SLOVENSKI STANDARD
SIST EN 50341-2-1:2021

01-junij-2021

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

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

Ta slovenski standard je istoveten z: EN 50341-2-1:2020

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EUROPEAN STANDARD

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

This European Standard was approved by CENELEC on 2020-04-15.

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CENELEC

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

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European foreword

1 The Austrian National Committee is identified by the following address:

Austrian Electrotechnical Association
Standardization
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Name of the relevant technical body: TK-L Starkstromfreileitungen und Verlegung von Energiekabeln (Overhead power lines)

2 The Austrian NC and its technical body TK-L “Overhead power lines” of Austrian Electrotechnical Association (OVE) prepared this Part 2-1 of EN 50341, listing the Austrian National Normative Aspects (NNA) under its sole responsibility, and duly passed it through the CENELEC and CLC/TC 11 procedures.

NOTE The Austrian NC also takes sole responsibility for the technically correct co-ordination of this EN 50341-2-1:2020 with EN 50341-1:2012. It performed the necessary checks in the frame of quality assurance/control. However, it is noted that this quality control was made in the framework of the general responsibility of a standards committee under the national laws/regulations.

3 This EN 50431-2-1, hereafter referred to as Part 2-1, is normative in Austria and informative in other countries.

4 This Part 2-1 shall be read in conjunction with EN 50341-1, hereafter referred to as Part 1. All clause numbers used in this NNA correspond to those of Part 1. Specific subclauses, which are prefixed “AT”, shall be read as amendments to the relevant text in Part 1. Any necessary clarification regarding the application of this NNA in conjunction with Part 1 shall be referred to the Austrian NC who will, in co-operation with CLC/TC 11, clarify the requirements.

When no reference is made in this NNA to a specific subclause, then Part 1 applies.

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

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

6 The National Austrian standards/regulations related to overhead electrical lines exceeding 1 kV AC are listed in 2.1 of this Part 2-1.

NOTE All national standards referred to in this Part 2-1 will be replaced by the relevant European Standards as soon as they become available and are declared by the austrian NC to be applicable and thus reported to the secretary of CLC/TC 11.

1 Scope

1.1 General

(A-dev) AT.1: A new overhead line is defined as the new construction of the totality of all conductors, their supports together with foundations, earthing grid, insulators, accessories and fittings used for the overground transport of electrical energy between two points A and B.

1.2 Field of application

(A-dev) AT.1: Stranded-conductors or cable structures with telecommunications components carried on the line that do not simultaneously function as earth wires or stranded conductors are subject to the provisions of Annex U.

2 Normative references, definitions and symbols

2.1 Normative references

(A-dev) AT.1: Normative references and other publications

Reference	*Title*
ÖNORM B 1990-1	*Eurocode - Basis of structural design - Part 1: Building construction - National specifications concerning ÖNORM EN 1990 and national supplements*
ÖNORM B 1991-1-4	*Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions - National specifications concerning ÖNORM EN 1991-1-4 and national supplements*
ÖNORM B 1992-1-1	*Eurocode 2 - Design of concrete structures - Part 1-1: General rules and rules for buildings - National specifications concerning ÖNORM EN 1992-1-1, national comments and national supplements*
ÖNORM B 1997-1-1	*Eurocode 7: Geotechnical design - Part 1: General rules - National specifications concerning ÖNORM EN 1997-1 and national supplements*
ÖNORM B 1997-1-3	*Eurocode 7 - Geotechnical design - Part 1-3: Pile foundations*
ÖNORM E 4007	*Electrical overhead lines; galvanized steel stranded conductors*
ÖNORM E 4101	*Electrical overhead lines; pin insulators type VHD and type VHD-G*
ÖNORM E 4102	*Electrical overhead lines; solid core line post insulators VKSt and VKS*
ÖNORM E 4104	*Electrical overhead lines; ball and socket; coupling dimensions*
ÖNORM E 4125	*Electrical overhead lines; ball and socket; IEC-coupling dimensions*
ÖNORM EN 1090-1	*Execution of steel structures and aluminium structures - Part 1: Assessment and verification of constancy of performance of steel components and aluminium components for structural use*
ÖNORM EN 1090-2	*Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures*
ÖNORM EN 12929-1	*Safety requirements for cableway installations designed to carry persons - General requirements - Part 1: Requirements for all installations*

