



BSI Standards Publication

Overhead electrical lines exceeding AC 1 kV

Part 2-24: National Normative Aspects (NNA) for
Romania (based on EN 50341-1:2012)

National foreword

This British Standard is the UK implementation of EN 50341-2-24:2024. It supersedes BS EN 50341-2-24:2019, which will be withdrawn on 22 November 2021 and together with the following list of National Normative Aspect standards, supersedes BS EN 50423-3:2005 and BS EN 50341-3:2001.

Country Code	Origin	Ref
AT	Austrian National Committee	BS EN 50341-2-1
BE	Belgian National Committee	BS EN 50341-2-2:2019
CH	Swiss National Committee	BS EN 50341-2-3
DE	German National Committee	BS EN 50341-2-4:2019
DK	Danish National Committee	BS EN 50341-2-5:2017
ES	Spanish National Committee	BS EN 50341-2-6:2017
FI	Finnish National Committee	BS EN 50341-2-7:2015
FR	French National Committee	BS EN 50341-2-8:2017
GB	British National Committee	BS EN 50341-2-9:2017 +A1:2018
GR	Greek National Committee	BS EN 50341-2-10
IE	Irish National Committee	BS EN 50341-2-11
IS	Iceland National Committee	BS EN 50341-2-12:2018
IT	Italian National Committee	BS EN 50341-2-13:2017 +A1:2017
LU	Luxemburg National Committee	No NNA available
NL	Nederland's National Committee	BS EN 50341-2-15:2019
NO	Norwegian National Committee	BS EN 50341-2-16:2016
PT	Portuguese National Committee	BS EN 50341-2-17
SE	Swedish National Committee	BS EN 50341-2-18:2016
CZ	Czech National Committee	BS EN 50341-2-19:2015
EE	Estonian National Committee	BS EN 50341-2-20:2018
PL	Polish National Committee	BS EN 50341-2-22:2016
SI	Slovak National Committee	BS EN 50341-2-23:2016
RO	Romanian National Committee	BS EN 50341-2-24:2019

BS EN 50423-3:2005 and BS EN 50341-3:2001 will be withdrawn upon publication of the rest of the series.

The UK participation in its preparation was entrusted to Technical Committee PEL/11, Overhead Lines.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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**Overhead electrical lines exceeding AC 1 kV - Part 2-24:
National Normative Aspects (NNA) for Romania (based on
EN 50341-1:2012)**

This European Standard was approved by CENELEC on 2024-11-06. 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.

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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.

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European foreword

The following statements 1 to 6 are required from CLC/TC 11 for all NNAs; the statement 7 has been added by the Romanian National Committee (NC).

1. The Romanian National Committee is identified by the following address:

Romanian Standards Association (Asociația de Standardizare din România - ASRO)
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email: asro@asro.ro
www.asro.ro

Name of the relevant technical body: Romanian Technical Committee no 165 “Overhead power lines” (ASRO/CT 165 - *Linii electrice aeriene*)

2. The Romanian NC and its technical body (ASRO/CT 165 - *Linii electrice aeriene*) prepared this Part 2-24 of EN 50341, listing the Romanian National Normative Aspects (NNA) under its sole responsibility, and duly passed it through the CENELEC and CLC/TC 11 procedures.

NOTE The Romanian NC also takes sole responsibility for the technically correct co-ordination of this EN 50341-2-24:2024 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 50431-2-24, hereafter referred to as Part 2-24, is normative in Romania and informative in other countries.
4. This Part 2-24 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 “RO”, 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 Romanian NC who will, in co-operation with CLC/TC 11, clarify the requirements.

Where 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 2-24 shall be taken into account in Romania.

However, any “boxed value”, whether in Part 1 or in this Part-2-24, shall not be amended in the direction of greater risk in a Project Specification.

6. The National Romanian standards/regulations related to overhead electrical lines exceeding 1 kV AC are listed in 2.1 of this Part 2-24.

NOTE All national standards referred to in this Part 2-24 will be replaced by the relevant European Standards as soon as they become available and are declared by the Romanian NC to be applicable and thus reported to the secretary of CLC/TC 11.

7. The subclauses 2.1/RO.1, 2.1/RO.2, 2.1/RO.2.1.1 and 2.1/RO.2.1.2 are “A-dev”.
The subclauses 4.3.1/RO.1, 4.5.1/RO.1 and 4.6.1/RO.1 are “snc”.
All other subclauses RO.X are “ncpt”.

This second edition replaces the first edition published in 2019. This new edition reviews and complements the previous one.

0 Introduction

0.7 Language

(ncpt) RO.1 Language

This standard EN 50341-2-24 (Part 2-24) is published in English and Romanian languages.

1 Scope

1.1 General

1.1 RO.1 General

(ncpt) This standard EN 50341-2-24 (Part 2-24) gives the requirements for design and construction of overhead electrical lines with nominal voltages exceeding A.C. 1 kV operating at 50 Hz frequency.

This Part 2-24 applies to new overhead electrical lines, as well as in the following cases:

- the extension of existing overhead electrical lines;
- the deviation of some portions of the existing overhead electrical lines in accordance with the provisions of technical regulations in force issued by the National Energy Regulatory Authority (see article 39 of ANRE Order 25/2016);
- new supports to be used for the replacement and/or relocation of existing supports.

This Part 2-24 is not applicable for the existing overhead electrical lines unless specifically required by Project Specification. The overhead electrical lines, that are in different stages of design or construction, can be completed in conformity with the standards in force at the beginning of project.

For the application of this standard for specific requirements relating to modernization, increasing safety and transport capacity of existing overhead electrical lines, reference shall be specified in the Project Specification. At the same time, the correlation between relevant regulations and associated standards shall be established in the Project Specifications.

The extension of existing electrical lines is considered as new overhead electrical lines, except the junction points that shall be detailed in the Project Specifications.

1.2 Field of application

1.2 RO.1 Overhead electrical lines having uninsulated, pre-insulated and insulated conductors

(ncpt) This Part 2-24 is applicable for the design and construction of overhead electrical lines with uninsulated, pre-insulated and insulated conductors where the internal and external clearances can be smaller than those specified in Part 1 (SR EN 50341-1:2013).

2 Normative references, definitions and symbols

2.1 Normative references

2.1 RO.1 Application of normative references in Part 1

(A-dev) The normative references in Part 1 (SR EN 50341-1:2013) are applicable, unless otherwise specified in this Part 2-24. Moreover, in Romania, the Eurocodes series adopted as national standards shall be applied pursuant the technical regulations on construction field.

2.1 RO.2 References to national laws, technical regulations and standards

(A-dev) The following national acts and normative documents contain provisions for design, construction and mounting of the overhead electrical lines. These normative acts (laws, governmental decisions, decrees) and normative documents (national technical regulations and standards) are mentioned in the text so that their content, in whole or in part, constitutes requirements of this standard (Part 2-24).

On the date of publication of this standard, the editions of the documents cited as normative references are in force. For dated references, only the cited edition applies. For undated references, the latest edition of the reference document (including amendments) applies. Taking into consideration that any normative document can be subject to revision, the parties involved in different agreements based on this standard shall investigate the possibility of using the latest edition of referenced documents.

