

**MADALPINGELISED ELEKTRIPAIGALDISED. OSA 5-52:  
ELEKTRISEADMETE VALIK JA PAIGALDAMINE.  
JUHISTIKUD**

**Low-voltage electrical installations - Part 5-52:  
Selection and erection of electrical equipment - Wiring  
systems**

**EESTI STANDARDI EESSÕNA****NATIONAL FOREWORD**

See Eesti standard EVS-HD 60364-5-52:2011+A11:2017 sisaldab Euroopa standardi HD 60364-5-52:2011, selle paranduse AC:2011 ja muudatuse A11:2017 ingliskeelset teksti.	This Estonian standard EVS-HD 60364-5-52:2011+A11:2017 consists of the English text of the European standard HD 60364-5-52:2011, its corrigendum AC:2011 and amendment A11:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 25.02.2011, muudatuse A11 01.12.2017.	Date of Availability of the European standard is 25.02.2011, for A11 01.12.2017
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 13.260, 91.140.50

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English version

**Low-voltage electrical installations -  
Part 5-52: Selection and erection of electrical equipment -  
Wiring systems**  
(IEC 60364-5-52:2009, modified + corrigendum Feb. 2011)

Installations électriques à basse-tension -  
Partie 5-52: Choix et mise en oeuvre des  
matériels électriques -  
Canalisations  
(CEI 60364-5-52:2009, modifiée +  
corrigendum Feb. 2011)

Errichten von Niederspannungsanlagen -  
Teil 5-52: Auswahl und Errichtung  
elektrischer Betriebsmittel -  
Kabel- und Leitungsanlagen  
(IEC 60364-5-52:2009, modifiziert +  
corrigendum Feb. 2011)

This Harmonization Document was approved by CENELEC on 2011-01-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document at national level.

Up-to-date lists and bibliographical references concerning such national implementations may be obtained on application to the Central Secretariat or to any CENELEC member.

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of the International Standard IEC 60364-5-52:2009, prepared by IEC TC 64, Electrical installations and protection against electric shock, together with common modifications prepared by the Technical Committee CENELEC TC 64, Electrical installations and protection against electric shock, was submitted to the formal vote and was approved by CENELEC as HD 60364-5-52 on 2011-01-24.

This European Standard supersedes HD 384.5.52 S1:1995 + A1:1998 and HD 384.5.523 S2:2001.

The main changes with respect to HD 384.5.52 S1:1995 + A1:1998 are as follows:

- Subclause 521.4 introduces minor changes with regard to busbar trunking systems and powertrack systems.
- Subclause 523.6 introduces minor changes with regard to the sizing of cables where harmonic currents are present.
- A new subclause 523.9 concerning single-core cables with a metallic covering has been introduced.
- Clause 525 introduces changes in the maximum value of voltage drop permitted between the origin of the consumer's installation and the equipment which should not be greater than that given in the relevant annex.
- Clause 526 introduces minor changes to electrical connections including additional exceptions for inspection of connections and additional notes.
- Clause 528 introduces additional requirements with regard to proximity of underground power and telecommunication cables.
- Clause 529 introduces minor changes to selection and erection of wiring systems in relation to maintainability, including cleaning.

The following dates were fixed:

- |  |       |            |
|--|-------|------------|
| – latest date by which the existence of the HD has to be announced at national level   | (doa) | 2011-07-24 |
| – latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement | (dop) | 2012-01-24 |
| – latest date by which the national standards conflicting with the HD have to be withdrawn   | (dow) | 2014-01-24 |

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## Endorsement notice

The text of the International Standard IEC 60364-5-52:2009 was approved by CENELEC as a Harmonization Document with agreed common modifications as given below.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60332-3 series	NOTE Harmonized in EN 60332-3 series (partially modified).
IEC 60332-3-24	NOTE Harmonized as EN 60332-3-24.
IEC 60364-4-43:2008	NOTE Harmonized as HD 60364-4-43:2010 (modified).
IEC 60364-5-51:2005	NOTE Harmonized as HD 60364-5-51:2009 (modified).
IEC 60364-7-715	NOTE Harmonized as HD 60364-7-715.

IEC 61000 series	NOTE Harmonized in EN 61000 series (partially modified).
IEC 61386-24	NOTE Harmonized as EN 61386-24.
IEC 61535	NOTE Harmonized as EN 61535.
IEC 62305 series	NOTE Harmonized in EN 62305 series (partially modified).

## COMMON MODIFICATIONS

### 521.9.1

**Add** the following note:

NOTE Insulated flexible conductors or cores according to HD 516 may also be used as fixed installation.

### 528.2

**Add** the following new paragraph:

"In the case of proximity between cable distribution systems for radio and television signals and power line systems, EN 50083 should be considered."

### 528.2

**Add** the following note:

NOTE For the connection of combined socket-outlets for telecommunication (also aerial) and power line systems, EN 41003 should be considered.

### **Annex A - Table A.52.2 – Erection of wiring systems**

**Delete** Table A.52.2.

### **Annex B - Table B52-18 – Current-carrying capacities**

Table B.52.18, right column, line Number of circuits 16, change from 0.38 to 0.68.