ÖNORM EN 1991-1-4	*Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions*
ÖNORM EN 1992-1-1	*Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings*
ÖNORM EN 1993-1-1	*Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings*
ÖNORM EN 1997-1	*Eurocode 7: Geotechnical design - Part 1: General rules*
ÖNORM EN 1997-2	*Eurocode 7 - Geotechnical design - Part 2: Ground investigation and testing*
ÖNORM EN 61232	*Aluminium-clad steel wires for electrical purposes*
ÖVE EN 60383-1	*Insulators for overhead lines with a nominal voltage above 1 kV - Part 1: Ceramic or glass insulator units for AC systems - Definitions, test methods and acceptance criteria*
ÖVE EN 60383-2	*Insulators for overhead lines with a nominal voltage above 1000 V - Part 2: Insulator strings and insulator sets for a.c. systems - Definitions, test methods and acceptance criteria*
ÖVE ÖNORM EN 61109	*Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria*
ÖVE ÖNORM EN 61952	*Insulators for overhead lines - Composite line post insulators for A.C. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria*
ÖVE/ÖNORM E 8383	*Power installations exceeding 1 kV AC*
ÖVE/ÖNORM EN 50110-1	*Operation of electrical installations - Part 1: General requirements (Part 2-100: National annexes)*
ÖVE/ÖNORM EN 50182	*Conductors for overhead lines - Round wire concentric lay stranded conductors*
ÖVE/ÖNORM EN 50189	*Conductors for overhead lines - Zinc coated steel wires*
ÖVE/ÖNORM EN 50522	*Earthing of power installations exceeding 1 kV a.c.*
ÖVE/ÖNORM EN 60865-1	*Short-circuit currents - Calculation of effects - Part 1: Definitions and calculation methods*
ÖVE/ÖNORM EN 61936-1	*Power installations exceeding 1 kV a.c. - Part 1: Common rules*
ÖVE-L 1	*Construction of overhead lines up to 1000 V*
OVE Directive R23-1	*Electrical, magnetic and electromagnetic fields in the frequency range from 0 Hz to 300 GHz Part 1: Limiting exposure of members of the public*
VbF	*Federal Decree on flammable liquids*
VEMF	*Federal Decree on electromagnetic fields*
DIN 48207	*Stranded conductors; laying of stranded conductors for overhead lines*

2.2 Definitions

2.2.5
box values

(A-dev) AT.1: Unless otherwise specified in an NNA, boxed values are to be applied as minimum requirements.

2.2.109

(ncpt) AT.1:
conductor pull
is the product of the rated cross section of the conductor and the tensile stress acting in this cross section in the tangential direction of the sag curve.

(ncpt) AT.2:
tensile strength
is the value derived from the conductor pull divided by the rated cross section of the conductor.

(ncpt) AT.3:
Mean tensile strength
is the horizontal component of the tensile stress in the conductor that occurs at the mean annual temperature, generally +10 °C, excluding wind load.

(ncpt) AT.4:
upward or downward pull
is the product of horizontal conductor pull and the tangent of the angle of inclination of the straight line connecting the two suspension points against the horizontal.

(ncpt) AT.5:

rated cross section
of a conductor is the metallic cross section calculated from the data sheets. The rated cross section of an aerial cables is defined as the mechanical load-carrying section of the cable only.

(ncpt) AT.6:
span
is the sector of a line between two consecutive supports of that line.

(ncpt) AT.7:
span length
is the horizontal distance between two consecutive supports of that line.

(ncpt) AT.8:
section
is the sector of an overhead line having one or more spans between two consecutive tension towers.

(ncpt) AT.9:
A conductor crosses an object
when, as a result of being deflected by wind acting in the direction of that facility, the outline of the conductor intersects the outline of the object.

(ncpt) AT.10:
crossing span
The span to which the condition according to AT.9 applies.

(ncpt) AT.11:
sag
of a conductor is the vertically measured distance between a point of the conductor axis and the straight line connecting the conductor‘s two points of suspension.

(ncpt) AT.12:
fittings
are constructional elements which are installed either individually or in combination on or between conductors, insulators as well as between conductors or insulators and supports.