2.1 RO. 2.1.1 National normative acts and technical regulations

2.1 RO.2.1.1 National normative acts

(A-dev) The following normative acts are applicable:

Law on electricity and natural gas no. 123/2012 (with subsequent completions and modifications);

Legea energiei electrice și a gazelor naturale nr. 123/2012 (cu modificările și completările ulterioare)

Water Law no. 107/1996 (with subsequent completions and modifications);

Legea apelor nr 107/1996 (cu modificările și completările ulterioare)

Law on the environmental protection no. 137/1995 (with subsequent completions and modifications);

Legea protecției mediului nr. 137/1995 (cu modificările și completările ulterioare)

Law no. 292/2018 on the environmental impact assessment of public and private projects (with subsequent completions and modifications);

Legea nr. 292/2018 privind evaluarea impactului anumitor proiecte publice și private asupra mediului (cu modificările și completările ulterioare)

Low no. 121/2019 on the assessment and management of ambient noise (with subsequent completions and modifications);

Legea nr. 121/2019 privind evaluarea și gestionarea zgomotului ambiant (cu modificările și completările ulterioare)

Law no. 440 of June 27, 2002 for the approval of Government Ordinance no. 95/1999 regarding the quality of assembly works for machinery, equipment and industrial technological installations;

Legea nr. 440 din 27 iunie 2002 pentru aprobarea Ordonanței Guvernului nr. 95/1999 privind calitatea lucrărilor de montaj pentru utilaje, echipamente și instalații tehnologice industriale

Decree no. 237/1978 for the establishment of normative documents concerning systematization, location, construction, and repairing work of the overhead electrical lines passing through forests and over agricultural lands;

Decretul nr. 237/1978 pentru stabilirea normativelor privind sistematizarea, amplasarea, construirea și repararea liniilor electrice care trec prin păduri și prin terenuri agricole

Government Ordinance no. 43/1997 regarding the legal regime of roads (with subsequent completions and modifications);

Ordonanța Guvernului nr. 43/1997 privind regimul drumurilor (cu modificările și completările ulterioare)

Government Emergency Ordinance no. 195/2005 on the environmental protection (with subsequent completions and modifications);

Ordonanța de urgență a Guvernului nr. 195/2005 privind protecția mediului (cu modificările și completările ulterioare)

2.1 RO.2.1.2 National technical regulations

(A-dev) The following technical regulations are applicable.

National Energy Regulatory Authority (ANRE) – Order no. 25/2016 on the approval of methodology for the issuance of placement permit by the network operators (with subsequent completions and modifications);

Autoritatea Națională de Reglementare în domeniul Energiei (ANRE) – Ordinul nr. 25/2016 privind aprobarea Metodologiei pentru emiterea avizelor de amplasament de către operatorii de rețea (cu modificările și completările ulterioare)

National Energy Regulatory Authority (ANRE) – Order no. 239/2019 on the approval of the Technical Norm concerning the delimitation of the protection and safety areas related to the energy capacities (with subsequent completions and modifications);

Autoritatea Națională de Reglementare în domeniul Energiei (ANRE) – Ordinul nr. 239/2019 pentru aprobarea Normei tehnice privind delimitarea zonelor de protecție și de siguranță aferente capacităților energetice (cu modificările și completările ulterioare)

Ministry of the Environment, Waters and Forests – Order no. 269/2020 on the approval of the general guide applicable to the stages of the environmental impact assessment procedure, the guide for environmental impact assessment in a cross-border context and other specific guidelines for different fields and categories of projects;

Ministerul Mediului, Apelor și Pădurilor – Ordinul nr. 269/2020 privind aprobarea ghidului general aplicabil etapelor procedurii de evaluare a impactului asupra mediului, a ghidului pentru evaluarea impactului asupra mediului în context transfrontieră și a altor ghiduri specifice pentru diferite domenii și categorii de proiecte

Ministry of Development, Public Works and Administration – Order no. 30/2023 on the approval of the technical Regulations for the production of concrete and the execution of concrete works, reinforced concrete and prestressed concrete – Part 1: Concrete production, reference number NE 012/1-2022;

Ministerul Dezvoltării, Lucrărilor Publice și Administrației – Ordinul nr. 30/2023 pentru aprobarea reglementării tehnice Normativ pentru producerea și executarea lucrărilor din beton, beton armat și beton precomprimat Partea 1: Producerea betonului, indicativ NE 012/1-2022

Ministry of Public Health – Order no. 1193/2006 regarding the limitation of the exposure of the general population to electromagnetic fields from 0 Hz to 300 GHz;

Ministerul Sănătății Publice – Ordinul nr. 1193/2006 pentru aprobarea Normelor privind limitarea expunerii populației generale la câmpuri electromagnetice de la 0 Hz la 300 GHz

Ministry of Transport, Construction and Tourism – Order no. 2231/2005 for the amendment and completion of the annex to the Order of the Minister of Transport, Construction and Tourism no. 176/2005 on the approval of the technical regulation Normative for the design, execution, verification and operation of electrical installations in hazardous areas associated with explosive atmospheres, reference number NP 099-04;

Ministerul Transporturilor, Construcțiilor și Turismului – Ordinul nr. 2231/2005 pentru modificarea și completarea anexei la Ordinul ministrului transporturilor, construcțiilor și turismului nr. 176/2005 privind aprobarea reglementării tehnice Normativ pentru proiectarea, executarea, verificarea și exploatarea instalațiilor electrice în zone cu pericol de explozie, indicativ NP 099-04.

2.1 RO.2.1.3 Romanian standards

ncpt) The following normative documents are Romanian standards and European / international standards adopted as national standards.

Reference	Title
SR 438-1:2012	Steel products for concrete reinforcement – Part 1: Hot rolled structural steel – Grades and quality technical requirements; <i>Produse de oțel pentru armarea betonului – Partea 1: Oțel beton laminat la cald – Mărci și condiții tehnice de calitate</i>
SR 438-2:2012	Steel products for concrete reinforcement – Part 2: Cold drawn round wire; <i>Produse de oțel pentru armarea betonului – Partea 2: Sârmă rotundă trefilată</i>
SR 438-3:2012	Steel products for reinforcement of concrete – Part 3: Welded fabric; <i>Produse de oțel pentru armarea betonului – Partea 3: Plase sudate</i>
SR 832:2008	Influences of electrical installations of high voltage on the communication networks – Prescriptions; <i>Influențe ale instalațiilor electrice de înaltă tensiune asupra liniilor de telecomunicații – Prescripții</i>
SR 2970:2005	Precast columns of reinforced and prestressed concrete for overhead electrical lines – General technical requirements for quality; <i>Stâlpi prefabricați din beton armat și beton precomprimat pentru linii electrice aeriene – Condiții tehnice generale de calitate</i>
SR 6290:2004	Crossings between overhead transmission lines and telecommunication lines; <i>Încrucișări între liniile de energie electrică și liniile de telecomunicații</i>
SR 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; <i>Caracteristici ale perturbațiilor de frecvență radio produse de liniile electrice aeriene și echipamentele electrice de înaltă tensiune – Partea 2: Metode de măsurare și procedură pentru determinarea valorilor limită</i>
SR EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Joints; <i>Eurocod 3: Proiectarea structurilor de oțel – Partea 1-8: Îmbinări</i>
SR EN 10025-2	Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels; <i>Produse laminate la cald din oțeluri de construcții – Partea 2: Condiții tehnice de livrare pentru oțeluri de construcții nealiate</i>
SR EN 10244-1	Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 1: General principles; <i>Sârme și produse trefilate de oțel – Acoperiri metalice neferoase pe sârme de oțel – Partea 1: Principii generale</i>
SR EN 10244-2	Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 2: Zinc or zinc alloy coatings; <i>Sârme și produse trefilate din oțel – Acoperiri metalice neferoase pe sârmă de oțel – Partea 2: Acoperiri de zinc sau aliaj de zinc</i>
SR EN 50182	Conductors for overhead lines – Round wire concentric lay stranded conductors; <i>Conductoare pentru linii aeriene – Conductoare cu sârme rotunde cablate în straturi concentrice</i>

