SLOVENSKI STANDARD
SIST EN 50341-2-23:2018

01-februar-2018

Nadzemni električni vodi za izmenične napetosti nad 1 kV - 2-23. del: Nacionalna normativna določila (NNA) za Slovaško (na podlagi EN 50341-1:2012)

Overhead electrical lines exceeding AC 1 kV – Part 2-23: National Normative Aspects (NNA) for SLOVAKIA (based on EN 50341-1:2012)

Lignes électriques aériennes dépassant 1 kV en courant alternatif - Partie 2-23: Aspects normatifs nationaux pour la SLOVAQUIE (basé sur l'EN 50341-1:2012)

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EUROPEAN STANDARD

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Overhead electrical lines exceeding AC 1 kV - Part 2-23: National Normative Aspects (NNA) for SLOVAKIA (based on EN 50341-1:2012)

Lignes électriques aériennes dépassant 1 kV en courant alternatif - Partie 2-23: Aspects normatifs nationaux pour la SLOVAQUIE (basé sur l'EN 50341-1:2012)

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

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European foreword

1. The Slovak National Committee (NC) is identified by the following address:
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2. The Slovak National Committee has prepared this Part 2-23 (EN 50341-2-23) listing the Slovak National Normative Aspects (NNA) under its sole responsibility and duly passed this document through the CENELEC and CLC/TC11 procedures.

   NOTE The Slovak National Committee also takes sole responsibility for the technically correct co-ordination of this EN 50341-2-23 with EN 50341-1. It has performed the necessary checks in the frame of quality assurance/control. However, it is noted that this quality assurance/control has been made in the framework of the general responsibility of The Slovak National Committee under the national laws/regulations.

3. This EN 50341-2-23 is normative in Slovakia and informative for other countries.

4. This EN 50341-2-23 has to be read in conjunction with EN 50341-1, hereinafter referred as Part 1. All clause numbers used in Part 2-23 correspond to those of Part 1. Specific subclauses which are prefixed SK are to be read as amendments to the relevant text in Part 1. Any necessary clarification regarding the application of Part 2-23 in conjunction with Part 1 shall be referred to the Slovak Office of Standards, Metrology and Testing that will, in co-operation with CLC/TC11, clarify the requirements. When no reference is made in Part 2-23 to a specific subclause, then Part 1 applies.

5. In the case of “boxed values“ defined in Part 1, amended values (if any) which are defined in Part 2-23 shall be taken into account in Slovakia.

   However, any “boxed values” whether in Part 1 or Part 2-23, shall not be amended in direction of greater risk in the Project Specification.

6. The national Slovak standards/regulations, regarding overhead lines exceeding 1 kV AC, are listed in 2.1/SK.2 and 2.1/SK.3.

   NOTE All national standards referred to in this Part 2-23 will be replaced by the relevant European Standards as soon as they become available and are declared by the Slovak Office of Standards, Metrology and Testing to be applicable and thus reported to the secretary of CLC/TC11.

1 Scope

1.1 General

(ncpt) **SK.1 New overhead line**

As a new overhead line is considered a brand new electric overhead line with nominal voltage exceeding 1 kV AC, between the points A and B.

The new branch line of the existing overhead line shall be considered as a new overhead line except for a junction support for which the specific requirements shall be defined in the Project Specification.

The extent of application of this standard in respect of reconstruction, relaying and extension of existing overhead lines shall be determined in the Project Specification. Simultaneously, the Project Specification shall determine, which of the previous national standards shall be used and to what extent they shall be used for the project in question.

1.2 Field of application

(ncpt) **SK.1 Field of application**

The requirements of this standard shall be adopted, where applicable (e.g. requirements on loads, external clearances, etc.), for telecommunication cables as well.

In case of overhead line under the design stage, parties concerned shall agree the extent of the application of this standard.

Overhead line under construction may be completed according to standards valid during the design stage of the line. The parties concerned shall agree any possible application of certain clauses of this standard.

