installed on line conductors of information technology cables, i.e. at exposed sites.

298 The above earthing shall be realised by low impedance bonding.

299 The electrical continuity of the metallic screen shall be maintained.

300 Stays and struts used on poles used for information technology cabling should be suitably insulated when
301 required e.g. when passing power cables, and also when using a metallic catenary wire to ensure the
302 safety of the public from hazardous voltages reaching accessible portions of the stay wire.

303 Connecting hardware selected for information technology cabling shall not be interchangeable with the
304 sockets or plugs used for mains power distribution.

305 Further requirements are set out in EN 50174-2:2000, Clause 4, 6.7, 6.8 and Annex A.

306 **4.3 Protection from voltages due to the proximity of high voltage systems**

307 This standard gives installation rules for the following situations:

308 a) proximity of information technology and power cables / overhead lines;

309 b) proximity of information technology cables and power earthing systems;

310 c) proximity of information technology and power earthing systems.

311 See 5.9 and Annex A.

312 **4.4 Fire and chemical hazard**

313 The choice of cables shall be made according to the national regulation relating to the Construction
314 Product Directive (see also EN 50174-2:2000, Clause 4).

315 **4.5 Explosive and asphyxiating gases**

316 The requirements of EN 50174-2:2000, 4.4, shall apply.

317 **4.6 Optical fibre hazard**

318 The requirements of EN 50174-2:2000, 4.5, shall apply.

319 **4.7 Mechanical hazard**

320 The hazard is mainly related to the mechanical stability of aerial cables. For proper installation national
321 regulations shall be followed in placing the poles and evaluating the maximum permitted span length. For
322 further details see Clause 5.

323 **4.8 Separation requirements for metallic cabling**

324 Cable and installation requirements for crossing of underground cables and overhead clearances are set
325 out in 5.9 as well as in EN 50174-2:2000, 6.5, (segregation of services) where safety and EMC aspects
326 are taken into account.

327 **4.9 Closures**

328 Closures providing facilities for the termination and (or) distribution of both information technology cables
329 and mains power cables shall be designed to provide separate covers for the two cabling types.
330 Alternatively, a single overall cover is allowed provided that the mains power cabling remains protected to
331 prevent electric shock after removal of the cover. This applies for example to a closure containing separate
332 termination points for information technology and mains power cabling, but not for termination points where
333 the power supply is provided within the information technology cabling termination point.

- 334 Where both information technology cabling and mains power cabling are contained within a closure then:
- 335 a) if the closure is metallic, it shall be earthed in accordance with the relevant wiring regulations for
336 protective earth;
- 337 b) the compartment in the closure shall have a barrier (either conducting or non-conducting) between
338 the two cable types. If compartment barriers are conductive, they shall be earthed in accordance with
339 the relevant wiring regulations for protective earth;
- 340 c) the front covers on the closure shall allow separate access to the information technology cabling and the
341 mains power cabling and shall be retained such that the use of a tool is necessary to gain access thereby
342 preventing inadvertent connection between the mains power and the information technology cabling;
- 343 d) the entry for the information technology cables and the mains power cables shall be separate and the
344 separation of the cables shall conform to the requirements of Clause 5.

345 **5 General installation practices for metallic and optical fibre cabling**

346 **5.1 General**

347 The installation practices take into account safety hazards and interference with other outside plant.
348 General EMC requirements and guidance are given in Clause 6.

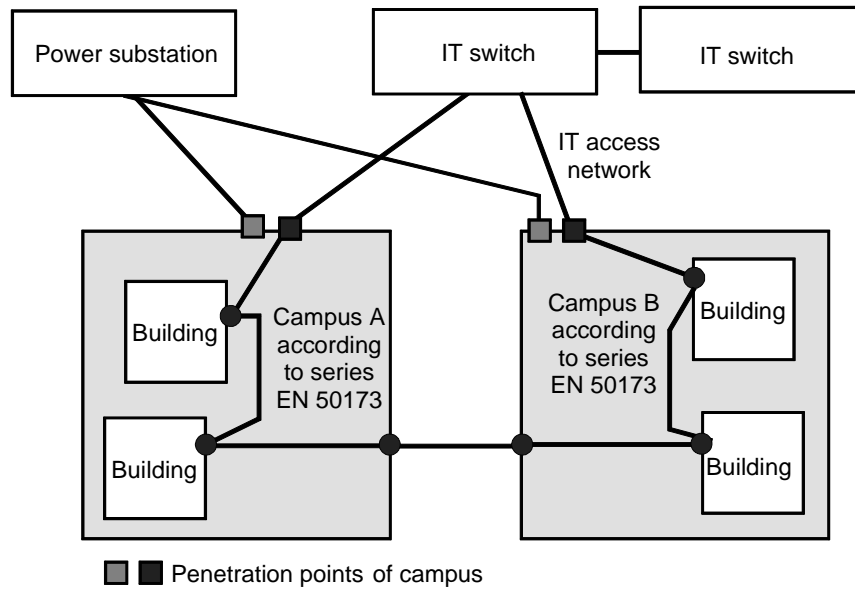
349 Metallic and optical fibre cabling in outside plant can be installed underground or overhead according to the
350 different possible situations. Generally, but particularly for underground installation, the cable management
351 system should allow for the installation of additional cables in the future without risk of damage.

352 Additional installation guidelines for optical fibre cabling are given in Clause 7.

353 The requirements within this standard do not cover:

- 354 a) any additional requirements for the information technology cables installed in hazardous or stressful
355 environments e. g. electricity supply and electric railway locations (see Clause 8);
- 356 b) coaxial cabling and components used within cable distribution systems for television and audio
357 signals (according to EN 50083 series).

358 Examples of areas covered by this standard are shown in Figure 2.



359

360 NOTE Neither the connection performance nor the media between the entry point and the building entrances are defined in
 361 EN 50173-1. Cabling denoted by dotted lines is not within the scope of this standard.

362

Figure 2 - Examples of areas covered by this document

363 **5.2 General precautions**

364 All cables and cabling components shall be checked on delivery to ensure that no mechanical damage
 365 has occurred during transportation.

366 Documentation supplied shall be checked for compliance with the procurement specification and retained.

367 The components shall be stored in a suitable place until required. Consideration shall be given to security
 368 and environmental conditions.

369 The components shall not be unpacked until required for installation.

370 When pulling-in cables, (particularly optical fibre cables) mechanical fuses (or equivalent protection) shall be
 371 used to ensure that the maximum tensile loads established by the cable manufacturer are not exceeded.
 372 Precautions shall be taken during installation to prevent the ingress of water and other contaminants.

373 **5.3 Pre-installation practices**

374 **5.3.1 General**

375 The installer shall establish that the routes defined in the installation specification are accessible and
 376 available according to the installation programme. The installer shall advise the client of all proposed
 377 variations (see 4.8.1 of EN 50174-1:2000).

378 The installer shall verify that the physical compatibility and the environmental conditions within the routes
 379 and the installation methods to be used are suitable for the design of cable and components to be
 380 installed.

381 Where underground installations are envisaged, the installer shall use the best digging methods to
 382 minimise any disruption or inconvenience (e.g. traffic, dust, reduced access to buildings and shops, etc.)
 383 to the population.

384 The installer shall identify the proposed locations at which cable drums, reels or boxes are to be
385 positioned during the installation programme and should establish the accessibility and availability of
386 those locations.

387 The installer shall identify proposed locations of cabinets and maintenance holes and should establish
388 their accessibility and availability according to the installation programme.

389 The cabinets and maintenance holes shall be located such that it is possible for subsequent
390 measurements, repair, expansion or extension of the installed cabling to be undertaken with minimal
391 disruption and in safety (see EN 50174-1:2000, 4.6).

392 Should a gas hazard be detected the installer shall inform the site contact nominated by the client and
393 appropriate action shall be agreed and undertaken.

394 The installer shall ensure that all necessary guards, protective structures and warning signs are used to
395 protect the cable, the installation personnel and third parties. Relevant national regulation for safe working
396 practices shall be complied with.

397 **5.3.2 Mechanical and environmental (rodents)**

398 Where there is a history of rodent damage special measures may need to be taken.

399 **5.4 Preparation of cable routes**

400 **5.4.1 General**

401 The requirements of EN 50174-2:2000, 5.4, shall apply.

402 When designing and maintaining information technology cable routes, the regulations related to the
403 prevention of dangerous voltages and any potential disturbances caused by power cables and other
404 heavy current cables shall be taken into consideration (see also 4.1).

405 **5.4.2 Underground cables**

406 Underground cables without suitable protection should be drawn into ducts, pipes or other suitable
407 structures to protect them from mechanical, electrolytic or chemical danger.

408 There are several techniques for installing cabling into ducts or pipes. If draw ropes are used they should
409 be installed prior to the installation of the cable as required. Under no circumstances shall draw ropes be
410 installed concurrently with the cable. Existing draw ropes should be checked for satisfactory function.

411 Cables that are to be laid directly in the ground shall be of suitable mechanical construction for this purpose.
412 Soil conditions should be carefully considered when a cable is buried directly in the ground. However, if
413 subsoil conditions are known to be corrosive, the cable may require additional protection and the cable
414 suppliers should be consulted. Marking tape shall be laid above any directly buried cable (see EN 12613).

415 Laying marking tape above the cable management system is always recommended.

416 When cables with metallic components are buried in rural areas with high risk of lightning strikes, extra
417 protection is strongly recommended (see 6.8). The need for lightning protection shall be considered
418 according to series EN 61663.

419 **5.4.3 Aerial cables**

420 The route of the cable shall be designed and built in such a way that damage or unsafe situations caused
421 by overloading the construction are avoided. At the crossing of two or more routes, different cables shall
422 not touch each other in any circumstances.

423 Special consideration shall be given to overhead routes that run parallel to or cross railways, tramways,
424 trolley bus cables, cable railways, cable ways, ski and chair lifts, motor ways, roads and navigable rivers
425 and waterways, etc.

426 The stresses on the cables and poles depend on the span length and the sag. The climatic conditions
427 that can have a major effect on tensions in poles, aerial cables and sag are heat, cold, wind and snow /
428 ice load on cables and poles. Reference shall be made to the national regulations for routes affected by
429 such conditions and the appropriate construction methods utilised.

430 The information technology cable route should be as straight as possible and shall be installed to respect
431 the minimum clearances above ground given in Table 1:

432 **Table 1 – Minimum installed clearances above ground for aerial cables**

Location	Clearance
Motorway, main roads	6 m
Non electric railway	6 m
Minor road crossings, areas accessible to vehicular traffic, field path, campus entrance	5,5 m
Minimum clearance no traffic crossing	4 m
Specific environment, Gardens	3 m

433 NOTE Aerial crossing of motorway, non electric and electrified railways is not recommended.

434 Where pole sharing is allowed, see 5.11.

435 Any information technology cables rising from the ground shall be mechanically protected to a height of at
436 least 2 m.

