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**Installations électriques des bâtiments**

**Partie 4:**

Protection pour assurer la sécurité

Chapitre 48: Choix des mesures de protection  
en fonction des influences externes

Section 481 – Choix des mesures de protection  
contre les chocs électriques en fonction des  
influences externes

**Electrical installations of buildings**

**Part 4:**

Protection for safety

Chapter 48: Choice of protective measures  
as a function of external influences

Section 481 – Selection of measures for  
protection against electric shock in relation  
to external influences

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ELECTRICAL INSTALLATIONS OF BUILDINGS

**Part 4: Protection for safety**  
**Chapter 48: Choice of protective measures as a**  
**function of external influences**  
**Section 481 – Selection of measures for protection**  
**against electric shock in relation to external influences**

## 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 cooperation 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, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, 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.

International Standard IEC 364-4-481 has been prepared by IEC technical committee 64:  
 Electrical installations of buildings.

The text of this standard is based on the following documents:

DIS	Reports on Voting
64(CO)169 64(CO)201	64(CO)190 64(CO)210

Full information on the voting for the approval of this standard can be found in the reports on voting indicated in the above table.

## ELECTRICAL INSTALLATIONS OF BUILDINGS

### Part 4: Protection for safety Chapter 48: Choice of protective measures as a function of external influences Section 481 – Selection of measures for protection against electric shock in relation to external influences

#### 481.1 General

481.1.1 The requirements of clause 481.2 indicate the measures for protection against electric shock defined in IEC 364-4-41 to be applied as a function of assessed conditions of external influences.

#### NOTES

1 In practice, only the following conditions of external influences are relevant to the selection of measures for protection against electric shock:

BA – Qualification of persons;

BB – Electrical resistance of the human body;

BC – Contact of persons with earth potential.

2 Other conditions of external influences have practically no influence on the selection and implementation of measures for protection against electric shock, but should be taken into consideration for the selection of equipment (see IEC 364-5-51, table 51A).

481.1.2 Where, for a given combination of external influences, several protective measures are permitted, the selection of the appropriate measure depends on local conditions and the nature of the equipment concerned.

NOTE – For special installations or special locations, see IEC 364-7.

#### 481.1.3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 364-4. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 364-4 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 364-4-41: 1992, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock*

IEC 364-5-51: 1979, *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Chapter 51: Common rules*

IEC 364-7-704: 1989, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 704: Construction and demolition site installations*

IEC 364-7-705: 1984, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 705: Electrical installations of agricultural and horticultural premises*

## 481.2 Measures of protection against direct contact

481.2.1 The measures of protection by insulation of live parts (see clause 412.1 of IEC 364-4-41) and by barriers or enclosures (see clause 412.2 of IEC 364-4-41) are applicable in all conditions of external influences.

481.2.2 The measures for protection by means of obstacles according to clause 412.3 of IEC 364-4-41 or by placing out of reach according to clause 412.4 of IEC 364-4-41 are permitted in locations accessible only in accordance with the operating instructions to instructed persons (BA 4) or skilled persons (BA 5) and if the following conditions are fulfilled:

- the nominal voltage existing in such locations does not exceed the limit of voltage band II;
- the rules stated in 481.2.4.1 and 481.2.4.3 are observed in the cases in question;
- the locations are clearly and visibly marked by appropriate signs.

481.2.3 Protection against direct contact is not required in locations accessible only to instructed persons (BA 4) or skilled persons (BA 5) duly instructed for the particular purpose and if the following conditions are simultaneously fulfilled:

- the locations are clearly and visibly marked by appropriate signs, and it is not possible to gain access to them except by means of a special device;
- doors giving entrance to closed electrical operating areas shall allow easy escape to the outside, and even if locked from the outside with a key, it is possible to open them from the inside without the use of a key;
- for gangways, the minimum distances according to 481.2.4.2 and 481.2.4.3 are observed.

### 481.2.4 *Minimum distances to be observed in operating and maintenance gangways*

NOTE - The figures indicated below are absolute minima; other considerations such as suitable working positions, escape facilities, etc. may make it necessary to adopt higher values.