Reference	Title
SR EN 50326	Conductors for overhead lines – Characteristics of greases; <i>Conductoare pentru linii aeriene – Caracteristici ale produselor de protecție</i>
SR EN 50522	Earthing of power installations exceeding 1 kV a.c.; <i>Legarea la pământ a instalațiilor electrice cu tensiune alternativă mai mare de 1 kV</i>
SR EN 60038	CENELEC standard voltages; <i>Tensiuni standardizate de CENELEC</i>
SR EN 61140	Protection against electric shock – Common aspects for installation and equipment; <i>Protecție împotriva șocurilor electrice – Aspecte comune în instalații și echipamente electrice</i>
SR EN 61467	Insulators for overhead lines – Insulator strings and sets for lines with a nominal voltage greater than 1 000 V – AC power arc tests; <i>Izolatoare pentru linii aeriene – Lanțuri de izolatoare și lanțuri de izolatoare echipate pentru linii de tensiune nominală mai mare de 1 000 V – Încercări la arc de putere în curent alternativ</i>
SR EN 62110	Electric and magnetic field levels generated by AC power systems – Measurement procedures with regard to public exposure; <i>Nivelurile câmpului electric și magnetic generat de sistemele de alimentare în curent alternativ – Procedurile de măsurare a nivelurilor de expunere a publicului</i>
SR EN IEC 60071-1	Insulation co-ordination – Part 1: Definitions, principles and rules; <i>Coordonarea izolației – Partea 1: Definiții, principii și reguli</i>
SR EN IEC 60071-2	Insulation co-ordination – Part 2: Application guidelines; <i>Coordonarea izolației – Partea 2: Ghid de aplicare</i>
SR EN IEC 61284	Overhead lines – Requirements and tests for fittings; <i>Linii electrice aeriene – Cerințe și încercări pentru accesorii</i>
SR EN IEC 61936-1	Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: AC; <i>Instalații electrice de tensiune alternativă mai mare de 1 kV și de tensiune continuă mai mare de 1,5 kV – Partea 1: Curent electric (tensiune) alternativ(ă)</i>
SR EN IEC 62641	Conductors for overhead lines – Aluminium and aluminium alloy wires for concentric lay stranded conductors; <i>Conductoare pentru linii electrice aeriene – Sârme din aluminiu și din aliaj de aluminiu pentru conductoare înfuniate în straturi concentrice</i>
SR EN IEC 63248	Conductors for overhead lines – Coated or clad metallic wire for concentric lay stranded conductors; <i>Conductoare pentru linii electrice aeriene – Sârmă metalică acoperită sau învelită pentru conductoare înfuniate în straturi concentrice</i>
SR EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods; <i>Acoperiri prin zincare termică pe produse fabricate din fontă și oțel – Specificații și metode de încercare</i>

Reference	Title
SR EN ISO 898-1	Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs with specified property classes – Coarse thread and fine pitch thread; <i>Caracteristici mecanice ale elementelor de asamblare executate din oțel carbon și oțel aliat – Partea 1: Șuruburi parțial și complet filetate și prezoane de clase de calitate specificate – Filete cu pas grosolan și filete cu pas fin</i>
SR EN ISO 898-2	Fasteners – Mechanical properties of fasteners made of carbon steel and alloy steel – Part 2: Nuts with specified property classes; <i>Caracteristici mecanice ale elementelor de asamblare executate din oțel carbon și oțel aliat – Partea 2: Piulițe de clase de calitate specificate</i>
SR EN ISO 9223	Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, determination and estimation; <i>Coroziunea metalelor și aliajelor – Corozivitatea atmosferelor – Clasificare, determinare și estimare</i>
SR EN ISO 9224	Corrosion of metals and alloys – Corrosivity of atmospheres – Guiding values for the corrosivity categories; <i>Coroziunea metalelor și aliajelor – Corozivitatea atmosferelor – Valori de referință pentru clasele de corozivitate</i>
SR EN ISO 9225	Corrosion of metals and alloys – Corrosivity of atmospheres – Measurement of environmental parameters affecting corrosivity of atmospheres; <i>Coroziunea metalelor și aliajelor – Corozivitatea atmosferelor – Măsurarea parametrilor de mediu care afectează corozivitatea atmosferelor</i>
SR ISO 1996-1	Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures; <i>Acustică – Descrierea, măsurarea și evaluarea zgomotului ambiant – Partea 1: Mărimi fundamentale și metode de evaluare</i>
SR ISO 1996-2	Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels; <i>Acustică – Descrierea, măsurarea și evaluarea zgomotului ambiant</i>
SR ISO 3864-1	Graphic symbols – Security signs and colours – Part 1: Design principles for safety signs and safety marks; <i>Simboluri grafice – Culoari și semne de securitate – Partea 1: Principii de proiectare pentru semne de securitate și marcaje de securitate</i>
SR ISO 9613-2	Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation; <i>Acustică – Atenuarea sunetului propagat în aer liber – Partea 2: Metodă generală de calcul</i>
STAS 4068/1-82	Maximum water discharges and storage – Determination of maximum water discharges and storage of watercourses; <i>Debite și volume maxime de apă – Determinarea debitelor și volumelor maxime ale cursurilor de apă</i>
STAS 4068/2-87	Maximum water discharges and storages – Yearly probabilities of maximum water discharges and storages under normal and special working conditions; <i>Debite și volume maxime de apă – Probabilitățile anuale ale debitelor și volumelor maxime în condiții normale și speciale de exploatare</i>
STAS 4273-83	Water constructional works – Integrating with importance classes; <i>Construcții hidrotehnice – Încadrarea în clase de importanță</i>

2.2 Definitions

For the purpose of this standard, in addition to the terms and definitions given in SR EN 50341-1:2013, the following terms and definitions apply.

2.2 RO.1

(ncpt)

overhead electrical line

overhead power line; overhead line (in a broad sense; OHL)

a system of electrical and supporting elements mounted above ground in still air, which is composed by conductors, insulators (including fittings and clamps), earthing systems and structural elements (the foundations and supports, either lattice towers or poles), and monitoring installations and damping devices of the conductors' vibrations and galloping, etc. being used for the transmission and distribution of electrical energy

Note 1 to entry: The overhead electrical lines can be: single circuit lines, double circuit lines or multiple circuit lines, from constructive point of view.

