SLOVENSKI STANDARD

SIST IEC 60364-5-52:2006

september 2006

Električne inštalacije zgradb – 5-52. del: Izbira in namestitev električne opreme – Inštalacijski sistemi

Electrical installations of buildings - Part 5-52: Selection and erection of electrical equipment - Wiring systems

ICS 91.140.50

Referenčna številka
SIST IEC 60364-5-52:2006(en)

IEC 60364-5-52

Edition 2.0 2001-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical installations of buildings –
Part 5-52: Selection and erection of electrical equipment – Wiring systems

Installations électriques des bâtiments –
Partie 5-52: Choix et mise en œuvre des matériels électriques – Canalisations

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX XB

ICS 13.260; 91.140.50

ISBN 2-8318-5879-8

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL INSTALLATIONS OF BUILDINGS –

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

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60364-5-52 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

The IEC 60364 series (parts 1 to 6), is currently being restructured, without any technical changes, into a more simple form (see annex E).

According to a unanimous decision by the Committee of Action (CA/1720/RV (2000-03-21)), the restructured parts of IEC 60364 have not been submitted to National Committees for approval.

The text of this second edition of IEC 60364-5-52 is compiled from and replaces

– part 5-52, first edition (1993) and its amendment 1 (1997);
– part 5-523, second edition (1999).

This publication has been drafted, as close as possible, in accordance with the ISO/IEC Directives, Part 3.

Annex A forms an integral part of this standard.

Annexes B, C, D and E are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

ELECTRICAL INSTALLATIONS OF BUILDINGS –

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

520.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60364. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60364 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60228: 1978, *Conductors of insulated cables*

IEC 60287-1-1:1994, *Electric cables – Calculation of the current rating – Part 1: Current rating equations (100 % load factor) and calculation of losses – Section 1: General*

IEC 60287-2-1:1994, *Electric cables – Calculation of the current rating – Part 2: Thermal resistance – Section 1: Calculation of thermal resistance*

IEC 60287-3-1:1995, *Electric cables – Calculation of the current rating – Part 3: Sections on operating conditions – Section 1: Reference operating conditions and selection of cable type* [1)]

IEC 60332-1:1993, *Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable*

IEC 60332-3-24:2000, *Tests on electric cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wire or cables – Category C*

IEC 60439-2:2000, *Low-voltage switchgear and controlgear assemblies – Part 2: Particular requirements for busbar trunking systems (busways)*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)* [2)]

IEC 60614 (all parts), *Specification for conduits for electrical installations*

IEC 61200-52:1993, *Electrical installation guide – Part 52: Selection and erection of electrical equipment – Wiring systems*

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

[1)] A consoldated edition 1.1 exists (1999) that includes IEC 60287-3-1 (1995) and its amendment 1 (1999).

[2)] A consoldated edition 2.1 exists (2001) that includes IEC 60529 (1989) and its amendment 1 (1999).

520.3 General

Consideration shall be given to the application of the fundamental principles of IEC 60364-1 as it applies to cables and conductors, to their termination and/or jointing, to their associated supports or suspensions and their enclosures or methods of protection against external influences.

521 Types of wiring systems

521.1 The method of installation of a wiring system in relation to the type of conductor or cable used shall be in accordance with table 52-1, provided the external influences are covered by the requirements of the relevant product standards.

521.2 The method of installation of a wiring system in relation to the situation concerned shall be in accordance with table 52-2.

521.3 Examples of wiring systems together with reference to the appropriate table of current-carrying capacity are shown in table 52-3.

NOTE 1 Other types of wiring systems, not covered in this standard, may be used provided they comply with the general rules of this standard.

NOTE 2 Table 52-3 gives the reference method of installation where it is considered that the same current-carrying capacities can safely be used. It is not implied that all these items are necessarily recognized in national rules of all countries.

521.4 Busbar trunking systems

Busbar trunking systems shall comply with IEC 60439-2 and shall be installed in accordance with the manufacturer's instructions. The installation shall be in accordance with the requirements of clauses 522 (with the exception of 522.1.1, 522.3.3, 522.8.7, 522.8.8 and 522.8.9), 525, 526, 527 and 528.

521.5 AC circuits

Conductors of a.c. circuits installed in ferromagnetic enclosures shall be arranged so that all conductors of each circuit are contained in the same enclosure.

NOTE If this condition is not fulfilled, overheating and excessive voltage drop may occur due to inductive effects.