437 **5.5 Cabling practices**

438 Proper installation practices shall be observed for cabling to ensure performance of the cabling system
439 over its life cycle.

440 Performance specifications for cable and connecting hardware assume the use of proper installation
441 practices and cable management techniques according to manufacturers' guidelines. If recommended
442 cable handling practices and installation methods are not observed, it is possible that specified
443 transmission capabilities of cabling components cannot be achieved.

444 During cable installation, appropriate techniques shall be followed:

445 a) the cabling components shall be installed in environmental conditions compliant with any relevant
446 standards;

447 b) bend radii shall never be less than the minima specified by the manufacturer/supplier;

448 c) cables shall not be exposed to temperatures exceeding their specified limits after installation, this
449 includes localised effects such as those from hot air blowers or gas burners;

450 d) no forces shall be allowed that cause damage (e.g. through improper fastening or crossovers) to the
451 cable sheath or the cable elements;

452 e) jointing chambers should be positioned at all joints, places where there are severe changes of
453 direction and cabinets;

- 454 f) leaving enough spare cable along the route (e.g. at jointing chambers or poles) to facilitate future
455 maintenance is recommended;
- 456 g) covers of jointing chambers shall be sized according to the maximum foreseeable load;
- 457 h) all cabling management systems at the entrance into a building shall be sealed to prevent the ingress
458 of dust, water, animals, gas, etc.;
- 459 i) if more additional cables are installed in a duct or sub-duct then great care shall be taken to prevent
460 damage to existing cables, when removing or installing cables.

461 **5.6 Cable management systems**

462 **5.6.1 Aerial supporting structures (overhead)**

463 Supporting structures, e.g. poles, shall be selected to be of dimensions and strength suitable for their
464 length and the load they are intended to carry, taking into account influences due to climatic and soil
465 conditions. The most economical layout will generally be obtained with a span of 50 m. If special
466 supporting structures are used, greater span lengths may be obtained. The deviation from the straight line
467 between poles should not be more than 20 % without using stays or struts.

468 Supporting structures shall be suitably treated to prevent decay.

469 Supporting structures should be checked periodically so that degradation and damage can be detected
470 and corrected if required.

471 Where necessary stays or struts can be attached to the pole at the resultant load points of the cables or at
472 road crossings. To ensure the safety of the public from hazardous voltages reaching accessible portions of
473 the stays or struts, they shall be suitably insulated when required (e.g. when passing power cables), and
474 also when using a metallic catenary wire. Catenary wires shall not be spliced in the field.

475 **5.6.2 Underground**

476 Except for particular cases (e.g. bridges, thrust boring) underground cable management systems (e.g.
477 pipes, ducts) should be made from suitable non conductive material. All underground cable management
478 systems should be made of a non-porous material. Sections shall be jointed to inhibit ingress of gases,
479 water and foreign materials.

480 **5.6.3 Attachments**

481 Attachment of suspension wires or catenary cables to buildings should be permitted only when it is clear
482 that the load on the fixing point will not exceed its design strength and the structure of the building is
483 capable of sustaining the load with a safety factor.

484 Attachment of suspension wires or catenary cables to buildings should be avoided in earthquake zones.

485 **5.6.4 Earthing of cables and cabling management systems**

486 Metallic parts (e. g. screens, suspension or catenary wires) and metallic cable management systems
487 should be connected to earth at both ends and at every earthed cabinet. They are also bonded together
488 with the metallic part of any cabinet even if not directly earthed. In case of TN-S systems the
489 requirements of EN 50310 shall apply.

490 Earth connections could also be necessary at intermediate points where there is a possibility of induced
491 voltage from power lines or in regions particularly exposed to lightning strikes. See also 5.9.4.

492 Where earth potential rise (EPR) is expected, see 5.10.2 and Annex A.

493 **5.6.5 Cabinets**

494 See 5.8.

495 **5.7 Labelling**

496 Cables, jointing chambers and cabinets shall be labelled with a unique identifier to enable tracing in both
497 directions. Labels shall be chosen allowing for the environments in which they will be used in order to
498 ensure adequate lifetimes. See also EN 50174-1.

499 Warning signs and labels shall be fitted in accordance with the installation specification.

500 **5.8 Installation of closures**

501 Outside plant cabinets shall be installed in a position according to the installation plan and shall

- 502 a) minimise the impact on the surrounding environment,
503 b) be positioned as far as possible from any source of possible interference (e.g. electricity substation,
504 aerial power plant, radio transmitters),
505 c) permit easy access for repair and maintenance.

506 It is recommended that:

- 507 - outside cabinets are installed next to walls to ensure better protection;
508 - accessible outside cabinets are provided with a lock to prevent unauthorised access.

509 Cabinets shall be labelled and identified according to the installation specification.

510 Any electrical equipment in cabinets shall be installed in a way that avoids damage to it from water.
511 Where possible, electrical equipment connected to the main electricity network should be installed clearly
512 separated from cabling, patch panel and other passive components.

513 The cable entrance to a cabinet or a jointing chamber shall

- 514 1) maintain the environmental and functional conditions,
515 2) provide the necessary cable support and prevent kinking at the point of entry,
516 3) provide strain relief for the cable if not already done by separate fixtures.

517 Any cabling not installed within a cable management system should be protected from physical damage
518 by use of appropriate sleeving.

519 Following jointing or termination, the cable should be arranged and identified within the cabinet in a
520 manner that allows access to connectors and joints with minimal disruption to neighbouring components
521 during subsequent repair, expansion or extension of the installed cabling.

522 Only connecting hardware specifically designed for outside use and particular environments shall be used.

523 Manufacturer's installation instructions for the connector and cable shall be strictly followed. If special
524 tools are required for termination, then only those recommended by the manufacturer shall be used.

525 The connecting hardware used for copper cabling shall be installed to provide minimal signal impairment
 526 by preserving wire pair twists as closely as possible to the point of termination (by not changing the
 527 original twist), see EN 50173-1.

528 5.9 Segregation of services

529 5.9.1 General

530 Information technology cables outside buildings shall be installed taking into account safety rules and
 531 minimising interference to and from all other existing services (e.g. power, communication and traction
 532 systems etc.). Generally interference can be avoided by respecting minimum distances between systems
 533 and, where necessary in particular cases, adopting appropriate countermeasures and particular
 534 installation methods. In order to achieve better performance and to reduce costs, all possible interference
 535 shall be considered during the planning phase of an installation.

536 5.9.2 Aerial cables

537 5.9.2.1 Interaction of overhead information technology cables with overhead power cables

538 Work on the crossing of overhead power cables and information technology cables shall not be carried
 539 out before an approach has been made to the owner of the existing cables and agreement to the crossing
 540 obtained.

541 Precautions shall be taken in order to avoid contact with parts of power cables and equipment.
 542 Information technology cables shall be lower than power cables.

543 In order to avoid possible contact between aerial information technology cables and overhead power
 544 plants through mechanical faults (e.g. fallen wires or poles), a good installation practice is to fix the
 545 minimum horizontal separation between information technology and power plants greater than the height
 546 of the higher cables. However, if particular rules for construction of both power and information
 547 technology aerial cables are applied, it is possible to reduce the clearances.

548 Maintenance of the minimum separation distances shall be ensured by also considering variable climatic
 549 conditions (sun, rain, wind, ice etc.). This requirement can be satisfied by using particular construction
 550 methods or taking suitable clearance margins into account during planning and also by appropriate cable
 551 design.

552 If at least one of the power or information technology conductors is insulated and the information
 553 technology poles are wooden or insulated, the minimum clearance between aerial information technology
 554 and overhead power cabling both using poles as support shall be as specified in Table 2..

555 **Table 2 - Minimum clearances between aerial information technology and overhead**
 556 **power cabling crossing or when running in parallel**

	Overhead power lines > AC 1 000 V		Overhead power lines < AC 1 000 V		
	Power cables / conductors	Power poles	Power cables	Power wires	Power poles
Information technology cables	$[1,5+(0,015 \times U)]^a$ m	1,0 m	0,5 m	1,0 m	0,5 m
Information technology poles	$[3+(0,015 \times U)]^a$ m	1,0 m	0,5 m	1,0 m	0,5 m

^{a)} U is the voltage of power line expressed in kV

557

558 If both cables are not insulated the minimum clearance shall be 1 m. In the case of pole sharing, see
 559 5.11.

560 Where the requirements of safety and electrical interference demand different limits for either spacing or
561 physical separation, the more stringent requirements shall take precedence.

562 Aerial information technology cables which are routed to buildings and which intersect there with low
563 voltage power cables shall be separated. If both power and information technology cables are fixed on
564 the external walls of the building and are insulated the minimum separation shall be 0,2 m otherwise the
565 minimum clearance shall be 1 m.

566 **5.9.2.2 Interaction of overhead information technology cables with roads and railways**

567 In order to minimise the interference zone, aerial crossing of roads and railways should be planned with a
568 crossing angle near to 90°.

569 The use of stays or struts to reinforce the stability of two poles adjacent to the road or railway is
570 recommended.

571 Aerial crossing of electrified railways is not recommended.

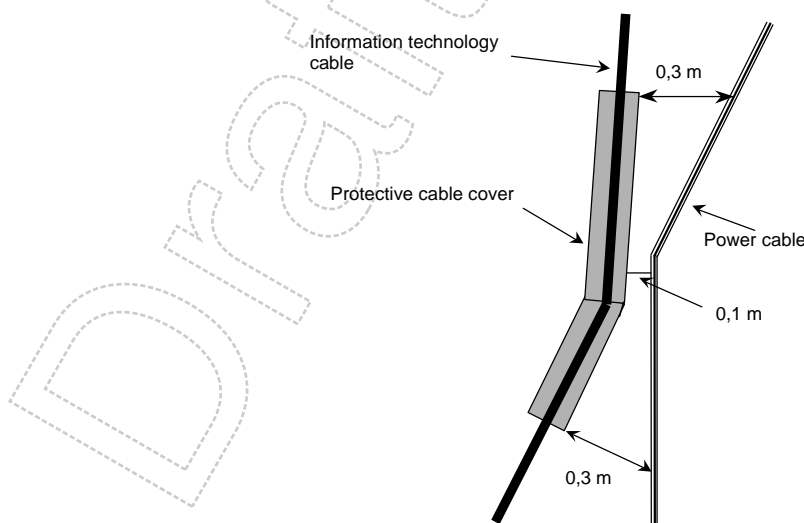
572 **5.9.3 Underground cables**

573 **5.9.3.1 Interaction of underground information technology cables with underground power
574 cables and underground parts of an earthing system**

575 For crossings between underground information technology cables and underground power cables both
576 cables should be insulated and the minimum separation shall be 0,3 m. The upper cable shall be the
577 information technology cable and shall have adequate protection extending at least 0,5 m each side of
578 the crossing.