2.3 Symbols

(A-dev) AT.1: Symbols

E_d	Total design value of the effect of actions	4.12.2/AT.5
G_K	Characteristic value of a permanent action	4.12.2/AT.5
$I_v\ (h)$	Turbulence intensity at a reference height h above ground	4.3.4/AT.1
k_p	Earth resistance coefficient	S.6/AT.2
k_{e25}	Coefficient for a return period of 25 years for ice loads in an overhead line network with nominal voltages exceeding AC 1 kV up to and including AC 45 kV	4.5.2/AT.1
k_{w25}	Coefficient for a return period of 25 years for reference wind pressures in an overhead line network with nominal voltages exceeding AC 1 kV up to and including AC 45 kV	4.5.2/AT.1
M_{freq}	Moment caused by frequent loading	7.6.5/AT.2
M_{cont}	Moment caused by conductor type at -5 °C excluding wind and ice	7.6.5/AT.2
M_{char}	Moment caused by characteristic load cases	7.6.5/AT.2
$q_{b,0}$	Basic velocity pressure	4.3/AT.1
$q_{b,0,50}$	Basic velocity pressure with return period of 50 years	4.12.2/AT.5
$q_{Ih}\ (h)$	Mean wind pressure associated with icing at reference height h above ground	4.6.3/AT.1
$q_{Ip}\ (h)$	Peak wind pressure associated with icing at reference height h above ground	4.6.3/AT.1
$q_p\ (h)$	Peak wind pressure at reference height h above ground	4.3.4/AT.1
$q_{p,50}\ (h)$	Peak wind pressure with return period of 50 years at reference height h above ground	4.12.2/AT.5
$V_h\ (h)$	Mean wind velocity at reference height h above ground	4.3.2/AT.2
W_{50}	Wind action with return period of 50 years	4.12.2/AT.5
$W_{C,IT,50}$	Wind action on ice-covered conductors with return period of 50 years, taking into account the enlarged diameter of the ice-covered conductor due to the ice load I_{50} .	4.12.2/AT.5
$W_{M,50}$	Wind action on ice-free supporting structure with a return period of 50 years	4.12.2/AT.5
$W_{C,50}$	Wind action on ice-free conductor with a return period of 50 years	4.12.2/AT.5
$W_{C,\Psi,50}$	Wind action on ice-free conductor with a return period of 50 years	4.12.2/AT.5
z_0	Roughness length of ground	4.3.2/AT.1

3 Basis of design

3.2 Requirements of overhead electrical lines

3.2.2 Reliability requirements

(snc) AT.1: Taking into account the local topographical and climatic conditions, load cases 2, 3, 4, 5 in 4.12.2 do not need to be taken into consideration for temporary lines with a duration of up to 6 months in seasons during which no ice loads are to be expected.

(ncpt) AT.2: Reliability level 1 is to be applied with a return period of 50 years. A higher reliability level can be applied for specific projects.

4 Actions on overhead electrical lines

4.3 Wind loads

4.3.1 Field of application and basic wind velocity

(A-dev) AT.1: The basic wind velocity $V_{b,0}$ and the basic wind velocity pressure $q_{b,0}$ must be selected for a line or a line section in accordance with ÖNORM B 1991-1-4.

However, the basic wind velocity $V_{b,0}$ is at least 20.0 m/sec and the basic wind velocity pressure $q_{b,0}$ is at least 0.25 kN/m², terrain category II must be used. For overhead lines exceeding AC 1 kV up to and including AC 45 kV, terrain categories III and IV can be assumed in accordance with ÖNORM B 1991-1-4.

NOTE AT: If the altitude above sea level at the location is more than 250 metres above that of the nearest location specified in ÖNORM B 1991-1-4 Table A.1, the basic values of the basic speed pressure $q_{b,0}$ according to Table A.2 shall be assumed, in the absence of a site-specific wind analysis (e.g. from the Zentralanstalt für Metereologie und Geodynamik, Vienna).

4.3.2 Mean wind velocity

(A-dev) AT.1: The following applies for terrain category II:

$$zo = \frac{h}{e^{\frac{1}{Iv(h)}}}$$

(A-dev) AT.2: The mean wind velocity $V_h(h)$ must be determined according to ÖNORM B 1991-1-4 and is calculated for terrain category II as follows:

$$V_h\,(h) = V_{b,0}\left(\frac{h}{10}\right)^{0.15}$$

The factor for taking into account the terrain structure c_o is 1.0 according to ÖNORM B 1991-1-4.

4.3.3 Mean wind pressure

(A-dev) AT.1: The specified values in ÖNORM B 1991-1-4 Table A.1 and A.2 for the basic wind velocity pressures are based on an air density of 1.25 kg/m³. Depending on the altitude above sea level, the specified basic wind velocity pressures can only be reduced according to ÖNORM B 1991-1-4 Table 2.

