

ELEKTRIÕHULIINID VAHELDUVPINGEGA ÜLE 1 KV. OSA  
2-20: EESTI SISERIIKLIKUD ERINÕUDED (SEN)

Overhead electrical lines exceeding AC 1 kV - Part 2-20:  
National Normative Aspects (NNA) for Estonia (based  
on EN 50341-1:2012)

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 50341-2-20:2018 sisaldab Euroopa standardi EN 50341-2-20:2018 ingliskeelset teksti.	This Estonian standard EVS-EN 50341-2-20:2018 consists of the English text of the European standard EN 50341-2-20:2018.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 14.12.2018.	Date of Availability of the European standard is 14.12.2018.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 29.240.20

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

EUROPEAN STANDARD

**EN 50341-2-20**

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2018

ICS 29.240.20

Supersedes EN 50341-2-20:2015

English Version

**Overhead electrical lines exceeding AC 1 kV - Part 2-20:  
National Normative Aspects (NNA) for ESTONIA (based on EN  
50341-1:2012)**

This European Standard was approved by CENELEC on 2018-11-26.

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

## Contents

European foreword .....	6
0 Introduction .....	7
0.7 Language .....	7
1 Scope .....	7
1.1 General .....	7
1.2 Field of application .....	7
2 Normative references, definitions and symbols .....	8
2.1 Normative references .....	8
3 Basis of design .....	10
3.2 Requirements of overhead lines .....	10
3.2.2 Reliability requirements .....	10
3.2.3 Security requirements .....	11
3.2.5 Strength coordination .....	11
3.2.6 Additional considerations .....	11
3.3 Limit states .....	11
3.3.3 Serviceability limit states .....	11
3.4 Actions .....	11
3.4.2 Classification of actions by their variation in time .....	11
4 Actions on lines .....	12
4.1 Introduction .....	12
4.3 Wind loads .....	12
4.3.1 Field of application and basic wind velocity .....	12
4.3.2 Mean wind velocity .....	12
4.3.3 Mean wind pressure .....	12
4.3.5 Wind forces on any overhead line component .....	12
4.4 Wind forces on overhead line components .....	13
4.4.1 Wind forces on conductors .....	13
4.4.2 Wind forces on insulator sets .....	13
4.4.3 Wind forces on lattice towers .....	14
4.4.4 Wind forces on poles .....	14
4.5 Ice loads .....	14
4.5.1 General .....	14
4.5.2 Ice forces on conductors .....	14
4.6 Combined wind and ice loads .....	14
4.6.1 Combined probabilities .....	14
4.6.2 Drag factors and ice densities .....	15
4.7 Temperature effects .....	15
4.8 Security loads .....	15
4.8.4 Mechanical conditions of application .....	15

4.9	Safety Loads .....	15
4.9.1	Construction and maintenance loads .....	15
4.9.2	Loads related to the weight of linesmen .....	16
4.10	Forces due to short-circuit currents .....	16
4.11	Other special forces .....	16
4.11.1	Avalanches, creeping snow .....	16
4.11.2	Earthquakes .....	16
4.11.3	Floating of ice, accidents of vessels .....	16
4.11.4	Mining out areas .....	17
4.12	Load cases .....	17
4.12.1	General .....	17
4.12.2	Standard load cases .....	17
4.13	Partial factors for actions .....	18
5	Electrical requirements .....	19
5.1	Introduction .....	19
5.2	Currents .....	19
5.2.1	Nominal current .....	19
5.2.2	Short-circuit currents .....	19
5.3	Insulation co-ordination .....	19
5.4	Classification of voltages and overvoltages .....	19
5.4.1	General .....	19
5.5	Minimum air clearance distances to avoid flashover .....	20
5.5.1	General .....	20
5.6	Load cases for calculation of clearances .....	21
5.6.2	Maximum conductor temperature .....	21
5.6.3	Wind loads for determination of electric clearances .....	21
5.6.4	Ice loads for determination of electric clearances .....	22
5.6.5	Combined wind and ice loads .....	22
5.8	Internal clearances within the span and at the top of support .....	22
5.9	External clearances .....	22
5.9.1	General .....	22
5.9.2	External clearances to ground in areas remote from buildings, roads, etc. ....	23
5.9.3	External clearances to residential and other buildings .....	23
5.9.5	External clearances to adjacent traffic routes .....	25
5.9.6	External clearances to other power lines or overhead telecommunication lines .....	25
5.9.7	External clearances to recreational areas (playgrounds, sports areas, etc.) .....	26
5.9.8	External clearances to line crossing pipelines or adjacent pipelines, including gas and oil pipelines .....	30
5.9.9	Overhead lines adjacent to aerodromes .....	31
5.10	Corona effect .....	32