579 If the separation at the crossing is less than 0,3 m then both cables shall be fitted into a protection pipe
580 for a linear extension either side of the crossing for at least 0,5 m. If at least one of either the information
581 technology cable or power cable is installed into a cable management system that assures adequate
582 mechanical protection the minimum separation can be reduced to 0,1 m.

583 If, in the case of parallel routing, the distance between information technology and power cables running
584 in parallel is less than 0,3 m then at least one of either information technology cable or power cable shall
585 have adequate mechanical protection (see Figure 3).



586

587 **Figure 3 - Example showing the protection of underground information**
588 **technology cables when located next to power cables**

589 Where there are buried parts of earthing systems, clearances should be maintained from earth electrodes
 590 and, in general, from metallic buried parts of power cables. In this case the safety clearance strongly
 591 depends on soil resistivity. Safety separation also depends on the dielectric strength of the sheath of the
 592 information technology cables. In all cases as great a separation as is practicable should be provided
 593 between the information technology cables and buried metallic parts of power cables.

594 For rural environments, the distances shall not be less than those given in Table 3. This table assumes
 595 information technology cable having a dielectric strength of at least 1,5 kV at 50 Hz.

596 **Table 3 – Minimum distance between buried insulated information technology cables**
 597 **and earthed electrodes of power systems in rural environment**

Soil resistivity (Ωm)	LV neutral earthing electrode ^a	High Voltage (< 25 kV) earthing system (with isolated neutral or arc suppression coil)	High Voltage (< 25 kV) earthing system (directly earthed neutral)
< 50	2 m	2 m	4 m
50 to 500		4 m	8 m
500 to 5 000		8 m	20 m
5 000 to 10 000		8 m	40 m
> 10 000		8 m	80 m

^a This distance is considered sufficient to avoid damage on information technology cables due to lightning on LV power systems.

598 The installer shall contact the owner of the HV installation concerning the risks and the size of the hot
 599 zone.

600 For HV power systems exceeding 25 kV, calculations shall be performed in order to fulfil the limits of
 601 ITU-T Recommendations K.33 and K.53.

602 In urban zones, due to the density of buildings and buried metallic conductors, only mechanical protection
 603 is required and the minimum distances for those circumstances apply.

604 Where it is necessary to run cables closer together than the distances given in Table 3, cables containing
 605 metallic parts shall be fitted in an insulated outer sheath. The outer sheath should extend sufficiently to
 606 ensure compliance with the limits.

607 5.9.3.2 Interaction of underground information technology cables with roads and railways

608 At crossings with roadways and railways, underground cables shall be laid inside protective cable pipes
 609 or conduits.

610 Jointing chambers should be located at sides of crossings to facilitate future cabling and maintenance.

611 The values in Table 4 are provided as a guide to the minimum clearances between the ground surface
 612 and the upper part of the underground plant.

613 **Table 4 - Minimum depth of information technology**
 614 **cabling below the ground surface**

Location	Depth
Railway	1,0 m
Pavement (also grassed area)	0,5 m
Urban and rural roads	0,6 m
Motorway	0,8 m

615
 616 Cable pipes or ducts under roads and railways should be laid in co-operation with the relevant authorities,
 617 who will specify access and safety requirements together with requirements for depth of cover and back
 618 filling.

619 **5.9.3.3 Interaction of underground information technology cables with other underground**
 620 **services**

621 Table 5 summarises some protective measures/clearances that should be observed when other
 622 underground services are found.

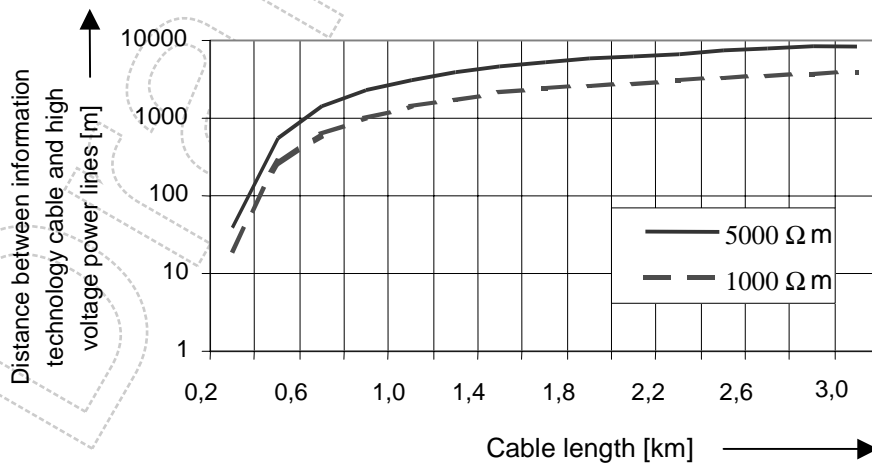
623 **Table 5 - Minimum clearances and protective measures at crossings between information technology**
 624 **cables and various underground services**

Other services	Clearances at crossing m	Protection measures	Notes
Inflammable gas or liquid ducts	1,5 m (operating pressure > 500 kPa) 0,5 m (operating pressure ≤ 500 kPa)		If the minimum spacing is less than the indicated values then the gas or liquid duct should be covered with a protective pipe or duct extending 1,0 m each side of crossing. For parallel paths, an intermediate layer should be provided.
Water pipes sewers and ducts	0,3 m except district heating 1,0 m	The installation should be mechanically protected with a pipe or duct. The protection should extend at least 0,5 m each side of the crossing.	If the minimum spacing is less than the indicated values then both installations should be protected with a pipe or duct or an intermediate layer should be provided.

625 **5.9.4 Power distributions systems and electrified traction lines (equipment of power stations)**

626 Where there is inductive coupling, each case should be treated individually and protection is needed
 627 every time that the result of calculations or measurements show that the induced voltage exceeds the
 628 values in ITU-T K.53.

629 When the distances given in Figure 4 are exceeded, it is not necessary to carry out any investigations or
 630 calculations. This is applicable for high voltage overhead lines exceeding 100 kV operating with direct-
 631 earthed systems.



632

633 **Figure 4 - Distance between information technology cable and high voltage power lines**

634 The curves assume an inducing current of 10 kA. In cases of higher inducing currents the distances are
635 also higher.

636 As a rule of thumb and considering the limit values, it is normally possible to avoid any calculations in the
637 following cases:

638 a) normal operating condition for power cables (not valid for electrified traction cables) below 30 kV;

639 b) fault condition for power cables operating with a voltage below 25 kV and with a parallelism below
640 5 km.

641 When, from the calculated results, it is necessary to reduce the induced voltage it is possible to apply one
642 or more mitigation methods until the induced voltage is reduced to an acceptable value.

643 A general protective method for metallic screened cable is to earth the screen of the information
644 technology cabling at both ends of the cable and if necessary at some specific points along the cable. For
645 metallic cable, protection of inner conductors can be performed using surge protective devices.

646 Other protective methods exist that are specifically for optical fibre cables or for metallic cables. To
647 ensure continuity of transmission for metallic cables it is possible to install isolation transformers instead
648 of or in combination with surge protective devices.

649 In the case of underground cables and when the methods described above are not enough to mitigate the
650 induced voltage, it is possible to lay cables inside a completely closed metallic duct which is earthed at
651 both ends.

652 5.9.5 Interference between information technology earthing systems and power earthing systems

653 In rural environments, the minimum separation between information technology earthing systems and
654 earthed electrodes of LV and HV (under 25 kV) power systems shall be as given in Table 6.

655 **Table 6 - Minimum distance between information technology earthing systems and earthed electrodes**
656 **of power systems in rural environment**

Soil resistivity Ωm	LV neutral earthing electrode (TT system)	LV neutral earthing electrode (TN system and IT system) ^a	HV earthing system (with isolated neutral or arc suppression coil)	HV earthing system (directly earthed neutral)
< 50	2 m	2 m	5 m	10 m
50 to 500	4 m		10 m	20 m
500 to 5 000	8 m		20 m	50 m
5 000 to 10 000	16 m		20 m	100 m
> 10 000	16 m		20 m	200 m

^a This distance is considered sufficient to avoid damage on information technology cables due to lightning on LV power systems.

657
658 For HV power systems exceeding 25 kV, calculations shall be performed in order to fulfil the limits of
659 ITU-T K.53.

660 In urban zones, due to the density of buildings and underground metallic conductors, mechanical
661 protection is required and the minimum distances for those circumstances apply.

662 5.9.6 Building entrance facilities for power and information technology cabling

663 To minimise induction loops and to assist the earthing and bonding arrangements the following applies:

- 664 a) metal pipes (e.g. for water, gas, heating) and cables should enter the building at the same place;
- 665 b) metal sheets, screens, metal pipes and connections of these parts shall be bonded and connected to
666 the main equipotential bonding of the building with low impedance conductors;
- 667 c) common routes for power and signal cable shall have adequate separation (by distance or
668 screening)

669 For further information see also EN 50310.

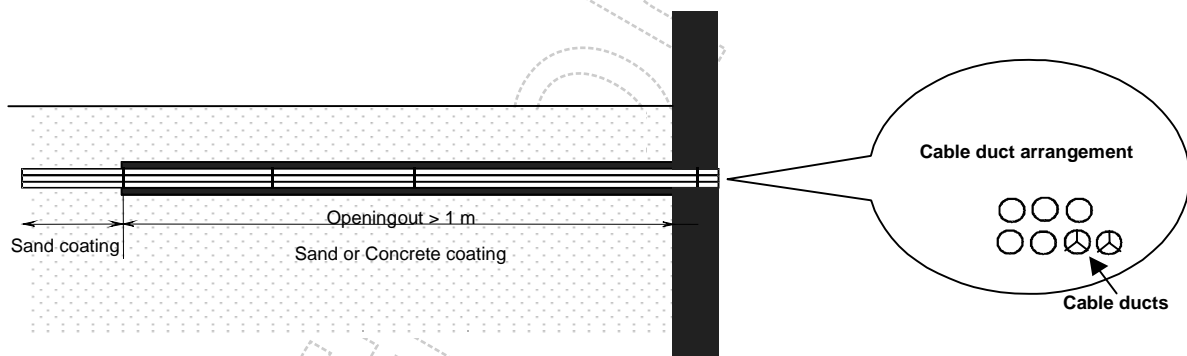
670 Incoming cabling management systems shall:

- 671 1) ensure continuity of cabling, and be connected directly by the shortest possible distance to the
672 equipment room of campus or building, without exceeding constraints (e.g. bending radius or ducts of
673 constant cross sectional area);
- 674 2) be sealed to prevent the ingress of dust, water, animals, gas etc.