Table 52-1 (52F) **– Selection of wiring systems**

Conductors and cables		Method of installation							
		Without fixings	Clipped direct	Conduit	Cable trunking (including skirting trunking, flush floor trunking)	Cable ducting	Cable ladder Cable tray Cable brackets	On in-sulators	Support wire
Bare conductors		–	–	–	–	–	–	+	–
Insulated conductors		–	–	+	+	+	–	+	–
Sheathed cables (including armoured and mineral insulated)	Multi-core	+	+	+	+	+	+	0	+
	Single -core	0	+	+	+	+	+	0	+

+ Permitted.

– Not permitted.

0 Not applicable, or not normally used in practice.

Table 52-2 (52G) **– Erection of wiring systems**

Situations	Method of installation							
	Without fixings	With fixings	Conduit	Cable trunking (including skirting trunking, flush floor trunking)	Cable ducting	Cable ladder, cable tray, cable brackets	On insulators	Support wire
Building voids	40, 46, 15, 16	0	15,16, 41,42	–	43	30, 31, 32, 33, 34	–	–
Cable channel	56	56	54, 55	0	44, 45	30, 31, 32, 33, 34	–	–
Buried in ground	72, 73	0	70, 71	–	70, 71	0	–	–
Embedded in structure	57, 58	3	1, 2, 59, 60	50, 51, 52, 53	44, 45	0	–	–
Surface mounted	–	20, 21, 22, 23	4, 5	6, 7, 8, 9, 12, 13, 14	6, 7, 8, 9	30, 31, 32, 33, 34	36	–
Overhead	–	–	0	10, 11	–	30, 31, 32, 33, 34	36	35
Immersed	80	80	0	–	0	0	–	–

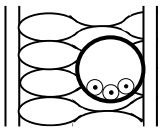
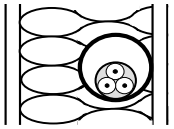
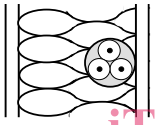
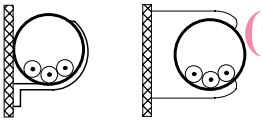
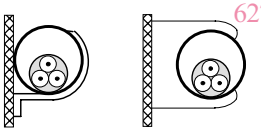
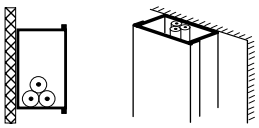
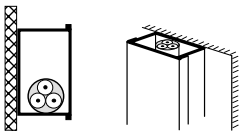
The number in each box indicates the item number in table 52-3.

– Not permitted.

0 Not applicable or not normally used in practice.

Table 52-3 (52H) **– Examples of methods of installation providing instructions for obtaining current-carrying capacity**

NOTE The illustrations are not intended to depict actual product or installation practices but are indicative of the method described.

Item No.	Methods of installation	Description	Reference method of installation to be used to obtain current-carrying capacity (see annex A)
1		Insulated conductors or single-core cables in conduit in a thermally insulated wall [a]	A1
2		Multi-core cables in conduit in a thermally insulated wall [a]	A2
3		Multi-core cable direct in a thermally insulated wall [a]	A1
4		Insulated conductors or single-core cables in conduit on a wooden, or masonry wall or spaced less than 0,3 × conduit diameter from it	B1
5		Multi-core cable in conduit on a wooden, or masonry wall or spaced less than 0,3 × conduit diameter from it	B2
6 7		Insulated conductors or single-core cables in cable trunking on a wooden wall – run horizontally [b] – run vertically [b, c]	B1
8 9		Multi-core cable in cable trunking on a wooden wall – run horizontally [b] – run vertically [b, c]	Under consideration [d]

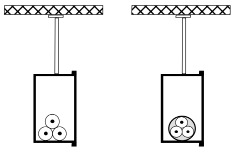
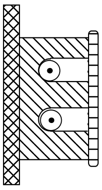
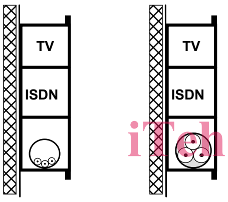
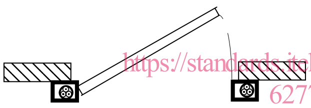
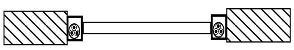
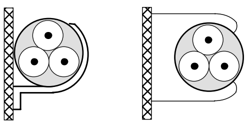
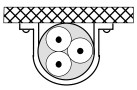
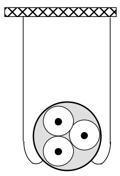
[a] The inner skin of the wall has a thermal conductance of not less than 10 $W/m^2 \cdot K$.

[b] Values given for installation methods B1 and B2 in annex A are for a single circuit. Where there is more than one circuit in the trunking the group reduction factor given in table A.52-17 is applicable, irrespective of the presence of an internal barrier or partition.