5.10.2	Audible noise .....	32
5.10.3	Corona loss .....	32
6	Earthing systems .....	32
6.1	Introduction .....	32
6.1.3	Earthing measures against lightning effects .....	32
6.2	Ratings with regard to corrosion and mechanical strength .....	32
6.2.1	Earth electrodes .....	32
6.2.2	Earthing and bonding conductors .....	33
6.4	Dimensioning with regard to human safety .....	33
6.4.1	Permissible values for touch voltages .....	33
6.4.3	Basic design of earthing systems with regard to permissible touch voltage .....	33
7	Supports .....	34
7.1	Initial design considerations .....	34
7.1.1	Introduction .....	34
7.2	Materials .....	34
7.2.6	Wood .....	34
7.3	Lattice steel towers .....	34
7.3.1	General .....	34
7.3.6	Ultimate limit states .....	34
7.3.8	Resistance of connections .....	35
7.4	Steel poles .....	35
7.4.8	Resistance of connections .....	35
7.5	Wood poles .....	35
7.5.3	Materials .....	35
7.5.5	Ultimate limit states .....	35
7.10	Maintenance facilities .....	35
7.10.1	Climbing .....	35
7.10.2	Maintainability .....	36
7.10.3	Safety requirements .....	36
8	Foundations .....	36
8.1	Introduction .....	36
8.2	Basis of geotechnical design .....	37
8.2.2	Geotechnical design by calculation .....	37
8.2.3	Design by prescriptive measures .....	38
8.2.4	Load tests and tests on experimental models .....	38
8.3	Soil investigation and geotechnical data .....	38
8.5	Fill, dewatering, ground improvement and reinforcement .....	38
8.6	Interactions between support foundations and soil .....	38
9	Conductors and earth-wires .....	39
9.1	Introduction .....	39

9.2	Aluminium based conductors .....	39
9.2.1	Characteristics and dimensions .....	39
9.6	General requirements .....	40
9.6.2	Partial factors for conductors .....	40
10	Insulators .....	40
10.2	Standard electrical requirements .....	40
10.4	Pollution performance requirements .....	40
10.7	Mechanical requirements .....	41
10.10	Characteristics and dimensions of insulators .....	41
11	Hardware .....	42
11.6	Mechanical requirements .....	42
12	Quality assurance, checks and taking over .....	42
Annex B (informative) Conversion of wind velocities and ice loads .....		43
Annex C (informative) Application examples of wind loads – Special forces .....		44
Annex E (normative) Theoretical method for calculating minimum air clearances .....		45
Annex F (informative) Empirical method for calculating mid span clearances .....		46
Annex G (normative) Calculation methods for earthing systems .....		47
Annex H (informative) Installation and measurements of earthing systems .....		48

## European foreword

- 1 The Estonian National Committee (NC) is identified by the following address

Estonian Centre for Standardisation  
Estonian National High Voltage Committee (HVC)  
Akadeemia tee 21/6, 12618 Tallinn, Estonia  
Phone: +372 605 5050  
Fax: +372 605 5070  
E-mail: [info@evs.ee](mailto:info@evs.ee)

- 2 The Estonian NC has prepared this Part 2-20 (EN 50341) listing the Estonian National Normative aspects, under its sole responsibility, and duly passed it through the CENELEC and CLC/TC 11 procedures.

