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Nizkonapetostne električne inštalacije - 1. del: Temeljna načela, ocena splošnih karakteristik, definicije

Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions

Errichten von Niederspannungsanlagen - Teil 1: Allgemeine Grundsätze, Bestimmungen allgemeiner Merkmale, Begriffe

Installations électriques à basse tension - Partie 1: Principes fondamentaux, détermination des caractéristiques générales, définitions

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SECRETARIAT: Germany	SECRETARY: Mr Wolfgang Niedenzu
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 8,SC 8B,TC 9,TC 17,TC 18,TC 20,TC 22,SC 22E,SC 22G,SC 22H,TC 23,SC 23B,SC 23E,SC 23H,SC 23K,TC 32,SC 32B,TC 34,SC 37A,TC 61,TC 69,TC 73,TC 81,TC 82,TC 85,TC 95,TC 99,TC 108,TC 109,PC 118,TC 120,TC 121,SC 121A,SC 121B,PC 128,SyC LVDC	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input checked="" type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING
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TITLE:

Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions

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1	CONTENTS		
2			
3	FOREWORD		5
4	1.1 Scope		7
5	1.1.1 Scope of this document		7
6	1.1.2 Scope of the IEC 60364 series		7
7	1.2 Normative references		8
8	1.3 Terms and definitions		8
9	1.4 Structure of the IEC 60364 series		9
10	1.5 Fundamental principles		9
11	1.5.1 Protection for safety		9
12	1.5.2 Design		11
13	1.5.3 Selection of electrical equipment		15
14	1.5.4 Erection and verification of electrical installations		17
15	1.6 Assessment of general characteristics		17
16	1.7 Electrical installations		18
17	1.7.1 General structure of an electrical installation		18
18	1.7.2 Maximum demand and diversity		18
19	1.8 Conductor arrangement		18
20	1.8.1 General		18
21	1.8.2 Live conductors		18
22	1.8.3 Protective conductors		21
23	1.8.4 System-referencing conductors		22
24	1.9 Types of electrical systems		22
25	1.9.1 General		22
26	1.9.2 Types of electric systems for alternating current		25
27	1.9.3 Types of electric systems for direct current		36
28	1.10 Compatibility		43
29	1.10.1 Compatibility of characteristics		43
30	1.10.2 Electromagnetic compatibility		43
31	1.11 Maintainability		43
32	1.12 Safety services		43
33	1.13 Continuity of service		44
34	Annex A (informative) Structure of the IEC 60364 series		45
35	Annex B (informative) List of notes concerning certain countries		49
36	Bibliography		50
37			
38	Figure 1 – Single-phase two-wire system		19
39	Figure 2 – Single-phase two-wire system		19
40	Figure 3 – Single-phase three-wire system		19
41	Figure 4 – Two-phase three-wire system		20
42	Figure 5 – Three-phase three-wire system		20
43	Figure 6 – Three-phase four-wire system		20
44	Figure 7 – Two-wire system		21
45	Figure 8 – Three-wire system		21

46	Figure 9 – Example of an AC TN-S system with separate neutral conductor and protective earthing conductor throughout the system	26
47		
48	Figure 10 – Example of an AC TN-C-S system with a PEN conductor separated into a protective earthing conductor and a neutral conductor	26
49		
50	Figure 11 – Example of an AC TN-C-S single-phase system with a PEN conductor separated into a protective earthing conductor and a mid-point conductor	27
51		
52	Figure 12 – Example of an AC TN-S multiple source system with two local sources and two distribution boards	28
53		
54	Figure 13 – Example of an AC TN-C-S multiple source system with one local source and one external source (e.g. public power supply network)	Error! Bookmark not defined.
55		
56	Figure 14 – Example of an AC TN-C-S multiple source system source system with one external source (e.g. public power supply network) and one local source connectec to a distribution board different from the (main) distribution board	30
57		
58		
59	Figure 15 – Example of an AC TT system	31
60	Figure 16 – Example of an AC TT multiple source system with two local sources	32
61	Figure 17 – Example of an external source in an AC TT supply system with a local source in an installation operating as an IT installation when disconnected from the external source	33
62		
63		
64	Figure 18 – Example of an external source in an AC TT supply system with a local source in an installation operating as a TT installation when disconnected from the external source	34
65		
66		
67	Figure 19 – Example of an external source in an AC TT supply system with a local source in an installation operating as an TN installation when disconnected from the external source	35
68		
69		
70	Figure 20 – Example of an AC IT system with exposed-conductive-parts earthed individually or in groups by protective earthing conductors	36
71		
72	Figure 21 – Example of a DC TN-S system without mid-point.....	37
73	Figure 22 – Example of a DC TN-S system with mid-point.....	38
74	Figure 23 – Example of a DC TN-C system without mid-point	38
75	Figure 24 – Example of a DC TN-C system with mid-point	39
76	Figure 25 – Example of a DC TN-C-S system without mid-point	39
77	Figure 26 – Example of a DC TN-C-S system with mid-point	40
78	Figure 27 – Example of a DC TT system without mid-point	41
79	Figure 28 – Example of a DC TT system with mid-point	41
80	Figure 29 – Example of a DC IT system without mid-point.....	42
81	Figure 30 – Example of a DC IT system with mid-point	42
82		
83	Table 1 – Types of electrical systems considered for AC installations	23
84	Table 2 – Types of electric systems considered for DC installations	24
85	Table 3 – Symbols indicating the conductor function	25
86	Table A.1 – Numbering system of the IEC 60364 series	Error! Bookmark not defined.
87	Table A.2 – Structure of the IEC 60364 series – Low-voltage electrical installations	47
88	Table C.1 – Correspondence between IEC 60364-1:2005 and this document. Error! Bookmark not defined.	
89		
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91 INTERNATIONAL ELECTROTECHNICAL COMMISSION