[c] Care shall be taken where the cable runs vertically and ventilation is restricted. The ambient temperature at the top of the vertical section can be increased considerably. The matter is under consideration.

[d] Values for reference method B2 may be used.

Table 52-3 *(continued)*

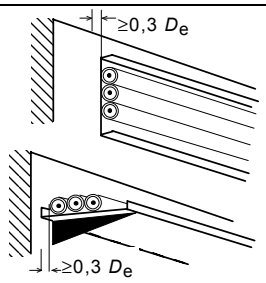
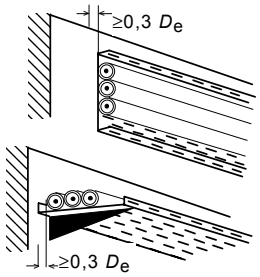
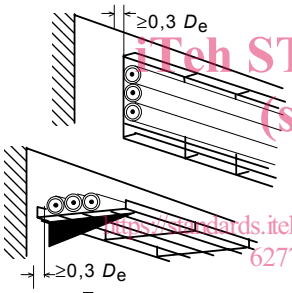
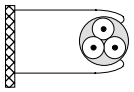
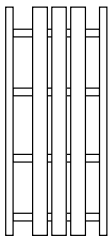
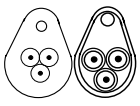
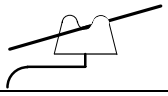
Item No.	Methods of installation	Description	Reference method of installation to be used to obtain current-carrying capacity (see annex A)
10	 10 11	Insulated conductors or single-core cable in suspended cable trunking [a]	B1
11		Multi-core cable in suspended cable trunking [a]	B2
12		Insulated conductors or single-core cable run in mouldings [b]	A1
13	 13 14	Insulated conductors or single-core cables in skirting trunking	B1
14		Multi-core cable in skirting trunking	B2
15		Insulated conductors in conduit or single-core or multi-core cable in architrave [c]	A1
16		Insulated conductors in conduit or single-core or multi-core cable in window frames [c]	A1
20		Single-core or multi-core cables: – fixed on, or spaced less than 0,3 × cable diameter from a wooden wall	C
21		– fixed directly under a wooden ceiling	C, with item 3 of table A.52-17
22		– spaced from a ceiling	Under consideration

[a] Values given for installation methods B1 and B2 in annex A are for a single circuit. Where there is more than one circuit in the trunking the group reduction factor given in table A.52-17 is applicable, irrespective of the presence of an internal barrier or partition.

[b] The thermal resistivity of the enclosure is assumed to be poor because of the material of construction and possible air spaces. Where the construction is thermally equivalent to methods of installation 6 or 7, reference method B1 may be used.

[c] The thermal resistivity of the enclosure is assumed to be poor because of the material of construction and possible air spaces. Where the construction is thermally equivalent to methods of installation 6, 7, 8, or 9, reference methods B1 or B2 may be used.

Table 52-3 *(continued)*

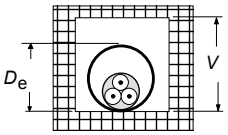
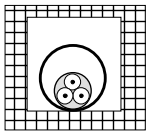
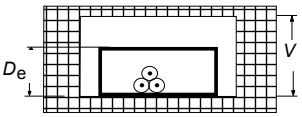
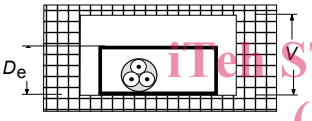
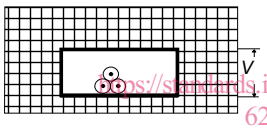
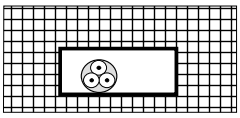
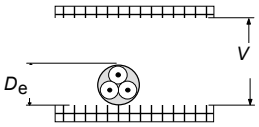
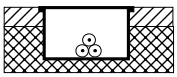
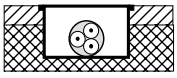
Item No.	Methods of installation	Description	Reference method of installation to be used to obtain current-carrying capacity (see annex A)
30		On unperforated tray [c]	C with item 2 of table A.52-17 [a]
31		On perforated tray [c]	E or F with item 4 of table A.52-17 [a, b]
32		On brackets or on a wire mesh [c]	E or F
33		Spaced more than 0,3 times cable diameter from a wall	E or F with item 4 or 5 of table A.52-17 or method G [a, b]
34		On ladder	E or F
35		Single-core or multi-core cable suspended from or incorporating a support wire	E or F
36		Bare or insulated conductors on insulators	G

[a] For certain applications it may be more appropriate to use specific factors, for example tables A.52-20 and A.52-21 (see A.52.4.2 of annex A).

