

Overhead lines — Calculation of the electrical component of distance between live parts and obstacles — Method of calculation

ICS 29.240.20

National foreword

This British Standard reproduces verbatim IEC 61865:2001 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee PEL/11, Overhead lines, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 29 March 2002

Summary of pages

This document comprises a front cover, an inside front cover, the IEC title page, pages 2 to 23 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 29 March 2002

ISBN 0 580 39248 1

**NORME
INTERNATIONALE
INTERNATIONAL
STANDARD**

**CEI
IEC**

61865

Première édition
First edition
2001-07

**Lignes aériennes –
Calcul de la composante électrique
de la distance entre les parties sous
tension et les obstacles –
Méthode de calcul**

**Overhead lines –
Calculation of the electrical component
of distance between live parts and obstacles –
Method of calculation**



Numéro de référence
Reference number
CEI/IEC 61865:2001

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	7
3 Terms, definitions and symbols	7
3.1 Definitions	7
3.2 Symbols	9
4 Approach used to derive the electrical distance	10
5 Overvoltages	11
5.1 Classification of overvoltages	11
5.2 Temporary overvoltages	11
5.3 Slow-front overvoltages	12
5.4 Fast-front overvoltages	12
6 Required withstand voltage of the air gap	13
6.1 General	14
6.2 Calculation of the required withstand voltage	16
7 Calculation of the distance associated with the overvoltages	17
Annex A (informative) Relationship between U_{50} and the gap length, d	18
Annex B (informative) Example of the calculation of the electrical component	20
Bibliography	23
Table 1 – Slow-front waves: probability of discharge	14
Table 2 – Fast-front waves: probability of discharge	15
Table B.1 – Summary of the results	22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**OVERHEAD LINES –
CALCULATION OF THE ELECTRICAL COMPONENT OF
DISTANCE BETWEEN LIVE PARTS AND OBSTACLES –
METHOD OF CALCULATION**

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 61865 has been prepared by IEC technical committee 11: Overhead lines.

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

FDIS	Report on voting
11/161/FDIS	11/162/RVD

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

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

Annexes A and B are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2005-11. At this date, the publication will be

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

INTRODUCTION

The minimum distances to be maintained between overhead line conductors and objects close to them are usually specified in national standards or regulations. Such minimum distances normally comprise

- an electrical distance, i.e. an air insulation distance which prevents an electrical discharge between the conductors and other objects, even when there are overvoltages present on the overhead line conductors;
- an additional distance to account for an extreme range of certain conditions (such as human activities, sizes of objects that may normally come under a line, movement of conductors due to temperature, load or environmental conditions) plus a safety margin to allow for uncertainties.

It is important that the two distances are specified correctly.

The method presented in this International Standard for calculating the electrical distance is mainly for use when reviewing or revising existing electrical distances (for example, to add new voltage levels). The method uses the overvoltages which occur on the lines together with the prevailing atmospheric conditions (including the effects of altitude, etc.) to derive the electrical component of the distance. The method is especially suited to the case of slow-fronted waves but is extended to cover the case of fast-front waves and temporary overvoltages.

OVERHEAD LINES – CALCULATION OF THE ELECTRICAL COMPONENT OF DISTANCE BETWEEN LIVE PARTS AND OBSTACLES – METHOD OF CALCULATION

1 Scope

This International Standard provides guidance for the calculation of electrical distances between live and earthed parts required to prevent air-gap breakdown which may endanger members of the public who legitimately come close to live parts. It is applicable only to overhead lines designed to operate at more than 45 kV phase-to-phase a.c. It deals with the electrical component of distances between conductors and movable objects – vehicles on the ground, vessels on water, persons on top of objects or on the ground, wildlife on the ground (but not airborne), etc.

This standard does not deal with the following public and worker safety aspects:

- stationary objects – structures beneath or next to lines, trees, ground contours, etc. These, in general, require consideration as to whether the structure can be climbed on, the extent to which the tree will grow, etc;
- minimum approach distance for live working, which is dealt with in IEC 61472;
- capacitive coupling or magnetic induction by overhead lines, such as voltages induced in vehicles under a line, or in pipelines buried alongside it;
- currents flowing in the ground that originate from lines and result in step and touch voltages around structures during line faults or lightning strikes;
- flashover of line insulators or spark gaps, or a phase-to-phase discharge, resulting in audible and electrical noise and intense arcs;
- dielectric breakdown of the air between the conductors and the ground due to large fires beneath conductors;
- minimum electrical distances required to prevent discharge to adjacent overhead power or communication circuits.

This standard does not give the electrical distance requirements for the design of overhead line structures. Neither does it give the distance requirements for overhead line structures which need to be accessible to workers while the line is energized (for example, distances to line workers or painters). Distances between conductors and the structure of the tower are normally chosen to meet the required operating reliability of the line. It is possible that this distance may not always be adequate to allow live working or, in some cases, access for workers to parts of the structure near to live conductors.