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

- 3 This revision supersedes EVS-EN 50341-2-20:2015.

The most significant technical changes with respect to the previous edition are:

- requirements for low voltage lines are included;
- telecommunication lines located on common structures with power lines are taken into account;
- the last amendments of Estonian legal documents are taken into account.

- 4 This Part 2-20 is normative in Estonia and informative for other countries.

- 5 This Part 2-20 has to be read in conjunction with EN 50341-1, referred to hereafter as Part 1. All clause numbers used in this Part 2-20 correspond to those in Part 1. Specific subclauses, which are prefixed “**EE**”, are to be read as amendments to the relevant text in Part 1. Any necessary clarification regarding the application of Part 2-20 in conjunction with Part 1 shall be referred to the Estonian NC that will, in cooperation with CLC/TC 11, clarify the requirements.

When no reference is made in Part 2-20 to a specific subclause, Part 1 applies.

- 6 In the case of “box values” defined in Part 1, amended values (if any), which are defined in Part 2-20, shall be taken into account in Estonia.

However any boxed value, whether in Part 1 or in Part 2-20, shall not be amended in the direction of greater risk in the Project Specification.

Terms with prepositions “from” and “up to”, denoting boundaries of values, always include the boundary values itself, as it is common in other Estonian normative documents.

- 7 The national Estonian standards/regulations related to overhead electrical lines are listed in Clause 2.

NOTE All national standards referred to in this Part 2-20 will be replaced by the relevant European Standards as soon as they become available and are declared by the Estonian Centre for Standardisation to be applicable and thus reported to the secretary of CLC/TC 11.



## 0 INTRODUCTION

### 0.7 Language

(snc) **EE.1 Language**

This Part 2-20 is published in English and in Estonian.

## 1 SCOPE

### 1.1 General

(snc) **EE.1 Application to new lines**

In Estonia the standard EN 50341-1 (Part 1) can only be applied using this NNA (EN 50341-2-20) containing National Normative Aspects for Estonia.

This Part 2-20 applies to all new overhead electric lines with nominal system voltages exceeding AC 1 kV and also for low voltage (below 1 kV AC) overhead lines performed by aerial cables. The requirements of the structural design are applicable also for DC overhead lines, where the electrical requirements are given in the Project Specification.

(ncpt) **EE.2 “New overhead line”**

A “new overhead line” means a completely new line between two points, A and B. A new branch line of the existing power line should be considered as a new power line including the junction support. Specific requirements for junction support should be defined with the Project Specification.

### 1.2 Field of application

(ncpt) **EE.1 Application to covered conductors and aerial cables**

The standard includes requirements for the design and construction of overhead lines with nominal system voltages up to 45 kV AC equipped with covered conductors and aerial cables. Additionally, the requirements of the equipment standards and manufacturers' instructions shall be followed.

(A-dev) **EE.2 Application to mounting of telecommunication equipment**

The Standard EVS-EN 50341:2013 is applicable to fixing of structural elements for telecommunication (antennas, All Dielectric Self Supporting (ADSS) equipment, junction boxes, etc.), if mounted on power line supports (towers), especially regarding wind forces and ice loads on such fixed elements. The design and installation should be done under the due control of the line owner and/or the competent authority. Mounting of telecommunication equipment on power line supports must be coordinated with the line owner and stated in the Project Specification.

This standard applies to telecommunication lines only in the case of their common installation with power lines. This standard does not apply to separately installed telecommunication overhead lines.

If telecommunication equipment (antennas, dishes, etc.) will be installed in the transmission line supports, and their size, location or mounting may have major effects on the loads or design of the structures, the requirements of EVS-EN 1993-3-1/NA:2009 shall also to be taken into account. If such structures include conductive parts, the requirements on clearances in subclause 5.8 should be applied.