2.2 RO.1.1

(ncpt)

route alignment (of an overhead electrical line)

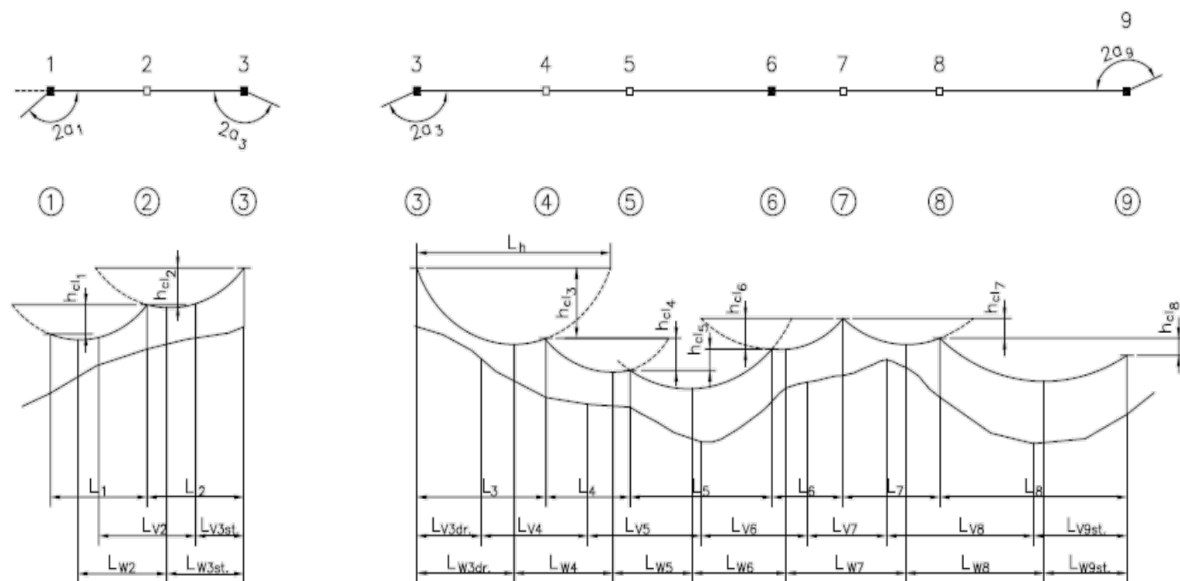
straight line portion of an overhead electrical line route, containing one or more spans where the overhead electrical line maintains its direction (see Figure 2/RO.1)

2.2 RO.1.2

(ncpt)

section (of an overhead electrical line)

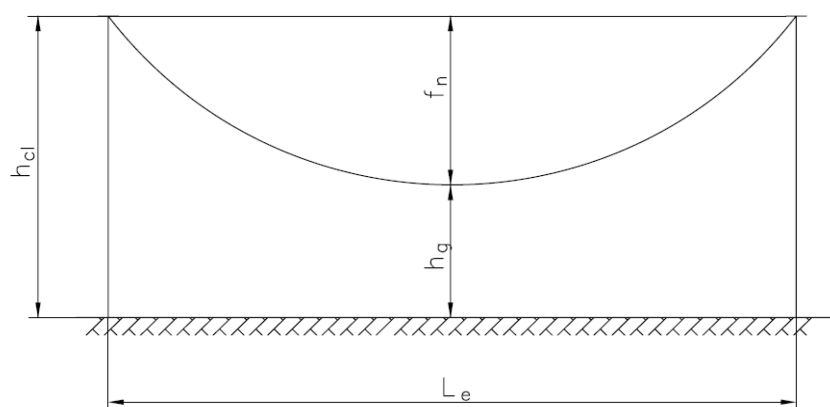
the sector of an overhead electrical line having one or more spans between two consecutive tension supports (see Figure 2/RO.1)



Key

- The route alignments are straight line portions on the route of an overhead electrical line, which are located between the supports 1 and 3 or between the supports 3 and 9;
- The supports 1, 3 and 9 can be the angle tension supports or the angle suspension supports. The support 6 can be an intermediate (tangent) tension support or (tangent) suspension support;
- Stringing sections are the portions of an overhead electrical line which are located between two tension supports;
- L_e – nominal span;
- L_i ($i=1 \dots n$) – actual spans;
- L_v – wind span;
- L_w – weight span;
- L_h – virtual span;
- h_i ($i=1 \dots n$) – difference in levels;
- f_n – maximum conductor sag corresponding to the nominal span;
- h_{cl} – the conductor attachment height to the clamp;
- h_g – minimum ground clearance;
- 2α – the angle between two consecutive alignments of an overhead electrical line route;
- θ – the angle of line direction change is the supplementary angle to the angle 2α .

Figure 2/RO.1 — Graphic representation for the alignment of line route, section, spans and difference in levels

**Key**

- L_e – nominal span;
- f_n – maximum conductor sag corresponding to nominal span;
- h_{cl} – the conductor attachment height to the clamp;
- h_g – minimum ground clearance;

Figure 2/RO.2 — Graphic representation for nominal span, maximum conductor sag corresponding to the nominal span, and minimum ground clearance

2.2
(ncpt)

**RO.1.3
approval of the emplacement (line route)**

a written response given by the system operator to the request of an applicant regarding the location of an objective in relation to an energy capacity, and where the operator's point of view related to the proposed objective emplacement is specified

2.2
(ncpt)

**RO.1.4
right-of-way for an overhead electrical line**

land area located along the overhead electrical line and the airspace above it, where are imposed restrictions in terms of overhead line coexistence with natural elements, objects, buildings and their related facilities; the right-of-way includes the protection area and safety area

2.2
(ncpt)

**RO.1.5
operating corridor of an overhead electrical line**

land strip non-arranged located along the line route between the existing permanent access roads towards zone, allowing pedestrian access for the operating personnel

2.2
(ncpt)

**RO.1.6
working corridor of an overhead electrical line**

land strip which can be temporary occupied, and usually located along the overhead electrical line axis and included between the erection work platforms, being needed for the installation of conductors, the access of machinery and transport of mounting materials

2.2
(ncpt)

**RO.1.7
crossing and under-crossing**

those crossings where the overhead electrical line over-cross or respectively under-cross an object

- 2.2
(ncpt) **RO.1.8**
crossing of an overhead electrical line with an objective (object)
that situation where at least one of the conductors of overhead electrical line, in normal or deviated position, in the load case consisting of maximum wind perpendicular to the direction of the overhead electrical line, in horizontal projection, it intersects with an objective (for example: railways, roads, overhead electrical lines, lighting poles, telecommunication lines, pipelines, fences, buildings, bridges, waterways, sports terrains, enclosures, car parks, land improvement facilities, irrigation facilities, photovoltaic systems, wind turbines, etc.)
- 2.2
(ncpt) **RO.1.9**
overhead electrical line proximity to an objective (object)
that situation where the objective (object) is located inside of the right-of-way of an overhead electrical line (as defined in 5.9.1.2), and the horizontal projection is outside, at the maximum deviation of the extreme conductors of overhead electrical line assuming the load case for maximum wind acting perpendicularly to the overhead electrical line
- 2.2
(ncpt) **RO.1.10**
difference in levels, h_i
the distance vertically measured between the attachment points of conductor at two successive supports (see Figure 2/RO.1)

[IEV 60050-466, definition 466-03-05 modified]
- 2.2
(ncpt) **RO.1.11**
span, L_i
the distance horizontally measured between the axes of two consecutive supports (see Figure 2/RO.1)

[IEV 60050-466, definition 466-03-01 modified]
- 2.2
(ncpt) **RO.2**
tower / pole
a part of the support consisting of its body, earth-wire peak(s) and cross-arms

Note 1 to entry: Constructions of metal, reinforced concrete, wood or other materials used to sustain the components of overhead electrical lines above the ground.

