

Overhead electrical lines exceeding AC 1 kV up to and including AC 45 kV —

Part 3: Set of National Normative Aspects

ICS 29.240.20

National foreword

This British Standard is the UK implementation of EN 50423-3:2005, incorporating Corrigenda April 2005, February 2009, June 2010 and October 2010.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CENELEC corrigendum February 2009 is indicated in the text by AC1 AC1.

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 secretary.

Compliance with a British Standard cannot confer immunity from legal obligations.

Amendments/corrigenda issued since publication

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EUROPEAN STANDARD

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NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2005

ICS 29.240.20

Incorporating Corrigenda April 2005, February 2009,
June 2010 and October 2010

English version

**Overhead electrical lines exceeding
AC 1 kV up to and including AC 45 kV
Part 3: Set of National Normative Aspects**

Lignes électriques aériennes
dépassant 1 kV AC jusqu'à 45 kV AC
Partie 3: Aspects Normatifs Nationaux

Freileitungen über AC 1 kV
bis einschließlich AC 45 kV
Teil 3: Nationale Normative Festlegungen

This European Standard was approved by CENELEC on 2004-10-01. 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 Central Secretariat or to any CENELEC member.

This European Standard exists in one official version (English). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The different parts of this European Standard were prepared by the respective CENELEC National Committees in cooperation with the Technical Committee CENELEC TC 11, Overhead electrical lines exceeding 1 kV a.c. (1,5 kV d.c.).

The texts of the drafts were submitted to the Unique Acceptance Procedure and were approved by CENELEC as EN 50423-3 on 2004-10-01.

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2005-10-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2007-10-01 |

Text of EN 50423-3

Please see the subparts specific to each National Committee.

NOTE This Part 3 of EN 50423 is published by CENELEC in English only.

Index of National Normative Aspects

Reference	Country		Valid version in
	Code	Name	
EN 50423-3-1	AT	Austria	EN 50423-3:2005 modified by Corr. February 2009
EN 50423-3-2	BE	Belgium	EN 50423-3:2005
EN 50423-3-3	CH	Switzerland	EN 50423-3:2005
EN 50423-3-4	DE	Germany	EN 50423-3:2005
EN 50423-3-5	DK	Denmark	EN 50423-3:2005
EN 50423-3-6	ES	Spain	EN 50423-3:2005
EN 50423-3-7	FI	Finland	Replaced by Corr. February 2009
EN 50423-3-8	FR	France	EN 50423-3:2005
EN 50423-3-9	GB	Great Britain and Northern Ireland	EN 50423-3:2005 modified by Corr. April 2005
EN 50423-3-10	GR	Greece	EN 50423-3:2005
EN 50423-3-11	IE	Ireland	EN 50423-3:2005
EN 50423-3-12	IS	Iceland	EN 50423-3:2005
EN 50423-3-13	IT	Italy	EN 50423-3:2005
--	LU	Luxembourg	No NNA
EN 50423-3-15	NL	Netherlands	EN 50423-3:2005
EN 50423-3-16	NO	Norway	Replaced by Corr. February 2009
EN 50423-3-17	PT	Portugal	EN 50423-3:2005
EN 50423-3-18	SE	Sweden	Replaced by Corr. February 2009

Reference	Country		Valid version in
	Code	Name	
EN 50423-3-19	CZ	Czech Republic	EN 50423-3:2005
EN 50423-3-20	EE	Estonia	Added by Corr. February 2009
EN 50423-2-21	SI	Slovenia	Added by Corr. February 2009
--	PL	Poland	No NNA
--	MT	Malta	No NNA
--	HU	Hungary	No NNA
--	SK	Slovakia	No NNA
--	LT	Lithuania	No NNA

National Normative Aspects (NNA)
for
AUSTRIA

based on EN 50423-1:2005

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	TELECOMMUNICATION LINES CARRIED ON OVERHEAD TRANSMISSION LINES	

Foreword

1. The Austrian National Committee (NC) is identified by the following address:

Austrian Electrotechnical Committee
Österreichischer Verband für Elektrotechnik (OVE)
Eschenbachgasse 9, A-1010 Vienna, Austria
Phone no. +43.1.587.63.73
Fax no. +43.1.586.74.08
name/number of relevant subcommittee: Fach(normen)ausschuss L
2. The Austrian NC has prepared this Part 3-1 of EN 50423 listing the Austrian national normative aspects, under its sole responsibility, and duly passed it through the CENELEC and CLC/TC 11 procedures.
3. This EN 50423-3-1 is normative in Austria and informative for other countries;
4. This EN 50423-3-1 has to be read in conjunction with EN 50423-1, hereinafter referred to as Part 1. All clause numbers used in this Part 3-1 correspond to those of Part 1. Specific subclauses, which are prefixed „AT“, are to be read as amendments to the relevant text in Part 1. Any necessary clarification regarding the application of Part 3-1 in conjunction with Part 1 shall be referred to the Austrian NC who will, in cooperation with CLC/TC 11 clarify the requirements.

When no reference is made in Part 3-1 to a specific subclause, then Part 1 applies.

5. In the case of „boxed values“ defined in Part 1, amended values (if any) which are defined in Part 3-1 shall be taken into account in Austria.

However any boxed value, whether in Part 1 or Part 3-1, shall not be amended in the direction of greater risk in a Project Specification.

6. The Austrian NC declares in accordance with subclause 3.1 of Part 1 that this Part 3-1 follows the „Empirical Approach“ (subclause 4.3), and that consequently subclause 4.2 „General Approach“ is not applicable for Austria.
7. The national Austrian standards/regulations related to overhead electrical lines exceeding 1 kV (A.C.) are identified/listed in 2.3.

NOTE All national standards referred to in this Part 3-1 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.

Clause National regulation

1 General scope – Field of application

(A-dev) **AT.1** Notes 1, 2 and 3 are normative in Austria:

NOTE 2 The construction of lines with covered conductors (KUF) and reduced internal or external clearance is permitted in Austria.

NOTE 4 This NNA applies to overhead lines with nominal voltage exceeding AC 1kV up to and including AC 45 kV and a maximum operating voltage of 52 kV according to ÖVE EN 60071-1. Hereinafter the latter will be described as high voltage overhead lines, group I.

2 Definitions, symbols and references

2.1 Definitions

(A-dev) **AT.2.(1)**

a **conductor crosses an object** when, as a result of being deflected by wind blowing in the direction of that facility, the outline of the conductor intersects the outline of the object

(A-dev) **AT.2.(2) crossing span**

a span to which the conditions of AT.2.(1) apply

(A-dev) **AT.3**

In addition to the definition in Part 1:

Conductors

are understood to mean bare, insulated, or sheathed wires and cables suspended between the supports of an overhead high-tension power transmission line – regardless of whether they are energized or not. Included here are lines having multiple functions (composite cables for conductors and earthwires). **OPCON** and **OPGW** are to be considered as conductors.

Covered conductors (KUF) are not shock-proof, i.e. covered conductors being valid with regard to protection of contact as bare conductors. For the minimum requirements of the design of covered conductors see ÖVE/ÖNORM E 8227

(A-dev) **AT.11**

line groups

are defined as follows in Table 2.1/AT.11

Table 2.1/AT.11 - Line groups

Line Group	Nominal Insulation (series)	Maximum Operating Voltage, Effective Value in kV	Proof Alternating Voltage A (Alternating Voltage Holding Voltage) Effective Value in kV	Normal Surge Level (Surge Holding Voltage) Peak Value in kV
I	till 45kV	till 52	till 105	till 250

Clause National regulation

(ncpt) **AT.30**
wooden poles
pylon with a wooden tower body

2.3 References

- (A-dev) **AT.21** ÖVE-L 1, Construction of overhead power lines up to 1000V
- (A-dev) **AT.22** ÖNORM B 4007 Scarffoldind – general – use, construction und load
- (A-dev) **AT.23** ÖNORM B 4700 Reinforced concrete structures – EUROCODE-orientated analysis, design and detailing
- (A-dev) **AT.24** ÖVE/ÖNORM E 8227 Covered conductors
- (A-dev) **AT.25** ÖNORM E 4101 Electrical overhead-lines; Pin insulators type VHD und VHD-G
- (A-dev) **AT.26** ÖNORM E 4102 Electrical overhead-lines; solid core post insulators VKSt und VKS
- (A-dev) **AT.27** ÖVE-EH 41 Earthing in alternating current systems with nominal voltages exceeding 1 kV
- (A-dev) **AT.28** ÖVE-L 5, Teil 1 Commissioning report for overhead lines
- (A-dev) **AT.29** ÖNORM ENV 1994-1-1 Eurocode 4: Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings
- (A-dev) **AT.30** ÖNORM B 4710_1 Concrete – Part 1: Specification, production, use and verification of conformity

Clause National regulation

4 Actions on lines

4.3.2 Wind loads

(ncpt) **AT.3** :

Table 4.3.2/AT.3 Specific wind pressure acting upon the directly affected components
Values relate to a wind velocity of 120 km/h and a thrust of 700 N/m²

Component		Specific aerodyn. drag coefficient C_x	$C_x \cdot q_{120}$ N/m ²	Reduction factor
full flat surfaces		1,6	1112	1
flat lattice walls	made of angle profiles	1,4	973	1
	made of rods	1,1	765	1
Timber poles, steel poles, concrete poles of circular or near-circular shape		0,7	487	1
steel poles and concrete poles of hexagonal or octagonal shape		1,0	695	1
Double poles of Timber, steel resp. concrete	in the pole-plane	0,7	487	1
	rectangular to pole-plane where $e < d_m$ ¹⁾	0,8	556	1
wires and conductors of Circular or elliptical shape	$d < 15,8$ mm	1,15	600	0,75
	$d > 15,8$ mm	1,0	521	0,75
Aircraft warning and radar sphere $d < 1,0$ m		0,4	278	1
¹⁾ e inner distance pole to pole d_m means diameter of pole				

(snc) **AT.10:** In special cases it may be necessary to assume a greater wind velocity than indicated in **Table 4.3.2/AT.3** (120 km/h).

4.3.3 Ice loads

(A-dev) **AT.2:** Normal and exceptional additional loads on conductors are to be selected with a view to the prevailing climatic conditions; the minimum assumptions are:

Normal additional load: $(4 + 0,2 \times d)$ in N/m
(d = conductor diameter in mm)

Exceptional additional load 25 <N/m>

Clause National regulation

(snc) **AT.3:** For **towers and equipment** the following loading conditions apply:

For Normal additional loads:

- (1) Conductor: Normal additional load
- (2) Insulator strings of glass or porcelain: minimum 20% of their self weight (for strings of composite insulators eventually higher percentages are to be considered.)
- (3) Tower body: no additional load
- (4) Crossarms made of steel profiles: minimum 40% of their self weight
- (5) Crossarms made of other materials: minimum 120 N/m² acting on total surface

4.3.6 Construction and maintenance loads

(ncpt) **AT.1:** Construction loads are to be assumed as perpendicularly acting single loads. They act on

- (1) crossarms which jut out more than 1,2 metres: at the crossarm's end
- (2) horizontal bracing of crossarms: in the middle of the bracing (crossarm's upper not horizontal bracings need not to be assumed with construction loads)
- (3) all bracing and diagonals inclined at less than 30 degrees to the horizontal, in the centre of the diagonals. In areas with climbing facilities (e.g. ladder, steps) on supports: diagonals of these parts need not to be calculated for construction loads.
- (4) all horizontal bracings of tower bodies in the middle of the bracings (e.g. plan bracing, secondary bracing)

At (1) and (2) loadings of normal conditions according to 4.3.10.4 are to be assumed additionally, but not in cases (3) and (4).

For material stress the other regular loading conditions are to be assumed according to relevant regulations (ÖNORM B 4605)

Poles of wooden towers need not to be assumed with construction loads.

4.3.10.4 Standard load cases

Loading cases as from table 4.3.10.4/AT.2 (suspension and angle suspension towers), table 4.3.10.4/AT.3 (tension and angle tension towers) and table 4.3.10.4/AT.4 (tapping towers) are to be considered.