(ncpt)

**EE.3 Application to installation of other equipment**

Only equipment belonging to the line (electric or telecommunication line) can be installed on the overhead lines. However, with the permission of the owner of the line, equipment serving communal services or environmental protection like road signs, warning signs or warning balls, etc., may also be installed. The installation height of equipment meant to be installed and maintained by an instructed person shall be such that the work can be done without climbing the support and the distances of safe electrical work can be followed. The additional loads due to this equipment on the line supports shall be taken into account if necessary.

(ncpt)

**EE.4 Application to existing overhead lines**

The Standard EVS-EN 50341:2013 shall not be applied to maintenance, branch lines, extensions or diversions of existing overhead lines in Estonia, unless specifically required in the Project Specification.

Overhead lines that meet the mechanical and electrical requirements in force at the time of their construction can be continually operated if this does not cause obvious danger. Such lines may be repaired and upgraded according to previously valid requirements. Thereat repair means replacing a damaged element with a similar new one; renovation means a more extensive improvement of the line with the aim of extending its life, while preserving the basic construction of the line.

Any modification of existing lines shall be subject to this standard, but previous norms and standards can also be used. It shall be made sure that the changes do not have a significant impact on the line's load. Modification means, for example, the relocation of some of the supports or the development of the line provided for in the initial design - for example, adding a circuit or reconductoring on existing supports.

In cases of major revisions of existing lines the degree of application of the Standard EVS-EN 50341:2013 should be in any case agreed upon by the parties concerned and specified in the Project Specification.

(ncpt)

**EE.5 Application to installations under construction or design**

Installations in the design and construction stage may be completed by using the standard valid at the beginning of planning unless otherwise agreed with the line owner and/or any other competent authority.

It must also be determined in the Project Specification which previous Standard and to what extent shall be applied to the project in question.

**2 NORMATIVE REFERENCES, DEFINITIONS AND SYMBOLS****2.1 Normative references**

(A-dev)

**EE.1 Application of references in Part 1**

References in EN 50341-1 apply without change.

(A-dev)

**EE.2 References to Estonian national laws, regulations and standards**

Choice of lines' route and construction or mounting of high voltage overhead lines is regulated by the following Estonian laws and government regulations. These laws and regulations are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

In addition to Part 1 the following Estonian standards and acts should be taken into account:

EVS 814:2003. *Normaalbetooni külmakindlus. Määratlused, spetsifikatsioonid ja katsemeetodid.* Frost resistance of normal-weight concrete. Definitions, specifications and test method

EVS 843:2016. *Linnatänavad.* Urban streets

EVS 884:2017. *Maagaasitorustik. Projekteerimise põhinõuded üle 16 baarise töö rõhuga torustikele.* Natural gas pipeline systems – Pipelines for maximum operating pressure over 16 bar – General requirements for design

EVS-EN 1991-1-4/A1:2010/NA:2010. *Eurokoodeks 1: Ehituskonstruksioonide koormused. Osa 1-4: Tuulekoormus. Eesti standardi rahvuslik lisa.* Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions. Estonian National Annex

EVS-EN 1991-1-4/NA:2007. *Eurokoodeks 1: Ehituskonstruksioonide koormused. Osa 1-4: Üldkoormused. Tuulekoormus. Eesti standardi rahvuslik lisa.* Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions. Estonian National Annex

EVS-EN 1993-3-1/NA:2009. *Eurokoodeks 3: Teraskonstruksioonide projekteerimine. Osa 3-1: Tornid, mastid ja korstnad. Tornid ja mastid. Eesti standardi rahvuslik lisa.* Eurocode 3 - Design of steel structures - Part 3-1: Towers, masts and chimneys - Towers and masts. Estonian National Annex

*Asjaõigusseadus ja muudatused.* Law of Property Act (RT I 1993, 39, 590) and amendments

NOTE RT – *Riigi Teataja* (The State Gazette), an official online publication of the Republic of Estonia, RTL – *Riigi Teataja Lisa* (Supplement of the State Gazette). The translations published in *Riigi Teataja* are unofficial texts – they do not have legal force and you cannot rely on them in judicial or any other official proceedings. In Estonia, legislation has legal force only in Estonian.

