# SLOVENSKI STANDARD
# SIST EN 50341-2-1:2023

**01-december-2023**

**Nadomešča:**
**SIST EN 50341-2-1:2021**

---

**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 50341-2-1:2022**

---



**ICS:**

| | | |
|---|---|---|
| 29.240.20 | Daljnovodi | Power transmission and distribution lines |

**SIST EN 50341-2-1:2023** **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 50341-2-1

October 2022

ICS 29.240.20

Supersedes EN 50341-2-1:2020

English Version

# 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 2022-06-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**



Ref. No. EN 50341-2-1:2022 E

# Contents

Page

## European foreword

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

**Austrian Electrotechnical Association**
Standardization
Eschenbachgasse, 9
A - 1010 Vienna
Austria
phone +43 1 587 63 73-0

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 60071-1 | *Isulation co-ordination, Part 1: Definitions, principles and rules* |
| 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

| | | |
|---|---|---|
| $a_{LTG}$ | Horizontal minimum clearance to a wind energy converter (WEC), depending on the line voltage | 5.9.3/AT.5 |
| $a_{RaumLTG}$ | Horizontal clearance for adaptions, extensions and replacements of an overhead line near a wind energy converter, depending on the line voltage | 5.9.3/AT.5 |
| $a_{RaumWEA}$ | Horizontal area for work, turning and manipulation during erection, operation and maintenance of a wind energy converter | 5.9.3/AT.5 |
| $a_{WEA}$ | Horizontal minimum clearance between the outermost not deviated conductor of the overhead line and the vertical axis of the tower of the wind energy converter | 5.9.3/AT.5 |
| $D_{WEA}$ | Diameter of the rotor of a wind energy converter | 5.9.3/AT.5 |
| $E_d$ | 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.7/AT.2 |
| $k_{l25}$ | 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 |
| $q_{lh}(h)$ | Mean wind pressure associated with icing at reference height h above ground | 4.6.3/AT.1 |
| $q_{lp}(h)$ | 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 |
| $f_{ctm}$ | Mean value of the centrical tensile stress of concrete | S.6 |
| $\gamma_c$ | Partial load factor of concrete | S.6 |
| $\tau d$ | Design value of the adhesive tensile stress | S.6 |

## 3 Basis of design

### 3.2 Requirements of overhead 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 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).

(A-dev) AT.2: If a return period different from 50 years has been chosen for the dsign of an overhead line, the windspeeds shall be derived based on formula 4.2 of ÖNORM EN 1991-1-4, appying a conversion factor $C_T$ respectively $c_{prob.}$

#### 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 forces on overhead line components

#### 4.4.1 Wind forces 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.

ncpt) AT.2: The stipulation of the reference height of insulator strings above ground *h* may simplified be considered like the reference height of conductors above ground.

##### 4.4.1.3 Drag factor

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

#### 4.4.2 Wind forces 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.