### **Annex D - Formulae to express current-carrying capacities**

**Delete** Annex D.

**Add** Annexes ZA to ZC below.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60228	-	Conductors of insulated cables	EN 60228	-
IEC 60287	Series	Electric cables - Calculation of the current rating	-	-
IEC 60287-2-1	-	Electric cables - Calculation of the current rating - Part 2-1: Thermal resistance - Calculation of thermal resistance	-	-
IEC 60287-3-1	-	Electric cables - Calculation of the current rating - Part 3: Sections on operating conditions - Section 1: Reference operating conditions and selection of cable type	-	-
IEC 60332-1-1	-	Tests on electric and optical fibre cables under fire conditions - Part 1-1: Test for vertical flame propagation for a single insulated wire or cable - Apparatus	EN 60332-1-1	-
IEC 60332-1-2	-	Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame	EN 60332-1-2	-
IEC 60364-1 (mod)	2005	Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions	HD 60364-1	2008
IEC 60364-4-41 (mod)	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41 + corr. July	2007 2007
IEC 60364-4-42	-	Low voltage electrical installations - Part 4-42: Protection for safety - Protection against thermal effects	HD 60364-4-42	-
IEC 60364-5-54 (mod)	-	Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors	HD 60364-5-54	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60439-2	-	Low-voltage switchgear and controlgear assemblies - Part 2: Particular requirements for busbar trunking systems (busways)	EN 60439-2	-
IEC 60449	-	Voltage bands for electrical installations of buildings	HD 193 S2	-
IEC 60502	Series	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV)	-	-
IEC 60529	-	Degrees of protection provided by enclosures - (IP Code)	-	-
IEC 60570 (mod)	-	Electrical supply track systems for luminaires	EN 60570	-
IEC 60702	Series	Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V	EN 60702	-
IEC 60947-7	Series	Low-voltage switchgear and controlgear - Part 7: Ancillary equipment	EN 60947-7	Series
IEC 60998	Series	Connecting devices for low-voltage circuits for household and similar purposes	EN 60998	Series
IEC 61084	Series	Cable trunking and ducting systems for electrical installations	-	-
IEC 61386	Series	Conduit systems for cable management	EN 61386	Series
IEC 61534	Series	Powertrack systems	EN 61534	Series
IEC 61537	-	Cable management - Cable tray systems and cable ladder systems	EN 61537	-
ISO 834	Series	Fire-resistance tests - Elements of building construction	-	-

## Annex ZB (normative)

### Special national conditions

**Special national condition:** National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Country	Clause	Special national condition
Norway	523.1	In Norway the following additional requirements apply: Special requirement may apply in Norway due to national building practice and the extended use of insulation materials in building walls.
Germany	521.11 521.12	<p>In Germany additional requirements apply (<b>see annex</b> to German Special National Condition on Clause 521.x)</p> <p>In Germany the following additional requirements apply:</p> <p>"521.x Inherently short-circuit proof and inherently earth-fault-proof wiring</p> <p>Where protective devices for the protection in case of short-circuit in accordance with 473.2.2.1 of IEC 60364 are not used, cables and conductors shall be laid inherently short-circuit proof and inherently earth-fault-proof.</p> <p>The following types of wiring are regarded as inherently short-circuit proof and inherently earth-fault proof:</p> <ul style="list-style-type: none"> <li>a) Conductor arrangements where contact between the conductors and contact with earthed parts are prevented and where no short-circuit is to be expected due to external influences (e.g. falling parts);</li> <li>b) Arrangement consisting of single-core cables, e.g. in accordance with IEC 60502, single-core non-metallic -sheathed cables in accordance with IEC 60227-4 or single-core rubber-insulated and sheathed flexible cables in accordance with IEC 60245-4;</li> <li>c) Cables and rubber-insulated and sheathed flexible cables laid so that they are accessible but not in the vicinity of combustible materials and where the risk of mechanical damage is prevented.</li> <li>d) Conductor arrangement consisting of single-core non-sheathed cables of suitable type of construction (e.g. special rubber-insulated cables in accordance with IEC 60XXX <sup>1)</sup>, rated voltage <math>U_0/U</math> at least 1,8/3 kV or equivalent).</li> </ul> <p>An arrangement of cables and insulated conductors which could burn out without endangering their environment (e.g. cables in ground) is considered as equivalent to inherently short-circuit proof and inherently earth-fault-proof wiring with regard to safety."</p>

<sup>1)</sup> In preparation.



Country	Clause	Special national condition
	521.13	<p>In Germany the following additional requirements apply:</p> <p>"521.13 Accessories</p> <p>Boxes and enclosures for accessories, e.g. connecting boxes for housing terminals, socket-outlets or switches shall comply with the requirements of EN 60670.</p> <p>Boxes and enclosures intended to be installed in concrete or in hollow walls, shall have the following markings according to EN 60670-1 on the boxes and enclosures or provided by the manufacturer on the smallest package unit or in the instructions of the manufacturer</p> <ul style="list-style-type: none"> <li>- for use in concrete: symbol 90 °C;</li> <li>- for use in hollow walls: symbol H.</li> </ul> <p>GP-enclosures according to EN 60670-24 (under preparation) are not allowed to be installed in Germany.</p> <p>Socket outlet-systems which accept the simultaneous connection of more than one plug in the interface of one socket outlet are not allowed in Germany.</p>
	521.6	<p>In Germany and the Netherlands in the case of basic-insulated conductors in conduit systems, cable trunking systems and cable ducting systems, only the conductors of one main circuit, including the auxiliary circuits associated with this main circuit, may be laid in conduit or in single-channel trunking or in one duct of a multi-channel trunking, except in electrical and enclosed operating areas. The uncut conductors of several circuits may, however, be fed through common through-run boxes.</p>