(ncpt) **SK.2 Installation of telecommunication equipment on supports**

Provisions of this standard also apply to the telecommunication equipment and devices (aerials, dish antennas, etc.) which are installed on individual supports of overhead power lines, especially in terms of wind and ice loads on such installed equipment. Design and installation has to respect requirements of the utility operating the line in question. The design of such telecommunication equipment has to incorporate such technical solutions and such precautions, which shall allow safe access and maintenance of both a power line and telecommunication equipment, and which shall provide protection of persons performing repairs or maintenance of the power line and/or telecommunication equipment against electric shock and protection of telecommunication equipment and attached installations against the influence of the power line (short-circuits, switching and lightning overvoltages etc.).

2 Normative references, definitions and symbols

2.1 Normative references

(ncpt) **SK.1 General**

National laws, Government regulations and other binding regulations are included in following 2.1/SK.2. International and national standards quoted in EN 50341-2-23 and not included in 2.1 EN 50341-1 are included in 2.1/SK.3.

The set of standards included in 2.1 EN 50341-1 under a common title of Eurocodes is valid in Slovakia including the Slovak National Application documents related to relevant standards, unless EN 50341-1 and/or these Slovak National Normative Aspects (EN 50341-2-23) specify otherwise.

NOTE Some EN, IEC, ISO and CISPR publications implemented as Slovak National Standards (STN) include informative notes and informative annexes useful in Slovakia.

(A-dev) **SK.2 National laws, government decrees and other binding rules of law**

Reference	Title
22/2001 Z.z.	Vyhláška, ktorou sa ustanovujú podrobnosti o zaradení vodných ciest a ich jednotlivých úsekov do príslušných tried podľa klasifikácie európskych vodných ciest *Regulation, which establishes the details on classification of waterways and their individual sections into relevant classes according to European waterway classification*
534/2007 Z.z.	Vyhláška o podrobnostiach o požiadavkách na zdroje elektromagnetického žiarenia a na limity expozície obyvateľov elektromagnetickému žiareniu v životnom prostredí *Regulation on the details on requirements on electromagnetic radiation sources and on limits of population exposure to electromagnetic radiation in the environment*
251/2012 Z.z.	Zákon o energetike a o zmene a doplnení niektorých zákonov (energetický zákon) *Act on energetics and on amendment to certain laws (Energy Act)*
FMPE 994/11:1981 FMD 621/1981-SM	Dohoda o postupu při interferenčním ovlivnění zabezpečovacího zařízení celostátních drah zařízeními elektrizační soustavy *The agreement on the common practice on interference influence of state railway security equipment by electricity system devices*

(ncpt) **SK.3 Standards**

Reference	Title
STN EN 1991-1-4	Eurokód 1. Zaťaženia konštrukcií. Časť 1-4: Všeobecné zaťaženia. Zaťaženie vetrom (Národná príloha NA pre SR, Mapa vetrových oblastí *Eurocode 1: Action on structures. Part 1-4: General actions – Wind Actions (National Annex NA for Slovakia, Wind zone map)*
STN 33 2040	Elektrotechnické predpisy. Ochrana pred účinkami elektromagnetického poľa 50 Hz v pásme vplyvu zariadenia elektrizačnej sústavy *Electric engineering regulations. Protection against effects of the electromagnetic fields 50 Hz in the zone of influence of electric power system device*
STN 33 2160	Elektrotechnické predpisy. Predpisy na ochranu oznamovacích vedení a zariadení pred nebezpečnými vplyvmi trojfázových vedení VN, VVN a ZVN *Electric engineering regulations. Rules for the protection of telecommunication lines and equipment against dangerous influences of three-phase high voltage, very high voltage and ultra high voltage lines*

