IEC 62497-2

Edition 1.0 2010-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Insulation coordination –
Part 2: Overvoltages and related protection

Applications ferroviaires – Coordination de l'isolement –
Partie 2: Surtensions et protections associées

IEC 62497-2:2010

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC 62497-2

Edition 1.0 2010-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Insulation coordination – Part 2: Overvoltages and related protection

Applications ferroviaires – Coordination de l'isolement – Partie 2: Surtensions et protections associées

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX

M

ICS 45.060

ISBN 978-2-88910-742-1

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – INSULATION COORDINATION –

Part 2: Overvoltages and related protection

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62497-2 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard is based on EN 50124-2.

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

FDIS	Report on voting
9/1336/FDIS	9/1359/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 2.

A list of all parts of IEC 62497 series, under the general title *Railway applications – Insulation coordination*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

INTRODUCTION

This International Standard is part of the series IEC 62497, Railway applications – Insulation coordination.

IEC 62497 consists of two parts:

– IEC 62497-1: Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment;

– IEC 62497-2: Part 2: Overvoltages and related protection.

This part 2 deals with the shortest durations of overvoltages referred to as Zone A and Zone B in Figure A.1 in informative Annex A.

RAILWAY APPLICATIONS – INSULATION COORDINATION –

Part 2: Overvoltages and related protection

1 Scope

This part of IEC 62497 applies to:

– fixed installations (downstream the secondary of the substation transformer) and rolling stock equipment linked to the contact line of one of the systems defined in IEC 60850;

– rolling stock equipment linked to a train line.

This standard gives simulation and/or test requirements for protection against transient overvoltages of such equipment.

Long-term overvoltages are not treated in this standard.

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 60099-1, *Surge arresters – Part 1: Non-linear resistor type gapped arresters for a.c. systems*

IEC 60099-4, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60850, *Railway applications – Supply voltages of traction systems*

IEC 61992-5, *Railway applications – Fixed installations – D.C. switchgear – Part 5: Surge arresters and low-voltage limiters for specific use in d.c. systems*

UIC 550, *Power supply installations for passenger stock*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1
voltages

3.1.1
overvoltage
any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions

3.1.2
temporary overvoltage
an overvoltage of relatively long duration due to voltage variations

NOTE A temporary overvoltage is independent of the network load. It is characterized by a voltage/time curve.

3.1.3
transient overvoltage
A short duration overvoltage of a few milliseconds or less due to current transfer

NOTE A transient overvoltage depends on the network load. It cannot be characterised by a voltage/time curve. Basically, a transient overvoltage is the result of a current transfer from a source to the load (network).

3.1.3.1
switching overvoltage
the transient overvoltage at any point of the system due to specific switching operation or fault [IEC 60664-1, 3.7.3]

3.1.3.2
lightning overvoltage
the transient overvoltage at any point of the system due to a specific lightning discharge

3.2
network
set of conductors fulfilling a certain function, the overvoltages of which are likely to damage the equipment they are connected to

4 Contact line network

NOTE The provisions of this Clause 4 do not take into account rapid transient overvoltages in the multimegahertz range such as generated by operation of vacuum circuit breakers which may require a specific overvoltage protection.

4.1 Equipment not protected by a metal-oxide arrester

If the equipment is not protected by a metal-oxide arrester, the protection against overvoltages shall take into account overvoltages limited only by the intrinsic isolation of the contact line and the possible presence of other types of arrester or spark gaps.

4.2 Equipment protected by a metal-oxide arrester

4.2.1 General

If the supplier wants to benefit from the presence of a metal-oxide arrester for reducing constraints resulting from 4.1, he shall perform a simulation of the behaviour of the protection against overvoltages.

The circuits of the protected equipment likely to modify the electrical behaviour of the protection shall also be simulated.

The equipment shall withstand the pulses defined in 4.2.2 and 4.2.3, where the values of the reference voltage U_p are defined in Table 1.

Table 1 – Values of the reference voltage U_p

Nominal network voltage according to IEC 60850 U_n kV	U_p kV
0,75	4
1,5	6
3	12
15	60
20	80
25	100
25	110 [a]
NOTE The values of U_p take into account the values of U_{res} as given in IEC 60099-1 and IEC 60099-4 and/or U_p as given in IEC 61992-5. But they relate to a theoretical arrester, for simulation purposes only, and present not any direct link to U_{res} of IEC 60099-1 and IEC 60099-4 and/or U_p of IEC 61992-5.	
[a] See footnote i to Table 1 of IEC 60850 regarding nominal voltage 25 kV.	

4.2.2 Simulation for long pulse

The long pulse is a voltage pulse of trapezoidal shape, lasting 2 ms with an amplitude equal to 70 % of the reference voltage U_p. It is applied to the equipment without considering the presence of its metal-oxide arrester.

4.2.3 Simulation for short pulse

The short pulse is the 4/10 current pulse defined in IEC 60099-4.

Its amplitude value is 100 kA.

It is applied to the equipment including the arrester, where the metal-oxide arrester is replaced by a theoretical one the characteristic of which, in log(current in kA) versus log(voltage in kV), is a straight line which includes the two points:

$$(\log(10), \log(U_p)) \text{ and } (\log(100), \log(1{,}5\ U_p)).$$

NOTE The safety margin 1,5 U_p takes into account residual voltages of the surge arrester at lightning impulse currents higher than 10 kA, induced voltage drops along the arrester and the connection lines and voltage increases due to travelling wave effects on the line between the surge arrester and the equipment.

5 Train line network

5.1 Equipment not protected by a metal-oxide arrester

If the equipment is not protected by a metal-oxide arrester, UIC 550 shall be applied.

5.2 Equipment protected by a metal-oxide arrester

If the equipment is protected by a metal-oxide arrester, the values of UIC 550 may be limited according to the characteristics of the metal-oxide arrester.

In case of connection of several arresters to the train line, it shall be ascertained that their cascading will not lead to damages.

6 Tests

In case of doubt on the model and/or the parameters to be taken into account in the simulation, investigation tests shall be carried out and the simulation improved until an acceptable level of trust is reached.

The supplier shall ascertain that each component involved is chosen and tested in order to withstand the worst constraints resulting from the simulation.

If the simulation shows constraints on a component which are not covered by its product standard or data sheet, or if both documents are missing, a dedicated test shall be carried out upon agreement between purchaser and supplier.

One or several tests on components may be replaced, if deemed preferable by the supplier, by a unique test on the assembled equipment.