Country	Clause	Special national condition
	521.7	<p>In Germany the following additional requirements are applicable:</p> <p>under certain circumstances, for ease of installation, the conductor may be Class 5 to EN 60228, in which case the designatory suffix under HD 361 is given by "-K".</p> <p>The use of a Class 5 conductor designated "-K" does not indicate that the cable is suitable for repeated flexing.</p> <p>Flexible cables or cords (except for those heavy duty types used as fixed installations in temporary buildings) should not be used as fixed wiring unless contained in an enclosure affording mechanical protection, except when used as the final connection to fixed equipment. In which case they should be of, at least, the 'ordinary' type.</p> <p>Flexible cables or cords should not be placed under carpets or other floor coverings, where there is</p> <ul style="list-style-type: none"> <li>a) any risk of thermal insulating effects, leading to excessive temperature rise (see 5.3.1, a));</li> <li>b) any risk of damage due to furniture or equipment resting on them or traffic passing over them.</li> </ul> <p>When flexible cables are required for use outdoors, whether of temporary or permanent usage, reference should be made to Table 2A and 2B of this HD to determine their suitability for such usage.</p> <p>PVC flexible cables or cords are unsuitable for permanent use outdoors. Neither should those that have a temporary designation be used in that manner outdoors in adverse conditions, e.g. at temperatures below those given in Table 4A, column 11.</p> <p>In the case of soft soldered joints or terminations the limiting temperature for the conductor under short circuit conditions is reduced to 160 °C. Account of this limitation should be taken in selecting and operating cables.</p> <p>Tinned copper conductors should not be used at temperatures above 200 °C because of the risk of mutual adhesion.</p> <p>Where the limiting temperature given in Column 10 of Tables 3A, 3B, 4A and 4B is such that the temperature of the surface of the cable is liable to exceed 50 °C, the cable should be so located or guarded as to prevent contact of persons or animals therewith. Cable surface temperatures above this can cause involuntary reaction in the event of contact with exposed skin. Account should be taken of these possibilities in the selection and use of cables.</p>
	527	<p>In Germany, in cable tunnels, cable ducting and other places with increased density of installed cables the installation of fire detectors sensitive to heat radiation and smoke is required. In extended wiring system installations the possibility to use mobile fire extinguishers is required. The use of a stationery fire extinguisher installation is recommended in case of extended wiring systems to which gaining access is difficult. In cable tunnels every 100 m a partition as fire resisting section should be provided and every cable breaking through should be sealed by a suitable and agreed fire resisting provision. Accessible cable tunnels and ducts shall be erected with a sufficient number of possibilities for gaining access in case of fighting a fire hazard, e.g. by easy removable covers, and devices for smoke removal shall be provided. Where fire protection seals with an automatic closing function and fire resisting capability are applied such seals shall be activated at once in case of a fire hazard.</p>

Country	Clause	Special national condition
	522.4.1	In Germany, in hollow wall installations boxes and enclosures with a protection degree not less than IP30 shall be used.
	522.8.1.1	<p>In Germany the following additional requirements apply: Add the following text:</p> <p>The tension applied to a cable should not exceed the values of tensile stress per conductor given below. This is subject to a total maximum tensile force of 1 000 N unless otherwise agreed by the cable manufacturer.</p> <p>50 N/mm<sup>2</sup> for non flexible cables during installation. 15 N/mm<sup>2</sup> for flexible cables, under static tensile stress and for non flexible cables in service in fixed circuits.</p> <p>In circumstances where a stress exceeding the above values would result, a separate stress bearing member or device should be used. The method of attaching such a member or device to the cable should be such that the cable is not damaged.</p> <p>In circumstances where flexible cables are under dynamic stress (including those due to inertia, e.g. reeling drums) the permissible tensions or fatigue life should be agreed between the design engineer and the cable manufacturer.</p> <p>Cables which are installed vertically, without intermediate support, which are inaccessible and unlikely to be moved or disturbed, should be supported at the top of the run such that the internal radius of the resultant bend is not less than the appropriate minimum bending radius for normal use according to Table 6(a), or for fixed installation according to Tables 6(b) and 6(c). The unsupported vertical length of such runs should not exceed 5 m.</p> <p>The rated voltage of a cable is the reference voltage for which the cable is designed and which serves to define the electrical tests.</p> <p>The rated voltage is expressed by the combination of two values <math>U_0/U</math>, expressed in volts:</p> <p><math>U_0</math> being the r.m.s. value between any insulated conductor and 'earth' (metal covering of the cable or the surrounding medium);</p> <p><math>U</math> being the r.m.s. value between any two phase conductors of a multicore cable or of a system of single core cables.</p> <p>In an alternating current system, the rated voltage of a cable shall be at least equal to the nominal voltage of the system for which it is intended. This condition applies both to the value <math>U_0</math> and to the value <math>U</math>.</p> <p>In a direct current system, the nominal voltage of the system shall be not higher than 1,5 times the rated voltage of the cable.</p> <p>NOTE The operating voltage of a system may permanently exceed the nominal voltage of such a system by 10 %.</p>
	522.8.8	In Germany the standards DIN 18015-3 and DIN 1053-1 have to be considered.

Country	Clause	Special national condition
	522.8.9	In Germany, in hollow wall installations boxes and enclosures with cable retention shall be used
	522.8.10	In Germany the following additional requirements apply: "Cable laid in the ground shall be laid at least at 0,6 m below ground level but at least 0,8 m below the carriageway of streets. For smaller installation depths the cable shall be protected by other means, e.g. wiring in suitable conduits."
	523.3	In Germany in addition the 24 h load diagram has to be taken into consideration
	527	In Germany there are specific requirements on fire protection in some areas.
	527.2.4	In Germany 527.2.4 is not applicable.
	527.2.5	In Germany, seals for cable penetrations shall be approved by the German Institute for constructional engineering (Deutsches Institut für Bautechnik DIBT).
	Annex A Table A.52.3	In Germany additional requirements apply ( <b>see annex</b> to German Special National Condition on Table A52-3)
	Annex D	In Germany Annex D does not apply.