(ncpt) **AT.1:**

Tabelle 4.3.10.4/AT.1 Loading cases for the rating of conductor supports

	1	2	3
1	Poles	Timber poles	Poles, except Timber poles
2	Suspension and angle suspension towers	Table 4.3.10.4/AT.2 A, B, C	Table 4.3.10.4/AT.2 A, B, C, D
3	Tension and angle tension towers	Table 4.3.10.4/AT.3 A, B/C	Table 4.3.10.4/AT.3 A, B/C, D
4	Tapping poles	Table 4.3.10.4/AT.4 A, B, C	Table 4.3.10.4/AT.4 A, B, C, D

Clause National regulation

(ncpt) **AT.2 :**

Table 4.3.10.4/AT.2 - Load cases for suspension and angle suspension towers

Normal loading conditions		
A	Horizontal forces	Wind Load: Wind perpendicular to the direction of the line, in the case of angle suspension towers in the direction of the bisectors, acting upon: tower, equipment, and ice-free conductors. Horizontal conductor pull: of all conductors
	Vertical forces	Permanent Loads Upward and downward pulls Weight of the normal additional load on crossarms, equipment and conductors of the adjacent span halves Construction Load Selfweight of support Normal additional loads and construction loads are to be taken into account for the rating of those components for which the additional consideration of these loads along with the other vertical loads produces the less favourable stresses
B	Horizontal forces	Wind Load: Wind in direction of the line, in the case of angle suspension towers vertical to the bisector of the angles, acting upon: tower, equipment, and ice-free conductors. Horizontal conductor pull: of all conductors.
	Vertical forces	as per loading condition A.
C	Horizontal forces	Reduction of the horizontal conductor pulls of all conductors in one adjacent span 95% Horizontal conductor pull of all conductors in the other adjacent span.
	Vertical forces	as per loading condition A
D	Horizontal forces	Discontinuation of the horizontal pull of one conductor resp. one bundle conductor in one adjacent span and reduction of the horizontal conductor pull of this conductor resp. bundle conductor in the other adjacent span to the following percentages: for single conductors 40 % for bundle conductors 20 % of the entire bundle conductor Horizontal conductor pull in all other conductors
	Vertical forces	as per loading condition A For the conductor or bundle conductor with discontinued horizontal conductor pull the upward or downward pull is discontinued. For the conductor or bundle conductor with reduced horizontal conductor pull the upward or downward pull is to be reduced to the same percentage as the horizontal pull.

Clause National regulation(ncpt) **AT.3** :**Table 4.3.10.4/AT.3 - Load cases for tension and angle tension towers
(analogously for terminal tension towers)**

Normal loading conditions		
A	Horizontal forces	Wind Load: Wind perpendicular to the direction of the line, in case of angle tension towers in the direction of the bisectors or in that of the main axis of the support which deviates least from the direction of the resultant horizontal conductor pull, acting upon: tower, equipment, and ice-free conductors. Horizontal conductor pull: of all conductors
	Vertical forces	Permanent Loads Upward and downward pulls Weight of the normal additional load on crossarms, equipment, and conductors of the adjacent span halves Construction Load Selfweight of support Normal additional loads and construction loads are to be taken into account for the rating of those components for which the additional consideration of those loads along with the other vertical loads produces the less favourable stressing
B/C	Horizontal forces	Wind Load: Wind in direction of the line, in the case of angle tension towers perpendicular to the bisectors of the angle or vertical to that main axis of the support which deviates least from the direction of the resultant horizontal conductor pull, acting upon: tower, equipment, and ice-free conductors. Reduction of horizontal conductor pulls of all conductors in one adjacent span to 50 %. Horizontal conductor pull of all conductors in the other adjacent span.
	vertical forces	as per loading condition A. In the case of conductors with reduced horizontal conductor pulls the upward and downward pulls are to be reduced to 50 %.
D	Horizontal forces	Discontinuation of the horizontal pull of one tensioned conductor or bundle conductor whilst the full horizontal conductor pull is being considered by all other conductors tensioned on the tower.
	Vertical forces	as per loading condition A For the conductor or bundle conductor with discontinued horizontal conductor pull the upward or downward pull is discontinued.

Clause National regulation

(ncpt) **AT.4:**

Table 4.3.10.4/AT.4 - Load cases for tapping towers

Normal loading conditions		
A	Horizon- tal forces	Wind Load: Wind in the direction of that main axis of the tower which deviates least from the resultant horizontal conductor pulls. acting upon: the tower, equipment, and conductors free of ice. Horizontal conductor pull: of all conductors
	Vertical forces	Permanent Loads Upward and downward pulls Weight of the normal additional load on crossarms, equipment, and conductors of the adjacent span halves Construction Load Selfweight of support Normal additional loads and construction loads are to be taken into account for the rating of those components for which the additional consideration of those loads along with the other vertical loads produces the less favourable stressing
B	Horizon- tal forces	Wind Load: Wind perpendicular to that main axis of the tower which deviates least from the resultant horizontal line pulls, acting upon: the tower, equipment, and conductors free of ice. Horizontal conductor pulls of all conductors
	vertical forces	as per loading condition A.
C	Horizon- tal forces	Wind Load: Wind perpendicular to that main axis of the tower which deviates least from the resultant horizontal line pulls, acting upon: the tower, the equipment, and the ice-free conductors. Terminated Conductors: Reduction of the horizontal conductor pulls of all conductors in an adjacent span or more adjacent spans to 50%. In case of wooden tapping poles in A-pole form only the conductor pulls of non-terminated conductors need to be considered for the through conductor. Horizontal conductor pulls of all conductors in all other adjacent spans. Non-terminated Conductors: Reduction of the horizontal conductor pulls of all conductors in an adjacent span or more adjacent spans to 95% Horizontal conductor pull of all conductors in the other adjacent spans.
	Vertical forces	as per loading condition A In the case of terminated conductors with reduced horizontal conductor pulls the upward and downward pulls are to be reduced to 50%.
D	Horizon- tal forces	Horizontal forces Terminated Conductors: Discontinuation of the horizontal conductor pull of a conductor or bundle conductor in a span of the through system whilst in the other span the full horizontal conductor pull is exerted, and possible simultaneous discontinuation of the horizontal conductor pull of a conductor or bundle conductor of the tapping system. Horizontal conductor pull in all other conductors of the adjacent spans. Horizontal forces Non-terminated Conductors: Discontinuation of the horizontal conductor pull of a conductor or a bundle conductor in an adjacent span and reduction of the horizontal conductor pull of this conductor or bundle conductor in the other adjacent span of each conductor system to the following percentages: for single conductors 40%, for bundle conductors 20% of the entire bundle conductor. Horizontal conductor pull in all other conductors.
	Vertical forces	as per loading conditions A In the case of the terminated conductors with discontinued horizontal conductor pull the upward or downward pull is discontinued. In the case of nonterminated conductors for which the horizontal conductor pull is discontinued, the upward or downward pull is also discontinued. In the case of conductors with reduced horizontal conductor pull the upward or downward pull is reduced to the same percentage as for the horizontal conductor pulls.

Clause National regulation

(ncpt) **AT.4:** For timber poles of lines Group II with nominal insulation 45¹⁾ the following applies:

Table 4.3.10.4/AT.4 - Loading assumptions for timber poles

Timber poles lines group II nominal insulation 45 kV ¹⁾	Loading assumption
Suspension and angle suspension towers	Table 4.3.10.4/AT.1 A, B, C
Tension and angle tension towers	Table 4.3.10.4/AT.2 A, B/C
Tapping poles	Table 4.3.10.4/AT.3 A, B, C
¹⁾ Calculation of wooden towers of other Group II -lines (above 45kV) which remain in service for only a short period is also covered here, provided that they do not violate the Protective Zone of a facility where Enhanced Safety applies. In the event of violation of the said Protective Zone, complete loading conditions apply also for timber poles as from 4.3.10.4/AT.1 ...AT.3 of lines Group II which remain in service for only a short period of time.	

(ncpt) **AT.5:** Depending upon the purpose for which they are used, distinctions are drawn between:

- (1) Suspension and angle suspension towers
- (2) Tension and angle tension towers
- (3) Tapping poles

(ncpt) **AT.6:** Table 4.3.10.4/AT.1 shows the loading conditions under which these supports are to be rated. Table 4.3.10.4/AT.2 to Tabelle 4.3.10.4/AT.4 show the loading assumptions for these loading conditions

(ncpt) **AT.7:** If, under special conditions, it is to be assumed that conductor pulls will be reduced or discontinued completely, it must be assumed that as a result the relevant least favourable stressing of the component to be rated will apply.

(ncpt) **AT.8:** If suitable measures are adopted at suspension towers and angle suspension towers to ensure that there is no stress as per loading conditions D (discontinuation of the conductor pull of one conductor) or loading conditions C (differential pull), these loading conditions need not be taken into account. However, if the said measures ensure only partial relief, the percentages shown in Table 4.3.10.4/AT.1 must be adjusted to the extent of the effective relief. Reference for loading condition C is on the basis of the assumption that the conductor on one side of the tower is stressed with the normal additional load at -5°C whilst on the other side there is no additional load. Reference for loading condition D is on the basis of the assumption that on one side of the tower a conductor or a conductor of a bundle conductor has ruptured whereby on the opposing side the conductor pull reduced by the said special measures must be taken into account.
In the case of lines equipped with suspension strings it may be additionally assumed for the purposes of loading conditions C and D that between the tower in question and the next conductor termination there are three level spans with normal span lengths and similarly equipped suspension towers.

(ncpt) **AT.9:** If towers of a multiple-circuit line are initially only partially utilised, this is to be taken into account in the rating.

(ncpt) **AT.10:** In unusual cases, under particularly unfavourable climatic conditions, it may be necessary to assume an additional loading assumption with wind pressure on ice-covered components

Clause National regulation

(ncpt) **AT.11:** If multiple strings are used, for the purpose of rating these supports and the components of these supports are also to be rated for the case of an individual string failing in the most unfavourable position.

4.3.11 Partial factors for actions

(ncpt) **AT.1:**

Table 4.3.11/AT.1 - Partial factors for actions - Ultimate limit states
Values given below supersede those given in tables of Part 1

Type of tower	Partial factors γ	Loading condition			
		A	B	C	D
Suspension and angle suspension towers	γ_G	1,3	1,3	1,3	1,3
	γ_W	1,3	1,3	n.a.	n.a.
	γ_I	1,3	1,3	1,3	1,3
	γ_A	n.a.	n.a.	n.a.	n.a.
	γ_C	1,3	1,3	1,3	1,3
Tension and angle tension towers	γ_G	A	B/C		D
	γ_G	1,3	1,3		1,3
	γ_W	1,3	1,3		1,3
	γ_I	1,3	1,3		1,3
	γ_A	n.a.	n.a.		n.a.
Tapping towers	γ_G	A	B	C	D
	γ_G	1,3	1,3	1,3	1,3
	γ_W	1,3	1,3	n.a.	n.a.
	γ_I	1,3	1,3	1,3	1,3
	γ_A	n.a.	n.a.	n.a.	n.a.
	γ_C	1,3	1,3	1,3	1,3
Remarks: γ_G = Partial Factor for Self Loads γ_W = Partial Factor for Wind Loads γ_I = Partial Factor Additional Loads γ_A = Partial Factor Exceptional loads γ_C = Partial Factor for Conductor Pull n.a. not applicable					

Clause National regulation**5 Electrical requirements****5.4 Internal and external clearances****5.4.2.1 General considerations and underlying principles**

(A-dev) **AT.1** Overhead HV-lines are to be so constructed that:

- (1) conductors which are live are kept at such a distance from one another and from earthed components of their supports that electrical arc-over will be avoided. This condition can be said to be satisfied if the internal clearances required in 5.4.3 are not fallen short of.
- (2) the chance contacting of parts under voltage without the use of any special means is prevented. This condition is regarded as being satisfied if
 - (2.1) the values stipulated in relevant clauses for the clearances between live conductors and the ground are not fallen short of, and
 - (2.2) the lateral clearance between live conductors and facilities as stipulated in relevant clauses are not fallen short of. If the lateral clearances are fallen short of with the result that the overhead line runs in the vicinity of facilities (as per 5.4.5.2 to 5.4.5.5) the current carrying conductors must be so arranged that the clearance stipulated in the relevant clauses is not fallen short of.
- (3) their supports and the foundations of their supports are built at an adequate distance from certain facilities. This condition is fulfilled when at least the measurements for these lateral clearances are observed.
- (4) the additional measures called for in the event of line routing in the vicinity of certain facilities are adopted. In this context distinctions are drawn between different types of facilities.
- (5) In the case of facilities not specified in 5.4.5.2 to 5.4.5.5 these present regulations for the determination of clearances and safety measures are to be applied analogously. There are separate technical regulations concerning clearances and safety measures to be adopted when working in the vicinity of overhead high-tension power transmission lines (ÖVE-E5 resp. ÖVE EN 50110-1 and ÖNORM B 4007).