[IEV 60050-466 modified by combination of definitions 466-08-01 and 466-07-01]
- 2.2
(ncpt) **RO.2.1**
nominal span, L_e
conventional span at which the conductors' attachment points are on the same horizontal level; the terrain is flat; the minimum admissible ground clearance corresponds to the maximum sag resulting as optimal value from technical-economic calculations; the nominal span corresponds to the nominal (normal) height of supports (see Figure 2/RO.2)
- 2.2
(ncpt) **RO.2.2**
virtual span L_h of an inclined span
distance from the place where the horizontal from one of the conductors' attachment points crosses the actual curve of conductor or its extension, as the considered point is inferior or superior to the conductor attachment point on the adjacent support (see Figure 2/RO.1)
- 2.2
(ncpt) **RO.2.3**
wind span, L_v
half of the sum of actual adjacent spans of a support, which influences the horizontal loads acting on support due to wind pressure on conductors (see Figure 2/RO.1)

- 2.2 (ncpt) **RO.2.4 weight span, L_w**
half of the sum of virtual adjacent spans of a support, which influences the vertical loads acting on support due to weight of conductors (see Figure 2/RO.1)
- 2.2 (ncpt) **RO.2.5 spans for dimensioning of supports**
the wind spans L_v and weight spans L_w adopted for dimensioning of supports, based on all locations' coverage criteria on the overhead line route, taking into consideration the technical and economic criteria depending on the meteorological zones for dimensioning (generally, dimensioning spans are adopted for normal supports) as follows:
 $L_v = (1,05 \dots 1,1) \cdot L_e$
 $L_{w \max} = (1,4 \dots 1,6) \cdot L_e$
 $L_{w \min} = (0,25 \dots 0,4) \cdot L_e$ for the suspension supports
 $L_{w \min} = (-0,6 \dots 0) \cdot L_e$ for the tension and terminal supports
- 2.2 (ncpt) **RO.2.6 span limited by distance between phases, L_f**
maximum span to prevent a disruptive discharge between phase conductors and between phase conductors and earth wires; it depends on minimum clearances at mid span and conductor sag, and commonly:
 $L_f = (1,2 \dots 1,3) \cdot L_e$
- 2.2 (ncpt) **RO.3 foundation footprint of support of an overhead electrical line**
land area determined by the geometric figure resulting from the support foundation perimeter above ground, including the guys
- 2.2 (ncpt) **RO.4 conductors of an overhead electrical line**
metallic cables (conductors / wires) strung between the attachment points to the supports or other special structures, belonging to the overhead electrical line, regardless if those are or not energised
- 2.2 (ncpt) **RO.4.1 pre-insulated conductors**
conductors covered with insulation material to protect the conductors against accidental contacts with the other conductors, being used for medium voltage overhead electrical lines, where the clearance between phases is needed to be reduced, and where it is desired to eliminate the defects caused by accidentally falling of vegetation towards the overhead electrical lines
- 2.2 (ncpt) **RO.4.2 insulated conductors**
conductors with protective coverings of insulation material to protect against permanent contacts with the other insulated conductors and/or earthed parts
- 2.2 (ncpt) **RO.4.3 twisted conductors**
insulated conductors which are twisted together (insulated conductor bundles)
- 2.2 (ncpt) **RO.4.4 tension in a conductor**
conductor stress multiplied by the actual cross-section of the conductor in different operating conditions

2.2 (ncpt) **RO.4.5**
horizontal tension in a conductor, T_0
value of tension in the point where the tangent to the conductor curve is horizontal

2.2 (ncpt) **RO.4.6**
conductor sag in a certain point
distance vertically measured between respective point on conductor curve and the straight line joining the two suspension points of conductor; when the suspension of the conductors is carried out by means of tension insulator sets, the fastening of conductors to the supports is considered at the attachment points of insulator sets on the elements of supports

The conductor sag can have different values in a certain point depending on the existing climatic-meteorological conditions in a given moment (for example: maximum sag, minimum sag, middle sag).

The greater conductor sag can be practically considered in the middle of the span (see Figure 2/RO.2). The maximum conductor sag is considered as maximum value between the sag corresponding to the load arrangement f) of subclause 4.12.2/RO.1, which is characterised by the temperature for ice deposit forming ($-5\text{ }^{\circ}\text{C}$) without wind, and between the sag corresponding to the load arrangement e) of subclause 4.12.2/RO.1, which is characterised by maximum temperature ($75\text{ }^{\circ}\text{C}$) for dimensioning of conductor or maximum temperature ($40\text{ }^{\circ}\text{C}$) for dimensioning of conductors OPGW without wind and ice accretion.

2.2 (ncpt) **RO.5**
design of an overhead electrical line

2.2 (ncpt) **RO.5.1**
protection area
an adjacent area of the energy capacity (objective), extended in space, where are introduced interdicts regarding the people access and constructions' regime

2.2 (ncpt) **RO.5.2**
safety area
an adjacent area to the energy capacity (objective), extended in space, where are established restrictions and interdicts to ensure normal operation and to avoid any danger to the persons, goods and environment; safety area includes also the protection area

2.2 (ncpt) **RO.5.3**
frequent traffic area
an area located:

- inside of the buildable perimeter of localities;
- inside of houses' yards from outside of the buildable perimeter of localities;
- inside of the industrial, agricultural, transport, military units etc. located outside the localities, including a sector of 15 m from the unit fence, except the electrical power objectives (substations, power stations);
- outside the localities where can frequently appear many people, for example: the places arranged for tourism and recreation, halts, camping and public transport stations etc.

Note 1 to entry: The enclosures fenced off where is admitted only the access for special qualified service staff, and the areas close to the roads and highways from outside the localities are not considered frequent traffic areas.

2.2 (ncpt) **RO.5.4**
reduced traffic area
an area not included in the categories of frequent traffic areas

- 2.2
(ncpt) **RO.5.5
road area**
a portion of road reservation plus two lateral strips on each of its sides, named safety areas and protection areas respectively. The width of road area is established by lay-out plans or construction projects of modernization and modification of the roads, that are prepared in conformity with the norms established by law
- 2.2
(ncpt) **RO.5.6
access road**
land strip with the width of 2,75 m which is temporary occupied for the access of transport facilities to the working corridor of the overhead electrical line
- 2.2
(ncpt) **RO.5.7
working platform of an overhead electrical line**
a land surface around the supports, needed for the performing of new works of modernization, refurbishment and maintenance of overhead electrical lines
- 2.2
(ncpt) **RO.5.8
special portions of line route**
those portions of line route where occur the co-existence of the overhead electrical line (OHL) with natural elements, objects, objectives, installations and constructions etc. located in the close proximity of OHL or those which cross with OHL

In relation to those, the overhead electrical line shall be carried out so that its proper operation is ensured, on the one hand, and to ensure the conditions necessary for the existence and proper operation of elements affected by the presence of the overhead electrical line, on the other hand.
- 2.2
(ncpt) **RO.5.9
normal terrains**
lands outside inhabited areas, that are accessible either to transport and agricultural machinery (except the roads) or to pedestrian circulation only
- 2.2
(ncpt) **RO.5.10
rough terrains**
lands accessible only to pedestrian circulation or totally lands inaccessible (for example, cliffs, caves, etc.)
- 2.2
(ncpt) **RO.5.11
exceptional or mandatory cases**
those cases where the provisions of a normative document cannot be applied for technical and economic reasons
- 2.2
(ncpt) **RO.5.12
environmental aggressiveness**
environmental condition where the environment is contaminated or not with substances, when the corrosion effect occurs on the metallic components of overhead electrical lines in operating conditions
- 2.2
(ncpt) **RO.5.13
protection measures**
all measures taken into consideration for the functioning of overhead electrical line, both under normal condition and broken wire condition in accordance with the requirements of this standard
- 2.2
(ncpt) **RO.5.14
safety measures**
all measures taken into consideration both for the overhead electrical line and neighbouring elements, for the protection of overhead electrical line against disruptive factors (for example, the action of chemical agents, falling of trees, landslides, changes of water

courses, etc.) on the one hand, and for the protection of installations, constructions etc. located in the vicinity of the overhead electrical line, on the other hand, as well as for the protection of people and animals which can accidentally come into contact with the energised parts