Country	Clause	Special national condition
		<p>In Germany the following additional requirements apply:</p> <p>A) Wiring in concrete;</p> <p>B) 1 cable and conductor.</p> <p>The cables and conductors listed under a) to c) are permissible.</p> <p>a) Aderleitungen single-core conductors, e.g. H07V..., in conduit.</p> <p>The conduit for feeding through or joining single-core conductors, e.g. at the intersection of wall and ceiling structural elements, shall be fed through in insulating boxes according to DIN EN 60670 (VDE 0606)-series (some countries note and SNC in CENELEC).</p> <p>When using single-core cable it shall be ensured that the conduit and boxes form an unbroken sealed system.</p> <p>b) Sheathed conductors, e.g. NYM, according to DIN VDE 0250-204 (VDE 0250-204); in conduit or recess clearances.</p> <p>c) Cables, e.g. NYY, according to DIN VDE 0276-603 (VDE 0276-603).</p> <p>C) 2 Accessories</p> <p>Boxes for appliances, appliance connection boxes, luminaire connection boxes and junction boxes shall be suitable for installation in concrete. They shall comply with DIN EN 60670 (VDE 0606) and shall be marked with the symbol B according to DIN 30600 Reg. No. 1716.</p> <p>D) Installation of cables in not accessible underground ducts and in protective conduits buried in the ground</p> <p>In not accessible underground ducts outside of buildings only cable or rubber-sheathed cable NSSHÖU according to DIN VDE 0250-812 (VDE 0250-812), trailing cables according to DIN VDE 0250-813 (VDE 0250-813) or similar types shall be installed.</p> <p>In protective conduits buried in the ground also sheathed conductors NYM according to DIN VDE 0250-204 (VDE 250-204) and plain lead-covered cable DIN VDE 0250-210 (VDE 0250-210) are allowed, if the cables remain accessible and exchangeable and the conduit is mechanically fixed, protected against the ingress of water and ventilated.</p> <p>NOTE This type of wiring should be restricted to exceptional cases and short distances, e.g. up to 5 m; the type of wiring according to 522.8.10 should be given preference.</p>

Country	Clause	Special national condition
	Annex ZB	<p>In Germany the following additional requirements apply:</p> <p>“Flat webbed house wires in accordance with DIN VDE 0250, Part 201 may be used if the following requirements are met:</p> <p>a) Flat webbed house wires according to DIN VDE 0250, Part 201 (NYIF. NYIFY) may only be installed in dry rooms and only in or under plaster. They shall be covered with plaster along their entire length.</p> <p>NOTE 1 The use of flat webbed house wires may be restricted in special specifications.</p> <p>NOTE 2 The insulation of cores in flat conductors is about half as thick as the insulation of single-core conductors. The covering is primarily intended to maintain the distances between the cores in order to ensure the permissible heat removal based on the maximum carrying current and the additional mechanical protection of the conductor by the plaster covering. In general, this is ensured by a crack-resistant plaster covering with a plaster thickness of about 4 mm.</p> <p>b) If flat webbed house wires are installed in cavities in ceilings or walls consisting of concrete, stone or similar non-combustible material, it is not necessary to cover them with plaster in accordance with item a).</p> <p>c) Even when covered with plaster, flat webbed house wires may not be laid on combustible construction materials (see DIN 4102, Part 1), e.g. wood.</p> <p>d) Flat webbed house wires shall not be bunched. Collecting flat webbed house wires together at the inlet points of electrical equipment, e.g. distribution boards, is not considered as bunching.</p> <p>e) Flat webbed house wires may only be fixed using means and methods which will ensure that the insulation is not damaged or deformed.</p> <p>NOTE 3 Means for fixing without damage are, e.g. :</p> <ul style="list-style-type: none"> <li>- gypsum plaster; or</li> <li>- clamps matching the shape of the wires and made of insulating material or of metal with insulating layer; or</li> <li>- sticking; or</li> <li>- nailing with suitable nails with insulating washers.</li> </ul> <p>f) Flat webbed house wires shall not be installed under plaster board unless these boards are attached entirely with plaster.</p> <p>g) Flat webbed house wires shall not be installed immediately on or under wire netting, metal mesh or similar.</p> <p>h) Flat webbed house wires may only be joined in installation boxes in accordance with DIN EN 60670-1 (VDE 0606-1) made of insulating material.</p>
Netherlands	521.6	<p>In Netherlands in the case of basic-insulated conductors in conduit systems, cable trunking systems and cable ducting systems, only the conductors of one main circuit, including the auxiliary circuits associated with this main circuit, may be laid in conduit or in single-channel trunking or in one duct of a multi-channel trunking, except in electrical and enclosed operating areas. The uncut conductors of several circuits may, however, be fed through common through-run boxes.</p>

Country	Clause	Special national condition
Ireland	522.6.2	In Ireland concealed wiring must be protected against damage caused by penetration by fixings and drills, by earthed metal enclosures or integral screens, except in the following areas: 150 mm horizontally from a corner, 150 mm vertically from a ceiling, straight vertical or horizontal run to a point, accessory or switchgear. In such cases, the wiring must be at least 50 mm from the reverse side of the wall.