Reference	Title
EN 50443	Účinky elektromagnetickej interferencie spôsobenej vysokonapäťovými elektrickými trakčnými sieťami striedavého prúdu a/alebo vysokonapäťovými napájacími sieťami striedavého prúdu na potrubia *Effects of electromagnetic interference on pipelines caused by high voltage a.c. electric traction systems and/or high voltage a.c. power supply systems*
STN 73 6133	Stavba ciest. Teleso pozemných komunikácií *Road Building – Road embankments and subgrades*
EN 13501-1+A1	Klasifikácia požiarnych charakteristík stavebných výrobkov a prvkov stavieb. Časť 1: Klasifikácia využívajúca údaje zo skúšok reakcie na oheň *Fire classification of construction products and building elements – Part 1:Classification using data from reaction to fire tests.*
EN 13501-5+A1	Klasifikácia požiarnych charakteristík stavebných výrobkov a prvkov stavieb. Časť 5: Klasifikácia využívajúca údaje zo skúšok striech namáhaných vonkajším ohňom *Fire classification of construction products and building elements - Part 5: Classification using data from external fire exposure to roofs tests*
EN 50522	Uzemňovanie silnoprúdových inštalácií na striedavé napätia prevyšujúce 1 kV *Earthing of power installations exceeding 1 kV AC.*
EN 62305-3	Ochrana pred bleskom. Časť 3: Hmotné škody na stavbách a ohrozenie života *Protection against lightning – Part 3: Physical damage to structures and life hazard*
EN ISO 14688-1	Geotechnický prieskum a skúšky. Pomenovanie a klasifikácia zemín. Časť 1: Pomenovanie a opis *Geotechnical investigation and testing - Identification and classification of soil - Part 1: Identification and description*
EN ISO 14688-2	Geotechnický prieskum a skúšky. Pomenovanie a klasifikácia zemín. Časť 2: Princípy klasifikácie *Geotechnical investigation and testing - Identification and classification of soil – Part 2: Principles for a classification*
EN ISO 14689-1	Geotechnický prieskum a skúšky. Pomenovanie a klasifikácia skalných hornín. Časť 1: Pomenovanie a opis *Geotechnical investigation and testing - Identification and classification of rock – Part 1: Identification and description*
EN 206	Betón. Špecifikácia, vlastnosti, výroba a zhoda *Concrete. Specification, performance, production and conformity*
STN 73 3050	Zemné práce. Všeobecné ustanovenia *Earth works. General requirements*

(ncpt) **SK.4 Other publications**

Reference	Title
STN 73 1001: 1988 (withdrawn on 1.4.2010)	Zakladanie stavieb. Základová pôda pod plošnými základmi *Foundation of structures. Subsoil under shallow foundations*
CIGRE TB 207:2002	CIGRÉ technical brochure No. 207 “Thermal behaviour of overhead conductors”
CIGRE TB 273:2005	CIGRÉ technical brochure No. 273 “Overhead conductor safe design tension with respect to Aeolian vibrations”
CISPR TR 18-2	Radio interference characteristics of overhead power lines and high-voltage equipment. Part 2 : Methods of measurement and procedure for determining limits

2.2 Definitions

(ncpt) **SK.1 span**

part of a line between attachment points of a *conductor* on two consecutive *supports* (IEV 466-03-01)

NOTE This definition is included for the reason that the English word “span” corresponds with the Slovak conversion used in STN IEC 50 (466) which means “a span length”.

(ncpt) **SK.2 overhead telecommunication line and equipment**

wire or cable line and telecommunication equipment leading above ground and outside buildings and transmitting information via electromagnetic waves

(ncpt) **SK.3 aluminium based conductor**

bare *conductor* made of round or shaped wires being concentric lay stranded with alternating directions of stranding, with grease or not, produced of materials or various materials according to one of following alternatives

– aluminium wires
– aluminium alloy wires
– combination of aluminium wires and aluminium alloy wires
– combination of aluminium wires and steel zinc coated wires
– combination of aluminium wires and aluminium clad steel wires
– combination of aluminium alloy wires and steel zinc coated wires
– combination of aluminium alloy wires and aluminium clad steel wires

(ncpt) **SK.4 steel based conductor**

bare *conductor* made of round or shaped wires being concentric lay stranded with alternating directions of stranding, with grease or not, produced of materials or various materials according to one of following alternatives

– steel zinc coated wires
– aluminium clad steel wires

2.3 Symbols

(ncpt) **SK.1 Symbols**

Symbols which are contained in EN 50341-2-23 and are not contained in EN 50341-1, or which are contained in EN 50341-2-23 also with a different meaning than in 2.3 EN 50341-1, are included below.