675 The entrance point inside the building should be located in the basement or at least at the ground floor.

676 It is recommended that the cable ducts are arranged as shown in Figure 5.

677



678

679 **Figure 5 – Example of an underground cable duct entrance for information technology cables into a building**

680 The ducts shall be sealed at or near to the entrance point inside the building.

681 Requirements for segregation of services are given in 5.9.3.

682 **5.9.7 Interface between internal and external cabling**

683 External information technology cables that enter a building should be terminated on a frame, block or
684 socket/box dependent on the number and types of cables entering. This termination point can be
685 considered as the interface between the external and internal cabling systems. The termination point of
686 the information technology cables should be as close as possible to the service entry point for the
687 building. Where cables without fire retardancy (euroclass F according to Construction Product Directive)
688 are used, the length within the building shall be as short as possible according to national regulations.

689 The use of a dedicated termination point is also recommended as it allows an appropriate point for
690 isolation, testing and measurement into and out of the building. It also provides a suitable point to install
691 any surge protective devices.

692 Connection of all external metallic parts of the cables (as a minimum the screen) and metallic ducts at the
693 same equipotential plane except in particular cases (e.g. hot zone, see Annex A and 5.10.3) is strongly

694 recommended. This equipotential plane is connected to the main earthing terminal directly or through the
695 bonding network (see also EN 50174-2:2000, 6.7, for information).

696 **5.9.8 Special precautions for entering a hot zone**

697 This clause applies only for information technology cabling with metallic parts (e.g. twisted pair cables,
698 optical fibre cables with metallic parts, etc.).

699 To identify a hot zone the owner of the high voltage installation shall be consulted.

700 When connecting information technology cabling inside a hot zone with information technology cabling
701 outside a hot zone provisions shall be made to

- 702 a) avoid flashover between the local earth and the remote earthing system of the information technology
703 cabling, e.g. central exchange,
- 704 b) protect people and information technology systems against over-voltages,
- 705 c) avoid part of the current flowing towards the distant earth through information technology cabling,
- 706 d) generally allow a continuity of information technology services in the hot zones even during electrical
707 fault conditions.

708 The following three steps shall be taken:

- 709 1) installation of a specific enclosure outside the hot zone as a physical interface with the external
710 information technology cabling. This enclosure shall be used only for the connection of the
711 information technology cabling entering the hot zones;
- 712 2) installation of galvanic insulation device at one or several locations inside the hot zone for each
713 metallic information technology conductor. This device shall have relevant transmission
714 characteristics to guarantee the quality of the link;
- 715 3) installation between the specific enclosure and the galvanic isolation device of an information
716 technology cable with sufficient sheath dielectric strength to withstand the EPR or by use of non
717 conductive ducts (see Figure 6).

718 The screen of the information technology cable, if any, shall be insulated at both ends. The following
719 applies:

- 720 - high dielectric strength sheath cabling entering the hot zone shall be run in separate ducts or a
721 dedicated cabling management system;
- 722 - aerial information technology cable should not be used in hot zones;
- 723 - spare (unused) pairs shall be safely terminated or their free ends enclosed in a high dielectric
724 strength cap;
- 725 - where additional protection against lightning is necessary, surge protective devices shall be installed
726 in the closure and earthed.

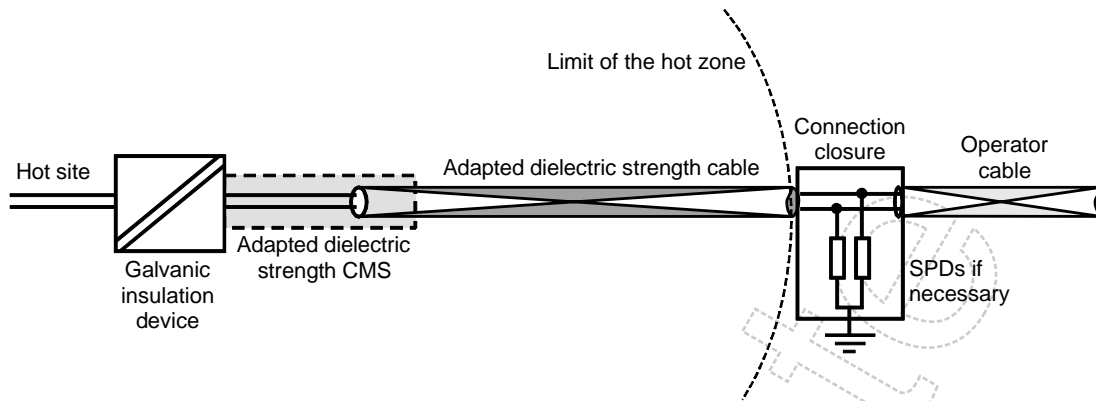


Figure 6 - Example of the use of a galvanic isolation device

- 727
- 728
- 729 Annex B gives examples of installation practices.
- 730 **5.10 Information technology cabling interconnections between buildings**
- 731 **5.10.1 Buildings with the same earthing system**
- 732 The requirements of EN 50174-2 shall apply.
- 733 **5.10.2 Buildings with different or separate earthing systems**
- 734 See EN 50310 for information.
- 735 For the purposes of this clause it has been assumed that for hazards caused by an EPR corrective
- 736 actions have been implemented.
- 737 As a general guide, buildings in close proximity may have cable screens directly connected to earth. This
- 738 is only possible where any circulating currents, due to potential differences between buildings, will not
- 739 disturb or damage services.
- 740 If direct connection of the cable screen to the earth system provides an unacceptably high current see the
- 741 HD 384 series for information.
- 742 Special requirements may need to be adopted for some particular environments (e.g. chemical industries
- 743 where an earth free installation may be required). For this particular case, each installation needs a
- 744 detailed study to fulfil all the safety and local regulations.
- 745 In the case of cable sharing (hybrid cables) to carry high voltage applications, very detailed labelling is
- 746 needed for safety reasons.
- 747 The maximum distance for which two buildings can be connected is strictly related to the application and
- 748 the type of cables. More information is given in EN 50173-1.
- 749 For fire and chemical hazard the requirements of EN 50174-2:2000, Clause 4, shall apply.
- 750 **5.11 Pole sharing**
- 751 **5.11.1 General precautions**
- 752 This clause deals with the use of low voltage distribution poles for lighting and for information technology
- 753 services.

754 Poles used for HV mains power (> 1 000 V) as well as those supporting both HV and LV lines are not
755 covered by this part of EN 50174.

756 An agreement shall be reached with the owner of the poles for joint use. Poles may be shared by more
757 than one information technology system with the agreement of the owner.

758 Special care shall be taken with regard to safety and electromagnetic interference in cases where there
759 are antennas on poles.

760 **5.11.2 Hazards requirements**

761 Personnel working on shared poles shall be made aware of safety rules or local regulations relating to the
762 access of LV works.

763 See 5.4.3.

764 The information technology cable shall be insulated.

765 **5.11.3 Pre-installation**

766 It is necessary to verify that joint use of poles is allowed and to give special consideration to

767 a) the voltage in the mains power system,

768 b) the mechanical capacities of poles,

769 c) the requirements described in this standard for earthing systems, aerial to underground junctions and
770 aerial connections.

771 Before undertaking mechanical calculations, it is necessary to determine the following:

772 1) the technical characteristics of the mains power system;

773 2) future possible modifications, such as the transformation of the LV into HV mains;

774 3) the reservation of the expected zone for a light fitting.

775 When installing a new earthing system for information technology cabling, the location of an existing
776 earthing systems or any metallic parts should be checked to avoid galvanic coupling, see 6.10.

777 Where an earthing system exists on a pole then it shall be dedicated to only one of the following
778 applications:

779 - mains power cabling,

780 - lighting,

781 - information technology cabling.

782 The use of mains poles for information technology cabling implies the installation of cables, support, stays
783 or struts and closures (connection, protection, amplification, radio, etc.).

784 Except for stays or struts, all equipment shall present a voltage insulation of at least 4 kV 50 Hz for one
785 minute.

786 Stays or struts, closures and accessories should be positioned in such a way to facilitate safe access.

787 Information technology cabling shall always be fixed below LV power cabling (including cables for mains
788 networks, conductors and devices for lighting as well as their feeder cables).

789 Locations of any equipment or cables should allow the use of any approved access.

790 Closures and accessories shall be installed below the information technology cables.

791 In addition, the dimensions and locations of closures and accessories shall be agreed between the owner
792 of the pole and the installer of the information technology cabling.

793 **5.11.4 Distances**

794 **5.11.4.1 Height above the ground of information technology cabling**

795 See 5.4.3.

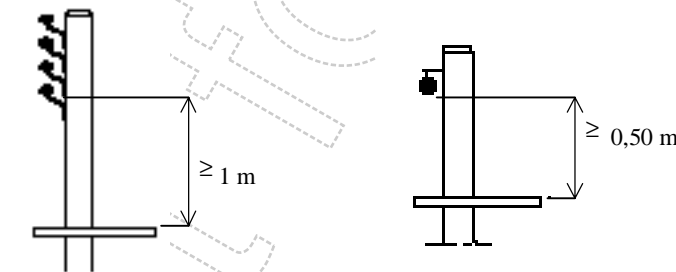
796 **5.11.4.2 Distances between systems**

797 Two cases are considered.

798 5.11.4.2.1 Without existing or foreseen lighting

799 The information technology cabling shall be supported such that the minimum vertical distance at the pole
800 between mains power and information technology cabling, is at least:

- 801 a) 1 m in cases where mains power conductors have no insulation (see Figure 7);
- 802 b) 0,50 m in cases of mains power in cables (insulated) (see Figure 7).



803

804 **Figure 7 - Separation distances at the pole**

805 Due to the sag, the minimum distance at any point along the line between information technology cables
806 and the power cables (insulated) shall be at least 0,3 m.

807 5.11.4.2.2 Presence of a lighting system

808 If the pole has a lighting device, information technology cabling and equipment shall be installed at least
809 0,20 m below this device and away from its feeder cable (see Figure 8).

810 In addition, the information technology cabling shall be supported such that the minimum distance, at the
811 pole, between mains and information technology cabling, is at least:

- 812 a) 1 m in cases where mains conductors have no insulation(see Figure 8);
- 813 b) 0,5 m for cables (insulated) (see Figure 8).