Country	Clause	Special national condition
Denmark	522.8.10	<p>In Denmark the following applies: The requirements are not required for cables with a rated voltage not exceeding 50 V ac or 120 V d.c. Cables shall be buried at least 0,35 m under terrain. Cables buried less than 0,7 m under terrain shall be protected by conduits, U-profiles or sheets. Cables buried more than 0,7 m under terrain shall be without additional mechanical protection, when a marking band is placed approximately 0,2 m above the cable. By more than one cable with less than 0,2 m between the outer cables only one marking band is required. Cables coming from the soil up in free air shall be mechanically protected as well under the terrain as above the terrain.</p> <p>NOTE Conduits or galvanized iron, steel or plastic conduits in accordance to DS 2119 for a working pressure of 0,6 MPa can be used for protection.</p>
	528.1  Table C52-3	<p>In Denmark, the following requirement applies: Installations without connection to the low-voltage installation and which are installed, supervised and maintained by other than skilled persons shall be separated from the low-voltage installations in a way that is possible to work on them without dismantling the low-voltage installation.</p> <p>In Denmark, the following applies – Where the current in a circuit of a group not exceeds 70 % of the current carrying capacity in accordance to Table C52-3 multiplied with an even correction factor for ambient temperature the following is allowed:</p> <ul style="list-style-type: none"> <li>• The current carrying capacity for the circuit does not need to be multiplied with a reduction factor for groups.</li> <li>• The circuit is not counted together with other circuits when numbers of circuits are counted for determination of the reduction factor. Where the current in all circuits in a group not exceeds 75 % of the current carrying capacity in accordance with Table C52-3 multiplied with an even correction factor for ambient temperature no further reduction is needed.</li> </ul>
UK	522.6.4	<p>In the UK, the following additional requirements apply:</p> <p>1 A cable installed under a floor or above a ceiling shall be run in such a position that it is not liable to be damaged by contact with the floor or the ceiling or their fixings. A cable passing through a joist within a floor or ceiling construction or through a ceiling support (e.g. under floorboards), shall:</p> <ul style="list-style-type: none"> <li>(i) be at least 50 mm measured vertically from the top, or bottom as appropriate, of the joist or batten; or</li> <li>(ii) incorporate an earthed metallic covering which complies with the requirements of Part 5-54 for a protective conductor of the circuit concerned, the cable complying with BS 5467, BS 6346, BS 6724, BS 7846, BS EN 60702-1 or BS 8436; or</li> <li>(iii) be enclosed in earthed conduit complying with BS EN 61386 and satisfying the requirements of Part 5-54 for a protective conductor; or</li> <li>(iv) be enclosed in earthed trunking or ducting complying with BS EN 50085 and satisfying the requirements of Part 5-54 for a protective conductor; or</li> <li>(v) be mechanically protected against damage sufficient to prevent penetration of the cable by nails, screws and the like.</li> </ul> <p>2 A cable concealed in a wall or partition at a depth of less than 50 mm from a surface of the wall or partition shall:</p> <ul style="list-style-type: none"> <li>(i) incorporate an earthed metallic covering which complies with the requirements of Part 5-54 for a protective conductor of the circuit concerned, the cable complying with BS 5467, BS 6346, BS 6724, BS 7846, BS EN 60702-1 or BS 8436; or</li> <li>(ii) be enclosed in earthed conduit complying with BS EN 61386 and satisfying the requirements of Part 5-54 for a protective conductor; or</li> <li>(iii) be enclosed in earthed trunking or ducting complying with BS EN 50085</li> </ul>



Country	Clause	Special national condition
		<p>and satisfying the requirements of Part 5-54 for a protective conductor; or</p> <p>(iv) be mechanically protected against damage sufficient to prevent penetration of the cable by nails, screws and the like; or</p> <p>(v) be installed in a zone within 150 mm from the top of the wall or partition or within 150 mm of an angle formed by two adjoining walls or partitions. Where the cable is connected to a point, accessory or switchgear on any surface of the wall or partition, the cable may be installed in a zone either horizontally or vertically, to the point, accessory or switchgear. Where the location of the accessory, point or switchgear can be determined from the reverse side, a zone formed on one side of the wall of 100 mm thickness or less or partition of 100 mm thickness or less extends to the reverse side.</p> <p>3 Where Clause 2 above applies, and the installation is not intended to be under the supervision of a skilled or instructed person, a cable installed in accordance with part (v) of Clause 2 above, and not complying with part (i), (ii), (iii), or (iv) of Clause 2 above, shall be provided with additional protection by means of an RCD having the characteristics specified in Part 4-41, 415.1.</p> <p>Irrespective of the depth of the cable from a surface of the wall or partition, in an installation not intended to be under the supervision of a skilled or instructed person, a cable concealed in a wall or partition the internal construction of which includes metallic parts, other than fixings such as nails, screws and the like, shall:</p> <p>incorporate an earthed metallic covering which complies with the requirements of Part 5-54 for a protective conductor of the circuit concerned, the cable complying with BS 5467, BS 6346, BS 6724, BS 7846, BS EN 60702-1 or BS 8436, or:</p> <p>(ii) be enclosed in earthed conduit complying with BS EN 61386 and satisfying the requirements of Part 5-54 for a protective conductor; or</p> <p>(iii) be enclosed in earthed trunking or ducting complying with BS EN 50085 and satisfying the requirements of Part 5-54 for a protective conductor; or</p> <p>(iv) be mechanically protected against damage sufficient to prevent penetration of the cable by nails, screws and the like; or</p> <p>(v) be provided with additional protection by means of an RCD having the characteristics specified in Part 4-41, 415.1.</p> <p>NOTE If the cable is installed at a depth of 50 mm or less from the surface of a wall or partition the requirements of Clause 2 above also apply.</p>
<b>Switzerland</b>	525  528.2	<p>In Switzerland, (in accordance with National Legislation) a voltage drop not exceeding 40 % is permitted in an installation between the connection point of a building (main circuit breaker) and the final circuits, example – a socket outlet.</p> <p>In Switzerland, in accordance with National Legislation Verordnung über elektrische Leitungen 734.31... in case of crossing or proximity of underground telecommunication cables and underground power cables, a minimum clearance of 300 mm shall be maintained, or the requirements according to a) or b) shall be fulfilled.</p>
<b>Belgium</b>	527	In Belgium there are specific requirements on fire protection in some areas.
<b>Italy</b>	528.2	In Italy a minimum clearance of 300 mm shall be maintained