(A-dev) **AT.3** : In addition to the prescriptions found in relevant items of clause 5 the following applies:

When crossing or routing **conductors within the protective zone of certain objects** or facilities, the following measures for „**Enhanced Safety**“ are to be considered if requested in the relevant clauses.

Measures for enhanced safety:**(1) Line routing**

In the event of a shortfall in the relevant lateral clearance in the vicinity of a facility with the result of a conductor runs within the protective zone acc. to 2.1/AT. 5 of a facility, unimportant whether the object is crossed or not, the demanded clearances must be adhered to. Measures for enhanced safety acc. to 5.4.2.1/AT.3 and 5.4.2.1/AT.4 are to be adopt acc. to tabe 5.4.2.1/AT.5.

Clause National regulation

(2) Attaching of conductors

(2.1) Pin insulators on suspension towers

- (2.1.1) The conductor carrying current is to be fastened to a pin insulator by means of a clamp construction, bridle ring or insulator lashing spiral. Simply securing by means of wire lashing is not permitted.
- (2.1.2) In the case of angle towers the conductor is to be so arranged that the resulting pull of the conductor will be initiated directly or via fittings.

(2.2) Insulator stings as tension insulators

- (2.2.1) On tension towers the conductors are to be fastened by means of multiple tension set strings as per 5.4.2.1/AT.3 (2.2.2) at the span in direction of the crossing span.
- (2.2.2) In the case of multi-unit insulator strings the tensioning is to be such that, in the event of an individual string failing, the electromechanical or mechanical nominal load for the remaining insulators and the maximum loads as per 2.1/AT.25 to 28 of the remaining fittings are at least equivalent to the pull of the conductor under exceptional loading conditions.

(2.3) Insulator strings on suspension towers

Multi-unit insulator strings are to be used in the crossing span. In the event of one single insulator string failing, the electromechanical or mechanical nominal load for the remaining insulators and the maximum loads as per 2.1/AT.25 bis 28 of the remaining fittings are at least equivalent to the loading under exceptional loading conditions.

(A-dev) **AT.4: Additional requests and measures for enhanced safety**

(1) Additional requests and measures for objects acc. to 5.4.5.3/AT13, 5.4.5.3/AT19, 5.4.5.3/AT20 and 5.4.5.3/AT22

- (1.1.1) On tension towers the conductors are to be fastened by means of multiple tension set strings as per 5.4.2.1/AT.3 (2.2.2) at the span in direction of the crossing span.
- (1.1.2) The conductors are to be fastened on suspension towers acc. to 5.4.2.1/AT.3 (2.1) and 5.4.2.1/AT.3 (2.3), when the suspension towers
- making the end of a crossing span
 - making a span within a protective zone (see 2.1/AT. 4) of facilities acc. to 5.4.5.3/AT10, 5.4.5.3/AT13, 5.4.5.3/AT14, 5.4.5.3/AT119, 5.4.5.3/AT20, 5.4.5.3/AT22 and 5.4.5.4/AT4 begrenzen.

In the case of earthed supports with pin or solid core pin insulators two insulators must be arranged perpendicularly to the direction of the line or in the direction of the bisector of the angles. The fastening of the conductor and of the safety jumper (made of the same material and having the same cross-section as the conductor) to the insulator is to be as per 5.4.2.1/AT.3 (2.1.1) and 5.4.2.1/AT.3 (2.1.2)

Clause National regulation

- (3) Ground wires are to be terminated on the tension tower in the section.

(1.2) In case of wooden poles the following applies:

- (1.2.1) They are to be provided with footing which may not be constructed of wood.
- (1.2.2) Tension towers must be A-poles (cross-braced, A-pole plane in the line direction) or a combination of A-poles.
- (1.2.3) Angle suspension towers must be A-poles (A-pole in the bisectors of the angles).
- (1.2.4) Tower top configurations must be designed as steel constructions. They are not to be secured by means of wood thread screws. Bent pins/supports are not permitted.
- (1.2.5) Oil switches and transformers may not be mounted on suspension towers. They may be mounted on tension towers if their connections to the conductors (jumpers) are not connected to conductors which are under tension.

(2) Additional requests for the crossing of objects acc. to 5.4.5.3/AT.10, 5.4.5.3/AT.14 and 5.4.5.4/AT.4

Where a conductor crosses objects acc. to 5.4.5.3/AT.10, 5.4.5.3/AT.14 and 5.4.5.4/AT.4 shortfalls of the required protective clearances in each case are not permitted, even allowing for the following unusual position of the conductor:

- (1) The crossing span of the line is under the regular additional load and all other spans of the line are not under load (unequal ice-load).
- (2) Failure of an individual string of a multi-termination in case of regular loading condition. In this case deflection of the conductor due to wind need not be taken into account.

Clause National regulation

(A-dev): **AT.5** – Overview measures for objects of greater importance

1			2	3	4	5	6	
1			Protective zone and crossing span	Protective zone		Crossing span		
2	Measures		For	Enhanced safety				
3			Acc.	5.4.2.1/AT.3	5.4.2.1/AT.4			
4	Section	Object		In the concerned span		In the section, which includes the concerend span		In the concer ned span
5	5.4.5.3/AT.9(1)	federal motorways type S and B, country roads		yes	-	-	-	-
6	5.4.5.3/AT.9(2)	traffic areas, etc.		yes	-	-	-	-
7	5.4.5.2/AT.3	residential – and school buildings, industrial or trading complexes, and similar		yes	-	-	-	-
8	5.4.5.3/AT.15	tramcar, trollybus wires, freight railways and electrical towing systems		yes	-	-	-	-
9	5.4.5.5/AT.1	sports grounds		yes	-	-	-	-
10	5.4.5.4/AT.1	overhead power lines		yes	-	-	-	-
11	5.4.5.3/AT.17	freight-carrying cable railways, agricultural and forestry ropeways		yes	-	-	-	-
12	5.4.5.3/AT.18	funicular railways for goods transport		yes	-	-	-	-
13	5.4.5.4/AT.3	overhead telecommunication lines, group A		yes	-	-	-	-
14	5.4.5.2/AT.6	outdoor antenna installations		yes	-	-	-	-
15	5.4.5.3/A T.19	cable lifts	providing public passenger transport service	yes	yes	-	-	yes
16	5.4.5.3/A T.20	cable railways		yes	yes	yes	yes	yes
17	5.4.5.3/A T.22	funicular railways		yes	yes	-	yes	yes
18	5.4.5.3/A T.13	waterways		yes	yes	-	-	yes
19	5.4.5.3/A T.14	railways for public passenger service		yes	yes	yes	yes	yes
20	-	branch lines		yes	yes	-	-	yes
21	5.4.5.4/A T.4	overhead telecommunication lines, group B		yes	yes	yes	yes	yes
22	-	Overhead telecommunication lines for cable lifts acc. 5.4.5.3/AT.19		yes	yes	-	-	yes
23	5.4.5.3/AT.10	motorways type A		yes	yes	-	-	yes

Clause National regulation**5.4.3 Clearances within the span and at the tower**

(ncpt) **AT.2** : If conductors are made of the same material, having the same cross-section and the same sag, it is permissible to determine the minimal distance D between the non-deflected conductors in the middle of a span from the formula :

$$D = k \times \text{SQR}(f + L) + Z$$

whereby the value 0,8 metres may not be fallen short of.

- D is the distance between conductors in metres in the middle of the span;
 f is the sag in the middle of the span in metres for those normal loading conditions according to Table 4.3.10.3AT.2, which produces the greater value;
 L is the length of the insulator string in metres (if the conductors are so fixed at the support that any deflection of insulators in a direction vertical to the axis of the line is prevented, then L = 0);
 Z is a supplement in metres which is allocated in Table 5.4.3/AT.10 depending on the nominal insulation of the line;
 k is the factor derived from Table 5.4.3/AT.3 which depends on the angle of deflection of the conductor and on the conductor arrangement on the support.

On overhead lines with covered conductors acc. to 2.1/AT.3, the calculated minimal distance D acc. 5.4.3/AT.2 may be reduced on 40 % in the middle of the span, in which 0,5 m may not be fallen below.

(A-dev) **AT.10** :

Table 5.4.3/AT.10 – Distances
(all values not indicated are given in metres)

Group		I						Application according to clause
Nominal Insulation		10	15	20	25	30 3)	45	
Peak Operating Voltage (effective value) kV		12	17,5	24	30	36 (37,5)	52	
Z as a function of the nominal insulation		0,12	0,17	0,20			0,30	5.4.3 span
Distance E from components	non deflected parts or cond.	0,12	0,17	0,22	0,26	0,30	0,40	5.4.3 tower
	deflected parts or cond.	0,12	0,17	0,20			0,30	
normal air clearance ¹⁾		0,12	0,17	0,22	0,26	0,32	0,48	5.4.3 / AT.7
increased air clearance ²⁾		0,15	,205	0,26	0,32	0,38	0,57	
¹⁾ Minimal clearance (internal) between conductors of the same system. ²⁾ Minimal clearance (internal) between conductors of one system to conductors of another system. ³⁾ Where extending existing 35 kV networks with peak operating voltage of 37,5 kV insulation may be in accordance with nominal insulation of 30 kV.								

Clause National regulation

5.4.4 Clearances to ground in areas remote from buildings, roads, railways and navigable waterways

(A-dev) **AT.1 : Clearances to ground in unobstructed countryside** (expression in German: „Geländeoberfläche“): the following applies:

additional requirements: none .

Clearances between conductors and the ground are to be measured right-angled to the surface of the ground. Minor unevenness in the ground may be ignored here.

Clearance of conductors

- | | |
|--|-----|
| (1) under normal conditions | |
| (1.1) above normal ground | 5 m |
| (1.2) above ground inaccessible to heavy road vehicles carrying high loads | 5 m |
| (1.3) above steeply sloping ground, normally not frequented | 4 m |
| (1.4) from rock faces, laterally measured rectangular to rock face | 3 m |
| (2) under exceptional loading conditions in cases (1.1)...(1.4) | 3 m |

 Text deleted 

(A-dev) **AT.3 : Clearances to trees under the line and to trees beside the line (Forest aisles and isolated trees and shrubs)**, the following applies:

additional requirements: none .

The following minimum clearances may not be fallen short of. They apply to the branch-free space, i.e. these minimum clearances may not be violated by treetops or branches either. Should the safety of operational of the line so require, these clearances are to be increased as necessary (diseased, hanging, or shallow-rooting trees, on steep slopes or where there is a risk of landslide, etc.). The height to which trees will grow until ready for harvesting, the nature of the soil, breakdown of the tree population, and the prevailing wind directions shall be taken into account.

Minimum Clearances

- | | |
|--|-------|
| (1) laterally of the conductor | 3 m |
| (2) below the conductor | |
| (2.1) under normal loading conditions | 3 m |
| (2.2) under exceptional loading conditions | 0,5 m |

Provided that it is not an overhead line with covered conductors, the protective zone determined by the lateral clearance according to 5.4.4 AT.3 (1) is to be kept free of branches above the conductor to the full height of the tree. Overhead lines with covered conductors has to be kept free of branches above the conductor at least to the height of 3 m.

Clause National regulation

At the crossing of woods (lanes) or with the line routing along to the forest the lateral distance for overhead lines with covered conductors may be reduced to 1,5 m. This distance is valid also to bare, voltage-carrying parts in the immediate area of the pylon (e.g. conductor attachment, earthing connections, clamps).

In order to facilitate the maintenance of overhead lines in forested areas any necessary timber or trimming of trees should be carried out regularly.