Symbol	Signification	References
b_{emp}	Minimum clearance between conductors within the span according to empirical formula	5.8/SK.3
c_{emp}	Constant in empirical formula for the minimum clearance between conductors within the span	5.8/SK.3

D_{el1}	Minimum clearance required to prevent a disruptive discharge between phase conductor and external object at earth potential during fast front and slow front overvoltages (external clearance)	5.5.3/SK.1
D_{el2}	Minimum clearance required to prevent a disruptive discharge between phase conductor and support structure during fast front and slow front overvoltages (internal clearance)	5.5.3/SK.1
D_{el3}	Minimum clearance required to prevent a disruptive discharge between phase conductor in window of a support and support structure during fast front and slow front overvoltages (internal clearance)	5.5.3/SK.1
D_{el4}	Minimum clearance required to prevent a disruptive discharge between phase conductor and earth wire during fast front and slow front overvoltages (internal clearance)	5.5.3/SK.1
D_{tr}	Horizontal distance of a tree trunk from the most endangered conductor	5.9.2/SK.2
f	Conductor sag under specified conditions	5.8/SK.3
g_c	Self-weight of a conductor per unit length	5.8/SK.3
H_{tr}	Height of a tree	5.9.2/SK.2
h_s	Pole height above ground	7.6.5/SK.2
h_{c_tr}	Height of the most endangered conductor above the horizontal plane of the tree base	5.9.2/SK.2
h_{pc}	Mean height of phase conductors of a given circuit on a support	4.4.1.1/SK.2
I_{R50}	Extreme reference ice load per conductor unit length at 10 m height above ground with return period T = 50 years	4.5.1/SK.3
K_{aH}	Altitude factor for altitudes $H > 1\,000$ m	5.3/SK.2
K_{a1000}	Altitude factor for altitude $H = 1\,000$ m	5.3/SK.2
K_h	Height factor for the ice load	4.5.1/SK.3
K_{lc}	Local condition factor for the ice load	4.5.1/SK.3
k_{emp}, k_{emp_r}	Factor depending on weight and diameter of a conductor and on mutual position of both conductors	5.8/SK.3 5.8/SK.4
L_{ins}	Vertical length of that part of insulator set which may swing in the direction perpendicular to the line	5.8/SK.1
m_{ins}	Mass of the insulator set	5.8/SK.5
r	Horizontal distance between the attachment point of a shorter insulator set and the point in a span, where the distance between conductors is checked	5.8/SK.1
t_l	Ice thickness on a conductor with a diameter of 30 mm according to the actual load combination	4.6.2/SK.2
U_{rwH}	Required withstand voltage for altitude $H > 1\,000$ m	5.3/SK.2
$U_{rw1\,000}$	Required withstand voltage for altitude $H = 1\,000$ m	5.3/SK.2
U_{rwLI}	Required withstand voltage for lightning impulse	5.3/SK.1
U_{rwSI}	Required withstand voltage for switching impulse	5.3/SK.1
U_{rw50Hz}	Required withstand voltage for power frequency overvoltage	5.3/SK.1
V_2	Wind velocity with return period of 2 years	4.6.6.1/SK.1
w	Probability factor	H.4.4/SK.1
z_a	Depth of geotechnical soil investigation below the foundation base	8.3/SK.1

α_{TSL}	Reduction factor of ice load for torsional security loads	4.8.2/SK.1
α_{LSL}	Reduction factor of ice load for longitudinal security loads	4.8.3/SK.2
δ	Angle describing mutual position of both conductors	5.8/SK.3
φ	Insulator set swing angle	5.8/SK.5
γ_R	Partial factor for resistance (EN 1997-1, Design approach 2)	8.2.2

3 Basis of design

3.2 Requirements of overhead lines

3.2.2 Reliability requirements

(ncpt) **SK.1 Reliability level of permanent lines**

Reliability level 1 (Return period of climatic action 50 years) is considered, unless a higher reliability level is specified in the Project Specification.

(ncpt) **SK.2 Reliability level of temporary lines**

Depending on their life duration, the return period of climatic actions for temporary lines, with duration less than 1 year, may be reduced due to the shorter exposure to climatic effects. Return periods of climatic loads and additional information is given in the following Table 3/SK.1.