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95 **LOW-VOLTAGE ELECTRICAL INSTALLATIONS –**

96

97 **Part 1: Fundamental principles, assessment of**
98 **general characteristics and definitions**

99

FOREWORD

100 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising
101 all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international
102 co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and
103 in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports,
104 Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their
105 preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with
106 may participate in this preparatory work. International, governmental and non-governmental organizations liaising
107 with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for
108 Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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110 consensus of opinion on the relevant subjects since each technical committee has representation from all
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113 Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC
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125 other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and
126 expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC
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128 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is
129 indispensable for the correct application of this publication.

130 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a)
131 patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in
132 respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which
133 may be required to implement this document. However, implementers are cautioned that this may not represent
134 the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC
135 shall not be held responsible for identifying any or all such patent rights.

136 IEC 60364-1 has been prepared by IEC technical committee 64: Electrical installations and
137 protection against electric shock. It is an International Standard.

138 This sixth edition cancels and replaces the fifth edition published in 2005. This edition
139 constitutes a technical revision.

140 This edition includes the following significant technical changes with respect to the previous
141 edition:

142 a) the entire document has been restructured and numbered in accordance with the directives
143 but preceded with the part number, i.e. 1.1, 1.2 etc.;

144 b) the scope has been expanded to include new areas of application and has been
145 restructured;

- 146 c) in 1.5.2.2.2, the topic of safety services and standby electric supply systems has been
147 added;
- 148 d) in 1.5.2.14, the topic of energy efficiency has been included;
- 149 e) in 1.5.2.15, the topic of prosumer electrical installations has been included;
- 150 f) in 1.5.3.5, the requirement for an equivalent safety level for the use of new materials and
151 innovations for which no product standards exist yet has been added. This must be verified
152 by a risk assessment;
- 153 g) in 1.5.4.3, the requirement for the effectiveness of protective measures for people and
154 livestock safety shall be maintained during the entire lifetime of the installation has been
155 added. This should be done by periodic verification;
- 156 h) Table 3 shows the symbol for the newly introduced "system-referencing conductor (SRC)";
- 157 i) the number of figures showing the type of earth connection in AC and DC systems is limited
158 to those which are most commonly employed. Some figures have been added for DC
159 systems;
- 160 j) Introduction of **Error! Reference source not found.** which relates the list of content of IEC 6
161 0364-1:2005 and the clauses of this document.

162 The text of this International Standard is based on the following documents:

Draft	Report on voting
64/XX/FDIS	64/XX/RVD

163
164 Full information on the voting for its approval can be found in the report on voting indicated in
165 the above table.

166 The language used for the development of this International Standard is English.

167 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
168 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
169 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
170 described in greater detail at www.iec.ch/publications.

171 A list of all parts in the IEC 60364 series, published under the general title *Low-voltage electrical*
172 *installations*, can be found on the IEC website.

173 The reader's attention is drawn to the fact that Annex B lists all of the "in-some-country" clauses
174 on differing practices of a less permanent nature relating to the subject of this standard.

175 The committee has decided that the contents of this document will remain unchanged until the stability
176 date indicated on the IEC website under webstore.iec.ch in the data related to the specific document.

177 At this date, the document will be

- 178 • reconfirmed,
- 179 • withdrawn, or
- 180 • revised.