5.4.5.2 Clearances to residential and other buildings

(A-dev) **AT.4** : For all buildings mentioned in 5.4.5.2/AT.2 and 5.4.5.2/AT.3 the following applies:

- | | |
|---|-------|
| (1) lateral distance of conductors from the nearest part of the building | 3 m |
| (2) clearance of conductors from nearest part of building | |
| (2.1) under normal loading conditions | 3 m |
| (2.2) under exceptional loading conditions | 2,5 m |
| (3) clearance of conductors from flat roofs having up to 15 degree pitch, and flat constructions such as balconies and terraces, etc. | |
| (3.1) under normal loading conditions | 4 m |
| (3.2) under exceptional loading conditions | 2,5 m |

(4) Mounting overhead lines at residential- or school buildings, industrial or trading complexes etc., external or internal substations: in sectors of the said mounting/tensioning areas of conductors the above mentioned clearances to facilities need not to be considered, Enhanced Safety applies.

Danger of electricity shall be payed attention to with measures which are to be considered as best appropriated (e.g. warning boards, barriers on roofs, etc.). Doors and windows may not exist within the mentioned clearances (windows if they are not locked properly or it is not prevented to come into contact with live parts).

(5) If the buildings belong to the same power supply station as the line (power station, transforming station, switching station) then smaller clearances are permissible, Enhanced Safety applies.

AC₁ (6) In the case of industrial and trading complexes, the special nature of the operations carried out (e.g. installations entailing a risk of fire or explosion) and also the operating/working space taken up by loading equipment, cranes, etc., must be taken into account, Enhanced Safety applies. **AC₁**

(7) Clearances of overhead lines to biogas installations

(7.1) General

(7.1.1) Definitions

(7.1.1.1) Biogas installation: An installation used in order to produce, process, store and/or use biogas.

(7.1.1.2) Objects: All containers and gasholders used to produce, process, store and/or use biogas.

(7.1.1.3) Discharges: All pipes such as blow-off pipes, discharges of overpressure protections, air dischargers of a biogas installation, irrespective whether they are integrated or separated.

(7.1.2) Protective zone of an object: the protective zone of an object is determined from the plan area which results when the ground plan of that object is enlarged equally on all sides by the extent indicated as follows:

- overhead lines < 110 kV ... 4,0 m

(7.1.3) The outline of the non-deflected conductor shall not intersect the protective zone as defined according to (7.1.2). In addition for deflected conductors EN 50423-3-1:2005 § 5.4.5.2, AT.3, shall apply.

(7.1.4) The protection zone of objects shall be defined irrespective of the following factors:

- single-walled membrane gas tanks – stand-alone type,
- double membrane gas tanks – stand-alone type,
- single-walled membrane gas tanks – stand-alone type with supplementary sheeting for weather protection,
- gasholder for biogas – encapsulated type.

(7.1.5) Discharges are regarded as buildings according to EN 50423-3-1:2005, § 5.4.5.2, AT.2.

(7.1.6) Conductors (stationary or deflected), supports and foundations shall not extend into the explosive areas of the biogas installation (zone 0, 1 and 2). For the conductors the installation rules for normal and exceptional loading conditions apply.

(7.2) Earthing installations

In case earthing installations of pressure vessels converge to the ones of overhead lines separate requirements have to be defined.

Examples for biogas installations: see fig. 5.4.5.2/AT1 and AT2. 

Figure 5.4.5.2/AT1: single-walled membrane gas tank – stand-alone type

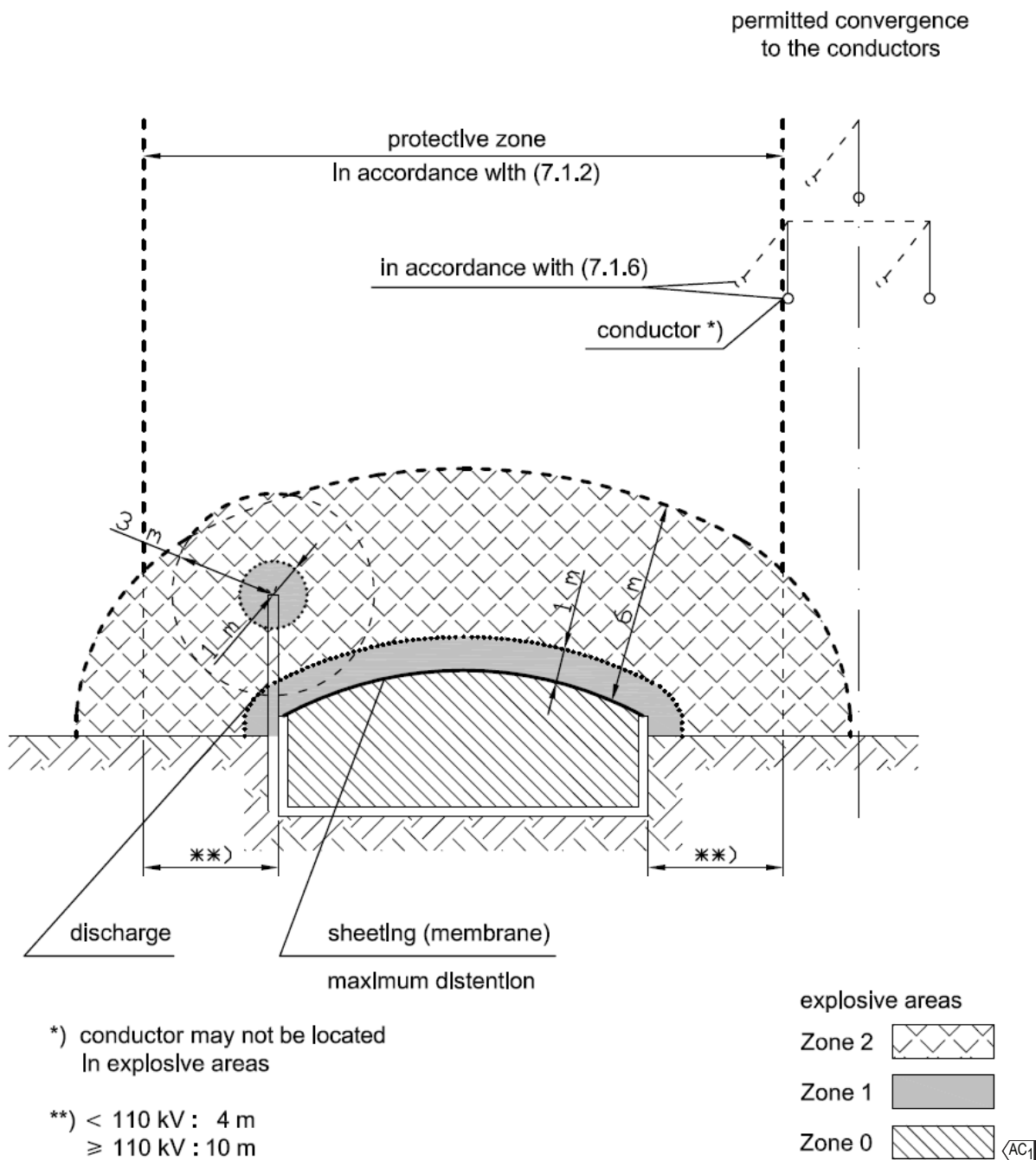
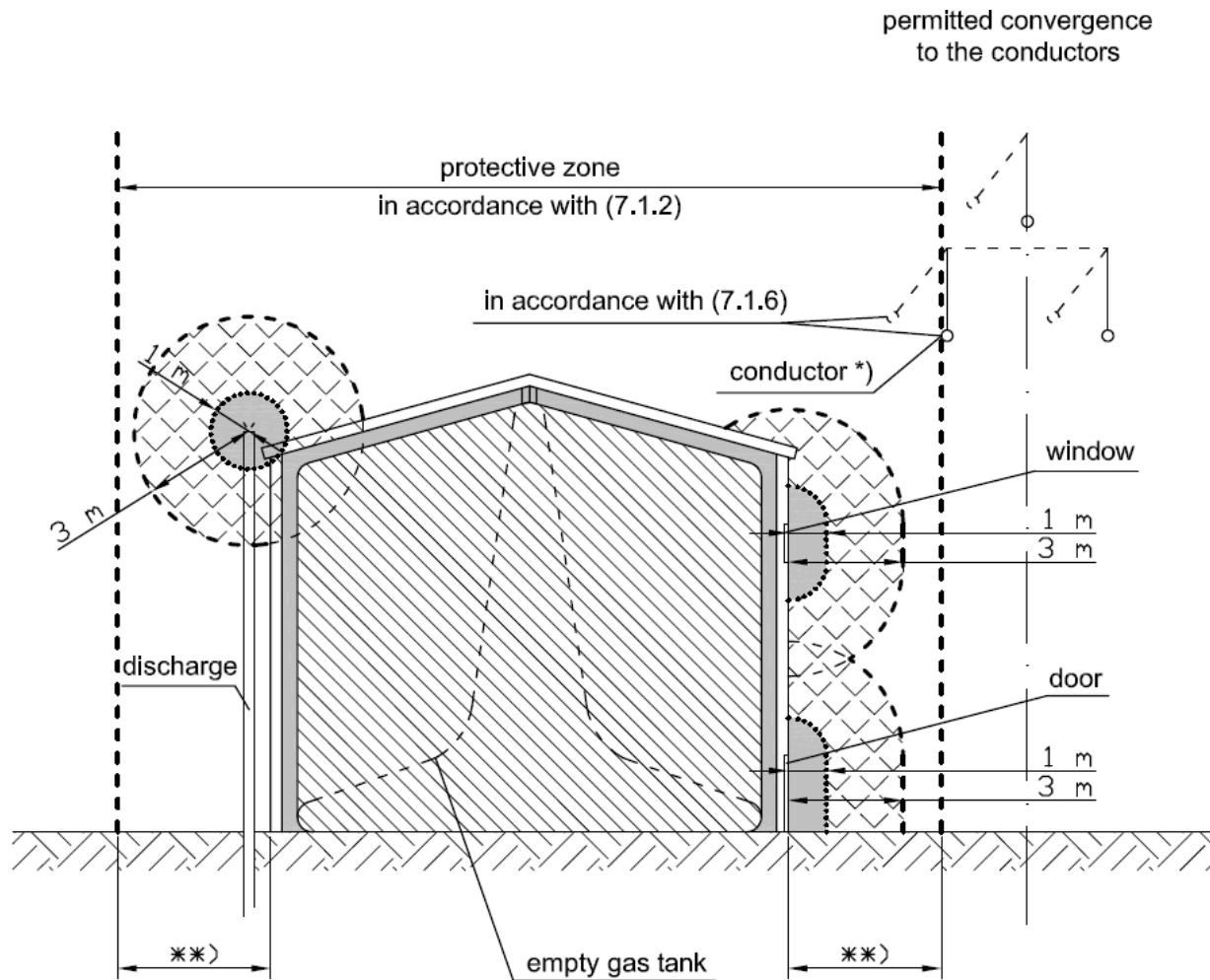


Figure 5.4.5.2/AT2: gas tank – encapsulated type



*) conductor may not be located in explosive areas

**>) < 110 kV : 4 m
≥ 110 kV : 10 m

explosive areas

Zone 2

Zone 1

Zone 0 AC₁

(8) Clearances of overhead lines pressure vessels (gas, liquid gas)

(8.)1 General

(8.1.1) Definition

(8.1.1.1) Pressure vessels (in terms of this specification): stationary containers used to store gases and gas-overlaid materials, whose product of prescribed highest working pressure in bar and capacity in litres exceeds 3.000 (bar × litres).

(8.1.2) Overground (stand-alone) pressure vessels

(8.1.2.1) Object: The overground (stand-alone) pressure vessel, including those valves which are connected to the pressure vessel.

(8.1.2.2) Protective zone of the object for overground (stand-alone) pressure vessels: the protective zone of the object is determined from the plan area which results when the ground plan of that object is enlarged equally on all sides by 5 m (see example A). If explosive areas exceed the protective zone the dimensions for explosive areas shall apply (see protective zone for > 30.000 l liquid gas, fig. 5.4.5.2/AT4). The protective zone is determined irrespective whether the stand-alone pressure vessel is designed for

- gases heavier or lighter than air,
- gases about as heavy as air or,
- liquid gas.

(8.1.2.3) The outline of the non-deflected conductor shall not intersect the protective zone as defined according to (8.1.2.2). Additionally EN 50423-3-1:2005 § 5.4.5.2, AT.3, applies for stationary and deflected conductors.

(8.1.2.4) Conductors (stationary or deflected), supports and foundations shall not extend into the explosive areas (zone 0, 1 and 2). For the conductors the installation rules for normal and exceptional loading conditions apply.