481.2.4.1 The following distances shall be observed where protection in accordance with clause 412.3 of IEC 364-4-41 is ensured (see figure 48A):

- a) Gangway width between obstacles or switch handles or between obstacles or switch handles and wall: 700 mm minimum
- b) Headroom below panelling: 2 000 mm minimum

NOTE - The above dimensions apply after all parts of the panelling have been mounted and closed.

481.2.4.2 In locations where no protective measure is provided, the following distances shall be observed with regard to operating and maintenance gangways:

a) Where the gangway has unprotected live parts arranged *on one side only* (see figure 48B):

- |   |                  |
|---|------------------|
| 1) width of gangway between wall and live parts:      | 1 000 mm minimum |
| 2) free passage in front of controls (handles, etc.): | 700 mm minimum   |

b) Where the passage has live parts *on both sides* (see figure 48C):

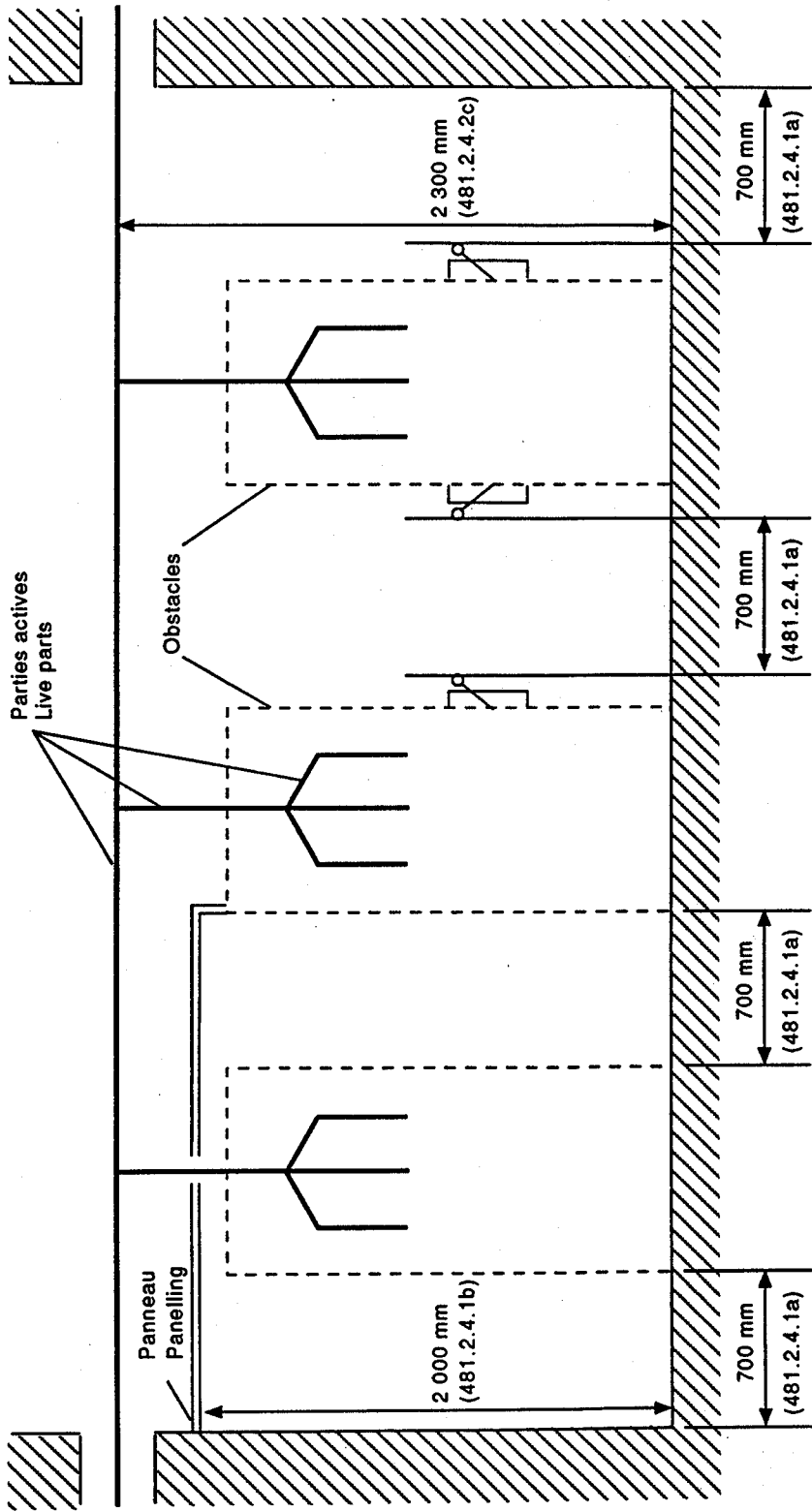
- |   |                  |
|---|------------------|
| 1) width of gangway between live parts and conductors on both sides:  |                  |
| i) Where the gangway is used only for maintenance purposes and barriers are provided before maintenance work is undertaken:                   | 1 000 mm minimum |
| ii) Where the gangway is used only for maintenance purposes and barriers are not provided before maintenance work is undertaken:              | 1 500 mm minimum |
| iii) Where the gangway is used for both operational and maintenance purposes and barriers are provided before maintenance work is undertaken: | 1 200 mm minimum |
| Where barriers are not provided before maintenance work is undertaken, the requirements of 481.2.4.2b)1)ii) shall be observed.                |                  |