181

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182

183 LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

184 185 Part 1: Fundamental principles, assessment of 186 general characteristics and definitions 187

188 1.1 Scope

189 1.1.1 Scope of this document

190 This part of IEC 60364 defines the scope and objective of the IEC 60364 series and specifies
191 the fundamental safety requirements for an electrical installation.

192 This document addresses the fundamental principles, assessment of general characteristics
193 and definitions of low-voltage electrical installations.

194 1.1.2 Scope of the IEC 60364 series

195 The International Standards of the IEC 60364 series specify the rules for the design, erection,
196 and verification of low-voltage electrical installations. The rules are provided for the safety of
197 human beings (persons), livestock and property against dangers and damage which can arise
198 from the intended use of low-voltage electrical installations and for the proper functioning of
199 those installations.

200 EXAMPLES: A non-comprehensive list of electrical installations or systems includes:

- 201 – residential premises;
- 202 – commercial premises;
- 203 – public premises;
- 204 – industrial premises;
- 205 – agricultural and horticultural premises;
- 206 – prefabricated buildings;
- 207 – caravans, caravan sites and similar sites;
- 208 – construction sites, exhibitions, fairs and other installations for temporary purposes;
- 209 – marinas;
- 210 – external lighting and similar installations;
- 211 – medical locations;
- 212 – mobile or transportable units;
- 213 – photovoltaic systems;
- 214 – stationary secondary batteries;
- 215 – low-voltage generating sets;
- 216 – temporary connected batteries (e.g. EV).

217 NOTE 1 "Premises" covers the land and all facilities including buildings belonging to it.

218 The International Standards of the IEC 60364 series covers

- 219 – circuits supplied at nominal voltages up to and including 1000 V AC or 1500 V DC; for AC,
220 the preferred frequencies which are taken into account in this standard are 50 Hz and 60 Hz.
221 The use of other frequencies is not excluded.
- 222 – circuits, other than the internal wiring of apparatus, operating at voltages exceeding
223 1000 V AC or 1500 V DC and derived from an installation having a nominal voltage not
224 exceeding 1000 V AC or 1500 V DC, for example, discharge lighting, electrostatic
225 precipitators;
- 226 – fixed wiring for information and communication technology (ICT), signalling, etc., including
227 installation and support of fibre optic cables;
- 228 – Wiring systems and cables not specifically covered by the standards for appliances.

229 The International Standards of the IEC 60364 series applies to:

- 230 • alterations or extensions of the installation, or both;
- 231 • parts of the existing installation affected by modifications, extensions or alterations;
- 232 • the design of functional aspects, such as energy efficiency, local production and storage of
233 energy (prosuming).

234 The International Standards of the IEC 60364 series applies to any kind of low-voltage electrical
235 installation or system, except:

- 236 a) electric traction equipment, including rolling stock and signalling equipment;
- 237 b) electrical circuits and equipment for automotive purposes within motor vehicles;
- 238 c) electrical installations of ships and of mobile and fixed offshore units;
- 239 d) electrical installations in aircraft;
- 240 e) public street-lighting installations which are part of the public electric power network;
- 241 f) installations in mines and quarries.

242 Electrical equipment is dealt with only in so far as its selection and application in the installation
243 are concerned.

244 The International Standards of the IEC 60364 series does not apply to the selection and
245 erection of the following electrical equipment:

- 246 i) radio interference suppression equipment, except where it affects the safety of the
247 installation;
- 248 ii) electric fences;
- 249 iii) external lightning protection systems for buildings (LPS);

250 NOTE 2 Atmospheric phenomena are covered in IEC 60364-1 but only in so far as effects on the electrical
251 installations are concerned (for example, with respect to selection of surge protective devices).

252 iv) electrical equipment of machines.

253 The International Standards of the IEC 60364 series is not intended to apply to low-voltage
254 public distribution networks.

255 1.2 Normative references

256 The following documents are referred to in the text in such a way that some or all of their content
257 constitutes requirements of this document. For dated references, only the edition cited applies.
258 For undated references, the latest edition of the referenced document (including any
259 amendments) applies.

260 IEC 60050-195, *International Electrotechnical Vocabulary (IEV) – Part 195: Earthing and*
261 *protection against electric shock*, available at <http://www.electropedia.org>

262 IEC 60050-826, *International Electrotechnical Vocabulary (IEV) – Part 826: Electrical*
263 *installations*, available at <http://www.electropedia.org>

264 1.3 Terms and definitions

265 For the purposes of this document, the terms and definitions given in IEC 60050-195 and
266 IEC 60050-826 and the following apply.