(8.1.3) Imbedded (buried) pressure vessels

(8.1.3.1) Imbedded pressure vessels are covered on all sides with earth or sand with a minimum thickness of 0,5 m.

(8.1.3.2) Only the explosive areas apply to imbedded pressure vessels. Conductors (stationary or deflected), supports and foundations shall not extend into the explosive areas (zone 0, 1 and 2). For the conductors the installation rules for normal and exceptional loading conditions apply.

(8.1.4) Pressure vessels in fire-resistive rooms

(8.1.4.1) Only the explosive areas apply to pressure vessels which are located in fire-resistive rooms (ÖNORM B 3800). Conductors (stationary or deflected), supports and foundations shall not extend into the explosive areas (zone 0, 1 and 2). For the conductors the installation rules for normal and exceptional loading conditions apply.

(8.1.4.2) EN 50423-3-1:2005, § 5.4.5.2, AT.3, apply to the building. ACI

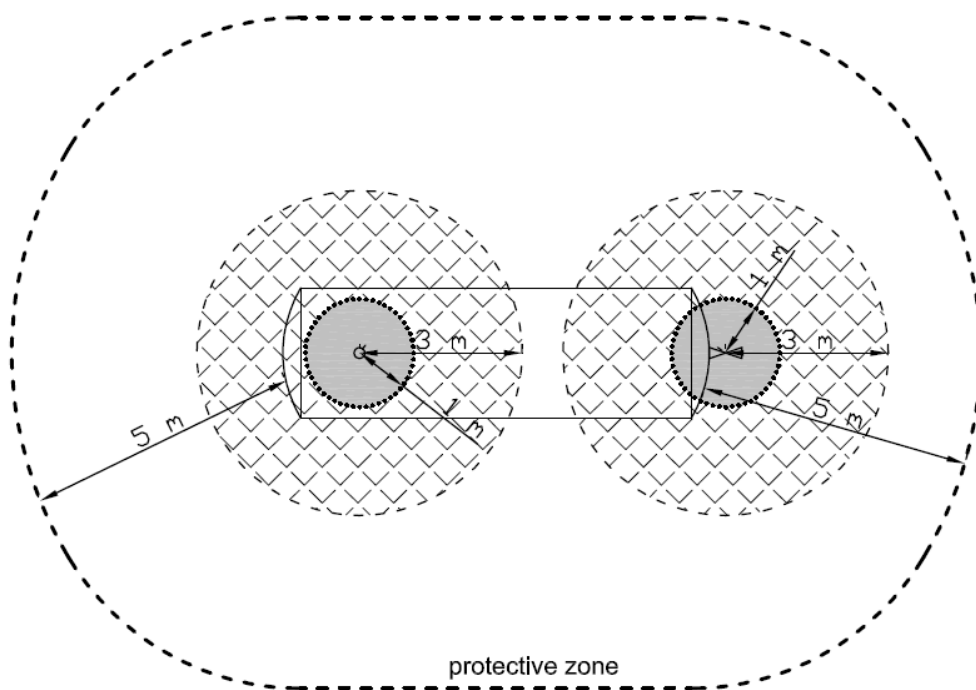
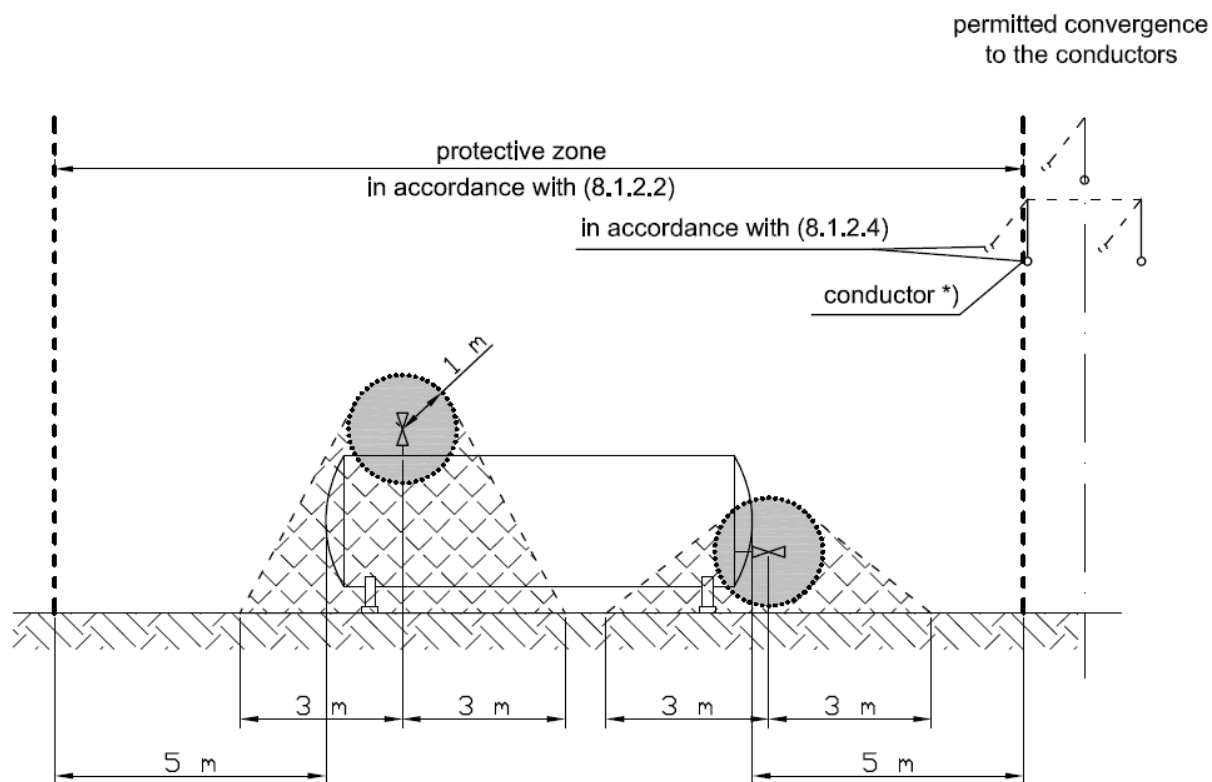
 Clause National regulation

(8.2) Earthing installations

In case earthing installations of pressure vessels converge to the ones of overhead lines separate requirements have to be defined.

Examples for pressure vessels: see fig. 5.4.5.2/AT3 and AT4. 

Figure 5.4.5.2/AT3: protective zone of pressure vessels, e.g. for methane



explosive areas

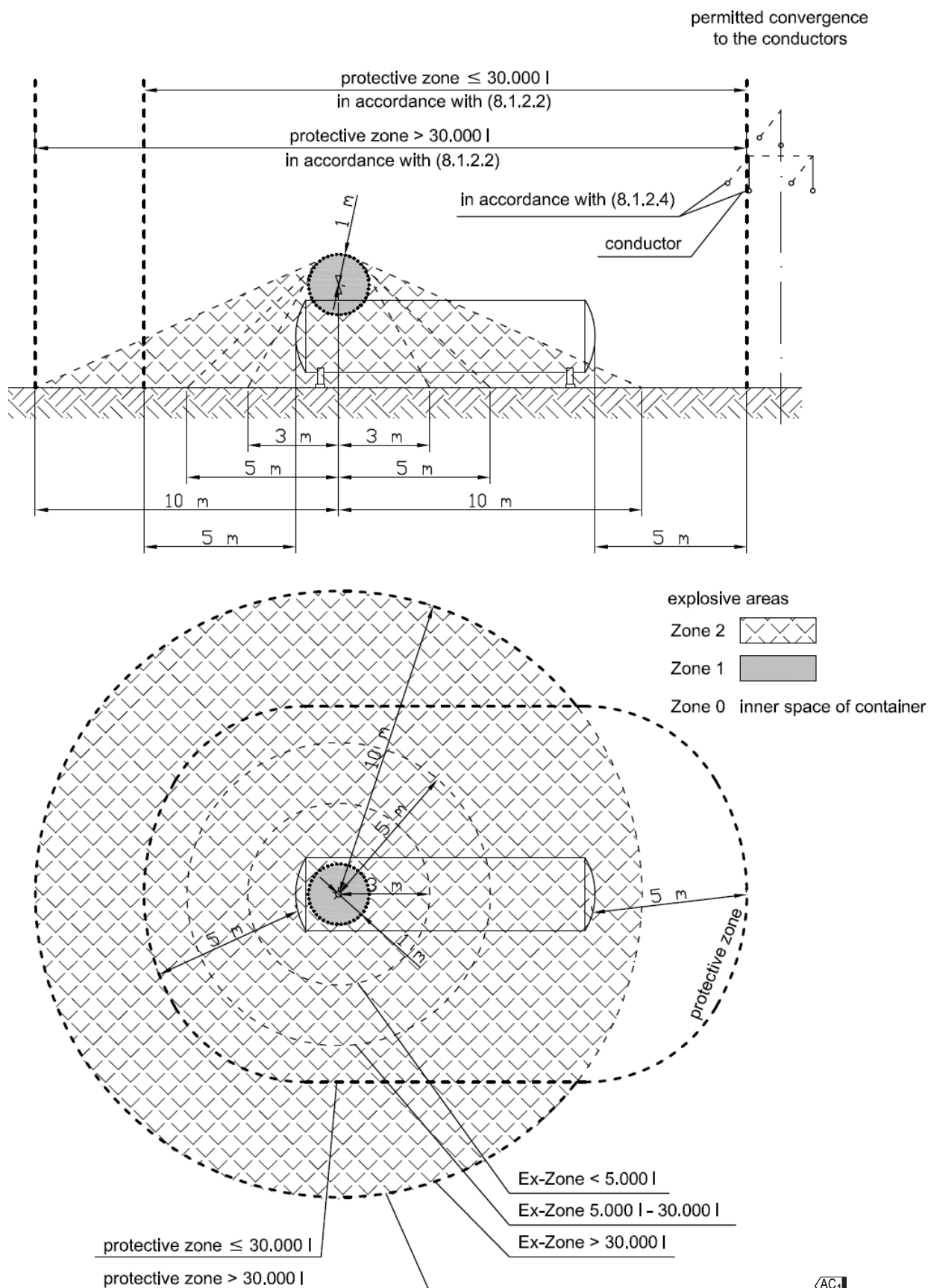
Zone 2

Zone 1

Zone 0 Inner space of container

AC₁ Clause National regulation

Figure 5.4.5.2/AT4: protective zone of pressure vessels, e.g. for liquid gas



AC₁

(9) Clearances of overhead lines to petrol stations

(9.1) General

(9.1.1) Definition

Petrol stations are stationary installations used to provide land, water and air crafts with liquid fuel from dispensing devices (e.g. petrol pumps), including storage tanks.

(9.1.2) EN 50423-3-1:2005, § 5.4.5.2, AT.3, apply to petrol stations in accordance with 1.1. Additional requirements shall be applied in accordance with the following specifications.

(9.1.3) Conductors (stationary or deflected), supports and foundations shall not extend into the explosive areas (zone 0, 1 and 2). For the conductors the installation rules for normal and exceptional loading conditions apply.

Example for the protective zone of petrol stations: see fig. 5.4.5.2/AT5.

(9.1.4) Overground stand-alone containers for flammable liquids, hazard categories I and II¹

(9.1.4.1) Protective zone for overground (stand-alone) containers for flammable liquids: the protective zone is determined from the plan area which results when the ground plan of the container is enlarged equally on all sides by 5 m.

(9.1.4.2) The outline of the non-deflected conductor shall not intersect the protective zone as defined according to (9.1.4.1) Supports and foundations shall not extend into the protective zone.

(9.1.4.3) When the explosive areas are additionally covered by non-combustible materials, EN 50423-3-1:2005, § 5.4.5.2, AT.3, shall apply.

(9.1.5) Imbedded containers for flammable liquids, hazard categories I and II¹

(9.1.5.1) Only the explosive areas apply to imbedded containers (e.g. filler piece, ventilation). Conductors (stationary or deflected), supports and foundations shall not extend into the explosive areas (zone 0, 1 and 2).

(9.1.5.2) The lateral distance of the foundations of the supports from imbedded containers shall be chosen in a way that safeguards the stability of the overhead line. The minimum distance, however, shall never fall short of 1 m.

(9.2) Natural gas stations

For compressor units of natural gas refuelling stations (stand-alone, in housings or in fire-resistive rooms) the requirements for pressure vessels (subclause (8)) shall apply.