Table 3/SK.1 – Return periods for temporary lines

Life duration	Return period (years)
≤ 3 days	2 [a) c)]
≤ 3 months (but > 3 days)	5 [b) c)]
≤ 1 year (but > 3 months)	10 [b) c)]

NOTES

[a)] For lines, installed for nominal duration of 3 days, it is possible to take into account the meteorological forecast for the given site

[b)] For temporary lines with duration more than 3 days, it is not recommended to use basic mean wind speed lower than 20 m/s.

[c)] Ice loads need not to be considered, provided the line is installed only in the season, when ice accretion does not occur. This period starts on 1st April and ends on 1st November.

3.2.5 Strength coordination

(ncpt) **SK.1 Strength coordination**

Only strength coordination for the above-ground part of steel structure of lattice tower stub is specified in this standard (see 7.3.6.1/SK.3). Additional requirements may be given in the Project Specification.

3.2.6 Additional considerations

(ncpt) **SK.1 Additional considerations**

Any further specific requirements, e.g. installation of aircraft warning spheres, night aircraft warning markers, fittings preventing biological pollution of insulators, fittings for bird protection etc., shall be specified in the Project Specification.

4 Actions on lines

4.3 Wind loads

4.3.1 Field of application and basic wind velocity

(snc) **SK.1 Basic wind velocity, wind zone map**

Basic wind velocities in Slovakia are given in Table 4/SK.1. Data given in this table are taken from National Annex of STN EN 1991-1-4.

The territory of Slovakia is divided into two fundamental wind zones, which are further divided according to location's altitude. Four main wind zones, for which different basic wind speeds $V_{b,0}$ are defined, are determined by this division. Wind zones are shown on Map of fundamental wind speed $V_{b,0}$ values, that is a part of the National Annex of STN EN 1991-1-4. More accurate data on the borders of wind zones may be provided by Slovak Hydrometeorological Institute.

Table 4/SK.1 – Basic wind velocities $V_{b,0}$

Wind zone	I	II	III	IV
Basic wind velocity $V_{b,0}$ (m/s)	24	26	30	33
NOTE 1: Zones I and II are given by a geographical location. Zone III corresponds to locations with altitudes between 700 and 1300 m above mean sea level and Zone IV corresponds to locations with altitudes exceeding 1300 m above mean sea level. NOTE 2: Based on long-term experience and monitoring in a given location, the wind zone may be specified otherwise than given in the Wind zone map in STN EN 1991-1-4.				

4.3.2 Mean wind velocity

(snc) **SK.1 Wind directional factor**

Mean wind velocity in Slovakia is independent of wind direction. The value of wind directional factor $c_{dir} = 1,0$ shall be used.

(ncpt) **SK.2 Orography factor**

The value of orography factor $c_o = 1,0$ shall be used, unless otherwise specified in the Project Specification.

(ncpt) **SK.3 Mean wind velocity for lines with nominal voltage up to 45 kV**

For elements associated with supports with nominal voltage up to 45 kV and with a maximum height of 24 m, the value of mean wind velocity $V_h(h)$, calculated at 10 m height above ground is considered.

4.3.3 Mean wind pressure

(ncpt) **SK.1 Air density**

The air density ρ in formula for calculation of mean wind pressure at a reference height h according to 4.3.3 is taken as 1,25 kg/m^3 independently of air temperature and altitude H.

4.4 Wind forces on overhead line components

4.4.1 Wind forces on conductors

4.4.1.1 General

(ncpt) **SK.1 Wind force on conductor, transferred to a support**

When calculating the wind force on conductor, apart from using a method given in 4.4.1.1, it is possible to use an alternative calculation method, where the total wind force on conductor, transferred to a support, is specified as a sum of halved wind forces acting on conductor in both adjacent spans. The values of peak pressure $q_p(h)$ and structural factor for the conductor G_c are calculated separately for both adjacent spans, while reference height of conductor above ground h for corresponding span is given as an arithmetic average of the reference heights h on supports, delimiting the span, specified in 4.4.1.1/SK.2.