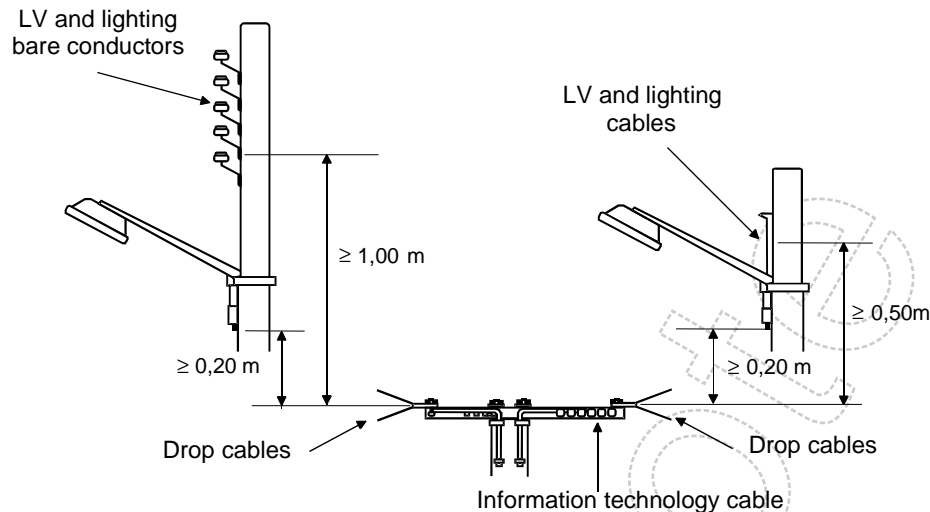


Figure 8 - Separation distance at the poles with lighting devices

814

815

816

817 5.11.4.3 Installation rules

818 On the same pole, the following shall be implemented:

- 819 a) adjacent supports for information technology cabling shall be separated by at least 0,3 m;
- 820 b) crossing of information technology bundles is not allowed unless an additional support at the pole is
821 used;
- 822 c) protection against lightning and proximity of lightning rods.

823 Generally cabling installed in urban areas does not need protection from lightning. Protection is generally
824 needed if cables containing metallic parts are installed in rural areas. For more detailed information refer
825 to EN 61663-1 for optical fibre cable and to EN 61663-2 for copper cable as well as series IEC 61024,
826 series IEC 61312 and IEC/TR 61662.

827 To reduce the risk of damage, the metallic element of cables shall be electrically continuous along the
828 length of cable and metallic elements should be earthed at least at both ends of cable. The most common
829 protection methods are

- 830 - use of all dielectric optical cables,
- 831 - use of shield conductor(s),
- 832 - use of surge protective devices.

833 The use of combined protective measures is also possible to reduce the likelihood of damage due to
834 lightning.

835

835 **6 Additional installation practice for metallic cabling**

836 **6.1 EMC-Considerations**

837 The requirements of EN 50174-2 shall apply.

838 **6.2 Balanced transmission**

839 The requirements of EN 50174-2 shall apply.

840 **6.3 Screening**

841 The requirements of EN 50174-2 shall apply.

842 **6.4 Mains and high voltage power distribution systems (above 1 000 V)**

843 The protective measures for resistive, inductive or capacitive coupling to the power distribution system,
844 can be made in the power distribution system, the information technology system or both as described in
845 5.9. If any measures have been made in the information technology cabling to prevent overvoltages
846 exceeding the limit values, installers and service personnel need to have knowledge about these
847 protected lines. This information should be a part of the documentation of the network. In addition
848 accessible parts of the network should be marked with warnings. When work on the cable or associated
849 plant is necessary it should be made safe either by earthing or isolation dependent on the protective
850 measures inherent to the system. This is done to ensure the safety of personnel. Applicable national
851 safety regulations shall be followed.

852 **6.5 Protection against very low frequency fields**

853 For detailed information see EN 50174-2:2000, 6.9.

854 **6.6 Electrical isolation components**

855 For more detailed information see EN 50174-2:2000, 6.10.

856 **6.7 Surge protective devices**

857 **6.7.1 General**

858 For detailed information see EN 50174-2:2000, 6.11.1.

859 **6.7.2 Design guidelines**

860 **6.7.2.1 General**

861 The following shall be considered:

- 862 a) protection against overvoltages (parallel protection) or overcurrents (series protection) or both;
- 863 b) the location of the surge protective device (at termination points, transition points between
864 overhead and under ground, and when the number of overhead spans exceeds 3);
- 865 c) the type of transmitted signals (AC, DC, data, high frequency, etc.) - the link requirements
866 specified according to EN 50173 series shall not be altered beyond the limits set.

867 In the selection of the nominal breakdown voltage, the tolerances of any feeding voltage as well as the
868 tolerances of the surge protective device shall be taken into account.

869 See also ITU-T K.12 and ITU-T K.28 for information.

870 **6.7.2.2 Protection of information technology cabling**

871 Situations where protection may be required are as follows:

- 872 a) in areas with high lightning probability;
- 873 b) where the attached equipment shows a considerable impulse transfer ratio from the mains power
874 to the information technology port or from an antenna port to the information technology port;
- 875 c) where not enough adequate protective measures have been provided in the outside information
876 technology network.

877 Typical examples of protection for information technology cabling are given in Annex B.

878 **6.7.3 Installation rules**

879 Suppliers' installation instructions shall be complied with.

880 All metal sheaths, screens, etc., shall be connected together at each end to form an overall bonded
881 network. Overvoltage protectors shall be connected between the conductors and this bonded metal work,
882 which shall be correctly bonded to earth via the lowest possible impedance.

883 Where surge protective devices are used to reduce high voltages appearing in information technology
884 lines due to induction from power line fault currents, they should be fitted to all individual information
885 technology cables at suitable intervals and at both ends of the affected length of line, or as near to this as
886 practicable. See Annex B.

887 To protect underground information technology cables against lightning surges, protective devices may
888 be placed at the points of connection to overhead lines as well as at the entrances of buildings. The
889 protective devices fitted at the Main Distribution Frame and all subscribers terminals reduce the risk of
890 damage to lines but their main function is to protect components having lower dielectric strength than the
891 cables. See ITU-T K.20 and ITU-T K.21 for information.

892 Protection systems against overvoltage surges are recommended at both ends of each information
893 technology line having four or more spans of cable. See series EN 61663 for information.

894 The earthing arrangements of SPD's forming part of a protection system shall be designed and installed
895 to prevent any possibility of a bypass of the protection arrangements.

896 In cases where the users power cabling is susceptible to surges, an isolation transformer may be installed
897 which will reduce the peak value of the surge.

898 **6.8 Protection against lightning**

899 Lightning-induced voltage surges are often described as a 'secondary effect' of lightning; there are three
900 recognised means by which these surges are induced in mains or information technology cables. For
901 resistive, inductive and capacitive coupling see, for instance, IEC 61024-1, IEC 61312 (series),
902 IEC 61662 (series), and EN 61663 (series), as appropriate.

903 **6.9 Protection against electrostatic discharge (ESD)**

904 For information see EN 50174-2.

905

905 **6.10 Corrosion**

906 The requirements of 6.14 of EN 50174-2:2000 shall apply.

907 Any surfaces associated with earthing, information technology cable terminating onto surge protective
908 devices or systems which are in electrical contact and installed in an outside environment shall be
909 protected from corrosion.

910 There are two techniques to achieve cathodic protection:

911 a) by the use of a reactive consumable anode made of metal such as magnesium, aluminium, zinc
912 or zinc alloy;

913 b) or by connecting the metal to be protected to the negative pole of a low voltage DC generator
914 and the positive pole to an anode made of steel, graphite, lead or titanium platinum. The goal is
915 to cancel the corrosion current by a counter current.

916 For further information see also EN 60068-2 series dealing with corrosion tests, 5.14 of
917 EN 50174-2:2000, ITU-T L.7 and ITU-T L.8.

918 Electrolytic and chemical danger may result, for instance, from marshy humus and chalky ground, from
919 deposits of rubble and sewage and from soft water containing dissolved carbon dioxide. When they are to
920 be laid in such environments, cables shall be equipped with an external, plastic sheath. Any protective
921 tubes for cables shall be made from plastic material.

922 Cathodic protection shall be used for cables with an external plastic enclosure over the metal shell, since
923 it has to be assumed that:

924 1) the plastic enclosure may be penetrated, for example, by atmospheric discharges or as a result of
925 mechanical damage,

926 2) the metal sheath below may be corroded (pitting) at the exposed point.

927 If cables, which act as earth electrodes, are to be laid in aggressive ground then attention shall be paid to
928 the provision of good protection against corrosion, e.g. by the use of an armouring made from heavily
929 galvanised round steel wire.

930 Intersections between underground information technology cable lines and cathodically protected
931 installations, which generate stray currents, shall be taken into consideration.

932 When laying information technology cables in the same trench as pipelines which will be cathodically
933 protected, the information technology cable shall be included in the cathodic protection.

934 NOTE It may be advisable to include in the cathodic protection those information technology cables which do not act as earth
935 electrodes, but which do have a conductive metal sheath beneath a plastic cover.

936 If the clearance between the information technology cable and the pipeline does not exceed 0,3 m, the
937 information technology cable shall be fitted with an insulating outer sheath. No additional mechanical
938 protection shall be provided due to the shadowing effect of the information technology cable on the
939 cathodic protection. The clearance between the information technology cable and the pipeline shall be no
940 less than twice the diameter of the information technology cable. Cables with aluminium sheathing which
941 is subject to anodic and cathodic corrosion are unsuitable for use in areas which are cathodically
942 protected or which carry stray currents.

943 **6.11 Protection against radar emission and broadcast emitters**

944 See EN 50174-2:2000, A.6.1 for information.

945 **7 Additional installation practices for optical fibre cabling**

946 **7.1 General**

947 This clause specifies additional requirements for an optical fibre cabling system (e.g., cable, connectors,
948 splices, connecting and protective hardware). It supplements the requirements given in Clauses 4 and 5.
949 It provides guidance to assist the user and installer with regard to the general aspects of the installation of
950 optical fibre cables covered by the EN 60794 series of specifications. Additional information is available in
951 Annex C of EN 60794-1-1:2002. Cables can contain multimode fibres, single mode fibres or a
952 combination of these fibre types. For cables with different types of optical fibres, some means of
953 segregating the fibres by type shall be employed. Additionally, it is recommended that spare capacity be
954 included to support present and future applications.

955 Optical fibre cabling provides a high performance communications pathway whose characteristics can be
956 degraded by incorrect installation.

957 Optical fibre cables generally have a strain limit rather lower than metallic conductor cables and in some
958 circumstances, special care and arrangements may be needed to ensure successful installation.