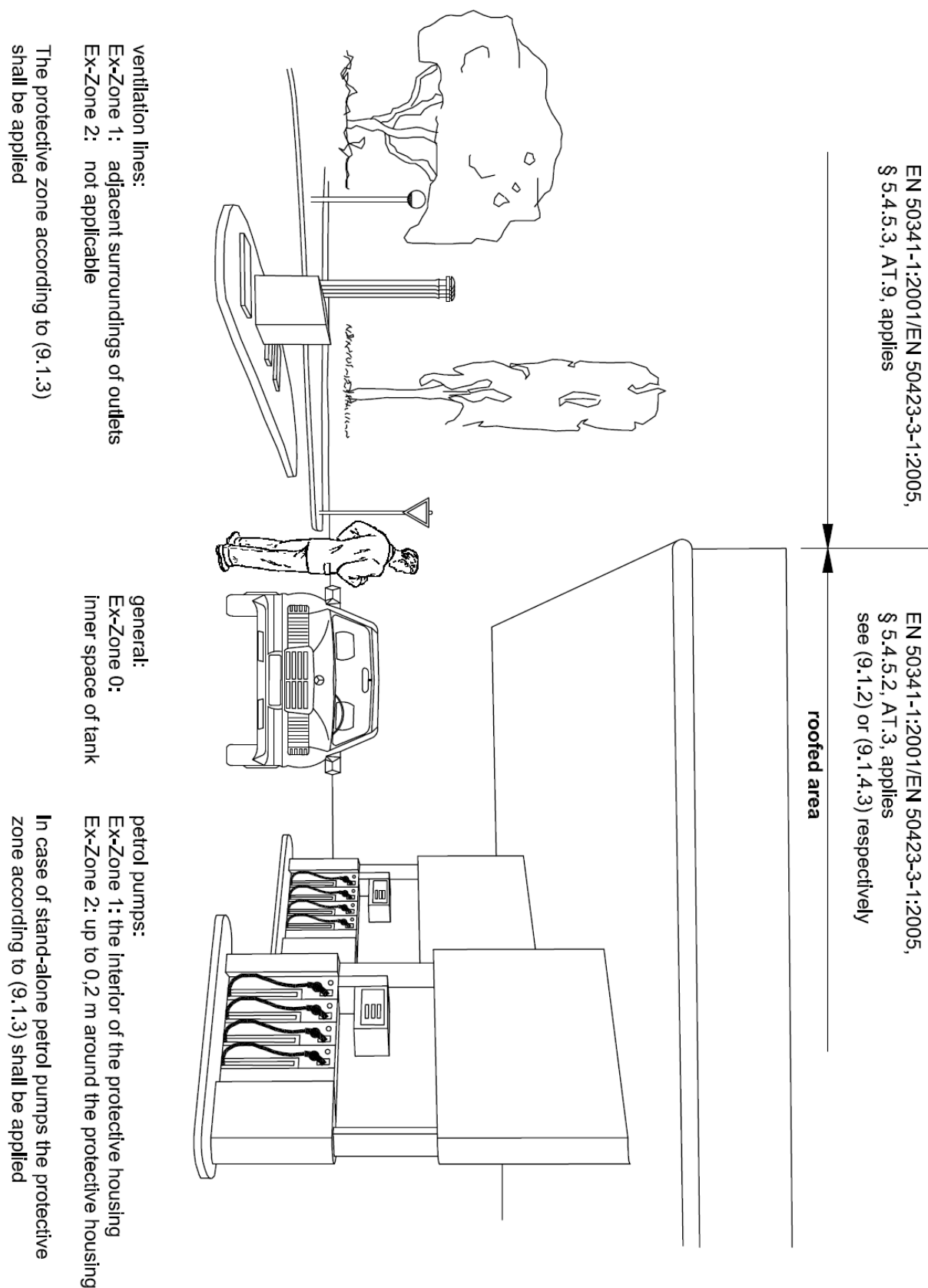
(9.3) Earthing installations

In case earthing installations of containers converge to the ones of overhead lines separate requirements have to be defined.

¹ according to Federal Decree 240/1991 on flammable liquids, „Verordnung über brennbare Flüssigkeiten – VbF“ 

AC Clause National regulation

Figure 5.4.5.2/AT5: protective zone of petrol stations, exemplary illustration. The explosive areas have to be defined for each case according to the authorization of the petrol station.



Clause National regulation(A-dev) **AT.5 : For street lamps, flag poles, advertising signs and similar structures**

the following applies: additional requirements: none.

Regarding clearances consider them like buildings

- | | |
|--|-------|
| (1) lateral distance of conductors from the nearest part of the facility | 3 m |
| (2) clearance of conductors from the nearest part of the facility | |
| (2.1) under normal loading conditions | 3 m |
| (2.2) under exceptional loading conditions | 2,5 m |

(A-dev) **AT.6 : Outdoor antenna installations**(1) for Outdoor antenna installations (**not mounted on line supports**)

the following applies: Measures for „Enhanced Safety“.

These include: outdoor antennae structures, antenna supports, antenna cables, jumpers and lines, supplementary components, and earthing devices of the same. Overhead HV-lines are not permitted to cross under outdoor antenna systems.

- | | |
|--|-------|
| (1.1) lateral distance of the conductors from the outdoor antenna system | 2 m |
| (1.2) clearance of conductors from the outdoor antenna system | |
| (1.2.1) under normal loading conditions | 2 m |
| (1.2.2) under exceptional loading conditions | 0,5 m |
| (1.3) clearance of conductors from climbable antenna supports normal loading conditions | 3 m |
| (1.4) Where an outdoor antenna system is located laterally to the overhead HV-line but at a higher elevation, then its lateral clearance from the conductors must be so great that, in the event of the antenna support collapsing there will still be a clearance between the outdoor antenna system and the overhead HV-line of at least | 1 m |

This does not necessarily apply if suitable measures are adopted (anchors, etc.) which would reliably prevent a collapsing of the outdoor antenna system in the direction of the overhead HV-line.

(2) for Outdoor antenna installations (**mounted on line supports**)

If antenna installations are mounted on OHL structures exceeding 1 kV, 5.4.5.2/AT.6(1) does not apply

the following applies: additional requirements: none

- (2.1) If antenna installations are mounted on transmission OHL structures, these structures remain designated as transmission line structures and their dimensioning underlies the relevant regulations for transmission overhead lines valid at the date of their erection.

Clause National regulation

(2.2) Supporting or mounting parts for antennas as well as climbing facilities, platforms, gratings/grillages etc. are to be considered as part of the support and are to be designed according to the current relevant regulations for transmission overhead lines.

(2.3) The determination of loads on antenna supporting parts and on OHL supports arising from antennas, is to be done according to the current relevant regulations for transmission overhead lines.

(2.4) Clearances are^{a)}:

(2.4.1) Clearance of live conductors from the antenna
under normal loading conditions 2 m

(2.4.2) Clearance of not live conductors which are connected with
earthened parts of the OHL support from the antenna
under normal loading conditions 0,5 m

The low voltage grid feeding the antenna installation may not be influenced exceeding permitted values.

^{a)} For design and installation of climbing facilities, platforms and pedestals, reference is made to regulation ÖVE EN 50110-1.

5.4.5.3 Clearances to line near roads, railways and navigable waterways

(A-dev) **AT.7 : bridges**

the following applies: additional requirements: none

In addition for facilities in the vicinity of bridges (e.g. traffic areas, lighting systems, etc.) the clearances appropriate to these facilities must also be taken into account. Apart from that the following apply:

- | | | |
|---------|---|-------------------------|
| (1) | lateral clearance of conductors from the bridge | 3 m |
| (2) | clearance of conductors above the bridge | |
| (2.1) | under normal loading conditions | 3 m |
| (2.2) | under exceptional loading conditions | 2,5 m |
| (3) | clearance of conductors under a bridge | |
| (3.1) | provided the bridge is used as support of the overhead HV-line: | clearances as per 5.4.3 |
| (3.2) | provided the bridge is not used as support of the overhead HV- line | |
| (3.2.1) | under normal loading conditions | 3 m |
| (3.2.2) | as above, but in the case of bounced up conductors | 1 m |

Clause National regulation

(3.3) If the traffic surface of a bridge is less than 5 metres above the live conductors, a protective plane is to be fitted to both sides of the bridge at the level of the traffic surface or just below. This plane has to cover the total width of the line plus two metres on either side whereby this protective plane must project at least 1 metre the traffic area of the bridge.

(A-dev) **AT.8 : municipal roads outside built-up areas** (expression in German: „Gemeindestraßen“) **and other roadways:**

additional requirements: none

- | | | |
|-------|---|-----|
| (1) | lateral distance of conductors from the edge of the road | 4 m |
| (2) | clearances of conductors from the road surface | |
| (2.1) | under normal loading conditions | 6 m |
| (2.2) | under exceptional loading conditions | 5 m |
| (3) | lateral distance of support foundations from edge of the road | 1 m |

(A-dev) **AT.9 : federal motorways, type „S“** (expression in German: „Bundesstraßen S - Schnellstraßen“) **and type „B“** („Bundesstraßen“), **country roads** („Landesstraßen“) and **for traffic areas within built-up areas, traffic areas in industrial and trading complexes, and traffic areas in public parks:**

(1) federal motorways, type „S“ and type „B“, country roads

additional requirements: Measures for „Enhanced Safety“

- | | | |
|---------|--|-----|
| (1.1) | lateral distance of conductors from the edge of the road | 4 m |
| (1.2) | clearances of conductors from the road surface | |
| (1.2.1) | under normal loading conditions | 6 m |
| (1.2.2) | under exceptional loading conditions | 5 m |
| (1.3) | lateral distance between support's foundations and the edge of the road surface provided that the legally declared building ban is relaxed | 2 m |

(2) traffic areas within built-up areas, traffic areas in industrial and trading complexes, and traffic areas in public parks

additional requirements: Measures for „Enhanced Safety“

- | | | |
|---------|--|-----|
| (2.1) | lateral distance of conductors from the edge of the road | 4 m |
| (2.2) | clearances of conductors from the road surface | |
| (2.2.1) | under normal loading conditions | 6 m |
| (2.2.2) | under exceptional loading conditions | 5 m |

Clause National regulation

(A-dev) **AT.10 : motorways type „A“** (expression in German: „Autobahnen“)

additional requirements: Measures for „Enhanced Safety“

- | | | |
|-------|--|-----|
| (1) | lateral distance of conductors from the edge of the road
or from the outer edge of the outer hard shoulder | 4 m |
| (2) | clearances of conductors from the road surface | |
| (2.1) | under normal loading conditions | 6 m |
| (2.2) | under exceptional loading conditions | 5 m |
| (2.3) | in case of conductors being
in unusual position acc. 5.4.2.1/AT.4(2) | 5 m |
| (3) | lateral distance of the support foundations
from edge of the road provided that authorities permit
violation of the legislative building ban which applies | 5 m |

(A-dev) **AT.11 : does not apply**

(A-dev) **AT.12 : waters** (Expression in German: Gewässer“,
Except for Waterways - official shipping waters - which are treated in AT.13 below

additional requirements: none .

Clearance under normal loading conditions

- | | | |
|-------|---|-----|
| (1) | from non-navigable or non-floatable waters | |
| (1.1) | above normal waterlevel | 5 m |
| (1.2) | above highest waterlevel | 3 m |
| (2) | from navigable or floatable waters | |
| (2.1) | above highest navigable water level „HSW“ | 5 m |
| (2.2) | above the highest structural part of the watercraft | 2 m |
| (3) | above the crest of passable flood banks | 6 m |
| (4) | Lateral clearance of support's foundations from bank edge
or from land- or water-side foot of flood banks or berms | 3 m |

Any shortfall of the above clearances are subject to approval of the responsible water board authorities. The orderly use of tow paths (expression in German: „Treidelwege“) may not be obstructed by supports or their foundations.