- |   |                  |
|---|------------------|
| 2) Free passage between controls (handles, etc.): |                  |
| i) in a maintenance gangway:                      | 900 mm minimum   |
| ii) in an operating gangway:                      | 1 100 mm minimum |

c) Height of live parts above the floor:	2 300 mm minimum
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481.2.4.3 Maintenance or operating gangways of a length exceeding 20 m shall be accessible from both ends.

NOTE - For shorter gangways, but of a length exceeding 6 m, accessibility from both ends is recommended



CEI-IEC 80/93

Figure 48A - Passages de service et d'entretien dans des installations avec protection au moyen d'obstacles  
Operating and maintenance gangways in installations with protection by obstacles

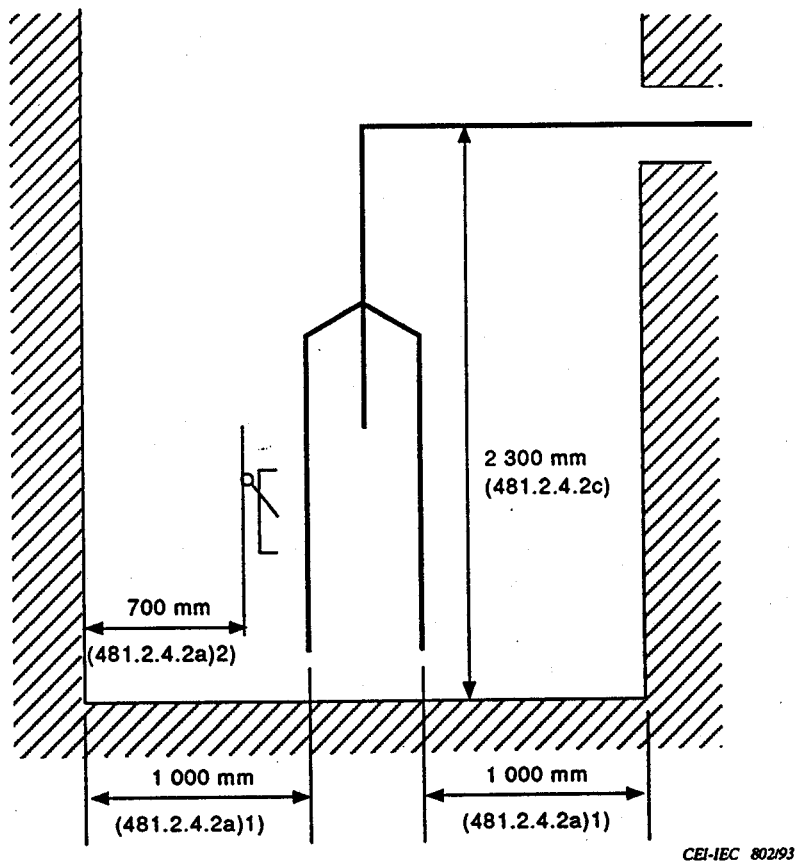


Figure 48B – Passages dans des installations avec parties actives d'un seul côté sans protection

Gangways in installations with live parts on one side without protection



### 481.3 Choice of protective measures against indirect contact

481.3.1 The measure of protection by automatic disconnection of the supply is applicable in any installation.

In general, the conditions of clause 413.1 of IEC 364-4-41 apply.