2.2 **RO.5.15**
(ncpt) **measures for enhanced protection**
the adoption of measures for enhanced mechanical safety with the aim to protect the overhead electrical line during operation, in special parts of the line route

2.2 **RO.5.16**
(ncpt) **additional measures for enhanced safety**
the additional measures for enhanced safety consist of doubling the number of insulator strings (doubling of rigid insulators links, respectively) or increasing the insulation level

2.2 **RO.5.17**
(ncpt) **enhanced insulation level**
the increasing of line insulation level towards the normal insulation level

2.2 **RO.5.18**
(ncpt) **double link on medium voltage lines**
phase conductor link to the suspension or tension supports of a medium voltage line with line post insulators, being performed by using two insulators; where the main link of conductors which takes the stress from the conductor in normal operating conditions is executed on one insulator, and on the other insulator is executed the link which is prepared to interfere when the main link is failed

2.2 **RO.5.19**
(ncpt) **safety link**
auxiliary link of phase conductor to a suspension support equipped with line post insulators, which is performed by using a piece of conductor inclined at top insulator's level, on the support side, and mechanically fixed to the conductor on both parts of suspension insulator to prevent the falling of conductor towards the ground in case of breaking the support link

2.2 **RO.5.20**
(ncpt) **broken conductors in an adjacent span**
the cases where the breaking of conductors (see the load arrangement f) in subclause 4.12.2/RO.1) affects the electrical clearances in the adjacent spans

2.3 Symbols

2.3 RO.1 Symbols

(ncpt) For the purposes of Part 2-24, the symbols listed below are applied. These symbols are not included or have different meaning from those given in subclause 2.3 of Part 1 (SR EN 50341-1:2013).

Symbol	Signification	Unit	Reference clause / subclause
a	air clearance between phase conductors in horizontal plane	m	5.8/RO.1
A _c	conductor cross-section area resulting from the dimensioning of conductor	mm ²	4.11/RO.2
b	air clearance between phase conductors in vertical plane	m	5.8/RO.1
b _{ch}	the thickness of ice deposit on conductor	mm	4.5.2/RO.1

Symbol	Signification	Unit	Reference clause / subclause
C_c	drag factor for the conductors, as specified in subclause 4.4.1.3 of SR EN 50341-1	-	4.4.1/RO.1 and Table 4/RO.2 to 4.12.2
D	the equivalent diameter of ice-covered conductor	mm	4.6.4/RO.1 & 4.6.5/RO.1
d	the equivalent diameter of ice-covered twisted wire cable	mm	4.6.5/RO.2
d_c	the diameter of conductor	mm	4.5.2/RO.1, 9.6.2/RO.1
d_{ce}	the equivalent diameter of twisted wire cables	mm	Figure 4/RO.5 to 4.6.5/RO.2
d_s	minimum horizontal safety distance corresponding to the extreme phase conductor at its maximum deviation	m	5.9.1.2 RO.1
D_{el}	minimum air clearance between phase conductors and the parts at earth potential (earthed parts)	m	Table 5/RO.1 to 5.7/RO.2
$D_{50Hz_p_e}$	minimum air clearance between any of the phase conductors and the parts at earth potential (earthed parts), which is required to prevent a disruptive discharge at power-frequency voltage	m	Table 5/RO.1 to 5.7/RO.2
D_{pp}	minimum air clearance between phase conductors	m	Table 5/RO.3 to 5.8/RO.1
$D_{50Hz_p_p}$	minimum air clearance between phase conductors, which is required to prevent a disruptive discharge at power frequency voltage	m	Table 5/RO.3 to 5.8/RO.1
f_c	maximum conductor sag	m	5.8/RO.1
g_c	the unit weight of conductor (self-weight of conductor per unit length)	N/m	4.12.2/RO.2
$g_{1,a}$	the conductor load per unit length, as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{2,a}$	the load per unit length due to the weight of ice deposit on conductor, as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{3,a}$	total load per unit length due to the weight of ice-covered conductor (total weight of conductor and ice deposit), as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{4,a}$	maximum wind load per unit length on conductor, as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{5,a}$	the wind load per unit length on ice-covered conductor, as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{6,a}$	total load per unit length due to the weight of conductor and maximum wind load on conductor, as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{7,a}$	total load per unit length due to the weight of conductor and ice deposit on conductor and wind load on ice-covered conductor, as a value under broken wire condition	N/m	Table 4/RO.2 to 4.12.2
$g_{1,e}$	the load per unit length due to the weight of conductor, as an extreme value	N/m	Table 4/RO.2 to 4.12.2
$g_{2,e}$	the load per unit length due to the ice deposit on conductor, as an extreme value	N/m	4.5.2/RO.1 and Table 4/RO.2 to 4.12.2

Symbol	Signification	Unit	Reference clause / subclause
$g_{3,e}$	total load per unit length resulting from weight of ice-covered conductor, as an extreme value	N/m	Table 4/RO.2 to 4.12.2
$g_{4,e}$	maximum wind load per unit length on conductor, as an extreme value	N/m	4.4.1/RO.1
$g_{5,e}$	the wind load per unit length on ice-covered conductor, as an extreme value	N/m	4.6.5/RO.1
$g_{6,e}$	total load per unit length due to the weight of conductor and maximum wind load on conductor, as an extreme value	N/m	Table 4/RO.2 to 4.12.2
$g_{7,e}$	total load per unit length due to the weight of conductor and ice deposit on conductor, and the wind load on ice-covered conductor, as an extreme value	N/m	Table 4/RO.2 to 4.12.2
$g_{1,n}$	maximum load per unit length due to the weight of conductor, as nominal value	N/m	Table 4/RO.2 to 4.12.2
$g_{2,n}$	maximum load per unit length due to the ice deposit on conductor, as nominal value	N/m	4.5.2/RO.1
$g_{3,n}$	maximum load per unit length due to the weight of conductor and ice deposit on conductor, as nominal value	N/m	Table 4/RO.2 to 4.12.2
$g_{4,n}$	the wind load per unit length on conductor, as nominal value	N/m	4.4.1/RO.1
$g_{5,n}$	the wind load per unit length on ice-covered conductor, as nominal value	N/m	4.6.5/RO.1
$g_{6,n}$	total load per unit length due to the weight of conductor and maximum wind load on conductor, as nominal value	N/m	Table 4/RO.2 to 4.12.2
$g_{7,n}$	total load per unit length resulting from the weight of conductor and ice deposits on conductor, and maximum wind load on ice-covered conductor, as nominal value	N/m	Table 4/RO.2 to 4.12.2
G_c	structural factor for conductors, as defined in subclause 4.4.1.2 in SR EN 50341-1	-	Table 4/RO.2 to 4.12.2
K	coefficient which depends on the nominal voltage of the overhead electrical line, and the materials and cross-section of conductors, and their position on the support	-	5.8/RO.1
k_e	factor by which is taken into consideration the effect of releasing the conductor from clamp at a specified value of conductor tension	N/mm	Table 4/RO.1
k_n	is the factor which take into consideration the number of conductors per phase	-	Table 4/RO.1
k_v	factor for vertical arrangement of conductors (approximately in the same vertical plane)	-	5.8/RO.1
k_h	factor for horizontal arrangement of conductors (approximately in the same horizontal plane)	-	5.8/RO.1
K_a	touch coefficient	-	6.1.3/RO.1
K_{pas}	step coefficient	-	6.1.3/RO.1
L_i	the span between supports	m	2.2/RO.1.11
$p_{0,i}$	specific tension in a conductor at any state (load case) defined in Technical Specification	N/mm ²	4.11/RO.1
p_o	specific tension in a conductor	N/mm ²	4.11/RO.2