Clause National regulation(A-dev) **AT.13 : waterways** (official shipping waters – „Wasserwege“)

additional requirements: Measures for „Enhanced Safety“

- | | | |
|-------|--|--|
| (1) | lateral distance of conductors from the edge of river bank or from crest of flood banks | 4 m |
| (2) | clearance of conductors from highest navigable water level according to § 21(2) and § 21(3) of Austrian „Schiffahrtsanlagenverordnung“ under normal loading conditions | 19 m |
| (3) | clearance of conductors above crest of flood banks under normal loading conditions | 6 m |
| (4) | lateral distance of support's foundations | |
| (4.1) | from foot of the flood dam | 5 m |
| (4.2) | from flood dam against cathastrophal flooding: | tower height + 5 m; |
| (4.3) | from riverbanks: | clearances in accordance with instructions issued by waterway authorities. |

(A-dev) **AT.14 : railways for public passenger services** (expression in German: „Schienenbahnen für öffentlichen Verkehr“)

additional requirements: Measures for „Enhanced Safety“

The unobstructed view of signals and level-crossings may not be violated by overhead lines. In the vicinity of railway stations, i.e. in spaces between the home signals and in the vicinity of platforms at railway halts, crossings are to be avoided as far as possible. When crossing trolley wires/facilities the use of wooden towers in the section is not permitted.

For railway power supply lines on own supports regulations according to 5.4.5.4 apply.

- | | | |
|---------|---|-------|
| (1) | Lateral distance between line conductors deflected by wind and the obstruction gauge limit and from trolley wire supports and signalling facilities | 4 m |
| (2) | Electrified railways, Trolley Wires and Power Supply Lines on Trolley Wire Supports | |
| (2.1) | Clearance between line conductors and trolley wires | |
| (2.1.1) | under normal loading conditions | 3 m |
| (2.1.2) | under exceptional loading conditions | 2 m |
| (2.1.3) | in the case of the line conductors being in unusual position acc. 5.4.2.1AT.4(2) | 2 m |
| (2.2) | clearance of line conductors from the power supply line | |
| (2.2.1) | under normal loading conditions | 2 m |
| (2.2.2) | under exceptional loading conditions | 0,5 m |
| (2.3) | clearance of line conductors from supports | |
| (2.3.1) | under normal loading conditions | 3 m |
| (2.3.2) | under exceptional loading conditions | 2 m |

Clause National regulation

- (3) Where electrification is expected, the following is recommended for the free route:
clearance of overhead line conductors from the top edge of
rails under normal loading conditions 12,5 m
- (4) Where no expectation of electrification
 - (4.1) clearance of line conductors from top edge of rails
 - (4.1.1) under normal loading conditions 7 m
 - (4.1.2) under exceptional loading conditions 6 m
 - (4.1.3) in the case of line conductors being in unusual
position acc. 5.4.2.1AT.4(2) 6 m
- (5) Lateral distance of overhead line supports from obstruction gauge limit and from
trolley wires and signalling units provided that the shortfall of the 12 metre building-
ban zone (regulations for railways „Eisenbahngesetz“ is permitted by the Railway
Authorities („Eisenbahnaufsichtsbehörde“) 5 m

(A-dev) **AT.15 : tramcar** (expression in German: „Straßenbahnen“) **and trolleybus wires,**
freight railways („Materialbahnen“), **electrical towing systems** („elektrische
Treidelanlagen“)

additional requirements: Measures for „Enhanced Safety“

For supplying power lines on separate own supports the regulations according to 5.4.5.4 apply

- (1) Lateral distance of the conductors to obstruction gauge limit,
in the case of trolleybus wires from the edge of the road and
from the trolley wire supports. 4 m
- (2) Clearance of the conductors of the line from trolley wires
and from power feed lines on trolley wire supports
 - (2.1) under normal loading conditions, 4 m
 - (2.2) under exceptional loading conditions 0,5 m
- (3) Clearance of conductors from the top edge of the rails
(where there are no overhead wires or power lines on trolley wire poles),
 - (3.1) under normal loading conditions, 7 m
 - (3.2) under exceptional loading conditions. 5 m
- (4) Lateral clearance of the line supports
 - (4.1) from the obstruction gauge limit and from poles for
trolley wire in those cases where the authorities relax
the building ban 5 m
 - (4.2) from trolley wires and from the edge of the road 2 m

Clause National regulation

(A-dev) **AT.16 : Moveable Counterpoises (Tackle Lines)** (expression in German: „Ortsveränderliche Bodenseilzüge“)

additional requirements: none

When determining distances from these systems the risk of the counterpoise being lifted and whipping up should be borne in mind, particularly in synclinal terrain.

clearance of the conductors from the counterpoise under normal loading conditions	2 m
--	-----

If it is intended to use guiding pulleys, guard cradles, and guard wires, etc., the clearances must be determined on a case-to-case basis in order to ensure the necessary electrotechnical security.

(A-dev) **AT.17 : freight-carrying cable railways** (expression in German: „Materialseilbahnen“), **agricultural and forestry ropeways** („land- und forstwirtschaftliche Seilwege“)

additional requirements: Measures for „Enhanced Safety“

Distances of the crossing-over overhead line are to be determined assuming the least favourable position of the cable railway (bouncing up, etc.).

- | | |
|--|-------|
| (1) lateral distance | |
| (1.1) between the conductors and the cable railway cables,
both of which deflected against one another by wind | 2 m |
| (1.2) between the deflected conductors of the overhead HV-line
and constructional parts of the cable railway | 3 m |
| (2) clearance of the conductors from the cable railway | |
| (2.1) under normal loading conditions | 2 m |
| (2.2) under exceptional loading conditions | 0,5 m |
| (3) lateral distance of the line supports from constructional
parts of the cable railway and from its deflected cable | 2 m |

In cases where the clearances indicated above cannot be guaranteed with certainty, barrier guards or other cushioning devices must be erected. Distances of the overhead HV-line from these latter fixtures are to be determined on a case-to-case basis in such a way that electrotechnical safety is assured.

Enhanced Safety measures are not necessary in the case of crossing-over cable railways which are not permitted to carry passengers, similarly in the case of agricultural and forestry ropeways, provided that in each case:

1. by virtue of official ruling, authorisation or order, it can be safely assumed that these services will not be operated during catastrophically weather (heavy snowfall, icing, gales, thunderstorms), or
2. barrier guards or other cushioning devices will be fitted which will reliably prevent contact between the conductors of the transmission line and parts of the cable railway.

The above regulations apply also in the case of telecommunication lines associated with agricultural and forestry supply cableways and routed along the same.

Clause National regulation

Crossing under these facilities or their telecommunication lines by an overhead HV-line is permitted only in exceptional cases where there is no alternative. In such cases the most unfavourable position of the conductors of the line (bouncing up after dropping off of exceptional additional load) and the lowest position of the cable or traction system of the cable railway and the transported goods must be taken into account. Enhanced Safety measures for the overhead HV-line are not necessary.

(A-dev) **AT.18 : Funicular Railways for goods transport** (expression in German: „Standseilbahnen für Güterbeförderung“)

additional requirements: Measures for „Enhanced Safety“

These include inclined hoists, brake inclines, winding engines, and aerial ropeways, etc., (also for industrial/works services). In case of synclinal longitudinal profile of the funicular railway, springing up of the traction cable must be taken into consideration.

- | | | |
|-------|--|-------|
| (1) | lateral distance of conductors from the obstruction gauge limit | 2 m |
| (2) | clearance of the line conductors from the obstruction gauge limit and from the traction cable when the latter springs up | |
| (2.1) | under normal loading conditions | 1,5 m |
| (2.2) | under exceptional loading conditions | 0,5 m |
| (3) | lateral distance of the HV-line's supports from the obstruction gauge limit | 2 m |

(A-dev) **AT.19 : cable lifts** (expression in German: „Seilliftanlagen“) **providing public passenger transport service**

additional requirements: Measures for „Enhanced Safety“

It is not permissible for lines to cross under cable lifts. The clearances are to be calculated assuming the least favourable position of the cable railway cable (bouncing up of cable, etc.).

- | | | |
|-------|--|-----|
| (1) | Lateral distance | |
| (1.1) | between line conductors and cable of the cable lift including the rolling stock, when both are deflected towards one another by wind | 2 m |
| (1.2) | between the deflected conductors of the line and constructional parts of the cable lift | 3 m |
| (2) | Clearance between line conductors and cable lift | |
| (2.1) | under normal loading conditions | 3 m |
| (2.2) | under exceptional loading conditions | 2 m |
| (3) | Lateral distance of line supports from structural parts of the cable lift/railway in cases where the railway authorities have agreed to relax the 12 metres no-building ban (regulations for railways) | 5 m |

Clause National regulation(A-dev) **AT.20 : cable railways („Seilschwebbahnen“) providing public passenger transport service**

additional requirements: Measures for „Enhanced Safety“

Overhead lines may only **cross under** cable railways providing public passenger transport service in exceptional cases where there is no alternative. In such cases the overhead line is to be shielded by a building structure (protective boarding, tunnel etc.). However, this building structure must not obstruct the operating of the cable railway, even under the most unfavourable cable position. Furthermore, it must permit the accessing of the cable railway cable and also the overhead telecommunication cable associated with the cable railway for the purpose of inspection and maintenance and at the same time prevent the cable railway cable and the associated telecommunication line from coming nearer to the overhead line than permitted.

Where overhead lines **cross over** a cable railway, the most unfavourable position of the cable railway cable (after bouncing up, etc.) must be taken into account.

(1) Lateral distance

(1.1) between line conductors and cable of the railway including the rolling stock, when both are deflected towards one another by wind 2 m

(1.2) between the deflected conductors of the line and constructional parts of the railway 3 m

(2) Clearance between line conductors and railway

(2.1) under normal loading conditions 3 m

(2.2) under exceptional loading conditions 2 m

(3) Lateral distance of line supports from structural parts of the railway in cases where the railway authorities have agreed to relax the 12 metres no-building ban (regulations for railways) 5 m

(A-dev) **AT.21 : does not apply**(A-dev) **AT.22 : funicular railways (expression in German: „Standseilbahnen“) providing public passenger transport services**

additional requirements: Measures for „Enhanced Safety“

In the case of synclinal longitudinal profile of the funicular railway a bouncing up of the traction cable is to be taken into consideration.

(1) Lateral clearance between line conductors deflected by wind and obstruction gauge limit 2 m

(2) Protective clearance of line conductors from the obstruction gauge limit and from the traction cable after the latter has bounced up

(2.1) under normal loading conditions 2 m

(2.2) under exceptional loading conditions 1 m

Clause National regulation

- | | |
|--|-----|
| (3) Lateral clearance of line supports from structural parts of the funicular railway in cases where the railway authorities have agreed to relax the 12 metres no-building ban (regulations for railways) | 5 m |
|--|-----|

5.4.5.4 Clearances to other power lines or overhead telecommunication lines:

(A-dev) **AT.1: Overhead Power Lines**

additional requirements: Measures for „Enhanced Safety“

Lines up to 1000 V may not be crossed underneath by HV-lines. Measures for Enhanced Safety acc. to 5.4.2.1/AT.3 are only to be adopted for the line crossing over. Regulations for the routing of overhead lines up to 1000 V at supports of HV-lines in accordance to ÖVE-L1. The routing of overhead lines up to 1000 V at supports of HV-lines is allowed

- | | |
|--|-------|
| (1) lateral distance between conductors of two HV-lines routed on separate supports whereby it is assumed that the conductor of one line is not deflected and the conductor of the second line is deflected by the wind in the direction of the first | 1,5 m |
|
(2) clearance of supports | |
| (2.1) of the line to deflected conductors of the other line under normal loading conditions. Of criterion is the group of line to which the deflected conductors belong. | 3 m |
| (2.2) of the deflected conductors of an overhead power line up to 1000 V | 1,5 m |
|
(3) Clearance of crossing conductors | |
| (3.1) under normal loading conditions | 2 m |
| (3.2) upper conductor under normal loading conditions in all spans of the section, lower non-deflected conductor without additional load at -5°C in all spans of the section | 2 m |
| (3.3) as (3.2) but with upper conductor under exceptional loading conditions at -5°C | 0,5 m |
| (3.4) in the case of overhead lines with insulator strings on the suspension towers: upper conductor under normal loading conditions in the crossing span, in all other spans without additional load. The lower, non deflected conductor without additional load at -5°C in all spans of the section. | 0,5 m |

(A-dev) **AT.2 : telecommunication cables of public network**

additional requirements: none

- | | |
|---|-------|
| (1.1) Lateral clearance of foundations of supports and their excavations from cables | 0,8 m |
| (1.2) as above, but provided that the cables have non-metallic mechanical protection on all sides | 0,3 m |

Greater clearance than indicated above, or special protective measures may become necessary. These will require the approval of the telephone authorities on a case-to-case basis.

