SLOVENSKI STANDARD

SIST EN 50124-2:2002

prva izdaja
julij 2002

Železniške naprave – Uskladitev izolacije – 2. del: Prenapetosti in ustrezna zaščita

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

ICS 29.080.01; 29.280

Referenčna številka
SIST EN 50124-2:2002(en)

EUROPEAN STANDARD **EN 50124-2**

NORME EUROPÉENNE

EUROPÄISCHE NORM March 2001

ICS 29.080.99; 29.280

English version

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

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

Bahnanwendungen -
Isolationskoordination
Teil 2: Überspannungen und geeignete Schutzmaßnahmen

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50124-2:2001 E

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 9X, Electrical and electronic applications in railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50124-2 on 1998-10-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2001-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2002-10-01

Annexes designated "informative" are given for information only.
In this standard, annex A is informative.

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Introduction

This European Standard is part of the series EN 50124, Railway applications - Insulation coordination, which consists of two parts:

– EN 50124-1 Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment;

– EN 50124-2 Part 2: Overvoltages and related protection.

This EN 50124-2 is also linked to EN 50163:1995, Railway applications - Supply voltages of traction systems. This EN 50124-2 deals with the shortest durations of overvoltages referred to as zone A and zone B in annex A of EN 50163, which is reproduced as an informative annex A of this EN 50124-2.

1 Scope

This European Standard 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 EN 50163;

– 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 document.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place in the text and the publications are listed thereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 50123-5	1997	Railway applications - Fixed installations - D.C. switchgear Part 5: Surge arresters and low-voltage limiters for specific use in d.c. systems
EN 50163	1995	Railway applications - Supply voltages of traction systems
EN 60099-1	1994	Surge arresters Part 1: Non-linear resistor type gapped surge arresters for a.c. systems (IEC 60099-1:1991)
EN 60099-4	1993	Surge arresters Part 4: Metal-oxide surge arresters without gaps for a.c. systems (IEC 60099-4:1991)
HD 625.1 S1	1996	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests (IEC 60664-1:1992, modified)
UIC 550	1994	Power supply installations for passenger stock

3 Definitions

For the purpose of this standard, the following definitions apply:

NOTE The definitions are in accordance with those of EN 50163 (see also annex A). Long-term, medium-term and short-term overvoltages are equivalent to respectively temporary, switching and lightning overvoltages defined in HD 625.1 S1 (IEC 60664-1).

3.1
overvoltage
any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions [IEC 60664-1]

3.1.1
long-term overvoltage
an overvoltage at relatively long duration due to voltage variations

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

3.1.2
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).

3.1.2.1
medium-term overvoltage
the transient overvoltage at any point of the system due to specific switching operation or fault [IEC 60664-1]

3.1.2.2
short-term 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

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

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 thereunder defined in 4.2.1 and 4.2.2, where the values of the reference voltage U_p are defined in Table 1.

Table 1 - Values of the reference voltage U_p

Network according to EN 50163	U_p (kV)
25 kV	100
15 kV	60
3 kV	12
1,5 kV	6
750 V	4

NOTE The values of U_p take into account the values of U_{res} as given in EN 60099-1 and -4 and/or U_p as given in EN 50123-5. But they relate to a theoretical arrester, for simulation purposes only, and present not any direct link to U_{res} of EN 60099-1 and -4 and/or U_p of EN 50123-5.

4.2.1 Simulation for long pulse

The long pulse is a voltage pulse of trapezoidal shape, lasting 2 milliseconds 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.

4.2.2 Simulation for short pulse

The short pulse is the 4/10 current pulse defined in EN 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.