959 It is important to pay particular attention to the cable manufacturer's recommendations and stated
960 physical limitations, and not to exceed the given cable tensile load rating for a particular cable. Damage
961 caused by overloading during installation may not be immediately apparent but can lead to failure later in
962 its service life.

963 Recommended optical fibre test schedules are contained in Annex A of EN 50346:2002.

964 **7.2 Pre-installation procedures**

965 The optical fibre cable should be tested for compliance with its specification, in particular insertion loss,
966 prior to installation. Installed (laid) optical fibre cable acceptance tests should be undertaken to avoid
967 contractual disputes.

968 **7.3 Optical fibre cable practices**

969 Optical fibre cables are available in several designs with many jacketing options (see series EN 60794 for
970 information). In many cases, a non-armoured cable is referred to as a duct cable. An all-dielectric cable
971 has no metallic or conductive components such as a metallic central member, metallic strength
972 member(s), armour or copper wires.

973 **7.4 Final assembly of closures**

974 Labels according to series EN 60825 should be applied adjacent to all accessible optical interfaces (see
975 EN 50174-1 for information).

976 **7.5 Termination practices**

977 **7.5.1 General**

978 This subclause details the recommended practices that should be adopted by the installer during the
979 jointing and termination of the installed optical fibre cable.

980 **7.5.2 Splicing methods**

981 Typical splicing methods include fusion and mechanical and are intended for use in a variety of
982 environments such as in jointing chambers, overhead or in open trenches. Splicing may be used to join
983 individual fibres or fibre ribbons.

984 **7.5.3 Fusion splicing**

985 Fusion splicing is a method of fusing two fibres together with an electric arc. Since the fibres are basically
986 welded together, it is possible to get an environmentally stable optical fibre connection. For this reason,
987 fusion splicing is recommended for optical fibre connections in the outside plant.

988 Fusion spliced joints are achieved by welding the core and cladding regions of the two optical fibre ends.
989 The fusion splice should be protected by a suitable sleeve or splint.

990 The fusion splice is generally retained within the protective sleeve by either friction or adhesive bonds to
991 the optical fibre. In some cases it is necessary to provide further strain relief for the completed joint.

992 **7.5.4 Mechanical splicing**

993 Mechanical spliced joints are achieved by the alignment of the two optical fibre ends within a protective
994 sleeve. A typical mechanical splice incorporates a gripping mechanism to prevent fibre separation and a
995 means for fibre alignment. Depending on the design, the mechanical splices may be reusable. Because
996 the mechanical splices depend on a physical contact between two cleaved fibre ends, these splices may
997 be more sensitive to large variations in temperature. Manufacturers' recommended instructions for
998 protection and retention of the optical fibres should be observed.

999 **7.6 Jointing/termination of optical fibres**

1000 **7.6.1 General**

1001 The use of either fusion splicing or mechanical jointing techniques provides a permanent stable, low
1002 attenuation connection of optical fibres.

1003 The performance of a splice is dependent upon the environmental conditions (e.g. humidity) as well as
1004 the capability of the technique, the workmanship applied to achieve the splice and the subsequent
1005 workmanship applied to protect the splice to ensure satisfactory operational lifetime.

1006 Termination can be achieved by direct application of connectors to the installed optical fibre, e.g. gluing
1007 techniques, or splicing of a pre-manufactured pigtail to the optical fibre of the installed optical fibre cable
1008 or mechanical connection of a pre-manufactured pigtail to the optical fibre of the installed optical fibre
1009 cable.

1010 Labelling of optical fibre installations should be such that the polarisation of duplex optical fibre
1011 connections is known and consistent throughout the installation.

1012 During the direct application of connectors to the installed optical fibre, the recommended installation
1013 procedures shall be followed.

1014 Optical fibre connectors are more susceptible than splices to temperature induced losses at extreme
1015 temperatures and are usually limited to temperature controlled environments.

1016 Connectors applied to optical fibres should be subjected to visual inspection as defined in EN 50346.

1017 **7.6.2 Mechanical protection**

1018 Each fusion or mechanical splice shall be protected in a splice tray or similar protective device that will
1019 mount inside a closure or an enclosure. The tray shall be used to store and organise the fibres and
1020 splices, protect the fibres, and ensure the fibres comply with the minimum bend radius. Stripped optical
1021 fibre should be protected with a heat shrink cap or silicone adhesive to prevent exposure to moisture.

1022 **7.7 Optical fibre management**

1023 **7.7.1 General**

1024 All splice joints and their strain relief mechanisms should be fixed within the optical fibre management
1025 system of the closure.

1026 Splices shall be supported where there is risk of damage that could limit operational lifetime.

1027 **7.7.2 Fibre storage and organising housings**

1028 Fibre storage and organising housings typically involve fibre and fibre splice storage, as well as fibre
1029 distribution and fibre cross connection.

1030 The following should be considered when selecting fibre storage and housings:

- 1031 a) always follow the specific installation specification of the manufacturer for the minimum bend
1032 radii of the cable,
- 1033 b) cable entry ports providing strain relief,
- 1034 c) provisions for electrically bonding/grounding cables,
- 1035 d) storage for excess fibre slack.

1036 Splicing is used where higher performance connections are desired (lower insertion loss and lower back
1037 reflection). The enclosures house and organise groups of spliced fibres.

1038 Splice module housings are used when directly splicing to the incoming fibres. Typically, these
1039 enclosures house and organise groups of fibres and accommodate splice trays, but have no patch panel
1040 capability.

1041 **7.7.3 Optical fibre splice closure**

1042 **7.7.3.1 General**

1043 An optical fibre splice closure, and the associated hardware, are intended to restore the mechanical and
1044 environmental integrity of an optical fibre cable following a splicing operation. Splice closures are used to
1045 provide environmental protection for exposed cable cores (sheath removed) and exposed fibres. They are
1046 used to protect through splices (continuation of a run), branch splices or to splice "drop" fibres to nodes.

1047 In addition, a splice closure provides the necessary facilities for organising and storing optical fibre and
1048 splices. Optical fibre closures shall be able to be re-entered and water resistant.

1049 The expected operating environment for an optical fibre splice closure is between $-40\text{ }^{\circ}\text{C}$ and $70\text{ }^{\circ}\text{C}$.
1050 Within this temperature range, it is necessary for the closure not to experience any functional degradation
1051 that could affect its performance. In addition there are several extreme environmental and mechanical
1052 conditions to which a closure may be subjected in certain deployment configurations. These include flood
1053 water or chemical exposure, immersion in ice, and exposure to steam.

1054 Outdoor closures may be installed in cabinets, jointing chambers, on poles and suspended from catenary
1055 wires. They shall be designed by calculating the number of splices, the amount and the density of the
1056 optical fibre and whether the cables are installed at one end or both ends of the splice closure. Optical
1057 fibre closures shall be capable of bonding and grounding cable screens and closures as required by
1058 applicable codes.

1059 In the case of sealed closures, pressurisation tests shall be carried out. See EN 60794-1-2:1999, method
1060 F8, for information.

1061 **7.7.3.2 Installation requirements**

1062 Optical fibre splice closures shall be accessible to maintenance personnel and maintenance vehicles.
1063 A closure should be located away from high traffic or conditions that could cause damage to the closure
1064 or injury to personnel.

1065 Cables with metallic or conductive components shall be bonded and earthed.

1066 **8 Additional installation practices for specific sites and services**

1067 **8.1 Hospitals**

1068 Different sources of electromagnetic noise exist in the vicinity of hospitals.

1069 Emitters and receivers can produce or be affected by high frequency electrical fields. If hospital
1070 equipment is affected it could be life threatening and special care has to be taken (see EN 60601-1-2).

1071 **8.2 Airports**

1072 Different sources of electromagnetic noise exist in the vicinity of airports.

1073 Navigation emitters (e.g. Instrument Landing System) and radar (e.g. air traffic control, air and surface search,
1074 airborne systems) produce high frequency electric fields and large peak pulse powers in a wide zone.

1075 For mitigation techniques see Annex A of EN 50174-2:2000.

1076 Care shall be taken to minimise any emissions which could affect navigation systems (e.g. landing systems).

1077 **8.3 Nuclear areas**

1078 High levels of electromagnetic noise are produced in the vicinity of nuclear power plant installations.

1079 The three main electromagnetic couplings are:

1080 1) galvanic coupling due to return current by the soil (stray current) and particular attention should
1081 be given to corrosion effects, and EPR areas;

1082 2) inductive coupling due to alternating currents (see also 4.3 and 6.8.3);

1083 3) radiated coupling due to high voltage sources (electrostatic influence) and due to antennas for
1084 communication and surveillance services.

1085 They produce

1086 a) low frequency electric and magnetic fields in a wide zone,

1087 b) low frequency harmonics (up to 9 kHz),

1088 c) transients, flashover discharges (e.g. heavy current faults, switching voltage surges),

1089 d) high frequency electric fields in a wide zone,

1090 e) corona effect (due to very high voltage).

1091 For mitigation techniques see EN 50174-2:2000, Annex A.

1092 This area is subject to EPR due to the presence of very high voltage and infrastructure protections
1093 against lightning (lightning rods). See Annex A.

1094 Relevant national regulation for safe working practices in nuclear and EPR areas shall be complied with.

1095 8.4 Explosive areas

1096 Refer to explosive atmospheres standards EN 50014, EN 50019, EN 50020 and series
1097 EN 60079/IEC 60079.

1098 8.5 Chemical manufacture /areas /plants

1099 In chemical environments, the main stress for equipment and accessories is corrosion. All metallic parts
1100 like earthing and bonding connections, EMC gaskets and seals, connectors and connection points,
1101 closures and cabinets, cable management systems are very sensitive to corrosion (refer for information
1102 to 6.10 and EN 50174-2:2000, 6.14).

1103 In such environments, use of non-metallic cable management systems is often recommended. In this
1104 case refer for information to EN 50174-2:2000, 6.5 and 6.6.3.2. For closures, refer to EN 50174-2:2000,
1105 5.8, for information.

1106 The selection of cables, connectors, CMS and accessories shall be based upon the requirements of the
1107 relevant European product standards (national regulations are mandatory).

1108 NOTE In this context controlled earth free installations are very common.

1109 8.6 Tunnels and bridges including their associated services

1110 On metallic bridges and in tunnels containing electric railway tracks, cables with an insulated covering
1111 shall be used. Information technology cables, of which the screen acts as protective earth conductor,
1112 shall be insulated from conductive parts of metallic bridges. A PEC should be used (see
1113 EN 50174-2:2000, 6.7.3.2, for information).