4.3.4 Turbulence intensity and peak wind pressure

(A-dev) AT.1: The turbulence intensity $I_v(h)$ and peak wind pressure $q_p(h)$ must be determined according to ÖNORM B 1991-1-4 for terrain category II as follows:

$$\mathrm{I_v}\,(h) = 0.18\left(\frac{\mathrm{h}}{10}\right)^{-0.15}$$

$$q_\mathrm{p}\,(h) = q_{\mathrm{b,0}}\,2.1\left(\frac{h}{10}\right)^{0.24}$$

4.4 Wind loads on overhead line components

4.4.1 Wind loads on conductors

4.4.1.1 General

(ncpt) AT.1: The designations of the coordinate axes u and v comply in Austria to x (for u) and y (for v). This affects the following formulae and the figures 4.1.a and 4.1.b.

(ncpt) AT.2: The increase in tensile forces in the conductors resulting from the wind loads can be ignored.

(ncpt) AT.3: These designations apply for $0 \le \phi \le 90°$.
The upper sign applies for $(\phi + \theta_1/2) \le 90°$, the lower sign for $(\phi + \theta_1/2) > 90°$.

(ncpt) AT.4: To determine the reference height of the conductors above ground, method 4 or 6 must be applied and applies both for the determination at the tower and for the determination within the span. Crossings of valleys and similar situations must be examined separately.

4.4.1.2 Structural factor

(A-dev) AT.1: The structural factor for conductors G_c must be determined according to ÖNORM B 1991-1-4 as follows:

$$G_\mathrm{c} = \left(1 + 2k_\mathrm{p}\,I_\mathrm{v}(h)\,\sqrt{B^2 + R^2}\right)\cdot\frac{q_\mathrm{h}\,(h)}{q_\mathrm{p}(h)}$$

The peak factor k_p of 3.00 must be taken into account; the resonance response factor R^2 of 0.00 can be applied.

4.4.1.3 Drag factor

(ncpt) AT.1: Method 1, 2 or 3 can be considered.

4.4.2 Wind loads on insulator sets

(ncpt) AT.1: The wind loads on insulator sets must be taken into account in the design of the supports. G_{ins} = 1.00 and C_{ins} = 1.20.

4.4.3 Wind loads on lattice towers

4.4.3.1 General

(ncpt) AT.1: To determine the wind forces acting on the tower, method 1 must be used.

The drag factors C_{t1}, and C_{t2} depend on the solidity ratio panel face 1 or panel face 2, see Section 4.4.3.2, Figure 4.3. Drag factors on standard lattice tower designs can be set to the value 2.8 uniformly for the whole tower.

NOTE AT: The value 2.8 already takes into account the overall wind load on the front and rear tower panel face.

4.4.4 Wind loads on poles

(ncpt) AT.1: For poles with a height of ≤ 15 m (for concrete poles 20 m), the above-mentioned drag factors can be used irrespective of their slenderness ratio.

(A-dev) AT.2: For poles with a height of more than 15 m (for concrete poles more than 20 m) above the terrain, the wind loads on the structure must be determined according to ÖNORM EN 1991-1-4.

towers(ncpt) AT.3: For wooden poles with a circular cross section, the drag factor is 0.7.

4.5 Ice loads

4.5.1 General

(ncpt) AT.1: As a general rule, icing is not to be taken into account for towers. In exposed locations, special provisions may be required for specific projects.

Ice loads must be taken into account for the following components:

– Earth wires and conductors
– Insulator sets
– Warning spheres, radar markers, etc.

4.5.2 Ice loads on conductors

(snc) AT.1: The extreme value of the ice load I_{50} is determined as defined below.

(1) Earth wires and conductors:

$I_{50} = 20 + 0.4 \times d$

For overhead lines exceeding AC 1 kV up to and including AC 45 kV, the ice loads can be multiplied by the factor k_{e25} = 0.5 if the heights above ground of the suspension points of the conductors do not exceed 20 m and no “additional measures for enhanced safety” according to 5.9.1/AT.5 are required.

The following applies in this case:

I_{50} extreme ice load in N/m

d conductor diameter in mm

k_{e25} Coefficient for a return period of 25 years for ice loads in an overhead line network with nominal voltages exceeding AC 1 kV up to and including AC 45 kV