Country	Clause	Special national condition																												
IE	522.6	<p>Wiring embedded in solid walls or concealed in hollow walls or partitions:</p> <p>Wiring shall be protected by an earthed metal screen, armouring, metal conduit or trunking against damage by impact or penetration by drills or nails except where the following two conditions apply:</p> <p>a) The distance measured horizontally between the wiring and the reverse side of the wall is not less than 50 mm.</p> <p>b) The wiring is installed:</p> <p>1) in a straight vertical or horizontal run going directly to a point, accessory or switchgear;</p> <p>2) within a vertical distance of 150 mm from the ceiling;</p> <p>3) within a horizontal distance of 150 mm from a corner formed by two adjoining walls.</p>																												
IE	522.8	<p>In industrial and commercial premises, cables emerging from the floor shall be provided with supplementary mechanical protection within a vertical distance of 1 250 mm from the floor.</p> <p>During the period of construction, cables installed in pre-cast concrete floors shall be provided with supplementary mechanical protection before further work or activity is carried out.</p> <p>During the period of construction, a cable emerging from the floor, and not fixed, shall be protected against impact by suitable means such as flexible conduit.</p>																												
IE	522.8.8	<p>This does not apply to earthed metal-enclosed systems.</p> <p>In attic spaces, care shall be taken to lay the wiring in an orderly manner and in such a way as to minimize the risk of damage to wiring.</p>																												
IE	522.8.10	<p>Addition:</p> <p>Suitable indication shall be provided above a buried cable at a distance of approximately 300 mm vertically below the completed surface, or at half the buried depth, whichever is the lesser.</p> <p>Minimum depth mm of cables buried in the ground:</p> <table><caption>Table 52B – Minimum depth (mm) of cables buried in the ground</caption><thead><tr><th>Location</th><th>SWA or NYCY cable laid directly in the soil</th><th>Non-armoured cable in a pipe in the soil (1) (2)</th><th>SWA or NYCY cable in high-impact resistant pipe in the soil (1)</th></tr></thead><tbody><tr><td>Agricultural</td><td>600</td><td>600</td><td>600</td></tr><tr><td>Industrial and commercial</td><td>450</td><td>450</td><td>250</td></tr><tr><td>Domestic gardens, paths, drives</td><td>450</td><td>300</td><td>250</td></tr><tr><td>Urban pathways</td><td>450</td><td>300</td><td>250</td></tr><tr><td>Vehicular traffic-bearing areas</td><td>750</td><td>750</td><td>750</td></tr><tr><td>Grass margins (roadside) and footpaths</td><td>600</td><td>600</td><td>600</td></tr></tbody></table> <p>Where cables buried in the ground are enclosed in ducting, of other than concrete material, this ducting shall be coloured red and shall have a high resistance to impact. For ducts or pipes of material other than concrete, e.g. polythene, the minimum degree of resistance to impact shall be a 750 N load rating for 5 % deflection in accordance with EN 50086-2-4.</p>	Location	SWA or NYCY cable laid directly in the soil	Non-armoured cable in a pipe in the soil (1) (2)	SWA or NYCY cable in high-impact resistant pipe in the soil (1)	Agricultural	600	600	600	Industrial and commercial	450	450	250	Domestic gardens, paths, drives	450	300	250	Urban pathways	450	300	250	Vehicular traffic-bearing areas	750	750	750	Grass margins (roadside) and footpaths	600	600	600
Location	SWA or NYCY cable laid directly in the soil	Non-armoured cable in a pipe in the soil (1) (2)	SWA or NYCY cable in high-impact resistant pipe in the soil (1)																											
Agricultural	600	600	600																											
Industrial and commercial	450	450	250																											
Domestic gardens, paths, drives	450	300	250																											
Urban pathways	450	300	250																											
Vehicular traffic-bearing areas	750	750	750																											
Grass margins (roadside) and footpaths	600	600	600																											

Country	Clause	Special national condition
IE	523.8	The following are exempt from this requirement: <ul style="list-style-type: none"> <li>- Parts of the route not exceeding 0,2 m in length;</li> <li>- Parts of the route protected by conduit not exceeding 1 m in length.</li> </ul>
IE	526.5	Wiring connections shall not be made inside trunking. Connections made in suitable boxes located under floorboards are deemed to be accessible. In the case of conduit systems, connections shall be enclosed in suitable inspection boxes forming part of the conduit system.
IE	526.7	Where the connections do not have a degree of protection against direct contact of a least IP2X, the opening of doors or covers shall require the use of a key or tool. Unless it is suitably designed, a cable lug shall not be used to terminate more than one conductor. Adequate electrical conductance shall be provided between metal sheaths or armouring of cables and the earthing terminals of equipment.  NOTE This requires proper design or a propriety method. For metal screens, the traditional method of twisting the screen to facilitate the connection is permissible.
IE	526.10	Proximity to insulating materials: Adequate clearance shall be maintained between connections to equipment and adjacent metal layers of thermal insulation.
IE	528.1	No cable shall be run in a lift shaft unless it forms part of the lift installation.