[b] Care shall be taken where the cable runs vertically and ventilation is restricted. The ambient temperature at the top of the vertical section can be increased considerably. The matter is under consideration.

[c] D_e = the external diameter of a multi-core cable:
– 2,2 x the cable diameter when three single core cables are bound in trefoil, or
– 3 x the cable diameter when three single core cables are laid in flat formation.

Table 52-3 *(continued)*

Item No.	Methods of installation	Description	Reference method of installation to be used to obtain current-carrying capacity (see annex A)
40		Single-core or multi-core cable in a building void [a, 2]	1,5 $D_e \leq V < 20\ D_e$ B2 $V \geq 20\ D_e$ B1
42		Single-core or multi-core cable in conduit in a building void [d]	Under consideration
24		Insulated conductors in cable ducting in a building void [a, c, d]	1,5 $D_e \leq V < 20\ D_e$ B2 $V \geq 20\ D_e$ B1
43		Single-core or multi-core cable in cable ducting in a building void [d]	Under consideration
44		Insulated conductors in cable ducting in masonry having a thermal resistivity not greater than 2 K · m/W [a, b, d]	1,5 $D_e \leq V < 5\ D_e$ B2 5 $D_e \leq V < 50\ D_e$ B1
45		Single-core or multi-core cable in cable ducting in masonry having a thermal resistivity not greater than 2 K · m/W [d]	Under consideration
46		Single-core or multi-core cable: – in a ceiling void – in a suspended floor [a, b]	1,5 $D_e \leq V < 5\ D_e$ B2 5 $D_e \leq V < 50\ D_e$ B1
50		Insulated conductors or single-core cable in flush cable trunking in the floor	B1
51		Multi-core cable in flush cable trunking in the floor	B2

[a] V = the smaller dimension or diameter of a masonry duct or void, or the vertical depth of a rectangular duct, floor or ceiling void.

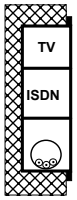
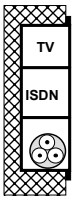
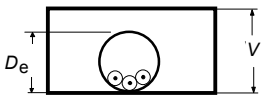
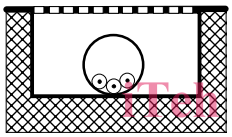
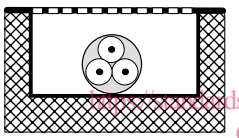
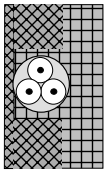
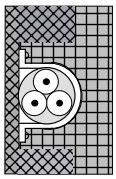
[b] D_e = the external diameter of a multi-core cable:

– 2,2 × the cable diameter when three single core cables are bound in trefoil, or
– 3 × the cable diameter when three single core cables are laid in flat formation.

[c] D_e = external diameter of conduit or vertical depth of cable ducting.

[d] Care shall be taken where the cable runs vertically and ventilation is restricted. The ambient temperature at the top of the vertical section can be increased considerably. The matter is under consideration.

Table 52-3 *(continued)*

Item No.	Methods of installation	Description	Reference method of installation to be used to obtain current-carrying capacity (see annex A)
52		Insulated conductors or single-core cables in embedded trunking	B1
53	 52 53	Multi-core cable in embedded trunking	B2
54		Insulated conductors or single-core cables in conduit in an unventilated cable channel run horizontally or vertically [a, b]	1,5 $D_e \leq V < 20\ D_e$ B2 $V \geq 20\ D_e$ B1
55		Insulated conductors in conduit in an open or ventilated cable channel in the floor [c, d]	B1
56		Sheathed single-core or multi-core cable in an open or ventilated cable channel run horizontally or vertically [d]	B1
57		Single-core or multi-core cable direct in masonry having a thermal resistivity not greater than 2 K·m/W Without added mechanical protection [e, f]	C
58		Single-core or multi-core cable direct in masonry having a thermal resistivity not greater than 2 K·m/W With added mechanical protection [e, f]	C

[a] *De* = external diameter of conduit
V = internal depth of the channel
The depth of the channel is more important than the width.

[b] Care shall be taken where the cable runs vertically and ventilation is restricted. The ambient temperature at the top of the vertical section can be increased considerably. The matter is under consideration.

[c] For multi-core cable installed in method 55, use ratings for reference method B2.

[d] It is recommended that these methods of installation are used only in areas where access is restricted to authorised persons so that the reduction in current carrying capacity and the fire hazard due to the accumulation of debris can be prevented.

[e] For cables having conductors not greater than 16 mm^2, the current-carrying capacity may be higher.

[f] Thermal resistivity of masonry is not greater than 2 K·m/W.