267 ISO and IEC maintain terminology databases for use in standardization at the following
268 addresses:

- 269 • IEC Electropedia: available at <https://www.electropedia.org/>
- 270 • ISO Online browsing platform: available at <https://www.iso.org/obp>

271 1.3.1

272 diversity

273 prospective simultaneous demand of a group of electrical loads

274 **1.3.2**
 275 **generating set**
 276 equipment converting non-electrical energy into electrical energy

277 **1.4 Structure of the IEC 60364 series**

278 The IEC 60364 series consists of six main parts:

- 279 • IEC 60364-1 "Fundamental principles, assessment of general characteristics and
 280 definitions"

281 This document defines the scope and objective of the IEC 60364 series and specifies the
 282 fundamental safety requirements for an electrical installation.

- 283 • IEC 60364-4 series "Protection for safety"

284 These documents specify the functional requirements for protection, taking into account the
 285 fundamental safety requirements given in this document.

- 286 • IEC 60364-5 series "Selection and erection of equipment"

287 These documents specify requirements for the selection and erection of electrical equipment
 288 to fulfil the functional safety requirements of the IEC 60364-4 series and the fundamental
 289 safety requirements given in this document.

- 290 • IEC 60364-6 "Verification"

291 This document specifies the requirements for verification and testing to show compliance
 292 with the requirements of the other parts of the IEC 60364 series. Requirements for reporting
 293 the verifications and testing are also given.

- 294 • IEC 60364-7 series "Requirements for special installations or locations"

295 These documents specify specific requirements for special installations or locations. These
 296 requirements either modify, replace or complement the requirements of the other parts of
 297 the IEC 60364 series.

- 298 • IEC 60364-8 series "Functional aspects"

299 These documents specify requirements related to functional aspects only. However, these
 300 requirements can impact the safety requirements of the other parts of the IEC 60364 series.

301 Annex A gives additional information on the structure.

302 **1.5 Fundamental principles**

303 **1.5.1 Protection for safety**

304 **1.5.1.1 General**

305 The requirements stated in 1.5.1.2 to 1.5.2.8 are intended to provide for the safety of human
 306 beings, livestock and property against dangers and damage which can arise from the intended
 307 use of an electrical installation, including its connected current using equipment, under all
 308 operating conditions. The requirements to provide for the safety of livestock are applicable in
 309 locations intended for them.

310 NOTE In electrical installations, hazards that can arise include:

- 311 – electric shock;
- 312 – excessive temperatures likely to cause burns, fires and other harmful effects;
- 313 – ignition of a potentially explosive atmosphere;
- 314 – undervoltages, overvoltages and electromagnetic influences likely to cause or result in injury or damage;
- 315 – power supply interruptions or interruption of safety services;
- 316 – arcing likely to cause fire, burns or blinding effects, excessive pressure, or toxic gases;
- 317 – mechanical movement of electrically activated equipment.

318 **1.5.1.2 Protection against electric shock**

319 **1.5.1.2.1 Basic protection**

320 Protection shall be provided against dangers to human beings and livestock that can arise from
321 contact with live parts.

322 This protection may be achieved by one of the following methods:

- 323 – preventing a current from passing through the body of a human being or livestock;
- 324 – limiting the current which can pass through a body to a non-hazardous value.

325 **1.5.1.2.2 Fault protection**

326 Protection shall be provided against dangers to human beings and livestock that can arise from
327 contact with exposed-conductive-parts.

328 This protection may be achieved by one, or a combination, of the following methods:

- 329 – preventing a current resulting from a fault from passing through the body of a human being
330 or livestock;
- 331 – limiting the magnitude of a current resulting from a fault, which can pass through a body of a
332 human being or livestock, to a non-hazardous value;
- 333 – limiting the duration of a current resulting from a fault, which can pass through a body of a
334 human being or livestock, to a non-hazardous time period.

335 **1.5.1.2.3 Additional protection**

336 In certain cases, further protection of human beings and livestock is necessary, and additional
337 protection shall then be provided.

338 **1.5.1.3 Protection against thermal effects**

339 The electrical installation shall be arranged so that human beings, livestock, property and the
340 environment adjacent to the electrical equipment are protected against harmful thermal effects
341 caused by the electrical equipment.

342 EXAMPLE Thermal effects can be the following:

- 343 – combustion;
- 344 – degradation of materials;
- 345 – electric arcing;
- 346 – burns resulting from high temperatures.

347 **1.5.1.4 Protection against overcurrent**

348 Human beings and livestock shall be protected against injury, and property shall be protected
349 against damage due to excessive temperatures or electromechanical stresses caused by
350 overcurrent likely to arise in conductors.

351 Protection may be achieved by limiting overcurrent to a safe value or duration, or both.

352 **1.5.1.5 Protection against fault current**

353 Human beings and livestock shall be protected against injury, and property shall be protected
354 against damage caused by fault current.