**ZB.1 Annex to German Special National Condition on Subclause 521.11****521.11 Cables and conductors****521.11.1 Cables**

Cables NYY or NYCWY according to DIN VDE 0276-603 (VDE 0276-603):2010 should have the following bending radii (see Part 5, Section 3G, Clause IV "Recommendation for use", Table 3 "Instructions for wiring", line 4):

- a) Permissible bending radius for wiring:
- single-core cables: 15fold cable diameter;
  - multi-core cables: 12fold cable diameter.
- b) Reduced bending radius by 50 % under the following conditions:
- single bending;
  - proper wiring;
  - heating the cable up to 30 °C;
  - bending the cable over template.

The distance between fixing means should be (see Part 5, Section 5G, Clause IV "Recommendation for use", Table 3 "Instructions for wiring", line 5.1 and 5.2):

Horizontal distance between fixing means: 20 times the cable diameter. These distances also apply for supporting areas for wiring on cable racks, or supporting structures. The distance shall not exceed 80 cm.

Vertical distance between fixing means: For vertical wiring along walls, the distances are allowed to be longer. However, distances shall not exceed 1,5 m.

**521.11.2 Conductors**

Conductors shall have in case of fixed installation the bending radii according to Table 01 (see DIN VDE 0298-300 (VDE 0298-300):2009-09):

**Table 01 – Minimum permissible bending radius for fixed installation**

		Conductor diameter mm			
		D ≤ 8	8 < D ≤ 12	12 < D ≤ 20	D > 20
Conductors with rigid conductors	Standard application	4	5	6	6
	Careful bending	2	3	4	4
Conductors with flexible conductors	Fixed installation	3	3	4	4
	Flexible application	4	4	5	6
NOTE 1 The minimum permissible bending radius corresponds to the internal radius.					
NOTE 2 Specifications apply for a cable temperature of (20 ± 10) °C.					
NOTE 3 D corresponds to the outer diameter for round conductors or the smaller external dimensions for flat conductors.					

The distance between fixing means should be according to Table 101 (see HD 516 S2):

**Table 101 – Maximum distance between fixing means**

Outer diameter of cables mm	Maximum distance mm	
	Horizontal	Vertical
$D \leq 9$	250	400
$9 < D \leq 15$	300	400
$15 < D \leq 20$	350	450
$20 < D \leq 40$	400	550

### 521.11.3 Sheathed Conductors (NYM)

These cables are intended for installation on, under and in plaster in dry, humid and wet rooms as well as in masonry and concrete, except for direct embedding in heaped, shaken or tamped concrete. These cables are also suitable for use in open air, provided that they are protected from direct exposure to sun light.

Tables 52F and 52G apply for the installation of sheathed conductors with the following restriction:

Sheathed conductors DIN VDE 0250-210 (VDE 0250-210) and plain lead-covered cable NYBUY according to DIN VDE 0250-204 (VDE 0250, Part 204) may be installed in underground protective conduit if the cables remain accessible and exchangeable and the conduit is mechanically fixed, protected against the ingress of liquids and ventilated.

NOTE This type of wiring should be restricted to exceptional cases and short distances, e.g. up to 5 m.

### 521.11.4 Installation of overhead span lines

Overhead span lines shall be attached and fixed so that sag or movement do not result in damage. The specifications for overhead lines in DIN VDE 0211 are applicable to the height of span lines. The specifications for overhead lines in DIN VDE 0211 (VDE 0211):1985-12 are applicable to the height of span lines (e.g. for crossings of traffic installations:

Vertical distances of conductors

- from the carriageway 6 m
- from the conventional clearance profile of a waterway 2,5 m

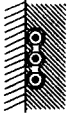
If specific distances over the highest water-level for shipping are stipulated, these will apply.

- from the top of rail 7 m
- from the components of the overhead contact line system of a railway 3 m
- from the components of the overhead contact line system of a trolleybus or tramway 1,5 m
- from the components of a cable railway 3 m

It has to be considered that the highest point at crossings between suspension and hauling ropes shall be determined, taking into account a 25 % higher maximum tensile stress of the suspension or hauling ropes.

**ZB.2      Annex to German Special National Condition on Table A.52-3**

**Table A.52-3 concerning the SNC about flat webbed house wires**

xx		Flat conductors direct in masonry	C
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## Annex ZC (informative)

### A-deviations

**A-deviation:** National deviation due to regulations, the alteration of which is for the time being outside the competence of the CENELEC national member.

This Harmonization Document does not fall under any Directive of the EC.

In the relevant CENELEC countries these A-deviations are valid instead of the provisions of the Harmonization Document until they have been removed.

Add the following A-deviations:

Country	Clause	Deviation
Germany	527	<p>In Germany the following additional requirements apply:</p> <p>According to the guideline on fire protection requirements for wiring systems "Musterrichtlinie über brandschutztechnische Anforderungen an Leitungsanlagen (Muster-Leitungsanlagen-Richtlinie MLAR)" established by the Technical Commission for Building Supervision of the ARGEBAU and introduced in the planning and building regulations of the individual Federal German States specific requirements concerning fire protection apply for wiring systems:</p> <ul style="list-style-type: none"> <li>– in necessary stair enclosures;</li> <li>– in rooms between necessary stair enclosures and exits into the open;</li> <li>– in necessary halls and in open passageways to external walls of buildings; and</li> <li>– for the penetration of cables through specific walls and ceilings."</li> </ul>
	528.2	In Romania a minimum clearance of 500 mm shall be maintained according to national regulation.
Romania	521.6	In Romania in the case of basic insulated conductors in conduit systems, cable trunking systems and cable ducting systems, only the conductors of one main circuit, including the auxiliary circuits associated with this main circuit, may be laid in conduit or in single-channel trunking or in one duct of a multichannel trunking, except in electrical and enclosed operating areas. The uncut conductors of several circuits may, however, be fed through common through-run boxes.
	523.8	<p>In Romania the following additional requirements apply:</p> <p>Where the heat dissipation differs, the current-carrying capacity shall be determined related to the heat dissipation of the most long route, when the part of the route with the highest temperatures has a length more then 10 m, but not less than 20 % of the total length of cable, according to national regulation</p>