In the installation or parts of the installation for which the corresponding section of IEC 364-7 (e.g. section 704 or 705) limits the conventional touch voltage to 25 V a.c. or 60 V d.c. ripple-free, one of the requirements of 481.3.1.1 or 481.3.1.2 apply.

#### NOTES

1 The requirements of 481.3.1.1 apply when the reduced conventional touch voltage is applicable to a complete installation.

2 One of the requirements of 481.3.1.2 applies when the reduced conventional touch voltage is applicable only to a part of an installation.

481.3.1.1 In the installation for which the corresponding section of IEC 364-7 (e.g. section 704 or 705) limits the conventional touch voltage to 25 V a.c. or 60 V d.c. ripple-free, the following requirements apply:

- in TN and IT systems, the maximum disconnecting times defined in tables 41A and 41B of IEC 364-4-41 shall be replaced by the following:

Table 48A - Maximum disconnecting times

TN system		IT system		
Installation nominal voltage	Disconnecting time	Installation nominal voltage	Disconnecting time s	
$U_o$ V	s	$U_o/U$ V	Neutral not distributed	Neutral distributed
120	0,35	120-240	0,4	1
230	0,2	230/400	0,2	0,5
277	0,2	277/480	0,2	0,5
400, 480	0,05	400/690	0,06	0,2
580	0,02*	580/1 000	0,02*	0,08

$U_o$  is the voltage between phase and neutral

\* If such disconnecting time cannot be guaranteed, it is necessary to take other protective measures, such as supplementary equipotential bonding.

- in TT systems, the condition of 413.1.4.2 of IEC 364-4-41 is replaced by the following:

$$R_A \times I_a \leq 25 \text{ V};$$

- in IT systems, the condition of 413.1.5.3 of IEC 364-4-41 is replaced by the following:

$$R_A \times I_d \leq 25 \text{ V}.$$

481.3.1.2 In the parts of the installation in which the corresponding section of IEC 364-7 limits the conventional touch voltage to 25 V a.c. or 60 V d.c. ripple-free, the rules of clause 413.1 may be applied if one of the following measures is taken:

- application of supplementary equipotential bonding according to the conditions of 413.1.6 of IEC 364-4-41, the value of 50 in the formula of 413.1.6.2 of IEC 364-4-41 being replaced by 25;
- protection by residual-current devices, the rated residual operating current of which is not more than 30 mA.

NOTE - Conditions of this paragraph permit the provision of protection of the whole installation in the general conditions of clause 413.1 of IEC 364-4-41 which exist in the greater part of this installation and the provision of a supplementary measure of protection in locations when IEC 364-7 requires a limitation on the conventional touch voltage.

481.3.2 The measure of protection by use of class II equipment or by equivalent insulation, according to clause 413.2 of IEC 364-4-41, is applicable in all situations, unless some limitations are given in IEC 364-7.

NOTE - For safety reasons it is important that the equipment shall be selected according to the external influences.

481.3.3 The measure of protection by non-conductive location is permitted in accordance with clause 413.3 of IEC 364-4-41.

481.3.4 The measure of protection by earth-free local equipotential bonding is permitted only in condition of external influences BC 1.

481.3.5 The measure of protection by electrical separation is applicable in all situations. However, in condition BC 4, it shall be limited to the supply of one item of mobile apparatus from one transformer.

481.3.6 The use of SELV according to 411.1.4 of IEC 364-4-41 or PELV according to 411.1.5 of IEC 364-4-41 is considered as a measure of protection against indirect contact in all situations.

#### NOTES

1 In certain cases, IEC 364-7 limits the value of the extra-low voltage at a value lower than 50 V, i.e. 25 V or 12 V.

2 The use of FELV requires another measure of protection against indirect contact (see 411.3.3 of IEC 364-4-41).

481.3.7 In certain installations or parts of the installation, for example, in locations where persons may be immersed in water, the corresponding section of IEC 364-7 requires particular protective measures.

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