Symbol	Signification	Unit	Reference clause / subclause
$p_{o,15}$	specific tension in a conductor at 15 °C	N/mm ²	9.6.4/RO.1
Q_{cc0}	the force due to the tension in a conductor	N	4.11/RO.2
Q_{cc}	the force due to the tension in a conductor– for broken wire condition (phase conductor)	N	Table 4/RO.1 to 4.11/RO.3
q_p	peak wind pressure in the gravity centre of conductor, as defined in subclause 4.3.4 of SR EN 50341-1	N/m ²	4.4.1/RO.1
q_{p_ch}	wind pressure simultaneously with ice deposit on conductors at reference height, h, above ground	N/m ²	4.6.4/RO.1/ Table 4/RO.2
α_c	maximum swing angle of conductor under wind action	degrees	5.8/RO.1
α_{isol}	swing angle of suspension insulator set	degrees	5.8/RO.1
λ_c	specific creepage distance for polluted areas	mm/kV	10.16/RO.1
γ_c	specific weight of conductor	N/m ³	9.6.4/RO.1
γ_{ch}	(hoar-frost) ice density	N/dm ³	4.5.2/RO.1
γ_i	partial factor for maximum ice load, defined in 4.13 of SR EN 50341-1, depending on selected reliability level	-	4.5.2/RO.1 and Table 4/RO.2 to 4.12.2
γ_w	partial factor for maximum wind pressure, defined in 4.13 of SR EN 50341-1, depending on selected reliability level	-	4.11/RO.2 and Table 4/RO.2 to 4.12.2
γ_a	combination factor applied for wind load and ice load acting simultaneously on the line conductors under broken wire condition	-	4.12.2/RO.4 and Table 4/RO.2
γ_p	partial factor for construction loadings	-	4.9.2/RO.1
θ	the angle of line direction change	degrees	4.4.1/RO.1
W_{ch}	the vertical force resulting from the weight of ice deposits on conductors	daN	4.5.2/RO.1
W_c	the vertical force resulting from the self-weight of conductor	daN	4.5.2/RO.1
d_c	the diameter of phase conductor or earth wire	mm	
ϕ	the angle between wind direction and the longitudinal axis of the cross-arm of support	degrees	

3 Basis of design

3.2 Requirements of overhead lines

3.2.1 Basic requirements

3.2.1 RO.1 Basic requirements

(ncpt) All components of an overhead electrical line shall be selected, designed and installed so that these are reliable during operation under normally occurring climatic conditions, under operating conditions at maximum voltage, at maximum loadings due to the effects of the electrical currents and at the loadings due to the short-circuit currents. The impacts of atmospheric and switching overvoltages shall be taken into consideration.

These requirements are accomplished if an overhead electrical line is designed and installed according to this standard.

3.2.2 Reliability requirements

3.2.2 RO.1 Reliability requirements

(ncpt) In Romania, the design of overhead electrical lines shall be performed in a such way that the reliability requirements given in the Part 1 (SR EN 50341-1:2013, Table 3.1) and the requirements related to the safety levels for reliability class 1 are fulfilled.

For the interconnection electric lines with nominal voltages exceeding or equal to 400 kV, the requirements for reliability class 2 shall be applied.

The requirements for reliability class 3 shall be applied for the sections of overhead electrical lines crossing Danube since each of these structures shall be taken into consideration individually.

3.2.5 Strength coordination

3.2.5 RO.1 Strength coordination

(ncpt) The strength coordination of overhead electrical lines is achieved by design on the basis of the following load cases:

- **normal operating condition** on the basis of nominal loads (nominal values taken into account for the calculation of conductors' sags) and extreme loads (maximum admissible values under normal operating conditions of overhead electrical lines);
- **broken wire condition** based on special values of loads that occur in the failure conditions of one (some) component(s) of the overhead electrical lines.

3.2.6 Additional considerations

3.2.6 RO.1 Protection of birds

(ncpt) Cross-arms, different elements of line-post insulators, and the other components of overhead electrical line supports (poles) with nominal voltages up to 20 kV shall be designed so that the birds cannot find any possibility to do nests within dangerous zones close to conductors.

4 Actions on lines

4.1 Introduction

4.1 RO.1 Introduction

(ncpt) The stipulations for loads acting on the overhead electrical lines are based on the evaluation of meteorological information provided by National Meteorological Agency.

4.3 Wind loads

4.3.1 Field of application and basic wind velocity

4.3.1 RO.1 Basic wind velocity

(snc) The wind loads depend on the geographical area where the overhead electrical line is built. In terms of wind velocity, the territory of Romania is divided in five meteorological zones identified as A, B, C, D and E zones, as shown in Figure 4/RO.1.