1114 Where it is not possible to provide reliable insulation between information technology cables and metallic
1115 bridges, any screens and armouring of the information technology cables shall at least be connected with
1116 the conductive parts of both ends of the bridges in such a way as to be electrically conductive. A PEC
1117 shall be used (see EN 50174-2:2000, 6.7.3.2, for information). This, however, shall not apply in the case
1118 of direct current railway installations because of electrolytic corrosion. See 6.10.

1119 8.7 Waterways, including rivers, canals, streams (natural or ducted / channelled etc.)

1120 When information technology cables are to be in or under water, the regulations of the relevant authorities
1121 shall be complied with.

1122 Only cables that are specifically designed or protected, by means of a protective cover can be laid in the
1123 vicinity of the shore. The term "vicinity of the shore" shall mean the entire embankment down to the
1124 bottom of the waterway and the shore-line between the high and low water marks. The points where the
1125 information technology cables come ashore shall be marked.

1126 Where underground information technology cable lines cross beneath waterways and other navigable
1127 waters the depth of the cable line and any necessary measures for the protection of the cable line and for
1128 the protection of shipping shall be agreed upon with the authorities responsible for waterways and
1129 shipping.

1130 In the case of non-navigable waterways and channels, the landowners (e.g. local authorities) and where
1131 appropriate also the water authorities are responsible.

1132 In the case of aerial crossings of waterways (navigable rivers, canals and other stretches of water),
1133 details shall be obtained in respect of the stipulated minimum clearance between the lowest wires or
1134 aerial cables at maximum sag and the surface of the water at the highest navigable water level. Any
1135 measures, which should be implemented for the protection of shipping, should be ascertained from the
1136 authorities responsible for waterways and shipping. In the case of non-navigable waterways a minimum
1137 clearance of 5 m above the surface of the water will, as a general rule, be sufficient when the water is at
1138 its normal level.

1139 In the case of crossings of high water protection installations (dikes), the presence of above ground
1140 information technology cables shall not interfere with the maintenance of such installations; the
1141 responsible authorities shall be involved at the planning stage of the information technology cabling.

1142 **8.8 Over-ground and underground railways**

1143 **8.8.1 General**

1144 A railway is a complex installation with moving sources of electric and electromagnetic disturbances; the
1145 implementation of the EMC standards within information technology installations alone is not a guarantee
1146 of satisfactory performance. All cases shall be considered with respect to a formal plan to the
1147 management of EMC. This plan should be established early in the project.

1148 **8.8.2 Electric and electromagnetic environment**

1149 Refer for information to relevant railway applications standards (EN 50121 series).

1150 Different sources of electromagnetic interference are produced in the vicinity of railway installations.

1151 Electromagnetic coupling occurs in three main ways:

1152 1) galvanic coupling (i.e. EPR) due to return current in the soil (stray current); particular attention
1153 should be given to corrosion in the case of direct current source feeders;

1154 2) electrostatic influence due to high voltage sources;

1155 3) induction phenomenon due to alternating currents (see also 4.3 and 6.8.3).

1156 Direct current sources (600 V up to 3 000 V) and alternating current sources (16 2/3 Hz at 15 kV, 50 Hz at
1157 25 kV or 2 x 25 kV) are used. They produce

1158 a) low frequency electric and magnetic fields in a wide zone,

1159 b) low frequency harmonics (up to 9 kHz),

1160 c) transients, flashover discharge (e.g. short circuit catenary / rail, pantograph / catenary
1161 disconnection),

1162 d) radio frequency (9 kHz to 400 GHz) fields from trains,

1163 e) corona effect.

1164 For mitigation techniques see EN 50174-2:2000, Annex A.

1165 DC railway and traction systems using the earth as a part of the current return path may have earth
1166 leakage. Users of information technology cables and equipment adjacent or near to DC traction systems
1167 experiencing earth leaking problems shall seek expert advice.

1168 **8.8.3 Installation guidelines**

1169 **8.8.3.1 Intersections of above-ground information technology cables with railway installations**

1170 The tracks shall be crossed at right angles.

1171 The information technology cable shall not obstruct the visibility of signals and road crossings.

1172 The functioning of technical equipment of railway installations shall not be impaired.

1173 The space to be left clear by the parts of the information technology cables shall be subject to agreement
1174 with the operator of the railway.

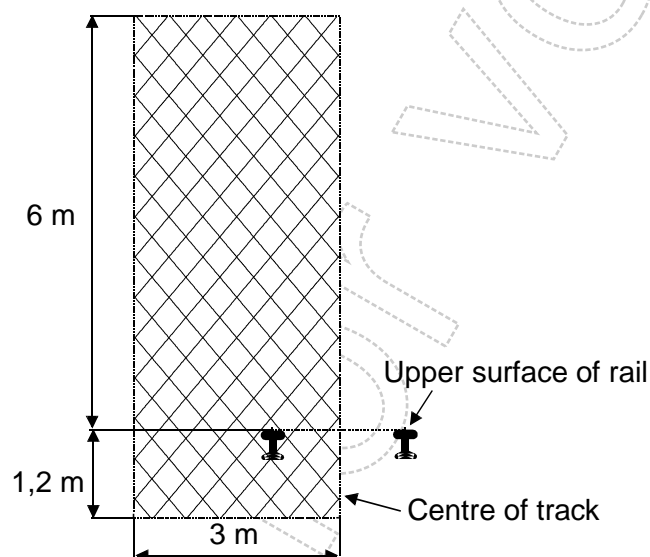
1175 In the case of standard gauge railways on which vehicles with a width of 3 150 mm run, the following
 1176 clearances shall apply (excluding information technology systems for signalling and controlling of the
 1177 rolling stock):

- 1178 a) 6 m above the upper surface of the rails;
- 1179 b) 3 m from the centre line of the track and horizontal to the track;
- 1180 c) 1,2 m below the upper surface of the rails.

1181 These areas shall not be occupied by any part of the information technology cable (e.g. even by anchors
 1182 and stays). See Figure 9.

1183 The minimum 6 m clearance shall be adhered to at maximum sag and under conditions of ice wind
 1184 loading.

1185



1186

1187 **Figure 9 - Clearance not including components of**
 1188 **information technology cabling for standard gauge railways**

1189 8.8.3.2 Close proximity to railways

1190 Avoiding aerial crossing of railways is strongly recommended.

1191 Information technology cables shall be provided with a high degree of resistance to fracture.

1192 As a means of preventing danger resulting from a falling contact wire, in addition to the space specified in
 1193 8.8.3.1, a triangular space shall be kept free from conductive components of the information technology
 1194 cabling. This space starts at a point 0,2 m above the contact wire and extends horizontally by 4 m to
 1195 either side of the centre line of the track (see Figure 10).

1196

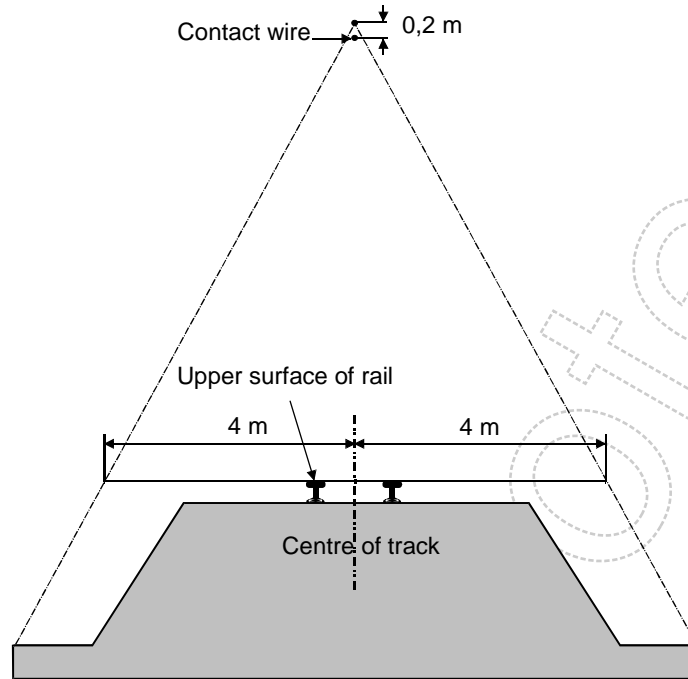


Figure 10 - Clearance not included components of information technology cabling for protection against falling contact wires

- 1197
- 1198
- 1199
- 1200 The vertical clearance between the aerial information technology cable and the earth contact wire shall be
- 1201 a minimum of 2 m.
- 1202 Railways with alternating contact wire (type of pantograph) voltages above 1 kV or with direct contact wire
- 1203 voltages above 1,5 kV shall not be crossed by information technology cables. Exceptions to this
- 1204 requirement are information technology cables that have been laid alongside a power line, which crosses
- 1205 the contact wire.
- 1206 The information technology equipment shall be protected against overvoltages caused by the contact line
- 1207 voltage being exceeded, e.g. by means of an overvoltage arrester or a protective transformer.
- 1208 Information technology cables shall be positioned at a horizontal distance of at least 4 m from the centre
- 1209 line of the track where the alternating contact wire voltage exceeds 1 kV or where the direct contact wire
- 1210 voltage exceeds 1,5 kV.
- 1211 In the case of crossings of railways, underground cables shall be laid inside protective ducts or conduits
- 1212 which shall extend to the base of the slope of the railway embankment and shall extend at least 1,75 m
- 1213 beyond the outside edge of the outermost rails.
- 1214 In the case of electric railways, ducts or conduits shall be made of an insulating material.
- 1215 **8.8.3.3 Exceptions**
- 1216 Exempted from the above are information technology cables which lead to signalling and points
- 1217 installations which are used for the operation of the railway. These installations shall be planned and
- 1218 carried out by experts approved by the railway authorities.
- 1219

Annex A (informative)

Earth potential rise (EPR)

1219
1220
1221
1222

1223 A.1 General

1224 The EPR for a single phase fault (phase/neutral) is the product of the part of the fault current flowing into
1225 the earthing system including earthing of earth wires, cable screens, etc, I_f (A), multiplied by the global
1226 resistance of the earthing system.