*Asjaõigusseaduse rakendamise seadus ja muudatused.* Law of Property Act Implementation Act (RT I 1993, 72, 1021) and amendments

*Ehitusseadustik ja muudatused.* Building Code (RT I 05.03.2015, 1) and amendments

*Ehitusseadustiku ja planeerimisseaduse rakendamise seadus ja muudatused.* An Act to Implement the Building Code and the Planning Act (RT I, 23.03.2015, 3) and amendments

*Elektrituruseadus ja muudatused.* Electricity Market Act (RT I 2003, 25, 153) and amendments

*Elektroonilise side seadus ja muudatused.* Electronic Communications Act (RT I 2004, 87, 593) and amendments

*Jäätmeseadus ja muudatused.* Waste Act (RT I 2004, 9, 52) and amendments

*Keskonnajärelevalve seadus ja muudatused.* Environmental Supervision Act (RT I 2001, 56, 337) and amendments

*Keskonnamõju hindamise ja keskkonnajuhtimissüsteemi seadus ja muudatused.* Environmental Impact Assessment and Environmental Management System Act (RT I 2005, 15, 87) and amendments

*Lennundusseadus ja muudatused.* Aviation Act (RT I 1999, 26, 376) and amendments

*Looduskaitse seadus ja muudatused.* Nature Conservation Act (RT I 2004, 38, 258) and amendments

*Maakatastriseadus ja muudatused.* Land Cadastre Act (RT I 1994, 74, 1324) and amendments

*Meresõiduohutuse seadus ja muudatused.* Maritime Safety Act (RT I 2002, 1, 1) and amendments

*Muinsuskaitse seadus ja muudatused.* Heritage Conservation Act (RT I 2002, 27, 153) and amendments

*Planeerimisseadus ja muudatused.* Planning Act (RT I 26.02.2015, 3) and amendments

*Raudteeseadus ja muudatused.* Railways Act (RT I 2003, 79, 530) and amendments

*Seadme ohutuse seadus ja muudatused.* Equipment Safety Act (RT I 23.03.2015, 4) and amendments

*Majandus- ja taristuministri määrus „Ehitise kaitsevööndi ulatus, kaitsevööndis tegutsemise kord ja kaitsevööndi tähistusele esitatavad nõuded“.* Regulation of the Minister of Economic Affairs and Infrastructure “Extent of a structure protection zone, procedures for operating in the protection zone and requirements for the protection zone designation” (RT I, 28.06.2015, 4)

*Majandus- ja taristuministri määrus „Tee projekteerimise normid“.* Regulation of the Minister of Economic Affairs and Infrastructure “Road design regulations” (RT I, 07.08.2015, 14)

*Sotsiaalministri määrus „Müra normtasemed elu- ja puhkealadel, elamutes ning ühiskasutusega hoonetes ja mürataseme mõõtmise meetodid“.* Regulation of the Minister of Social Affairs “Audible noise limits in residential and recreational areas, residential and social buildings and noise level control methods” (RTL 2002, 38, 511)

Other valid relevant normative regulatory documents should also be taken into account.

Internal normative documents of a utility may be referred to in the Project Specification.

### 3 BASIS OF DESIGN

#### 3.2 Requirements of overhead lines

##### 3.2.2 Reliability requirements

(ncpt)

##### EE.1 Selection of reliability levels

Three reliability levels are used, as shown in the following table:

Table EE.3.1 — Reliability levels

Reliability level	Nominal system voltage	Line type
1	$U_n < 110 \text{ kV}$	Normal lines
	$U_n = 110 \text{ kV}$	Unimportant lines
2	$U_n = 110 \text{ kV}$	Normal lines
3	$U_n \geq 110 \text{ kV}$	Important lines, including all 330 kV lines
NOTE The type of line is considered normal unless otherwise specified in the Project Specification.		