# SLOVENSKI STANDARD
# SIST EN 50163:1998

**01-november-1998**

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**Railway applications - Supply voltages of traction systems (IEC 60850:1988 (Related))**

Railway applications - Supply voltages of traction systems

Bahnanwendungen - Speisespannungen von Bahnnetzen

Applications ferroviaires - Tensions d'alimentation des réseaux de traction



**Ta slovenski standard je istoveten z: EN 50163:1995**



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**ICS:**

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| 29.280 | Elektriļ na vleļ na oprema | Electric traction equipment |
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EUROPEAN STANDARD
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# EN 50163

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English version

## Railway applications
## Supply voltages of traction systems

Applications ferroviaires
Tensions d'alimentation des réseaux de traction

Bahnanwendungen
Speisespannungen von Bahnnetzen



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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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## Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not IEC 850:1988 could be accepted without textual changes, has shown that some CENELEC common modifications were necessary for the acceptance as European Standard.

A first draft, prepared by the Technical Committee CENELEC TC 9X, Eléctrical and electronic applications for railways, and the ad hoc Working Group on the revision of IEC 850 was submitted to the Unique Acceptance Procedure but did not receive a sufficient number of positive votes.

A new draft was submitted to the formal vote and was approved by CENELEC as EN 50163 on 1995-03-06.

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) | 1996-03-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 1996-03-01 |



For products which have complied with the relevant national standard before 1996-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-03-01.

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## Introduction

National variations to this standard may exist provided they fulfil the following conditions:

- they apply to minor routes or well-localised areas;
- they are not likely to give advantage to local manufacturers at the time of the tenders;
- they do not involve European traffic.

In that case, they are considered de facto as special national conditions.

## 1 Scope

This standard applies to line voltages of traction systems under normal operating conditions.

NOTE: Specifications in other international documents referring to "the maximum voltage value specified in IEC 850" shall be interpreted as referring to $U_{max1}$ until such time as these documents have determined the appropriate definition of maximum voltage following the publication of EN 50163.



## 2 Definitions

### 2.1 voltage $U$

The potential at the train's current collector, measured between the supply conductor and the return conductor.

The values given in table 1 assume that the electrification system is operating normally with no maintenance outages or electrical faults.

This standard concerns mean value of d.c. voltage or r.m.s value of the fundamental (1st harmonic) a.c. voltage.

### 2.2 nominal voltage $U_n$

The designated value for a system.

### 2.3 highest permanent voltage $U_{max1}$

The maximum value of the voltage likely to be present indefinitely.

2.4 **highest non-permanent voltage $U_{max2}$**

The maximum value of the voltage likely to be present for maximum 5 min.

2.5 **lowest permanent voltage $U_{min1}$**

The minimum value of the voltage likely to be present indefinitely.

2.6 **lowest non-permanent voltage $U_{min2}$**

The minimum value of the voltage likely to be present for maximum 10 min.

Even when no value is shown in table 1, the voltage may fall below $U_{min1}$ for short periods of time.

2.7 **overvoltage**

A transient rise of voltage lasting less than 2 s.

2.8 **long-term overvoltage**



A transient rise of voltage, lasting typically more than 20 ms, due to low impedance phenomena (e.g. a rise in substation primary voltage).



Such overvoltages are independent of line road and may be described by a voltage/time curve only.

For a.c. systems, the r.m.s. value of the fundamental (1st harmonic) voltage is to be considered.

NOTE: For $t$ = 20 ms, the overvoltage is $U_{max3}$ (see annex A).

2.9 **medium-term overvoltage** *

A transient rise of voltage, lasting typically less than 20 ms, due to current transfer following switching (e.g. the opening of a circuit-breaker).

Such overvoltages are related to the line load and cannot be described by a voltage-time curve alone.

2.10 **short-term overvoltage** *

A transient rise of voltage lasting less than 20 μs (e.g. lightning strikes).

* The values relative to medium-term and short-term overvoltages are not quantified in this standard.

## 3 The European voltage systems

### 3.1 *Voltage*

The characteristics of the main voltage systems (overvoltages excluded) are detailed in table 1 below.

**Table 1**

| Electrification system | Lowest non-permanent voltage $U_{min2}$ (V) | Lowest permanent voltage $U_{min1}$ (V) | Nominal voltage $U_n$ (V) | Highest permanent voltage $U_{max1}$ (V) | Highest non-permanent voltage $U_{max2}$ (V) |
|---|---|---|---|---|---|
| d.c. (mean values) | | 400<br>500<br>1 000<br>2 000 | 600[1)]<br>750<br>1 500<br>3 000 | 720<br>900<br>1 800<br>3 600 | 770[2)]<br>950[3)]<br>1 950<br>3 900 |
| a.c. (r.m.s. values) | 11 000<br>17 500 | 12 000<br>19 000 | 15 000<br>25 000 | 17 250<br>27 500 | 18 000[4)]<br>29 000 |

1) Future d.c. traction systems for tramways and local railways should conform with system nominal voltage of 750, 1 500 or 3 000 V.
2) In case of regenerative braking, a voltage $U_{max2}$ of 800 V may be admissible.
3) In case of regenerative braking, a voltage $U_{max2}$ of 1 000 V may be admissible.
4) This value has to be confirmed by measurements and might have to be changed.



### 3.2 *Frequency*

The nominal value of the 15 kV system frequency is 16 2/3 Hz. It ranges from 16 1/6 Hz to 17 Hz.

The nominal value of the 25 kV system frequency is 50 Hz. It ranges from 49 Hz to 51 Hz.

### 3.3 *Long-term overvoltages*

The variation with time of the ratio $U/U_n$ is identified by the following relation:

$$\frac{U}{U_n} < \frac{K}{t^A}$$

with

$t$ = time in seconds (0,02 < t < 2)
A = 0,0745

The representation in log-log coordinates of this equation is a set of parallel lines, the common slope of which is given by A, and the position of which is given by *K*.

The value of $K$ depends on the network as follows:

$K$ = 1,264 for d.c. systems
$K$ = 1,211 for a.c. 15 kV system
$K$ = 1,158 for a.c. 25 kV system

Those values of $K$ have been calculated so that the value of $U$ at $t$ = 2 s is $U_{max1}$.

NOTE: Within the short range where $U_{max2} > U$, the value $U_{max2}$ prevails over the value U given by the above mentioned relation.

## 3.4 *Spectrum of the voltage U*

The maximum value of the voltage $U$ according to duration is illustrated in annex A (informative).