1227 Where the earthing system can be represented by an equivalent hemisphere (radius R_e), the voltage
1228 decrease V outside the equipotential area is given by equation A.1:

$$1229 \quad V = \rho \times I_f / 2\pi \times d \quad (A.1)$$

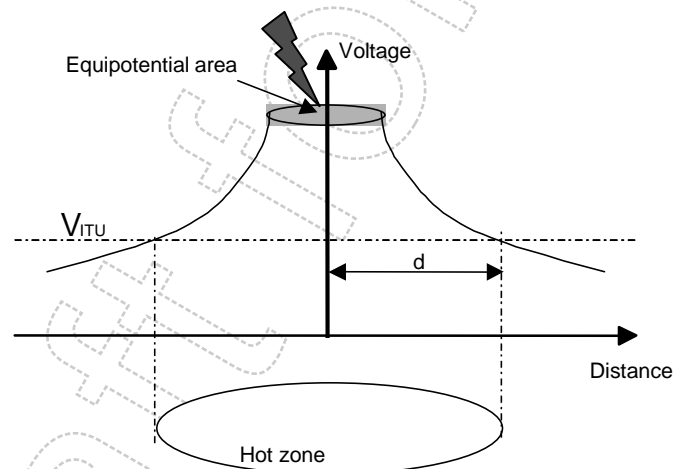
1230 where

1231 ρ soil resistivity (Ωm)

1232 I_f fault current (A)

1233 d distance (m) between the centre of the area of highest potential of the earthing system and the
1234 considered point (see Figure A.1).

1235



1236

1237

Figure A.1 - Definition of hot zone

1238 A.2 Limit of the hot zone

1239 A.2.1 General

1240 The worst case limit of the hot zone, d (m), measured from the centre of the equipotential zone of the HV
1241 installation, can be evaluated with the equation A.2 :

$$1242 \quad d = \rho \times I_f / 2\pi \times V_{ITU} \quad (A.2)$$

1243 where

1244 ρ soil resistivity (Ωm)

1245 I_f fault current (A) flowing to the earthing system

1246 V_{ITU} voltage limit (V) given in ITU-T K.53 for a typical situation

1247 For a more precise calculation of the limit of the hot zone see ITU-T K.33.

1248 Where the EPR around a hot site is not known or cannot be calculated because of lack of data,
1249 recommended minimum distances for the limit of the hot zone are given in A.2.2 and A.2.3.

1250 **A.2.2 Example of a hot zone around HV installations less than 25 kV**

1251 Where the EPR is not known, the limit of the hot zone can be taken from Table A.1 (see Table A.1 of
1252 EN 50352).

1253 **Table A.1 – Minimum distance (HV installations less than 25 kV)**

Soil resistivity	Power supply system with isolated neutral or arc suppression coil ($I_r < 40 \text{ A}$)	Power supply system with directly earthed neutral ($I_r > 1000 \text{ A}$)
< 50 Ωm	5 m	10 m
50 Ωm to 500 Ωm	10 m	20 m
500 Ωm to 5 000 Ωm	20 m	50 m
5 000 Ωm to 10 000 Ωm	20 m	100 m
> 10 000 Ωm	20 m	200 m

1254

1255 **A.2.3 Example of a hot zone around HV installations exceeding 25 kV**

1256 Where the EPR is not known, the limit of the hot zone can be taken from Table A.2 (ρ in Ωm gives the
1257 distances d in m).

1258 **Table A.2 - Minimum distance (HV installations exceeding 25 kV)**

Time to clear the power faults	Fault current flowing to earth		
	4 kA	8 kA	12 kA
$t \leq 0,2$	$\rho/2$	ρ	$1,5\rho$
$0,2 < t \leq 0,35$	$2\rho/3$	$4\rho/3$	2ρ
$0,35 < t \leq 0,5$	$5\rho/6$	$5\rho/3$	$2,5\rho$
$0,5 < t \leq 1$	$5\rho/4$	$2,5\rho$	4ρ

1259

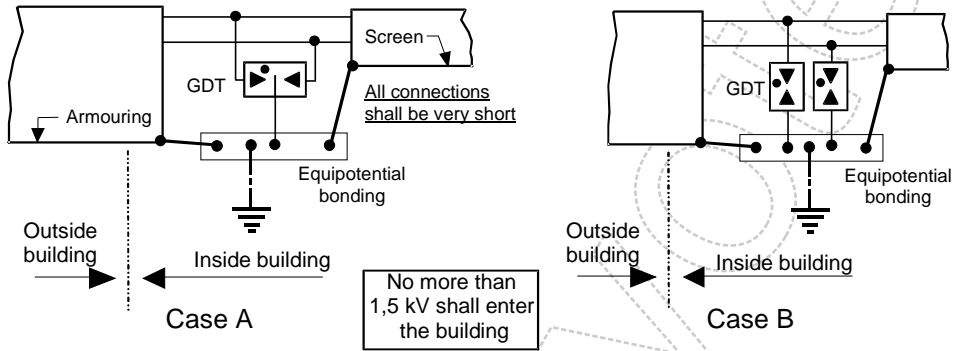
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Annex B
(informative)

Typical examples of protection for information technology cabling

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1264 B.1 At the point of taking over interface (port) between inside and outside building information
1265 technology cabling.



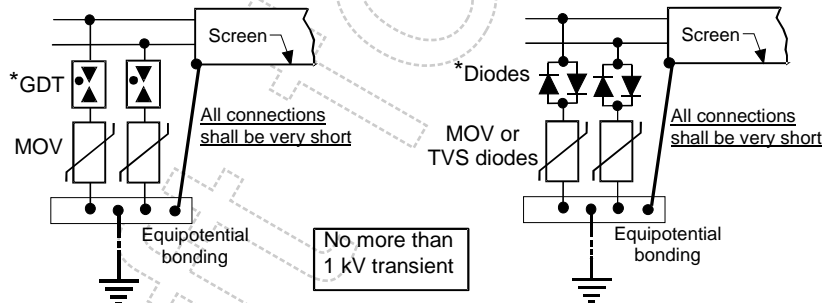
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Figure B.1 - Example of connection between inside and outside building

1268 The use of a 3-electrode arrester (case A) is a better choice, because the unbalanced breakdown is
1269 minimised.

1270 B.2 At the distributor

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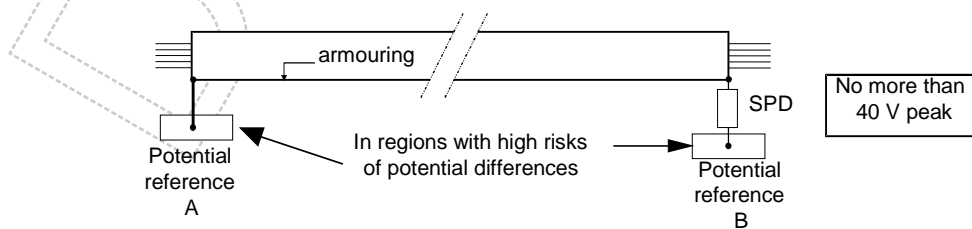
* These devices are necessary to reduce the parallel capacity of the MOV's. Diodes shall have low stray capacitance.

Figure B.2 - Example at main frame distributor

1276 B.3 At other locations

1277 B.3.1 Example 1: In non-equipotential zones

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Figure B.3 - Example of non-equipotential zones

1281 NOTE SPD devices should be, according to case, GDT, GDT + MOV, diodes + MOV.

1282 B.3.2 Example 2: ERP hot zone

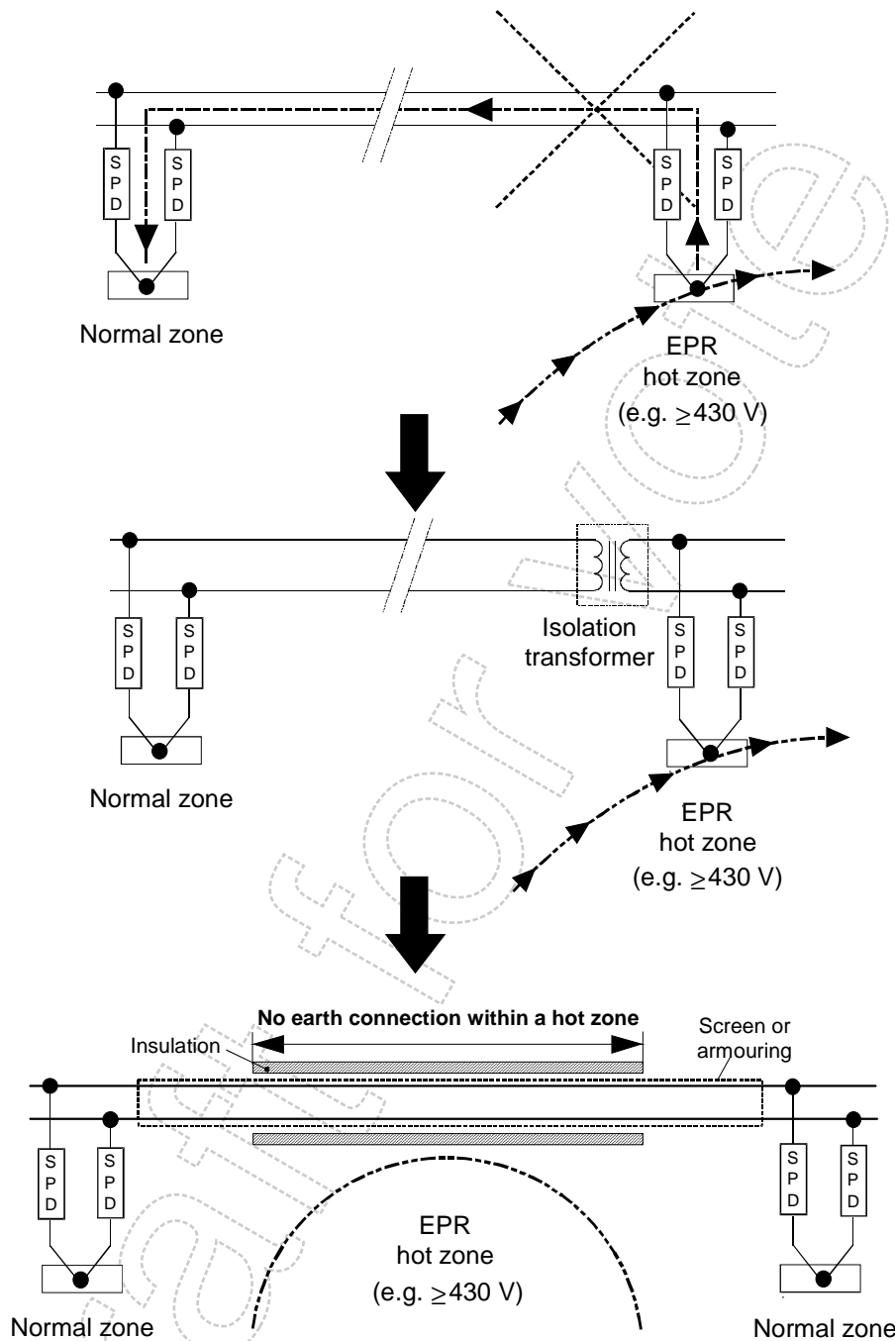


Figure B.4 - Example of a hot zone

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1284

1285 NOTE SPD devices should be, according to case, GDT, GDT + MOV, diodes + MOV.

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