Clause National regulation(A-dev) **AT.3 : overhead telecommunication lines, group A**

additional requirements: Measures for „Enhanced Safety“

These lines include telecommunication lines which are not connected with either the public telecommunications network or with any other communication facilities, and which are not routed together with public telecommunication lines, also

- (1) which do not cross beyond the boundaries of a property or neighbouring properties belonging to one and the same owner, or
- (2) belong to a freight-carrying cable railway to an agricultural and forestry ropeway as per 5.4.5.3.2/AT.17, or to a funicular railway for goods transport as per 5.4.5.3.2/AT.18 and run in parallel to them.

Except under the conditions as per 5.4.5.3.2/AT.17, overhead HV-lines are not permitted to cross under these telecommunication lines.

With the exception of telecommunication lines specified in 5.4.5.3.2/AT.17, the same clearances as those indicated in 5.4.5.4/AT.4 below for overhead telecommunication lines „Group B“ are to be observed. In the case of telecommunication lines mentioned in 5.4.5.3.2/AT.17, the same conditions as those applying to the associated cable railway also apply.

Clause National regulation

(A-dev) **AT.4 : overhead telecommunication lines, group B**

additional requirements: Measures for „Enhanced Safety“

This category includes telecommunication lines of railways, all those overhead telecommunication lines not covered in the additional NNA for Austria after section 12 or are covered in 5.4.5.4/AT.3. However, in the case of a telecommunication lines associated with a cable lift providing a public passenger transport service as per 5.4.5.3.2/AT.19, whereby the telecommunication line runs alongside the cable railway, then the measures which are to be adopted in the case of the cable railway must also be applied to the telecommunication line.

It is not permitted to cross under overhead telecommunication lines of „Group B“ by overhead high voltage transmission lines.

When crossing such communication lines shortfalls of the required protective clearances are not permitted, even if the following unusual position of the conductors occurs:

- (a) The crossing span of the HV-line is loaded with normal additional load and all other spans of the line are not under additional load (unequal ice-load).
- (b) Breakage of an individual string of a multi-termination in case of normal loading condition. In this case deflection of conductors due to wind need not be taken into account.

- | | |
|---|-------|
| (1) lateral clearance of the HV-line conductors from the conductors of the telecommunication line | 2 m |
| (2) clearance of the HV-line conductors from the conductors of the telecommunication line | |
| (2.1) under normal loading conditions | 2 m |
| (2.2) under exceptional loading conditions | 0,5 m |
| (2.3) in the case of line HV-conductors being in unusual position acc. 5.4.2.1/AT.4(2) | 1 m |
| (3) clearance of the HV-line conductors from the telecommunication line supports | |
| (3.1) under normal loading conditions | 3 m |
| (3.2) in the case of the HV-line conductors being in unusual position acc. 5.4.2.1/AT.4(2) | 2 m |
| (4) lateral distance of the HV-line supports from the telecommunication line | 2 m |

In the case of overhead HV-lines exceeding 1 kV being routed in parallel to overhead HV-lines up to 1000 V on supports from which a telecommunication cable is suspended, measures in accordance with 5.4.2.1/AT.3 are adequate for the Protective Zone.

If a telecommunication overhead line or telecommunication aerial cable with bare supporting elements is indirectly endangered by current carrying wires or stranded conductors because they run in the same span above the telecommunication line and underneath the overhead HV-line, the measures foreseen in 5.4.2.1/AT.3 for Enhanced Safety need only to be adopted in the concerned span of the overhead HV-line.

If an aerial telecommunication cable with thermo-plastic insulation is crossed directly in the same manner, for the HV-line in the span in question measures as described for

Clause National regulation

Enhanced Safety in 5.4.2.1/AT.3 concerning the crossing of an overhead HV-line are sufficient.

5.4.5.5 Clearances to recreational areas**(A-dev) AT.1 : sports grounds**

additional requirements: Measures for „Enhanced Safety“

Sports grounds in this present context are understood to mean sites used for the purpose of open-air sports, and which need permission from the authority to be used as sports grounds. Included here are public open air swimming baths and camping grounds in those cases where these facilities are also subject to authority approval.

In cases where lines are crossing sports grounds, the following clearances must be observed from those areas where sporting activities are performed actively. As far as other areas or facilities within the sports ground are concerned, the relevant regulations are to be applied analogously.

Rifle ranges may only be crossed outside the scattering range allowed by the apertures. Competition ski jumping facilities should not be crossed at or between the jumping off and the landing points. Where such a crossing is unavoidable, however, the clearance as per (2.4) from the theoretical flight path must be observed.

- | | | |
|-------|---|-----|
| (1) | lateral clearance of the conductors from sports grounds | 3 m |
| (2) | protective clearance of the conductors under normal loading conditions from | |
| (2.1) | sections of sports fields used for the performance of earthbound sports or playing of ball games with small, soft balls (such as running, long-jump, curling, tennis, etc.) | 6 m |
| (2.2) | sections of sports fields used for the performance of non-earthbound sports, or for the playing of ball games with larger or harder balls (such as all throwing events, baseball, pole-vault, football, handball, etc.) | 9 m |
| | In the case of certain sports and disciplines such as golf, hammer, and javelin, etc., clearances should be determined on a case-to-case basis depending on the likely risk. | |
| (2.3) | Open-air public swimming pools and Camping Grounds
For those sectors used for active sports (2.1) and (2.2) apply. | 6 m |
| (2.4) | Competition Ski Jumping Facilities | 7 m |

Clause National regulation

6 Earthing systems

6.3 Construction of earthing systems

6.3.1 Installation of earthing electrodes

(ncpt) **AT.1:** Separate technical regulations exist for the dimensioning, the extent and the design of earthing systems (see ÖVE-EH 41).

AT.2: In the case of wooden towers the following must also be observed:

- (1) As a general rule the insulator carriers on wooden towers are not earthed since this enables exploitation of the insulation capacity of wood against surge voltages.
- (2) If earth wires are mounted on an overhead line constructed with wooden towers, the earth conductors are to be connected to the earth wire sufficiently far away from the tower and are to run free to below the lowest insulator crossarm. Between the earth conductor and the insulator crossarm a clearance is to be observed which will assure sufficient distance to surge voltages.

AT.3: In the case of steel and reinforced concrete towers the following must also be observed:

- (1) In the case of reinforced concrete towers the lengthwise reinforcement may, bearing in mind the necessary cross-section, be used as part of the earth conductor. An adequate reciprocal connecting of this pins involved and also fixed connecting points must be provided. In the event of there being no continuous steel reinforcement rod available along the entire length, provision must be made for an efficiently conducting joint between the tower configuration and the connecting point of the earthing system. The metal parts used to fasten the insulators are to be attached in an efficiently manner to the conducting wire running along the pole (possibly using the crossarm's reinforcement).
- (2) In the case of switches on steel- or reinforced concrete towers the installation of insulators in the control rod is not demanded.

AT.4: Overhead lines with covered conductors must be provided with earthing terminals for the earthing of the covered conductors. These earthing terminals must be visible or labeled well.

8 Foundations

8.2 General requirements

(ncpt) **AT.3 :** Provided that the present regulations for the design of foundations made of concrete and reinforced concrete do not specify any deviations, separate technical regulations (ÖNORM B 3304, B 3307, B 4710-1) apply. For foundations at least concrete class C 12/15 shall be used.

Clause National regulation**8.5.2.1 Geotechnical design by calculation, General**

- (A-dev) **AT.3** : For the calculation of mechanical resistance of reinforced concrete foundations separate technical regulations apply (ÖNORM B 4200, Teil 7 and ÖNORM B 4700). Under exceptional loading conditions as per 4.3.10 the permissible stresses according to this standard may be increased by 30% or alternatively the required support safety ratings may be reduced by 23%.
- For the calculation of adhesive stresses for steel profiles embedded in concrete in the case of reentrant contours the polygonal course inscribed into and circumscribed about itself (expression in German: „Fadenmaß des Umfanges“) are to be assumed. If the calculated adhesive stress exceeds the value of 60 N/cm² for a concrete class of C15/12 or of 80 N/cm² for a concrete class of C 16/12 and above, then the entire leg force is to be taken up by brackets or similar. Separate technical regulations apply here (ÖNORM ENV 1994-1-1).
- Forces from tower footing are to be transferred to the foundation reliably (expression in German: „formschlüssig“) e.g. by means of brackets or the like.
- For non-reinforced uplift foundations in the mathematically required adhesion zone, counted from the foundation bottom, the stressing of the concrete in the compound cross-section formed by the leg and the concrete may not exceed the values given in 8.5.2.1/AT.2 above.
- Otherwise, the tensile stress exerted upon the concrete must be entirely taken up by reinforcement provided under the foundation's surfaces.
- In the case of stepped foundations of tension towers the cross-sections located in the said adhesion zone in the top edge of the step are to be secured by means of splice bars.
- For the embedding length of reinforcement and splice bars separate technical regulations apply (ÖNORM B 4700) whereby in the case of delivery of concrete in open and dry foundation pit concrete classes up to C 25/30 may be allowed for. In all other cases mechanical strength classes of up to C 16/20 maximum may be taken into the calculation.

8.5.3 Geotechnical design by prescriptive measures

- (A-dev) **AT.1** : does not apply

Clause National regulation**9 Conductors and overhead earthwires (ground wires) with or without telecommunication circuits****9.1 Intoduction**

(A-dev) **AT.1** : Overhead lines with covered conductors has to be designed so, that the penetration of water into the conductor is avoided

9.5.6 Test requirements

(ncpt) **AT.2** :

**Table 9.5/AT.2 - Conductor material:
Conductors - Characteristic values and dimensions ^{a)}**

1		2	3	4	5	6	7	8
Conductor Material		Number of Strands	Specific Conductor weight ^{b)}	Tensile Strength app. ^{c)}	Permissible Initial Tensile Stress	Endurance Tensile Strength	Moduls of Elasticity	Thermal Coefficient of Elongation
			N/(m/mm ²)	N/mm ²	N/mm ²	N/mm ²	N/mm ²	1/°C
Alu-minium Conductor Steel Reinforced	Al/St 3:1	36/7	41 * 10 ⁻³	395	120	280	90 000	1,67 * 10 ⁻⁵
		78/19					84 000	
	Al/St 4,3:1	30/7	37,5 * 10 ⁻³	330	110	240	82 000	1,78 * 10 ⁻⁵
	Al/St 6:1	6/1	35 * 10 ⁻³	285	90	200	81 000	1,92 * 10 ⁻⁵
		26/7					77 000	1,89 * 10 ⁻⁵
	Al/St 7,7:1	54/7	33,6 * 10 ⁻³	260	85	189	70 000	1,93 * 10 ⁻⁵
		54/19					68 000	1,94 * 10 ⁻⁵
Al/St 11,3:1	48/7	32 * 10 ⁻³	230	75	165	62 000	2,09 * 10 ⁻⁵	
AlMgSi-Steel Conductors	AlMgSi/St 3:1	36/7	41 * 10 ⁻³	490	160	360	90 000	1,67 * 10 ⁻⁵
		78/19					84 000	
	AlMgSi/St 4,3:1	30/7	37,5 * 10 ⁻³	445	140	330	82 000	1,78 * 10 ⁻⁵
	AlMgSi/St 6:1	6/1	35 * 10 ⁻³	400	120	300	81 000	1,92 * 10 ⁻⁵
		26/7					77 000	1,89 * 10 ⁻⁵
	AlMgSi/St 7,7:1	54/7	33,6 * 10 ⁻³	380	115	284	70 000	1,93 * 10 ⁻⁵
		54/19					68 000	1,94 * 10 ⁻⁵
AlMgSi/St 11,3:1	48/7	32 * 10 ⁻³	350	105	265	62 000	2,09 * 10 ⁻⁵	
Aluminium Stranded Conductors		7	27,5 * 10 ⁻³	155	60	120	60 000	2,3 * 10 ⁻⁵
		19					57 000	
		37		140			57 000	
		61					55 000	
		91					55 000	
AlMgSi Stranded Conductors		7	27,5* 10 ⁻³	270	95	240	60 000	2,3 * 10 ⁻⁵
		19					57 000	
		37		260			57 000	
		61					55 000	
		91					55 000	

footnotes see next page

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