355 Protection may be achieved by limiting fault current to a safe value or duration, or both.

356 **1.5.1.6 Protection against voltage disturbances**

357 Human beings and livestock shall be protected against injury, and property shall be protected
358 against any harmful effects, as a consequence of a fault between live parts of circuits supplied
359 at different voltages.

360 Human beings and livestock shall be protected against injury, and property shall be protected
361 against damage, as a consequence of overvoltages such as those originating from atmospheric
362 events or from switching.

363 Human beings and livestock shall be protected against injury, and property shall be protected
364 against damage, as a consequence of undervoltage and any subsequent voltage recovery.

365 **1.5.1.7 Protection against power supply interruptions**

366 Where danger or damage is foreseen to arise due to an interruption of power supply, suitable
367 provisions shall be made in the installation or installed equipment.

368 **1.5.1.8 Protection against the effects of electromagnetic interference**

369 The installation shall have an adequate level of immunity against electromagnetic disturbances.

370 Consideration shall be given to any anticipated electromagnetic emission generated by the
371 installation or installed equipment.

372 **1.5.2 Design**

373 **1.5.2.1 General**

374 For the design of the electrical installation, the following shall be taken into account:

- 375 – the protection of human beings, livestock and property in accordance with 1.5.1;
- 376 – the proper functioning of the electrical installation for the intended use;
- 377 – the foreseeable future needs (e.g. increased capacity, energy storage possibilities).

378 The information required as a basis for design is listed in 1.5.2.2 to 1.5.2.5. The requirements
379 with which the design shall comply are stated in 1.5.2.6 to 1.5.2.13. Other aspects to be
380 considered are given in 1.5.2.14 to 1.5.2.19.

381 The electrical installations shall be designed so that the operation of a device or the insertion
382 of an external connection cannot intentionally create a fault.

383 **1.5.2.2 Power supplies**

384 **1.5.2.2.1 Characteristics of power supplies**

385 In order to design a safe installation, relevant characteristics of the power supply or power
386 supplies are required. The characteristics of a power supply shall be determined by calculation,
387 measurement or enquiry (e.g. from the distribution system operator, manufacturer). Changes to
388 the characteristics of a power supply can affect the safety of the installation.

389 EXAMPLE A supply can be a network, generators, power convertor equipment, inverters, transformers.

390 The following characteristics, as applicable, shall be determined:

- 391 a) nature of current: alternating current or direct current, or both;
- 392 b) function of conductors:
 - 393 • for alternating current:

- 394 – line conductor(s);
- 395 – neutral conductor;
- 396 – mid-point conductor;
- 397 – protective conductor;
- 398 • for direct current:
 - 399 – line conductor(s);
 - 400 – mid-point conductor;
 - 401 – protective conductor;

402 The function of some conductors may be combined in a single conductor.

403 c) the presence of galvanic separation;

404 d) values and tolerances:

- 405 • voltage and voltage tolerances;
- 406 • voltage interruptions, voltage fluctuations and voltage dips;
- 407 • frequency and frequency tolerances;
- 408 • maximum allowable current;
- 409 • prospective short-circuit currents;

410 NOTE 1 For voltages and frequencies, see IEC 60038.

411 e) protective provisions inherent in the power supply;

412 f) bi-directional energy flow;

413 g) particular requirements of the operator of the supply network, e.g. distribution system
414 operator (DSO).

415 NOTE 2 In some countries, a DSO is also referred to as a distribution network operator (DNO).

416 **1.5.2.2.2 Electrical supply systems for safety services and standby electric supply** 417 **systems**

418 Where the provision of safety services or a standby system are required, the characteristics of
419 the sources of the power supply for these systems shall be assessed separately. Such supplies
420 shall have adequate capacity, reliability and rating and appropriate change over time for the
421 operation specified.

422 NOTE 1 Safety services can be required by the authorities concerned with fire precautions and other conditions for
423 emergency evacuation of the premises, or by the person specifying the installation.

424 NOTE 2 Standby supplies can be required by the person specify the installation.

425 Where there is an electrical supply system for safety services or a standby electric supply
426 system, all of the following shall be determined:

- 427 – source of power supply (nature, characteristics);
- 428 – circuits to be supplied by the electric source for safety services;
- 429 – circuits to be supplied by the standby electric source.

430 **1.5.2.3 Nature of demand**

431 The demand of the installation shall be determined to facilitate an energy-efficient, economic,
432 reliable and safe design.

433 Based on the demand, the number and type of circuits required shall be determined by:

- 434 – location of points of power demand;