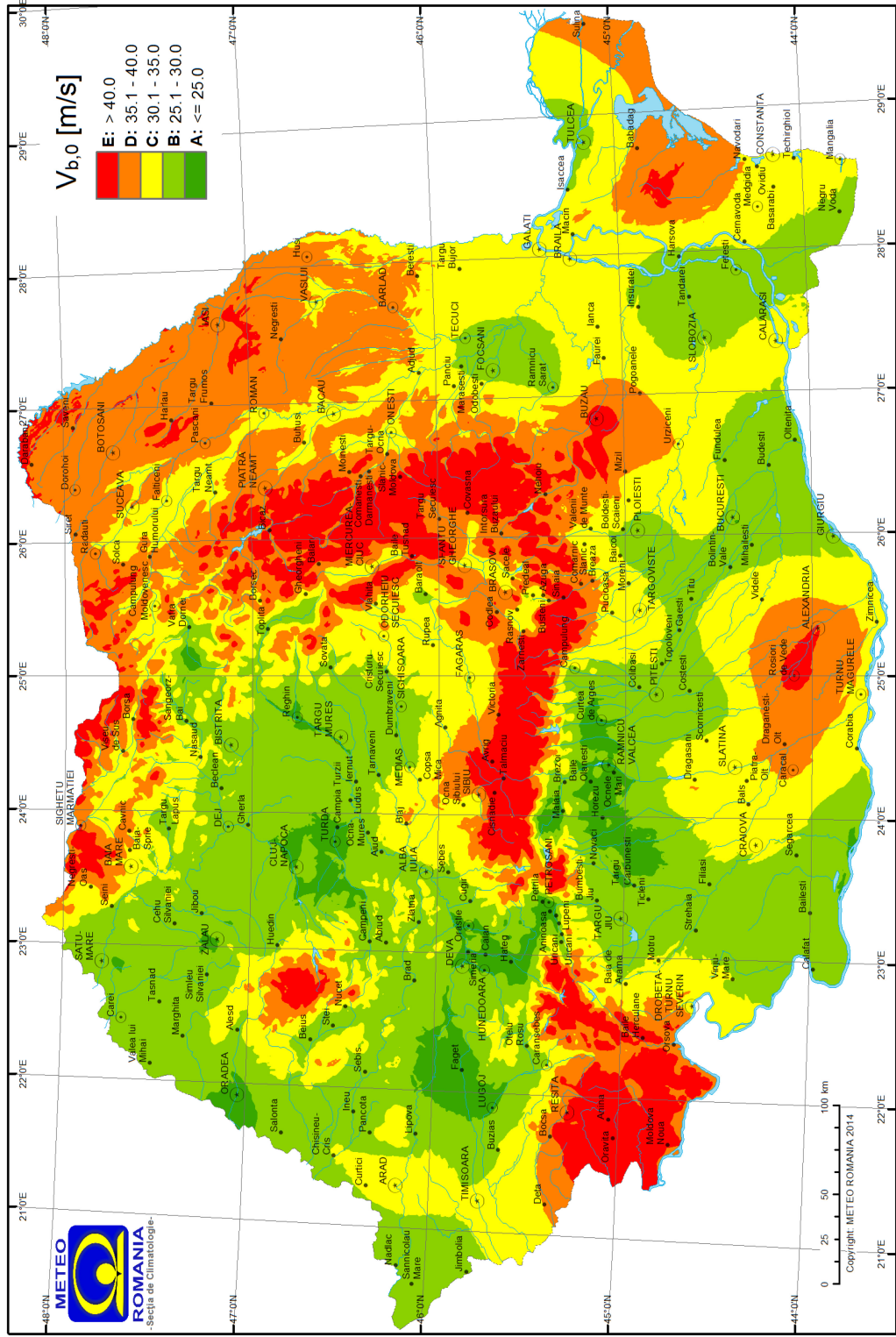


Figure 4/RO.1 — Map of basic wind velocity zones, V_{b,0} [m/s]
(Recording period of 10 min at height of 10 m above ground, and 50 years return period)

4.4 Wind forces on overhead line components

4.4.1 Wind forces on conductors

4.4.1 RO.1 Wind forces on conductors

(ncpt) The total wind force on the phase conductors and overhead earth wires is calculated with the formula in subclause 4.4.1.1 of SR EN 50341-1:2013 with the following details:

The wind force component in the direction of cross-arms:

$$Q_{Wc_V} = n_c \times q_x \times G_c \times C_c \times \frac{d_c}{1000} \times \left[\frac{L1}{2} \cos^2 \left(\phi - \frac{\theta 1}{2} \right) \cos \left(\frac{\theta 1}{2} \right) \pm \frac{L2}{2} \cos^2 \left(\phi + \frac{\theta 2}{2} \right) \cos \left(\frac{\theta 2}{2} \right) \right]$$

The wind force component perpendicular to the cross-arm:

$$Q_{Wc_U} = n_c \times q_x \times G_c \times C_c \times \frac{d_c}{1000} \times \left[\frac{L1}{2} \cos^2 \left(\phi - \frac{\theta 1}{2} \right) \sin \left(\frac{\theta 1}{2} \right) \mp \frac{L2}{2} \cos^2 \left(\phi + \frac{\theta 2}{2} \right) \sin \left(\frac{\theta 2}{2} \right) \right]$$

NOTE The terms with plus/minus sign “±”:

- if $\phi + \frac{\theta}{2} \leq 90^\circ$, then the upper sign applies (“+” at Q_{Wc_V} and “–” at Q_{Wc_U})
- if $\phi + \frac{\theta}{2} > 90^\circ$ then the lower sign applies (“–” at Q_{Wc_V} and “+” at Q_{Wc_U})

where:

n_c – is the number of sub-conductors per phase ($n_c = 1$ for the earth wire)

$q_x = \gamma_w \times q_p(h)$ – is the peak wind pressure applicable in the load cases N1, N3, N5, N9 and N11

$q_x = \gamma_p \times q_{p_cm}(h)$ – the wind pressure in the conditions of construction and maintenance (construction and maintenance load case, $v=10$ m/s)

γ_w – is the partial factor for maximum wind load, defined in subclause 4.12

γ_p – is the partial factor for loads due to the construction, defined in subclause 4.9.2/RO.1

$q_p(h)$ – is the peak wind pressure [daN/m²], defined in 4.3.4 and Figure 4/RO.2.

If in the Project Specification isn't otherwise specified, then the following basic wind velocities given in table 4/RO.1 below shall be taken into consideration.

Table 4/RO.1 — The basic wind velocity depending on the meteorological zone

Meteorological zone	The basic wind velocity, $V_{b,o}$
A	25 m/s
B	30 m/s
C	34 m/s
D	37 m/s
E	41 m/s

The height "h" is the reference height above ground (h) for the conductor (see the table 4.3 of SR EN 50341-1:2013)

NOTE For dimensioning of supports, the calculation of swing angle of conductors and suspension insulator sets, and for verification of the air clearance distances (electrical clearances), the height "h" shall be calculated by the method 1 given in table 4.3 (the individual height for each phase conductor / earth wire). For mechanical calculation of the conductors, the method 3 shall be applied separately for

phase conductors and earth wires. Alternatively, the method 4 can be used instead of method 1, and the method 6 instead of method 3.

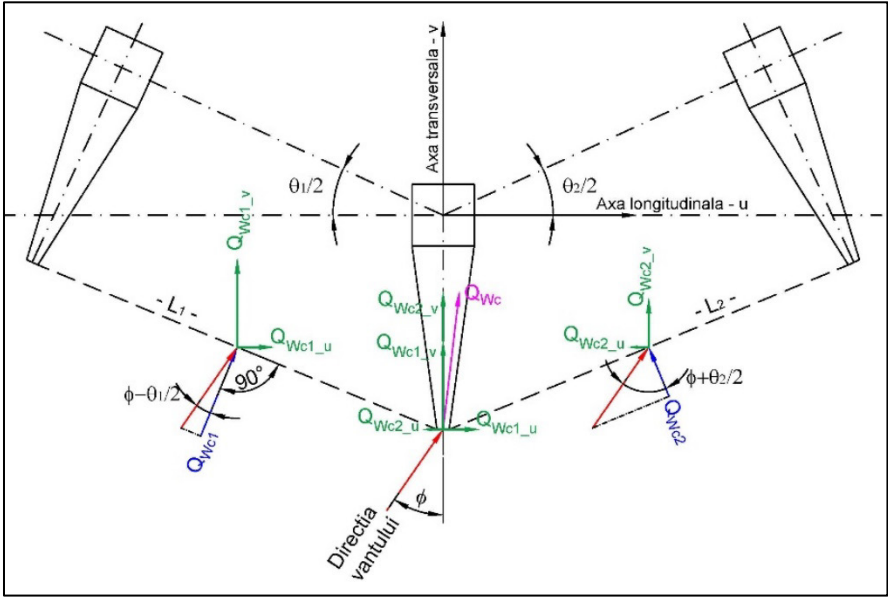
G_C – is the structural factor defined in subclause 4.4.1.2 of SR EN 50341-1:2013;

$C_C = 1,0$ – is the drag factor for the conductor, as defined in subclause 4.4.1.3 of SR EN 50341-1:2013, the method 1;

d_c – is the diameter of phase conductor or earth wire [mm];

ϕ – is the angle between wind direction and the longitudinal axis of the cross-arm;

θ – is the angle of line direction change.



Key

Romanian	English
Axa longitudinală	The longitudinal axis
Direcția vântului	The wind direction
Axa transversală	The transverse axis

Figure 4/RO.2 — Wind forces on conductors – general case

4.4.1 RO.2 Wind forces on aerial cables

(ncpt) The wind forces on aerial cables shall be calculated separately both for hanging ropes and aerial cables. For the aerial cables, the “d” is equal to the diameter of circumscribed cylinder, as defined in Figure 4/RO.5.

4.4.3 Wind forces on lattice towers

4.4.3.2 Method 1

4.4.3.2 RO.1 Method 1

(ncpt) The structural factor for lattice tower, G_t is equal to 1.

4.5 Ice loads

4.5.1 General

4.5.1 RO.1 Ice thickness on conductors