Country	Clause	Deviation										
France	ZB	<p>Add a new subclause</p> <p>521.XX Cables</p> <p>In France the following additional requirements apply :</p> <p>In many case power cables U1000 R2 V (NF C 32-321), U 1000 RVFV (NF C 32-322), FR-N1X1X2, FR-N1X1G1, FR-N1X1X2Z4X2 and FR-N1X1G1Z4G1 (NF C 32-323) shall be used.</p> <p>For special fire resistant requirement, classification CR1-C1 (NF C 32-310) is mandatory.</p> <p>Add a new subclause</p> <p>521.XX Minimum permissible bending radius</p> <p>Minimum permissible bending radius for rigid core shall be according to the attached Table FR A:</p> <p><b>Table FR A – Minimum permissible bending radius for rigid core</b></p> <table><tr><th>Cable type</th><th>Minimum bending radius</th></tr><tr><td>Unarmoured rigid cable</td><td>6 D</td></tr><tr><td>Armoured rigid cable</td><td>8 D</td></tr><tr><td>Unarmoured fire resistant cable</td><td>10 D</td></tr><tr><td>Armoured fire resistant cable</td><td>12 D</td></tr></table> <p>D: outer cable diameter.</p>	Cable type	Minimum bending radius	Unarmoured rigid cable	6 D	Armoured rigid cable	8 D	Unarmoured fire resistant cable	10 D	Armoured fire resistant cable	12 D
Cable type	Minimum bending radius											
Unarmoured rigid cable	6 D											
Armoured rigid cable	8 D											
Unarmoured fire resistant cable	10 D											
Armoured fire resistant cable	12 D											



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## LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

### Part 5-52: Selection and erection of electrical equipment – Wiring systems

#### 520 Introduction

##### 520.1 Scope

Part 5-52 of IEC 60364 deals with the selection and erection of wiring systems.

NOTE 1 This standard also applies in general to protective conductors, while IEC 60364-5-54 contains further requirements for those conductors.

NOTE 2 Guidance on Part 5-52 of IEC 60364 is given in IEC 61200-52.

##### 520.2 Normative references

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

IEC 60228, *Conductors of insulated cables*

IEC 60287 (all parts), *Electric cables – Calculation of the current rating*

IEC 60287-2-1, *Electric cables – Calculation of the current rating – Part 2-1: Thermal resistance – Calculation of thermal resistance*<sup>1</sup>

IEC 60287-3-1, *Electric cables – Calculation of the current rating – Part 3-1: Sections on operating conditions – Reference operating conditions and selection of cable type*<sup>2</sup>

IEC 60332-1-1, *Tests on electric and optical fibre cables under fire conditions – Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-42, *Electrical installations of buildings – Part 4-42: Protection for safety – Protection against thermal effects*

<sup>1</sup> A consolidated edition 1.2 exists (2006) that includes IEC 60287-2-1 (1994) and its amendments 1 and 2 (1999 and 2006).

<sup>2</sup> A consolidated edition 1.1 exists (1999) that includes IEC 60287-3-1 (1995) and its amendment 1 (1999).

IEC 60364-5-54, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors*

IEC 60439-2, *Low-voltage switchgear and controlgear assemblies – Part 2: Particular requirements for busbar trunking systems (busways)*<sup>3</sup>

IEC 60449, *Voltage bands for electrical installations of buildings*

IEC 60502 (all parts), *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1,2$  kV) up to 30 kV ( $U_m = 36$  kV)*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*<sup>4</sup>

IEC 60570, *Electrical supply track systems for luminaires*

IEC 60702 (all parts), *Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V*

IEC 60947-7 (all parts 7), *Low-voltage switchgear and controlgear – Part 7: Ancillary equipment*

IEC 60998 (all parts), *Connecting devices for low-voltage circuits for household and similar purposes*

IEC 61084 (all parts), *Cable trunking and ducting systems for electrical installations*

IEC 61386 (all parts), *Conduit systems for cable management*

IEC 61534 (all parts), *Powertrack systems*

IEC 61537, *Cable management – Cable tray systems and cable ladder systems*

ISO 834 (all parts), *Fire-resistance tests – Elements of building construction*

### **520.3 Terms and definitions**

For the purposes of this document the following terms and definitions apply.

#### **520.3.1**

##### **wiring system**

assembly made up of bare or insulated conductors or cables or busbars and the parts which secure and if necessary enclose the cables or busbars

#### **520.3.2**

##### **busbar**

low impedance conductor to which several electric circuits can be separately connected

[IEV 605-02-01]

### **520.4 General**

Consideration shall be given to the application of the fundamental principles of IEC 60364-1 as it applies to

<sup>3</sup> A consolidated edition 3.1 exists (2005) that includes IEC 60439-2 (1995) and its amendment 1 (2005).

<sup>4</sup> A consolidated edition 2.1 exists (2001) that includes IEC 60529 (1989) and its amendment 1 (1999).